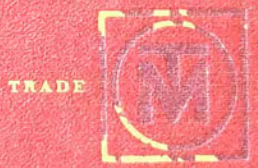
11st EDITION

TOWNSON & MERCER LIMITED

CATALOGUE OF

PHYSICAL APPARATUS AND LABORATORY EQUIPMENT



34 CAMOMILE STREET
LONDON, E.C.3

TOWNSON & MERCER LTD

Established 1798

TWENTY-FIRST EDITION

Catalogue of Physical Apparatus and Laboratory Equipment

including

Apparatus for Teaching Elementary and Practical Physics, Mechanics, Heat, Light, Sound, Electricity, Physical Geography; also Botanical Apparatus, Diagrams, Meteorology, Geometrical Models, Mathematical Instruments, General Laboratory Apparatus, etc.

SEPTEMBER 1931

Manufactured by

TOWNSON & MERCER LTD.

CHEMICAL AND SCIENTIFIC APPARATUS MANUFACTURERS

34 CAMOMILE STREET · LONDON, E.C.3

AND

PRECISION WORKS, 390 SYDENHAM ROAD, CROYDON

Telephone: London Wall 5754 (2 lines).

Telegraphic Address: Townson, Stock, London.

Codes: Lieber's latest.

The following are some of the Medals and Diplomas that have been awarded to us for the quality of the General Chemical, Physical, Bacteriological and Mining Apparatus that we manufacture.





GOLD MEDAL, KIMBERLEY, 1892





SILVER MEDAL, LONDON, 1884

GOLD MEDAL





ST LOUIS, 1904



SILVER MEDAL





BRONZE MEDAL, LONDON, 1901



GOLD MEDAL

SILVER MEDAL





MADRID, 1883





SILVER MEDAL, LONDON, 1904





GOLD MEDAL, LONDON, 1899



SILVER MEDAL,



CALCUTTA, 1883-4



GOLD MEDAL,



BRUSSELS, 1910.

TOWNSON & MERCER LTD

TOWNSON & MERCER LTD.

Manufacturers of

Chemical and Scientific Apparatus
Etc.

Pure Chemicals and Laboratory Fittings

34 CAMOMILE STREET
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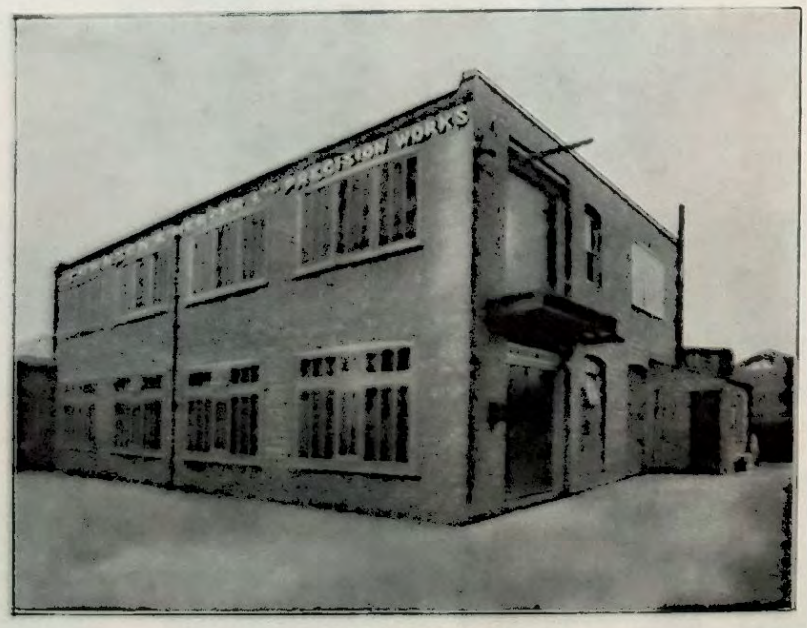
and the principal
UNIVERSITIES AND EDUCATIONAL AUTHORITIES
throughout the United Kingdom and Abroad

Complete Laboratory Furnishers

Estimates prepared and suggestions given for any type of equipment



INSTRUMENT WORKS, CROYDON

34 CAMOMILE STREET · LONDON · E · C · 3

TOWNSON & MERCER LTD

PREFACE TO TWENTY-FIRST EDITION

IN submitting the Twenty-First Edition of our Physical Apparatus Catalogue, we again respectfully tender our sincere thanks to our numerous patrons for their valued and continued support, with the assurance that it will be in the future, as in the past, our utmost endeavour to preserve.

The highest Awards at the various Exhibitions in the United Kingdom and Colonies which we have received are a sufficient guarantee as to the quality of the articles which we supply.

The Export Department will, as hitherto, have our personal superintendence, and we take this opportunity of returning our best thanks to our foreign Customers for the numerous testimonials we have received as to the despatch and careful manner in which the orders have been executed and packed.

On referring to the Catalogue it will be noticed that considerable additions have been made in the list of Physical Apparatus and Diagrams adapted for Laboratories and the practical Scientific Teaching given at Colleges, County Council Schools and Technical Institutes.

We have considerably reduced the prices of several articles where it has been possible to do so, and, bearing in mind that the best are the cheapest in the long run, we will only, as hitherto, supply such instruments upon which the utmost reliance can be placed, and we venture to state that the prices will compare most favourably with those of any other firm in the trade.

Illustrations.—These must not be taken as binding in detail, as we are continually making improvements.

Special Apparatus.—We make a speciality of making up Apparatus to Clients' own specifications.

We shall be pleased to submit Estimates and Drawings for General Laboratory fittings in Institutions, Colleges, etc.

TERMS

HOME ORDERS. On receipt of an order according to this Catalogue, an invoice will be sent, and the goods forwarded immediately on receipt of remittance, or accompanied by a satisfactory reference in London.

FOREIGN ORDERS. Must be accompanied by either a remittance, or instructions for payment in London, on delivery of Bills of Lading, etc.

BREAKAGES. We do not hold ourselves responsible for breakages in transit, as the utmost care is used in packing, and in the event of breakages, application should be made **at once** to the Railway Company, or Carrier, **who alone are responsible.**

EMPTIES. Full price allowed for Returned Cases and Packing Material **when actually received, Carriage Paid, and in good condition.** The name of the sender must be on all Returned Empties.

Please address all communications to 34 Camomile Street, E.C.3.

The Prices are subject to market fluctuations.

Cheques to be crossed "Barclays Bank Limited."

Telegraphic Address: "TOWNSON, STOCK, LONDON."

Telephone: LONDON WALL 5754 (Two Lines).

TOWNSON & MERCER LTD.

Laboratory Outfitters and Contractors to the principal Home and Colonial Departments of H.M. Government, War Office, India Office, South Africa, Orange River Colony, London County Council, and the principal Universities and Education Authorities throughout the United Kingdom and Abroad.

We also publish the following Catalogues:—

Special Gas Analysis Apparatus.
Chemical Apparatus.
Balances and Weights.
Petroleum and Tar Testing Apparatus.
Electric Furnaces.
Chemicals, Reagents, Stains, etc.

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Reference Page.

COMPARISON BETWEEN INCHES, MILLIMETRES AND BRITISH STANDARD WIRE GAUGE

S.W.G.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Inches	·300	·276	·252	·232	·212	·192	·176	·160	·144	·128	·116	·104	·092	·080	·072
Millimetres	7·62	7·01	6·41	5·89	5·38	4·87	4·47	4·06	3·66	3·25	2·95	2·65	2·33	2·03	1·83
S.W.G.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Inches	·064	·056	·048	·040	·036	·032	·028	·024	·022	·020	·018	·016	·014	·013	·012
Millimetres	1·63	1·42	1·22	1·01	·914	·813	·711	·610	·560	·508	·457	·406	·356	·330	·305
S.W.G.	31	32	33	34	35	36	37	38	39	40	42				
Inches	·0116	·0108	·01	·009	·0084	·0076	·0068	·006	·0052	·0048	·004				
Millimetres	·279	·274	·254	·229	·213	·193	·172	·152	·127	·122	·103				

Inch	1/64	1/32	3/64	1/16	5/64	3/32	1/8
Inch	·015	·031	·047	·062	·078	·093	·125
Millimetres	·381	·786	1·175	1·55	1·95	2·33	3·15

COMPARISON OF THERMOMETER SCALES.

Table for conversion of Centigrade to Fahrenheit and vice versa.

Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.
0	32·0	17	62·6	34	93·2	51	123·8	68	154·4	85	185·0
1	33·8	18	64·4	35	95·0	52	125·6	69	156·2	86	186·8
2	35·6	19	66·2	36	96·8	53	127·4	70	158·0	87	188·6
3	37·4	20	68·0	37	98·6	54	129·2	71	159·8	88	190·4
4	39·2	21	69·8	38	100·4	55	131·0	72	161·6	89	192·2
5	41·0	22	71·6	39	102·2	56	132·8	73	163·4	90	194·0
6	42·8	23	73·4	40	104·0	57	134·6	74	165·2	91	195·8
7	44·6	24	75·2	41	105·8	58	136·4	75	167·0	92	197·6
8	46·4	25	77·0	42	107·6	59	138·2	76	168·8	93	199·4
9	48·2	26	78·8	43	109·4	60	140·0	77	170·6	94	201·2
10	50·0	27	80·6	44	111·2	61	141·8	78	172·4	95	203·0
11	51·8	28	82·4	45	113·0	62	143·6	79	174·2	96	204·8
12	53·6	29	84·2	46	114·8	63	145·4	80	176·0	97	206·6
13	55·4	30	86·0	47	116·6	64	147·2	81	177·8	98	208·4
14	57·2	31	87·8	48	118·4	65	149·0	82	179·6	99	210·2
15	59·0	32	89·6	49	120·2	66	150·8	83	181·4	100	212·0
16	60·8	33	91·4	50	122·0	67	152·6	84	183·2		

USEFUL MULTIPLIERS

To Convert			Multiply by
Metres	to	Yards	1·1
Yards	,,	Metres	·9
Centimetres	,,	Inches	·4
Inches	,,	Centimetres	2·54
Kilogrammes	,,	Pounds	2·2

To Convert			Multiply by
Pounds	to	Kilogrammes	·45
Grammes	,,	Ounces	·035
Ounces	,,	Grammes	28·36
Litres	,,	Gallons	·22
Gallons	,,	Litres	4·5

HYDROMETERS. To convert

A. Degrees of Twaddell's hydrometer into specific gravity (water=1000)—multiply by 5 and add 1000.
B. Specific Gravity (water=1000) into degrees of Twaddell's hydrometer—subtract 1000 and divide by 5.
C. Specific Gravity (air=1) to specific gravity (H=1) multiply by 14·483.
D Specific Gravity (H=1) to specific gravity (air=1)—multiply by 0·06926.

TABLE FOR USE WITH THE WET AND DRY BULB THERMOMETERS

t°C.	0	1	2	3	4	5	6	7	8	9	10	11
0	4·6	3·7	2·9	2·1	1·3							
1	4·9	4·0	3·2	2·4	1·6	0·8						
2	5·3	4·4	3·4	2·7	1·9	1·0						
3	5·7	4·7	3·7	2·8	2·2	1·3						
4	6·1	5·1	4·1	3·2	2·4	1·6	0·8					
5	6·5	5·5	4·5	3·5	2·6	1·8	1·0					
6	7·0	5·9	4·9	3·9	2·9	2·0	1·1					
7	7·5	6·4	5·3	4·3	3·3	2·3	1·5	0·4				
8	8·0	6·9	5·8	4·7	3·7	2·7	1·7	0·8				
9	8·5	7·4	6·3	5·2	4·1	3·1	2·1	1·1	0·2			
10	9·1	8·0	6·8	5·7	4·6	3·5	2·5	1·5	0·5			
11	9·8	8·6	7·4	6·2	5·1	4·0	2·9	1·9	0·9			
12	10·4	9·2	8·0	6·8	5·6	4·5	3·4	2·3	1·3			
13	11·1	9·8	8·6	7·3	6·2	5·0	3·9	2·8	1·7			
14	11·9	10·6	9·2	8·0	6·7	5·6	4·4	3·3	2·2	1·1		
15	12·7	11·3	9·9	8·6	7·4	6·1	5·0	3·8	2·7	1·6	0·5	
16	13·5	12·1	10·7	9·3	8·0	6·8	5·5	4·3	3·2	2·1	1·0	
17	14·4	13·0	11·5	10·1	8·7	7·4	6·2	4·9	3·7	2·6	1·5	0·4
18	15·3	13·8	12·3	10·9	9·5	8·1	6·8	5·5	4·3	3·1	2·0	0·9
19	16·3	14·7	13·2	11·7	10·3	8·9	7·5	6·2	4·9	3·7	2·5	1·4
20	17·4	15·7	14·1	12·6	11·1	9·7	8·3	6·9	5·6	4·3	3·1	1·9

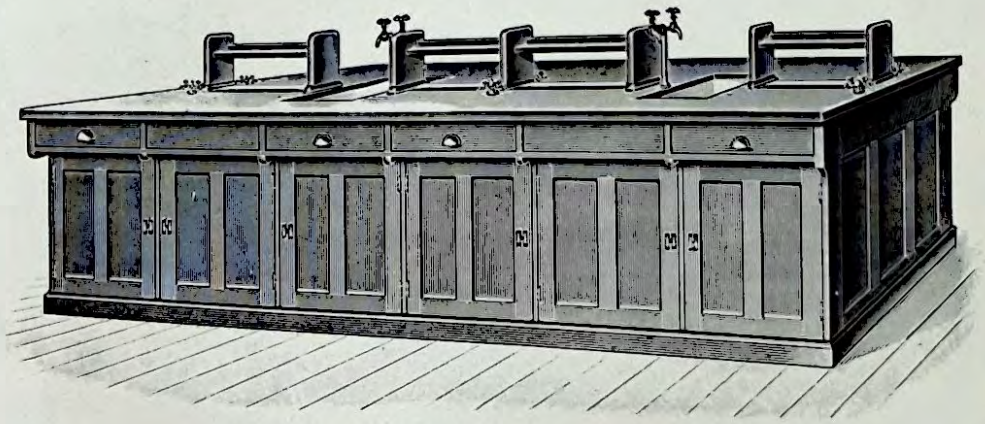
APPROXIMATE E.M.F.'S OF VARIOUS CELLS.

Cell.	E.M.F.
Daniell	1·1 volts
Clark	1·434 ,,
Leclanché	1·5 ,,

Cell.	E.M.F.
Siemens' Dry	1·5 volts
Bunsen	1·9 ,,

Cell.	E.M.F.
Grove	1·9 volts
Bichromate	2·0 ,,

Laboratory Furniture and Fittings, including Tools, etc.



Laboratory Fittings

Laboratories (Chemical and Physical) erected and equipped; Fume Cupboards, Students' Benches and Lecture Tables fitted up; Connections made to Gas, Water, and Drains—in fact, every requirement for a fully equipped Laboratory.

We make this work a speciality, and have had the pleasure of executing contracts for a number of Hospitals and Technical Schools under the various County Councils.

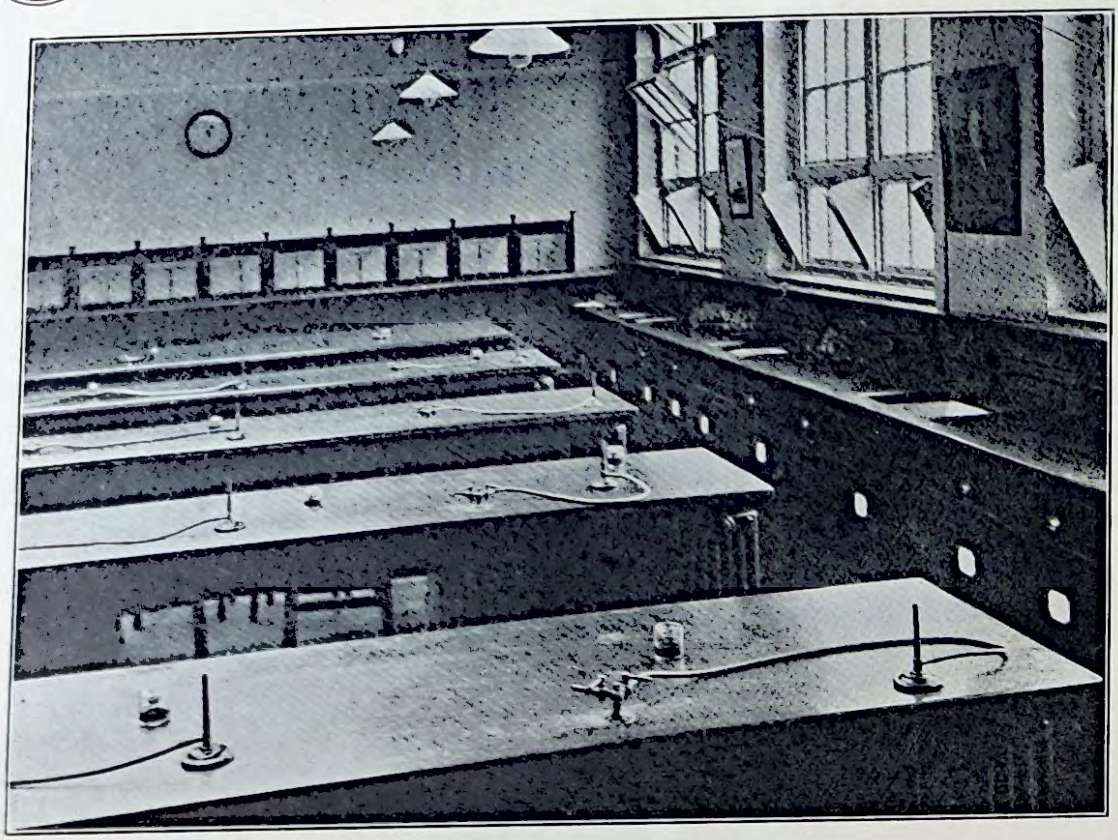
The knowledge, only to be derived from long experience, of the technical requirements as to the arrangements for rapid dispersion of corrosive fumes, dangerous gases, etc., efficient connections to Drains, Water and Gas, ventilation and light in a Chemical Laboratory, cannot, unfortunately, be possessed by the usual building contractor.

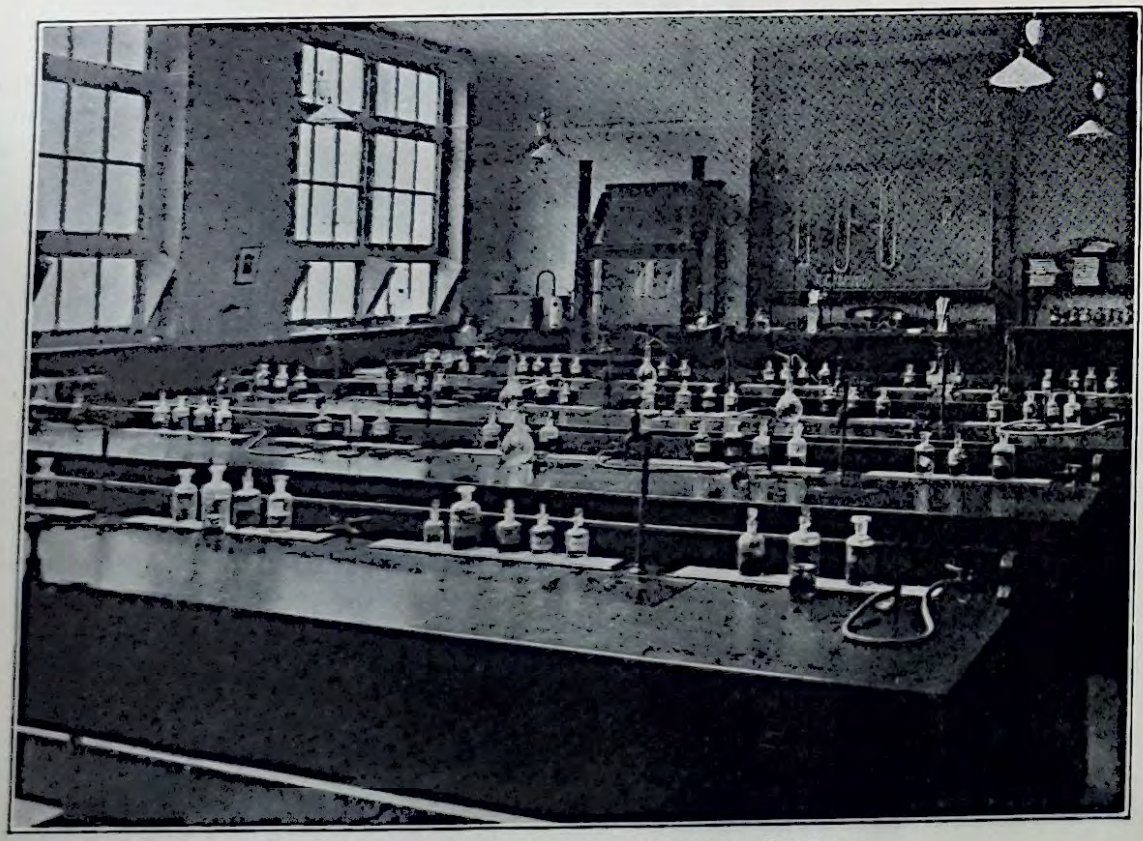
We should be pleased to arrange for our representative to visit any Science School or Institution in course of erection, or about to be erected or fitted, to give advice as to the best arrangement of Benches, etc.—out-of-pocket expenses (fares, etc.) merely being charged.

If a personal visit is not considered to be expedient, we should be pleased to furnish advice by post.

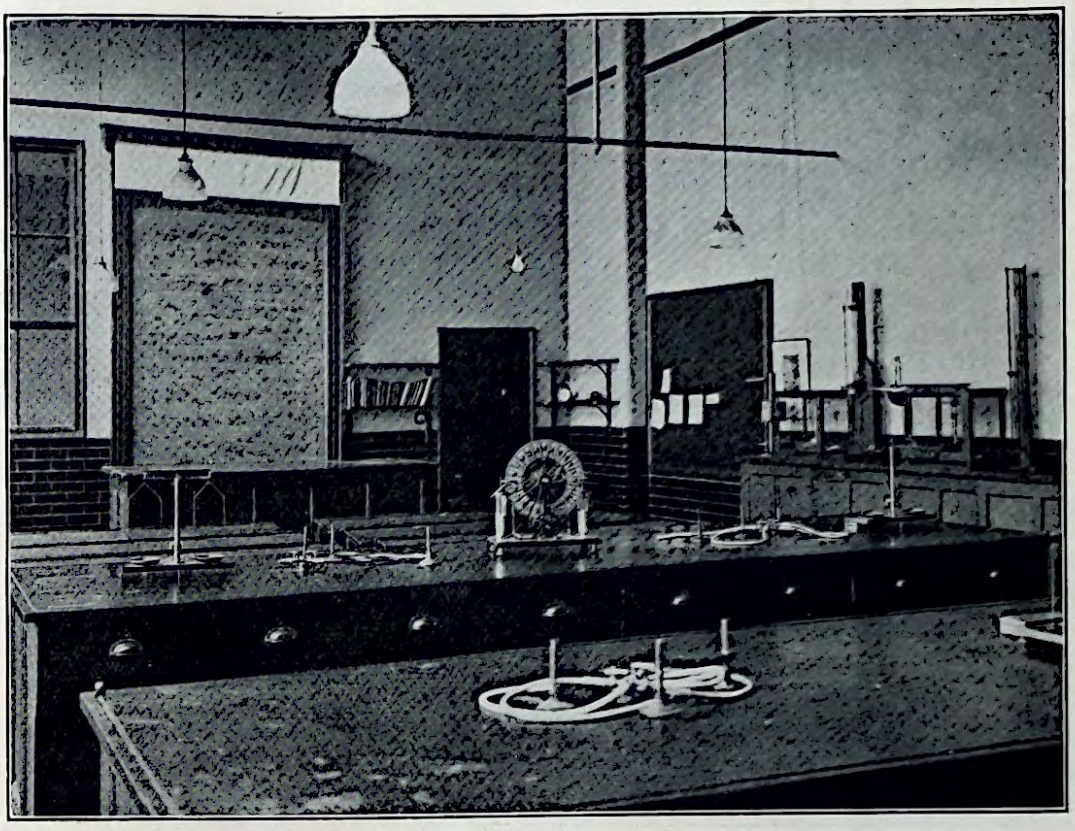
Plans and Estimates given for Laboratory Fittings upon receipt of the Ground Plan, which should show positions of Doors, Windows and Flues, Gas and Water connections, also number of Students to be accommodated.

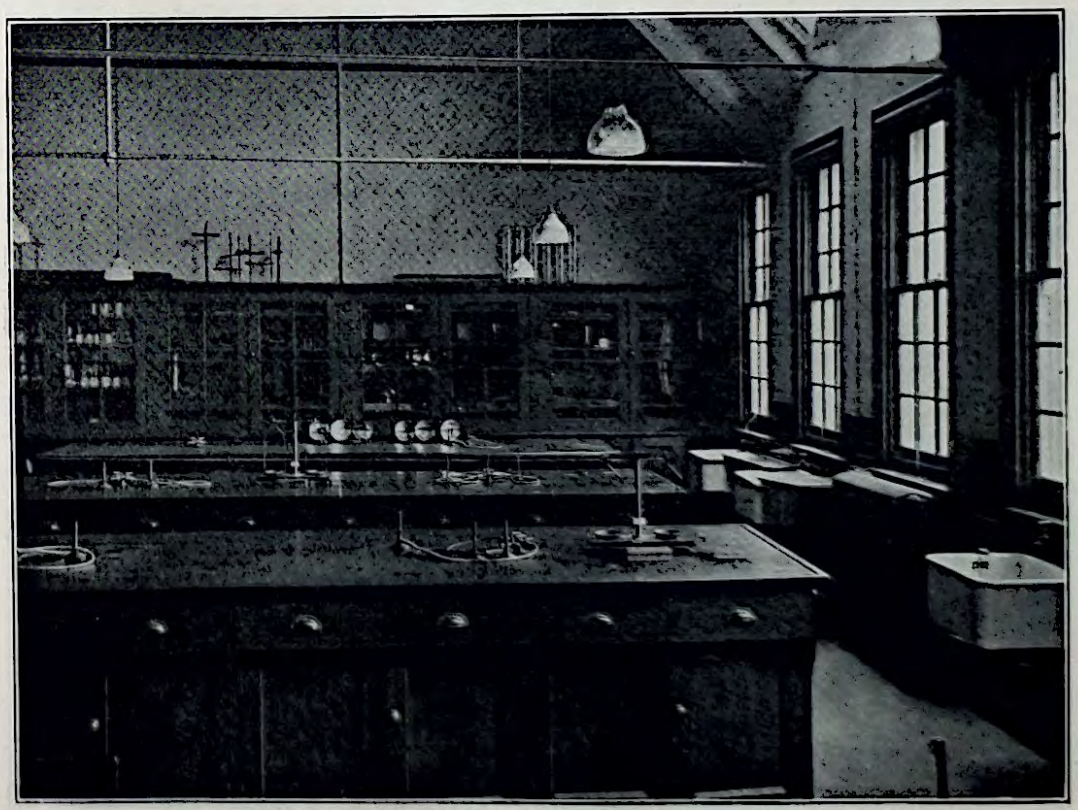
The following pages illustrate various types of Laboratories fitted and equipped by us.



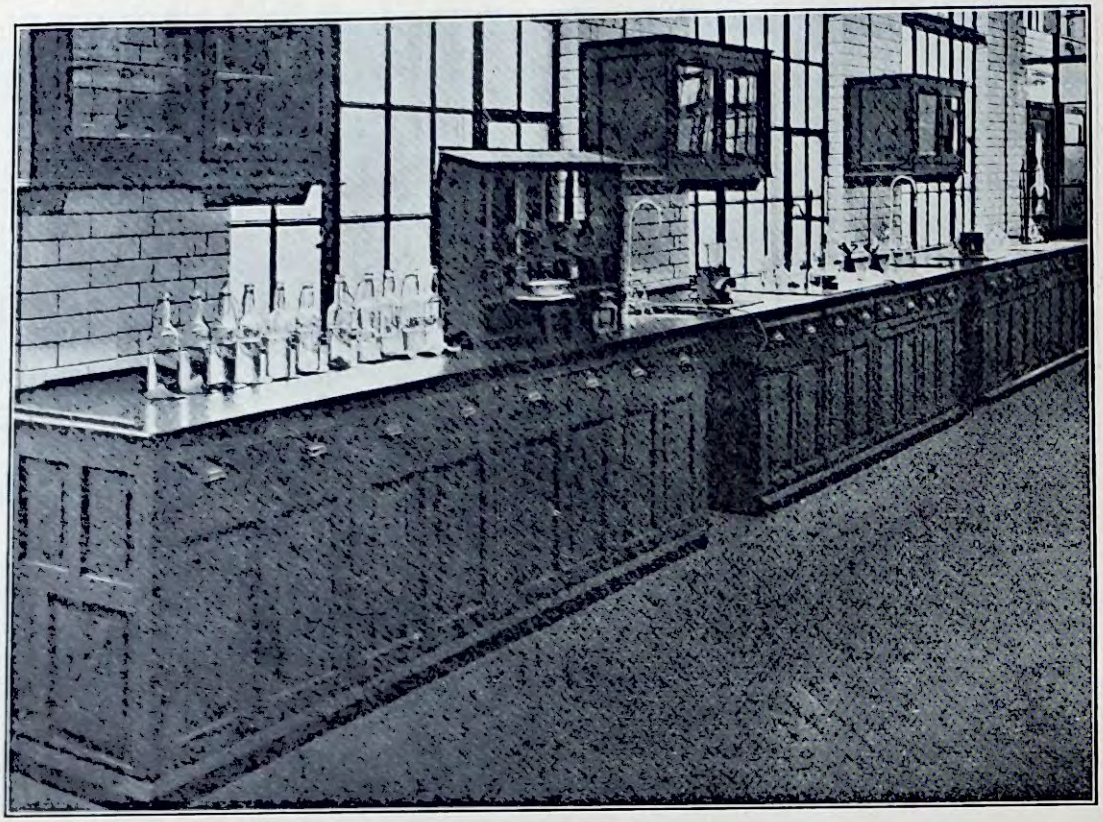


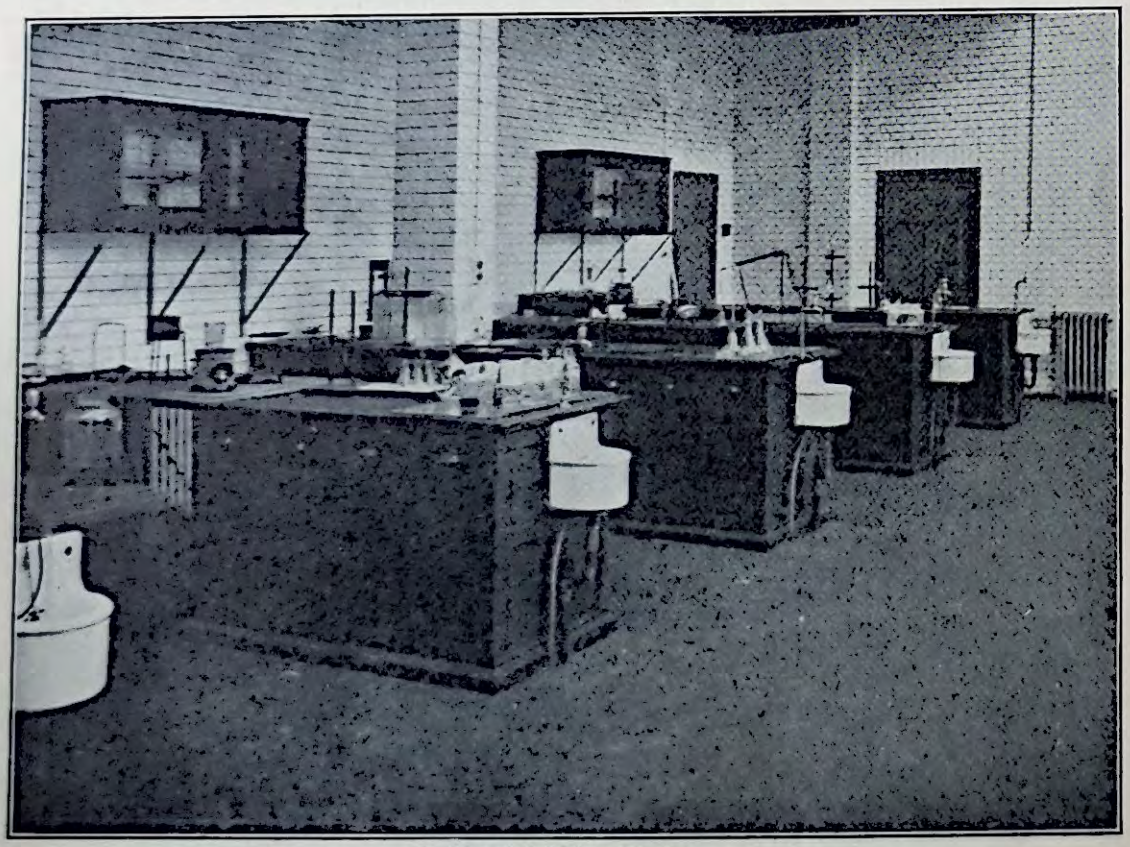
Physics and Chemistry Laboratories for Students



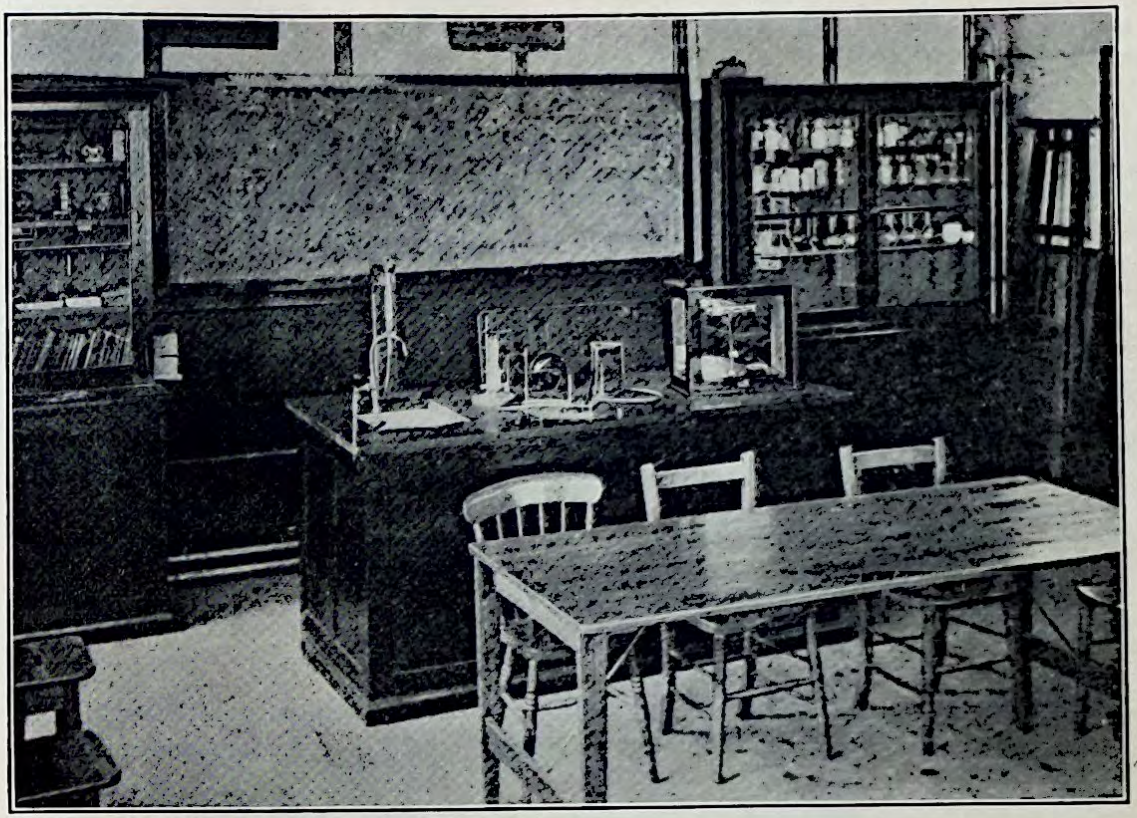


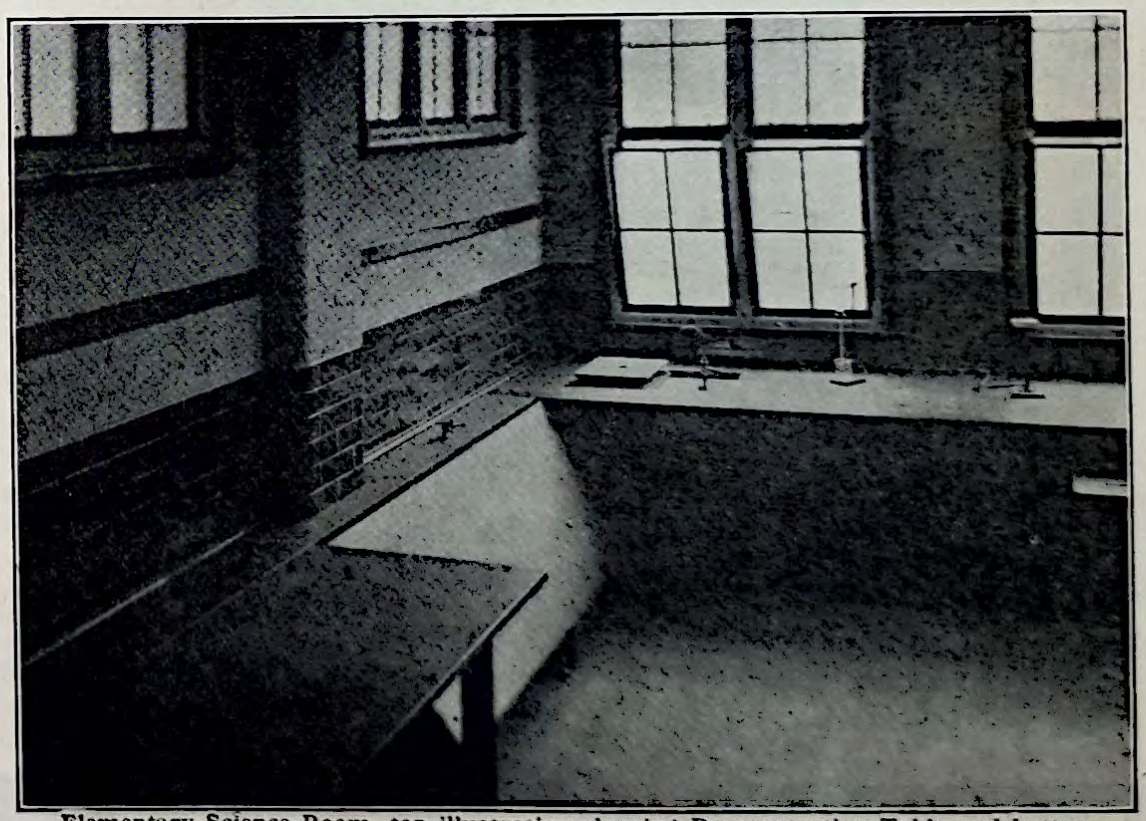
Physics Laboratories, showing General Arrangement of Benches



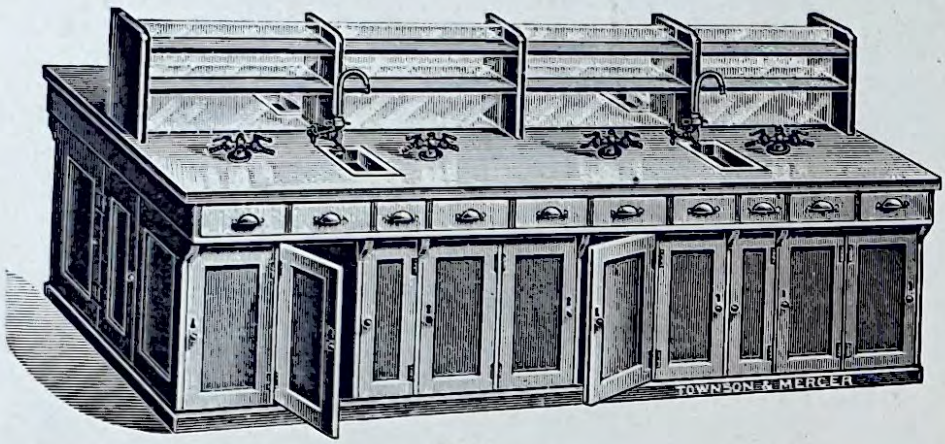


Industrial Laboratories



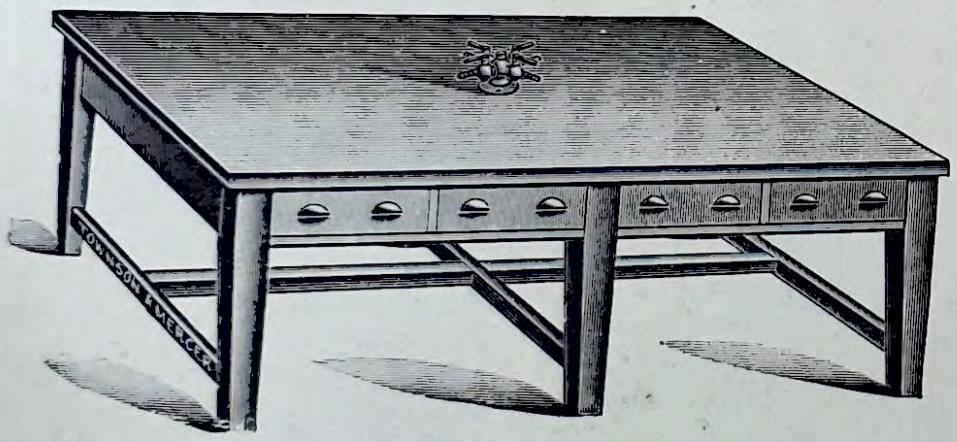


Elementary Science Room, top illustration showing Demonstration Table and bottom illustration showing Collapsible Bench, allowing the room to be used as an Ordinary Class-room, if desired



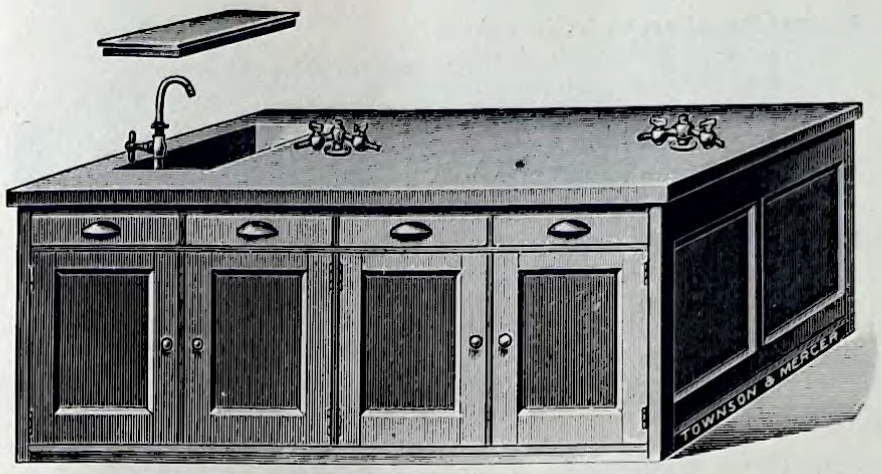
8000

8000 **Chemical Bench,** Best Pitch Pine, with heavy Teak Tops, fitted complete with Shelves, Gas Taps, Water Taps and Sinks, etc. Prices on application, stating requirements.



8001

8001 **Physics Table,** Heavy Teak Top, Wax Polished, Stout Pitch Pine Framing, fitted with Gas Taps, etc. Price on application, stating size required.

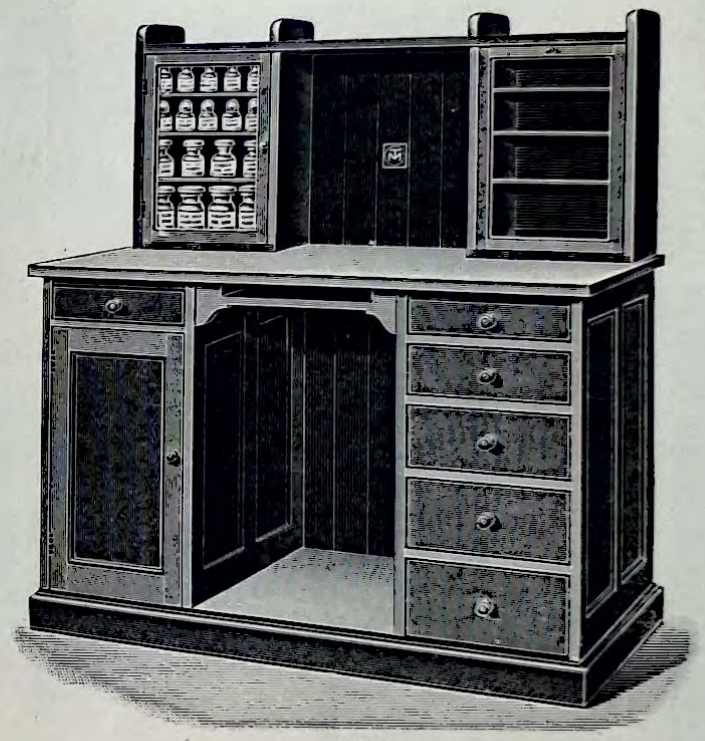


8002

8002 Lecture Table, Pitch Pine, Polished, Drawers and Cupboards, with Stout Teak Top, Stoneware Sink with Overflow, Water and Gas Taps and Pipes.

Price on application, stating size required.

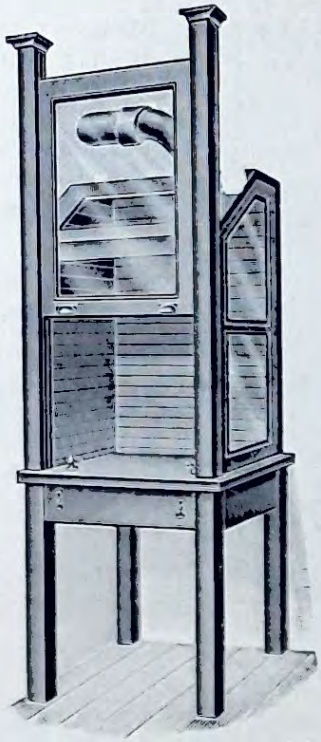
Special quotations for fitting and connecting to Gas and Water Supply and Drains on receipt of particulars.



8003

8003 Laboratory Bench, specially designed for Bacteriological work, suitable for private Laboratories, etc. Teak Top, Pitch Pine under-work, with set of Drawers in one Pedestal and Cupboard in other, leaving knee space between the two. The Top carrying two cupboards, each with three plate glass shelves, with glazed doors, one being entirely removable to allow of easy access to Re-agent Bottles, etc., the removable door fitting in slot under Bench Top. The left-hand cupboard being used for Instruments, etc. The whole surmounted by a shelf for Books, etc. The space between the Cupboards suitably provides room for Microscope under Glass shade. Stained and Polished if required to suit existing Furniture.

Price on application stating size required.

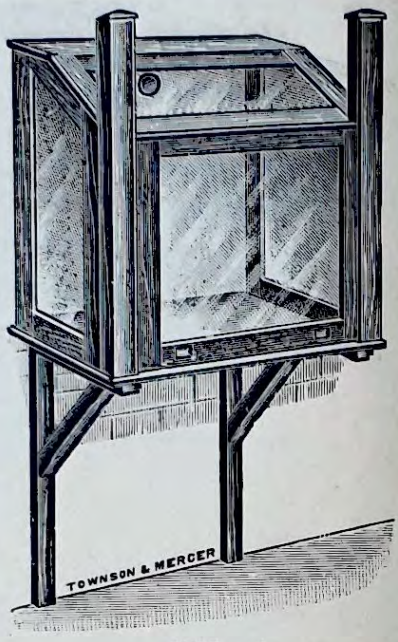


8004

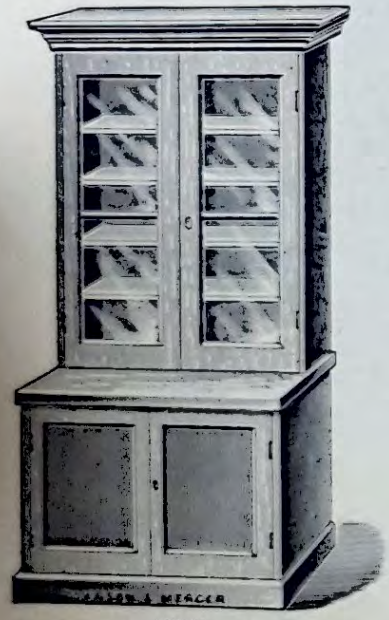
8004 Fume Chamber, with Glass Sides, Top and Front, with Counterpoised Sliding Sash of Pitch Pine, Polished, on Slate Slab or Lead lined base. Can also be supplied with Cupboards below if required.

8005 Fume Chamber, of well-seasoned Pitch Pine, Polished, with Counterpoised Sliding Front and Slate Slab or Lead-lined Base, 3 ft. long, 2 ft. deep. Prices quoted on receipt of requirements.

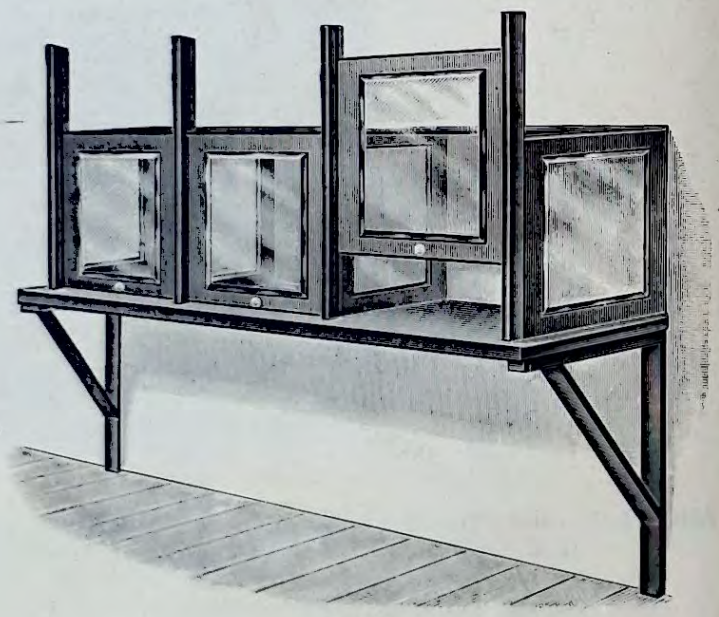
8006 Apparatus Cupboard, of well-seasoned Pitch Pine, Polished, with Glass Doors to top Cupboard, fitted with Shelves. Height 7 ft., width 4 ft. 6 in., depth of upper portion 13 in., lower portion 20 in., fitted with locks, complete.



8005



8006



8007

8007 Range of Balance Cases, with Top, Ends, and Fronts Glazed. Counterpoised Sliding Sashes on Slate or Teak Base supported by stout framed Bearers. Can be made in any range to suit requirements.



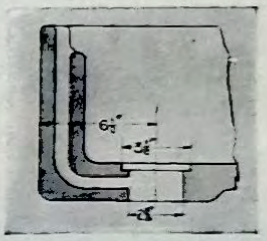
8008

8008 Laboratory Sinks, Enamelled Fireclay, White Glazed inside, approximate overall dimensions—

12 ×12 ×7 in.	nett	**£0**	**14 6**
22½×12½×6 „	„	**1**	**3 0**

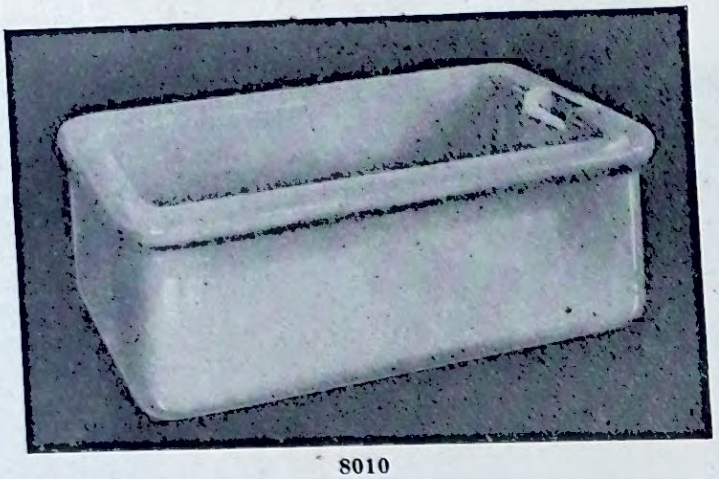


8009

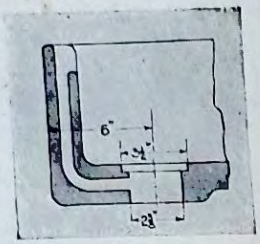


8009 Laboratory Sinks, Belfast Pattern, in Glazed Fireclay, Improved Overflow, easy of access for cleaning purposes.

Overall Measurements.		White inside and out.				White inside, Cane outside.				
21×16× 7 in.	... ...	nett	**£1**	**12**	**3**	... ...	nett	**£1**	**7**	**9**
24×16× 7 „	... ...	„	**1**	**16**	**6**	... ...	„	**1**	**11**	**3**
24×18× 7 „	... ...	„	**2**	**0**	**9**	... ...	„	**1**	**15**	**0**
27×18× 7 „	... ...	„	**2**	**5**	**0**	... ...	„	**1**	**18**	**9**
30×18× 7 „	... ...	„	**2**	**9**	**3**	... ...	„	**2**	**2**	**3**
24×18× 8 „	... ...	„	**2**	**5**	**9**	... ...	„	**1**	**19**	**6**
27×18× 8 „	... ...	„	**2**	**10**	**9**	... ...	„	**2**	**3**	**3**
30×18× 8 „	... ...	„	**2**	**16**	**3**	... ...	„	**2**	**8**	**6**
24×16×10 „	... ...	„	**2**	**10**	**9**	... ...	„	**2**	**3**	**3**
24×18×10 „	... ...	„	**2**	**16**	**3**	... ...	„	**2**	**8**	**6**
27×18×10 „	... ...	„	**3**	**3**	**6**	... ...	„	**2**	**14**	**0**
30×18×10 „	... ...	„	**3**	**9**	**9**	... ...	„	**2**	**19**	**6**



8010



8010 Laboratory Sinks, Edinburgh Pattern, in Glazed Fireclay, with rolled edges, Improved Open Overflow, easy of access for cleaning purposes.

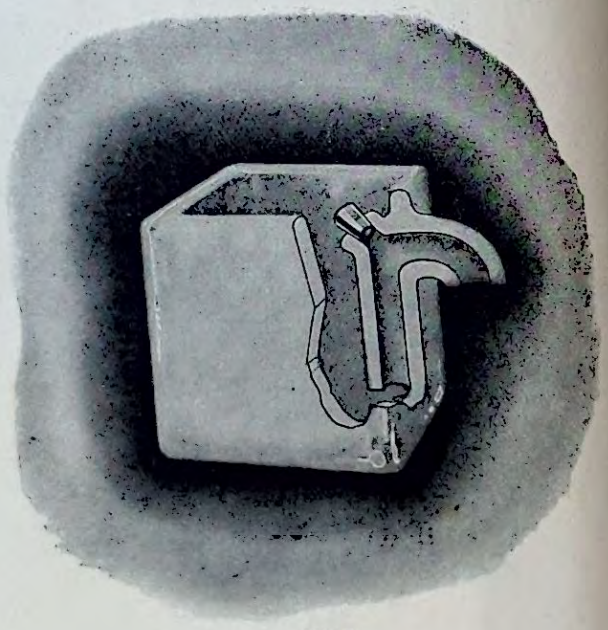
Overall Measurements.		White inside and outside.		White inside, Cane outside.	
18×15×8 in.	nett	£1 9 6	nett	£1 6 0
21×15×8½ ,,	,,	1 16 6	,,	1 11 3
24×15×8½ ,,	,,	2 0 9	,,	1 15 0
27×17×9 ,,	,,	2 14 3	,,	2 6 6
30×17×9 ,,	,,	2 19 6	,,	2 11 0
36×17×9 ,,	,,	4 0 9	,,	3 9 0



8011

8011 Receivers, with ordinary outlet, White Glazed inside.

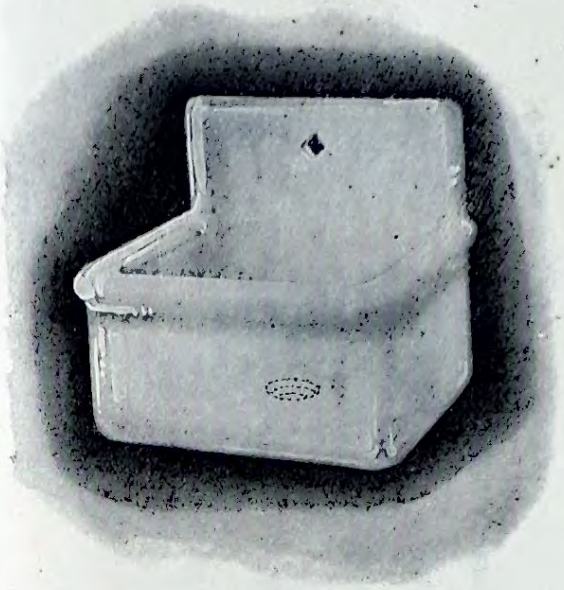
Overall sizes			
12× 8×7 in.	nett	£1 3 9
15×10×8 ,,	,,	1 7 6
24×10×8 ,,	,,	1 18 3



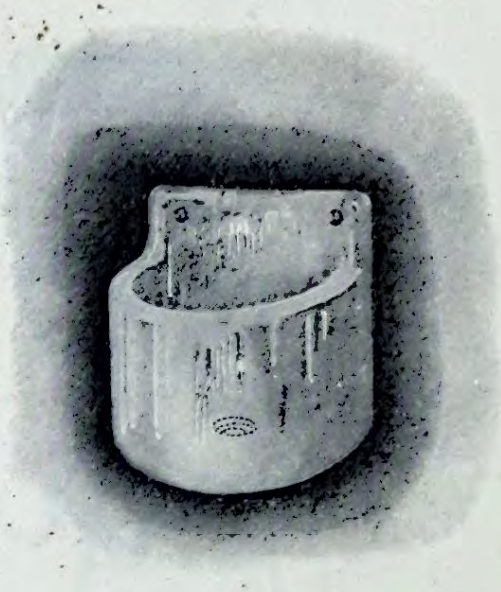
8012

8012 Receivers, with Syphon Outlet and India-rubber Inspection Cork, White Glazed inside.

Overall size 13×13×13 in. ... ... nett **£1 18 6**



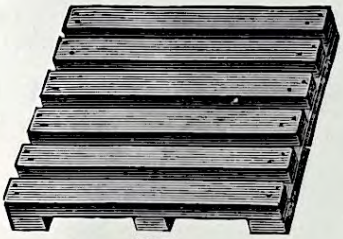
8013



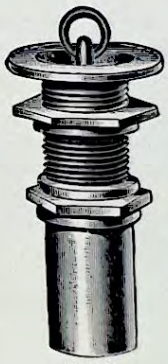
8014

8013 **Laboratory Sink,** width 1½ in. Fixed Back Skirting, with two screw holes for screwing to bench, round fronted with outlet 2½ × 2 in. Glazed White inside and out.
Outside measurements, 10½ × 6 × 6 in. **£0 12 6**

8014 **Laboratory Sink,** Glazed Fireclay White inside and Buff outside, Rolled Edge, 6-in. Back Skirting and outlet 2½ × 2 in. in centre at back. Outside measurements, 17 × 13 × 7 in. **£1 11 3**



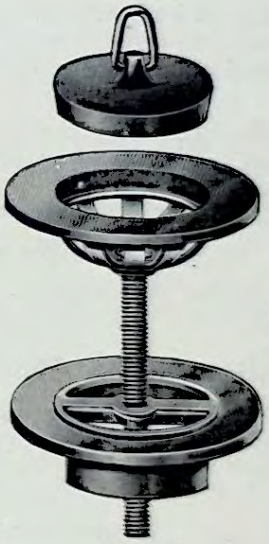
8022



8015



8016



8017-9



8020

8015 **Brass Plugs and Washers** with Union for Sinks No. 8008

1	1¼	1½ in.
4/0	**5/6**	**7/6** each

8016 **Brass Plugs and Washers** with Union for Sinks No. 8009-10 **4/0** **6/0** **9/0** ,,

8017 **Heavy Cast Brass Belfast Waste.** Size 2 in., Flange 3½ in., long tail turning, 5-in. screw connection. With brass plug ... ...each **£0 3 9**

8018 Ditto, ditto, With rubber plug ... ...each **£0 4 3**

8019 Ditto, ditto, With vulcanite plug ... ... ,, **0 5 0**

8020 **Union,** Royle's, complete with rubber

¼	⅜	⅜ × ½	½	¾ × ½	¾ × ¾	1 in.
1/4	**1/10**	**2/0**	**2/6**	**2/7**	**2/7**	**3/9** each

8021 **Rubbers,** spare for above ... ...

½	⅝	¾	1 in.
3d.	**4d.**	**5d.**	**6d.** each
2/6	**3/0**	**3/6**	**4/6** doz.

8022 **Teak Grating,** Drainers, for placing in bottom of sink. (Prices for any size of grating on application.)



8023–4



8025–6

LABORATORY STOOL OF EXCEPTIONAL VALUE

A Worker's Stool capable of withstanding the hardest usage, of universal utility, and sold at a price which makes it competitive with ordinary wooden chairs and stools which possess none of its merits and advantages. The triangulated metal legs render it extraordinarily strong and rigid, and so compact that minimum floor space is occupied.

It has the swivelling backrest of fibre board, and this is positioned to suit all average requirements. The seat is of stained and polished wood, with smooth rounded front edge, and is dished for maximum comfort.

***8023**	Stock heights are 16 in., 18 in., 20 in. and 22 in.	**£0 15 0**
***8024**	,, ,, ,, 24 in., 26 in., 28 in. and 30 in.	**0 18 6**
	Other heights to order.	

LABORATORY CHAIR NON-ADJUSTABLE

***8025** An inexpensive chair which will stand up to the hardest usage in any class of work where an upholstered chair is required.

Specification

The Chair, which is not adjustable, is made from hard enamelled steel tubing and best mild strip steel.

Seat is dished for maximum comfort, and seat and backrest are well padded and upholstered in Rexine.

Backrest swivels, automatically adjusting itself to the angle of the sitter's back, and is positioned to meet average requirements.

Stock heights are 18 in. and 20 in., but any height can be made to order as desired.

	The construction of this chair endows it with rigidity and strength; it is practically indestructible and will outlast any number of wooden chairs or stools	**£1 5 0**
***8026**	Ditto, cheaper model, with strong Fibre Seat and Back (not upholstered)... ...	**1 0 0**



8027–8



8029

***8027 LABORATORY REVOLVING CHAIR**

Special Features

1. It is adjustable for height by simply rotating the seat. Lowest height 17 in., extending to 23 in.
2. Backrest is not adjustable, but is positioned to meet average requirements.
3. The Backrest swivels and so adjusts itself to any angle of the sitter's back.
4. Castors are fitted to facilitate ease of movement, or domes can be fitted if preferred.

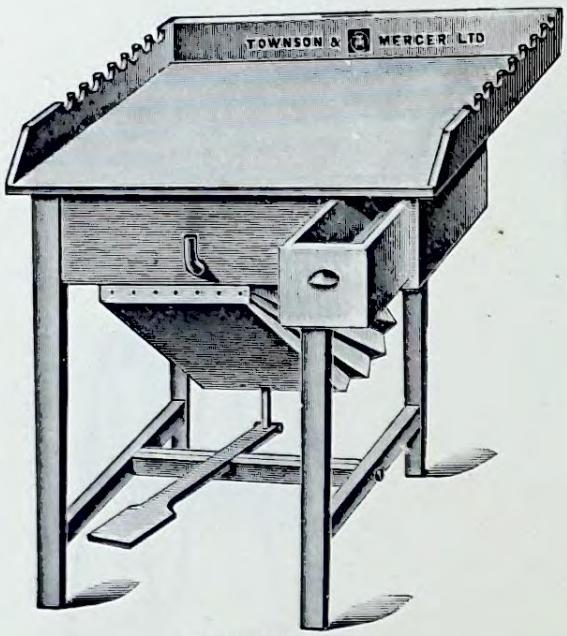
Specification

Made from enamelled steel tubing and best mild strip steel, exceptionally strong in construction, with seat so dished as to give the maximum degree of comfort. Seat and Backrest are padded and upholstered in Rexine Leather Cloth. Seat is 15 in. long and 11 in. wide, Backrest 5 in. wide **£1 10 0**

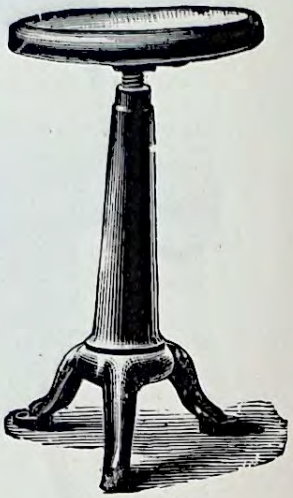
***8028** Ditto, cheaper model, with strong Fibre Seat and Back (not upholstered)... ... **1 6 0**

***8029 FOLDING CHAIR**

Frame made from enamelled best mild strip steel, exceptionally strong in construction. Seat and Backrest in Polished Plywood. Height of seat 18 in., weight 13 lb. **£0 12 6**



8030–8031



8032

*8030 **Blowpipe Table,** suitable for Glass Blowing or other blowpipe work, with double-action leather Bellows, Woodwork Stained and Polished, top covered with Uralite. Size of top approximately 28 × 24 in. £5 0 0

*8031 Ditto, fitted with larger Bellows and Drawer at side for Tools, etc. Size of top, 28 × 28 in. Other Patterns made to order on receipt of particulars 6 5 0
For Blowpipes for use with above, see Nos. 8311-8316.

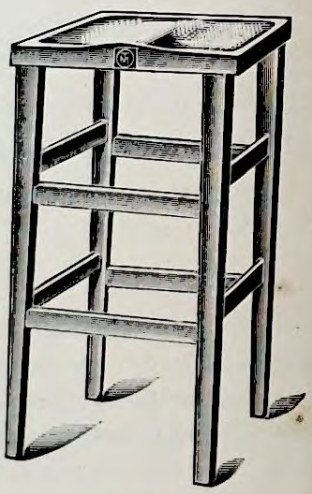
*8032 **Bench Stool,** with Adjustable Seat and Cast Iron Stand 1 0 0



8033



8034



8035

*8033	**Laboratory Stools,** Elm Seats, with Turned Legs and Rails. ...	Height 24	27	30 in.
		10/6	**12/6**	**14/0** each
*8034	,, ,, Polished Beech, with shaped top... ...	...Height 24	27	30 in.
		22/6	**25/0**	**28/0** each
*8035	,, ,, ,, ,, Any height up to 30 in.			**£1 8 6**

Other Patterns supplied to order on receipt of particulars.

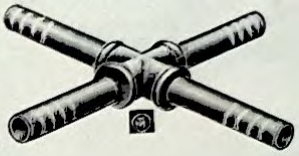
Gas Taps, etc., for Benches



8036



8037



8038



8039

*8036	**Connecting Tube, Brass,**			3-way, without taps	...	...	...	...	each	£0	1	6
*8037	,,	,,	,,	with two taps	...	...	...	...	,,	0	4	6
*8038	,,	,,	,,	4-way, without taps	...	...	...	...	,,	0	2	6
*8039	,,	,,	,,	with three taps	...	...	...	...	,,	0	5	6



8040



8041



8042



8043



8044



8045



8046



8047



8048



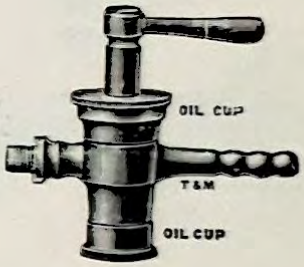
8049



8050



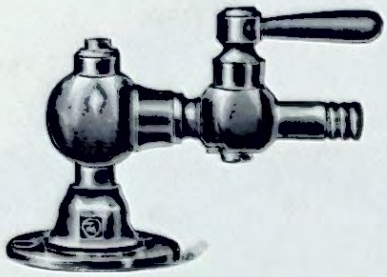
8051



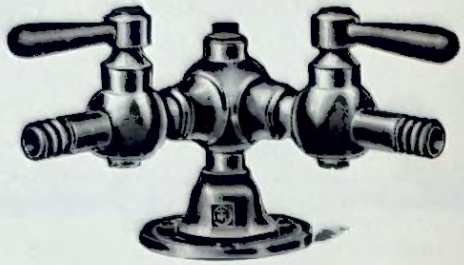
8053-4

LABORATORY BENCH TAPS

*8040	**Gas Distributor,**			Black Bronze without Tap	...	...	...	...	...	...	£0	2	6
*8041	,,	,,	1	Tap, mounted on Foot to screw to Bench				...	...	...	0	3	6
*8042	,,	,,	2	Taps, ,, ,, ,,				...	...	...	0	5	0
*8043	,,	,,	3	,, ,, ,, ,,				...	...	...	0	7	0
*8044	,,	,,	4	,, ,, ,, ,,				...	...	...	0	8	6
*8045	,,	,,	1	Tap, as above, but with Lever Handle				...	...	...	0	3	6
*8046	,,	,,	2	Taps, ,, ,, ,,				...	...	...	0	5	3
*8047	,,	,,	3	,, ,, ,, ,,				...	...	...	0	7	6
*8048	,,	,,	4	,, ,, ,, ,,				...	...	...	0	9	6
*8049	,,	,,	1	Tap, to screw direct into Gas Barrel				...	...	...	0	1	9
*8050	,,	,,	2	Taps ,, ,, ,,				...	...	...	0	4	6
*8051	,,	,,	1	Tap, as above, but with Lever Handle				...	...	...	0	2	0
*8052	,,	,,	2	Taps, ,, ,, ,,				...	...	...	0	5	6
*8053	**Vacuum Tap,** Brass, designed by Dr. Silberrad, ⅛-in. bore							...	...	...	0	15	0
*8054	Ditto, ditto, ¼-in. bore, as supplied to Research Laboratory, Woolwich							...	...	...	1	2	6



8056



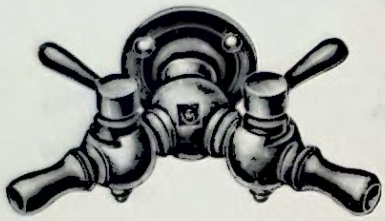
8057

Gas Taps, large size, with Lever Handles, black bronzed, with base to screw to bench, for use with Combustion Furnaces, etc.

		Sizes	¼ in. inlet × ¼ in. bore	⅜ in. inlet × ⅜ in. bore	½ in. inlet × ½ in. bore
*8056	Single Way		8/0	10/0	12/6
*8057	Double Way		11/6	16/6	21/0



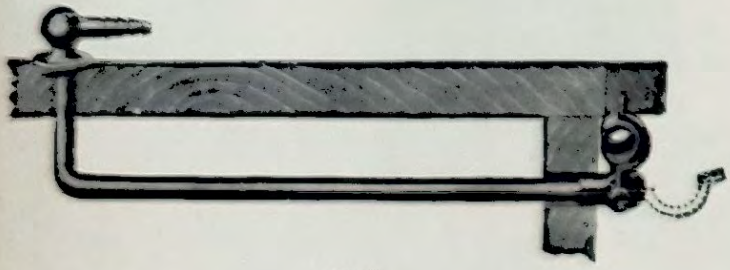
8058



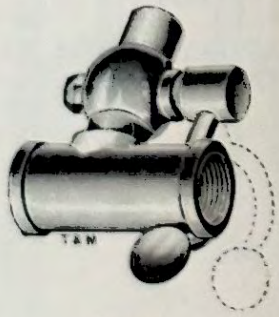
8059

Gas Taps, with Lever Handles, black bronzed, with wall plate for use with Combustion Furnaces, etc.

		Sizes	⅜ in. inlet × ¼ in. bore	½ in. inlet × ⅜ in. bore	¾ in. inlet × ½ in. bore
*8058	Single Tap		5/6	7/6	9/-
*8059	Double Way Tap ...		10/6	15/-	18/-



8060



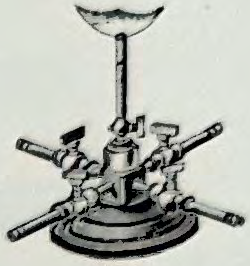
8060

*8060 **Gas Tap,** improved form, for fixing under ledge of bench to control gas supply.

For ⅜ × ⅜ in. **5/6** ½ × ½ in. gas pipe. **6/0** each.



8063



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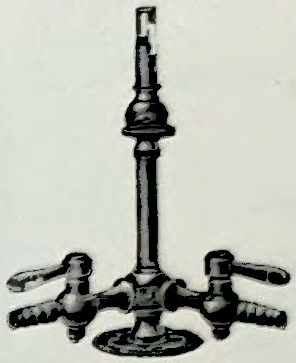
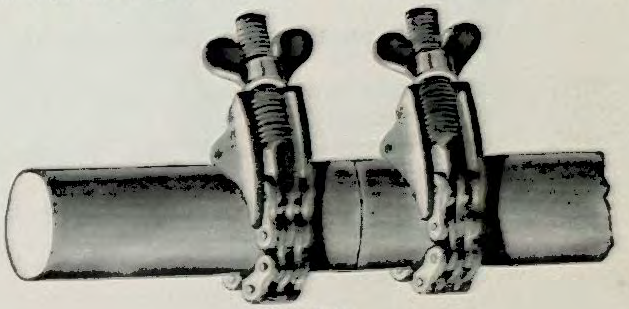
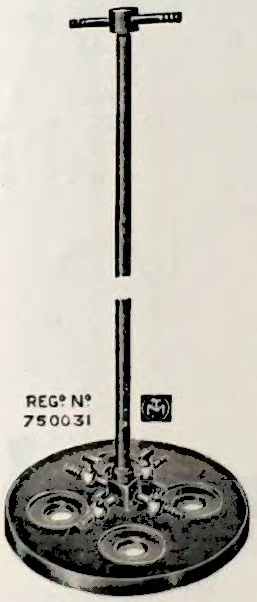


8065

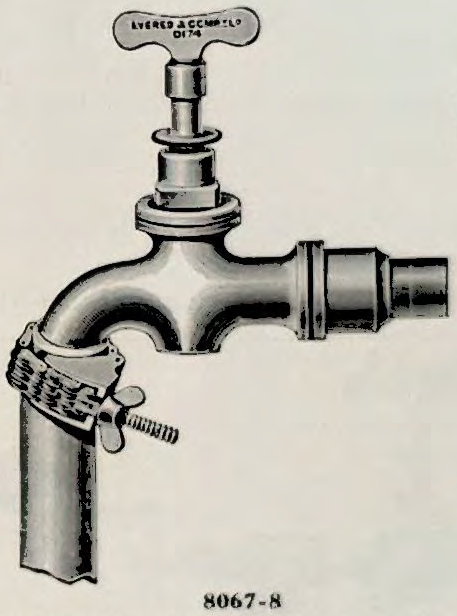
*8062	**Gas Distributor,** with 2 Taps and one Leading Tube	£0	6	0
*8063	,, ,, ,, 3 ,, ,, ,, ,, ...	0	8	3
*8064	,, ,, ,, 4 ,, ,, Bench Light	0	14	0
*8065	,, ,, ,, 2 Lever Handle Taps and Bench Light, to screw to Bench	0	11	0



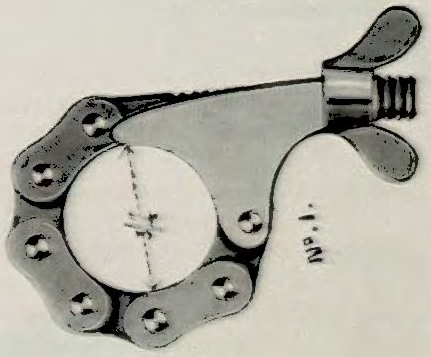
8067-8



8066



8067-8



8067-8

*8066 **Improved Gas Distribution Apparatus,** designed by H. S. White, Esq. Consists of heavy iron base carrying four stopcocks and having four circular recesses intended to hold the bases of Bunsen burners when not in use. The gas is fed to the base by a vertical tube about four feet long, ensuring that rubber tube is clear of the bench. Particularly useful for temporary, portable or similar benches ... each, net £1 7 6

"Tourniquet" Hose Fixing. This hose connector cannot be pulled off nose of tap when fixed. Can be used on either round or oval nosed taps, by simply slipping the Hose over nose of tap, and applying the "Tourniquet" Fastener. A few turns of the thumb-screw will fix the Hose so firmly that it is impossible to remove it until the thumb-screw is loosened.

*8067	Size for ½-in. and ⅝-in. Hose	each	0	2	0
*8068	,, ⅝-in. and ¾-in. ,, ...	,,	0	2	6

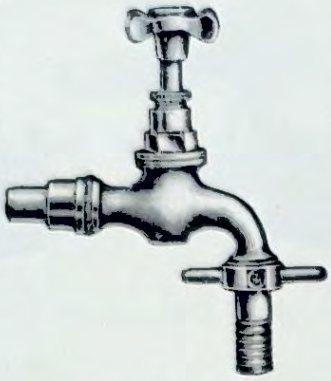
Water Taps



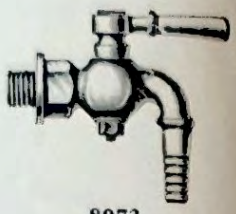
8070



8071



8072



8073



8074

Water Taps, Gun-Metal, with long Bib, and Corrugated Nozzle for India-rubber Tubing.

		¼	⅜	½	¾	in.
*8070	With Screw-down Valve	5/0	5/6	6/9		each
*8071	With Capstan Head Valve	5/9	6/3	7/6	11/3	,,
*8072	With Corrugated Nozzle and Coupling for India Rubber Tubing		7/6	8/6	12/6	,,

*8073	**Water Taps,** Gun-Metal, with Bib, ¼ in. bore, Corrugated, for India-rubber Tubing	each	£0	5 6
*8074	Ditto, ditto, with Straight Ends	,,	0	4 6
*8075	Ditto, ditto, with Side Angle Nozzle	,,	0	5 6

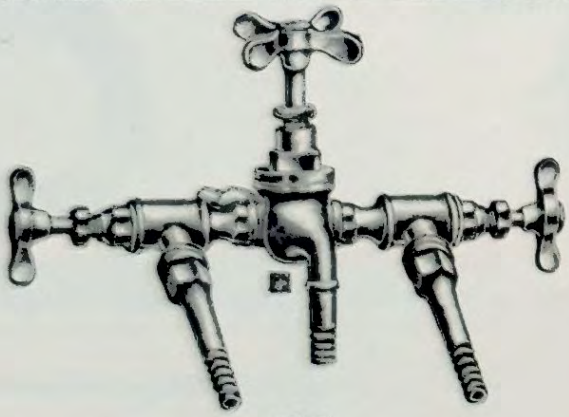
Any of the Water Taps illustrated can be supplied Chromium Plated (Prices on application).



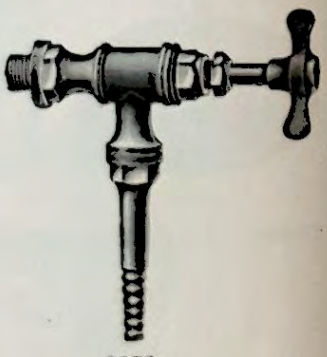
8075



8076

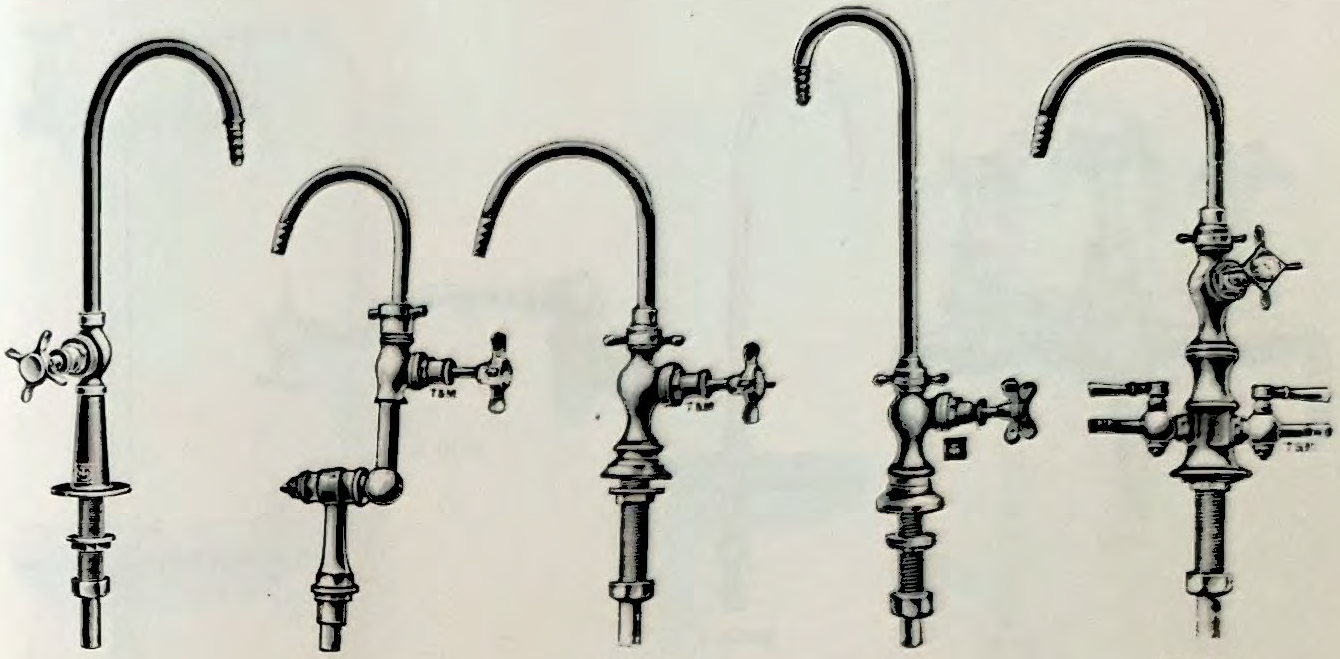


8078

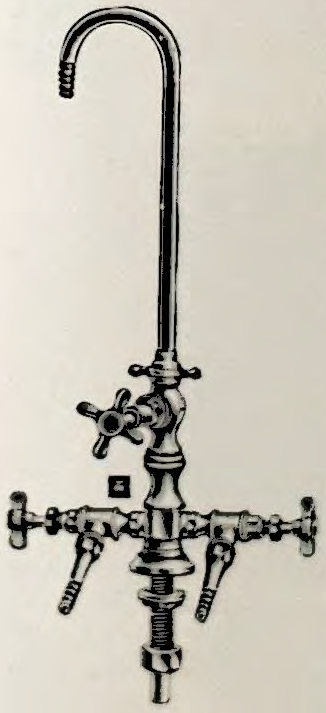


8079

*8076	**Water Taps,** Gun-Metal, with Long Bib, Capstan Head Screw-down Valve, two Lever Stopcocks with bent Bibs, for Pumps, Aspirators, etc.	£0 19 0
*8077	Ditto, as above, with Straight Lever Stopcocks at side	0 19 0
*8078	Ditto, Gun-Metal, ⅜ in. bore, with Screw-down Valves, Capstan Heads, with 2 side Taps, ¼ in. bore, for connecting to Rubber Tubing	0 19 6
*8079	Ditto, Gun-Metal, with Screw-down Valve, ¼ in bore, as fitted to No. 8078 ...	0 5 9

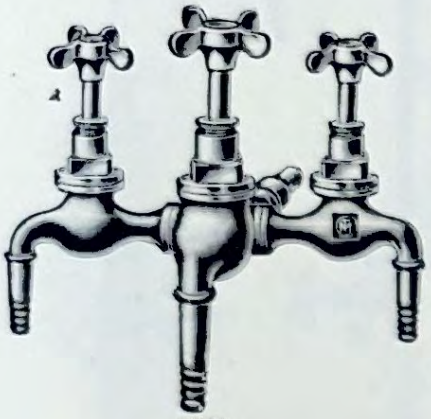


8081 8082 8083 8084 8085-6

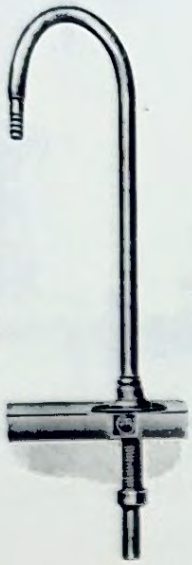


8087-8

*8081	**Water Taps,** Gun Metal, fitted with Swan Neck, in ½-in. Copper Tube, with Cap and Lining for ½-in. Lead Pipe. Height from base to nose 9 in. ... ... each	£0 18 6
*8082	**Water Taps,** Gun Metal, with Screw-down Valve, Swan Neck, and Swivel in ½-in. Copper Tube to fold down, for Lecture Tables. Height from hexagon shoulder to nose, 9 in.	1 2 0
*8083	**Water Taps,** Gun Metal, with Screw-down Valve, Swan Neck, in ½-in. Copper Tube, and long Screws, with Nut and Lining to fix to Bench. Height from base to nose, 7 in.	1 0 0
*8084	**Water Taps,** Gun Metal, ½-in., with Screw-down Valve, long Swan Neck and long Screws, with Nut and Lining to fix to Bench. Height from base to nose, 13 in. ...	1 5 0
*8085	**Water Taps,** Gun Metal, ½ in., with Screw-down Valve, Swan Neck, and 2 Side Taps, long Screws with Nut and Lining to fix to Bench. Height from base to nose, 11 in.	1 16 0
*8086	**Water Taps,** ditto, as above, but with Bib Taps at side. Height from base to nose, 11 in.	2 0 0
*8087	**Water Taps,** Gun Metal, with Screw-down Valve, long Swan Neck and 2 Side Screw-down Taps, long Screws, with Nut and Lining to fix to Bench. Height from base to nose 11 in.	1 18 6
*8088	**Water Taps,** ditto, as No. 8087. Height from base to nose, 13 in.	2 2 0



8091



8092-4

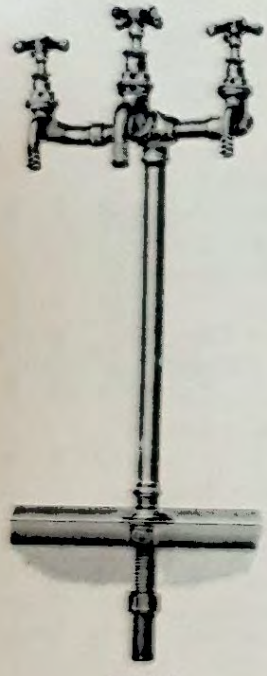


8095

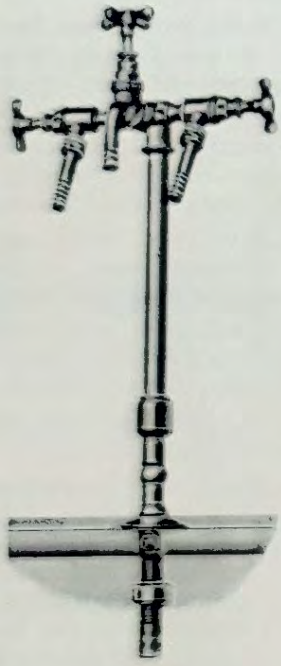


8096

*8091	**Water Taps,** High Pressure, Screw-down Bib Valve, with Capstan Head, Shank screwed for ⅜ in., Iron, fitted with ½ in. Screw-down Side Taps	£0	18 6
*8092	**Water Bends** for front controlled taps, Polished Gunmetal with Copper Swan-neck, back, nut and union. Height from bench to nozzle ... ... 4 in. ...	0	6 9
*8093	Ditto ditto ... ... 7 in. ...	0	9 0
*8094	Ditto ditto ... ... 9 in. ...	0	10 0

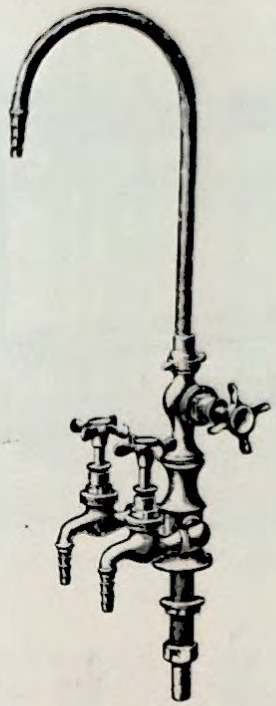


8097-8



8099

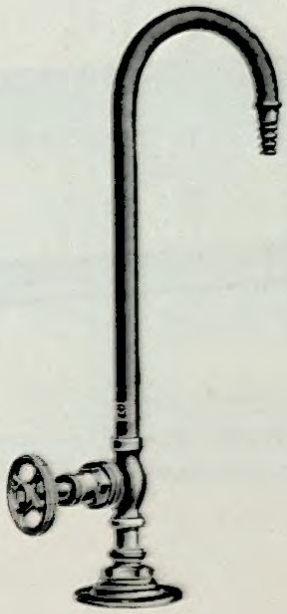
*8095	**Water Taps,** for photographic use; can be used either as a spray or as a jet by reversing the end nozzle. On turning the bracket back to the wall back the supply of water is automatically cut off. Brass Oxidised	1	1 0
*8096	**Water Standard,** Gunmetal ½ in. Copper tube with two Screw-down Taps, ½ in. bore taps 7 in. apart. Height from bench to nozzle of taps, 12 in.	1	12 0
*8097	**Water Standard,** Gunmetal ½ in. Copper tube with ½ in. bore tap and two Side Taps, ½ in. bore, 7 in. apart. Height from bench to nozzle of tap, 13 in.	2	2 0
*8098	Ditto, ditto as No. 8097, but with two ½ in. bore Side Taps ...	1	16 0
*8099	**Water Standard,** Gunmetal, with ½ in. bore Tap and two ½ in. bore Side Taps. Height from bench to nozzle of tap, 12 in.	1	15 0



8101



8102

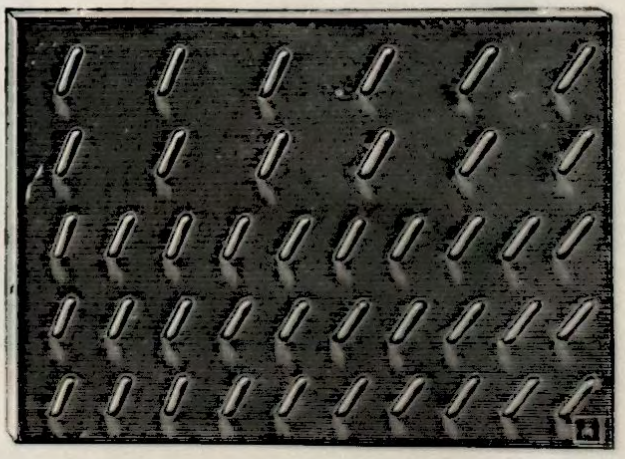


8103

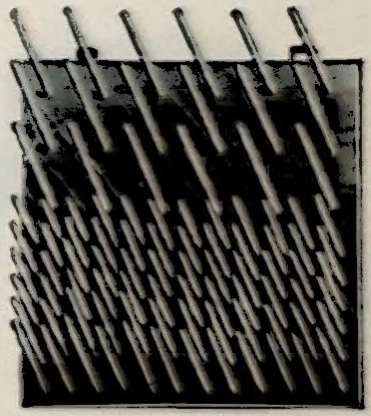
*8101 **Water Taps,** Gun Metal, Three-way Standard Fitting, Screw-down Taps, with Swan Neck, in strong ½-in. Copper Tube, Side Taps ½ in. Height from base to nose, 16 in. **£2 6 0**

*8102 **Water Tap Standard,** with ¾-in. strong Copper Tube, with ¾-in. Iron Female Connection, suitable for attaching any Tap with ¾-in. Iron Shank, as Nos. 8071, 8076, etc. **0 15 0**

*8103 **Water Tap,** Gun Metal, Standard Fitting, with Swan Neck, in ¾-in. strong Copper Tube, ½-in. Iron Shank. Height from base to nose, 12 in. **1 4 0**



8104-5

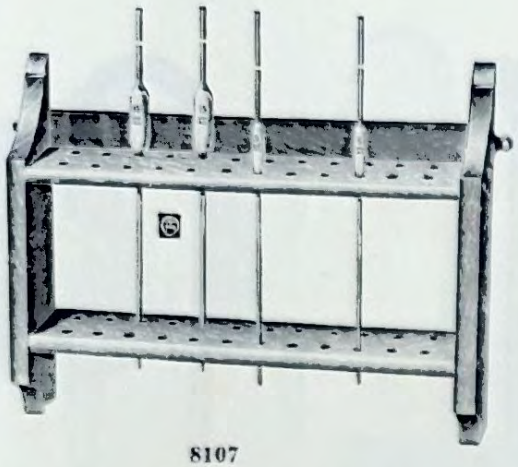


8106

*8104 **Draining Rack,** for Test Tubes or Bottles, of Teak, 1 in. thick, with 42 Pegs and fitted with Brass Plates, to hang on wall, size 24×16 in. ... ... each **£0 18 6**

*8105 Ditto, ditto, 30×24 in. **1 5 0**

*8106 Ditto, cheaper quality, of hard Whitewood, 16×16 in., with 18 large and 72 small pegs **0 14 6**



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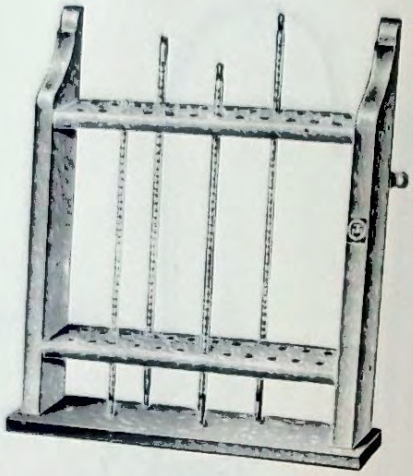


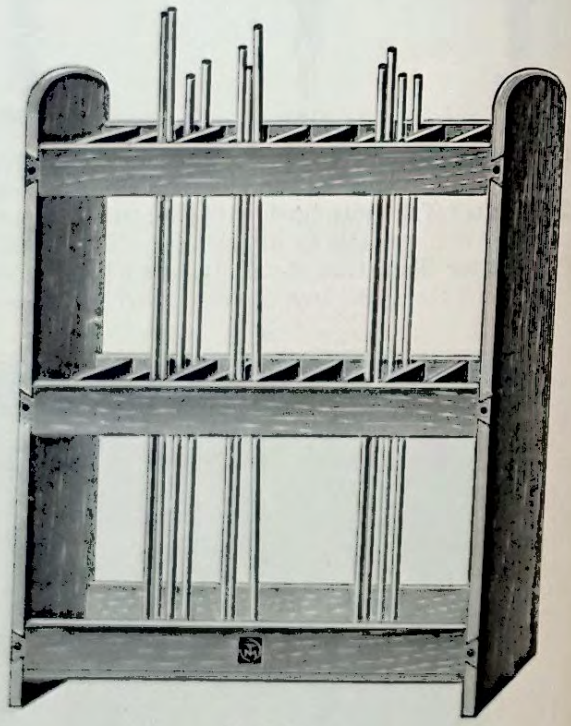
8108

*8107 **Pipette Rack,** of Teak, to fix to wall, 18 in. long, to hold 24 Pipettes £0 8 0

*8108 **Thermometer Rack,** of Teak, to fix to wall, 15 in. long, to hold 24 Thermometers... 0 7 0



8109



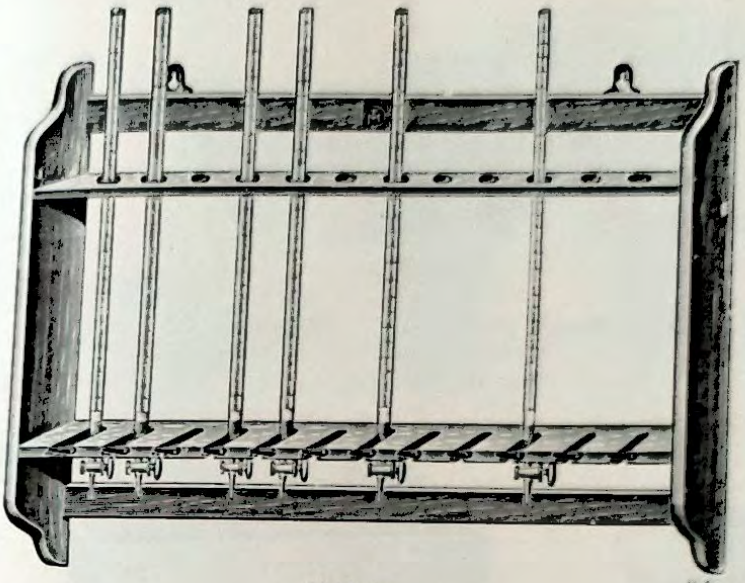
8110-11

*8109 **Sheet Iron Rack,** for suspending India-rubber Tubing to prevent same from kinking £0 8 3

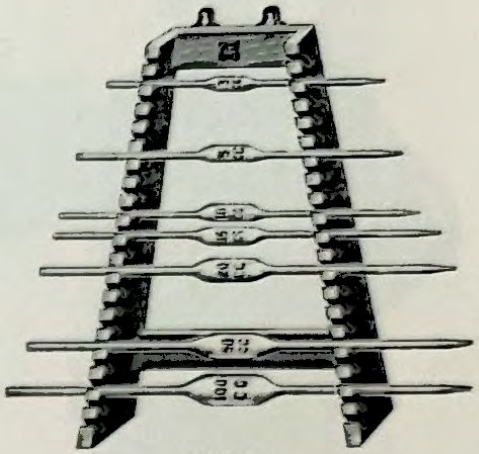
*8110 **Glass Tubing Rack,** made of well seasoned Teak, fitted with ten divisions. Height 39 in., width 30 in., back to front 6 in. ... ... each 1 8 6

*8111 Ditto, ditto, made of Varnished Pine. Cheaper make ... ... ,, 0 15 0

We shall be pleased to quote for any other sizes or other design on receipt of particulars.

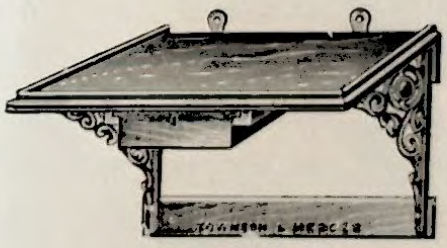


8115-6



8117-8

*8115	**Burette Rack,** made of well seasoned Teak to hold twelve Burettes, fitted with Brass Plates for hanging to wall ... ... each	£0	12	6
*8116	Ditto, ditto, as above, to hold eighteen Burettes ... ... ,,	0	16	6
*8117	**Burette or Pipette Rack,** made of well seasoned Teak, to hold twelve Burettes or Pipettes and fitted with brass plates for hanging on wall ... ... each	0	8	0
*8118	Ditto, ditto, as No. 8117, to hold twenty Burettes or Pipettes ... ... ,,	0	12	0



8119-20



8121

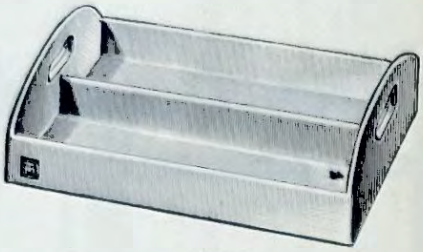
*8119	**Balance Bracket,** made of well seasoned Teak, ornamental Iron Brackets, fitted with Drawer, Lock and Key, and brass plates for fixing to wall, suitable for Balances carrying 100 or 250 grammes. 24×14 in. ... ... each	£1	10	0
*8120	Ditto, ditto, as No. 8119, but without the Drawer ... ... ,,	1	4	0

We shall be pleased to quote for any other sizes of above or any other design on receipt of particulars.

*8121	**Brush,** suitable for cleaning sinks, etc. ... ... each	0	0	9



8129-30



8123

8123 **Bench Trays,** White Stoneware, size 8×5¼×1½ in., for holding six Acid Bottles, 8 oz. capacity ... **£0 13 6**



8124



8125-7

(F) **8124** **Bench Trays,** White Porcelain, for Acid Bottles.

7	8	10	12½	15	cm. diam.
6d.	**8d.**	**11d.**	**1/2**	**1/7**	each
5/6	**7/0**	**10/0**	**12/0**	**16/0**	per doz.

8125 **Teak Trays,** well-finished joints, dovetailed, for removing apparatus from store room to laboratory, etc., size 20×14×3 in. each **£0 12 6**

8126 Ditto, ditto, size 24×16×3 in. ,, **0 16 0**

8127 Ditto, ditto, ,, 30×18×3 in. ,, **0 19 0**

8128 **Squeegees,** for collecting spilt mercury from Benches, etc. each, **1/0** and **0 2 0**

8129 **Laboratory Overall Coats,** Men's, long White Drill ... each nett, **12/6** and **0 14 6**

8130 Ditto, ditto, long Khaki Drill ... ... ,, nett, **12/0** and **0 14 6**

The above Coats supplied in the following sizes all one price—

Chest	34	36	38	40	42	in.
Waist	32	34	36	38	40	in.

8131 **Laboratory Overall Coats,** Ladies, long White Drill with Belt. Bust 34–40 in. each nett, **11/6**, **12/6** and **0 15 0**

8133 **Laboratory Aprons,** black linen ... ... each nett **0 3 6**

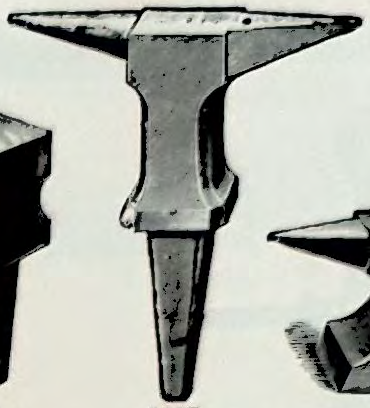
8134 **Sponges,** large size for Laboratory use ... ... **2 6** to **5 0** each

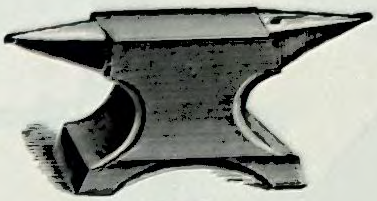
(F) Foreign Manufacture.

Tools


8135


8136


8137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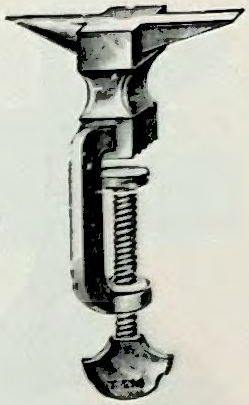

8138

8135 Anvil, Hardened Steel, for Blowpipe Experiments.

$1\frac{1}{2}\times1\frac{1}{2}\times\frac{1}{2}$	$2\times2\times\frac{1}{2}$	$2\frac{1}{2}\times2\frac{1}{2}\times\frac{1}{2}$	$2\times2\times1$	$4\times4\times1$	in.
2/6	**3/0**	**3/6**	**4/6**	**10/6**	each

8136 Ditto, Assayers', with fang ... ... Face 1×1 $1\frac{1}{2}\times1\frac{1}{2}$ 2×2 in.

5/9 **7/0** **10/6** each

8137 **Anvil or Beck Iron,** length about 5 inches ... ... each **£0 7 6**

8138 Ditto, **Bench,** with Clamp, to screw to table, length $3\frac{1}{2}$ in. **0 7 6**

8139 **Anvils,** small, weight ... ... 1 2 lbs.

6/6 **9/6** each


8140


8141


8142


8143


8144

8140 **Carpenter's Squares,** Rosewood ... ... 6 $7\frac{1}{2}$ 9 in.

2/6 **3/6** **4/6** each

8141 **Dotting or Centre Punches,** length 4 inches ... ... each **£0 0 9**

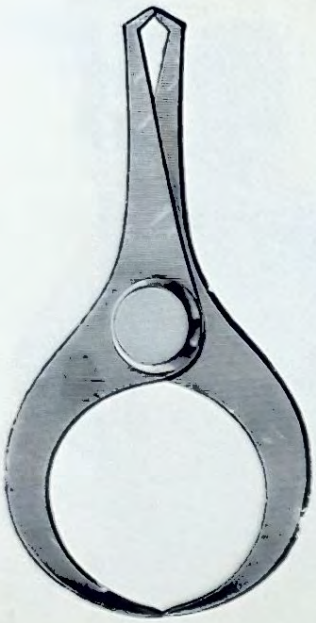
8142 **Brad Awls,** with Round Polished Handles ... ... " **0 0 6**

Length 3 4 5 in.

(F) **8143** **Callipers,** with curved arms ... ... **10d.** **1/0** **1/3** each

(F) **8144** **Callipers,** with straight arms ... ... **10d.** **1/0** **1/3** "

(F) Foreign manufacture.



8145



8146



8147



8149



8150

(F) **8145** **Callipers,** for inside and outside measurements, 3½ in. **£0 1 4**

8146 Ditto, Spring Dividers, 6 in. **£0 2 3**

Length 12 16 in.

8147 **Case Openers,** Forged Steel ... ... **5/0** **6/0** each

12 × ½ 15 × ⅝

8148 **Case Openers,** Cheaper Quality ... ... **2/3** **3/0** each

¼ ⅜ ½ ¾ 1 inch blade

8149 **Chisels,** in Ash Handles ... ... **1/3** **1/5** **1/6** **1/8** **2/0** each



8151



8152



8153

8150 **Chisels,** for cutting Metals.

8 × ¾ 10 × ⅞ 10 × 1 in. blade

1/6 **2/3** **2/9** each

8151 **Combination Pliers.** Solid Steel, Round Joint, Raised Side Cutter, Burner Hole, Cutters in Joint, Turnscrew ends.

6 7

Fine Black Finish **1/9** **2/0** each

Length 5 6 in.

8152 **Cutting Nippers** ... **2/8** **3/0** each

8153 **Pipe Wrench Pliers.**

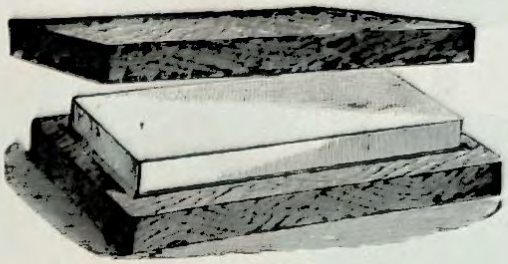
Length 6 7 9 12 in.

1/6 **2/0** **2/9** **4/3** each

(F) Foreign manufacture.



8155



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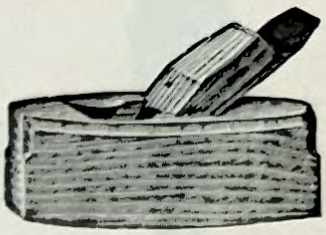

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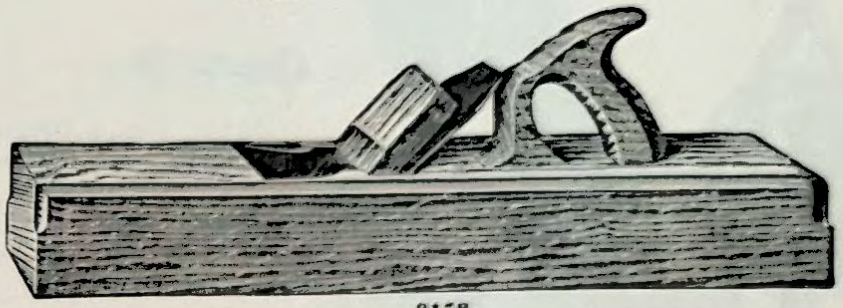


8158

								4	4½	5		6 in.	
8155	**Mallets,** of Selected Hard Beechwood	...	...	...	...	...		2/6	3/0	3/6		4/6	each
								Length	4	6		8 in.	
8156	**Oilstones,** Best Washita, in Case	...	...	...	...	...	...	...	3/0	5/0		6/6	each
8157	**Planes, Smoothing,** Double Iron, 2¼ in., Best Quality	...	...	...	...	...		...	...	...	each	£0 12	6
8158	Ditto, **Jack,** Double Iron, 2¼ in., about 17 in. long, Best Quality	...	...	...	...	...		...	...	...	„	0 15	9



8159



8160



8161



8162



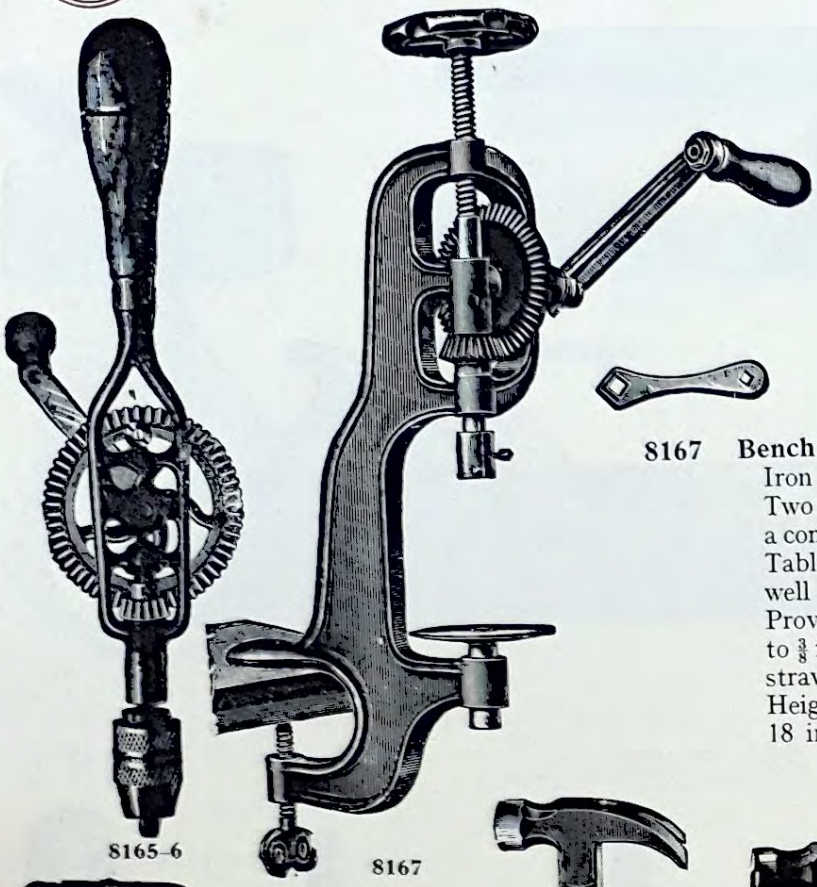
8163

												Length	6	7½	in.
8159	**Pincers,** with Claw Handle	...	...	...	...	...	...	...	...	...	...		1/8	2/4	each
8160	**Pliers,** Cutting	...	...	...	...	...	...	...	...	...	...	„	5	6	in.
8161	„ Flat Nosed	...	...	...	...	...	...	...	...	...	...		2/0	2/3	each
8162	„ Round Nosed	...	...	...	...	...	...	...	...	...	...		1/6	1/9	„
													1/6	1/9	„
8163	„ Gas	...	...	...	...	...	...	...	...	...	...	„	6	8	in.
													2/3	3/0	each

(F) **8165 Drill,** Miller's Fall, improved pattern, best make, with Drills in Wood Handle **18/6**

(F) **8166** Ditto, cheaper quality, with Drills in Wood Handle, each, **5/6, 7/6, 9/6**

8167 Bench Drilling Machine. Solid Iron Frame, Cut Gears, and Two Speeds, quickly changed by a convenient shifter. Adjustable Table, Steel Feed Screw, all well made and nicely fitted. Provided with 3-jaw chuck, 0 to $\frac{3}{8}$ in., and 8 fluted drills nicely straw tempered, sizes $\frac{1}{16}$ to $\frac{11}{64}$ in. Height from table to feed wheel, 18 in. **£2 12 6**



8165–6 8167



8168



8169



8170



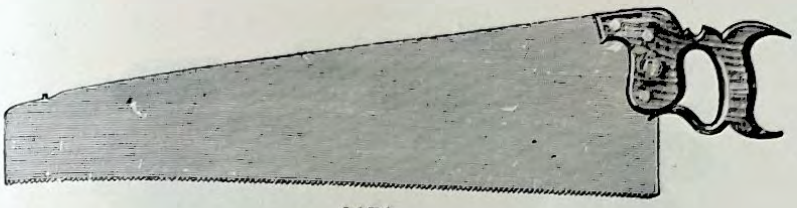
8171



8172

		Diameter	$\frac{1}{16}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	in.		
8168	**Gimlets**		0/6	0/7	0/9	1/0	each		
		Nos.	1	2	3				
8169	**Hammers,** with Ash Handles		1/9	2/0	2/3	each			
8170	**Hammers, Canterbury,** Oval Handles		2/3	2/9	3/0	each			
8171	**Knife, Cork Cutting**		...	...	...	each	£0	0	8
			6	7	8	10	in.		
8172	**Shears,** for Cutting Metal		2/7	2/9	3/0	4/0	each		

(F) Foreign manufacture.



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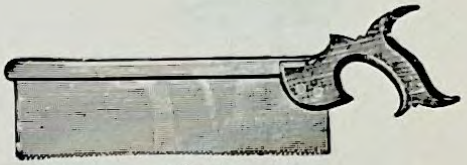

8175

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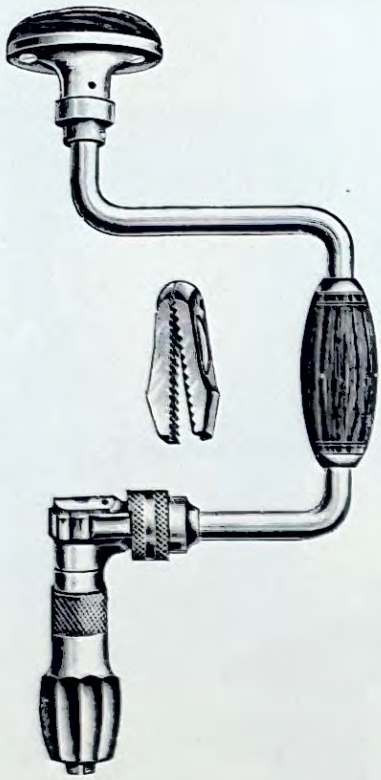
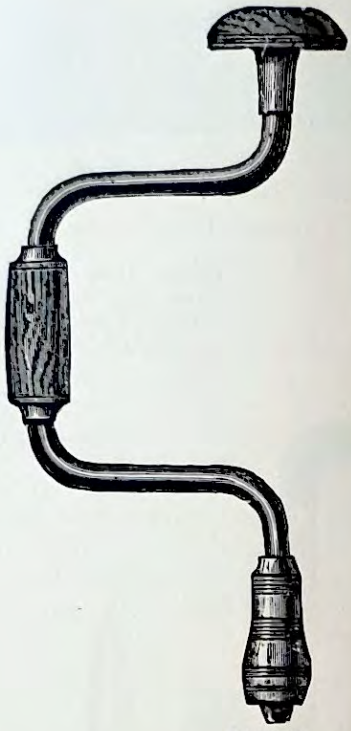


8185/1



8186



8185/2

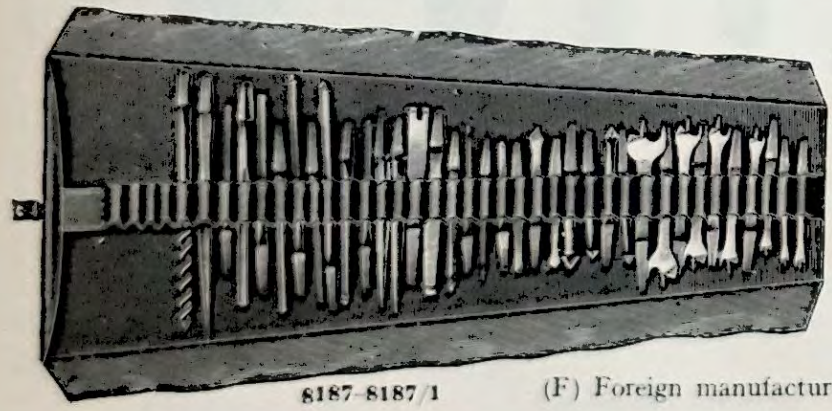
8185/1 **Improved Ratchet Braces,** best quality and finish throughout, Lignum Head, with Ball Bearings, Rosewood Handle, Steel Sweep and Jaws, registered Grip, Alligator Jaws, Nickel-plated finish

8	10	in. sweep
18/6	**19/6**	

8185/2 **Brace,** Bright Steel, Ball Bearing Head, Teakwood Head and Handle, 10 in. sweep **£0 8 6**

(F) **8186** **Drills, Archimedian,** with Screw Chuck and 6 Drills, superior make.

		8	10	12	in.
		3/0	**3/6**	**4/0**	each
		$\frac{3}{8}$	$\frac{7}{16}$ $\frac{1}{2}$ $\frac{5}{8}$ $\frac{3}{4}$ $\frac{7}{8}$	1	in.
8186/1	Ditto, **Centre Bits**	**7d.**	**8d.** **9d.** **10d.** **10d.** **1/0**	**1/2**	each
8186/2	Ditto, **Countersinking Bits**	**9d.**	**9d.** **10d.** **1/2** — —	—	,,
8186/3	Ditto, **Turnscrew Bits**			each	**£0 0 10**



8187-8187/1

Brace Bits in Sets. These Sets do not contain a number of useless Bits, but are made up of patterns and sizes of every day requirements.

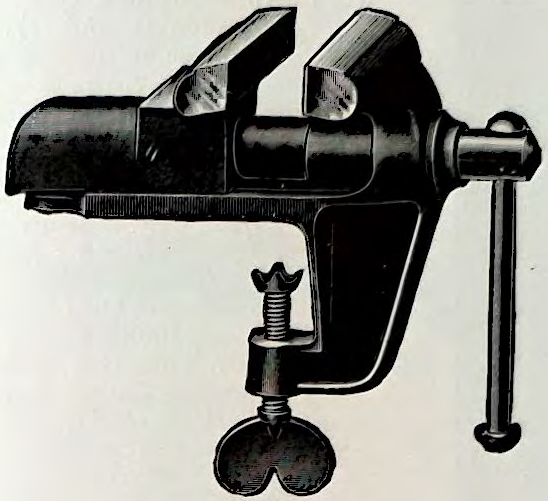
8187 Black Bits, assorted, sharpened and bright inside.

12	18	24	36	
9/6	**14/0**	**18/9**	**31/0**	per set

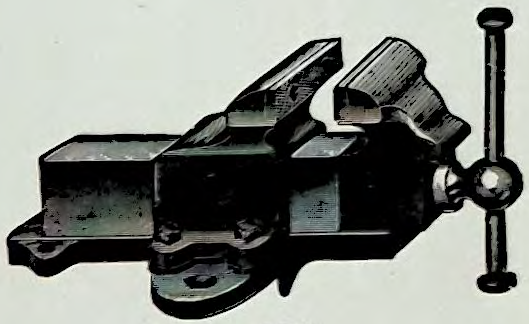
8187/1 Strong Leather Rolls for above Bits.

12	18	24	26
5/0	**6/0**	**7/0**	**9/0**

(F) Foreign manufacture.



8188

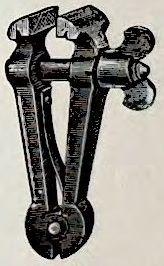


8189

(F) **8188**	**Vices,** Parallel, with Covered Screw and Steel Jaws ... Size about	2	2½	2¾		in.	
			4/0	**5/0**	**7/0**		each
8189	**Vices,** Steel Jaws, heavy make. Length of Jaws	2⅛	2½	3	3½	4	in.
		11/6	**12/6**	**15/6**	**22/6**	**30/0**	each



8190–1



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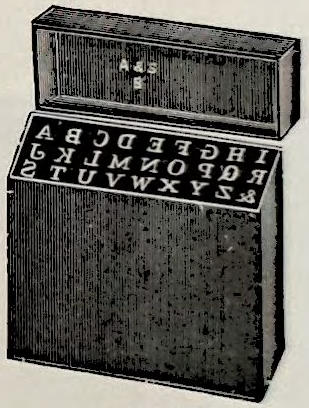
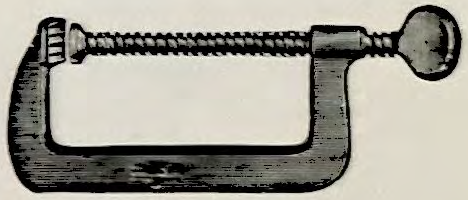


8193–4



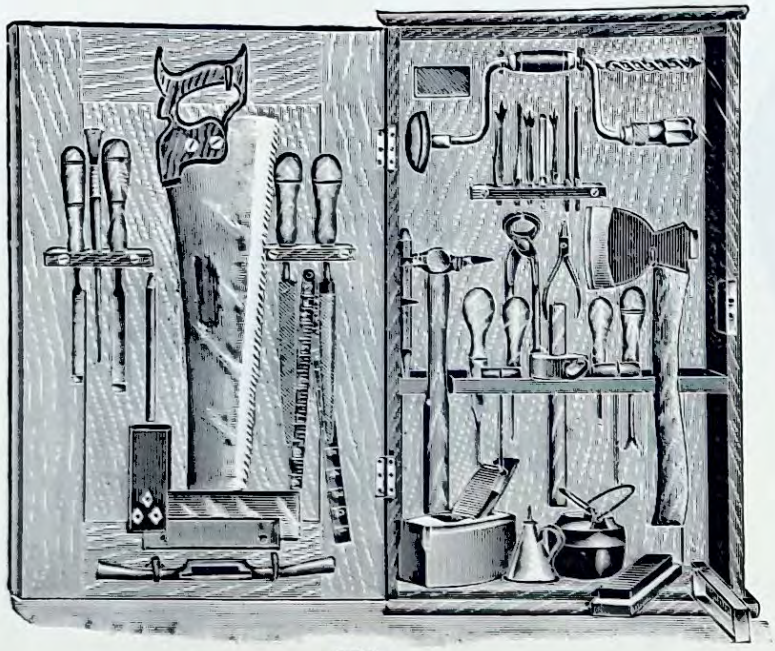
8195

8190	**Vices,** Watchmakers', for hand use	each	**£0**	**3**	**6**				
8191	,, with Hollow Spindle, for holding Wires, etc.	,,	**0**	**3**	**6**				
8192	,, Watchmakers', to hold small articles, length 5 inches	,,	**0**	**3**	**6**				

Letter and Figure Punches, in Sets. Made from Best Quality Steel, carefully hardened and tempered, cut by expert men, and fully warranted.

	Sizes	⅛	3/16	¼	5/16	⅜	in.	
***8193**	For Metal or Wood Stamping, in Tin Cases. Figures	**5/6**	**6/9**	**7/6**	**9/6**	**11/6**	per set	
***8194**	,, ,, ,, ,, ,, Letters	**15/0**	**18/6**	**20/0**	**26/0**	**32/0**	,,	
(F) **8195**	**Cramp,** Malleable Iron, with Thumb Screw ... ... each	**3/-**	and	**0**	**4**	**0**		

(F) Foreign manufacture



8198

8198 Tool Cabinet, Oak, Polished, Dovetailed and Hand-made throughout, containing a set of thoroughly reliable and useful Tools of the best Quality, fitted with Lock and Key, etc., size 26½ × 17 × 5½ in., and contains 36 Tools, as follows:—

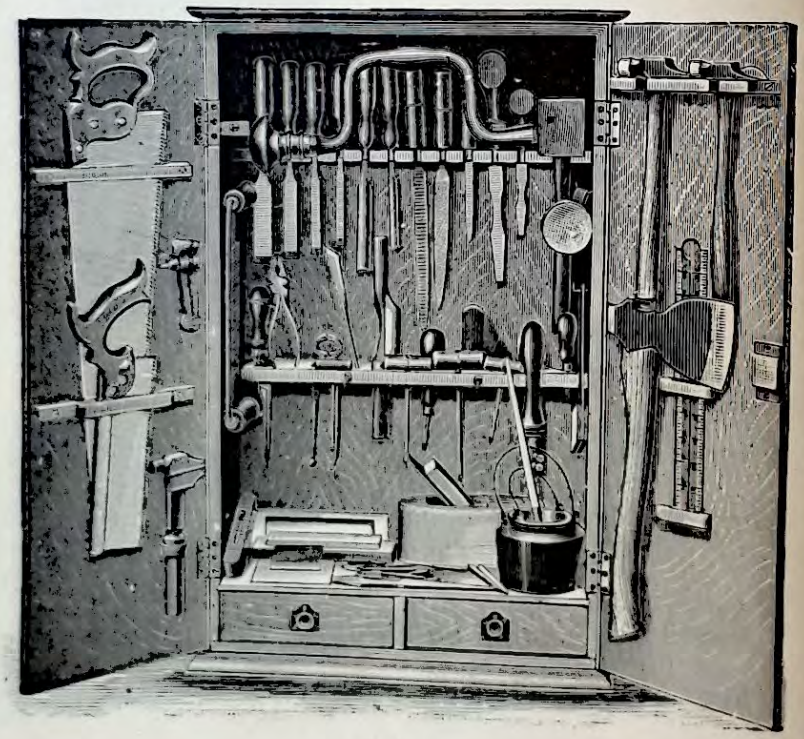
Hand Saw, Cast Steel, 18 in.
6 in. Rosewood Square.
Two-foot Rule.
Turnscrew, Oval Handle, 4 in.
Rasp, Handled, 7 in.
File, 7 in., Half Round.
Marking Gauge, Beechwood.
Steel Brace, 7 in.
Three Centre Bits.
One Shell Bit.
Two Prussian Bits.
One Auger Bit.
Flat Nose Pliers.
Tack Lifter.
Hammer.
Carpenter's Pencil.
Two Chisels, Beech Handles.
Brad Punch.
Smoothing Plane.
Oil Can.
Hatchet, Best Quality.
Oilstone in Case.
Two Bradawls.
Two Gimlets.
Scraper Blade.
Glue Pot.
Glue Brush.
Pincers.
Spokeshave.
Cold Chisel, 7 in.
Centre Punch.

Nett **£8 0 0**

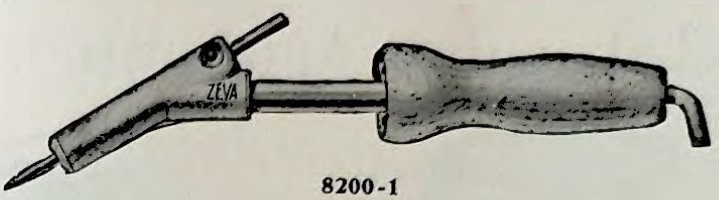
8199 Tool Chest, Polished Oak, 22 in. high, with Lock and Key, containing the following Tools:—

Two Hammers.
Hatchet.
Mallet.
Hand-Saw.
Pincers.
Pliers.
Two-foot Rule.
Square.
Spokeshave.
Plane.
Two Gimlets.
Two Bradawls.
Compasses.
Two Turnscrews.
Tack-Claw.
Cold Chisel.
Brad Punch.
Two Files.
Rasp.
Two Chisels.
Gouge.
Oil Stone.
Oil Can.
Glue Pot and Brush.
Nails, etc.

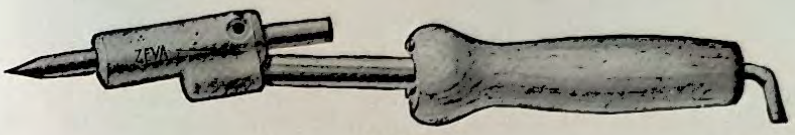
Nett **£9 10 0**



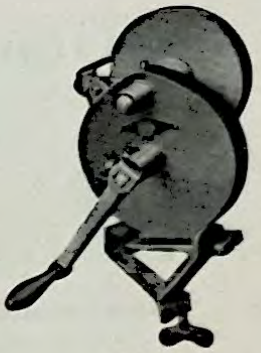
8199



8200-1



8202–3



8204

ELECTRIC SOLDERING IRONS

The Soldering Irons listed below are an entirely new range, which has been adopted on the grounds of complete reliability. They are unique in strength, balance, and efficiency. The construction is based on the principle that no oxidization can take place without oxygen, so the element is literally **cast in** to the aluminium housing.

They carry a six months' guarantee for eight hours work per day—subject to fair usage.

Being free from all electrical maintenance troubles, their first cost is quickly recovered, and they are recommended for all purposes where other Electric Soldering Irons have failed to stand up to the work. All types above the P.O. size are earthed, and fitted with 3-core flex. (Illustration of both types here.)

(F)	***8200**	Small size for instrumental work. Watts 50, weight 10 oz.	Type P ...	**20/0**	each
(F)	***8201**	Telegraph and light general type. Watts 145, weight 15 oz.	,, PO ...	**34/0**	,,
(F)	***8202**	Straight type for light general use. Watts 90, weight 15 oz.	,, PG ...	**34/0**	,,
(F)	***8203**	As above for sheet metal and general tinman's work. Watts 280, weight 2 lbs.	do. ...	**49/0**	,,

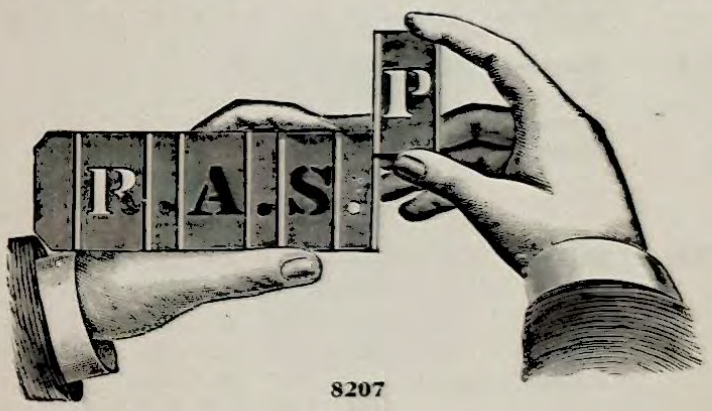
CARBORUNDUM HAND GRINDERS

These Machines, second only to the Niagara Grinders in construction and finish, are good, serviceable machines, well made and carefully assembled. The castings are of good grade of gray iron ; the gears are cast iron, machine cut. The grinders are finished in blue, and equipped with Carborundum Wheels and practical Tool Rests.

		Size of Wheel	4 × 1	5 × 1	6 × 1 in.
(F)	***8204**		**16/6**	**22/0**	**28/0** each



8205–6



8207

		Sizes	1	1¼	1½	2	2½ in.	
***8205**	**Stencils,** Stout Zinc, Alphabet A to Z		**3/9**	**5/9**	**6/0**	**7/6**	**9/6**	per set
***8206**	Figures only		**1/4**	**2/0**	**2/3**	**2/9**	**3/3**	,,
***8207**	Ditto, Brass interchangeable Locking, fitted in wood box with separate compartments, each set contains two each of all the letters except X Y Z, one each figure 1 to 9, two figures 0 and ten blanks, stops, etc.—total 70 pieces, including Ink and Brush.							

		Sizes	½	¾	1	1½	2 in.	
***8208**	**Stencil Brushes**	Price	**10/6**	**11/0**	**12/0**	**16/6**	**24/0**	Per set, complete each **1/0** and **£0 1 6**
***8209**	**Stencil Inks**				Per tin		Black **1/0** Red **2/0** Blue **2/0**	each

(F) Foreign manufacture.

General Laboratory Apparatus



8226–7



8226–9



8227

8220 **Asbestos Millboard,** for use on Hot Plate over Bunsen Burner, etc., instead of wire gauze, sand dishes, etc., $\frac{1}{8}$ in. thick, in sheets of about 40 in. square, per lb. **£0 1 4**

		4×4	5×5	6×6	9×9	12×12 in.	
8221	Ditto, cut into squares, $\frac{1}{8}$ in. thick ...	**2/0**	**3/0**	**4/0**	**8/0**	**12/0**	per doz.

8222 **Asbestos Paper** ... ... per lb. **£0 1 8**

8223 ,, ,, Thin ... ... ,, **0 2 3**

8224 ,, **Yarn,** $\frac{1}{8}$, $\frac{3}{16}$ or $\frac{1}{4}$ in. diameter ... ... ,, **0 3 6**

		3	5	
8225	,, **Tape**	**6/9**	**6/9**	cm. wide. per lb.

8226 **Sillax Laboratory Porcelain Basins** (British made). Sizes up to and including No. 5 glazed inside and out; other sizes unglazed on outside at base. Basins ordinary form with lip.

No.	000	00	0	1	2	3	4	5	6	6b	7	8	8a	9	
Diameter	61	75	82	86	92	100	110	122	150	170	190	207	225	265	mm.
Capacity ...	42	75	85	125	140	180	225	300	475	675	775	1200	1450	2300	c.c.
Per doz. ...	**5/9**	**6/6**	**7/9**	**8/6**	**12/3**	**13/6**	**20/0**	**25/3**	**31/6**	**43/6**	**45/0**	**75/0**	**83/0**	**90/0**	
Dozen rate for gross lots.	**5/6**	**6/3**	**7/3**	**8/0**	**11/9**	**13/0**	**19/0**	**24/0**	**30/0**	**41/6**	**43/0**	**72/0**	**79/0**	**86/0**	

(F) **8227** **Basins,** Porcelain, good quality, for students' use.

No.	000	00	0	1	2	3	4	5	6	7	8	
Diameter ...	60	70	80	85	95	105	110	120	150	180	210	mm.
Capacity approx.	35	50	75	95	115	160	225	270	380	650	1100	c.c.
	7d.	**7d.**	**8d.**	**9d.**	**1/0**	**1/2**	**1/6**	**1/10**	**3/0**	**3/8**	**5/3**	each
	6/3	**6/3**	**7/0**	**8/0**	**10/3**	**12/0**	**16/0**	**19/9**	**31/6**	**39/6**	**55/6**	per doz.

8228 **Basins,** Royal Worcester Porcelain, Nos. 00 to 5 glazed inside and out; Nos. 6 to 12 glazed inside and partially outside.

No.	000	00	0	1	2	3	4	5	6	7	8	
Diameter ...	60	75	82	86	92	100	110	122	150	190	207	mm.
Capacity approx.	42	60	85	125	140	180	225	300	475	775	1200	c.c.
	10d.	**1/0**	**1/2**	**1/6**	**1/9**	**2/1**	**2/4**	**2/10**	**3/10**	**5/7**	**6/10**	each
	9/0	**11/3**	**13/6**	**17/3**	**20/3**	**24/0**	**27/0**	**33/0**	**45/0**	**65/3**	**81/0**	per doz.

(F) **8229** **Basins,** State Berlin Porcelain, made at the Government works, glazed inside and out to No. 5, Nos. 6 to 12 glazed inside and partially inside.

Nos.	00	0	1	2	3	4	5	6	7	8	
Diameter... ...	75	82	86	92	100	110	122	150	190	207	mm.
Capacity approx.	60	85	125	140	180	225	300	475	775	1200	c.c.
	1/0	**1/2**	**1/6**	**1/9**	**2/1**	**2/4**	**2/10**	**3/10**	**5/3**	**6/9**	each
	11/3	**13/6**	**17/3**	**20/3**	**24/0**	**27/0**	**33/0**	**45/0**	**58/0**	**75/0**	per doz.

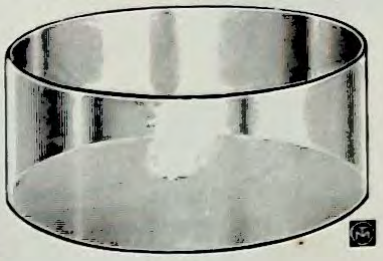
(F) Foreign manufacture.



8230



8231



8232

(F) **8230** **Basins,** Enamelled, Sheet Steel, Deep, with Lip.

Diameter	8	10	12	14	16	18	20	cm.
	1/0	**1/2**	**1/3**	**1/6**	**2/0**	**2/3**	**2/6**	each
(F) **8231** Ditto, with Lip and Handles ...	**1/2**	**1/4**	**1/6**	**1/10**	**2/2**	**2/4**	**2/8**	,,

(F) **8232** **Basins,** Kavalier's Bohemian Resistance Glass, with Flat Bottom and Polished Edges, without Spout (Crystallising Dishes).

Diameter	5	6	7	8	9	10	11	13	15	19	cm.
	6d.	**6d.**	**7d.**	**8d.**	**9d.**	**10d.**	**1/0**	**1/3**	**1/8**	**2/9**	each
	5/0	**5/6**	**6/0**	**7/0**	**8/0**	**9/0**	**10/0**	**13/6**	**17/0**	**30/0**	per doz.

(F) **8233** **Basins,** Bohemian Resistance Glass, with Flat Bottom and Polished Edges, with Spout.

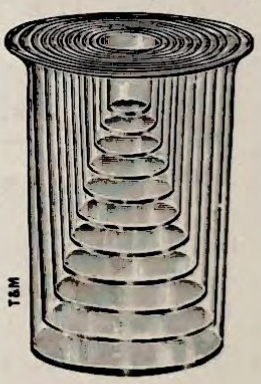
Diameter	5	6	7	8	9	10	11	13	15	19	cm.
	6d.	**7d.**	**8d.**	**9d.**	**11d.**	**1/0**	**1/3**	**1/5**	**1/11**	**3/0**	each
	5/3	**6/0**	**7/3**	**8/0**	**9/6**	**10/6**	**13/0**	**15/6**	**21/0**	**32/6**	per doz.

8234 **Covers** for Beakers, Gas Jars, etc., ground on one side—(Glass Circles or Plates).

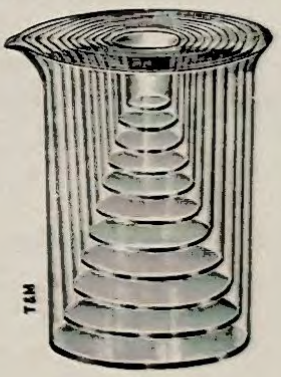
Diameter	2	2½	3	3½	4	4½	5	6	in.
	9d.	**11d.**	**1/1**	**1/4**	**1/8**	**2/0**	**2/6**	**4/0**	per doz.

(F) **8235** **Covers,** Concave (Clock Glasses), with plain edge.

Diameter	3	3½	4	4½	5	6	7	8	9	in.
	1/10	**2/4**	**2/9**	**3/6**	**5/0**	**6/0**	**10/6**	**12/6**	**16/6**	per doz.



8236



8237

(F) **8236** **Beakers,** Good Quality Resistance Glass, medium form.

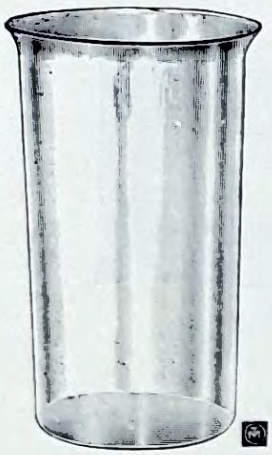
Approx. capacity	110	170	270	380	550	750	1000	1250	1750	c.c.
	5d.	**6d.**	**7d.**	**9d.**	**1/0**	**1/2**	**1/5**	**1/11**	**2/2**	each
	4/3	**5/0**	**6/6**	**8/0**	**10/6**	**13/0**	**15/6**	**20/3**	**24/0**	per doz.

(F) **8237** **Beakers,** Good Quality Resistance Glass, Tumbler form with Spout.

Approx. capacity	100	140	240	350	550	750	1000	c.c.
	5d.	**6d.**	**7d.**	**8d.**	**1/0**	**1/2**	**1/5**	each
	4/0	**5/0**	**6/0**	**7/6**	**10/6**	**13/0**	**15/6**	per doz.

For Schola Glass Beakers and Flasks, see page 65.

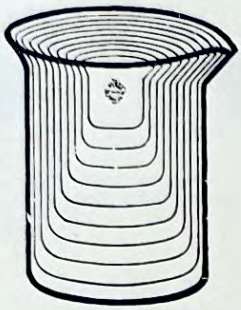
(F) Foreign manufacture.



8238–40



8239–41



8242



8243

8238 **Beakers,** British, without spout. Medium Form.

Approx. capacity	25	40	60	100	150	250	400	600	1000	c.c.
	5d.	**6d.**	**7d.**	**8d.**	**9d.**	**10d.**	**1/0**	**1/3**	**1/8**	each
	4/0	**5/0**	**6/0**	**6/6**	**7/0**	**9/0**	**11/0**	**14/0**	**18/0**	per doz.

8239 **Beakers,** British, Griffin Form, with Spout, made of Resistance Glass.

Approx. capacity	25	40	60	100	150	250	400	600	900	c.c.
	5d.	**6d.**	**7d.**	**8d.**	**9d.**	**10d.**	**1/0**	**1/3**	**1/8**	each
	4/0	**5/0**	**6/0**	**6/6**	**7/0**	**9/0**	**11/0**	**14/0**	**18/0**	per doz.

(F) **8240** **Beakers,** Kavalier's Bohemian Resistance Glass, Medium Form, without Spout.

App. cap'y	20	40	75	110	170	270	380	550	800	1100	1600	c.c.
	4d.	**5d.**	**5d.**	**6d.**	**8d.**	**10d.**	**1/0**	**1/4**	**1/7**	**1/11**	**2/2**	each
	3/6	**4/0**	**4/3**	**5/6**	**6/6**	**8/6**	**10/9**	**13/9**	**16/9**	**20/3**	**23/3**	per doz.

(F) **8241** **Beakers,** Kavalier's Bohemian Resistance Glass, Griffin Form, with Spout.

App. cap'y	20	40	80	140	240	350	550	750	1000	1400	1850	c.c.
	6d.	**6d.**	**6d.**	**8d.**	**9d.**	**11d.**	**1/3**	**1/6**	**1/11**	**2/3**	**2/8**	each
	4/7	**4/9**	**5/3**	**6/6**	**7/6**	**9/3**	**12/9**	**16/0**	**20/3**	**24/3**	**30/0**	per doz.

8242 **Beakers,** Pyrex Resistance Glass, Medium Form without Spout.

App. cap'y	30	50	100	150	200	250	300	400	500	600	800	1000	1500	2000	c.c.
	9/6	**9/6**	**10/6**	**11/3**	**12/6**	**13/6**	**14/0**	**16/0**	**17/6**	**19/0**	**21/9**	**29/3**	**40/0**	**49/0**	doz.

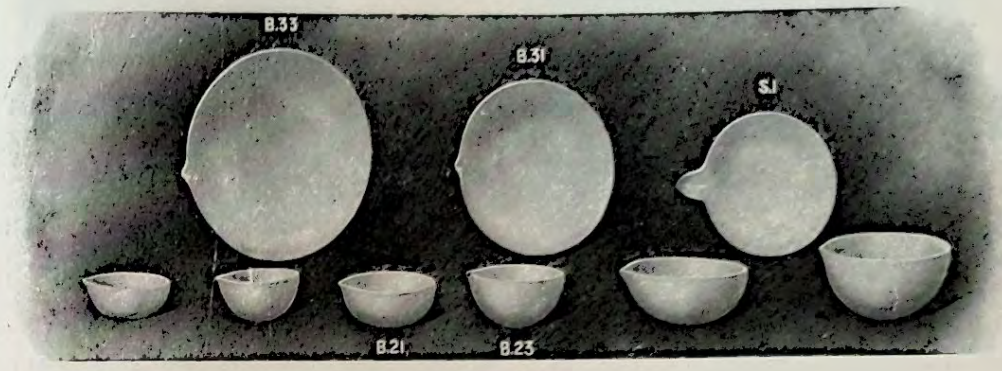
8243 **Beakers,** Pyrex Resistance Glass, Griffin Form, with Spout.

Approx. cap'y	30	50	100	150	250	300	400	500	600	800	1000	1500	2000	c.c.
	9/6	**9/6**	**10/6**	**11/3**	**13/6**	**14/0**	**16/0**	**17/6**	**19/0**	**21/9**	**29/3**	**40/0**	**49/0**	doz.

(F) Foreign manufacture.

Silica Ware

Pure Fused Silica Ware. Opaque "Vitreosil"



8246–8248

Striking Properties of **Vitreosil.** Vitreosil does not crack or fly even when cold water is poured into a red hot basin. Is acid-proof and absolutely insoluble in water. It is 99·8 SiO_2.

Vitreosil dishes are constant in weight, may generally be used as a substitute for Platinum, will stand permanently 1200°C, and for short periods much higher temperatures. One of the best insulators of electricity, and at high temperatures unequalled. Vitreosil is made by British workmen in Britain by a British process.

8246 Evaporating Dishes, Glazed.

No.	B.1	B.3	B.5	B.6	B.7	B.9	B.10	
Approx. Capacity	20	45	70	85	60	100	200	c.c.
Inside Dia. ...	2	2¼	3¼	3½	3½	3⅞	4¼	in.
Inside Depth ...	—	1	1 3/16	1 3/16	⅞	1⅜	1⅞	in.
Price	**2/8**	**3/0**	**3/4**	**4/0**	**3/8**	**4/4**	**5/0**	each

8247 Unglazed Evaporating Dishes.

No.	B.11	B.12	B.13	B.15	B.17	B.19	B.21	B.23	B.25	B.27	
Approx. Cap.	400	500	600	700	800	1200	1400	1800	1800	2500	c.c.
Inside Dia....	5⅜	5½	6	6	7	7	8	8	9	9	in.
Inside Depth	2¼	2½	2½	3	2¾	3¾	3¼	4¼	3½	4¾	in.
Price ...	**7/8**	**8/0**	**8/4**	**9/4**	**10/0**	**10/4**	**11/8**	**13/4**	**15/0**	**16/8**	each

8248 Flat Dishes (With Spout)—Glazed.

No.	F.1	F.2	F.3	F.4	
Approx. Capacity...	20	25	75	125	c.c.
Inside Dia.... ...	2½	2⅞	3¾	4⅞	in.
Inside Depth ...	½	½	11/16	13/16	in.
Price	**3/0**	**3/4**	**3/8**	**5/0**	each

8249 Circular Capsules, Glazed, Round Bottom without Lip.

	A.5	A.1	A.2	A.6	A.3	A.4	AA.1	AA.9	AA.10	
Approx. Capacity ...	10	15	20	30	35	55	45	50	80	c.c.
Inside Dia.	1⅜	1¾	2	2¼	2⅜	2¼	2	2 3/16	2¼	in.
Inside Depth	½	½	½	½	½	⅝	1	1	1	in.
Price	**1/8**	**1/8**	**2/4**	**2/4**	**2/8**	**3/4**	**3/4**	**3/4**	**4/0**	each

8250 Squat Shape Crucibles, Glazed:

No.	C.000	C.00	C.0	C.1	C.2	C.3	C.7	
Approx. Capacity...	5	10	15	25	40	75	100	c.c.
Outside Dia. ...	1	1⅜	1⅝	1⅞	2¼	2⅝	3⅝	in.
Outside Height ...	11/16	¾	1	1⅛	1 1/16	1⅛	2	in.
Price	**1/4**	**1/6**	**1/8**	**2/0**	**2/4**	**3/4**	**4/0**	each
Lids	**1/2**	**1/2**	**1/2**	**1/4**	**1/8**	**2/0**	**2/4**	each

8251 Platinum Shape Crucibles, Glazed.

No.	C.4	C.5	C.6	C.8	
Approx. Capacity...	30	20	30	100	c.c.
Outside Dia. ...	2	1¾	1 11/16	2⅞	in.
Outside Height ...	2	1¾	1¾	3 3/16	in.
Price	**3/4**	**2/8**	**2/8**	**5/4**	each
Lids	**1/4**	**1/2**	**1/2**	**2/4**	each

8252 Gooch Crucible, Glazed. (With Fixed Perforated Bottom.)

Outside Dia. ...	1 5/16	in.
Outside Height ...	1 3/16	in.
Price	**10/0**	each

Other Sizes and Prices on application.



8264



8265



8266

(F) **8264** **Beakers,** Enamelled Steel—

Diameter	7	8	9	cm.
Approx. Capacity	250	350	500	c.c.
	1/0	**1/2**	**1/3**	each
	10/6	**12/0**	**13/0**	per doz.

(F) **8265** **Beakers,** with Spout, stout Glass, for Cold Solutions—

¼	½	¾	1	1½	2	litres
1/0	**1/2**	**1/5**	**1/7**	**1/9**	**2/2**	each
10/6	**12/6**	**15/6**	**17/0**	**20/0**	**25/0**	per doz.

8266 **Water Bath,** Stout Copper, with four Rings for Basins, etc. The 23 cm. size has five rings—

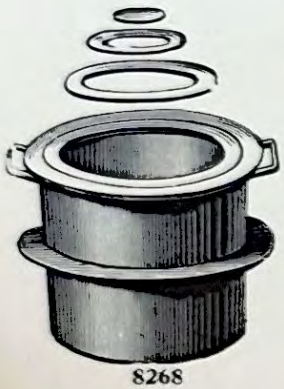
13	15	18	20	23	cm.
7/6	**8/9**	**10/6**	**12/0**	**14/6**	each

8267 Tripod Stands for above ... ... **1/9** **2/3** **2/6** **3/0** **3/6** ,,

(F) **8268** **Water Bath,** Iron, Enamelled inside, with two Handles, Copper Rings, and Flange to fit on Tripod Stands.

12	14	15	18	20	23	25	cm.
6/0	**7/0**	**8/0**	**10/0**	**11/6**	**14/6**	**17/6**	each

8269 Tripod Stands for above ... ... **1/9** **2/0** **2/3** **2/6** **3/0** **3/6** **4/0** ,,

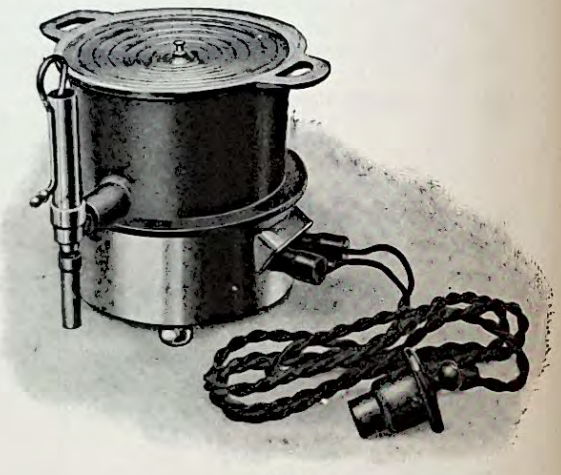


8268



8270

Ordinary, with set of Copper Concentric Reducing Rings.
Complete with two yards of Flexible Cord and Adapter.



8271

With Water inlet, set of Copper Concentric Reducing Rings, and Brass Constant Water Level Fitting.
Complete with two yards of Flexible Cord and Adapter.

Laboratory Water Baths, electrically heated, Porcelain Cast Iron enamelled, with Copper Concentric Rings. A new and improved series of electrically heated Water Baths, made of Cast Iron, White Porcelain enamelled inside and japanned outside. When supplied with Inlet and Constant Water Level as shown on illustration No. 8271, the fitting, in addition to being screwed in, is secured by a set screw, which makes it impossible for it to get out of its proper vertical position.

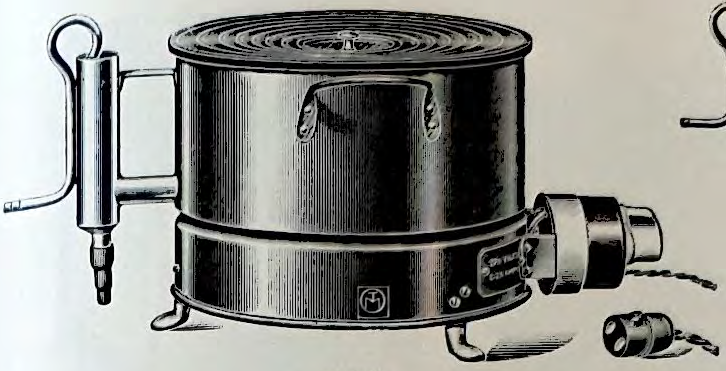
They are efficient and reliable, and are always ready for immediate use. Spare heating elements can be supplied, and these can be very easily replaced, being fixed by two screws only.

Three-heat regulation can be arranged, if required, at an extra cost of **3/6** for each size, including triple flexible cord.

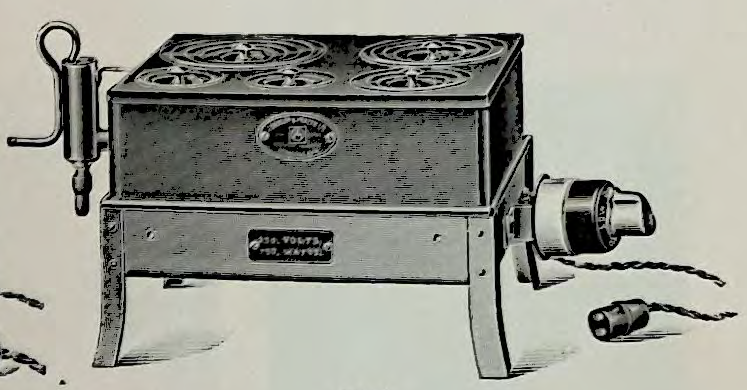
Sizes	13	17	21 cm.
Loading	350	550	700 watts
Set of Rings comprise	4 rings and 1 lid	6 rings and 1 lid	8 rings and 1 lid
8270	**£1 12 6**	**£1 18 0**	**£2 10 0** each
8271 (With constant level as illustration)	**2 0 0**	**2 5 0**	**2 17 6** ,,
Spare heating elements	**3/9**	**5/6**	**7/3** each
Standard voltages	100/110	200/220	230/250

When ordering, please state voltage required.

(F) Foreign manufacture.



8273



8274

*8273 **Water Bath,** Copper, electrically heated, three-heat regulation, with water level—

20 cm. diameter ... ... each	£3	10 0
25 cm. ,, ... ,,	4	4 0

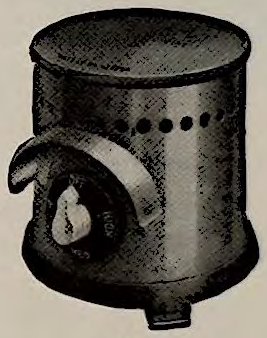
When ordering please state voltage required.

*8274 **Water Bath,** Copper, electrically heated, 25×21 cm. and 9 cm. high, with Constant Level Arrangement and fitted with Porcelain Plate containing 5 openings of different sizes with Porcelain Rings for Evaporations, etc. Three-heat regulation **5 0 0**

When ordering please state voltage required.



8275



8276



8279-80



8281-3

Electric Hot Plates. Open type (one heat).

*8275 Size, 7 in. diameter, 4¾ in. high. Maximum loading, 1 kW. **£1 3 0**

Electric Hot Plates. Enclosed type, with three-heat regulating switches.

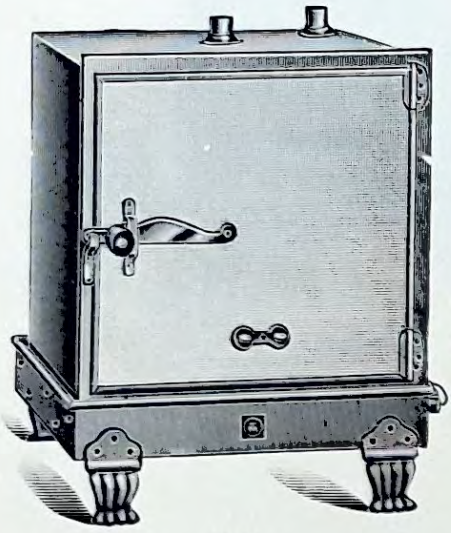
*8276	Size 6⅝×6¼ in. Consumes 1 —½ or ¼ unit per hour	2 8 0
*8277	,, 7¼×6¼ in. ,, 1¼—⅜ or $\frac{3}{10}$,, ,, ...	2 12 0
*8278	,, 9 ×6⅝ in. ,, 2 —1 or ½ ,, ,, ...	3 0 0

Electric Hot Plates. Polished copper; complete with 2 yards of Flex and Lamp-Holder Adapter.

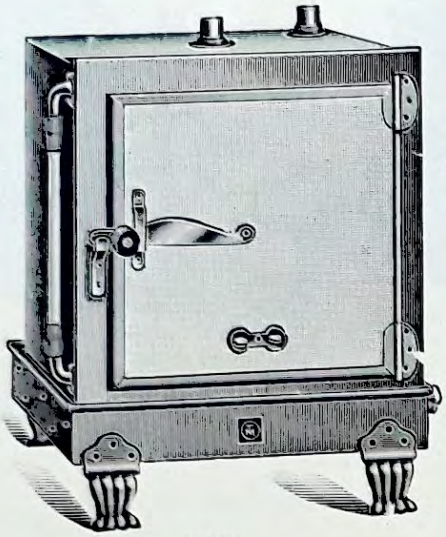
*8279	Size 16×5½×8 in. Maximum loading 150 watts. **£2 17 0**; Nickel-plated	3 2 0
*8280	,, 23×5½×12 in. ,, ,, 300 watts. **4 4 0**; ,, ,,	4 15 0

Electric Hot Plates, of heavy Cast Iron with base finished black, top ground and polished.

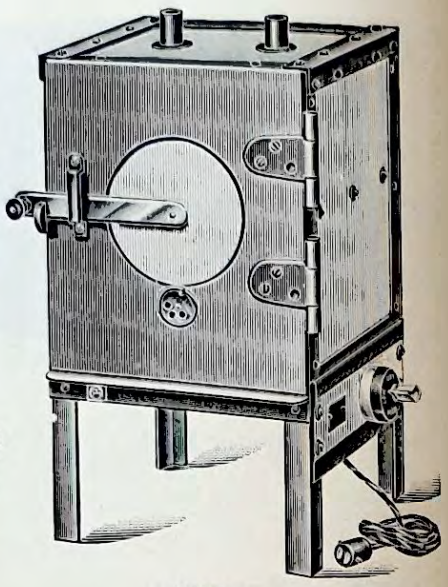
*8281	Dimensions 8×4½ in. Current consumption 800/200 watts.	2 13 0
*8282	,, 16×10 in. ,, ,, 1500/1000/500 watts. ...	4 13 6
*8283	,, 18×12 in. ,, ,, 2000/1300/700	8 15 0



8285



8286



8287

***8285** **Drying Oven,** Copper, electrically heated, for temperatures up to 110°C., with three-heat regulations.

Internal dimensions	20×20×20	25×25×25	30×30×30	cm.
	£4 10 0	**£5 15 0**	**£7 10 0**	each

When ordering please state voltage required.

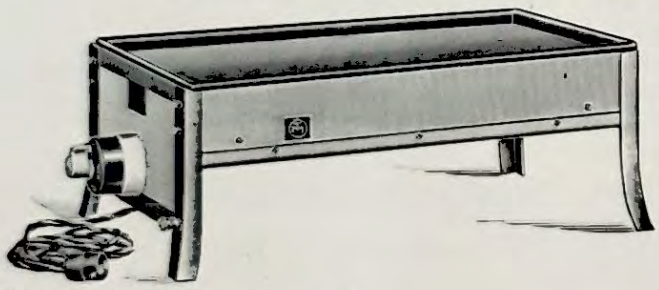
***8286** **Copper Water Drying Oven,** Electrically Heated, with three-heat regulations.

Diameter inside oven	20×20×20	25×25×25	30×30×30	35×35×35	cm.
	£7 10 0	**£8 15 0**	**£11 0 0**	**£12 10 0**	each

When ordering please state voltage required.

***8287** **Drying Oven,** Hot Air, Electrically Heated, built up of Stout Angle Iron with Uralite sides and top, fitted with two Tubulures at top and Air Regulator to door. Suitable for temperatures up to 300°C., complete with three-heat regulations.

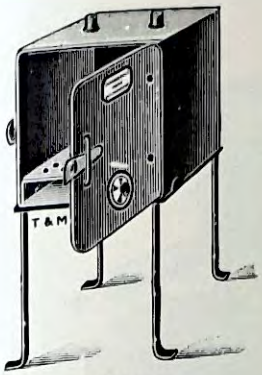
Length ...	20	25	30	35	cm.
Depth ...	20	25	30	35	,,
Height ...	20	25	30	35	,,
	£5 0 0	**£6 0 0**	**£7 10 0**	**£8 5 0**	each



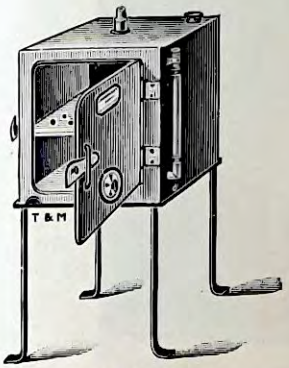
8288

***8288** **Sand Bath,** Stout Sheet Iron, with removable Copper Tray. Electrically Heated with three-heat regulations.

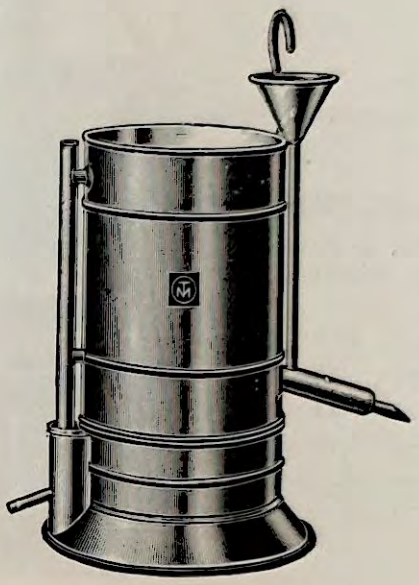
Size	30×20	45×20	45×25	cm.
	£2 15 0	**£3 12 6**	**£4 13 0**	each



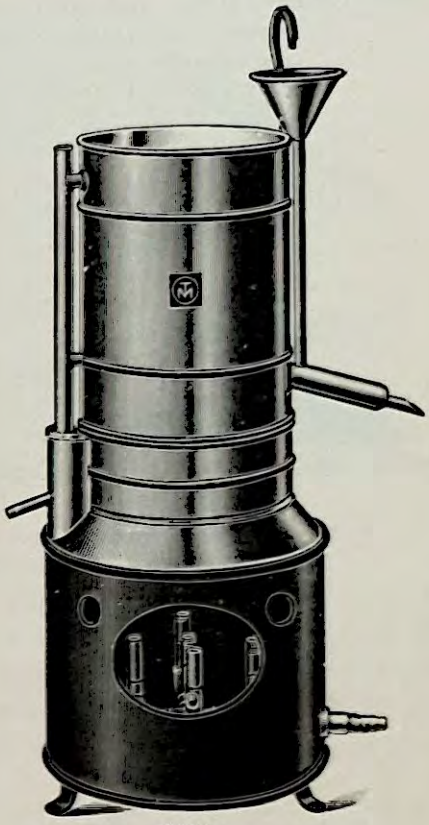
8290-1



8292-4



8295



8296

*8290	**Drying Oven,** Square, Stout Copper, with Air Regulator.									
	Length ...	15	18	20	23	25	28	30	cm.	
	Depth ...	15	18	20	23	25	28	30	,,	
	Height ...	15	18	20	23	25	28	30	,,	
		25/6	**27/6**	**28/0**	**33/0**	**41/6**	**47/0**	**52/6**	each	
8291	**Iron Stands** for above	**3/0**	**3/0**	**3/6**	**3/6**	**4/0**	**4/6**	**4/6**	,,	
*8292	**Water Ovens,** Polished Copper, with Water Gauge, with Ventilator in door and Tubulure for Thermometer.									
	Length ...	14	16	18	20	23	25	28	30	cm.
	Depth ...	14	16	18	20	23	25	28	30	,,
	Height ...	14	16	18	20	23	25	28	30	,,
8293	With Water Gauge	**33/0**	**37/6**	**42/0**	**47/0**	**57/6**	**66/6**	**74/6**	**85/6**	each
8294	**Iron Stands** for above	**3/0**	**3/0**	**3/0**	**3/6**	**3/6**	**4/0**	**4/6**	**4/6**	,,

Automatic Stills for Heating by Gas, Coke, Coal, Petroleum or Steam. The Stills are made of Stout Copper, heavily tinned inside, and are easily taken to pieces to be cleaned.

*8295	**Automatic Still,** Stout Copper, heavily tinned inside, for making distilled water and delivering 6 pints per hour	**£4**	**5**	**0**
*8296	Ditto, ditto, with Gas Burner and stout Iron Stand	**5**	**2**	**6**
*8297	Ditto, ditto, with Stout Sheet Iron Furnace, for use with Coke, Coal, or Wood Fuel	**7**	**5**	**0**
*8298	Ditto, ditto, with Primus Stove for burning Petroleum, and stout Sheet Iron Stand as No. 8296	**6**	**7**	**6**
*8299	Ditto, ditto, with Solid Drawn Copper Coil tested to 100 lb. pressure per sq. in., for Steam Heating	**6**	**10**	**0**

***8300 Water Oven and Still Combined,** of Stout Copper Tinned inside, fitted with constant level apparatus to maintain the level of water, single compartment with Still Head, producing about 6 pints Distilled Water per hour. Copper Door covered with Uralite.

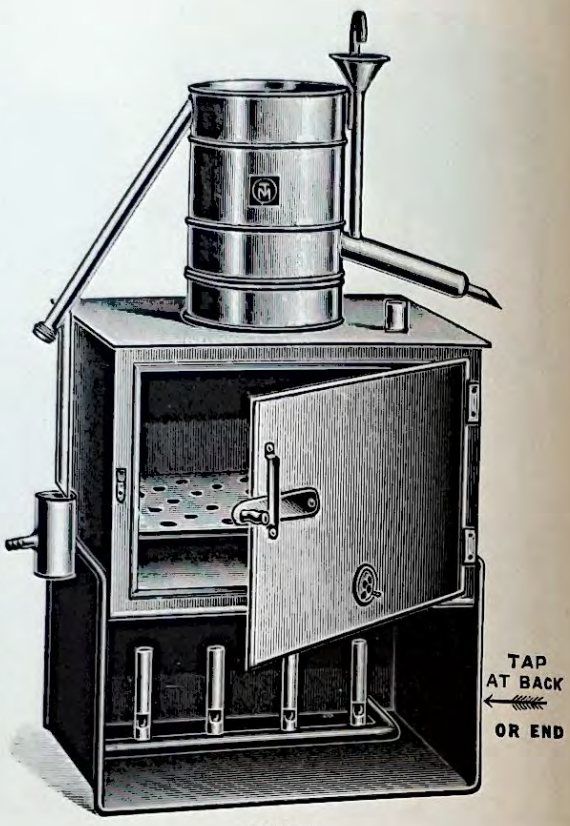
Front of Oven, outside, 23 cm.; Front to Back, 23 cm.; Height, 23 cm.	£6 10 0
Front of Oven, outside, 35 cm.; Front to Back, 25 cm.; Height, 25 cm.	8 5 0
Front of Oven, outside, 40 cm.; Front to Back, 30 cm.; Height, 35 cm.	9 17 6

***8301 Water Oven and Still Combined,** as above, but Oven with two compartments, side by side.

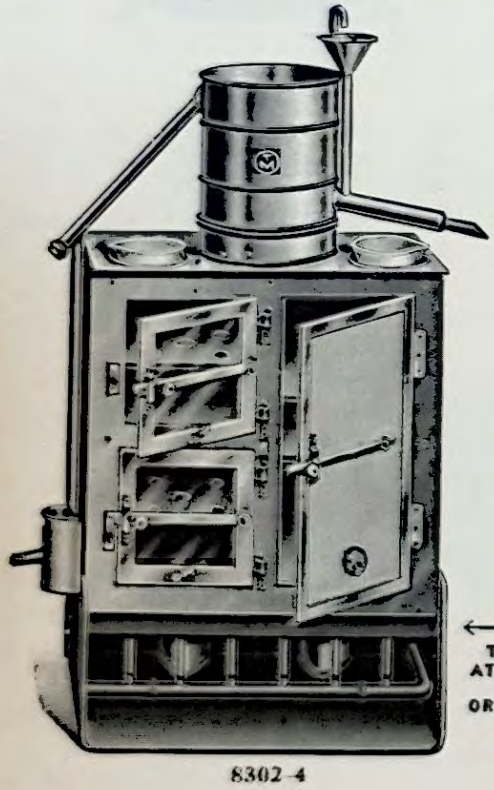
Size of Compartments:—

8×8×8 in. with Copper Doors ...	£13 0 0
10×10×10 in. with Copper Doors	18 0 0
8×8×8 in. with Glass Doors ...	14 0 0
10×10×10 in. with Glass Doors	18 10 0

The above will be supplied with the Stopcock for gas supply where required, either side or at the back.



8300–1

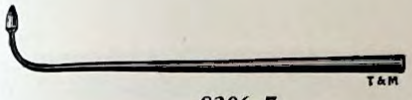


8302–4

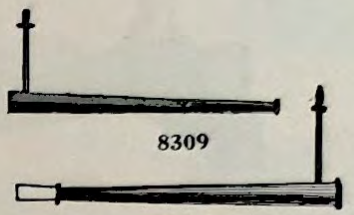
Water Oven Still and Evaporating Bath Combined, with two compartments 8×8×8 in., with Gun Metal Frames, Fittings and Plate-Glass Panels to Doors, and one compartment 18×8×8 in., with Copper Door covered with Uralite. Top of oven fitted with 2 holes and covers for evaporating basins on stout iron stand and screen with burners complete.

*8302	As illustrated	£21 5 0
*8303	Ditto, with all Doors of Copper and covered with Uralite	20 0 0
*8304	Ditto, with all Doors fitted with Plate-Glass Panels	22 0 0

Blowpipes

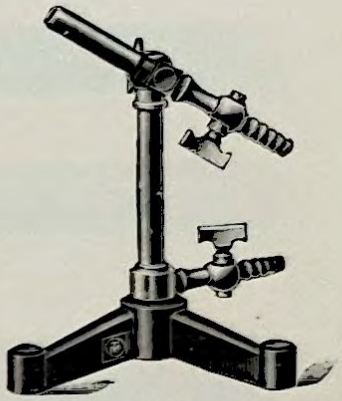


8306–7



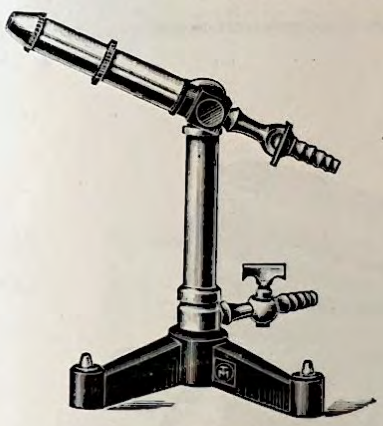
8309

8310

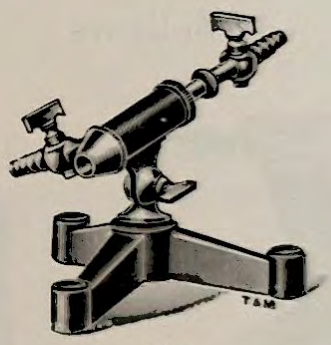


8311

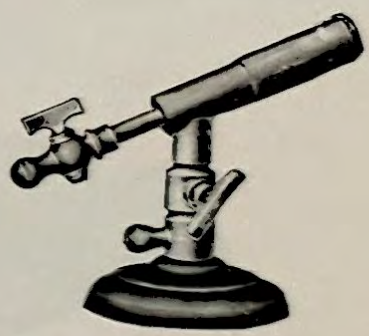
(F) **8306**	**Blowpipes,** Brass, with Jet	each **6d.**; per doz.	**£0 5 6**
(F) **8307**	,, ,, Nickel-plated	,, **8d.** ,,	**0 7 6**
(F) **8308**	,, with Bone Mouthpiece	,, **1/0** ,,	**0 10 6**
8309	,, Black's, Japanned Tin	,, **6d.** ,,	**0 5 0**
(F) **8310**	,, ,, Brass, with Bone Mouthpiece ...	,, **1/9** ,,	**1 0 0**
8311	**Blowpipe,** with two Stopcocks, large size, mounted on Iron Tripod Foot ...		**0 16 6**



8312-3



8314



8315

8312	**Blowpipe,** with two Stopcocks, Universal Joint, Sliding Sleeve for Flame Adjustment and two extra Jets	**£0 18 0**
8313	Ditto ditto ditto Large size	**1 2 6**
8314	**Blowpipe,** with Swivel Joint and two Stopcocks, Glass Blower's pattern for use with glass jets	**0 18 6**
8315	,, Thuringian pattern, with movable Brass Inner Tube, for the fitting of different size glass jets, with two taps mounted on iron stand with ball and socket joint	**0 19 0**

(F) Foreign manufacture.



8316

8316 THE L.T. BLOWPIPE.

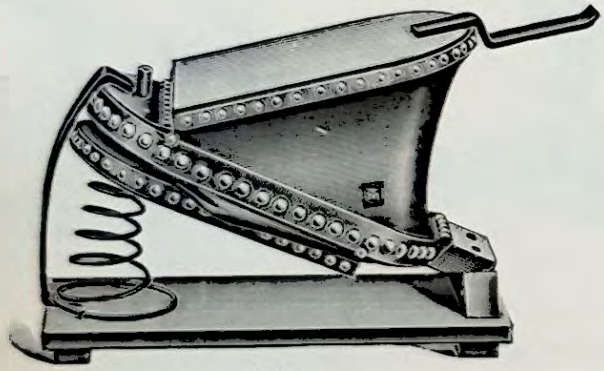
This blowpipe is supplied with six separate interchangeable jets, and is capable of carrying out work from the largest to the very smallest of that likely to be required in the laboratory. It gives an exceptionally large and very steady flame for glass blowing, and it is possible to change over from one jet to another with one hand in a few seconds without the work cooling off and have the jets always correctly adjusted without trouble or having to touch hot metal.

The jets are inserted by removing knurled cap at back of blowpipe; jet is then pulled out and the one required pushed in up to a coned seating which keeps both the adjustment for length and centre always correct.

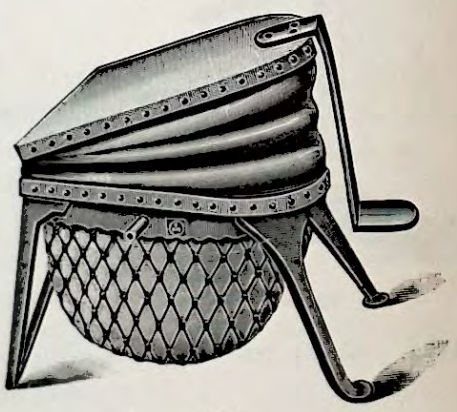
The flame can be tilted through about 45° from horizontal up and down, and also swivelled on foot and clamped in position required.

It can also be used for soldering and small brazing jobs by removing from its fork on stand and holding in the hand **£2 2 0**

Bellows



8317



8318

8317 Bellows. Continuous Blast, worked by the foot, very compact and requiring small space.

	Nos. 3	4	5	
	37/0	**41/0**	**46/0**	each

8318 Bellows. Continuous Blast, on Iron Stand with India-Rubber Discs and Net.

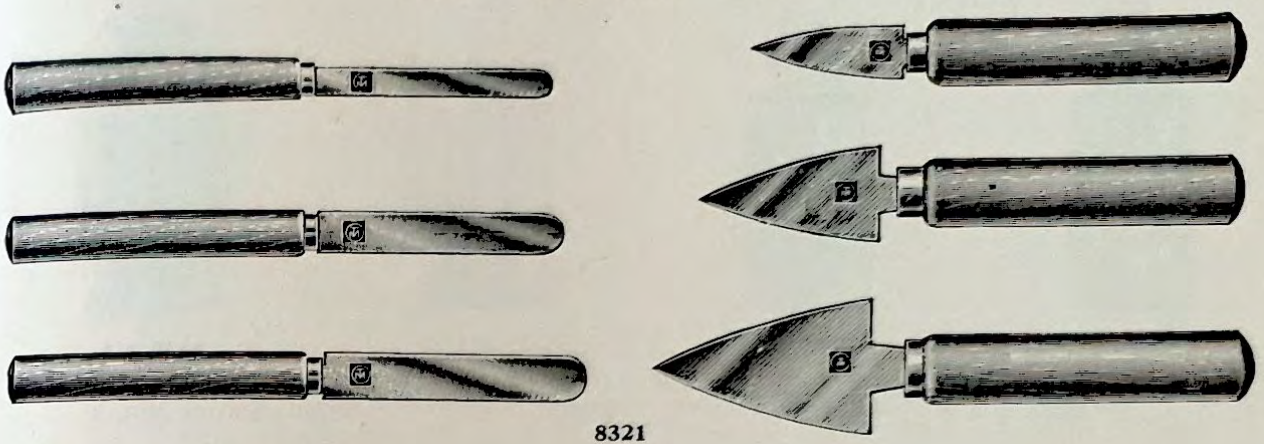
	Nos. 3	5	
	40/0	**45/0**	each

8319 Spare Rubber Discs. Two Discs used on each Bellows ... ...

	Nos. 3	5	
	2/3	**2/9**	each

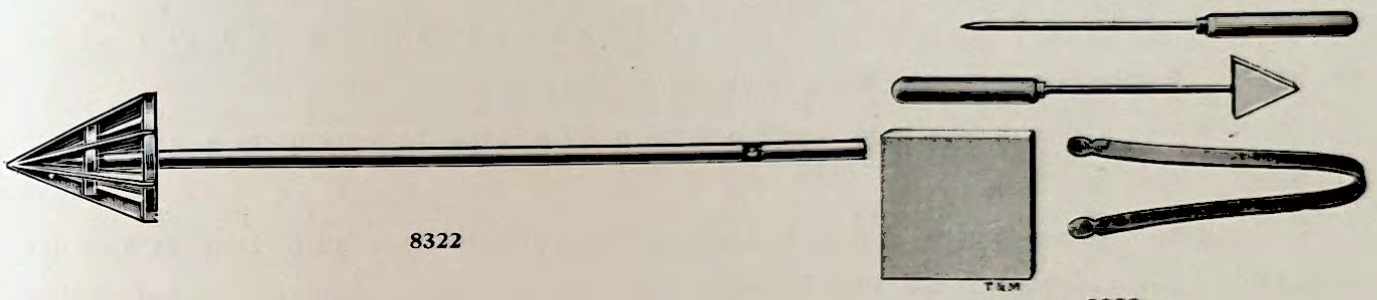
8320 Spare Nets ... ... **1/8** **1/9** each

Glass Blowers' Tools



8321

8321 **Glass Blowers' Tools.** Set of Reimers consisting of Four Spear and Four Spatula, per set **£0 16 6**

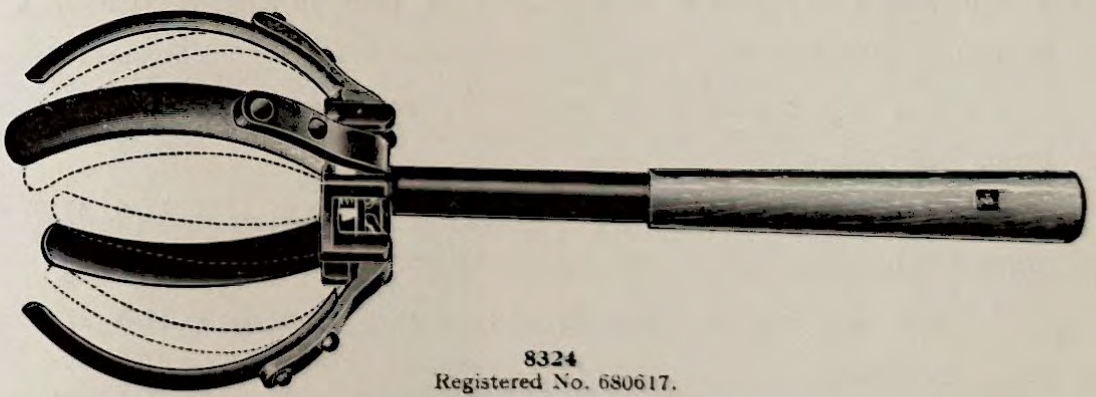


8322

8323

		Small	Large	
8322	**Glass Blowers' Tools,** Cones for flanging glass tubes, etc. ...	**10/0**	**15/0**	each

8323 **Set Glass Blowers' Tools,** consisting of Flat Tongs, Iron Rod in Handle, Iron Cone, Flat Iron Plate, per set **£0 4 0**



8324
Registered No. 680617.

8324 **Glass Blowers' Tools,** Clamps for holding Flasks in two sizes.

To take 30 c.c. to 100 c.c. ... ... each **£0 14 0**
„ 150 c.c. to 500 c.c. ... ... „ **0 15 0**

Bottles



8325/7



8326/8



8329/331/33



8330/2/4

8325 **Bottles,** English Flint Glass, for Test Solutions, Stoppered, Moulded, Narrow Mouth.

Capacity	½	1	2	3	4	6	8	oz.
	4/6	**5/0**	**5/6**	**5/9**	**6/6**	**7/6**	**8/0**	per doz.

8326 **Bottles,** English Flint Glass, for Dry Chemicals, Stoppered, Moulded, Wide Mouth.

Capacity	½	1	2	3	4	6	8	oz.
	5/0	**5/6**	**5/9**	**6/0**	**7/0**	**8/0**	**9/0**	per doz.

(F) **8327** **Bottles,** Good Quality, White Glass, closely stoppered, Narrow Mouth.

½	1	2	4	6	8	10	12	16	20	24	30	40	oz.
4/6	**5/0**	**6/0**	**7/0**	**8/0**	**9/0**	**10/0**	**12/0**	**13/0**	**14/0**	**18/0**	**20/0**	**22/6**	per doz.

(F) **8328** Wide Mouth.

½	1	2	4	6	8	10	12	16	20	24	30	40	oz.
5/0	**5/9**	**6/9**	**8/0**	**8/9**	**10/6**	**11/0**	**13/0**	**14/0**	**16/0**	**19/6**	**21/0**	**24/0**	per doz.

(F) **8329** **Bottles,** White Glass Flat Stoppers, each bottle and stopper numbered, for Laboratories. Narrow Mouth.

½	1	2	4	6	8	10	12	16	20	24	32	40	48	64	oz.
4/0	**4/6**	**5/0**	**6/0**	**7/0**	**7/6**	**9/6**	**10/0**	**12/6**	**14/0**	**18/0**	**20/0**	**22/6**	**25/0**	**27/3**	doz.

(F) **8330** Ditto, Wide Mouth.

½	1	2	4	6	8	10	12	16	20	24	32	40	48	64	oz.
4/6	**5/0**	**6/0**	**6/6**	**7/6**	**8/6**	**10/6**	**11/6**	**13/6**	**16/0**	**19/6**	**21/0**	**24/0**	**26/6**	**30/0**	doz.

8331 **Bottles,** English, Best White Flint Glass, with Patent Dust-proof Flat Stoppers, Narrow Mouth.

½	1	2	4	6	8	10	12	16	20	24	32	48	64	oz.
5/6	**5/6**	**6/3**	**7/3**	**8/0**	**9/9**	**11/0**	**12/6**	**14/0**	**15/3**	**18/0**	**22/9**	**29/6**	**37/3**	doz.

8332 Ditto, Wide Mouth.

½	1	2	4	6	8	10	12	16	20	24	32	48	64	oz.
6/6	**6/6**	**9/0**	**10/3**	**11/0**	**12/8**	**15/0**	**16/9**	**18/0**	**19/9**	**22/9**	**27/0**	**37/9**	**47/3**	doz.

8333 **Bottles,** Amber Glass with Flat Stoppers as Nos. 8329-8330. Narrow Mouth.

1	2	4	6	8	10	12	16	20	24	32	40	48	oz.
5/6	**6/8**	**7/3**	**8/6**	**9/0**	**11/6**	**12/0**	**15/0**	**16/9**	**21/9**	**24/0**	**27/0**	**30/0**	doz.

8334 Ditto, Wide Mouth.

1	2	4	6	8	10	12	16	20	24	32	40	48	oz.
6/0	**7/3**	**8/0**	**9/0**	**10/3**	**12/9**	**13/9**	**16/3**	**19/3**	**23/6**	**25/3**	**28/9**	**31/9**	doz.

(F) Foreign manufacture.



8336



8337


8338


8339

(F) **8336** **Bottles,** Half-White Glass, without Stoppers, Wide or Narrow Mouth.

Capacity ...	125	200	250	400	500	750 c.c.	1	1½	2	litre
Narrow Mouth	**2/8**	**3/6**	**3/10**	**5/6**	**6/10**	**8/9**	**10/3**	**13/6**	**14/9**	doz.
Capacity ...	3	4	5	6	7½	10	12½	15		litre
Narrow Mouth	**18/6**	**25/0**	**28/0**	**40/0**	**50/0**	**63/0**	**86/0**	**99/0**		doz.

(F) **8337**

Capacity ...	125	200	250	400	500	750 c.c.	1	1½	2	litre
Wide Mouth...	**3/2**	**4/0**	**4/9**	**6/3**	**7/6**	**9/9**	**11/3**	**14/6**	**16/0**	doz.
Capacity ...	3	4	5	6	7½	10	12½	15		litre
Wide Mouth...	**23/0**	**29/6**	**36/0**	**48/0**	**60/0**	**72/0**	**100/0**	**112/0**		doz.

(F) **8338** **Bottles,** Wide Mouth, Moulded with Round Shoulders (Kalis)—

Capacity	1	2	4	6	8	10	12	16	20	oz.
	1/3	**1/6**	**1/9**	**2/3**	**2/9**	**3/2**	**3/9**	**4/8**	**5/3**	per doz.
	13/0	**16/0**	**19/0**	**24/0**	**30/0**	**34/0**	**41/0**	**50/0**	**57/0**	,, gross

(F) **8339** **Bottles,** Clear White Glass, Square Shoulders, for Samples, Wide Mouth.

Capacity	1	2	3	4	6	8	oz.
	2/0	**2/3**	**2/6**	**3/0**	**3/6**	**4/0**	per doz.
	22/6	**24/6**	**27/0**	**33/0**	**38/6**	**44/0**	,, gross


8340


8341


8342

8340 **Bottles,** with Polished Wood Top and Cork, Wide Mouth, for Samples, etc.

Capacity	1	2	3	4	6	8	oz.
	4/3	**5/0**	**5/7**	**6/0**	**7/0**	**7/8**	per doz.

(F) **8341** **Lamp Blown Bottles,** of Clear Glass, for Specimens, Corked.

1½×½	2×½	2½×½	3×½	3½×½	4×½	1½×⅝	2×⅝	2½×⅝	3×⅝	3½×⅝	in.
6/0	**7/0**	**7/6**	**8/0**	**9/0**	**10/0**	**6/6**	**7/6**	**8/6**	**9/6**	**10/0**	per gross
4×⅝	5×⅝	5½×⅝	2×¾	2½×¾	3×¾	3½×¾	4×¾	5×¾	6×¾		in.
11/0	**12/6**	**13/6**	**10/6**	**11/0**	**12/0**	**13/6**	**14/6**	**16/0**	**20/0**		per gross

(F) **8342** **Lamp Blown Flat Bottom Tubes** of Clear Glass, for Specimens, Corked.

1½×⅜	2×⅜	2×½	2½×½	2×⅝	3×⅝	4×⅝	5×⅝	2×¾	2½×¾	3×¾	4×¾	in.
3/3	**3/6**	**4/3**	**4/9**	**5/6**	**6/0**	**7/6**	**8/6**	**7/6**	**8/0**	**9/0**	**10/0**	per gross
5×¾	6×¾	2×⅞	3×⅞	4×⅞	5×⅞	6×⅞	2×1	3×1	4×1	5×1	6×1	in.
10/6	**12/0**	**11/0**	**11/9**	**13/0**	**16/0**	**17/6**	**12/6**	**15/0**	**17/0**	**20/0**	**22/0**	per gross

(F) Foreign manufacture.



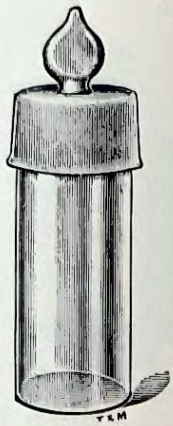
8345



8346



8347



8348

8345 **Weighing Bottles,** with Wide Necks and Hollow Closed Stoppers.

Height to top of neck	50	50	65	65	75	75	80	mm.
Diameter	25	30	30	35	30	35	40	mm.
Each	**1/0**	**1/3**	**1/6**	**1/8**	**1/9**	**1/11**	**2/6**	each
	11/0	**14/0**	**16/6**	**18/6**	**19/6**	**21/6**	**28/0**	per doz.

8346 **Weighing Bottles,** Straight Sided, without Necks, Hollow Stoppers.

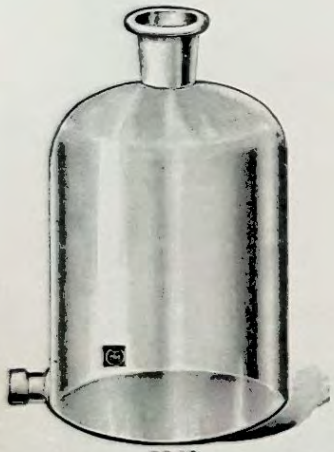
Height to top of neck	35	50	65	65	75	75	80	mm.
Diameter	20	25	30	25	30	35	40	mm.
	10d.	**1/0**	**1/4**	**1/6**	**1/8**	**2/0**	**2/6**	each
	9/0	**11/0**	**14/0**	**16/6**	**18/6**	**22/0**	**28/0**	per doz.

8347 **Weighing Bottles,** Globular Form, Stoppered.

Capacity ...	50	100	150	200	250	cc.
	1/9	**2/0**	**2/6**	**3/0**	**3/6**	each
	19/6	**22/6**	**28/6**	**34/6**	**40/0**	per doz.

8348 **Weighing Bottles,** Guttmann's, with Ground-on Cap.

Height... ...	50	50	60	70	mm.
Diameter ...	20	25	30	35	mm.
	1/3	**1/4**	**1/8**	**2/3**	each
	14/0	**15/0**	**16/6**	**25/6**	per doz.



8349



8350

(F) 8349 **Bottles,** Strong White Glass, with Tubulure at Bottom (Aspirators).

Capacity ...	¼	½	1	2	3	4	5	6	8	10	15	20 litres
	1/8	**2/0**	**3/0**	**3/6**	**4/9**	**5/9**	**6/9**	**8/6**	**10/0**	**15/0**	**22/6**	**32/6** each

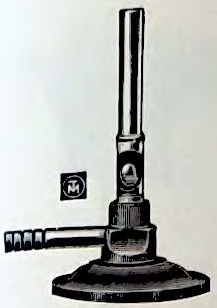
(F) 8350 **Bottles,** Strong White Glass, with Tubulure at Bottom, fitted with Ground-in Stopcock.

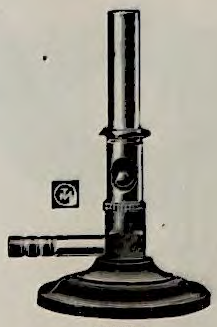
Capacity ...	½	1	2	3	4	5	6	8	10	15	20 litres
	9/0	**9/6**	**12/9**	**13/9**	**16/9**	**18/0**	**20/0**	**22/6**	**27/0**	**40/0**	**60/0** each

(F) 8350/1 Ditto, ditto, with Stopcock ground-in at bottom and Stopper at top.

Capacity ...	½	1	2	3	4	5	6	8	10	15	20 litres
	10/0	**10/6**	**14/0**	**15/0**	**18/6**	**19/6**	**21/6**	**25/9**	**32/0**	**47/6**	**66/6** each

(F) Foreign manufacture.


8351–2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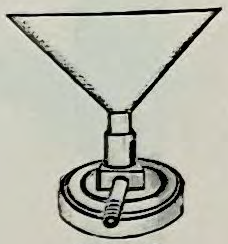
8357


8358–60

8351 **Bunsen Burner,** $\frac{7}{16}$th inch Brass Tube, lacquered, fitted with Air Regulator and mounted on Japanned Iron Base ... ...each, **1/2**; per doz. **£0 13 0**

8352 Ditto, ditto, $\frac{1}{2}$ in. Brass Tube ... ... ,, **1/9**; ,, **0 19 0**

8353 **Bunsen Burner** (Kellas). Best Quality, fitted with Brass Shield above regulator to prevent spilt liquid choking the slide.

Diameter of Burner Tube ...	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	1	in. outside
	2/0	**2/5**	**3/3**	**4/0**	each

All Bunsen Burners can be supplied with Stopcocks at **1/9** each extra.

Fittings for Bunsen Burners. Diameter of Burner	$\frac{7}{16}$	$\frac{1}{2}$	$\frac{5}{8}$	1	in.
8354 Brass Rose Burner	**9/9**	**12/6**	**20/3**	**25/0**	per doz.

8355 **Flat Burner,** Cast Brass, to fit $\frac{7}{16}$ Bunsen Burner. Width of top, $2\frac{1}{4}$ in. ... ... each **£0 1 3**

Ditto, to fit $\frac{1}{2}$ in. Bunsen Burner, ditto ... ... each **0 1 6**

8356 **T Attachment,** length 4 in., to fit over Bunsen Burner, with Holder to take tubes up to 1 in. diameter ... ... To fit $\frac{7}{16}$ **3/0** $\frac{1}{2}$ **3/6** in. Burners each

8357 **Gas Burner** (Catswing), mounted on Iron Stand for glass bending, or bench light.

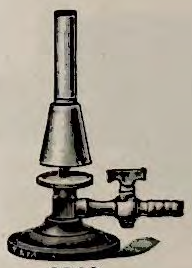
Height	6	8	10	12	in.
	1/6	**1/8**	**1/10**	**2/0**	each

8358 **Gas Furnace,** with wide flat Burner, $2\frac{1}{4}$ in., for heating Tube **£0 4 0**

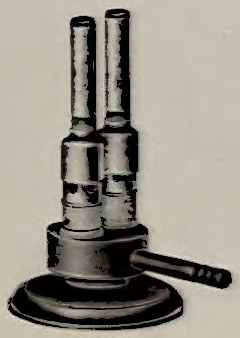
8359 ,, ,, ,, $3\frac{1}{2}$ in. ,, ... **0 6 0**

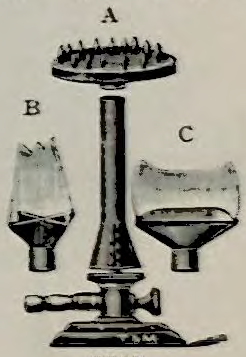
8360 ,, ,, ,, $5\frac{1}{2}$ in. ,, ... **0 8 6**


8361


8362


8364


8364



8363

8361 **Bunsen Burner,** Techlu's, with Regulating Cone. This Burner can be used for any temperature from the ordinary Bunsen Flame to a powerful roaring flame, suitable for Glass Bending. Diameter of Tube, $\frac{1}{2}$ in. ... ... each **£0 3 2**

8362 Ditto, with Stopcock, $\frac{1}{2}$ in. ... ... ,, **0 5 9**

(F) 8363 **Bunsen Burners,** Techlu's, with Regulating Cone, and Screw Shut-off instead of Stopcock. Diameter of Tube, $\frac{1}{2}$ in. ... ...per doz. **53/0**, each **0 4 6**

Fittings for use with Techlu's Burners, made of Sheet Iron:

A Rose Burner ... ... each **0 1 4**

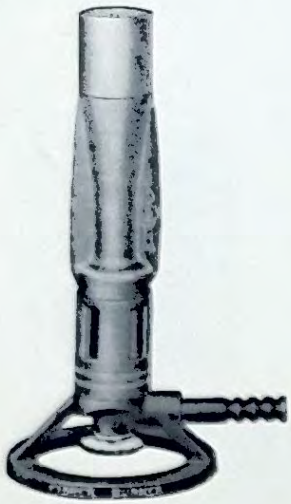
B Star Burner ... ... ,, **0 2 0**

C Flat Burner ... ... ,, **0 1 4**

(F) 8364 **Universal Burner,** suitable for Acetylene, Gasolene, Coal Gas or Oil Gas—

Set of	1	2	3
	5/9	**10/9**	**15/6**

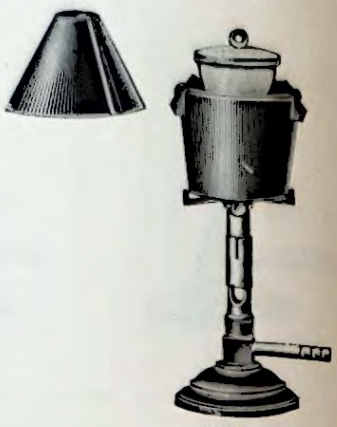
(F) Foreign manufacture.



8366



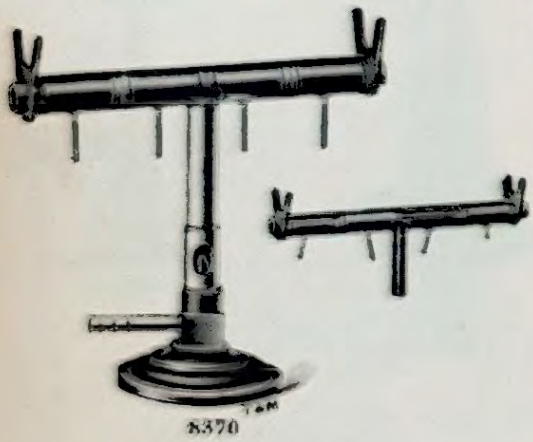
8367



8368–9

(F) *8366 **New Fisher Burner,** with Nickel Grid. Produces a flame of maximum temperature without blast. Can be used with any gas except Acetylene. The entire flame is hotter than the tip of a Bunsen Burner; prolongs the life of platinum ware; saves time. The tube, the needle-valve and its tubing connections are brass, the grid is pure nickel and the base is white alloy metal. No iron or steel is used. Has adjustable packing gland around the needle-valve, which prevents leaking. The nickel grid in the top is 10 mm. thick and has 100 square openings; this prevents back-flashing. Can be adjusted to give the maximum temperature with various pressures, using natural, product, water, and other gases, except acetylene ... ... each **£0 12 6**

(F) *8367 **The Meker Pattern Burner,** for natural draught. The special feature of these Burners is that the whole flame is practically uniform in temperature, which gives them a great advantage over the ordinary Bunsen flame, the heat of which varies considerably at different heights of the flame.



8370

No.	1	2	3	4	
Height of Burner ...	115	130	155	190	mm.
Diameter of Flame	16	20	25	30	,,
	4/6	**6/0**	**7/6**	**12/0**	each

8368 **Midget Furnace,** for use with Bunsen Burner. The inside lining of this Furnace is hardened by a special process to withstand great heat.
With $\frac{7}{16}$-in. Burner, complete ... **£0 6 0**

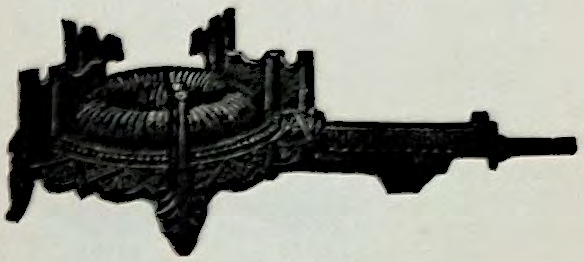
8369 Ditto, larger size, with $\frac{9}{16}$-in. Burner... **0 8 6**

8370 **Gas Furnace,** Professor Ramsay's, University College, London, for heating Tubes. The upper part has an aperture about $\frac{1}{16}$-in. the whole length, and is supplied with four movable shutters, so that the whole or part can be used. At each end is a stout support for Tubes and Bayonet Catches, so that two or more can be attached. They are adapted to drop over $\frac{9}{16}$-in Bunsen Burners each **£0 14 6**
Complete, with Bunsen Burner **0 16 3**

(F) Foreign manufacture



8371



8372-3

8371 **Standard Burner,** cheap form, the Gas and Air being perfectly adjusted, and burning without smell.

No.	C12	C15	C20	
Diameter across support for vessels	6	6½	7	in.
	3 0	**3 6**	**4 3**	each

Patent Radial Burners.

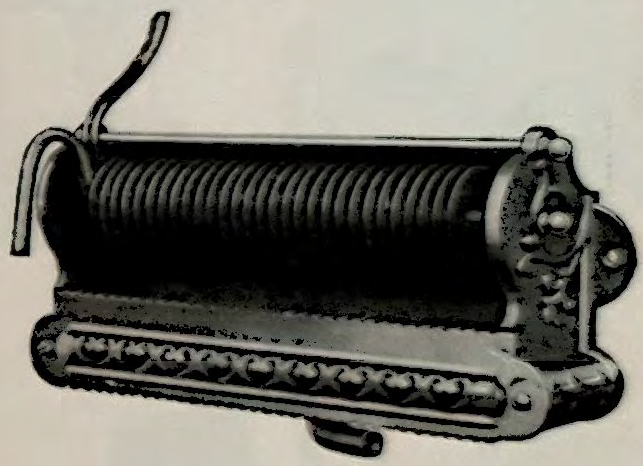
Size		SR	LR	
Maximum Gas Consumption per hour...		12	20	cubic ft.
8372 ,, ,, ,, Without Stand		**5 3**	**7 0**	each
8373 ,, ,, ,, With Stand		**8 0**	**10 0**	,,



8374



8375



8376

Fletcher's Argand Bunsen, giving short and compact Flame

Size	½	¾	in.	
8374 ,, ,, ,, Without Stand	**5 6**	**6 6**	each	
8375 ,, ,, ,, With Stand	**7 6**	**9 6**	,,	

8376 **Instantaneous Water Heater.** This is a very powerful and efficient Water Heater, of an exceedingly small size, being only 14 in. wide and 6 in. high over all. It will deliver one quart of water per minute heated from 60° F. to 125° F. (scalding hot). It is free from drip or smell, unless worked with an excessive pressure of gas and beyond its intended power; in this case the tap should be turned down a little, and the smell disappears... ... ... **£2 15 0**


8378


8379


8380


8381

(F) **8378** **Spirit Lamps,** Glass, with Ground-Glass Cap and White Stoneware Wick Holder and Wick, ready for use.

Capacity	30	70	125	200	250	c.c.
	1/7	**1/9**	**1/10**	**2/0**	**2/5**	each
	17/0	**18/6**	**20/0**	**23/0**	**26/0**	per doz.

(F) **8379** **Spirit Lamps,** with Nickel-plated Brass Screw Wick Holder.

Capacity	70	125	200	250	c.c.
	2/5	**2/6**	**3/1**	**3/7**	each
	26/0	**27/0**	**36/0**	**38/0**	per doz.

(F) **8380** **Spirit Lamps,** Glass, with Ground-on Cap and Stopper at side for filling, with White Stoneware Wick Holder and Wick, complete.

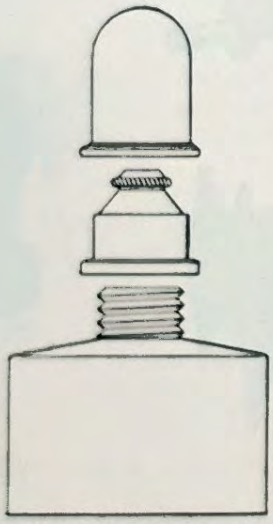
Capacity	70	125	200	250	c.c.
	2/4	**2/11**	**3/3**	**3/8**	each
	25/0	**31/0**	**35/0**	**39/0**	per doz.

(F) **8381** **Spirit Lamps,** Brass, with Rack and Pinion.

Capacity	75	125	150	200	c.c.
	2/3	**2/6**	**2/9**	**3/3**	each


Lamp with Glass Body **8382**


All Metal Lamp with its cap fitted **8383**


All Metal Lamp Diagram **8383**

The New Patent Spirit Lamp

Patent No. 14642/23. Its advantages are :—

1. The cap will never break, as glass ones invariably do after short time in use.

2. If after a severe shock or accident the glass body gets broken, a new bottle can be fitted at small cost, using the other fittings, which are interchangeable. With the old system lamp, if the cap or the body gets broken, a new lamp has to be bought.

3. Spirit will not evaporate.

4. The splendid appearance of both kinds of lamps (Glass or Metal) is something the actual users (Doctors, Dentists, Chemists, Professors, Students, etc.) will appreciate. Made in the following sizes :—

		2 oz.	4 oz.	
(F) **8382**	Glass Body	**1 9**	**2 3**	each
		18 0	**24 0**	per doz.
			4 oz.	
(F) **8383**	All Metal		**3 0**	each
			33 0	per doz.

(F) Foreign manufacture.



8385

8385 "LAMB" LABORATORY LAMP Burns Petrol

Specially adapted for use in County Area Schools. Burns Petrol.

The "Lamb" Laboratory Lamp has been specially designed to provide for all classes of heating as required in the laboratory.

In perfecting the original sample, we were favoured with the advice of qualified science masters, who subjected each stage in the manufacture to very stringent tests before passing as satisfactory. As a result, we feel we can safely claim that in the "Lamb" Laboratory Lamp we are offering to science masters and teachers, and all those interested in laboratory work, an appliance that will fill a long felt want. Supplied complete with three interchangeable burners as follows:—

No. 1 Burner (as illustrated fitted to lamp). Gives circular flame for general heating requirements in the laboratory.

No. 2 Burner (right illustration). Gives Bunsen flame.

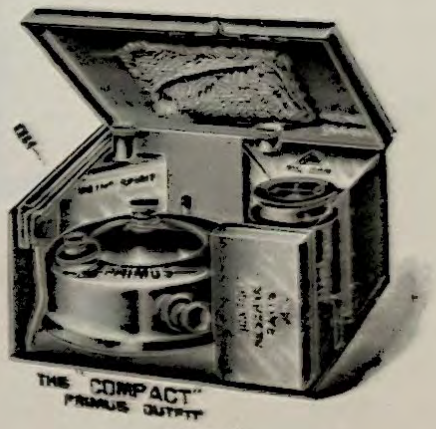
No. 3 Burner (left illustration). Gives fish-tail flame for heating glass tubes or rods for bending purposes.

As will be recognised from the foregoing, this one lamp meets every requirement of the laboratory, taking the place of the spirit lamp and Bunsen burner—not only so, but in addition is more efficient and economical. The special fish tail burner gives a broad flame, thus heating uniformly a greater length of glass and ensuring a regular bend under all conditions. Safety blow-out peg provided with each Lamp.

Packed complete in strong card containers with set of spare parts, including nipple key and full instructions, **8/0** each.



8386-9



8390-1

(F) **8386** **The Primus Stove,** burning ordinary Paraffin without wick. Made of Brass with Cast Iron Top Ring. One pint of Paraffin will burn for three hours, making the cost only about ½d. per hour. Burns without smoke or smell, capacity 1½ pints. No. 0 ... **£0 12 6**

8387 Ditto, Large Size, capacity 2½ pints. No. 1 ... ... **0 14 3**

8388 Ditto, as No. 8386, but burning almost without noise. No. 4 ... ... **0 13 9**

8389 Ditto, as No. 8387, „ „ „ „ „ No. 5 ... ... **0 16 6**

(F) **8390** **The Travelling Primus Stove,** burns Paraffin without wick with a blue atmospheric flame. The stove is made to take to pieces and the tank is provided with a screw cap, and therefore does not need to be emptied after using. It is fitted in a box made of stout Tin, with compartments for the various parts of the Stove, Spirit Bottle, etc.

No. 1. Size of Box, 6½×5½×3½ in., capacity of Lamp, 1 pint **£0 15 6**

8391 No. 2. „ „ 8 ×6½×4½ in. „ „ 1½ pints **1 0 0**

(F) Foreign manufacture.



8392-3



8394-5

(F) *8392 **The Aetna Blowpipe Lamp,** burning ordinary Paraffin without wick. It gives a pure and very hot flame up to 3000°F., will burn upside down or in any other position, using ¼ pint of oil per hour. Length of flame 10 in. Easily regulated. Capacity, 1 pint. With Inclined Burner **£0 13 6**

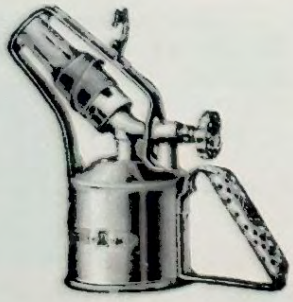
*8393 Ditto, smaller size, ½-pint capacity **0 11 0**

*8394 Ditto, with Vertical Burner, 1 pint capacity **0 14 0**

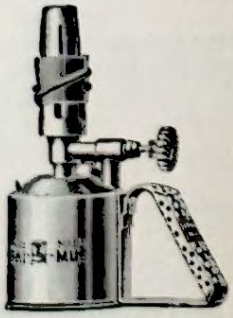
*8395 Ditto, ditto, 1¼ pint capacity **0 15 6**



8396-7



8398



8399

(F) *8396 **Primus Blow Lamps** for Benzoline or Petrol. They produce a flame of 2500°F., and will melt ¼ in. copper rod in one minute.

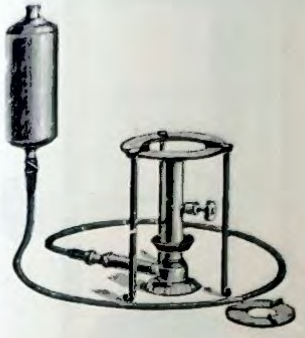
*8397 **Blowlamp** with Inclined Burner. Capacity of Tank, ½ pint ... ... each **£0 9 0**

*8398 Ditto, ditto, with supporting straps. Capacity of Tank, ½-pint **0 11 9**

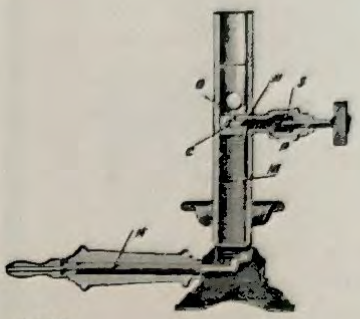
*8399 **Blowlamp,** with Vertical Burner. Capacity of Tank, ½-pint **0 11 9**

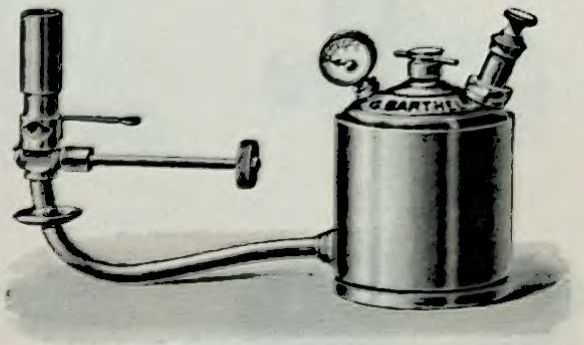
(F) Foreign manufacture.

Barthel's Patent Burners



8400





8401

(F) **8400** **Barthel's** Patent Automatic **Bunsen Burner,** for Methylated Spirit, with Container, 5 ft. Flexible Metallic Tubing, Iron Tripod Stand, complete.

No. 1. Flame, 5 in. approx.	...	...	...	...	£1	6	6
No. 2. ,, 8 in. ,,	...	...	...	...	1	15	6
No. 3. ,, 10½ in. ,,	...	...	...	...	2	0	0
Extra 5-ft. lengths of Flexible Metallic Tubing	...	...	...	each	0	4	0
Extra Tripod Stands with Ring for	No. 1	2	3			
	3 6	3 6	5 6	each		

Instructions.—Join one end of the flexible metallic tubing to the container, and the other end to the Bunsen burner. Fill the container with methylated spirit, about 1½ pints, and hang it up a yard above the bench or table (not higher).

To light up the Bunsen burner, first open the tap underneath the container, give the methylated spirit time to fill the flexible tube, then give the screw regulating valve of the burner half a turn to the left, and let some spirit overflow into the saucer till same is about one-third filled. Then close the regulating valve, set light to the spirit in the saucer; this having burnt out, open the valve half a turn only and set light to the spirit vapours escaping at the mouth of the burner.

When the spirit in the saucer has been lit, any spirit remaining in the parts of the burner this side of the valve will give a large flare, which will quickly disappear. When the burner is first lit up the flame will not at once burn quite steadily, but it will be perfect after a while. Such unsteadiness must not be mistaken for the irregular yellowish flame, which appears if the burner has not been sufficiently warmed up. In the latter case, turn the flame down a little till the burner is sufficiently heated and vapour forms steadily.

Regulation.—By the screw regulating valve the flame can be regulated large or small, but the flame should never be smaller than 1½ in. To extinguish the burner, close the valve.

After continued use renew the wire gauze, which should always rest on the four spikes inside the tube. For a stronger flame take a wider mesh gauze.

Caution.—The perfect burning of Barthel's Patent Bunsen Burner depends upon the accurate size of the nozzle. All burners are sent out carefully tested, and all users are strongly cautioned against increasing size of nozzle, which is absolutely unnecessary and detrimental to the lamps.

N.B.—As the flame of this Bunsen Burner is of considerably greater heat than that of Gas Bunsen Burners, it is necessary, when heating vessels over wire gauze, to use none but iron wire gauze, brass will melt.

(F) **8401** **The Kryolith Mano Roarer Automatic Bunsen Burner,** for Benzoline. A universal apparatus, serves as Blow-Lamp, Bunsen Burner, Cooker, etc. The best heat producer for Schools, Laboratories, Demonstrations and Lecture Rooms, Chemical Works, also for Hot Air Engines, Petroleum Motors, etc. Heat of flame up to 2,000 C. = 3,574 F. Flame 8 in., equal to two Gas Bunsen Burners **£2 10 0**

(F) Foreign manufacture.



8402

Capacity $\frac{1}{10}$th litre, flame 8 in.

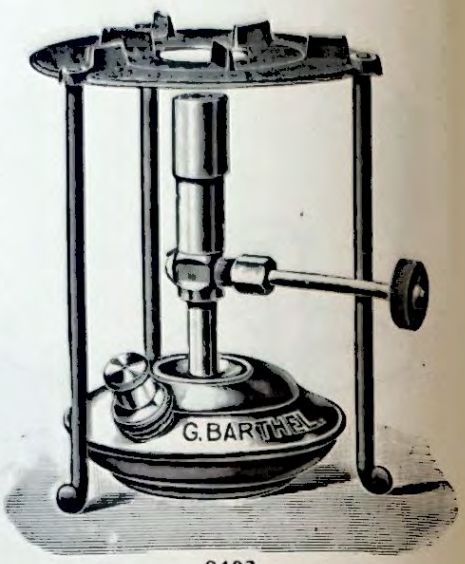
(F) **8402 Barthel's Combined Spirit Lamp and Bunsen Burner.**

This lamp gives a steady blue flame from six to seven inches in height, and of a far greater heating power than the ordinary type of spirit lamp. It is started by means of an asbestos clip, which is saturated with methylated spirit, then lit, and held round the wick tube. No. 8 ... **£0 17 0**

(F) **8403 Barthel's "Pinit" Benzine Lamp.**

This Lamp is somewhat more powerful than the ordinary Bunsen Gas Burner, and is well adapted as a substitute for gas burners in analytical work. Requires no wick. Flame tube can be changed for a flat burner for Cooking.

Price of Lamp	**£1 4 0**
Tripod Stand, with Ring	**0 3 9**
Rose Burner	**0 2 6**



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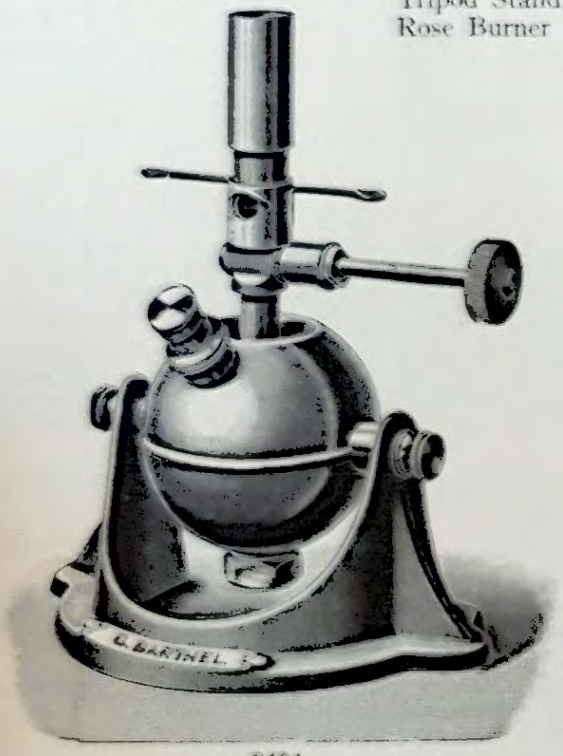
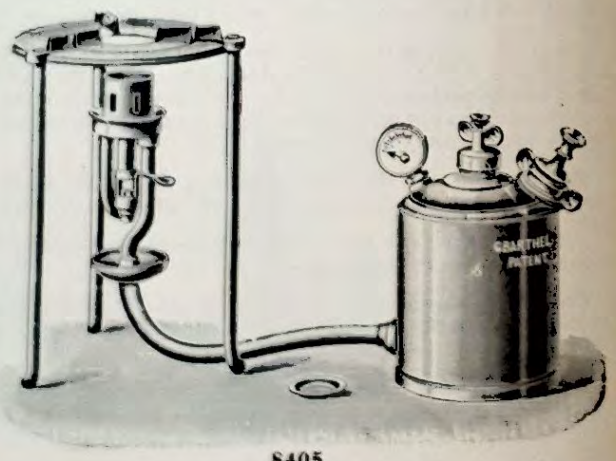


8404

(F) **8404 Barthel's "Malachit" Benzine Lamp.** The reservoir is mounted in bearings so that the flame can be used in any position from the vertical to the horizontal. It is specially suitable for glass bending. The intensity of the flame can be regulated by collar on burner **£1 12 0**



8405

(F) **8405 The "Korall" Bunsen Burner for Paraffin Oil.** This will be found a first-rate Burner where paraffin is preferred as fuel. It burns with a perfectly blue flame, which can be easily adjusted from a quiet burning to a blast flame by means of the air regulator.

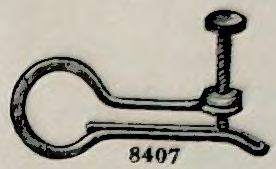
Price of Burner...	**£2 10 0**
Tripod with Ring	**0 3 9**

(F) Foreign manufacture.

Clips for Burettes, etc.



8406



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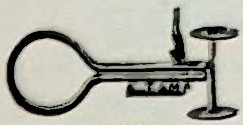
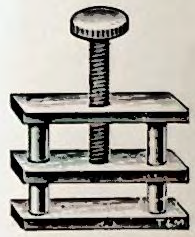


8408

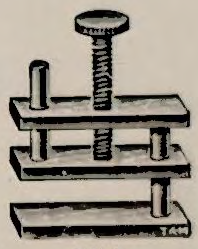


8409

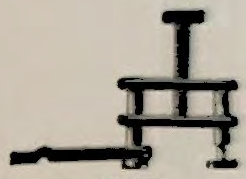
		Nos. ...	1	2	3	4	
(F) **8406**	**Clips,** Mohr's, Nickelled...		**2/6**	**2/9**	**3/6**	**4/0**	per doz.
		Nos.	1	2	3		
(F) **8407**	Ditto, with Screw		**6d.**	**7d.**	**8d.**		each
			5/0	**6/0**	**7/0**		per doz.
(F) **8408**	**Clips,** New Form, with Spring Clip to hold open ...		**6d.**	**7d.**	**8d.**		each
			5/0	**6/0**	**7/0**		per doz.
(F) **8409**	**Clamps,** Bunsen's ... Width between screws...		22	28	32		mm. inside
			9d.	**10d.**	**1/0**		each
			8/0	**9/0**	**10/6**		per doz.



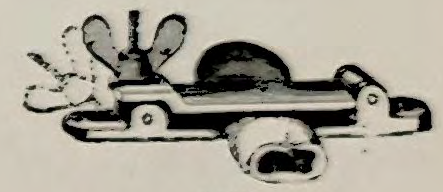
8410



8411



8412



8413

(F) **8410** **Clamp,** Hofmann's, New Pattern, with Flat Bottom, Nickel-plated.

Nos.	1	2	3	4		
Width between bars	½	¾	⅞	1		in.
	6d.	**7d.**	**7d.**	**8d.**		each
	5/3	**5/9**	**6/0**	**6/6**		per doz.

(F) **8411** **Clamp,** Hofmann's, with Centre Bar and Open Side.

Width between bars	½	¾	⅞	1	in.
	7d.	**7d.**	**8d.**	**8d.**	each
	5/6	**6/0**	**6/6**	**7/0**	per doz.

(F) **8412** **Clamp,** Hofmann's, the bottom part with hinge, enabling the removal without unscrewing. Nickel-plated

Width between bars	½	¾	⅞	1	in. inside
	7d.	**7d.**	**8d.**	**8d.**	each
	5/6	**6/0**	**6/6**	**7/0**	per doz.

8413 **Clamp,** with Screw Holes for fixing to Bench for larger sizes of Rubber Tubing, each **£0 2 0**

(F) Foreign manufacture.

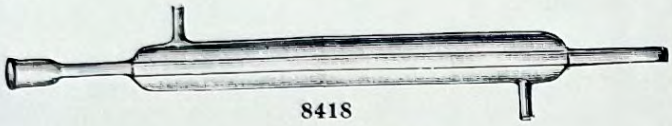


8416

8416 **Condensers,** Liebig's, Glass Body and Tubes with Rubber Connections.

Length of body	20	25	30	40	45	50	60	75 cm.
	2/3	**2/4**	**2/6**	**3/0**	**3/6**	**4/0**	**5/0**	**6/6** each

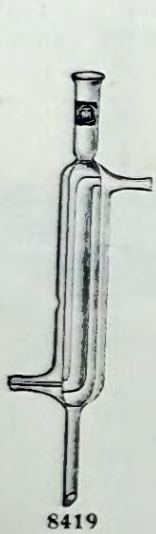
8417 **Condenser Tubes** for above Condensers, Inner Tubes only **8d. 10d. 1/0 1/2 1/3 1/4 1/8 2/0** each



8418

8418 **Condensers,** made entirely of Glass, with the inner tube fused in.

Length of body	25	30	40	45	50	60	cm.
	4/0	**4/6**	**5/0**	**5/6**	**6/0**	**7/6**	each



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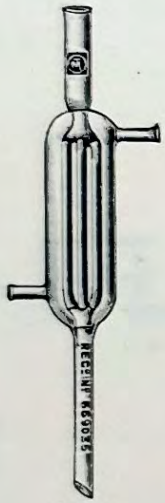


8420



8421



8422

8419 **Condensers,** Double Surface, suitable for use with Soxhlets Extraction Apparatus, etc.

Length of body	10	15	20	25	30	cm.
	7/0	**7/6**	**8/6**	**9/6**	**11/3**	each
	75/6	**82/0**	**92/0**	**104/0**	**121/0**	doz.

8420 **Condensers,** Glass, Reflex, designed by J. Lewis, Registered No. 569035, with three fall Inner Tube.

Length of Body	15	20	25	cm.
	7/6	**8/6**	**10/0**	each

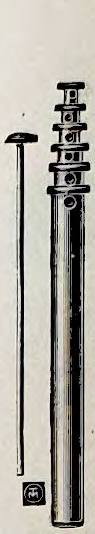
8421 **Condensers,** Glass, Allihn's Inner Tube fused in.

Length of body	20	25	30	40	45	50	60	cm.
	4/0	**4/6**	**5/0**	**5/9**	**6/6**	**7/6**	**9/0**	each

(F) **8422** **Condenser,** Glass, Inland Revenue Pattern, body 8×2½ in. ... ... each **£0 12 6**

(F) Foreign manufacture.

Cork Borers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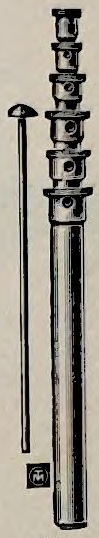
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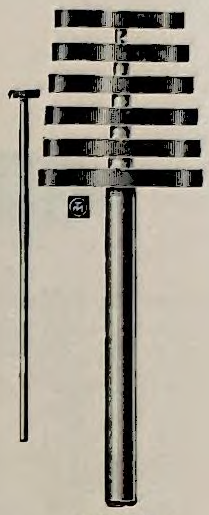
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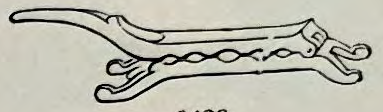
8427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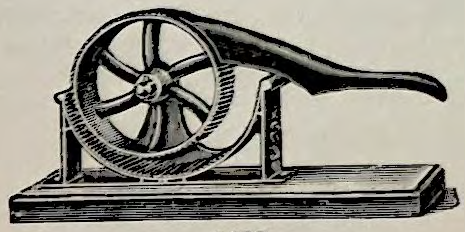

8429

8423 **Cork Borers,** made of Seamless Brass Tube with rod.

	Sets of 3	4	6	9	12	
	1/3	**1/8**	**2/0**	**3/6**	**5/6**	each

8424 **Cork Borers,** Superior make, of Seamless Brass Tube, polished and lacquered, with cast Brass Heads with Rod ... Sets of

3	4	6	9	12	
1/6	**2/3**	**3/0**	**4/9**	**6/6**	each

8425 **Cork Borers,** Superior make, of Seamless Brass Tube, with separate Handle to each Borer.

Sets of 3	4	6	9	12	18	
2/0	**2/9**	**3/6**	**6/0**	**9/0**	**17/6**	each

(F) **8426** **Cork Borers,** Superior make, of Seamless Steel Tubing, with separate Malleable Iron Handles.

Sets of 3	4	6	9	12	
4/0	**6/0**	**8/0**	**12/0**	**16/0**	each

(F) **8427** **Cork Borer Sharpeners** ... ... each **£0 1 10**

8428 **Cork Pressers,** Bronzed Iron ... ... ,, **0 3 6**

(F) **8429** ,, New form, very powerful, will fit any size cork ... ,, **0 7 6**

Camel-Hair Brushes


8430


8431


8432

		Small	Medium	Large	
(F) **8430**	**Camel-Hair Brushes**	**8d.**	**1/0**	**1/3**	per doz.
		7/0	**11/0**	**13/0**	per gross

(F) **8431** **Camel-Hair Brushes,** Flat, Tin-Bound, in Cedar Handles.

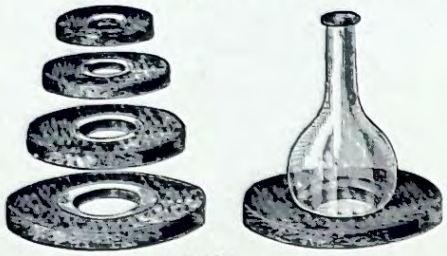
½	¾	1	1½	2	2½	3	
7d.	**9d.**	**10d.**	**1/2**	**1/6**	**1/10**	**2/3**	each

(F) **8432** **Camel-Hair Brushes,** Round or Dabbers.

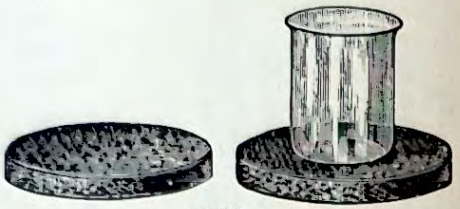
Nos. 1	2	3	4	6	8	
4d.	**5d.**	**7d.**	**9d.**	**1/0**	**1/3**	each
3/6	**4/0**	**6/0**	**8/0**	**11/0**	**13/6**	per doz.

(F) Foreign manufacture.

Compressed Cork Rings and Mats (Suberit)



8434



8435

For use in Laboratories, etc. These articles will be found invaluable to the Chemist, cork being an excellent non-conductor of heat, and affording a soft yet firm support upon which delicate apparatus such as Flasks, Beakers, Basins, etc., containing hot liquids, may be rested. Risk of breakage by sudden change of temperature or by sharp contact with a hard support, is reduced to a minimum.

(F) **8434** **Suberit Cork Rings,** thickness, 4½ cm.

No.	1	2	3	4	5	
Diam. outside	24	19½	15½	11½	8	cm.
,, inside	19½	15½	11½	8	4½	cm.
Set of 5 Rings, **15/0**	**6/6**	**4/0**	**3/0**	**1/6**	**10d.**	each

(F) **8435** **Suberit Cork Mats.**

No. ...	1	2	3	4	5	6	
Diameter	12	12	12	12	12	12	cm.
Thickness	40	30	25	20	12	6	mm.
Set of 6 Mats, **4/0**	**1/2**	**11d.**	**9d.**	**7d.**	**6d.**	**5d.**	each

Corks



8439

8436 **Corks,** Finest Quality, picked for Chemical purposes.

Diam., small end	½	9/16	⅝	¾	⅞	1	1⅛	1¼	
	3/0	**3/9**	**4/6**	**5/8**	**7/6**	**9/8**	**11/0**	**12/0**	per gross

8437 **Corks,** Cheaper Quality, for bottles, etc.

Diam., small end	⅜	½	⅝	¾	⅞	1	1⅛	1¼	
	1/3	**1/8**	**2/3**	**3/3**	**5/0**	**6/3**	**7/6**	**8/9**	per gross

8438 **Corks,** Bungs, best White, for Bottles and Jars.

Diam.	⅞	1	1⅛	1¼	1⅜	1½	1⅝	1¾	2	2¼	2½	2¾	3	3¼	3½	3¾	4	in.
	3d.	**4d.**	**5d.**	**7d.**	**8d.**	**9d.**	**11d.**	**1/2**	**1/4**	**2/0**	**2/6**	**3/6**	**4/6**	**5/6**	**8/0**	**8/9**	**10/0**	per doz.
	2/6	**3/6**	**4/6**	**6/0**	**7/0**	**8/0**	**10/0**	**12/0**	**15/0**	**22/6**	**27/0**	**40/0**	**52/0**	**62/0**	—	—	—	per gross

8439 **Corks,** Good Quality, Red Rubber, solid or with 1 or 2 holes.

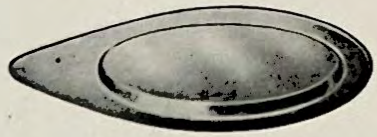
Diam. small end	⅜	½	⅝	¾	⅞	1	1¼	1½	1⅝	1¾	1⅞	2	2¼	in.
	1d.	**1½d.**	**2d.**	**3d.**	**4½d.**	**6d.**	**8d.**	**10d.**	**1/0**	**1/3**	**1/5**	**1/7**	**2/0**	**2/6**	each
	1/0	**1/4**	**1/9**	**2/6**	**4/0**	**5/3**	**7/0**	**9/0**	**11/0**	**13/6**	**15/0**	**17/0**	**22/0**	**27/0**	per doz.

8440 **Corks,** Good Quality, Red Rubber, solid, or with 1 or 2 holes. No. 1 being very small is supplied only in the solid form.

Nos.... ...	1	2	3	4	5	5a	6	6a	7	7a	8	8a	9	10	11	12	
Diam. at Top	10	12	14	17½	21½	23	25½	28	31	32	35	38	42	43	47½	52½	mm.
,, Bottom	5	8½	10	13½	16	17	19	22	25	27	28	30	33½	37	41	47	mm.
Length ...	17	17	17	24	25	25	29	30	32	32	34	34	40	44	50	53	mm.
	2d.	**2d.**	**2d.**	**3d.**	**4d.**	**5d.**	**6d.**	**7d.**	**9d.**	**10d.**	**11d.**	**1/3**	**1/8**	**1/10**	**2/9**	**3/6**	each
	1/0	**1/6**	**1/9**	**2/6**	**3/0**	**3/9**	**4/6**	**6/0**	**7/6**	**9/0**	**10/0**	**12/6**	**17/6**	**20/6**	**30/0**	**37/6**	doz.

(F) Foreign manufacture.

Crucibles, Porcelain





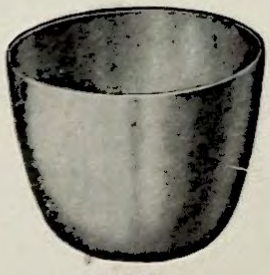
8441–2



8443–6



8447



8448–9

Crucibles, Porcelain, good quality, with cover.

	Nos. ...	000	00	0	1	2	3	4	5	
	Capacity	5	10	17	30	50	90	145	280	c.c.
(F) **8441**	Crucibles only	**5d.**	**5d.**	**5d.**	**7d.**	**8d.**	**9d.**	**10d.**	**1/2**	each
		4/6	**4/6**	**4/6**	**6/0**	**6/6**	**8/0**	**9/0**	**12/0**	per doz.
(F) **8442**	Crucibles with Lids, complete.									
		8d.	**8d.**	**8d.**	**10d.**	**11d.**	**1/1**	**1/3**	**1/7**	each
		6/6	**6/6**	**6/6**	**9/6**	**10/0**	**11/0**	**13/6**	**17/6**	per doz.

Crucibles, British, Porcelain, made at the Royal Worcester Factory.

	Nos. ...	000	00	0a	0	1	2	
	Diameter	26	30	36	41	46	57	mm.
	Height ...	19	25	26	25	30	36	mm.
	Capacity ...	5	10	15	17	25	50	c.c.
8443	Crucibles only	**6d.**	**8d.**	**10d.**	**1/0**	**1/3**	**1/9**	each
		5/0	**6/9**	**8/3**	**10/6**	**13/6**	**18/9**	per doz.
8444	Crucibles, with Lids, complete.							
		11d.	**1/1**	**1/3**	**1/6**	**1/10**	**2/3**	each
		10/0	**11/9**	**13/3**	**15/6**	**19/3**	**24/6**	per doz.

8445 **Crucibles,** British, Sillax Laboratory Porcelain.

Diameter (rim)	26	30	36	41	46	57	mm.
Capacity ...	5	10	15	17	25	50	c.c.
	3/9	**3/9**	**4/3**	**4/3**	**5/9**	**8/0**	per doz.

8446 Lids for above ... ... **3/6** **3/8** **3/9** **4/6** **4/6** **5/4** per doz.

(F) **8447** **Crucibles,** Stout Sheet Iron, with Covers.

Height	30	35	40	45	50	50	60	65	70	70	mm.
Diameter	45	45	55	60	60	70	75	80	85	105	mm.
	11d.	**1/0**	**1/2**	**1/3**	**1/4**	**1/6**	**1/8**	**1/10**	**2/1**	**2/6**	each
	10/0	**10/6**	**13/6**	**13/6**	**14/6**	**16/6**	**17/6**	**20/0**	**22/6**	**27/6**	doz.

8448 **Crucibles** and **Covers,** Pure Nickel, complete.

Diameter	2	2½	3	3½	4	5	6	7	8	10	cm.
	1/10	**1/11**	**2/2**	**2/4**	**2/9**	**3/5**	**4/2**	**5/5**	**6/1**	**8/6**	each
	19/3	**20/9**	**23/6**	**25/0**	**29/9**	**37/0**	**44/7**	**58/6**	**66/0**	**92/3**	doz.

8449 **Crucibles,** Pure Nickel, without cover.

1/2	**1/3**	**1/6**	**1/7**	**1/10**	**2/3**	**2/9**	**3/7**	**4/1**	**5/6**	each
12/0	**13/0**	**15/6**	**16/6**	**20/0**	**23/9**	**29/3**	**38/6**	**43/9**	**60/0**	doz.

(F) Foreign manufacture.


8450


8451


8453


8454


8455

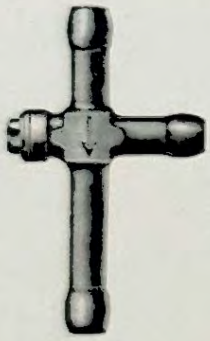
8450 **Filter Pump.** Improved pattern, Registered No. 704540, designed by K. Hickman, Esq., of the Imperial College of Science, South Kensington. In the Pump the air is sucked from a central jet, the area of which can be determined by inspection or measurement. The water jet is formed by an annulus existing between the constricted walls of the pump and the central air jet. The vacuum efficiency of the pump with regard both to the suction and the volume dealt with remains the same.

The air being in contact with moving water only there is no retarding effect from the walls of the pump. It may be made to deal with small volumes of air giving good vacuum off low water pressures, or a large capacity and medium or good vacuum may be obtained with heavy pressures. The pump is especially useful where it is desired to suck water instead of air. Price **2/6** each; **27/6** per doz.

8451	**Pump, Filter Tube,** Improved, with Gauge Tube	**£0**	**3**	**6**
8452	,, ,, ,, ,, without Gauge Tube	**0**	**3**	**0**
8453	,, ,, ,, Geissler's...	**0**	**2**	**0**
8454	,, ,, ,, University College pattern	**0**	**2**	**6**
8455	,, ,, ,, New pattern	**0**	**3**	**0**



8456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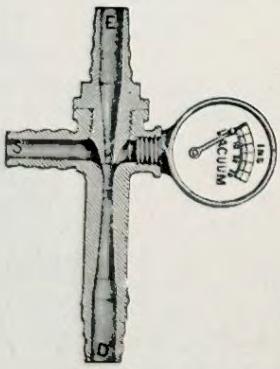


8458


8459

8456	**Pump, Filter Tube,** Brass, Nickel-plated ... ... per doz. **56/0**; each	**£0**	**5**	**0**
8457	,, ,, ,, Korting's pattern, Brass	**0**	**10**	**0**
8458	,, ,, ,, ,, with Vacuum Gauge	**1**	**6**	**0**

(F) **8459** **Filtering Flasks,** Bunsen's, Conical Form, Stout Glass.

	125	250	500	750	1000	1500	2000	c.c.
With Side Tube	**1/6**	**2/0**	**2/6**	**2/9**	**3/3**	**3/9**	**4/9**	each

(F) Foreign manufacture.



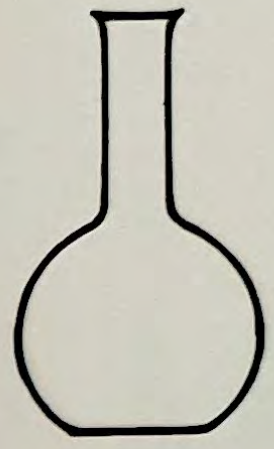
Fig. A.
8460



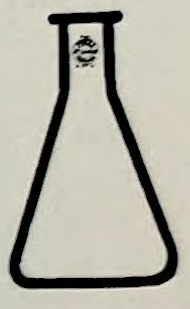
Fig. A.
8461-2



Fig. D.



8463/5



8464/6

(F) **8460** **Flasks,** Good Quality Resistance Glass, specially recommended for Schools and Educational purposes. Fig. A.

Capacity	70	125	200	250	350	500	750	c.c. 1	litre
	4d.	**5d.**	**6d.**	**7d.**	**9d.**	**10d.**	**11d.**	**1/1**	each
	3/6	**4/6**	**4/9**	**5/9**	**7/9**	**9/0**	**9/6**	**11/0**	per doz.

8461 **Flasks,** British Resistance Glass, with Flat Bottom, Fig. A, or Round Bottom, Fig. D.

Capacity	50	100	150	200	300	400	500	600	800	1000	c.c.
	8d.	**9d.**	**10d.**	**11d.**	**1/0**	**1/1**	**1/2**	**1/4**	**1/6**	**1/9**	each
	6/0	**7/0**	**8/0**	**8/6**	**10/0**	**11/0**	**12/0**	**14/0**	**16/0**	**20/0**	per doz.

(F) **8462** **Flasks,** Best Quality, Bohemian Resistance Glass; Fig. A, Ordinary; or Fig. D, Round Bottom.

Capacity	35	70	100	150	200	250	350	500	600	750	c.c.
	5d.	**6d.**	**7d.**	**8d.**	**9d.**	**10d.**	**1/1**	**1/3**	**1/4**	**1/4**	each
	4/3	**5/3**	**5/6**	**6/6**	**7/9**	**8/6**	**11/0**	**12/9**	**14/0**	**14/0**	per doz.
							1	$1\frac{1}{2}$		2	litres
							1/6	**1/9**		**1/11**	each
							16/0	**18/6**		**20/6**	per doz.

8463 **Flasks,** Pyrex Glass, with Flat Bottom, British made.

Capacity	50	100	150	250	400	500	700	1000	c.c.
	9/3	**9/6**	**11/3**	**13/0**	**14/9**	**16/0**	**20/0**	**23/3**	per doz.

8464 **Flasks,** Pyrex Glass, Erlenmeyer's Conical, British made.

Capacity	50	100	150	200	250	300	500	750	1000	c.c.
	8/9	**9/6**	**9/6**	**11/3**	**12/0**	**13/6**	**16/0**	**18/6**	**22/9**	per doz.

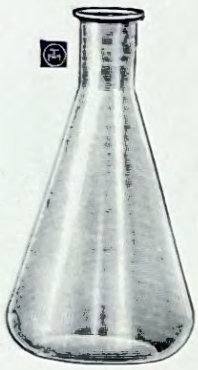
8465 **Flasks,** Monax Glass, with Flat Bottom, British made.

Capacity	50	75	100	175	250	350	500	750	1000	c.c.
	7/9	**8/6**	**8/6**	**9/6**	**10/6**	**11/6**	**14/0**	**20/0**	**22/6**	per doz.

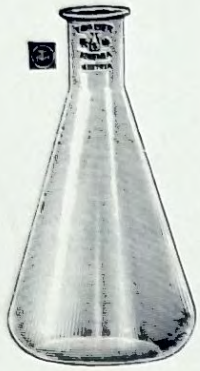
8466 **Flasks,** Monax Glass, Erlenmeyer Conical, British made.

Capacity	50	100	150	200	250	350	500	750	1000	c.c.
	7/9	**8/6**	**9/0**	**10/0**	**10/6**	**11/6**	**14/0**	**20/0**	**22/6**	per doz.

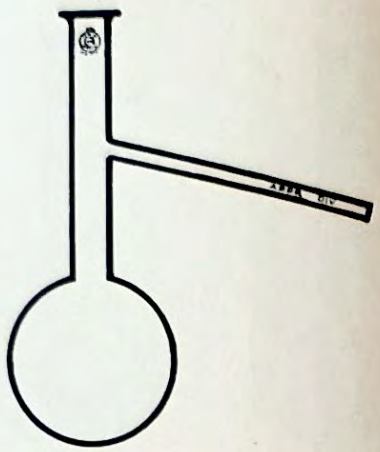
(F) Foreign manufacture.



8467



8468



8470

8467 **Flasks**, Conical, British Resistance Glass.

Capacity	50	100	175	250	350	500	600	750	1000	c.c.
	8d.	**9d.**	**10d.**	**11d.**	**1/1**	**1/2**	**1/4**	**1/6**	**1/9**	each
	6/0	**7/0**	**8/0**	**9/0**	**11/0**	**12/0**	**14/0**	**16/0**	**20/0**	per doz.

(F) **8468** **Flasks**, Best Quality, Bohemian Resistance Glass, Conical, Erlenmeyer's form.

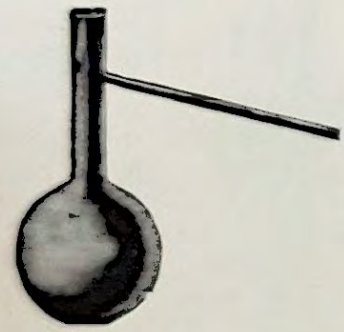
Capacity	70	100	150	200	250	350	500	600	750	1000	c.c.
	7d.	**7d.**	**8d.**	**9d.**	**10d.**	**1/0**	**1/3**	**1/4**	**1/4**	**1/6**	each
	5/6	**5/6**	**6/6**	**7/9**	**8/6**	**11/0**	**12/9**	**14/0**	**14/6**	**16/0**	per doz.

(F) **8469** **Flasks**, with side Tube and Round Bottom, for distillation.

Capacity	30	60	125	250	350	500	750	1000	1500	2000	c.c.
	10d.	**1/0**	**1/2**	**1/9**	**2/0**	**2/3**	**3/0**	**3/6**	**4/6**	**5/6**	each
	8/6	**10/6**	**12/6**	**19/0**	**21/6**	**24/9**	**33/0**	**39/0**	**50/0**	**61/0**	per doz.

8470 **Flasks**, Pyrex Glass, British made.

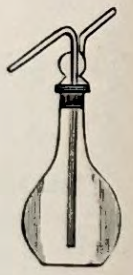
Capacity	50	100	250	500	700	1000	c.c.
	21/9	**24/9**	**32/9**	**38/3**	**55/3**	**63/0**	per doz.



8471



8472



8473

8471 **Flasks**, Copper, with Side Tube for Fractional Distillation.

150	300	500	750	1000	c.c.
17/3	**20/0**	**22/6**	**25/6**	**28/6**	each

8472 **Washing Flask**, Gmelin's, fitted with bent Tubes and Rubber Cork, complete.

Capacity	500	750	1000	1500	c.c.
	1/9	**2/0**	**2/6**	**3/3**	each

(F) **8473** **Washing Flask**, with Tubes ground into Neck.

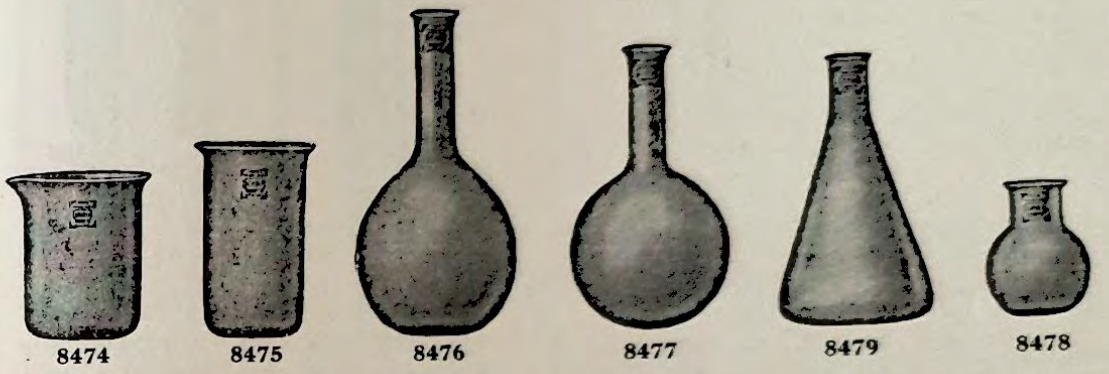
Capacity	250	500	750	1000	c.c.
	4/9	**5/6**	**7/6**	**8/0**	each

(F) Foreign manufacture.

Regd. Trade Mark. SCHOLA No. 474100.

Beakers and Flasks

Made in England.



8474 8475 8476 8477 8479 8478

These Beakers and Flasks are made in a Resistant Glass; they are designed for the use of students and others who require good serviceable glassware, but who do not require the highest grade. The workmanship is of the best quality, and the Beakers and Flasks are of excellent value at the low prices quoted.

8474 Squat Beakers (Spouted).

Nominal capacity ...	100	150	250	400	600	900	c.c.
Price	4/6	5/6	7/0	8/0	11/0	13/0	per doz.
,, ...	6d.	7d.	8d.	9d.	1/1	1/3	each

8475 Tall Beakers (without Spout).

Nominal capacity ...	100	150	250	400	600	1000	c.c.
Price	4/6	5/6	7/0	8/0	11/0	14/0	per doz.
,, ...	6d.	7d.	8d.	9d.	1/1	1/4	each

8476 Flat-Bottom Florence Flasks.

Actual capacity	150	250	380	490	600	800	1100	c.c.
Price	5/0	6/0	7/0	8/0	9/0	11/0	12/0	per doz.
,, ...	6d.	7d.	8d.	9d.	10d.	1/1	1/2	each

8477 Round-Bottom Florence Flasks.

Actual capacity ...	140	530	1100	c.c.
Price	5/0	9/0	12/0	per doz.
,, ...	6d.	10d.	1/1	each

8478 Flat-Bottom, Wide-Mouth (CO_2) Flasks.

Actual capacity	70	130	230	c.c.
Price ...	5/0	6/0	7/0	per doz.
,, ...	6d.	7d.	8d.	each

8479 Conical Flasks (Erlenmeyer).

Actual capacity	150	210	280	350	580	800	1000	c.c.
Price ...	5/0	6/0	7/0	8/0	9/0	11/0	12/0	per doz.
,, ...	6d.	7d.	8d.	9d.	10d.	1/1	1/2	each

The capacity of the Flasks is measured to the base of the neck.

Quantities of less than one dozen charged at single prices.



8480



8481



8482



8483

(F) **8480** **Funnels,** Superior White Glass, Plain (Fig. 8480), or Ribbed (Fig. 8481).

(F) **8481**

2½	4	5	6½	7½	9	10	11½	13	15	18	20	22½	25	30	cm. diam.
1	1½	2	2½	3	3½	4	4½	5	6	7	8	9	10	12	in.
5d.	**6d.**	**7d.**	**8d.**	**9d.**	**10d.**	**11d.**	**1/1**	**1/3**	**1/6**	**2/0**	**2/6**	**3/6**	**4/6**	**8/9**	each
4/6	**5/0**	**5/6**	**6/6**	**7/6**	**8/6**	**10/0**	**12/0**	**13/6**	**16/0**	**21/0**	**27/0**	**38/0**	**46/6**	**97/6**	per doz.

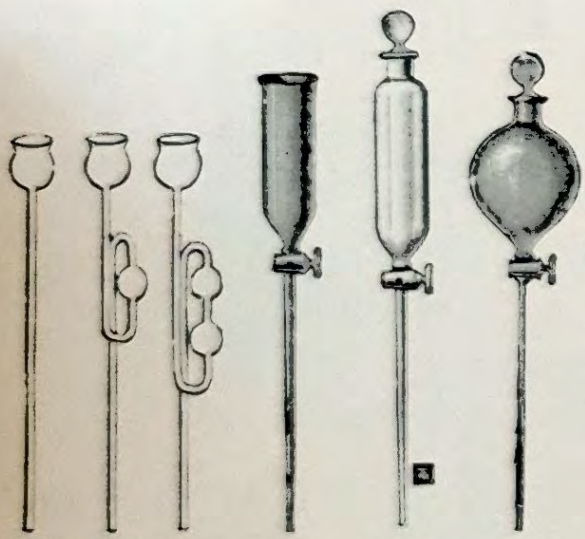
Sizes of Filter Paper required to fit above Funnels.

Diameter of Funnel ...	4	5	6·5	7	9	10	13	15	cm.
,, ,, Filter Paper	7	9	11	12·5	15	18·5	24	27	cm.

(F) **8482** **Funnels,** Kavalier's, Bohemian Resistance Glass, with polished edges, Plain (Fig. 8482), or Ribbed (Fig. 8483).

(F) **8483**

4	5	6	7	8	9	10	11	12	15	cm.
7d.	**8d.**	**10d.**	**11d.**	**1/1**	**1/2**	**1/3**	**1/4**	**1/8**	**2/3**	each
6/0	**6/10**	**8/8**	**9/9**	**11/3**	**12/6**	**13/6**	**14/6**	**17/10**	**25/0**	per doz.



8484 **8485** **8486** **8487** **8488** **8489**

(F) **8484** **Funnels,** Safety, with long Tube for fitting up Gas Flasks, etc.

Length	15	20	25	30	35	45	cm.
	3d.	**3d.**	**4d.**	**4d.**	**5d.**	**6d.**	each
	2/6	**2/9**	**3/0**	**3/3**	**4/6**	**5/6**	per doz.

8485 **Funnels,** Safety, with one Bulb.

Length	30	40	50	cm.
	8d.	**10d.**	**1/0**	each
	7/0	**8/6**	**10/6**	per doz.

8486 ,, Safety, with two Bulbs.

Length	30	40	50	cm.
	10d.	**1/0**	**1/2**	each
	8/6	**10/6**	**12/6**	per doz.

(F) **8487** ,, Cylindrical Shape, with Stopcock.

30	50	100	150	200	c.c.
3/3	**3/9**	**4/6**	**5/6**	**6/0**	each

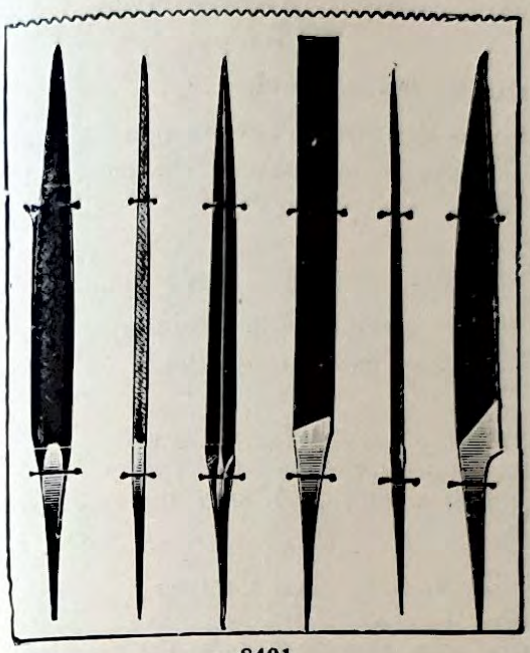
(F) **8488** ,, Cylindrical Shape, with Stopcock and Stopper

30	50	100	150	250	c.c.
3/6	**4/0**	**5/0**	**5/6**	**6/6**	each

(F) **8489** ,, with Stoppered Bulb and Stopcock.

Capacity 30	50	100	150	250	500	750	1000	c.c.
3/9	**4/0**	**5/0**	**5/6**	**6/6**	**8/0**	**10/0**	**12/0**	each

(F) Foreign manufacture.



8491

(F) **8491** **Files,** Set of six, 3½ in. long, as illustrated, per set ... **£0 3 0**

8492 ,, Round, for enlarging Holes in Corks.

4	5	6	in.
7/0	**8/0**	**9/0**	per doz.

8493 ,, Triangular, for cutting Glass Tube and Rod.

3½	4	5	6	in.
7/0	**7/3**	**8/6**	**10/9**	per doz.

8494 ,, Flat.

6	7	8	9	10	in.
10/0	**12/0**	**14/0**	**16/0**	**18/0**	per doz.

8495 **Rasps,** Flat.

6	7	8	9	10	in.
13/0	**15/6**	**18/0**	**20/0**	**22/0**	per doz.

8496 **Rasps,** Half-round.

13/0	**15/6**	**18/0**	**20/0**	**22/0**	,,

Wood Handles for Small Files, **2d.** each extra.



8497



8498



8499



8499/1-8501

(F) **8497** **Gas Cylinders,** on Foot with Flange at top, ground to fit Glass Plates.

Height ...	6	6	8	10	12	12	12	in.
Diameter inside	1½	2	2	2	2	2½	3	in.
	11d.	**1/0**	**1/3**	**1/6**	**1/9**	**2/0**	**2/7**	each
	9/6	**10/6**	**13/6**	**16/0**	**18/6**	**21/0**	**28/0**	per doz.

Gas Jars, with Neck and Open Bottom.

Capacity	400	500	600 c.c.	1	1½	2	2½	3	litres
(F) **8498** Plain	**1/2**	**1/3**	**1/6**	**1/9**	**2/0**	**2/4**	**2/8**	**3/0**	each
(F) **8499** Stoppered ...	**2/6**	**2/9**	**3/0**	**3/6**	**4/6**	**5/6**	**6/3**	**7/0**	,,

8499/1 **Gas Deflagrating Spoon** ... ... per doz., **4/0**; each **£0 0 5**

8500 ,, ,, with Tin Plate Cap ... ... ,, **6/6** ,, **0 0 8**

8501 ,, ,, with Brass Cap ... ... ,, **7/6** ,, **0 0 9**

(F) Foreign manufacture.



Made entirely in Great Britain by British Labour

Particular attention is drawn to the fact that the low prices are due to improved methods of manufacture which not only make for cheapness but uniformity and reliability.

8502 **Plain White Filter.** No. 311 replacing C. S. & S. No. 595.

A good quality paper for general use in laboratory work. Quick filtering, and retaining finest precipitates.

Size in cm.	5·5	7	9	11	12·5	15	18·5	24	27	32	38·5	40	45	50	65	
,, in.	2⅛	2¾	3½	4⅜	4⅞	5⅞	7¼	9½	10⅝	12⅝	15⅛	15¾	17¾	19¾	25⅝	
	2/3	**3/0**	**4/3**	**5/6**	**6/6**	**8/6**	**14/6**	**21/0**	**22/0**	**28/0**	**37/6**	**40/6**	**51/0**	**65/0**	**105/0**	per 1000

8503 In reams 18×23 in., 500 sheets, No. 311. **31/6**

8504 No. 311½ is a thicker and stronger variety, recommended for larger sizes. Replacing C. S. & S. No. 597.

Size in cm.	5·5	7	9	11	12·5	15	18·5	24	27	32	38·5	40	45	50	65	
	2/9	**3/3**	**4/6**	**5/9**	**7/6**	**9/6**	**14/9**	**23/0**	**25/0**	**33/6**	**45/0**	**48/0**	**61/6**	**76/6**	**124/6**	per 1000

8505 In reams 18×23 in., 500 sheets, No. 311½, **37/6**.

8506 A thin, slow, strong, very reliable paper, retains finest precipitates, useful with pump.

Size in cm.	4·5	5·5	7	9	11	12·5	15	18·5	24	27	32	
	2/0	**2/3**	**3/0**	**4/3**	**5/6**	**6/6**	**8/6**	**14/6**	**21/0**	**22/6**	**25/6**	per 1000

8507 Very fast for metallurgical and coarse precipitates.

Size in cm.	4·5	5·5	7·5	9·0	11·0	12·5	15·0	18·5	24·0	27·0	32·0	
	3/3	**3/6**	**5/3**	**6/6**	**7/9**	**10/0**	**12/6**	**20/0**	**30/6**	**32/6**	**35/6**	per 1000



Whatman Filter Paper No. 1.

A high-grade Filter Paper for general qualitative work, and for filtering ordinary precipitates when the ash weight of the paper is of no consequence. A 15 cm. filter requires 50-80 seconds to filter 100 c.c. of water. Widely used in Sugar Laboratories and for the filtration of yellow Ammonium Phospho-Molybdate after digestion, in determining phosphorus in fertilisers.

8508	Diameter in cm.	4·25	5·5	7	9	11	12·5	15
	,, ,, in.	1⅝	2¼	2¾	3½	4⅜	5	5⅞
	Ash per circle in grammes	·00026	·00043	·00073	·00012	·0075	·0023	·00326
	Per 100 circles	**4d.**	**5d.**	**6d.**	**7d.**	**9d.**	**1/0**	**1/3**
	Diameter in cm.	18·5	24	27	32	38·5	40	50
	,, ,, in.	7¼	9½	10⅝	12½	15¼	15¾	19⅝
	Ash per circle in grammes	·00496	·0054	·00835	·0106	·0138	·0148	·0215
	Per 100 circles	**1/9**	**3/0**	**3/8**	**5/8**	**6/10**	**7/9**	**10/10**

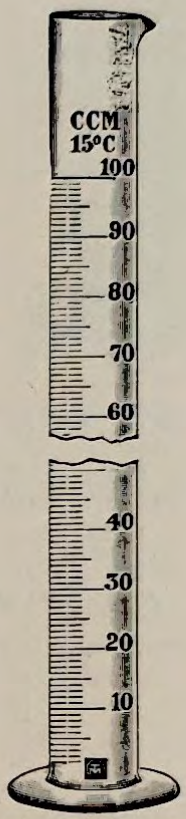
8509 In sheets 18¼×22½ in. ... per ream **£2 10 0**
per 100 sheets **0 11 0**



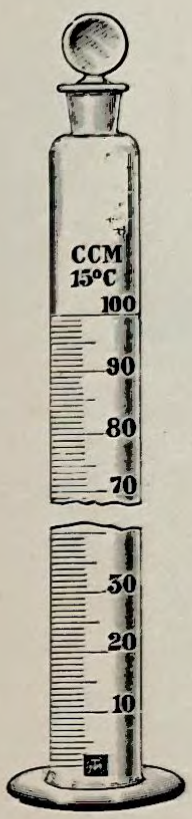
8512



8513



8514



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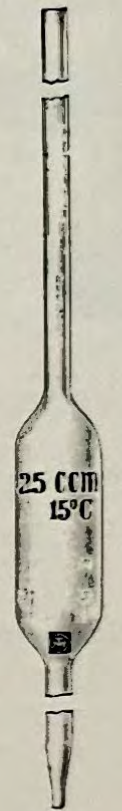


8516



8517

(F) **8512** **Burettes,** with Clip and Glass Jet.

Capacity	10	25	50	100	100 ml.
Divided into	1/10	1/10	1/10	1/5	1/10
	1/6	2/0	2/9	4/6	6/3 each
	16/6	22/6	31/0	52/0	72/0 per doz.

(F) **8513** **Burettes,** with Stopcock.

Capacity ...	10	25	50	100	100 ml.
Divided into	1/10	1/10	1/10	1/5	1/10
	3/0	3/4	4/0	5/9	7/0 each
	34/0	38/0	45/6	66/0	80/0 per doz.

Graduated Test Measure and Mixers, on Glass Foot.

	10	25	50	100	200	250	500	1000	2000 ml.
	1/10	1/5	1/5	1/5	2	1/5	1/5	1/10	1/10 ml.
(F) **8514** Without Stopper ...	1/0	1/2	1/4	1/6	2/0	2/4	3/0	4/10	10/6 each
	10/6	12/0	14/0	16/0	22/0	25/0	33/0	54/0	120/0 per doz.
(F) **8515** With Stopper ...	1/6	1/9	2/0	2/4	3/2	3/6	4/6	7/6	13/0 each
	16/0	19/0	22/6	25/0	35/0	39/0	52/0	85/0	150/0 per doz.

(F) **8516** **Graduated Pipettes,** to deliver cubic centimetres gauged at one mark.

1	2	3	5	10	15	20	25	50	100 ml.
5d.	6d.	6d.	6d.	8d.	9d.	10d.	11d.	1/2	1/6 each
4/0	4/6	4/6	5/0	7/0	8/0	9/0	9/6	12/6	16/0 per doz.

(F) **8517** **Graduated Scale Pipettes,** divided into parts

1	1	2	5	5	10	25 ml.
1/10	1/100	1/10	1/10	1/10	1/10	1/5 ml.
9d.	1/3	1/4	1/1	1/2	1/3	2/0 each
8/0	13/0	14/0	11/6	12/6	13/0	22/0 per doz.

(F) Foreign manufacture.



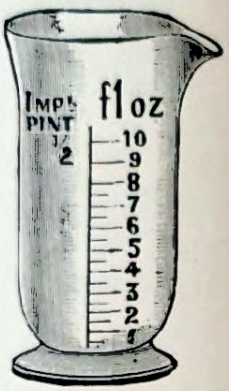
8518



8519



8520



8521

(F) **8518** **Graduated Flasks,** gauged at one mark in the neck. Without Stopper.

25	50	100	200	250	500	1000	2000 ml.
1/0	**1/1**	**1/3**	**1/5**	**1/9**	**2/1**	**2/9**	**4/9** each
11/3	**12/0**	**13/0**	**15/6**	**19/0**	**21/0**	**30/0**	**54/0** per doz.

(F) **8519** With Stopper.

25	50	100	200	250	500	1000	2000 ml.
1/4	**1/6**	**1/9**	**2/0**	**2/3**	**3/0**	**4/0**	**6/3** each
14/6	**16/0**	**19/0**	**20/0**	**23/0**	**32/0**	**44/0**	**71/0** per doz.

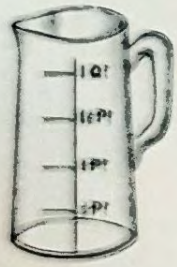
Graduated Measures, Drachms and Ounces, conical form to 4 oz. cylindrical upwards.

		½ oz.	1 oz.	2 oz.	4 oz.	
(F) *8520	,, Conical	**8d.**	**8d.**	**9d.**	**10d.**	each

		6	8	10	16	20	40	oz.
(F) *8521	,, Cylindrical	**1/0**	**1/2**	**1/7**	**2/0**	**2/2**	**3/0**	each

		½ oz.	1 oz.	2 oz.	4 oz.
(F) *8522	,, Same as above, with Official Stamp. Conical	**1/6**	**1/6**	**1/7**	**1/8**

		6	8	10	16	20	40	oz.
(F) *8523	,, Cylindrical, do., do.	**2/0**	**2/2**	**2/8**	**2/10**	**3/1**	**3/11**	each



8524



8525



8526

		1 pint	2 pints
8524	**Jugs,** Glass, Graduated. Unstamped	**2 0**	**2 6** each
	Stamped ...	**3 0**	**4 0** ,,
8525	**Graduated Measure,** Enamelled Iron, 8 oz. ... ... each		**£0 1 9**
8526	,, Enamelled Iron, Capacity 2½ pints. Gauged in half-pints, ounces, and cubic centimetres ... ... each		**0 4 0**

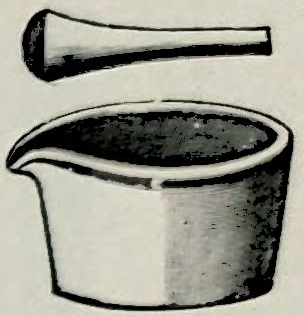
(F) Foreign manufacture



8527



8528



8529

(F) **8527** **Mortars and Pestles,** stout White Glass.

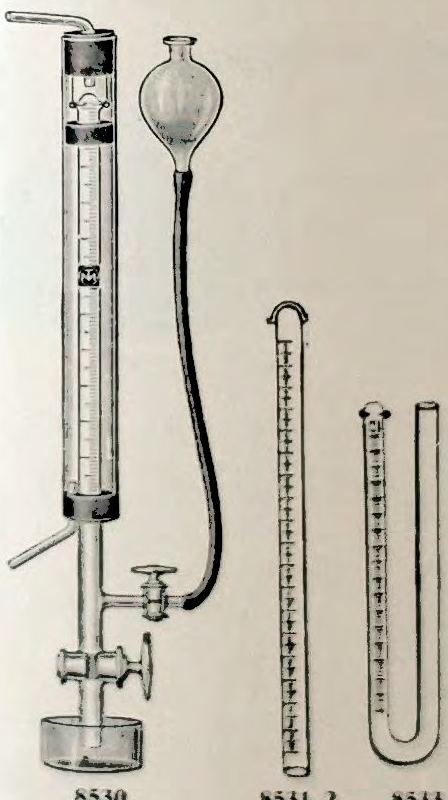
Dia.	60	80	100	120	160	200	mm.
	1/9	2/0	2/8	3/3	5/6	8/6	each
	18/11	21/8	28/10	35/3	59/6	91/9	per doz.

8528 **Mortars and Pestles,** complete, Genuine Wedgwood Ware. Pestles fitted with Wood Handles.

No. ...	0000	000	00	0	1	2	3	4	5	6	7	8	10	12	
Outside diam.	3	3½	3½	4	4½	5	6	6½	7	8	9	10	12	14	in.
	2/4	2/6	2/10	3/0	3/5	3/10	4/5	5/9	7/6	9/10	12/8	16/2	24/8	27/4	each
Pestles only	10d.	10d.	1/0	1/0	1/2	1/4	1/5	1/10	2/6	3/3	4/3	5/3	8/0	12/0	..

(F) **8529** **Mortars and Pestles,** Porcelain, Glazed outside.

No. ...	00	0	1	2	3	4	5	6	
Diameter...	6½	8	9	11	13	15	17½	20	cm.
	10d.	1/3	1/8	2/3	2/11	4/3	5/6	6/6	each
	9/0	13/6	17/9	24/0	31/0	46/3	59/3	70/6	per doz.



8530

8531-2

8533

***8530** **Eudiometer,** modified, designed by Mr. J. W. Yates, has all the advantages of the single and double Eudiometer. Gases are admitted through the lower tap and volumes adjusted to atmospheric pressure through the levelling tube. The sparking can also be done through the levelling tube—under pressure if necessary, thus preventing the need of clamping down Eudiometer.

Price **£1 17 6**

8531 **Eudiometer,** Bunsen's, with Platinum Wires, graduated into millimetres.

300	400	500	600	800	mm. linear
6/0	6/9	7/3	10/6	13/6	each

8532 **Eudiometer,** Bunsen's, with Platinum Wires, graduated into c.c.

50	50	50	100	c.c.
½	⅕	1/10	1	
6/0	6/6	6/9	10/6	each

8533 **Eudiometer,** Ure's, 50 cubic centimetres, graduated into ⅕ths ... ... each **£0 7 0**

(F) Foreign manufacture.



8534-8537



8538



8539

(F) **8534** **Specific Gravity Hydrometer,** for liquids heavier than water; Scale divided into tens, 1000 to 2000, in Cardboard Case ... ... each **£0 3 3**

(F) **8535** **Specific Universal Hydrometer,** 700 to 2000. Scale divided into fives... ,, **0 4 0**

(F) **8536** **Specific Scale**, divided in fives. 700 to 1,000 ... ... **0 3 0**

(F) **8537** **Specific Scale,** 700 to 800, 800 to 900, etc., to 2000, in separate Spindles, each containing 100 degrees in single divisions ... ... each **0 2 9**

(F) **8538** **Hydrometer Immersion Tubes,** White Glass, with Spout—

Height ...	6	8	8	8	10	10	12	12	12	14	14	14	16	18	in.
Diameter	1¼	1¼	2	2¼	1⅝	2	1⅝	2	2½	1½	2	2½	2	2	in.
	9d.	**11d.**	**1/2**	**1/5**	**1/4**	**1/5**	**1/5**	**1/6**	**1/9**	**1/6**	**1/9**	**2/4**	**2/6**	**3/0**	each
	7/6	**9/6**	**12/6**	**15/0**	**14/0**	**15/0**	**15/0**	**16/6**	**20/0**	**16/6**	**20/0**	**25/0**	**27/6**	**32/6**	per doz.

Other sizes made to order.

8539 **Pneumatic Troughs,** Brown Stoneware, Round—

Diameter		Height			
23 cm.	...	7½ cm.	...	each	**£0 3 0**
30 ,,	...	12½ ,,	...	,,	**0 6 0**
40 ,,	...	15 ,,	...	,,	**0 10 0**



8540



8541-2



8543-4



8545

(F) **8540** **Pneumatic Troughs,** Stout Glass Round—

Diameter	15	20	23	25	30	35 cm.
Height	10	10	10	12	12	15 ,,
	1/10	**2/6**	**3/6**	**4/0**	**5/6**	**9/6** each

(F) **8541** **Pneumatic Troughs for Mercury,** Porcelain, Narrow Form, to contain about 4 lb. Mercury ... ... each **£0 3 6**

8542 **Pneumatic Troughs for Mercury,** Brown Stoneware ... ... ,, **0 2 0**

(F) **8543** **Pneumatic Troughs for Mercury,** Porcelain, Wide Form, 180×60 mm. ,, **0 5 9**

8544 Ditto, Ditto, Brown Stoneware ... ... ,, **0 3 6**

8545 **Pneumatic Trough Shelves,** Earthenware (Beehive Shelves)—

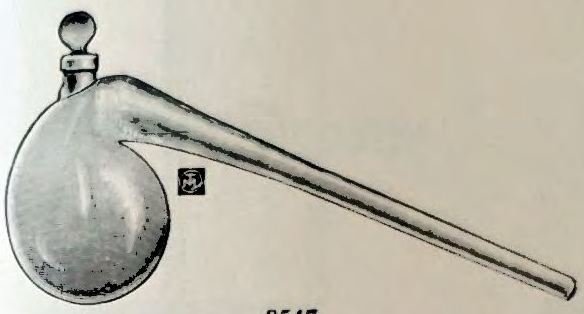
Diameter	5	7½	10	12½	15 cm.
	7d.	**8d.**	**10d.**	**1/3**	**1/8** each
	6/3	**7/0**	**9/0**	**14/0**	**18/6** per doz.

8546 **Pneumatic Trough,** Shelves, Glass. Diameter 7½ 10 cm.

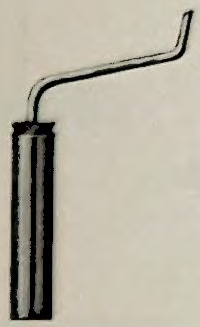
2/3 **2/9** each

25/0 **30/0** doz.

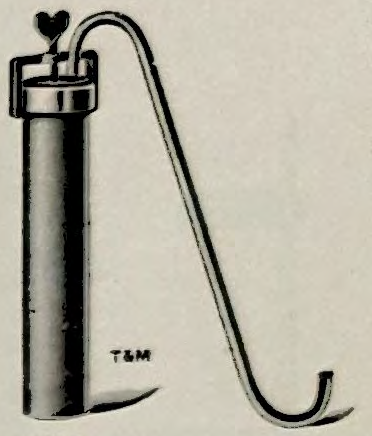
(F) Foreign manufacture.



8547



8548



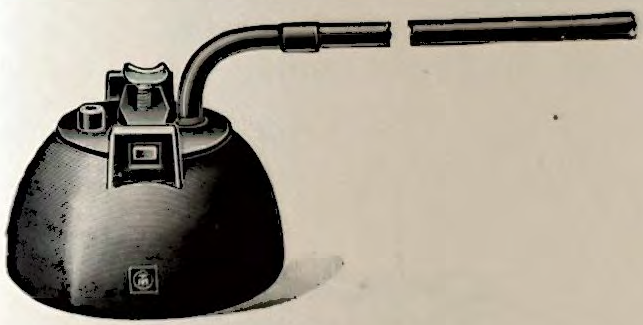
8549

(F) **8547** **Retorts,** Kavaliers' Bohemian Resistance Glass. Stoppered.

70	100	150	200	250	400	500	750 c.c.	1 litre	
1/0	**1/3**	**1/6**	**1/7**	**1/7**	**2/0**	**2/0**	**2/6**	**2/8**	each
10/9	**12/9**	**16/0**	**17/0**	**17/0**	**21/9**	**21/9**	**27/0**	**28/0**	per doz.

8548 **Retorts,** Tube, Copper, Brazed, for making smaller quantities of Oxygen, fitted with Cork and Glass Leading Tube **£0 5 9**

8549 **Retorts,** Copper, Brazed, with Cover, Bridge Clamp and Leading Tubes ... **0 16 6**



8550



8551-2



8553

8550 **Retorts,** Cast Iron, capacity about 3 pints, the Cover being kept in position by a strong Bridge Clamp **£0 17 6**

8551 **Sand Bath Dishes,** Shallow, Tinned Iron.

Diameter ...	4	5	6	7	8	9	in.
	2d.	**2d.**	**3d.**	**4d.**	**5d.**	**6d.**	each
	1 0	**1 4**	**2 0**	**2 9**	**3 6**	**4 6**	per doz.

8552 „ „ Stout Sheet Iron, Shallow, Round Bottom.

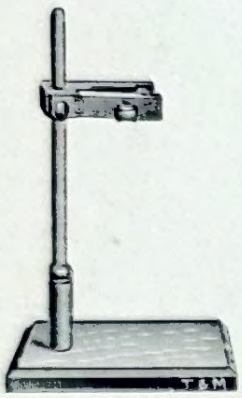
Diameter ...	5	6	7	8	10	12	in.
	7d.	**8d.**	**9d.**	**10d.**	**1 2**	**1 6**	each
	6 0	**6 9**	**8 0**	**9 0**	**12 0**	**15 9**	per doz.

8553 „ „ Tinned Iron, Deep Form with Flat Bottom.

Diameter	4	5	6	7	8	9	10	12	in.
	2/3	**3 0**	**3 3**	**4 3**	**5 0**	**7 0**	**10 6**	**14 9**	per doz.

(F) Foreign manufacture.

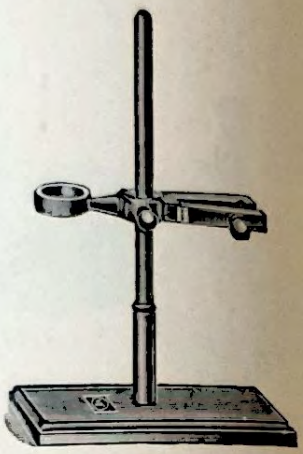
Stands for Burettes, Funnels, etc.



8554/6/8



8555/7/9



8560-62

8554	**Burette Stand,** with Clamp, Hardwood fitted with Cork and Boxwood Screws, for Burettes, Tubes, etc. ... ... Single	£0	3	2
8555	Ditto, ditto ... ... Double	0	4	3
8556	Ditto, ditto ditto Varnished ... ... Single	0	3	10
8557	Ditto, ditto ... ... Double	0	5	0
8558	Ditto, ditto Plain Teak with Clamp Boxwood Screws, etc.... ... ... Single	0	5	6
8559	Ditto, ditto ditto ... ... Double	0	6	9
8560	**Burette and Funnel Stand Combined,** Hardwood with Boxwood Screws ... each	0	5	3
9561	Ditto, ditto Plain Teak ... ... ,,	0	6	9
8562	Ditto, ditto Polished Mahogany ... ... ,,	0	6	9

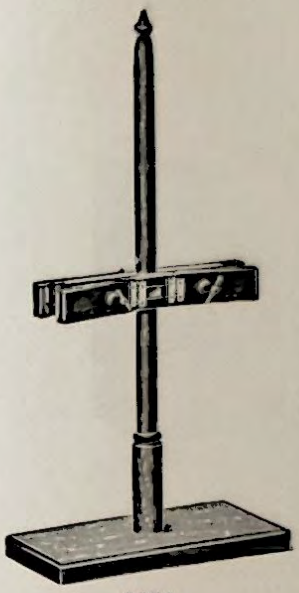


8563/5/7



8564/6/8

8563	**Funnel Stands,** Hardwood, with Boxwood Screws, square botton, for Single Funnel each	£0	2	6
9564	Ditto, ditto ditto for Double Funnel ... ... ,,	0	3	0
8565	Ditto, ditto Hardwood, varnished, for Single Funnel ... ... ,,	0	3	0
8566	Ditto, ditto ditto for Double Funnel ... ... ,,	0	3	9
8567	Ditto, ditto Plain Teak with Boxwood Screws, etc., for Single Funnel ... ,,	0	4	6
8568	Ditto, ditto ditto for Double Funnel ... ,,	0	5	6



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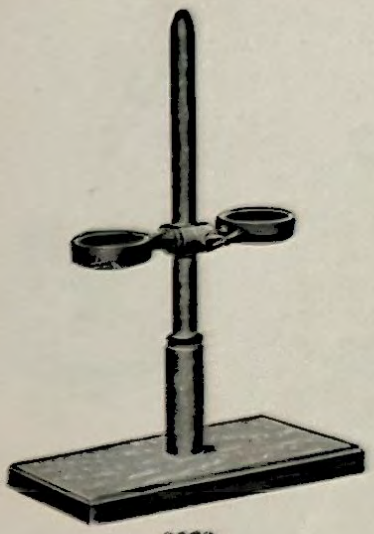
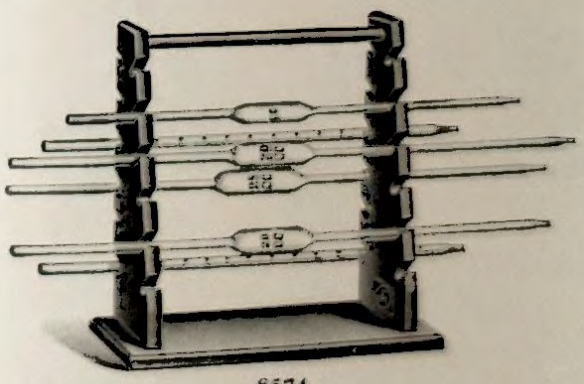


8573

These Stands are made entirely of best seasoned Teak wood. We have made a new departure from the old-fashioned wood clamping screws, and we now use brass screws both for actuating the jaws of Burette Stands and clamping in position on the rods.

8570	**Burette Stands,** Teak, with Brass Clamping Screws	Single, each	£0	5 0
8571		Double ,,	0	6 3
8572	**Funnel Stands,** Teak, with Brass Clamping Screws	Single, each	0	4 9
8573		Double ,,	0	6 0



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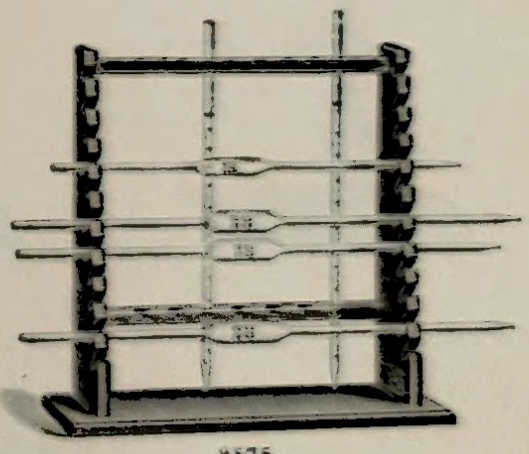
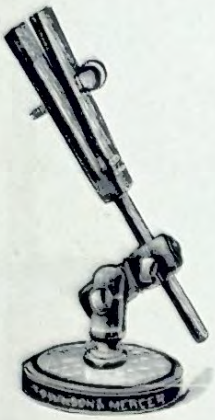


8575

8574	**Pipette Stand,** Teak, to hold 12 Pipettes ... ... each	£0	6	0
8575	,, ,, Teak, to hold 22 Pipettes, 12 Horizontal and 10 Vertical ,,	0	9	0


8576



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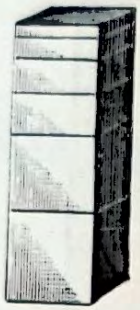
8578


8579

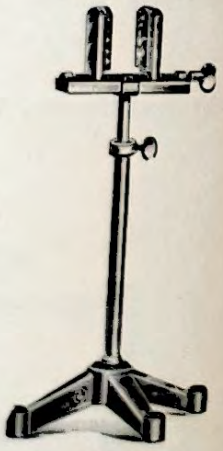

8580-1

8576	**Stands,** Universal Holder (Bunsen's), Mahogany, with sliding upright rod and loaded foot ... ... each	**£0**	**10** **6**
8577	,, Universal Holder (Bunsen's), Mahogany, without the sliding upright rod ,,	**0**	**9** **0**
8578	,, Universal Holder on Foot, Mahogany, Universal Joint (Shark) ... ... ,,	**0**	**7** **6**
8579	**Blocks of Wood,** Stained Black (set of 6), 4, 2, 1, ½, ¼, 3/16 in. high and 4 in. square, set	**0**	**4** **3**
8580	,, Round, White Wood, 4 in. dia. (set of 6) ... ... ,,	**0**	**3** **6**
8581	,, Round, Polished Mahogany, 4 in. dia. (set of 6) ... ... ,,	**0**	**7** **6**



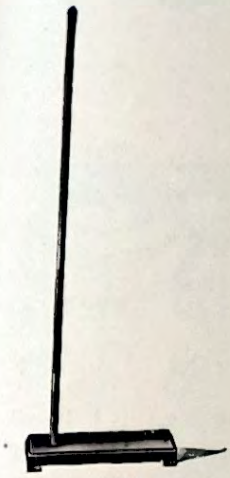
8582


8583


8584

8582	**Stands** (Rising Tables), Polished White Wood, dia. of Table	4	5	6 in.
		4 **0**	**5** **0**	**6** **0** each
8583	**Adjustable Table,** substantially constructed for carrying heavy apparatus, such as electric motor, etc. The main body is of cast iron, stove enamelled, base 8×8 in. The top is made of teak wood, 6×6 in., carried by a turned steel pillar, 1 in. dia. The height is adjustable from 7 in. to 10 in., and can be firmly clamped by a steel tommy screw. Wright complete, 14 lb. ... ... each	**£1**	**7**	**6**
8584	**Adjustable Stand,** Brass, on Iron Tripod Foot, fitted with clamp with parallel sliding jaws ... ... each	**0**	**12**	**0**

Stands for Retorts



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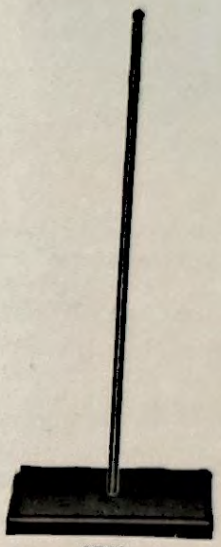

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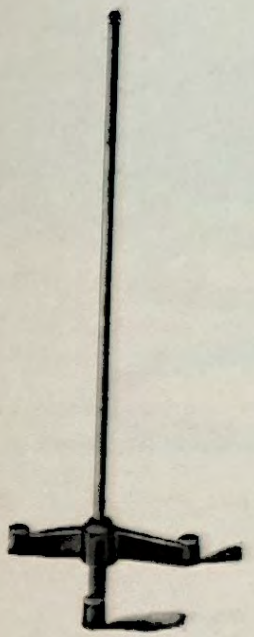
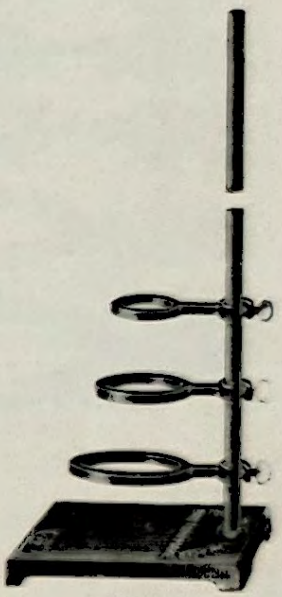


8587



8588–8599

8585 **Iron Bases,** fitted with Rods, for Retort Stands, etc.

Size of Rod ...	16 × ¼	20 × ⅜	24 × ½	30 × ¾	in.
,, Base ...	5½ × 3½	7½ × 4½	8½ × 5½	9½ × 6	,,
	1 8	2 4	3 6	6 9	each

8586 **Iron Bases,** fitted with Rod in Centre.

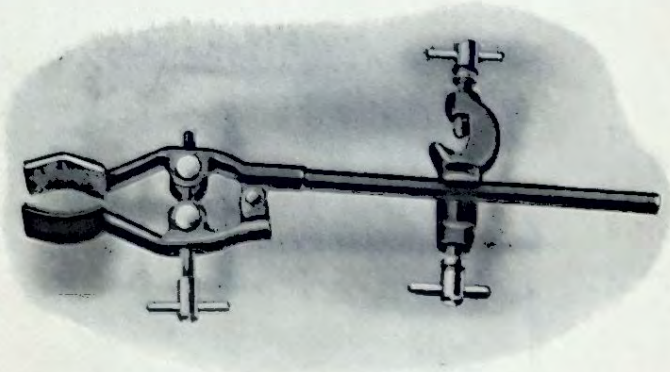
Size of Rod ...	20 × ⅜	24 × ½	30 × ½	36 × ¾	in.
,, Base ...	11 × 5	12 × 6	13½ × 6	16 × 8	,,
	3 6	5 0	6 6	8 0	each

8587 **Iron Tripod,** Feet fitted with Rods for Clamps, etc.

Size of Rod	12 × ⅜	16 × ½	20 × ⅝	24 × ½	30 × ¾	in.
Radius ...	2½	3½	4½	5½	6½	,,
	1 6	2 0	2 8	3 3	5 3	each

8588 **Retort Stand,** with two Malleable Iron Rings, 2 in. and 3 in., with open bosses; length of rod, 12 in., on round base

| | | | | |



8600–8602

A series of Clamps of new design, pressed up from Steel Plate, shaped to give maximum strength. The Rods are drawn steel rod, brazed into the clamp body, so cannot come loose.

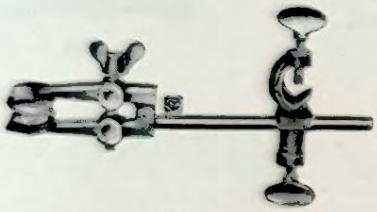
Black Stove Enamel finish.

The Jaws are lined with Cork and are actuated by brass right and left hand screws.

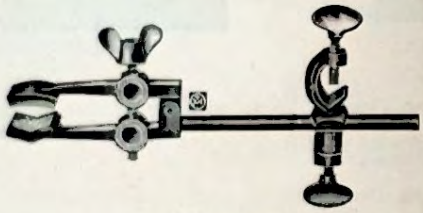
8600 **Clamps,** Pressed Steel, small size, length of Jaw 2⅜ in., complete with Boss Head. Each **2/4,** per doz. **£1 5 6**

8601 Ditto, ditto, medium size, length of Jaw 3¼ in., complete with Boss Head. Each **2/6,** per doz. **1 7 6**

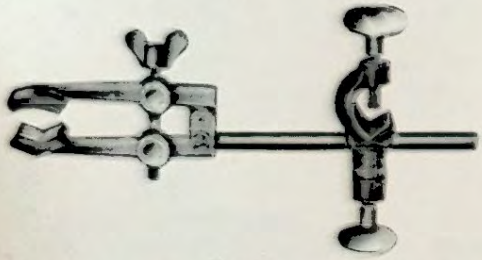
8602 Ditto, ditto, large size, length of Jaw 4 in., complete with Boss Head. Each **3/0,** per doz. **1 13 0**



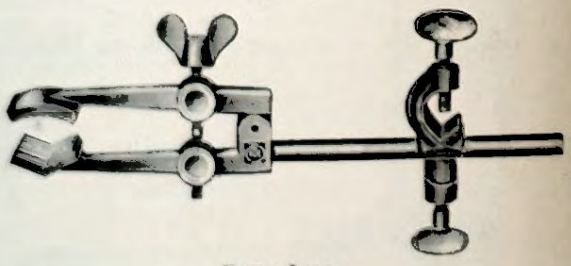
Small



Medium



Large



Extra Large

Clamps, Malleable Iron, with Right and Left Screws, ends lined with cork, with or without bosses, to suit Stands with rods up to ⅝ inch diameter.

		Small	Medium	Large	Extra Large	
	Length of Jaws	2⅜	3¼	4	5	in.
	For holding tubes up to	1¼	1⅝	2¼	3	,,
8603	Without Boss Head	**2 3**	**2 9**	**3 3**	**4 3**	each
8604	With Boss Head, suitable for rods up to	½	½	$\frac{8}{16}$	⅝	in. dia.
		3 6	**4 0**	**4 8**	**6 0**	each

Clamps, for Retort Stands, as above (Gun Metal).

		Small	Medium	Large	Extra Large	
8605	Without Boss Head	**3 6**	**4 0**	**4 9**	**6 6**	each
8606	With Boss Head, suitable for rods up to	½	½	$\frac{8}{16}$	⅝	in.
		4 9	**5 3**	**6 3**	**8 6**	each



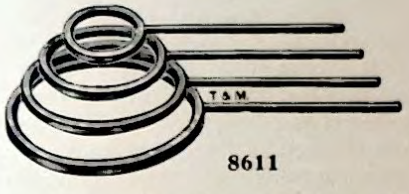
8614



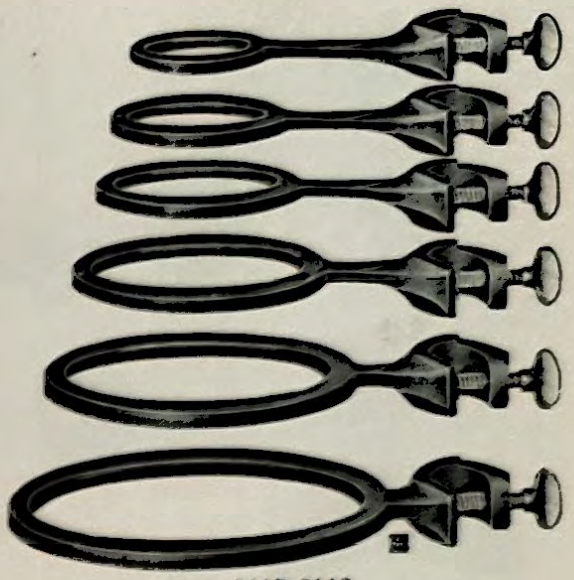
8607–8609



8610



8611



8612–8613

8607	Boss Heads, Malleable Iron with Lacquered Brass Thumbscrews, suitable for rods up ½ in. ... ... each **1/2**; per doz.	**£0 13 0**
8608	Ditto, larger, suitable for rods up to ⅝ in. ... ... ,, **1/7** ,,	**0 17 0**
8609	Ditto, extra large, for rods up to ⅝ in. ... ... ,, **2/3** ,,	**1 4 0**
8610	Ditto, Boss Head, movable with Set Screw, for holding rods up to ½ in. in any position each **2/9**; per doz.	**1 10 0**

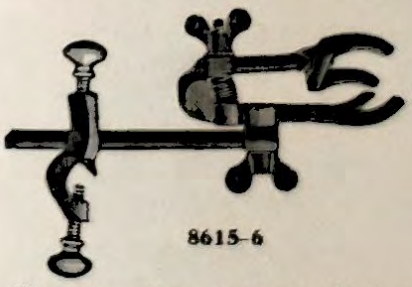
8611 **Rings,** for use with Retort Stands, Malleable Iron, with rod about 6 in. long.

Diameter of Ring	2	2½	3	3½	4	4½	5	6 in.
	5d.	**7d.**	**8d.**	**9d.**	**10d.**	**1/0**	**1/2**	**1/3** each

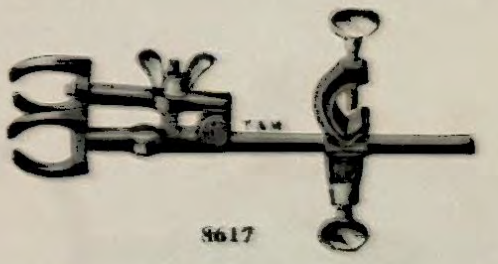
8612 **Rings,** Heavy Pattern, for use with Retort Stands, with open Bosses and Lacquered Brass Thumbscrews suitable for Stands with rods up to ½ in. diameter.

Diameter of Ring	2	2½	3	3½	4	4½	5 in.
Malleable Iron	**11d.**	**1/1**	**1/2**	**1/3**	**1/4**	**1/6**	**1/8** each
8613 Brass	**1/4**	**1/6**	**1/8**	**1/10**	**2/0**	**2/2**	**2/5** ,,

8614 **Iron Table,** with Boss, to fit on Retort Stands, 4½ in. diameter ... ... each **£0 2 0**

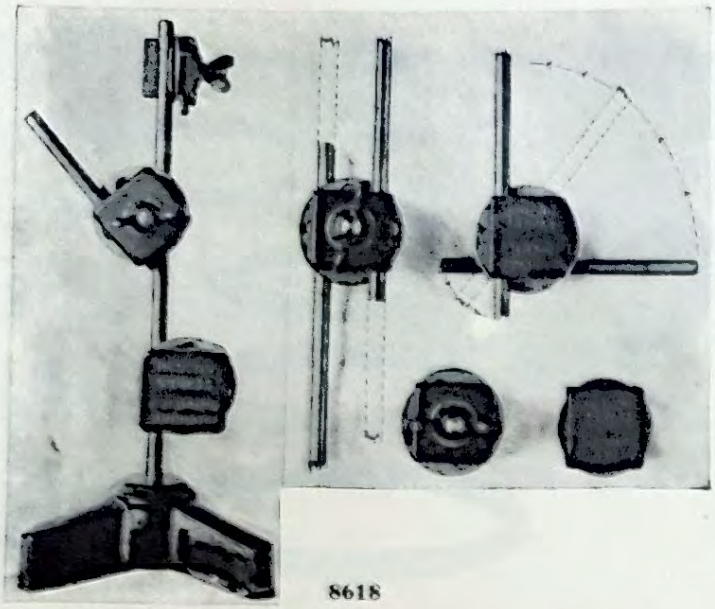


8615–6



8617

8615	**Clamp,** universal, strong, Malleable Iron, large size, for Retorts and Condensers, with movable Jaw. Length 12 in.; Jaws 5 × 2⅜ in. Without Boss, **5/9**; with Boss	**£0 7 6**
8616	**Clamp,** as No.8615, extra large, suitable for Stands with ⅝ in. rods. Length 14½ in.; Jaws 6¼ × 4 in. ... ... Without Boss **9/0**; with Boss	**0 11 3**
8617	**Clamp,** strong Malleable Iron, for Condensers and large Tubes. Length 10½ in.; Jaws 5 × 2⅞ in. ... ... Without Boss, **4/3**; with Boss	**0 5 11**



8618

8618 The Universal Bosshead Clamp is adaptable for many purposes. It is used in connection with all kinds of Scientific and other apparatus where accuracy, rigidity, and quick setting-up is desired in the laboratory, at the lecture table, in the field, and for experimental and research work.

It may be used as a clamp, as a bosshead, as a joint, as a hinge, for extension rods, etc.

Consists of two metal blocks, each having a V-shaped groove on its inner surface. These two blocks are separated by a washer, and the three are connected by a screw which is controlled by a winged nut and washer. The upright of, say, a Retort Stand, is held between one block and washer while the rod of an instrument or a piece of apparatus is gripped by the other. The thicker rod is always placed in the deeper groove.

The operating of the Clamp, etc., is done with the left hand, while the right hand controls the tightening screw.

The Universal Bosshead Clamp (Registered No. 685,233) admits of an absolutely universal movement, which is controlled by one screw.

The tightening is practically instantaneous, and with it the rigidity of grip is perfect. There is no lost motion.

It will grip two rods of the same diameter; it will grip two rods of different diameters. For example:—

No. 1 will grip—$\frac{5}{8}$ in. and $\frac{1}{4}$ in.; $\frac{3}{8}$ in. and $\frac{3}{16}$ in.; $\frac{5}{16}$ in. and $\frac{5}{16}$ in.; $\frac{5}{16}$ in. and $\frac{1}{4}$ in.; $\frac{5}{16}$ in. and $\frac{3}{16}$ in.; $\frac{1}{4}$ in. and $\frac{1}{4}$ in.; $\frac{1}{4}$ in. and $\frac{3}{16}$ in.

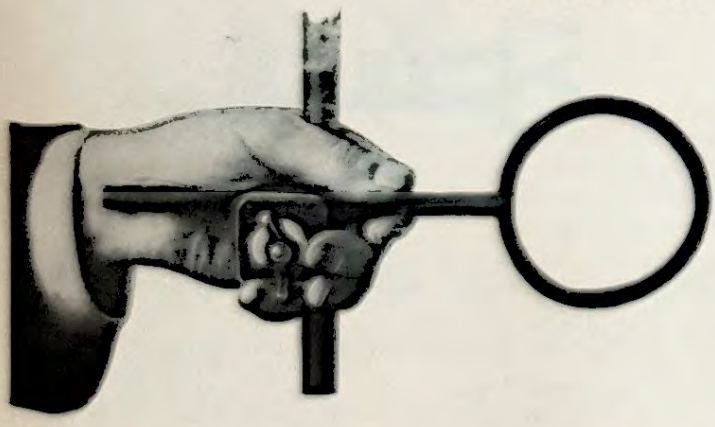
No. 2 will grip—$\frac{7}{16}$ in. and $\frac{5}{8}$ in.; $\frac{7}{16}$ in. and $\frac{5}{16}$ in.; $\frac{3}{8}$ in. and $\frac{3}{8}$ in.; $\frac{3}{8}$ in. and $\frac{5}{16}$ in.; $\frac{5}{16}$ in. and $\frac{5}{16}$ in.

No. 3 will grip—$\frac{1}{2}$ in. and $\frac{1}{2}$ in.; $\frac{1}{2}$ in. and $\frac{7}{16}$ in.; $\frac{1}{2}$ in. and $\frac{3}{8}$ in.; $\frac{1}{2}$ in. and $\frac{5}{16}$ in.; $\frac{1}{2}$ in. and $\frac{1}{4}$ in.; $\frac{7}{16}$ in. and $\frac{7}{16}$ in.; $\frac{7}{16}$ in. and $\frac{3}{8}$ in.; $\frac{7}{16}$ in. and $\frac{5}{16}$ in.; $\frac{7}{16}$ in. and $\frac{1}{4}$ in.

The thicker rod is always placed in the deeper groove.

The Bosshead Clamp will also grip Rods, Laths, etc., of flat section.

Price, with Gun Metal Blocks: No. 1, **2/6**; No. 2, **3/0**; No. 3, **3/6** each.



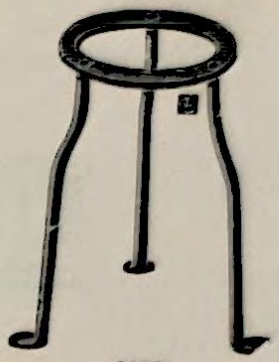
INSTRUCTIONS

In whatever capacity the Clamp may be used, the general instructions are as follows:

Support and manipulate the block carrying the apparatus with the left hand, as shown on the illustration; the right hand is free to adjust the apparatus, and finally to tighten the clamping screw of the block.



8619



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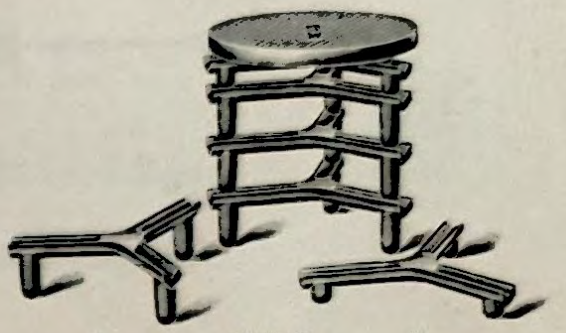


B 8621-2 A

8619 **Tripod Stands,** Triangular, with stout Wrought Iron Tops.

Height	7 in.	...	Size of Triangle	5	in.	...	...	...	...	each	£0	1	0
,,	8 ,,	...	,,	,,	5	,,	...	...	...	...	,,	0	1	1
,,	8 ,,	...	,,	,,	6	,,	...	...	...	...	,,	0	1	2
,,	8 ,,	...	,,	,,	7½	,,	...	...	...	...	,,	0	1	6
,,	10 ,,	...	,,	,,	9½	,,	...	...	...	...	,,	0	2	0

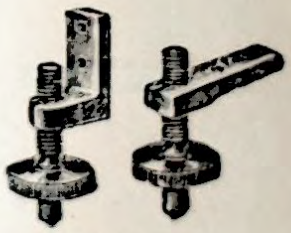
8620 Ditto, with Round Wrought Iron Tops.

Height	6 in.	...	Diameter	3	in.	...	...	...	...	...	each	£0	1	0
,,	7 ,,	...	,,	4	,,	...	...	...	...	...	,,	0	1	1
,,	8 ,,	...	,,	5	,,	...	...	...	...	...	,,	0	1	2
,,	8 ,,	...	,,	6	,,	...	...	...	...	...	,,	0	1	5
,,	10 ,,	...	,,	8	,,	...	...	...	...	...	,,	0	2	6

8621 **Geometrical Stands** or grooved tripods, originally designed by Prof. C. V. Boys, fitting into each other and forming a rigid stand, they are very useful for raising up apparatus and are superior to the ordinary wood blocks.

Shallow Pattern.	A.	Height	1 in.	...	...	per doz.	£0 15 0
Tall Pattern	B.	,,	2 ,,	...	...	,,	0 17 6

8622 **Circular Iron Plates,** with Planed Tops to suit above tripods. Diameter 8 10 in.
3/6 6/6 each



A 8623 B



8624



8625



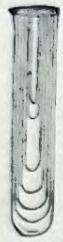
8626

8623 **Levelling Screws.** Brass. For Balances, Galvanometers, etc., either pattern A or B each £0 1 6

8624 Ditto, ditto, all Brass, for Levelling Apparatus ... ... per set of 3 0 10 6

8625 **Spring Clips,** steel, for fixing up Burette Racks, Tools, etc. Dia. ½ ¾ 1 in.
1/6 1/8 1/10 2 0 doz.

8626 **Spring Clips,** steel, extra strong ... ... Diameter 1¼ in. ... 2 6 doz.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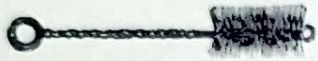
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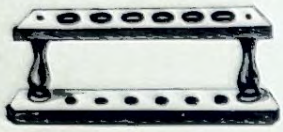
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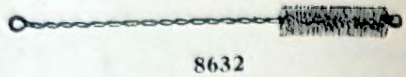
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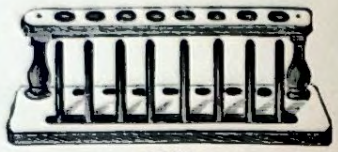

8630

(F) **8627** **Test Tubes** (with or without Rim). Resistance Glass for Bacteriological and Chemical Use.

Length ...	2	2	2	3	3	4	4	4	in.
Diameter...	¼	⅜	½	⅜	½	½	⅝	¾	,,
Per gross	**1/9**	**2/6**	**3/3**	**3/3**	**4/0**	**5/0**	**5/6**	**6/0**	
Length ...	5	5	5	6	6	6	6	6	in.
Diameter...	⅜	¾	½	½	⅝	¾	⅞	1	,,
Per gross	**6/9**	**7/6**	**5/9**	**6/3**	**7/9**	**10/0**	**13/0**	**14/6**	
Length			6	7	8	8	9	10	in.
Diameter			1¼	1¼	1¼	1½	1½	1½	,,
Per gross			**26/0**	**27/6**	**30/0**	**46/0**	**54/0**	**62/6**	

8628 **Test Tube Stand,** Teak, with 1 row of Holes.

6	8	12	holes
1/4	**1/7**	**2/2**	each
15/0	**18/0**	**23/6**	per doz.

8629 ,, ,, Teak, with 2 rows of Holes.

12	18	24	holes
2/3	**3/1**	**3/10**	each
25/0	**35/0**	**43/0**	per doz.

8630 ,, ,, Teak, with Draining Pegs.

6	8	12	24	holes and pegs
2/0	**2/6**	**3/3**	**5/2**	each
22/6	**27/6**	**36/0**	**58/6**	per doz.

8631 **Test Tube Cleaner** (Brushes) with Sponge or Bristle ends, on Tinned Wire.
per doz. **£0 1 6**

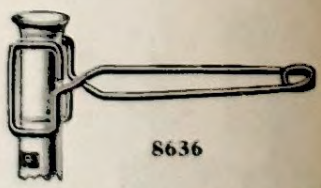
8632 **Brushes,** with Long Stem, for Tubes, Burettes, etc.

Small	Medium	Large	
5/6	**7/0**	**10/0**	per doz.


8633


8634


8635


8636

(F) **8633** **Test Tube Holders,** Flat Brass, in Wood Handle ... per doz. **7/3**; each **£0 0 8**

8634 ,, ,, White Wood, length about 6 in., with Wire Spring ... ... ,, **3/3**; ,, **0 0 4**

(F) **8635** ,, ,, Flat Form, strong Spring Clip, in Wood Handle ... ... ,, **7/9**; ,, **0 0 9**

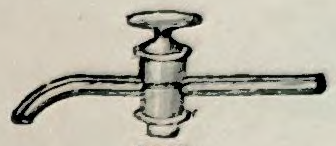
(F) **8636** ,, ,, Stout Wire, Nickel-plated, improved pattern ... ... ,, **4/0**; ,, **0 0 5**

(F) Foreign manufacture.

Stopcocks



8638–9



8640



8641

8638 **Stopcocks,** Glass, with hole drilled in Solid Plug.

1	2	3	4	5	6	mm. bore
2/6	**2/9**	**3/0**	**3/9**	**4/6**	**5/0**	each

8639 **Stopcocks,** Glass, with light Hollow Plug.

6	8	10	12	mm. bore
5/3	**7/3**	**10/6**	**15/0**	each

8640 **Stopcocks,** Glass, with Bib and Hole drilled in Solid Plug.

1	2	3	4	5	6	mm. bore
2/6	**2/9**	**3/0**	**3/9**	**4/6**	**5/0**	each

8641 **Stopcocks,** Glass, for joining or Repairing Burettes ... per doz., **27/0**; each **£0 2 6**



8642



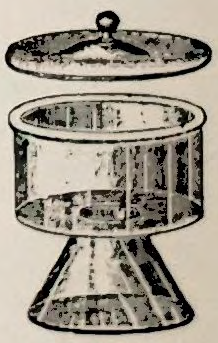
8643

8642 **Tube Connectors,** of Glass Ground, to fit

Diameter of Tube	6	8	10	12	15	20	25	mm.
	1/10	**1/11**	**2/0**	**2/3**	**3/0**	**3/6**	**5/0**	each

8643 **Tube Connectors,** Capillary Tube ... ... each **£0 3 9**

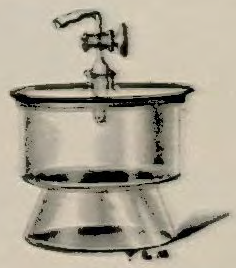
8644 ,, ,, ,, ,, with Hooks ... ... ,, **0 4 6**



8645



8646



8647

(F) **8645** **Desiccators,** Scheibler's, with Ground Cover and Perforated Zinc Disc.

Inside diameter	4	5	6	7	8	9	10	12	in.
	4/6	**5/0**	**7/0**	**11/0**	**15/6**	**19/0**	**25/0**	**39/0**	each

(F) **8646** **Desiccators,** for Vacuum, with Glass Cover and Tubulure in centre.

Inside diameter	4	5	6	7	8	9	10	12	in.
	5/6	**6/0**	**7/0**	**12/6**	**16/0**	**24/0**	**29/0**	**45/0**	each

(F) **8647** **Desiccators,** ditto, with Glass Tap ground into Lid, with Hook on end of Tap.

Inside diameter	4	5	6	7	8	in.
	12/6	**14/0**	**15/0**	**18/6**	**25/0**	each

(F) Foreign manufacture.



8650–8654



8655

8650 **Tubing,** best black Vulcanised Rubber, for connections, etc.

Diameter internal	1/16	1/8	3/16	1/4	5/16	3/8	1/2	5/8	3/4	7/8	1 in.
	5d.	6d.	10d.	1/3	1/6	2/3	3/0	5/3	7/6	9/9	11/3 yard
8651 Ditto, Red	4d.	5d.	9d.	1/1	1/3	2/0	2/10	5/3	7/6	9/9	11/3 ,,

8652 Ditto, Extra Thick Gas, strong, pliable, will not kink and resists the odour of gas better than any other soft tubing.

Black	1/4	5/16	3/8 in. internal
	7d.	10d.	1/0 per yard

8653 Ditto, Red, ¼ in. bore, wall ⅛ in., best quality. ... ... per foot **5d.**; in coils of 60 ft. **4½d.**

8654 Special Red India-rubber Tubing with moulded ends in one piece, for Bunsen Burners, length 2 ft. ... ... each **1/6** per doz. **£0 16 0**

8655 Ditto, Flexible Metal, suitable for Bunsen Burners, 5/16 in. internal diameter, with rubber connections at both ends, in lengths of 3 ft. **0 1 9**

The above tubing can be supplied in any length at the rate of **6d.** per foot and **2d.** extra for each end connection.

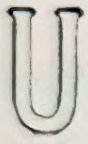
8656 Ditto, Best Red Vulcanised Rubber for pressure.

Dia. inside	1/8	1/8	3/16	1/4	1/4	3/16	5/16 in.
,, outside	3/8	1/2	1/2	1/2	7/16	5/8	3/4 ,,
	1/8	3/0	2/9	2/9	2/3	3/6	6/0 yard



8657





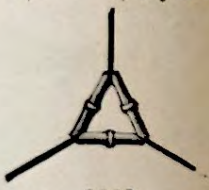
8658



8659



8661



8662

8657 Three-way Tubes, **Y** or **T** form, Glass. Diameter 5 6 7 8 9 10 mm.

	3d.	3d.	4d.	5d.	5d.	6d. each
	2/0	2/6	3/6	4/3	4/6	5/6 doz.

Chloride of Calcium U Tubes, Length 4 5 6 6 7 8 10 in.

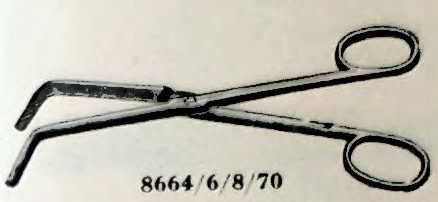
Dia.	½	⅝	¾	¾	¾	1 ,,
8658 Plain form	6d.	7d.	7d.	8d.	9d.	10d.	1/3 each
	4/6	5/6	6/0	6/6	7/6	8/6	13/6 doz.
8659 Ditto, with side tubes	7d.	9d.	10d.	11d.	1/1	1/2	1/6 each
	6/3	8/6	9/0	10/0	11/0	12/0	16/6 doz.

8660 **Triangle,** Iron Wire, to support Crucibles, covered with Pipe Clay, 1½, 2, 2½ in. sides per doz. **1/9**; each **£0 0 2**

8661 Ditto, ditto, 3-in. sides ... ... per doz. **2/0**; ,, **0 0 3**

8662 Ditto, new form, with Ridges in centre of Clay Tubes, 5½, 6½, and 7½ cm. ... doz. **0 3 0**

Crucible Tongs



8664/6/8/70

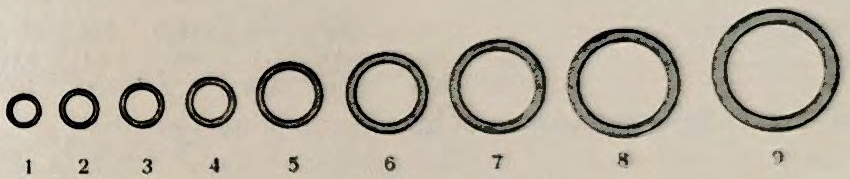


8672

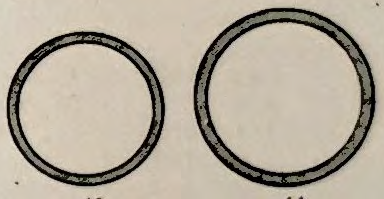


8665/7/9

			6	7	8	10	12	in.	
8664	**Crucible Tongs,**	Strong Light Wrought Iron	4/0	4/6	5/9	7/3	15/0	per doz.	
			6	7	8	9	10	12	in.
8665	,,	with Bow ...	4/6	5/0	6/3	7/0	7/9	15/6	per doz.
						6	7	8	in.
8666	,,	Strong Light, Brass				7/0	8/0	10/6	per doz.
8667	,,	,, with Bow				7/6	9/0	11/6	,,
8668	,,	,, Aluminium				7/6	8/9	10/6	,,
8669	,,	,, with Bow				7/9	9/0	11/0	,,
(F) 8670	,,	Polished Gun Metal				15/9	18/9	23/6	,,
(F) 8671	,,	,, ,, with Bow				16/9	20/0	24/6	,,
(F) 8672	,,	Bright Iron, 8 in., with Cup at end for picking up globules of mercury						per pair	3/0



1 2 3 4 5 6 7 8 9



10 11

8673



21 22 23

8675 8674

Tubing, Glass, free from Lead, for Bending and Connecting Apparatus, Leading Tubes, etc., in lengths of 1 metre, see Nos. 1 to 11 for thickness.

(F) 8673	3 mm. outside diameter ... ...per lb.							£0	1 11
	Above 4 mm. to 5 mm. outside diameter ... ... ,,							0	1 9
	,, 6 mm. to 20 mm. ,, ,, ... ,,							0	1 4
	,, 20 mm. to 25 mm. ,, ,, ... ,,							0	1 6
	,, 25 mm. to 30 mm. ,, ,, ... ,,							0	1 7
	,, 31 mm. to 35 mm. ,, ,, ... ,,							0	1 10
	,, 36 mm. to 40 mm. ,, ,, ... ,,							0	2 1
	,, 41 mm. to 45 mm. ,, ,, ... ,,							0	2 3
	,, 46 mm. to 49 mm. ,, ,, ... ,,							0	2 8
	,, 50 mm. to 54 mm. ,, ,, ... ,,							0	3 3
	,, 55 mm. to 60 mm. ,, ,, ... ,,							0	3 9
(F) 8674	**Tubing, Glass,** Barometer, see Nos. 21 to 23 for sizes ... ... ,,							0	2 3
(F) 8675	,, ,, Thermometer ... ... ,,							0	2 6

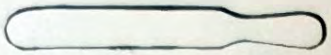
(F) Foreign manufacture.



8677–8



8679



8680–1



8682

8677 **Spatulas, or Palette Knives,** Steel Blade, in Cocus Wood Handle.

Length of Blade	3	4	5	6	7	8	10	12	in.
	1/2	**1/3**	**1/4**	**1/7**	**2/0**	**2/8**	**3/9**	**5/6**	each
	12/6	**13/0**	**14/3**	**17/0**	**21/6**	**29/0**	**41/0**	**60/0**	per doz.

8678 Ditto, ditto, Steel, Nickel-plated, to prevent rust

	3	4	5	6	7	in.
	1/9	**1/10**	**2/1**	**2/3**	**2/9**	each
	19/6	**20/6**	**22/6**	**24/6**	**30/0**	per doz.

8679 Ditto, ditto, Steel (Artist's thin).

Length of Blade	4	5	6	in.
	1/4	**1/6**	**1/9**	each
	14/6	**16/6**	**20/0**	per doz.

8680 Ditto, ditto, Bone.

10	12½	15	20	cm.
2/9	**4/6**	**6/0**	**12/6**	per doz.

(F) **8681** **Spatulas,** Vulcanite.

Length	7½	10	12½	13	17·5	20	22·5	25	cm.
	5d.	**5d.**	**6d.**	**7d.**	**9d.**	**10d.**	**11d.**	**1/3**	each
	4/6	**4/6**	**5/6**	**6/0**	**8/0**	**9/0**	**10/0**	**13/6**	per doz.

8682 **Spatula and Knife Combination,** of Stainless Steel, total length 3½ in.
Each, **2/9**; per doz., **£1 10 0**

Wire Gauzes



8687



8688

Wire Gauze, cut into Squares.

				4×4	5×5	6×6	9×9	12×12	in.
8683	Iron ...	Mesh No.	30	**1/8**	**3/0**	**3/10**	**9/6**	**14/0**	per doz.
	,, ...	,,	20	**1/4**	**2/3**	**3/0**	**7/6**	**12/0**	,,
	,, ...	,,	10	**1/0**	**1/9**	**2/2**	**5/4**	**8/8**	,,

				4×4	6×6	12×12	in.
8684	Brass ...	,,	20	**2/0**	**4/6**	**17/0**	per doz.
	,, ...	,,	30	**2/4**	**5/3**	**20/0**	,,
	,, ...	,,	60	**3/6**	**7/9**	**30/0**	,,
8685	Copper ...	,,	20	**2/0**	**4/6**	**17/0**	,,
	,, ...	,,	30	**2/4**	**5/3**	**20/0**	,,
	,, ...	,,	60	**3/6**	**7/9**	**30/0**	,,
	,, ...	,,	90	**6/6**	**14/0**	**54/0**	,,

8686 **Wire Gauze,** cut into Squares. Extra Stout, recommended for general use.

	4×4	5×5	6×6	in.
Iron	**1/9**	**2/3**	**3/9**	per doz.
	20/0	**26/0**	**43/6**	,, gross

8687 **Wire Gauze,** Iron, with Asbestos combined.

8·5	10	12·5	15	cm.
3/3	**3/9**	**4/3**	**5/0**	per doz.
35/0	**40/0**	**47/6**	**55/6**	,, gross

8688 ,, ,, ,, Basin Form, with Asbestos combined.

Diameter of Basin	10	12·5	15	cm.
	9d.	**10d.**	**1/1**	each
(F) Foreign manufacture.	**8/0**	**9/0**	**10/6**	per doz.



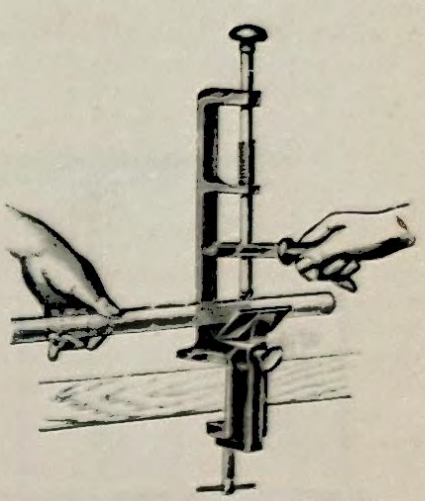
8692



8689



8690-1



8693

8689	**Glass Cutting Knives,** with wood handle	per doz. **19 6;** each	**£0 1 9**
(F) **8690**	**Glass Tube Cutters,** with Hard Steel Wheel	„ **18 6;** „	**0 1 8**
(F) **8691**	Ditto, large size	„ **33 0;** „	**0 3 0**
8692	**Cutting Knife,** pocket form, for Ampoules, etc.	„	**0 2 6**
(F) **8693**	**Glass Cutting Machine** for fixing to bench	„	**1 10 0**



8694

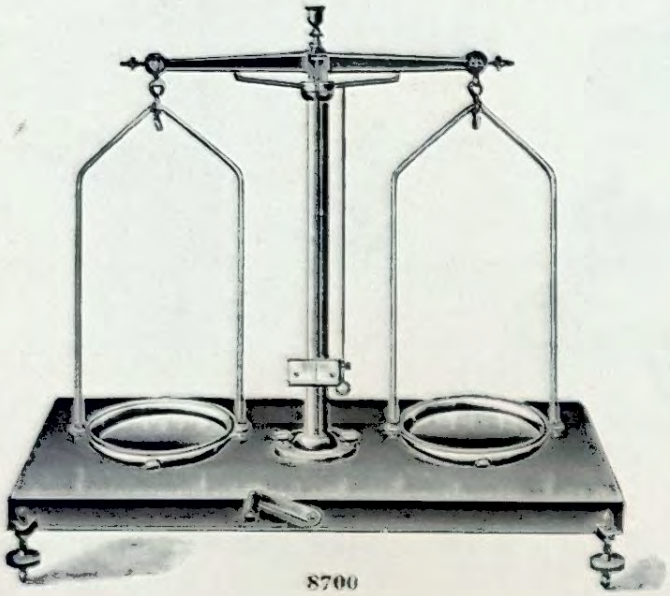


8695-6

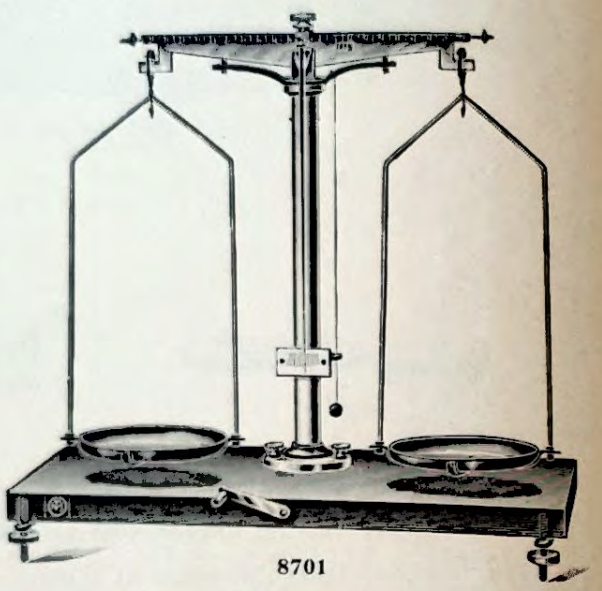
8694	**Diamonds,** for writing on glass, in Hardwood Handles. Best quality	each **10 0** and	**£0 12 6**
8695	„ Glazier's, for cutting glass, standard quality ...	„ **10 6** „	**0 12 6**
8696	„ „ „ best quality, nickel plated	„ **18 6** „	**1 2 6**

(F) Foreign manufacture.

Apparatus for Practical Physics including Balances and Weights.



8700



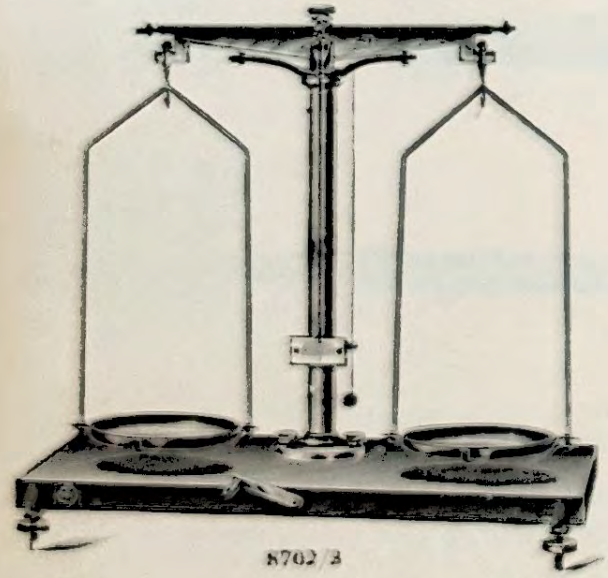
8701

(F) ***8700** **Balance,** for School use, to carry 250 grammes and sensible to 5 mgr., mounted on Polished Mahogany Board with Levelling Screws and Pendulum ... ... nett **£1 12 6**

***8700/1** Ditto, fitted with Extra Pan for specific gravity **2 0 0**

(F) ***8701** **Balances,** with Beam of Magnalium, graduated on one side for rider, with Beam Support Set Screws and Pendulum, mounted on Polished Hardwood Base.

	100	250	grammes
With Agate Knives and Planes	**40/0**	**42/6**	each



8702/3

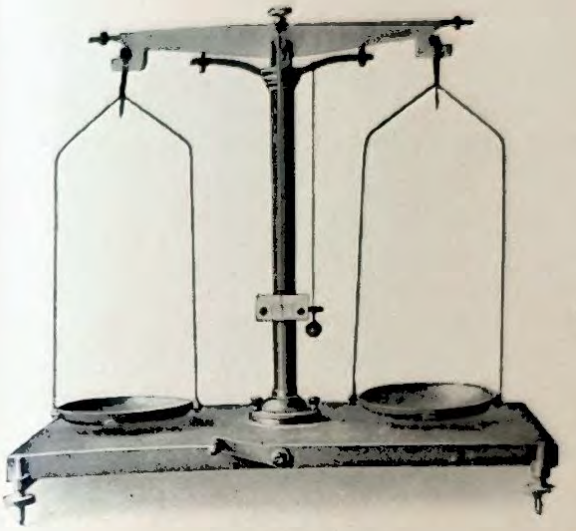
(F) ***8702** **Balances** with Brass Beam, graduated for Rider, High Column for Physical work, support for Beam, Steel Knives working on Agate Bearings, Set Screws and Pendulum for Levelling, Needle Pointer, and movable Brass Pans, on Polished Mahogany Board.

To carry	100	250	500	1000	grammes
Dia. of pans	8	10	12	15	cm.
Sensible to	1	2	5	10	mg.
Price ...	**42 6**	**45 0**	**50 0**	**57 6**	each

(F) ***8703** **Balances,** with Brass Beam similar to No. 8702, but Beam not graduated. Steel Knives and Planes, Steel Pointer, Bows and Movable Pans of Brass, mounted on Mahogany Board.

To carry	100	250	grammes
Diam. of pans	8	10	cm.
Sensible to	2	5	mg.
	38 0	**40 0**	

(F) Foreign manufacture.



8703/1

*8703/1 **Balance,** British made, with Brass Beam graduated on one side for use with rider, Agate Knives and Bearings, Brass Bows and Pans, mounted on polished Mahogany Board, with Set Screws and Pendulum for levelling.

To carry 100 250 grammes
50 0 **52/6**

*8703/2 Ditto as above, but with Steel Knives and Bearings. To carry 100 250 grammes
45 0 **47/6**

(F) *8704 **Balances,** with Open Beam, Agate Knives and Bearings, and improved stops to take the weight off the knife edges when not in use. Mounted on polished Mahogany Board, with Set Screws and Pendulum for levelling.

To carry	100	250	500	1000 grammes
Sensible to	1	2	5	10 milligrammes
	45/0	**47/6**	**60 0**	**65 0** each

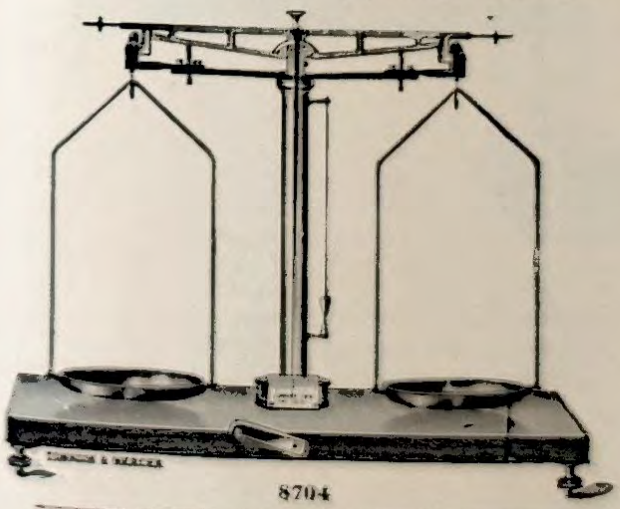
(F) *8705 Ditto, with Graduated Beam.
To carry 100 250 milligrammes
47/6 **50 0**

(F) *8706 **Special Balance Sets** for Students, consisting of Balance as No. 8701, to carry 100 grammes, with Agate Knives and Planes, polished Mahogany Balance Case as No. 8713, Set of Weights 100 grammes to 1 mg. in Polished Box with Forceps, Mahogany Stool, Glass Vessel and West's Graduated Tube No. 8764, for Specific Gravity work. Set complete **£4 2 6**

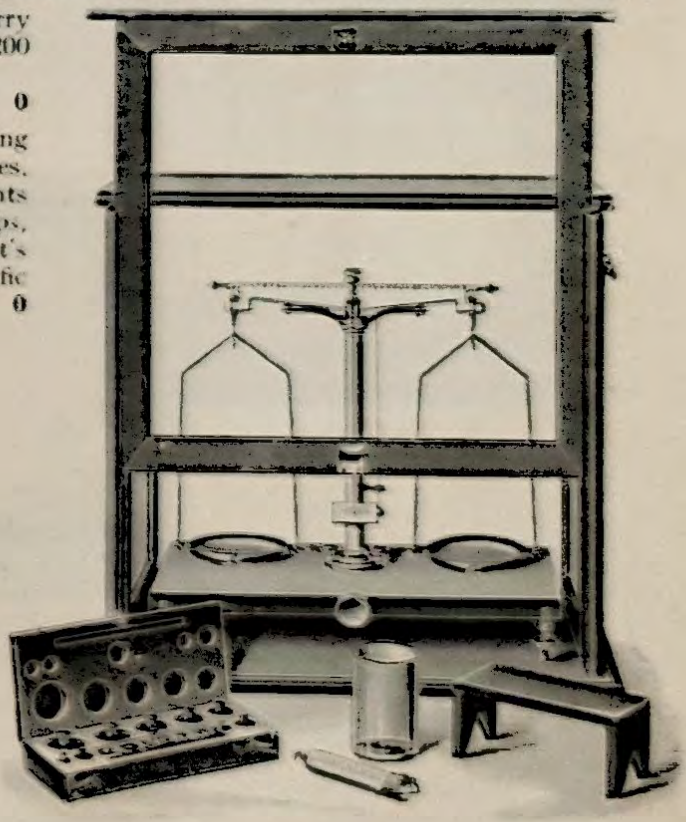
(F) *8707 Ditto, ditto, as above, but Balance to carry 250 grammes and Set of Weights 200 grammes to 1 mg., with Forceps.
Set complete ... **£4 11 0**

(F) *8708 **Special Balance Set** for Students, consisting of Balance No. 8700, to carry 250 grammes, Balance Case as No. 8712, Set of Weights 200 grammes to 1 mg., with Forceps, Mahogany Stool, Glass Vessel and West's Graduated Tube, No. 8764, for Specific Gravity. Set complete ... **£3 7 0**

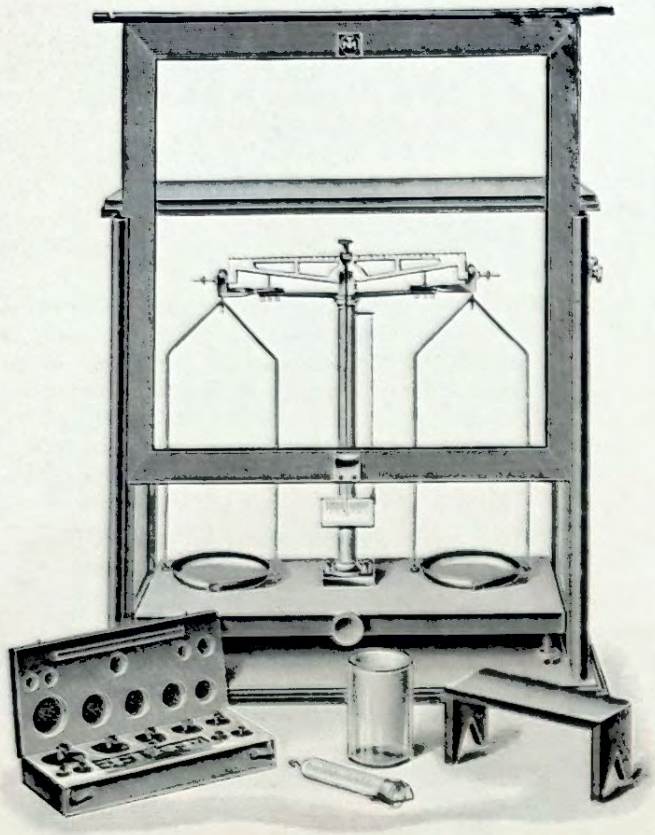
(F) Foreign manufacture



8704



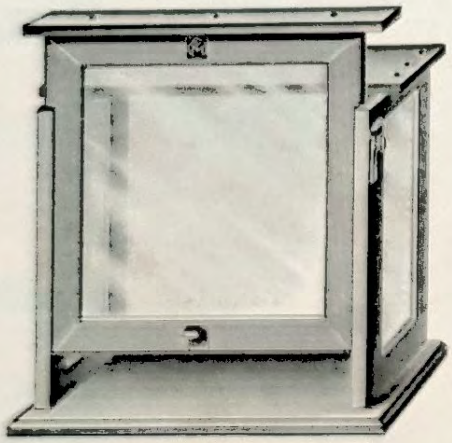
8706



8709

(F) *8709 **Special Balance Sets** for Students, consisting of Balance as No. 8705, to carry 100 grammes, fitted with Agate Knifes and Planes. Polished Mahogany Balance Case, Fig. 8713. Set of Weights 100 grammes to 1 mg. in Polished Wood Box with Forceps. Mahogany Stool, Glass Vessel, and West's Graduated Tube No. 8764 for specific gravity.
Set complete **£4 7 6**

(F) *8710 Ditto, ditto, as above, but Balance to carry 250 grammes, with Set of Weights 200 grammes to 1 mg., in Polished Box with Forceps.
Set complete **£4 16 0**

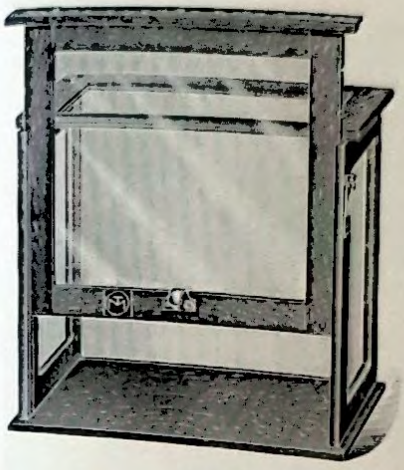


8711-12

*8711 **Balance Cases**, Whitewood, stained and polished to resemble Mahogany.

	To take Balance	100	250	500	1000	grammes
		21/0	**22/0**	**27/0**	**38/6**	each
*8712	Ditto, ditto, Solid Oak, varnished	**21/0**	**22/0**	**27/0**	**38/6**	,,

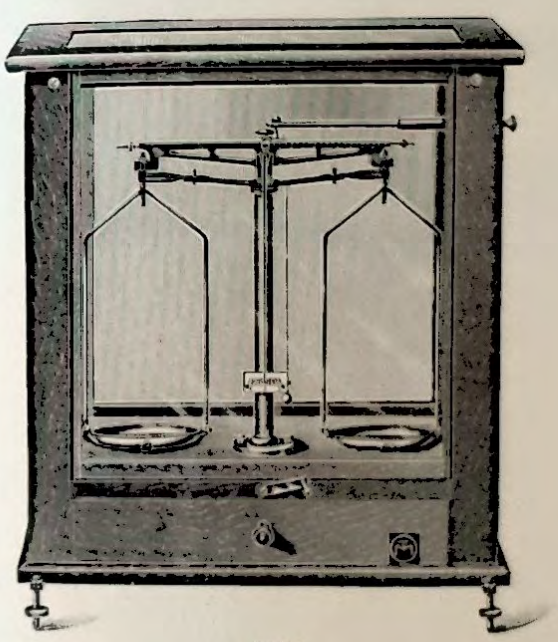
(F) Foreign manufacture



8713

*8713 **Balance Cases,** Solid Mahogany, Polished, glass sides and top.

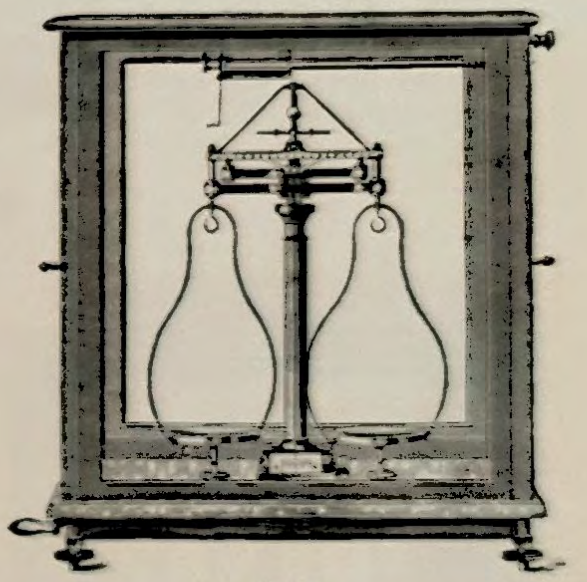
To take Balance	100	250	500	1,000 grammes
	27/6	**30/0**	**40/0**	**45/0** each



8714

(F) *8714 **Balance** with open Beam graduated for rider with rider apparatus, Agate Knives and Planes and improved stops to take the weight off the knife edges when not in use, in polished Mahogany Case with Drawer and counterpoised front sliding door and set screws and pendulum for levelling.

To carry	10	250 gm.
Sensible to	1	2 mg.
	115/0	**125/0**

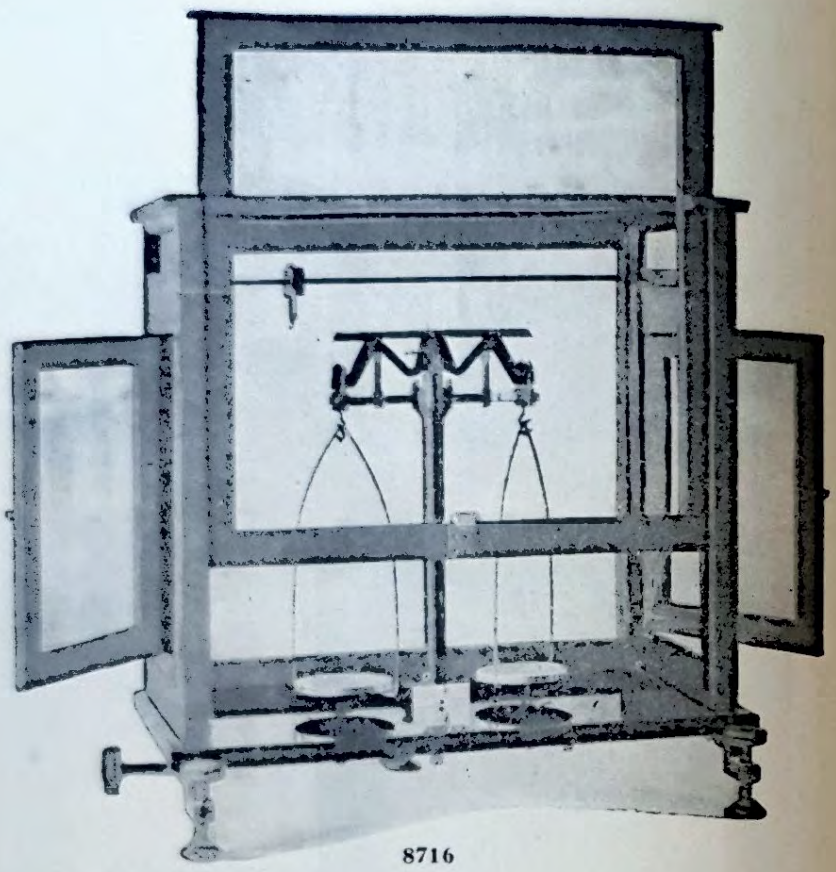


8715

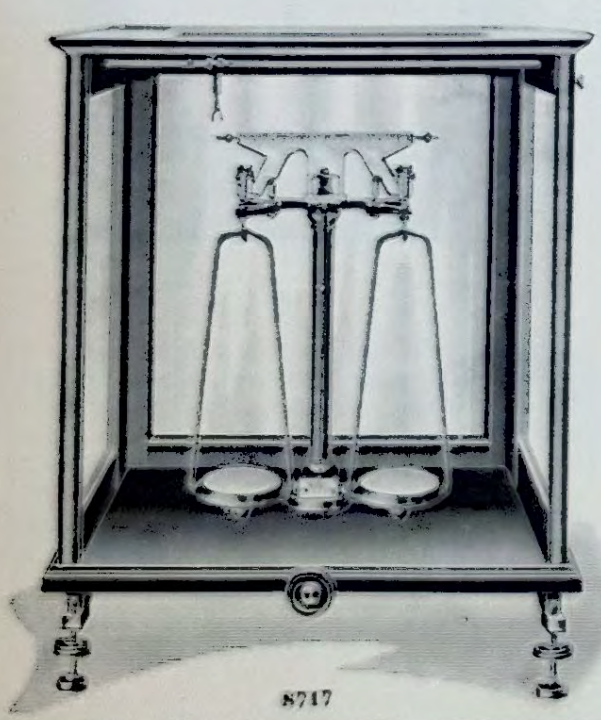
*8715 **Short Beam Balance,** British made, with Triangular Beam to carry 200 grm., sensible to $\frac{1}{25}$th mg., triple action Arrest, Rider Scale in front of the Beam, vertical action Rider Slide, mounted on thick black glass Plate in polished Mahogany Case, with two side doors, counterpoised front sliding door, all working parts completely enclosed ... **£12 0 0**

(F) Foreign manufacture

(F) *8716 **Balance** to carry 200 grammes, sensible to 1/10 milligramme, with Open Beam 15 cm. long, graduated both sides, Agate Knife Edges and Planes, Vertical Rider Apparatus, mounted on thick black Glass Plate, with Levelling Screws, in polished Mahogany Case with front sliding door and two side doors, **£10 0 0.**



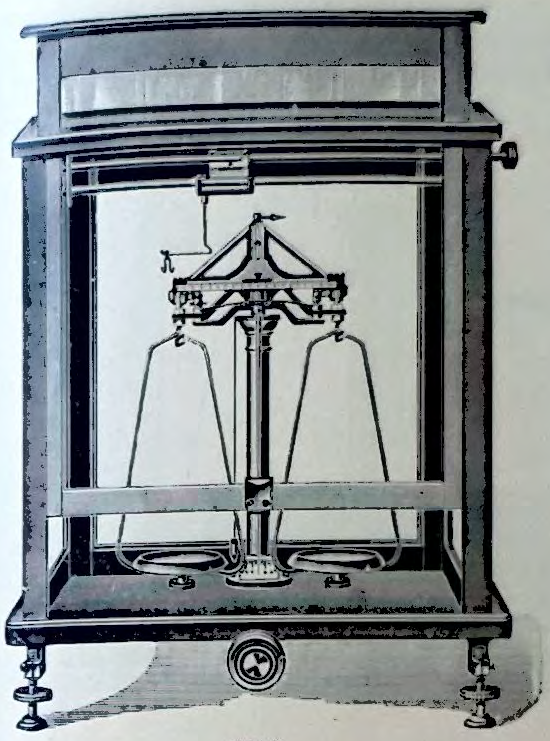
8716



8717

(F) *8717 **Balance** to carry 200 grammes, sensible to 1/10 milligramme, with solid Aluminium Beam 15 cm. long, graduated both sides, with Agate Knife Edges and Planes, Vertical Rider Apparatus, mounted on thick black Glass Plate, with Levelling Screws, in large polished Mahogany Case with counterpoised front door and two side doors **£11 0 0**

(F) Foreign manufacture.

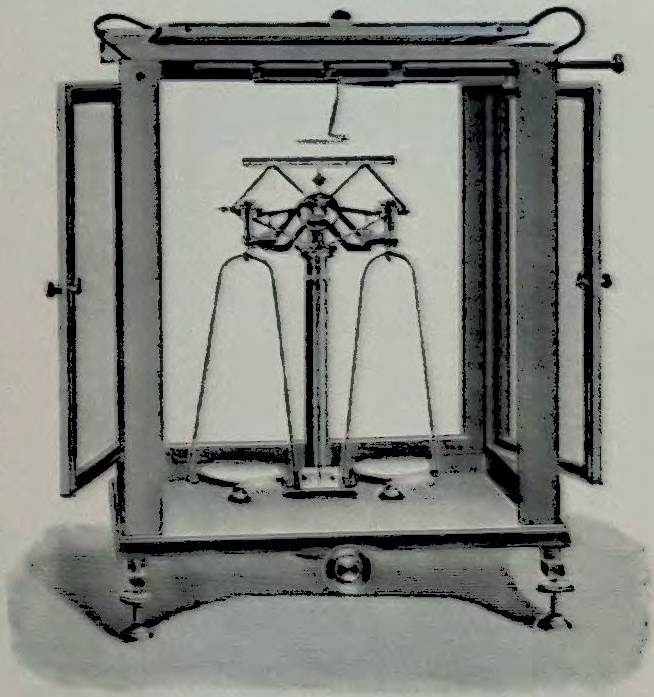


8718

(F) ***8718 Balance,** to carry 200 grammes, sensible to 1/10 milligramme, with aluminium triangular Beam 14 cm. long, with Front Rider Scale, Circular Arrestment and Compensating Suspenders, Agate Knives and Planes, Vertical Rider Apparatus, Pans platinum plated, in large Polished Mahogany Case with counterpoised Front Sliding Door and two Side Doors mounted on thick black glass plate with levelling screws **£13 10 0**

(F) ***8719 Balance** for scientific purposes, very fine precision work, with short square Beam of gilt phosphor bronze. The Beam is of such absolute stability that a deflection is impossible. The Balance oscillates with a medium load in 9 to 10 seconds. Circular Arrest of Beam, Compensating Stirrups, Agate Knives and Bearings, Beam divided into 100 adjusted parts, Vertical Rider Apparatus, Pans platinised, in Polished Mahogany Case with counterpoised Front Door and two Side Doors, mounted on thick black glass plate.

£17 12 6



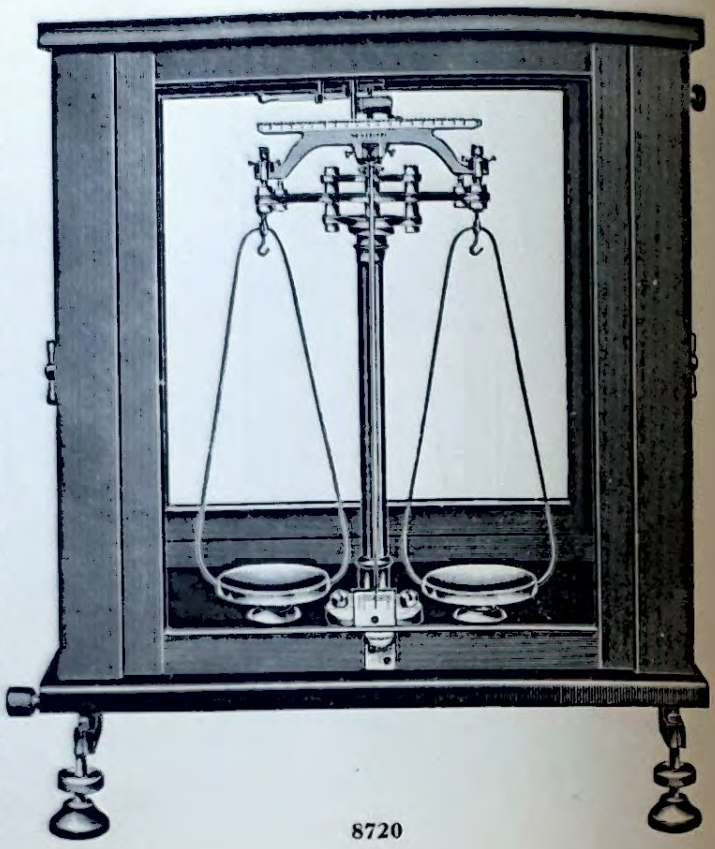
8719

(F) Foreign manufacture

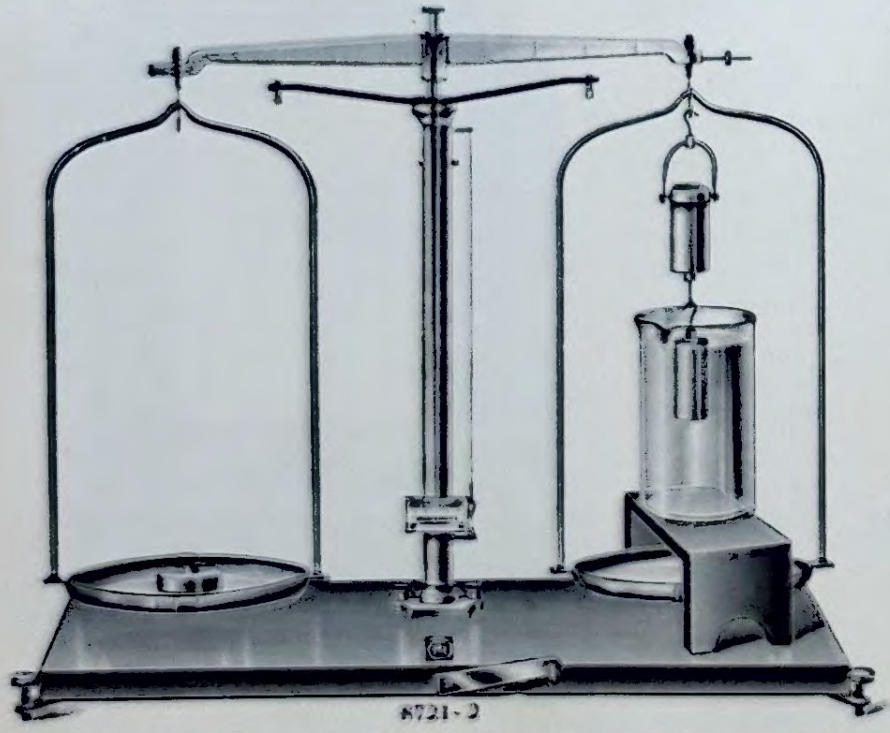
***8720 Balance,** by Paul Bunge, No. 9a, to carry 200 grammes, sensible to $\frac{1}{10}$ milligramme, Beam of hard bronze, 13 cm. long, all swinging parts of finely polished German silver, Agate Knives and Planes, Graduated Beam and Rider Apparatus in Polished Walnut Case with side doors, mounted on stout Black Glass Plate.

Nett **£17 10 0**

In place of a rider scale the Beam itself is graduated over its entire length into 100 divisions, and the Balance is adjusted with the rider in position over the left knife edge, so that moving a 50 milligramme rider the full length of the beam will cause an alteration of the equilibrium of the balance by 1 decigramme or, if adjusted, with a 5 milligramme rider 1 centigramme. In this way milligramme weights are not required, one notch corresponding to 1 milligramme or $\frac{1}{10}$ milligramme. The time of oscillation with a medium load is only 9 seconds.



8720

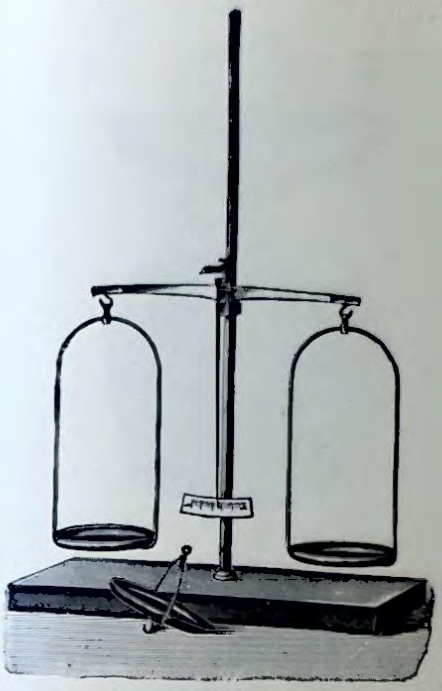


8721-2

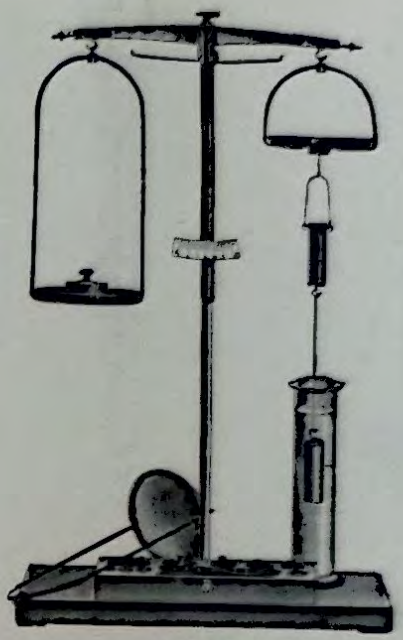
(F) **8721 Balance, "Science School,"** by Becker's Sons (Brummen), to carry 1000 grammes in each Pan, sensible to 15 milligrammes, Beam 13¾ in. long with Adjusting Screw and Support, Steel Knife Edges, Removable Brass Pans 6 in. diameter, Double Hooks to Stirrups for Specific Gravity Work, mounted on Polished Mahogany Base **£3 18 0**

(F) **8722** Ditto, as above, with Archimedes' Bucket and Cylinder Glass Immersion Jar and Polished Mahogany Bridge ... **£4 8 0**

(F) Foreign manufacture.



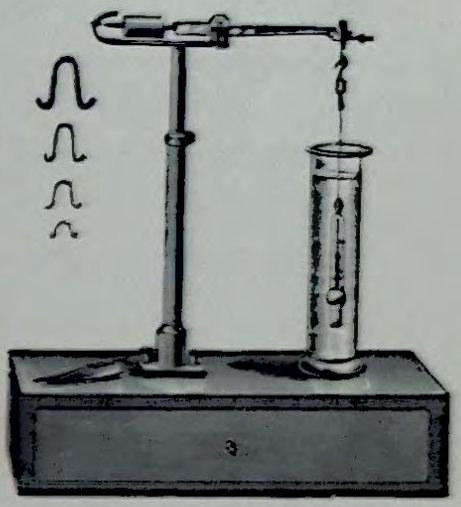
8723



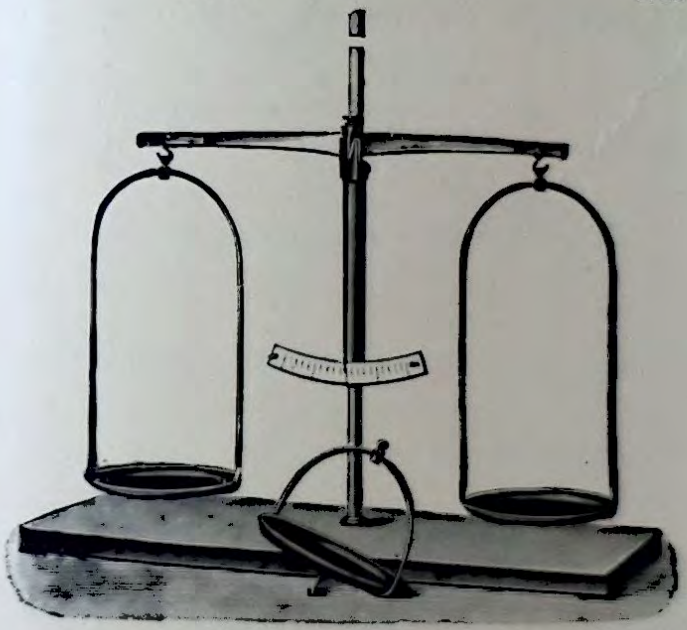
8724

***8723 Balance** for Physical Work, to carry 250 grammes, sensible to 3 milligrammes. Upright support 20 in., Brass Beam 10 in. with Screw for fixing at different heights. Index Needle 8 in., Index Scale 2½ in., Brass Pans 3¾ in. with Specific Gravity Pan, Bows 8½ in. long. Mounted on Polished Wood Base. **£1 10 0**

***8724 Balance, "Student's Physical,"** as No. 8723, with Archimedes' Bucket and Cylinder, Glass Immersion Jar and Set of Weights (200 grammes to 1 milligramme), in Polished Block with Forceps ... **£2 5 0**



8727-8



8725

(F) ***8725 Balance, "Lecture Theatre"** Pattern, to carry 1,000 grammes, sensible to 20 milligrammes, Beam 14 in. long, Index Needle 9 in., boldly divided Index Scale 6 in., with Screw for fixing at different heights on support, 27 in. high, mounted on Polished Wood Base, Brass Pans 5½ in., Bows 12 in. long, complete with Pan for Specific Gravity Work **£2 17 6**

(F) ***8726** Ditto, as above, with Archimedes' Bucket and Cylinder, Glass Immersion Jar and Set of Weights (1,000 grammes to 1 centigramme, with fractions under Glass Cover), in Polished Walnut Box with Hinged Cover and Forceps **4 10 0**

(F) ***8727 Balances,** Specific Gravity, with Riders, Plummet, Thermometer, Forceps, and Trial Glass, complete in Polished Mahogany Box with Drawer **2 17 6**

(F) ***8728** Ditto, as above, with Agate Knives and Planes **3 5 0**

(F) ***8729 Spare Thermometer-Plummets** for use with the Specific Gravity Balances ... ... each **0 9 6**

(F) Foreign manufacture



8730–1–3–5



8732–4



8736–7



8738–9

*8730 **Spring Balances**, with Hook, reading in grammes.

To weigh	50	50	50	100	100	150	250	500	500	1000	gm.
Divided into ...	2½	5	1	1	5	5	5	5	10	10	,,
	1/2	1/2	1/7	4/3	1/7	3/6	5/0	7/6	6/8	8/2	each

*8731 **Spring Balances**, with Hook.

To weigh ...	12	15	20	25	25	30	40	50	60	75	100	lb.
Divided into	4	4	4	4	8	8	8	8	8	16	16	oz.
	1/3	2/3	3/7	5/0	1/3	2/3	3/7	5/0	7/6	4/3	7/9	each

*8732 **Spring Balances**, with Hook and Round Tin Scale.

To weigh ...	12	15	20	25	25	30	40	50	60	75	100	lb.
Divided into	4	4	4	4	8	8	8	8	8	16	16	oz.
Diam. of scale	7	8	9	10	7	8	9	11	11	11	12	in.
	2/6	3/11	5/6	7/6	2/6	3/11	5/6	8/3	10/9	7/5	11/8	each

*8733 **Spring Balances**, with Hook.

To weigh ...	5	10	12	15	20	20	25	30	50	kilos
Divided into	¼	½	½	½	½	¼	¼	¼	½	,,
	1/3	5/0	1/3	2/3	3/7	2/3	2/8	3/9	7/7	each

*8734 **Spring Balances**, with Hook and Scale Pan.

To weigh ...	5	10	12	15	20	20	25	30	50	kilos.
Divided into	¼	½	½	½	½	¼	¼	¼	½	,,
Diam. of pan	7	8	7	8	9	9	10	10	11	in.
	2/9	7/0	2/9	4/2	5/11	4/7	5/7	6/8	12/3	each

*8735 **Spring Balances**, with Hook.

To weigh	2	4	6	8	10	12	lb.
Divided into	¼	½	1	1	1	1	oz.
	8/6	8/6	8/0	8/6	9/6	14/0	each

*8736 **Spring Balances**, in Tubular Brass Cases, with Hook.

To weigh ...	2	4	2	4	8	8	8	12	20	lb.
Divided into	¼	¼	1	1	1	2	4	4	8	oz.
	5/0	8/0	3/9	5/0	8/0	5/3	3/9	4/6	3/9	each

*8737 **Spring Balances**, in Tubular Brass Cases, with Hook.

To weigh ...	3	4	5	6	8	5	10	12	15	20	kilos.
Divided into	¼	¼	¼	¼	¼	¼	¼	¼	¼	½	,,
	3/9	3/11	4/6	5/0	5/10	3/2	3/11	4/6	5/0	5/10	each

*8738 **Compression Balances**, with Round Pan and Brass Dial.

	7	14	25	28	50	lb
Sensible to	¼	1	1	2	2	oz
	12/6	13/0	24/0	15/0	25/6	each

*8739 **Compression Balances**, as above, in grammes.

	5	10	15	20	25	kilos.
	¼	¼	¼	¼	½	,,
	12/9	13/3	15/0	25/6	26/6	each



8741



8742-5



8746

***8741 Circular Spring Balance,** with Hook.

To weigh ...	20	20	25	30	25	50	75	100 kilos.
Divided into ...	¼	½	½	½	½	½	½	½ ..
Diam. of dial	5	5	5	5	8	5	8	10 in.
	16/6	**16/6**	**16/6**	**16/6**	**32/0**	**16/6**	**32/0**	**50/0** each

***8742 Circular Spring Balances,** with Hook.

To weigh ...	50	56	100	100	112	150	200	250 lb.
Divided into ...	4	4	4	8	8	8	8	8 oz.
Diam. of dial	5	6	10	5	6	8	10	13 in.
	16/0	**19/0**	**48/0**	**16/6**	**19/6**	**32/0**	**48/0**	**68/0** each

***8743 Circular Spring Balances,** with Tinned Scales and Chains.

To weigh ...	50	56	100	100	112	150	200	250 lb.
Divided into ...	4	4	4	8	8	8	8	8 oz.
Diam. of dial	5	6	10	5	6	8	10	13 in.
Diam. of scale	11	12	14	14	16	18	18	24 ..
	19/9	**23/9**	**57/0**	**25/6**	**31/6**	**54/0**	**70/0**	**105/0** each

***8744 Circular Spring Balance,** with Hook.

To weigh ...	10	15	20	25	30	40	50 kilos.
Divided into ...	50	50	50	50	50	100	100 gm.
Diam. of dial	6	6½	8	8	9	9	9 in.
	14/0	**15/0**	**19/0**	**19/6**	**25/0**	**26/0**	**27/0** each

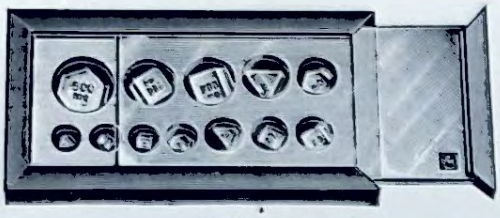
***8745 Circular Spring Balance,** with Hook and Scale Pan.

To weigh ...	10	15	20	25	30	40	50 kilos.
Divided into ...	50	50	50	50	50	100	100 gm.
Diam. of dial	6	6½	8	8	9	9	9 in.
Diam. of pan	10	11	12	12	12	12	12 ..
	17/0	**18/9**	**24/9**	**24/9**	**29/9**	**30/9**	**31/9** each

(F) ***8746 Lever Letter Balances,** with Brass Graduated Arc and Levelling Screw.

Graduated to	50	100	250	500	1000 gm.
	2/6	**3/0**	**5/6**	**7/6**	**12/0** each

(F) Foreign manufacture.



8750–1



8752

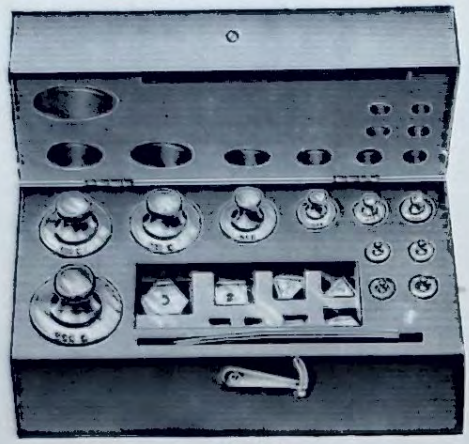
=**8747 Weights,** in Polished Wood Block with Lid, Forceps, Brass Weights, fractions of gramme in Nickelene, under Glass Cover, 100 grammes to 1 milligramme, for School use ... **£0 8 6**

(F) ***8748 Weights,** Tall form for science classes and schools. In Polished Wood Boxes with hinged cover. The fractions are of Nickeline protected by Glass Cover.

50 100 gm. to 1 mg.
9/6 10/6
200 500 1,000 gm. to 1 mg.
15/9 21/0 30/0



8747



8748–9

(F) ***8749 Weights,** as above, 100 grammes to 1 milligramme, with two 100 gramme Weights, total 300 grammes, **12/0**

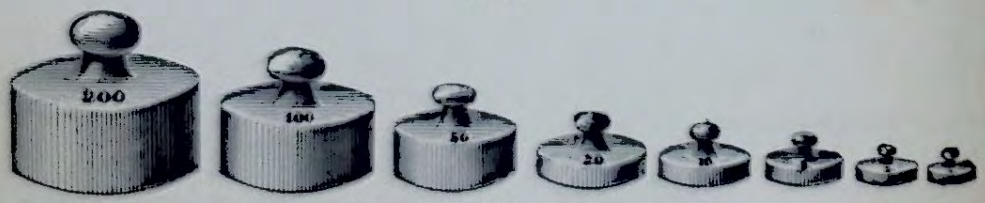
(F) ***8750** Ditto, in Polished Mahogany Box, with Glass Sliding Lid and Nickeline fractions, 500 to 1 milligramme **£0 2 6**

(F) ***8751** Ditto, with Aluminium fractions **0 5 0**

(F) ***8752 Separate Fractional Weights,** Nickeline, for above sets.
1 2 5 10 20 50 100 200 500 milligrammes ... ... per doz. **0 0 9**



8753



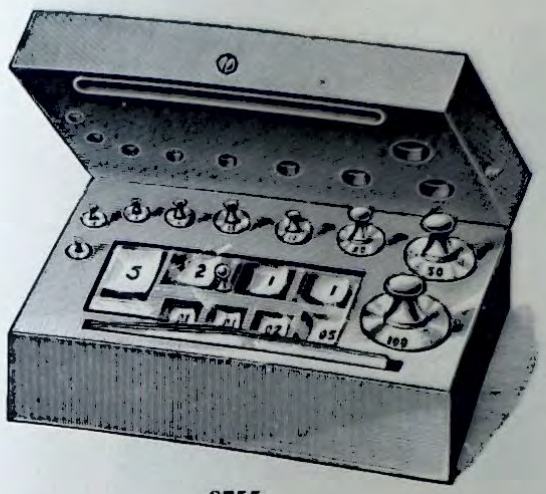
8754

(F) ***8753 Separate Brass Weights** for above sets, Tall form.

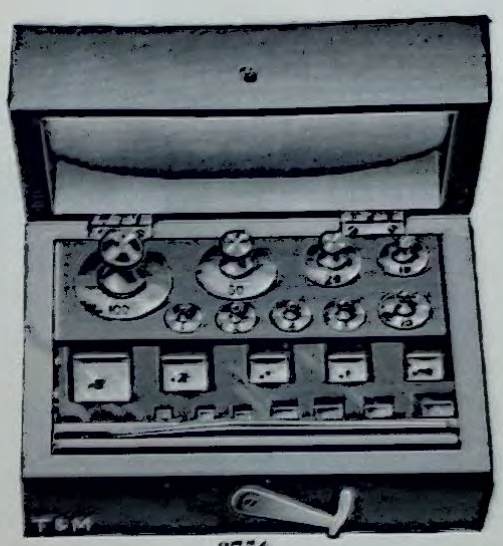
1	2	5	10	20	50	100	200	500	1000 gm.
2d.	**2d.**	**3d.**	**4d.**	**5d.**	**10d.**	**1/4**	**2/3**	**4/9**	**8/3** each
1/8	**1/11**	**2/9**	**3/9**	**4/9**	**9/6**	**15/0**	**24/0**	—	— per doz.

(F) ***8754 Separate Brass Weights,** flat form, same prices as for No. 8753.

(F) Foreign manufacture



8755



8756

(F) *8755 **Weights,** by Becker's Sons, Brummen Students' Sets. Polished Hardwood. Blocks with Lid and Forceps, Aluminium Fractions under Glass Cover.

50	100	200 gm. to 1 mg.
10/0	**11/0**	**15/0** per set

(F) *8756 Ditto, by Becker's Sons, in Polished Mahogany Boxes, velvet-lined, with Brass Forceps. Brass Weights lacquered, Fractions of aluminium under Glass Cover, each weight fitted separately.

50	100	200	500	1000 gm. to 1 mg.
14/6	**15/6**	**22/0**	**30/0**	**42/0** per set

(F) *8757 **Separate Fractional Weights,** aluminium, for above Sets.
·5, ·2, ·1, ·05, ·02, ·01, ·005, ·002, ·001 ... ... each **£0 0 4**

(F) *8758 **Separate Brass Weights,** for above Sets.

1	2	5	10	20	50	100	200	500	1000 gm.
6d.	**6d.**	**6d.**	**8d.**	**9d.**	**1/0**	**1/6**	**2/9**	**6/0**	**10/0** each



8759



8760

(F) *8759 **Weights,** Analytical, in Polished Mahogany Box. Weights from 1 gm. upwards, nickel plated, Fraction of pure nickel under Glass Cover with Riders and Forceps.

50	100	200 gm. to 1 mg.
26/0	**29/0**	**36/0**

(F) *8760 Ditto, Analytical, in Polished Mahogany Box, with Ivory Pointed Forceps. The Brass Weights from 1 gm. upwards gold plated, fraction of gramme of pure nickel (except the 5, 2, and 1 mg., which are of aluminium), under Glass Cover with Riders, accurately adjusted.

50	100	200	500	1000 gm. to 1 mg.
36/0	**46/0**	**65/0**	**86/0**	**115/0**

(F) *8761 Ditto, **Fractional Weights,** pure nickel, for No. 8760 (1, 2, and 5 mg. are of aluminium) ... ... **6d.** each

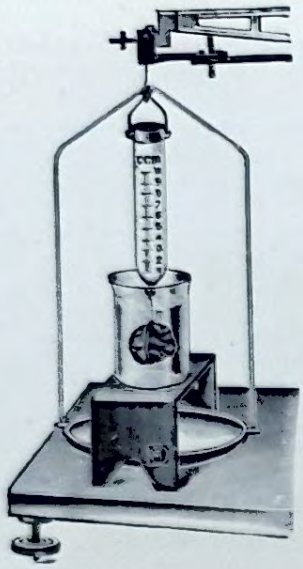
(F) *8762 Ditto, **Brass Weights,** gold plated, for No. 8760.

1	2	5	10	20	50	100	200	500	1000 gm.
2/0	**2/3**	**2/9**	**3/0**	**3/10**	**5/3**	**7/9**	**10/3**	**12/9**	**16/6** each

(F) *8763 **Riders,** aluminium.

1	2	5	10	50	100 mg.
6d.	**6d.**	**6d.**	**8d.**	**9d.**	**1/0** each

(F) Foreign manufacture



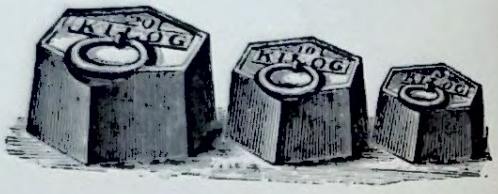
8764



8765



8767



8766

*8764 **Specific Gravity Tube,** designed by G. H. West, B.Sc., consisting of a Glass Tube graduated 10 c.c. in $\frac{1}{10}$ths, with Hook at bottom for suspension, and fitted with light metal clamp and wire to attach to stirrup of balance ... ... each **£0 1 9**

*8765 **Glass Vessels,** for use with above ... ... „ **0 0 9**

*8766 **Weights,** Iron, Hexagon Pattern, with Ring Handle.

100	200	500 grammes	1	2	5	10 kilos.
6d.	**8d.**	**1/2**	**1/9**	**2/9**	**5/9**	**10/0** each
5/9	**7/6**	**13/3**	**20/0**	**31/6**	**66/0**	**115/0** per doz.

*8767 Ditto, Iron, Avoirdupois, Flat Round, with 2 oz. to $\frac{1}{4}$ oz. in Brass.

$\frac{1}{4}$ oz. to 1	2	4 lb.
3/6	**4/3**	**5/9** per set



8768

*8768 **Weights,** Iron, Square Shape, with Ring Handle.

$\frac{1}{4}$	$\frac{1}{2}$	1	2	4	7	14	28	56 lb.
7d.	**8d.**	**1/0**	**1/8**	**2/6**	**3/6**	**5/6**	**10/0**	**22/0** each



8770



8771



8772-3

(F) **8770** **Forceps,** Brass, nickel plated ... ... 8 9 10 cm.
6d. **6d.** **7d.** each
5/3 **5/6** **6/3** per doz.

(F) **8771** Ditto, with curved ends ... ... **6d.** **6d.** **7d.** each
5/3 **5/6** **6/3** per doz.

(F) **8772** Ditto, with Ivory Points, straight, length 10½ cm. ... per doz. **£1 1 0** each **£0 2 0**

(F) **8773** Ditto, ditto, bent ... ... **1 2 0** .. **0 2 1**



8774



8775



8776

8774 **Specific Gravity Tables or Bridges,** Polished Mahogany, for supporting Beakers, etc., above Pans of Balance.

For 100 250 500 1000 gm. Balances
1 0 **1 0** **1 3** **1 6** each

(F) **8775** **Desiccator,** Stout Glass, to fit into the corner of Balance Cases,

5 cm. dia. × 4 cm. high **£0 1 4**
7½ .. .. 6 .. .. **0 2 3**

8776 **Undersets** for Balances, Lacquered Brass, for placing beneath the Levelling Screws ... ... per set of 3 **0 2 6**

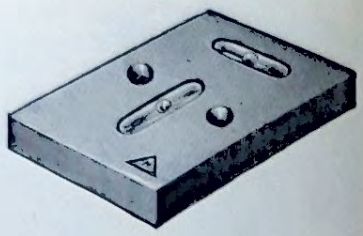
(F) Foreign Manufacture



8778



8779



8780

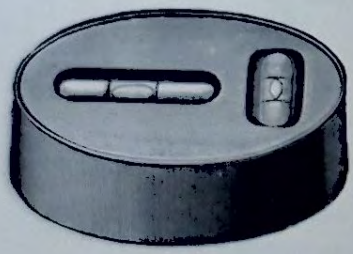
*8778	**Spirit Level,** Brass, for Balances, diameter of flange 1 inch	each	£0	2	6
*8779	Ball ditto, Brass Base, with a perfectly true steel ball working on a concave glass surface, diameter of flange 1 inch	each	0	2	6
*8780	**Spirit Level,** Double Tube, length 1¼ inches, width 1 inch, depth ¼ inch	each	0	4	0



8782



8781

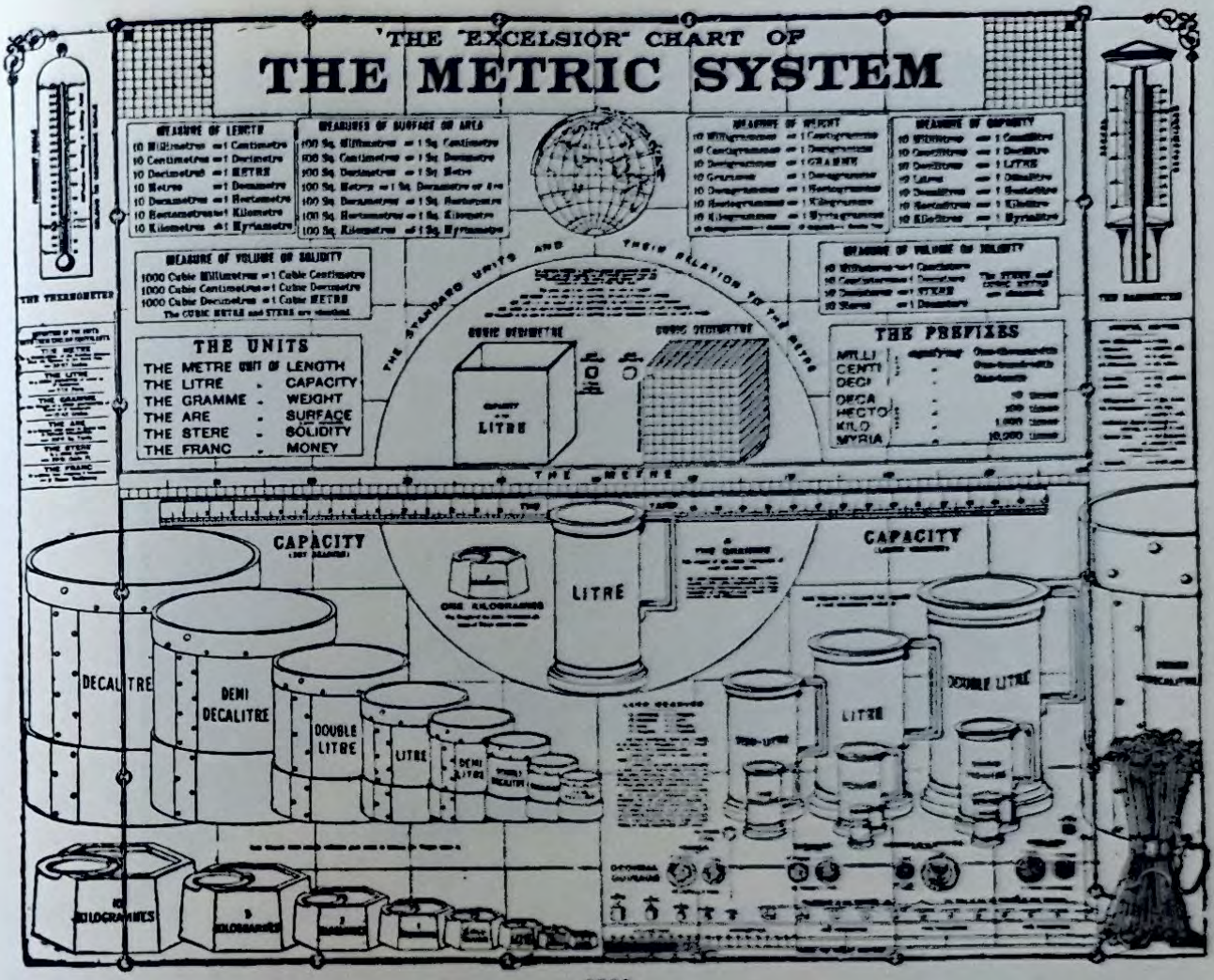


8783

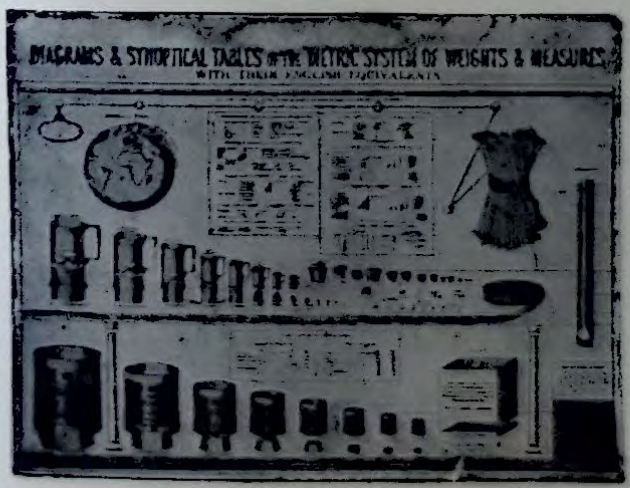


8784

8781	**Spirit Level,** Brass Tube, 2½ inches long, for Balances, etc.		£0	1	3
8782	„ Best Quality, Brass Tube 2½ inches long, in Leather Case, for Balances, etc.	each	0	2	0
8783	**Cross Spirit Level** for adjusting balances, mounted on Nickelled Brass Case ...		0	6	6
8784	**Index Reader,** consisting of Reading Lens in Metal Frame, mounted on Brass Stand with universal joint	each	0	10	6



8800

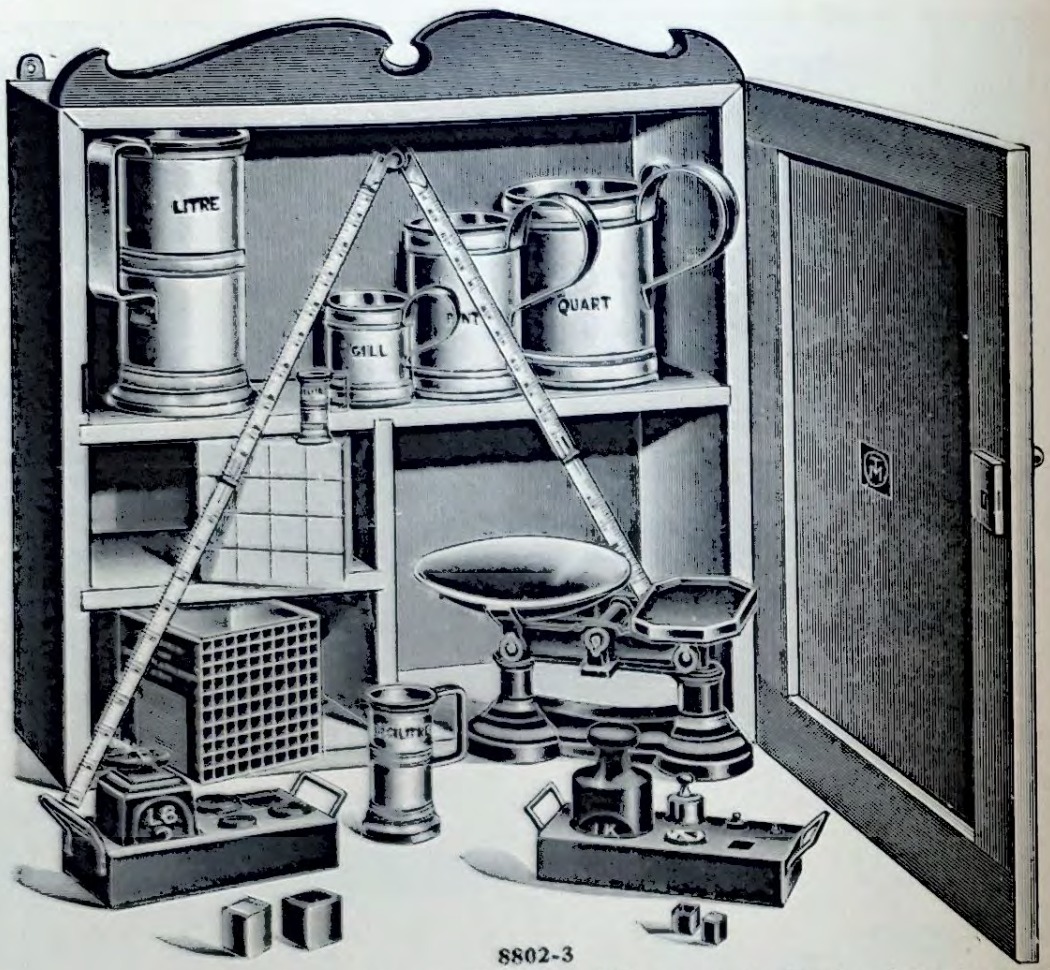


8801

=8800 **Metric System.** The "Excelsior Chart, size 50 × 42 in., printed in Colours, showing all Weights and Measures in their actual sizes, with Explanatory Handbook. On Cloth and Rollers, Varnished ... ... nett **£0 12 6**

=8801 **Metric System of Weights and Measures,** size 44 × 33 in., Diagrams and Synoptical Tables with English equivalents, mounted on Rollers and Varnished, with Handbook.

each, nett **£0 7 6**



8802-3

***8802 Comparative Set of British and Metric Weights and Measures,** showing the relation between long, square and cubic measures in the two systems.

METRIC.

1. 1-Kilogramme (1000 grammes)
2. 1-Hectogramme (100 ,,)
3. 1-Decagramme (10 ,,)
4. 1-Gramme
5. 1-Decigramme (1/10 ,,)
6. 1-Centigramme (1/100 ,,)
7. 1-Milligramme (1/1000 ,,)
8. 1-Litre Measure
9. 1-Deci-litre ,, (1/10 litre)
10. 1-Centi-litre ,, (1/100 ,,)
11. 1-Cubic Deci-metre Wood, divided on one face into inches.
12. 1-Ditto, Hollow, divided one face into square centimetres.
13. 1-Cube, 1 centimetre, square side.
14. 1-Cube, 1 centimetre, Hollow (internal size).
25. 1-Metre Rule, Boxwood, 4-fold, divided into centimetres and millimetres, reverse side into inches and eighths.
26. 1-Hand Chart of the Metric System.
27. 1-Balance for comparison of Weights of the two Systems.

ENGLISH.

15. 1-2 lb. Weight.
16. 1-2 oz. ,,
17. 1-1 oz. ,,
18. 1-½ oz. ,,
19. 1-¼ oz. ,,
20. 1-Quart Measure
21. 1-Pint ,, (¼ Quart)
22. 1-Gill ,, (⅛ Quart)
23. 1-Cubic Inch Wood
24. 1-Cubic Inch Hollow (internal size).

The above Set packed in Wooden Hinged Box **£2 17 6**

***8803** In Polished Hardwood Cabinet, with divisions, with Lock and Key complete **4 10 0**

***8804 Cabinet of Weights and Measures,** illustrating the Metric System.

CONTENTS

1. 1-Kilogramme (1000 grammes)
2. 1-Hectogramme (10 ,,)
3. 1-Decagramme (10 ,,)
4. 1-Gramme (1 ,,)
5. 1-Decigramme (1/10 ,,)
6. 1-Centigramme (1/100 ,,)
7. 1-Milligramme (1/1000 ,,)
8. 1-Cubic Decimetre, Wood, divided on face into square centimetres.
9. 1-Cubic Decimetre, hollow, divided one face into sq. centimetres.
10. 1-Cube 1 centimetre side.
11. 1-Litre Measure (1 litre)
12. 1-Deci-litre ,, (1/10 ,,)
13. 1-Centi-litre Measure (1/100 litre)
14. 1-Metre Rule, Boxwood, 4-fold, divided into Centimetres and Millimetres, Reverse side into inches and eighths.
15. 1-Hand Chart of the Metric System.

The above Set packed in Wooden Hinged Box **£1 15 0**

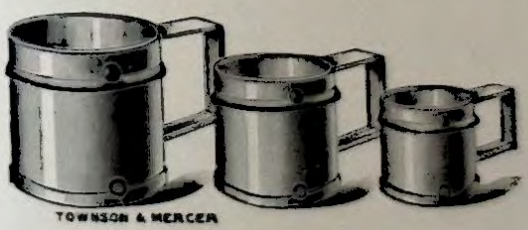
***8805** Ditto, in Polished Hardwood Cabinet, with divisions, Lock and Key complete **2 17 6**

(Charts of the Metric System, see Nos. 8800, etc.)



8806-8

8806	**Metric System.** Size 60×50 in. A Synoptic Table with Diagrams, showing the actual size of Weights and Measures. By C. H. Dowling, C.E. With Handbook, by James Yates, Esq., M.A., etc., etc. Mounted on Cloth and Rollers, Coloured and Varnished ... ... nett	£1	0	0
8807	**Reductions of the above,** size 50×42 in., with Handbook, on Cloth and Rollers Varnished ... ... nett	0	14	0
8808	Ditto, size 33×27 in., with Diagrams a fourth of the actual size, with Handbook, mounted on Cloth and Rollers, Coloured and Varnished...	0	6	0
8809	Handbooks ... ... each, nett	0	0	6



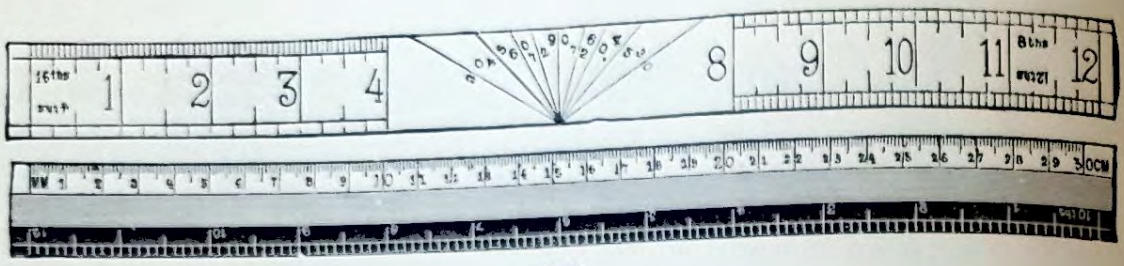
8810-11



8812

		Capacity	Centi-litre.	Deci-litre.	½ litre.	litre.	
8810	**Measures,** Tinned-Iron, with Handle, officially stamped		2 6	2 6	4 0	5 0	each
8811	**Measures,** Tinned-Iron, with handle, as Fig. 8810, officially stamped		Gill. 1 9	Pint. 2 3	Quart. 3 0	Gallon. 7 6	each
(F) **8812**	**Measures,** Enamelled Steel, Blue outside and White inside.	Capacity	¼ 2 3	½ 2 6	1 3 6	2 5 6	litres each

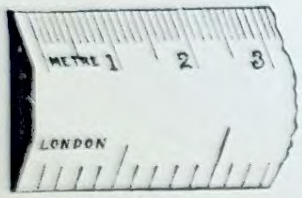
(F) Foreign manufacture.



8813

8813 **Rule,** Boxwood, special pattern for Schools, 12 in. long, with Double Bevel showing $\frac{1}{10}$ of an inch and millimetres on front, and $\frac{1}{4}$, $\frac{1}{8}$, $\frac{1}{12}$, and $\frac{1}{16}$ of an inch, and angles 30, 45, 60, 72, and 90 degrees on back ... ... per doz. **4/6**; per gross **£2 8 0**

8814 Ditto, Boxwood, Gordon's L.C.C. Educational Department Pattern, divided into inches, $\frac{1}{10}$ centimetres and millimetres ... ... per doz. **5/0**; per gross **2 15 0**



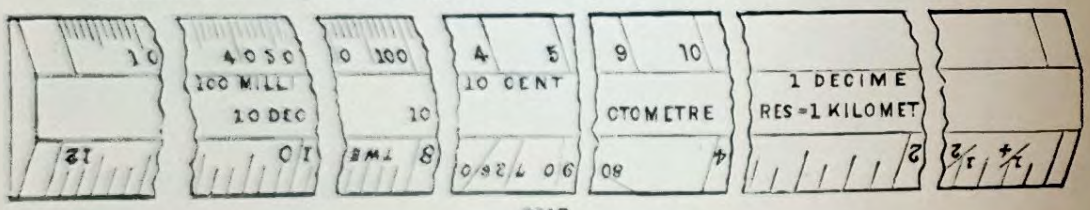
8815



8816

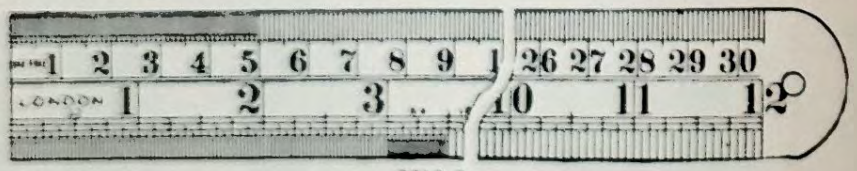
8815 **Rule,** Boxwood, Polished, 12 in. long, bevelled one edge and graduated centimetres and millimetres; other edge in inches and $\frac{1}{10}$ths ... ... per doz. **4/0**; per gross **£2 5 0**

8816 Ditto, ditto, 12 in. long, thin, flat, with square edges, graduated centimetres and millimetres one edge, other edge inches and $\frac{1}{10}$ths ... per doz. **4/0**; per gross **2 5 0**



8817

8817 **Rule,** Boxwood, with Double Bevel, 12 in. long, graduated $\frac{1}{8}$, $\frac{1}{10}$, and angles on one face edge and centimetres and millimetres on the other edge, with $\frac{1}{10}$ one edge and $\frac{1}{16}$ in. on the other edge at back ... ... per doz. **4/6**; per gross **£2 8 0**



8818-9

8818 **Rule,** Bright Hardened Steel, engine divided on one edge into centimetres and millimetres, with 5 centimetres divided into $\frac{1}{2}$ millimetres; on the other edge into $\frac{1}{2}$, $\frac{1}{10}$, $\frac{1}{20}$, and $\frac{1}{50}$ of an inch. 12 inch ... ... each **£0 2 0**

8819 Ditto, as above, but with edge divided into $\frac{1}{32}$, $\frac{1}{50}$, and $\frac{1}{64}$ of an inch. 12 inch ... each **0 2 0**

8820 **Rule,** Bright Hardened Steel, engine divided on one edge, into centimetres and millimetres with 5 centimetres divided into $\frac{1}{2}$ millimetres; on the other edge into $\frac{1}{2}$, $\frac{1}{10}$, $\frac{1}{20}$, and $\frac{1}{50}$ of an inch.

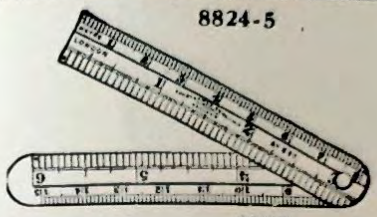
	6×$\frac{1}{8}$	12×$\frac{1}{8}$ in.
	1 3	**2 3** each

8821 Ditto, as above, but with other edge divided into $\frac{1}{16}$, $\frac{1}{32}$, and $\frac{1}{64}$ of an inch.

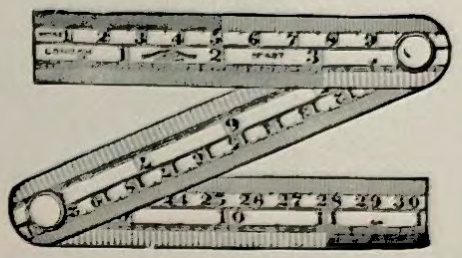
	6×$\frac{1}{8}$	12×$\frac{1}{8}$ in.
	1 4	**2 4** each



8824-5

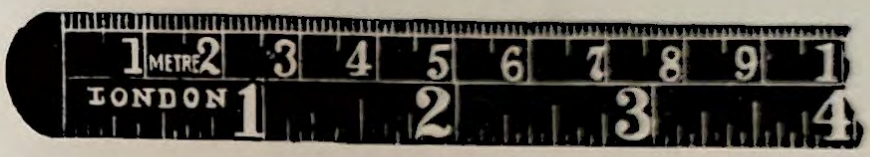


8822



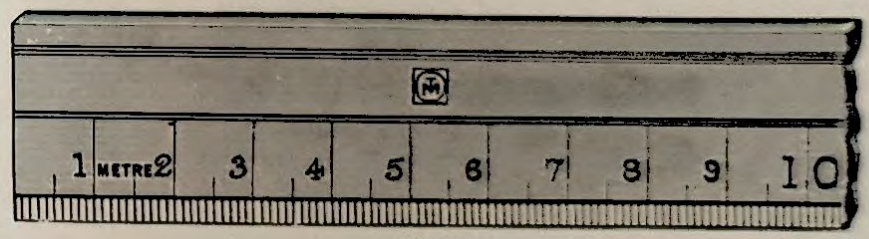
8823

8822	**Rule,** Steel Two-fold, 6×½ in., divided into centimetres and millimetres, one edge inches, and 1/20 or 1/16 inch on other edge ... ... each	£0	1	6
8823	Ditto, Three-fold, 12 in. long, divided into centimetres and millimetres, one edge inches, and 1/16 on other edge	0	2	3
8824	Ditto, Four-fold Boxwood, length 2 ft., divided into inches, ½, 1/16, centimetres and millimetres ... ... each	0	2	0
8825	Ditto, Four-fold Boxwood, as above, 1 m. long...	0	2	9



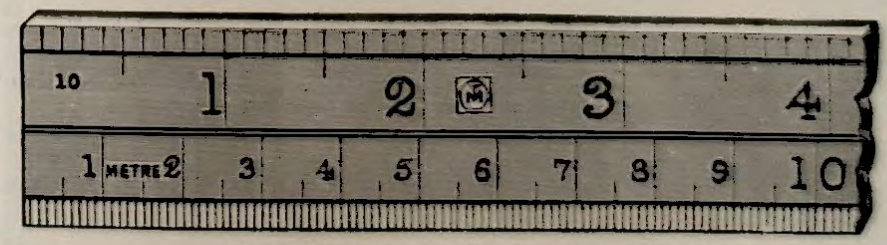
8826

8826	**Rule,** Flexible Steel, 12×⅜ in., centimetres and millimetres on one edge, ½, ¼, ⅛, and 1/16 of an inch on the other edge ... ... each 1 0, per doz.	£0	10	0



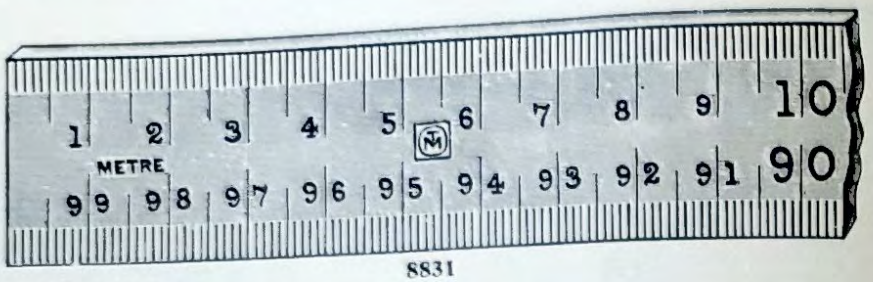
8827-8

8827	**Rule,** Boxwood, 1 m. long, graduated into centimetres and millimetres on one side only, best quality ... ... each 2 0, per doz.	£1	2	0
8828	Ditto, ½ m. long, best quality ... ... 1 1 ..	0	11	6



8829-30

8829	**Rule,** Boxwood, 1 metre long, graduated one side only into centimetres and millimetres on one edge, and 1/20 of an inch on the other edge, best quality. Each 2 1, per doz.	£1	3	0
8830	Ditto, ditto, ½ m. long, best quality ... ... 1 2 ..	0	13	0



8831

8831 **Rule,** Boxwood, 1 m. long, best quality, graduated in centimetres and millimetres on both edges of one side, reading left to right and reverse ... each **2/6**, per doz. **£1 8 6**

8832 Ditto, ditto, 1 m. long, best quality, graduated in centimetres and millimetres on one edge, inches and $\frac{1}{10}$ other edge, 0 in centre reading 0-50 cm. each side, suitable for Levers, etc. ... ... each **2/9**, per doz. **1 10 0**



8833-6

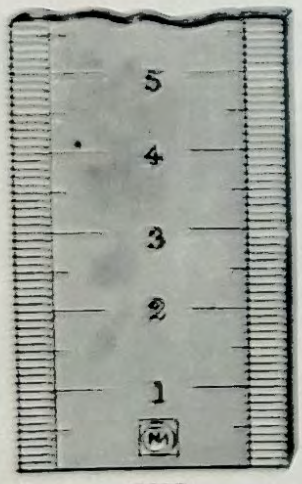
8833 **Rule,** Boxwood, graduated one side on both edges in centimetres and millimetres, with both edges bevelled, 1 m. long ... ... each **3/0**, per doz. **£1 12 6**

8834 Ditto, ditto, $\frac{1}{2}$ m. long ... ... ,, **1/9** ,, **0 18 0**

8835 Ditto, ditto, one edge in millimetres and other edge in $\frac{1}{10}$ inch, 1 m. long. Each **3/0**, per doz. **1 12 6**

8836 Ditto, ditto, $\frac{1}{2}$ m. long ... ... ,, **1/9** ,, **0 18 0**

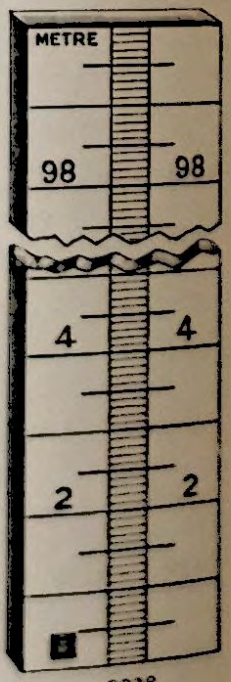




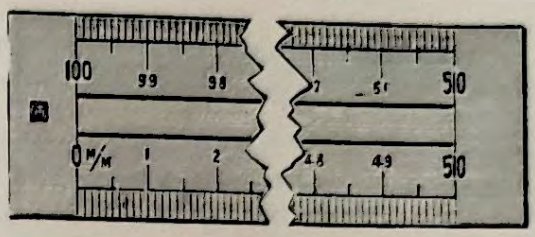
8837

8837 **Rule,** Boxwood, graduated in millimetres on both edges, with figures in centre reading vertically 0 to 100... ... ... each **£0 2 6**

8838 Ditto, ditto, best quality, graduated in millimetres in centre, with figures on each edge reading vertically ... ... each **£0 3 0**

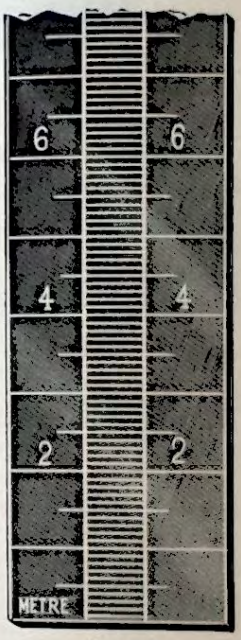


8838

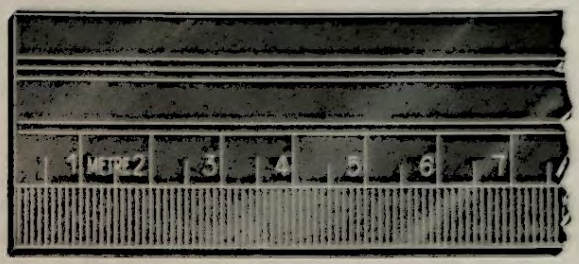


8839

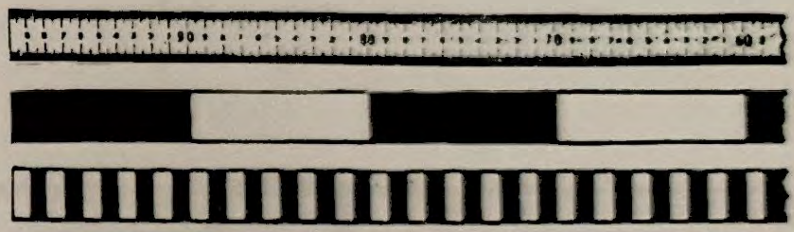
8839 **Rule,** Boxwood, ½ metre long, best quality, graduated centimetres and millimetres on both edges of one side, reading left to right and reverse... ... ... each **£0 1 4**



8841-2



8843-4



8845

(F) 8840 Glass Scales, 10 centimetres long, divided in inches and millimetres on plain glass, each **1/10;** per doz. **£1 1 0**

(F) 8841 Ditto, ditto, 1¼ in. wide with vertical readings, divided into millimetres on plain glass.

Length ...	15	25	50 cm.
	2/0	**3 6**	**6 0** each

(F) 8842 Ditto, ditto, 1¼ in. wide, with vertical readings, divided into millimetres, as Fig. 8841, silvered on back.

Length ...	15	25	50 cm.
	3 6	**5 6**	**8 0** each

(F) 8843 Ditto, ditto, with horizontal readings on Plain Glass, as figured.

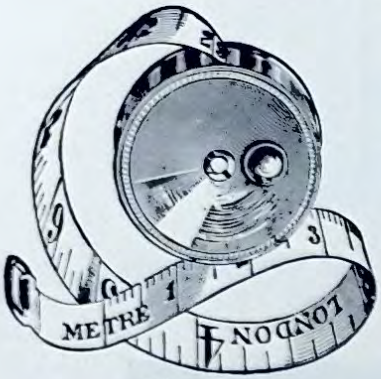
Length ...	15	25	50 cm.
	2 0	**3 6**	**6 0** each

(F) 8844 Ditto, ditto, as above, silvered on back, horizontal readings as No. 8843.

Length ...	15	25	50 cm.
	3 6	**5 6**	**8 0** each

8845 **Demonstration Rule,** 1 metre long, with one side plain, one side graduated into decimetres, one side into centimetres, and the other into millimetres to illustrate the metric system ... ... each **£0 7 6**

(F) Foreign manufacture



8856–7

8846 **Scales,** Stout Card, 1 metre long, engine divided into millimetres. Each **6d.**, per doz. **£0 5 6**

8847 Ditto, as above, ½ metre long. Each **4d.**, per doz. **0 3 6**

8848 Ditto, Stout Paper, 1 metre long, Engine divided into millimetres. Each **4d.**, per doz. **0 3 0**

8849 Ditto, as above, ½ metre long. Each **3d.**, per doz. **0 2 6**

8850 Ditto, Stout Card, 1 metre long, divided each edge into millimetres and figured in centre for vertical readings. Each **6d.**, per doz. **0 5 6**

8851 Ditto, as above, ½ metre long. Each **4d.**, per doz. **0 3 6**



8858

8852 **Scales,** Stout Paper, 1 metre long, divided each edge into millimetres and figured in centre for vertical readings ... ... each **4d.**, per doz. **£0 3 0**

8853 Ditto, as above, ½ metre long ... ... each **3d.**, per doz. **0 2 6**

8854 Ditto, Paper, Transparent, ½ metre long, divided into millimetres, for Galvanometer Scales... each **0 0 7**

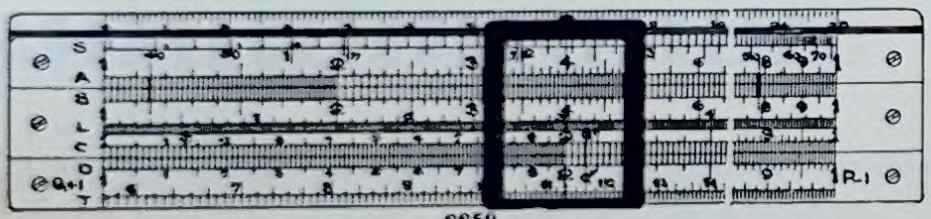
8855 Ditto, Stout Card, ½ metre long, divided into millimetres, for Galvanometer Scales ... ... ,, **0 0 6**

(F) 8856 **Measures, Spring Tape,** Linen—divided into inches one side, and centimetres and millimetres the other ... ... length 1 **2/0** 2 **3/0** m. each

8857 Ditto, ditto, Steel, divided one side, 3 feet into inches and other side metre into millimetres, enclosed in Nickel-plated Case with Spring Stop ... ... each **£0 3 6**

8858 **Measuring Tapes,** Linen, Wind-up, with Leather Case and Folding Handle, marked one side English, other side Metric. Width of Tape, $\frac{9}{16}$ in. ... ... 33 **6/6** 66 **10/0** ft. each

Slide Rules



8859

NEW "UNIFACE" PATTERNS.

In the improved "Uniface" Slide Rules, "windows" or recesses at the back are entirely dispensed with; all working is done at the front of the Rule, and readings of Sines, Tangents and Logarithms are made with the greatest possible ease and celerity by means of the Cursor Line.

"Uniface" Rules are Unquestionably the Simplest.

They are almost self-explanatory, as may be seen from the illustration above, which shows the Cursor Line set to 2 on Scale C and D (and therefore to 4 on Scales A and B), in which position the angle whose tangent is ·2 can be read off under the Cursor line on Scale T, as 11° 19′, and the angle whose sine is ·04 may be read off on Scale S as 2° 18′, and the logarithm of 2 is shown on Scale L to be ·301.

= 8859 **Celluloid Slide Rule, "Uniface,"** 10¼ in., or 27 cm., with Calculating Scales, A, B, C, and D., and Sine, Tangent and Log. Scales, Transparent Cursor, with Instruction Sheet, in Case ... each **£0 17 6**

= 8860 Ditto, Bevelled, with inch and millimetre Measuring Scales (a strong and handsome Rule) in Case ,, **1 0 0**

= 8861 As No. 8859, but with Log-log and Cubes Scales in addition, with Instruction Sheet, in Case... ,, **1 0 0**
(One of the best designed Slide Rules on the market).

= 8862 Ditto, Bevelled, with inch and millimetre Scales, in Case ... ... ,, **1 2 6**

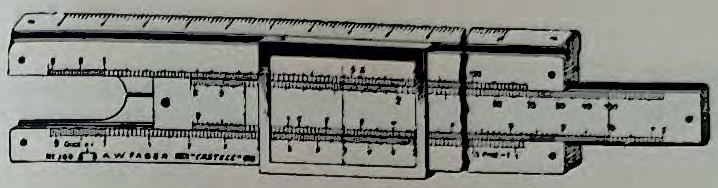
= 8863 Ditto, with Electrician Scales also, in Case... ... ... ,, **1 2 6**

= 8864 Ditto, ditto, Bevelled, etc., etc., in Case ... ... ,, **1 5 0**

= 8865 **New Metal "Omnes" Slide Rule,** 11 in. Transparent Cursor ... ... ,, **0 7 6**

(The most wonderful cheap Slide Rule ever produced; contains all the Scales of the "C.E.M." Rule; simple and very accurate; a mathematical education in itself; THE RULE for the Student, for the working Engineer, and for Hot Climates).

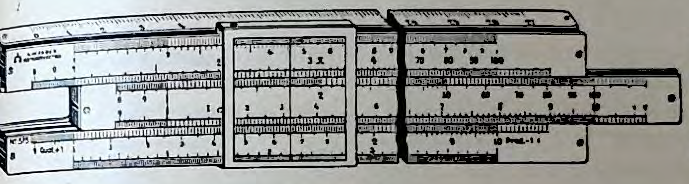
(F) Foreign manufacture.



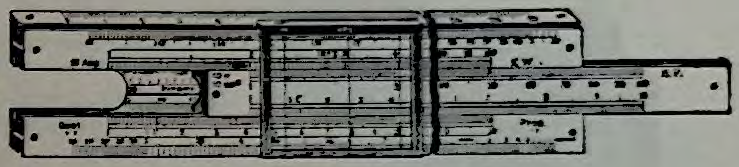
8866

(F) *8866 **Faber's Precision Calculating Rule,** 10-in. scale length, with white celluloid surface and Ordinary Aluminium Cursor with Glass. On the upper face of the rule are the two usual logarithmic scales for multiplication and division, squaring and cubing, and the extraction of square and cube roots. On the under side of the slide are the sine and tangent scales, SS and TT, for carrying out trigonometrical calculations, and the logarithmic scale LL, by means of which higher powers and roots can easily be determined.

This is a very important Rule, which is of great service for technical and commercial calculations. It appeals to the Architect, the Constructional Engineer, the Mechanical Engineer, the Electrical Engineer, the Physicist and the Chemist ... **£1 1 0**



8867



8868

(F) *8867 **Faber's Precision Calculating Rule, System Rietz,** 10-in. scale length, with usual log. divisions as on rule 360, but a little wider, in order to add on the face special log. scales for cubes and logarithms. This simplifies the reading of logarithms, cubes, cubic roots; therefore this rule is in general use in all technical institutes and offices ... each **£1 4 0**

(F) *8868 **Faber's Precision Calculating Rule,** 11½ in. long, with white celluloid surface and Ordinary Aluminium Cursor with 3-line Glass ... ... each **£1 4 0**

By means of which powers and roots of the form a^x and $\sqrt[x]{a}$ can be calculated, where a and x may be fractional. The length of the rule imposes a limit to the scale, and having regard to the most usual values required, it is arranged in such a way that a is between 1·1 and 1000,000, x between 0·1 and 10, but the result may be found also in nearly all other cases. Owing to the provision of new power scales, powers of e and natural logarithms are to be read by simply setting the cursor.

This special slide rule, introduced for Electrical and Mechanical Engineers, has been very extensively adopted in professional circles, owing to its practical utility and simplicity of operation. It is an indispensable aid not only to the Special Engineer, but also to the Manufacturer and Works Manager.

Large Calculating Rules for Demonstration purposes

These Extra Large Rules have been prepared for the purpose of assisting teachers in colleges and technical schools to explain the details and working of the Calculating Rule to their pupils, the scales and figures being sufficiently large to be read at a distance by the whole class.

Though being four or nine times the size of the Rules of regular length, No. 360, etc., all the positions on either Rule, whether long or short, are in exact proportion to each other. This enables A. W. Faber's Instruction Book to be used also for these Demonstration Rules.

The back of the slide has the scales for sines, logarithms and tangents.

The Cursor consists of a wooden frame with wire line, and travels in a groove along the upper edge of the Rule. It is easily moved forward or backward.

The Rules are made of well-seasoned wood, painted in white, with black divisions and figures.

They are provided with two Eyelets to hang them.

On the reverse side they can be adjusted by screws to enable a correct regulation of the movement of the slide.

(F)***8869** **Rule,** 49¾ in. long, scale length 39¼ in. ... ... each **£3 10 0**

(F)***8870** ,, 99½ ,, ,, ,, ,, 79 ,, ... ,, **6 10 0**

(F) Foreign manufacture.



8871-3

THE FULLER CALCULATOR, A 500-INCH SLIDE RULE

The Fuller Calculator is a logarithmic calculator. Its fundamental principle is precisely the same as the Mannheim Slide Rule, but it differs radically in mechanical construction. The principles of logarithmic calculators are too well known to those likely to be interested for it to be necessary to enlarge upon the subject here, especially as it is absolutely unnecessary to have any knowledge of the subject to use the calculator. The Fuller Calculator will perform all calculations involving:

MULTIPLICATION	PERCENTAGES, and
DIVISION	COMBINED MULTIPLICATION
PROPORTION	AND DIVISION.

Giving an accuracy of 1 in 10,000.

It costs only a fraction of the cost of an Arithmometer, and it is far less complicated to use. Its construction is so simple that there is nothing to get out of order, consequently maintenance charges are practically nil. Anyone can calculate with the Fuller after a brief study of the instructions without any mathematical knowledge whatever. For Percentage and Proportional Calculations it is the most efficient calculator of its type in existence.

Advantages of the Fuller.

No Mechanical Parts or anything to go out of order—the Fuller cannot "lie."

Simple Operation—only two forms of movement to remember, and the same sequence of operation for all varieties of calculations.

Speed.—The quickest of all calculators, especially for a series of the same percentage or ratio, as, having been set, it is only necessary to bring the amount under one indicator, when the answer appears under the other.

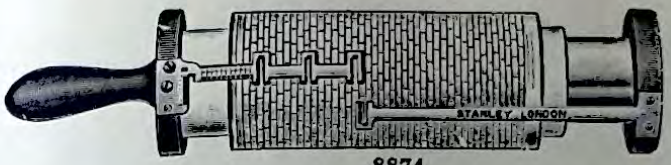
Low Cost.—Enables firms to equip individual members of their staffs.

Made in Three Models.

8871 No. 1. ... ... Price **£5 10 0**
In Mahogany Case with detailed instructions. The most popular, as supplied to all professions. Contains on the inner cylinder many useful tables and various data.

8872 No. 2 ... ... Price **6 10 0**
In Mahogany Case with detailed instructions. Is identical with No. 1, but has on the inner cylinder, in place of the tables, etc., (1) a Scale of Logarithms giving the log of any number, whether greater or less than unity, to AT LEAST four places; (2) a Scale of Sines of Angles from 5° 35″ up to 88° correct to four places. With these scales Log Sines can be found to four places with one setting. This model is extremely useful for calculations involving trigonomical functions.

8873 No. 3 ... ... Price **8 10 0**
In Mahogany Case with detailed instructions. Known as the Fuller Bakewell, has on the inner cylinder a scale of cosines squared, and one of sines × cosines. This enables calculations to be performed affecting Tacheometrical Surveying.



8874



8875–8

*8874 **BARNARD'S CO-ORDINATE CALCULATING RULE,** in Mahogany Case, with Book of Instructions **£8 10 0**

This Spiral Slide Rule, which will be found to be of very greatest possible use to civil engineers and surveyors, is an improvement on our well-known Fuller's Rule, and is the invention of Mr. H. O. Barnard, of the Surveyor-General's Department, Ceylon. Like Professor Fuller's Rule, it enables the user to perform with speed and accuracy arithmetical computations involving: multiplication, division, proportion, continuous fractions, roots and logarithms: but, in addition, the natural and logarithmic values of trigonometrical functions of any angle can be determined by inspection with the same accuracy as in numerical computation, while the products, quotients, etc., of these functions by lengths of numbers integral or fractional are obtained with equal ease, rapidity and precision.

Scales. MODEL "K." **THE OTIS KING'S PATENT CALCULATOR**

For all calculations involving multiplication, division, and proportion, including costs, percentages, discounts, brokerage and foreign exchange problems.

The Holder carries a logarithmic scale from 1 to 10 graduated in clearly marked divisions.

The Cylinder carries two scales in series, both being identical with the Holder Scale. This double scale, because it ensures that every incoming factor is at a place to which the Cursor can be immediately set, frequently reduces the number of operations involved in a series of calculations. Model "K," therefore, is recommended, except where readings of logarithms, roots and powers are regularly required.

MODEL "L."

The Holder Scale on this Model is identical with the Holder Scale on Model "K."

The Cylinder carries two scales, but the upper half only is identical with the Holder Scale. These operate together for multiplication, division, etc. The lower half consists of a scale from 0 to 1, graduated in 2,000 equal divisions, and is used in conjunction with the Holder Scale to give direct readings of the logarithms of any number, by means of which roots and powers are obtained.

Construction.

The Otis King's Calculator consists of two metal tubes, the smaller (Cylinder) being free to rotate and slide within the larger (Holder). Spiral scales are mounted on each of these tubes, while a third tube mounted on the Holder forms a tubular Cursor, carrying at each end an engraved arrow, which can be set to any mark, or to which any mark can be set.

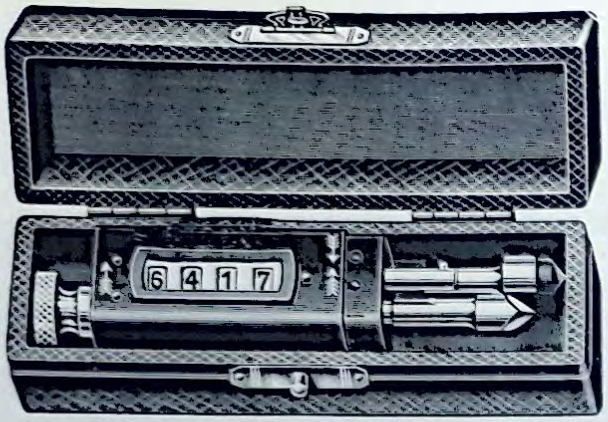
The three parts of the instrument are inseparable, and being made of metal throughout there is no possibility of their warping, or being affected in any other way by climatic conditions. The instrument, in fact, is practically indestructible.

Three metal sprags on the top of the Holder keep the Cursor in position, and at the same time prevent it from touching the scales. The bottom end of the Cylinder is covered with velvet, which holds it firmly in position and prevents chafing of the top scale between the two tubes. All exposed metal parts are heavily nickelled, except the Cursor, which is dead black. The contrast in colour facilitates the reading of the scales and obviates eyestrain.

Size of instrument fully extended, 10¼ in. by 1⅛ in.; closed, 6 in. by 1⅛ in.

Otis King's Calculator, equivalent to a 66-in. slide rule. Size fully open 10×1⅛ in.; closed, 6×1⅛. Weight 4 oz. In case.

		Nickel Cursor.	Black Cursor.
*8875	Model "K." For all commercial and technical calculations to four significant figures, with Paper Scale	21/0	22/6
*8876	Ditto, with Celluloid Scale	23/6	25/0
*8877	Model "L." For all powers and roots, fractional or otherwise, with Paper Scale	21/0	22/6
*8878	Ditto, with Celluloid Scale	23/6	25/0



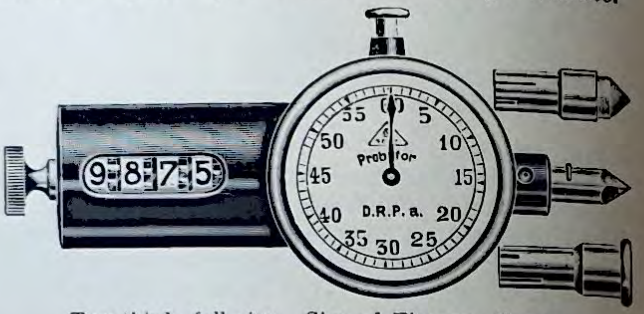
(F) **8879** **Speed Indicator,** Direct reading, with instantaneous zero set-back, for indicating up to 10,000 revolutions. In Pocket Case ... **£0 9 6**

The latest and most highly perfected Revolution Counter on the market for testing the speed of all classes of machines, motors, dynamos, etc.

This Indicator is supplied in a velvet-lined case, with one conical steel point and two rubber points, one conical and the other hollow.

This Indicator is supplied with brass figure wheels, and can be operated for either right or left hand rotation, by merely changing the point from one spindle to the other.

Suitable for speeds up to 5,000 revolutions per minute.



Two-thirds full size. Size of Figures, 4½ mm.

(F) **8880** **Revolution Counter,** in combination with anti-magnetic Stop-Watch. **£1 15 0**

This small high-class Counter is the product of nearly 20 years' specialisation in the manufacture of counters, and has, within a very short period, met with a very favourable reception in all civilised states, and created a strong demand on account of its neat and handy form and its ingenious and appropriate combination of counter and stop-watch.

The purpose of this counter is to accurately and conveniently ascertain the speed or rotation of shaftings, motors and working-machines of every description developed by them within a minute or the fraction of a minute.

Counter and **works of Watch** have so been combined that they are simultaneously thrown in and out of gear. The Driving-spindle runs idle, so that when inserting the Spindle in the centre of the shaft the speed of which is to be ascertained, the Driving-spindle is also made to revolve, but does not actuate Counter and Stop-watch. Only by pressing the instrument more strongly against the shaft, the mechanism will be actuated. Immediately upon removing the Driving-spindle from the shaft to be measured, Watch and Counter stop, and the result may be read off at a glance. **A pressure of the finger** upon the small knob effects the **zero set-back** of the hand and simultaneously **the winding up of the Watch** for the next measurement. One turn of the Milled Knob effects the zero-position of all the figures.

The Watch goes for one minute. If being used as Stop-watch, the socket supplied with each Counter is placed upon the Driving-spindle; by exercising a slight pressure upon the socket, the Watch will be actuated.

The appliance is ready for use and may be employed for any direction of rotation without any adjustment. It registers up to 10,000 revolutions. On account of the best materials used for its construction, such as hardened steel (figure-wheels, pinions and gear-wheels are made of a special brass-alloy) each instrument will be subject to **a guarantee of one year's duration,** dependent, however, upon the proper handling of the device.

Each instrument is furnished with directions for use.



Two-thirds full size. Size of Figures, 4½ mm.

(F) **8881** **Revolution Counter,** with instantaneous zero set-back **£0 12 6**

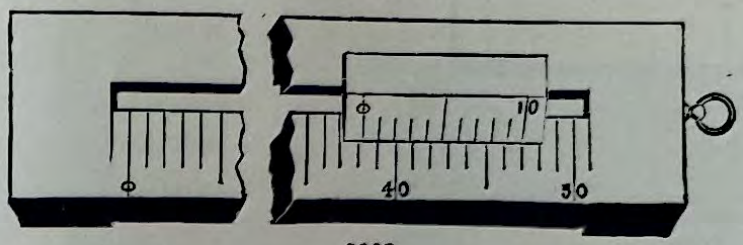
This New Revolution Counter embodies the advantage that it is always ready for use and always counts forward in any desired direction of rotation without reversing the point or socket and without any kind of adjustment.

It indicates up to 10,000 revolutions, and may be used for 5,000 revolutions per minute. Zero set-back is effected by turning the milled knob once.

The drive in the interior is positive, so that a hurling forward of the first row of figures is out of the question, even in conjunction with high speeds, which is frequently the case with imitations on the market. The figure wheels and pinions are made to consist of a special brass alloy; the other parts of highest class, thoroughly tested materials.

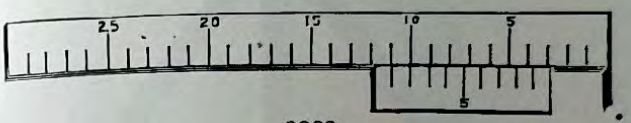
(F) Foreign manufacture.

Verniers



8882

8882 **Vernier, Straight,** Large Demonstration Model, 24 in. long, reading to ·1 of a division; 10 divisions on Vernier equal to 9 on the Scale ... ... each **£0 10 6**



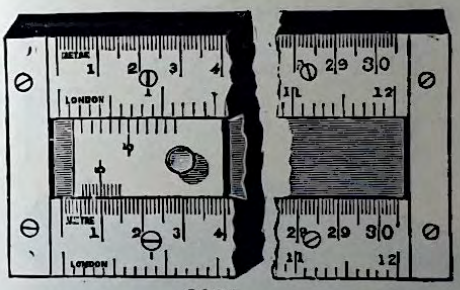
8883



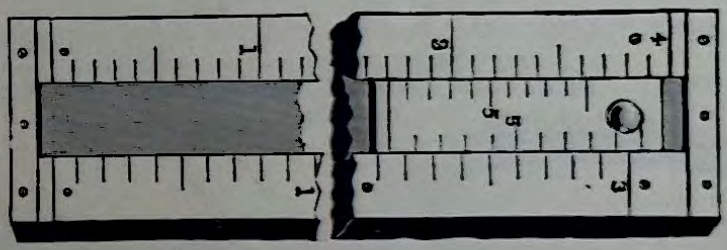
8884

8883 **Vernier, Straight,** with 30 centimetre Boxwood Scale, in centimetres, Polished, with Brass Stop, 30×5×1 centimetres ... ... each **£0 5 6**

8884 Ditto, ditto, 20 in. long, with Boxwood Scales and Vernier Slide, reading to ·01 in. and ·1 mm., mounted in Polished Hardwood Frame; 10 divisions on Vernier equal to 9 on the Scale ... ... each **0 12 6**



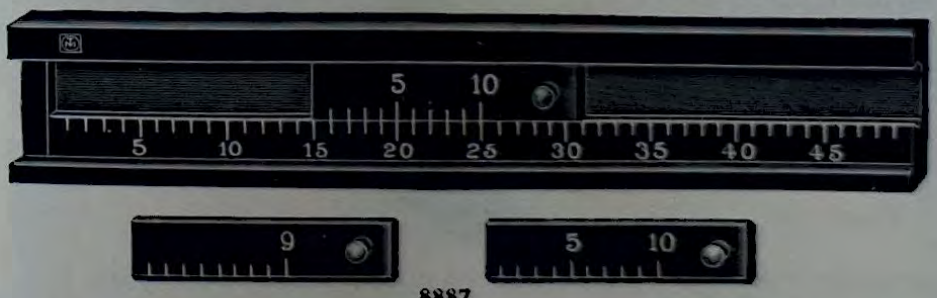
8885



8886

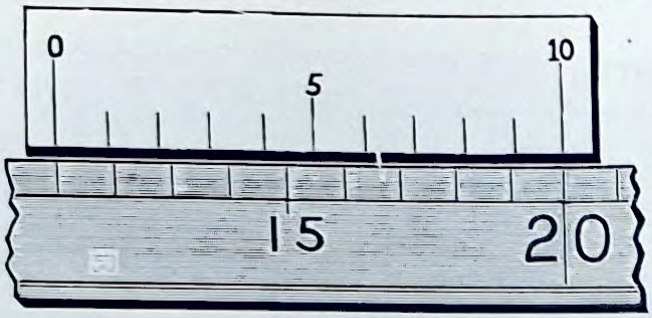
8885 **Model Vernier,** 12 in. Boxwood Scale in tenths, and 30·5 centimetres in millimetres, on wood block, 13×2½×½ in. ... ... each **£0 5 0**

8886 Ditto, but Scaled 10 centimetres as one centimetre and 5 inches as 1 inch, size 17×4 .. **0 10 6**



8887

8887 **Demonstration Vernier,** Hardwood, Polished Black with White Figuring, length of Scale 50 centimetres divided into centimetre divisions, with three Verniers reading to $\frac{1}{8}$th, $\frac{1}{9}$th and $\frac{1}{10}$th. **£1 5 0**

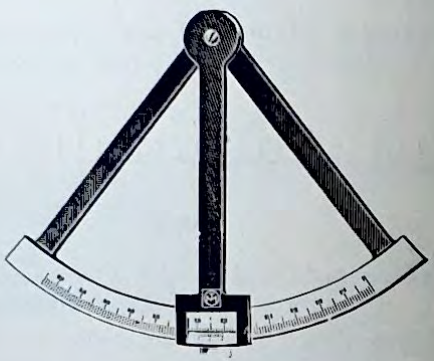


8888

8888 **Boxwood Rule,** 1 metre long, divided into centimetres and figured every 5 cm., with Boxwood Vernier, 10 cm., complete **£0 3 0**
Rule only ... ... each **0 2 3**
Vernier only ... ,, **0 0 9**



8889-90

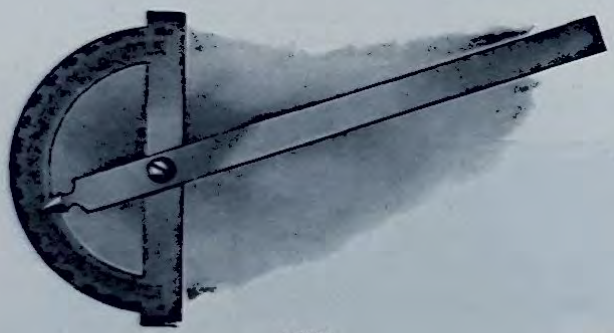


8891

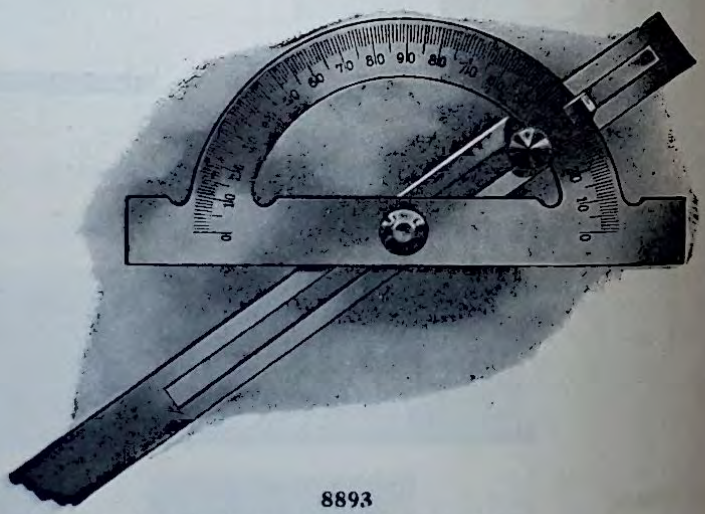
8889 **Vernier, Circular,** large Demonstration Model, Polished Hardwood; 10 divisions on Vernier equal to 9 on the Scale ... ... each **£0 9 0**

8890 Ditto, ditto, as above, Superior Make, Mahogany with Polished Hardwood Scale and Vernier Head ... ... each **0 15 0**

8891 Ditto, ditto, with Aluminium Frame and Vernier, reading to $\frac{1}{10}$th mm., with Lock Nut for fixing Vernier ... ... each **1 1 0**



8892



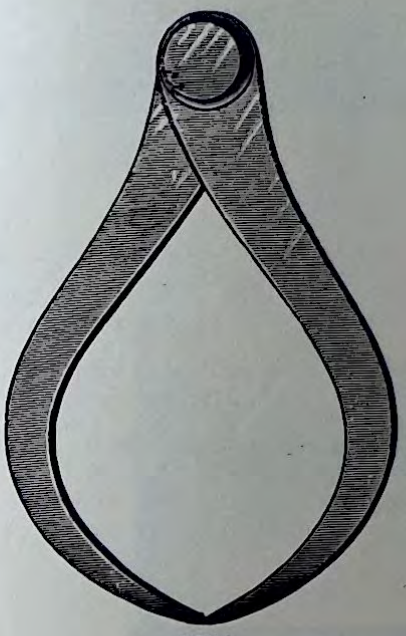
8893

(F) *8892 **Protractor,** Steel, Nickel-plated, diameter of circle 8 cm., length of arm 12 cm., divided into single degrees... ... ... each **£0 6 6**

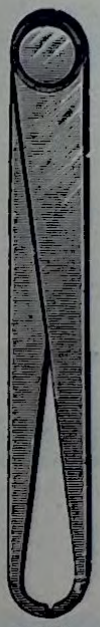
(F) *8893 Ditto, Steel, Nickel-plated, diameter of circle 15 cm., divided into single degrees, length of arm 20 cm. ... ... each **1 7 6**

(F) Foreign manufacture.

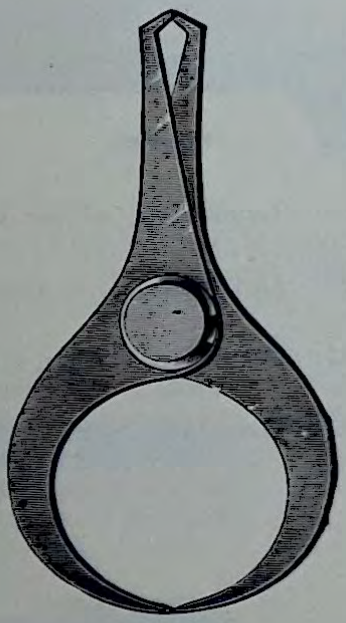
Callipers



8894



8895



8896

(F) **8894**	**Callipers,** Bright Steel, with Curved Arms.			Length	3	4	5	in.
					10d.	**1/0**	**1/3**	each
(F) **8895**	,,	,,	,,	with Straight Arms	**10d.**	**1/0**	**1/3**	,,
(F) **8896**	,,	,,	,,	for inside and outside measurements, length 4 in.	each		**£0** **1** **2**	

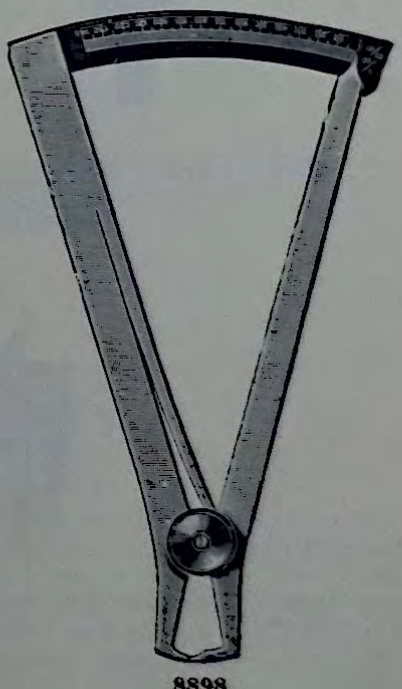


8897

(F) **8897** **Graduated Callipers,** for both inside and outside measurements, with Lock Screw, Nickel-plated, graduated to 3¼ inches and 80 millimetres each **£0 5 0**

(F) **8898** Ditto, ditto, Spring Gauge, with Brass Scale, divided to $\frac{1}{10}$th mm.
Opening 0-10 0-15 mm.
3/6 **4/6** each

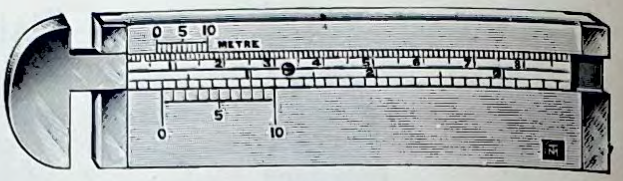
(F) Foreign manufacture.



8898



8899-8900



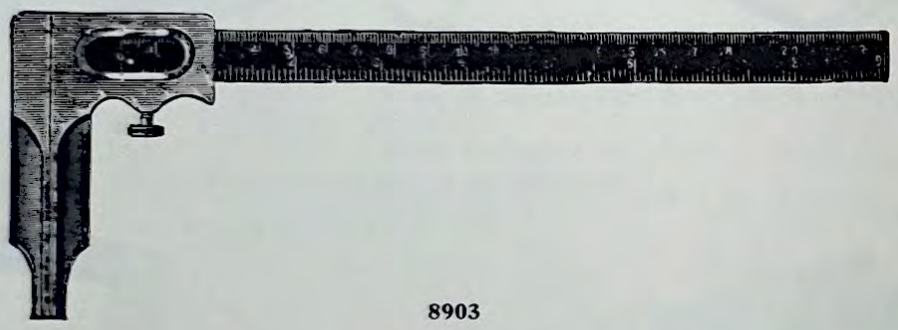
8901-2

(F) **8899** **Graduated Calliper Gauges,** Brass, reading to ... ... 80 100 mm.
2/9 **3/3** each

(F) **8900** Ditto, ditto, with Vernier reading to ... ... 80 100 mm.
4/0 **4/6** each

8901 **Graduated Sliding Calliper Gauge,** Boxwood, with Brass Slide graduated into inches and millimetres, with two Verniers ... ... each, **2/9**; per doz. **£1 12 0**

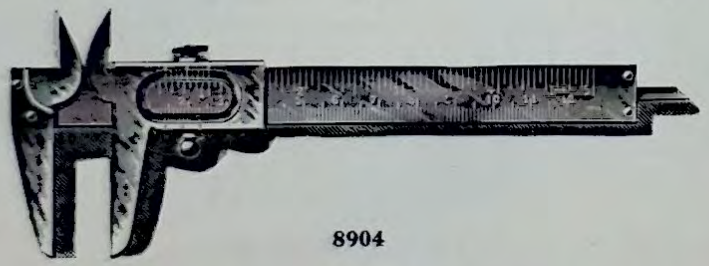
8902 **Graduated Sliding Callipers,** Boxwood, 4×1½ in., same shape as No. 8901, marked in $\frac{1}{10}$ths of an inch and millimetres, with Vernier. The reverse side gives a most useful table showing millimetre equivalents in decimals and fractions of an inch ... ... each, **3/3**; per doz. **1 17 0**



8903

(F) ***8903** **Graduated Sliding Calliper Gauges,** Steel, divided into millimetres and inches on one face. with two Verniers.

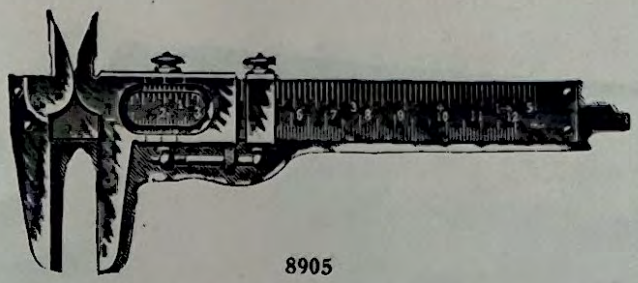
Length of Scale	100	150	200	mm.
,, Side Arms	30	45	55	mm.
	5/0	**6/0**	**8/0**	each



8904

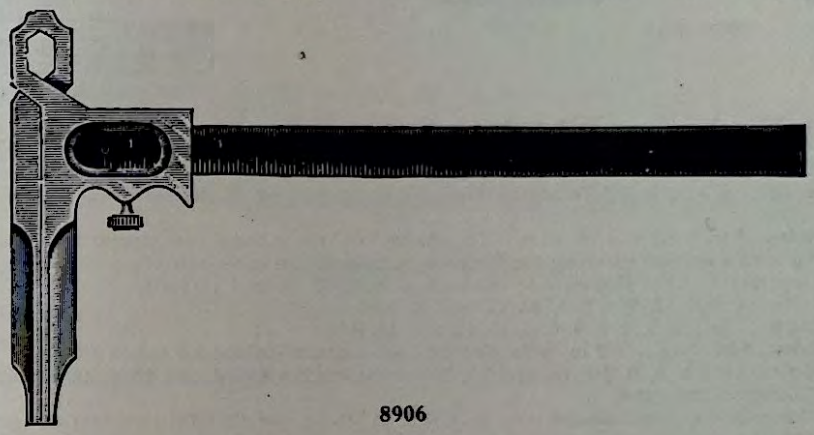
(F) ***8904** **Graduated Sliding Calliper Gauge,** Steel, Nickel-plated, divided into millimetres and inches, with two Verniers and Locking Screw for inside and outside measurements, also for Depth Gauge, reading up to 5 inches and 120 millimetres ... ... each **£0 6 0**

(F) Foreign manufacture.



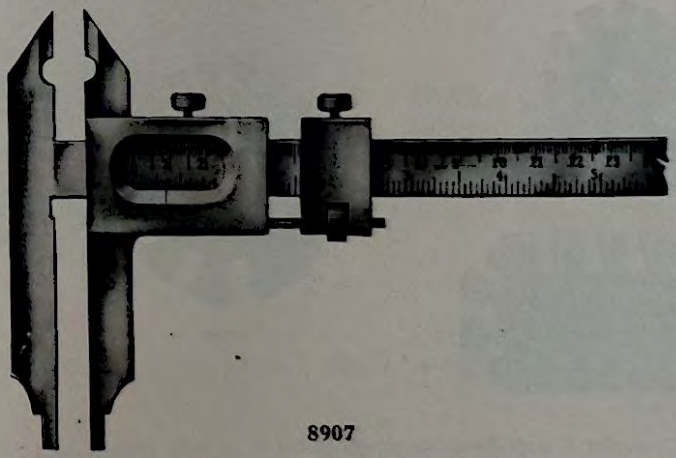
8905

(F) *8905 **Graduated Sliding Calliper Gauge,** Steel, Nickel-plated, as No. 8904 but with Micrometer Adjustment for fine readings ... ... each **£0 9 6**



8906

(F) *8906 **Graduated Sliding Calliper Gauge,** Steel, Nickel-plated, for inside and outside measurements, divided into inches and millimetres, with two Verniers, reading up to 9 inches and 23 centimetres **£0 14 6**



8907

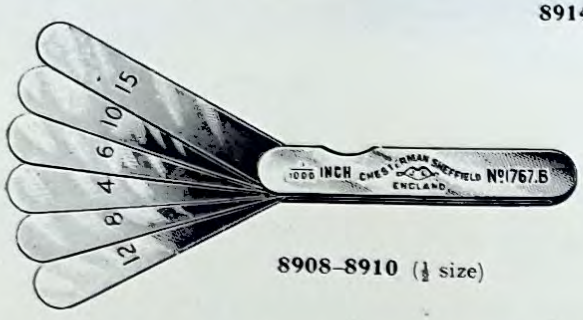
(F) *8907 **Graduated Sliding Calliper Gauges,** Steel, Nickel-plated, for inside and outside measurements, divided into inches and millimetres, with two Verniers, and Micrometer Adjustment for fine readings.

Reading to	200	250	mm.
,,	8	10	in.
	17/6	**20/0**	each
Velvet-lined Cases for above	**3/6**	**4/6**	,,

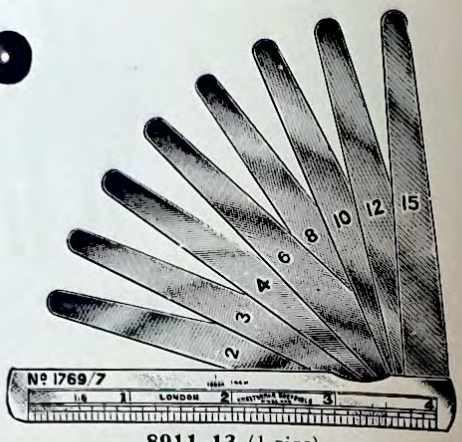
(F) Foreign manufacture.



8914–7



8908–8910 (½ size)



8911–13 (½ size)

Steel Feeler or Thickness Gauges for Engineers, &c.

Each article consists of a series of Tempered Steel Blades of varying thicknesses, which may be used singly or in combination.

With Straight Blades, 3 in. long × ½ in. wide. The blades fold into a metal case similar to a pocket knife, and each blade is engraved with a number denoting the thickness in thousandths of an inch:

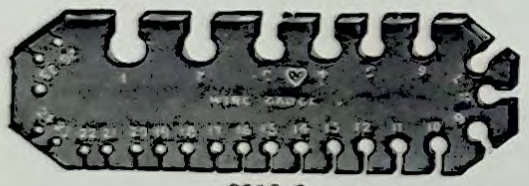
8908	(See illustration). Six Blades, viz.: one each, 4, 6, 8, 10, 12, and 15/1000... ... ... each	**£0**	**3**	**6**
8909	Eight Blades, viz.: 2, 3, 4, 6, 8, 10, 12, and 15/1000 ... ... ,,	**0**	**4**	**6**
8910	Ten Blades, viz.: 2, 2, 2, 3, 4, 6, 8, 10, 12, and 15/1000 ... ... ,,	**0**	**5**	**6**

With Tapered Blades, 4 in. long × 1·2 in. wide, and the Case machine-divided for use as a Rule.

8911	Six Blades, viz.: 4, 6, 8, 10, 12, and 15/1000, case marked inches and 16ths on one side, and millimetres the other ... ... each	**0**	**5**	**0**
8912	(See illustration) Eight Blades, viz.: 2, 3, 4, 6, 8, 10, 12, and 15/1000; Case marked inches and 16ths on one side, and millimetres the other ... ... each	**0**	**6**	**0**
8913	Ten Blades, viz.: 2, 2, 2, 3, 4, 6, 8, 10, 12, and 15/1000; Case marked inches and 16ths on one side, and millimetres the other ... ... each	**0**	**7**	**6**



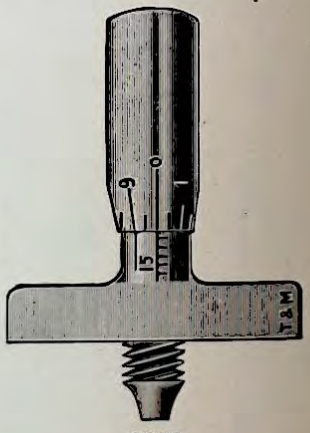
8921



8918–9



8920



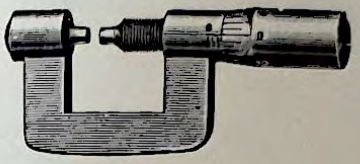
8922

(F) **8914**	**Hole and Cylinder Gauge,** Steel Cone, graduated in $\frac{1}{10}$ mm. from 1 to 15 mm. ... each	**£0**	**3**	**6**
8915	,, ,, ,, ,, ,, ,, ,, ,, 15 to 30 mm. ... ,,	**0**	**4**	**6**
8916	,, ,, ,, ,, ,, ,, ,, ,, 30 to 45 mm. ... ,,	**0**	**6**	**6**
8917	,, ,, ,, ,, ,, ,, ,, ,, 45 to 60 mm. ... ,,	**0**	**8**	**0**

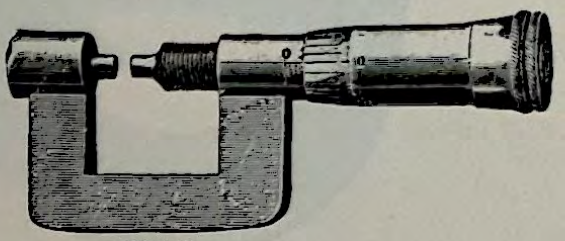
		Reading Nos. 1 to 26	18 to 40 S.W.G.	
8918	**Wire Gauge, Standard,** Steel, Nickelled, Oblong Shape **7/0**		**10/6**	each
8919	,, ,, ,, reading one side, Nos. 1 to 26, and obverse reading in millimetres	**£0**	**9**	**6**
8920	,, ,, ,, Steel, Nickelled Round Shape, reading Nos. 1 to 26	**0**	**7**	**0**
8921	,, ,, Double, for Pocket, reading Nos. 1 to 26	**0**	**7**	**0**
(F) **8922**	**Depth Gauge,** Steel Nickelled, with Micrometer Gauge, dividing to $\frac{1}{50}$ mm., measuring to 15 mm.	**0**	**8**	**6**

(F) Foreign manufacture.

Micrometer Gauges



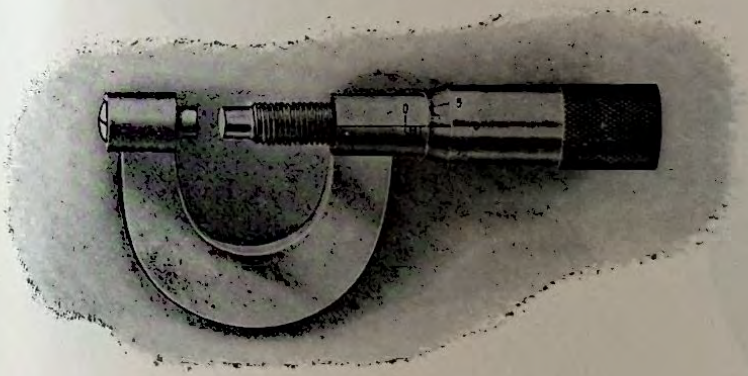
8923/5



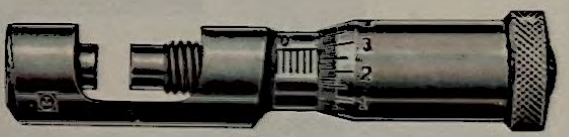
8924/6

(F) *8923 **Graduated Micrometer Gauges,** Steel, Nickel-plated, Best Quality.

			Reading from $\frac{1}{100}$ mm. to	10	15	20	25 mm.
				6/0	7/0	8/0	9/0 each
(F) *8924	,,	,,	,, with Friction Clutch	7/0	8/0	9/0	10/0 ,,
(F) *8925	,,	,,	,, Reading from $\frac{1}{1000}$ to	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	1 in.
				7/0	8/0	9/0	10/0 each
(F) *8926	,,	,,	,, with Friction Clutch	8/0	9/0	10/0	11/0 ,,
	Velvet-lined Cases for above			2/0	2/3	2/6	2/6 ,,



8927



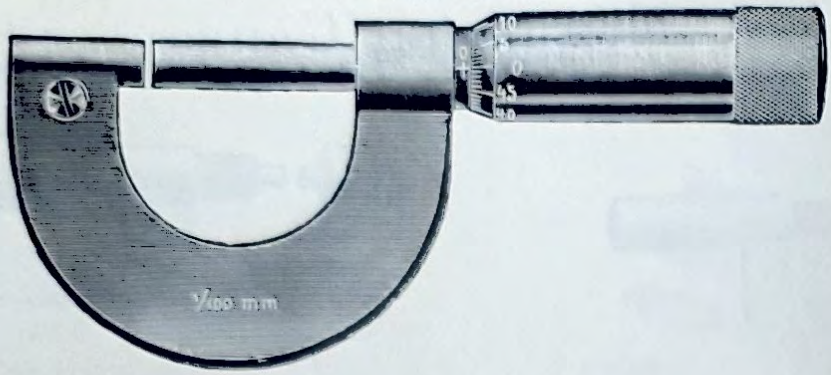
8929

(F) *8927 **Graduated Micrometer Gauges,** Steel, Nickel-plated, Horse-shoe pattern, best quality.

			Reading from $\frac{1}{50}$ mm. to	10	15	20	25 mm.
				8/0	9/0	10/6	13/6 each
(F) *8928	,,	,,	,, with Friction Clutch	9/0	10/0	11/6	15/6 ,,

(F) *8929 **Micrometer Gauge,** new pattern for Students' use, measuring $\frac{1}{50}$ mm. to 12 mm., with Friction Clutch ... ... each, 5/0, per doz. **£2 14 0**

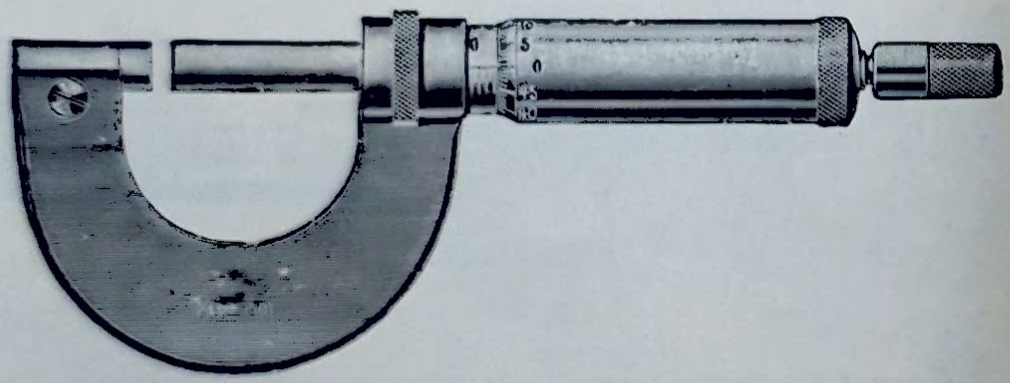
(F) Foreign manufacture.



8930

(F) *8930 **Graduated Micrometer Gauges,** Steel, Nickel-plated, Horse-shoe pattern, with covered Screw, protecting same from dust.

	Reading from $\frac{1}{100}$ mm. to	10	15	20	25	mm.
		10/6	**11/6**	**13/6**	**16/6**	each
(F) **8931**	Ditto, ditto, with Friction Clutch	**12/0**	**13/0**	**15/6**	**18/9**	„

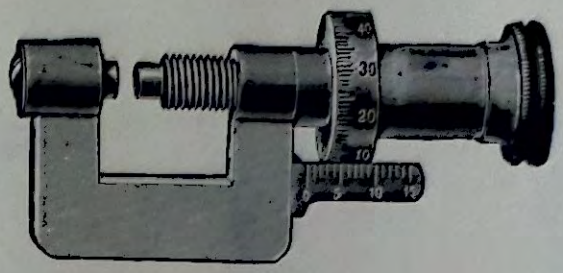


8932

(F) *8932 **Graduated Micrometer Gauges,** Standard Pattern, fitted with ratchet attachment. Highly Finished, in Velvet-lined Leather Cases.

Reading from $\frac{1}{100}$ mm. to	15	20	25	mm.
	22/0	**25/0**	**27/6**	each

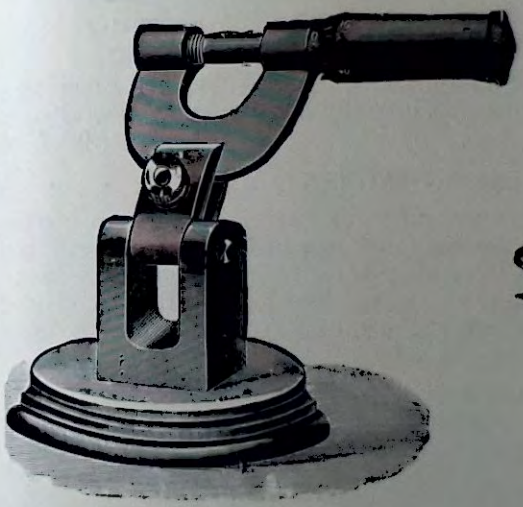
(F) Foreign manufacture.



8933

(F) *8933 **Graduated Micrometer Gauges,** Graduated Revolving Drum and Fixed Scale, fitted with Friction Clutch for fine reading.

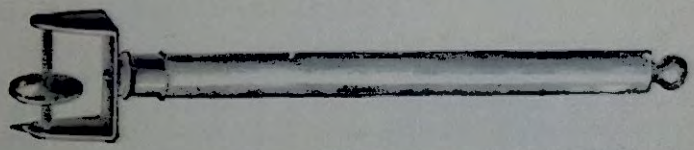
Reading from $\frac{1}{100}$ mm. to	10	15	20	25	mm.
	15/6	**18/0**	**20/0**	**22/0**	each



8934-5



8937



8936



8938

8934	**Stand,** with Clamp for holding Micrometer Gauges, Brass ... ... each			**£0**	**8**	**0**
8935	,, ,, ,, ,, ,, Iron ... ... ,,			**0**	**4**	**6**
8936	**Opisometer,** Brass, with Bone Handle ... ... per doz.	**16**	**0**	**0**	**1**	**6**
8937	,, ,, larger size, with Ebony Handle	**30**	**0**	**0**	**2**	**9**
(F) 8938	**Tracing Wheel** in Wooden Handle	**11**	**0**	**0**	**1**	**0**

(F) Foreign manufacture.



8939



8940



8943



8941-2

(F) **8939** **Universal Map Measurer,** with Dial registering Statute Miles, Nautical Miles and Kilometres, in Nickelled Case with Compass, for measuring instantly and accurately any distance, whether straight or curved ... ... each **£0 7 6**

INSTRUCTIONS FOR USING THE INSTRUMENT

Place the needle at 39 by turning the little cog-wheel with the finger; run the said wheel over the map, holding the handle perpendicularly, and following closely the line or distance to be measured. The needle will then indicate the distance in miles, versts, or kilometres, according to the map measured and the dial-circle used.

For the scales based upon the inch, for measuring miles and versts, use the outer circle of the dial, divided into 39 inches, the dots between the marks representing half-inches. For the kilometre scale, use the inner circle of the dial, dividing into 99 centimetres, first placing the needle at 99.

(F) **8940** **Self-registering Rotameter,** in inches and sixteenths of an inch. The large Dial reads to 4 inches, and the inches are divided into sixteenths. The small registering Dial in the centre marks the revolutions of the hand up to 10 times, measuring exactly 40 in., each **£0 7 0**

INSTRUCTIONS FOR USING THE INSTRUMENT

Place the hand at 4 and the small dial at 0 by turning the little cog-wheel with the finger; run the said wheel over the map, holding the instrument perpendicularly, and following closely the line or distance to be measured. The hand and the small registering dial will then indicate the length of the line in inches and sixteenths of an inch, or in miles, furlongs, or yards, according to the scale of the map.

EXAMPLE

If the small dial shows, for instance, the number 6 and the hand indicates $2\frac{7}{16}$ inches, the length of the line measured would be $(6 \times 4 = 24 + 2\frac{7}{16})$ $26\frac{7}{16}$ inches, corresponding to 26 miles and $3\frac{1}{2}$ furlongs on a map to the scale of 1 inch to the mile.

8941 Ditto, ditto, with two hands registering from $\frac{1}{8}$ in. to 25 ft. ... ... each **£0 7 0**

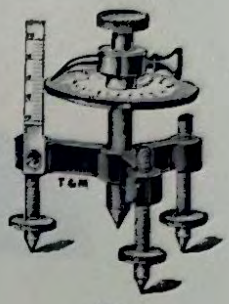
8942 Ditto, ditto, „ „ „ „ $\frac{1}{16}$ in. to 12 yds. ... ... „ **0 7 6**

(F) **8943** **Speed Indicator,** registering 10,000 revolutions. The small Needle can be adjusted to zero from any point. With Bell, complete... ... ... **0 10 6**

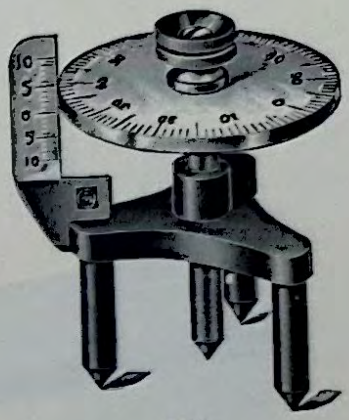
(F) Foreign manufacture.



8944



8945

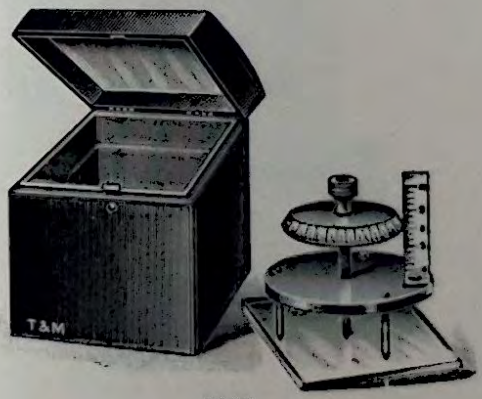


8946

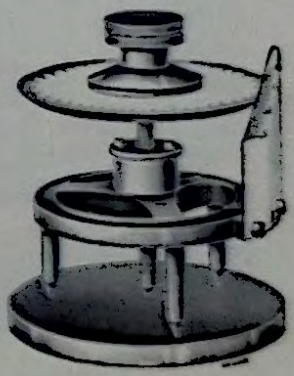
8944 **Spherometer,** for measuring the curvature of Lenses, reading to $\frac{1}{200}$ mm.
each **7/6**, per doz. **£4 5 0**

8945 Ditto, Lavell's, improved form, with Index Pointer to facilitate reading.
each **9/6**, per doz. **5 8 6**

8946 **Spherometer,** large size, diameter of graduated Dial, 5 cm., with vertical scale divided into $\frac{1}{2}$ mm., and reading to $\frac{1}{200}$ mm. ... ... each **0 18 6**



8947



8948

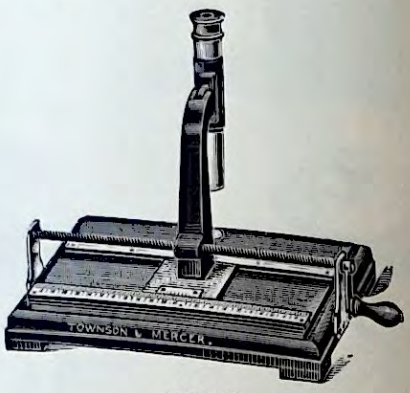
8947 **Spherometer,** Best quality and finish, reading 20 mm. to $\frac{1}{200}$ mm., Upright Scale divided into $\frac{1}{4}$ mm. reading 10 mm. either up or down, Bevelled Recording Disc, divided into 100 divisions, with Glass Trying Plate, in Case **£2 0 0**

8948 **Spherometer,** Best Quality, reading to ·001 mm. The screw is carefully calibrated, and any error in the pitch of the screw is compensated by inclining the scale in the required direction, thus ensuring accuracy of readings. A plane glass surface optically worked is supplied with each instrument. In Mahogany Case **4 4 0**

Vernier Microscopes

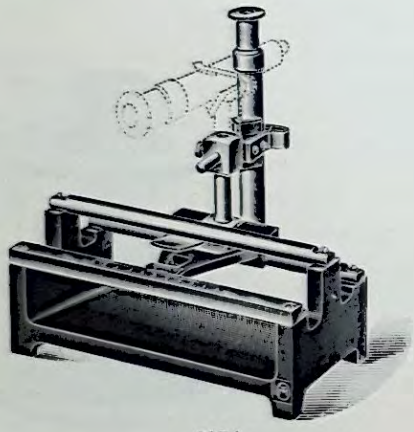


8950–1

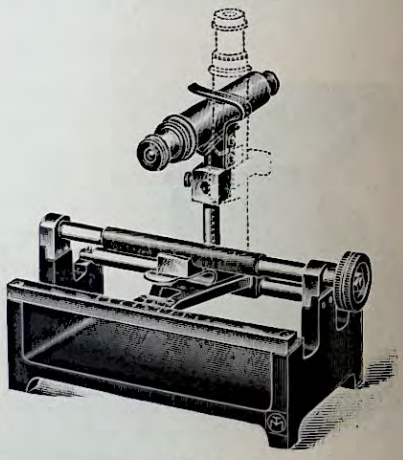


8952–3

*8950	**Vernier Microscope,** reading to $\frac{1}{20}$th mm., well and accurately made, mounted on Iron Base	£3	12 6
*8951	,, ,, hinged to allow horizontal and vertical readings	3	17 6
*8952	,, ,, another pattern, working from the side instead of the front, hinged to allow horizontal and vertical readings ...	4	4 0
*8953	,, ,, as above, with Rack to Telescope and extra Vernier ...	4	15 0



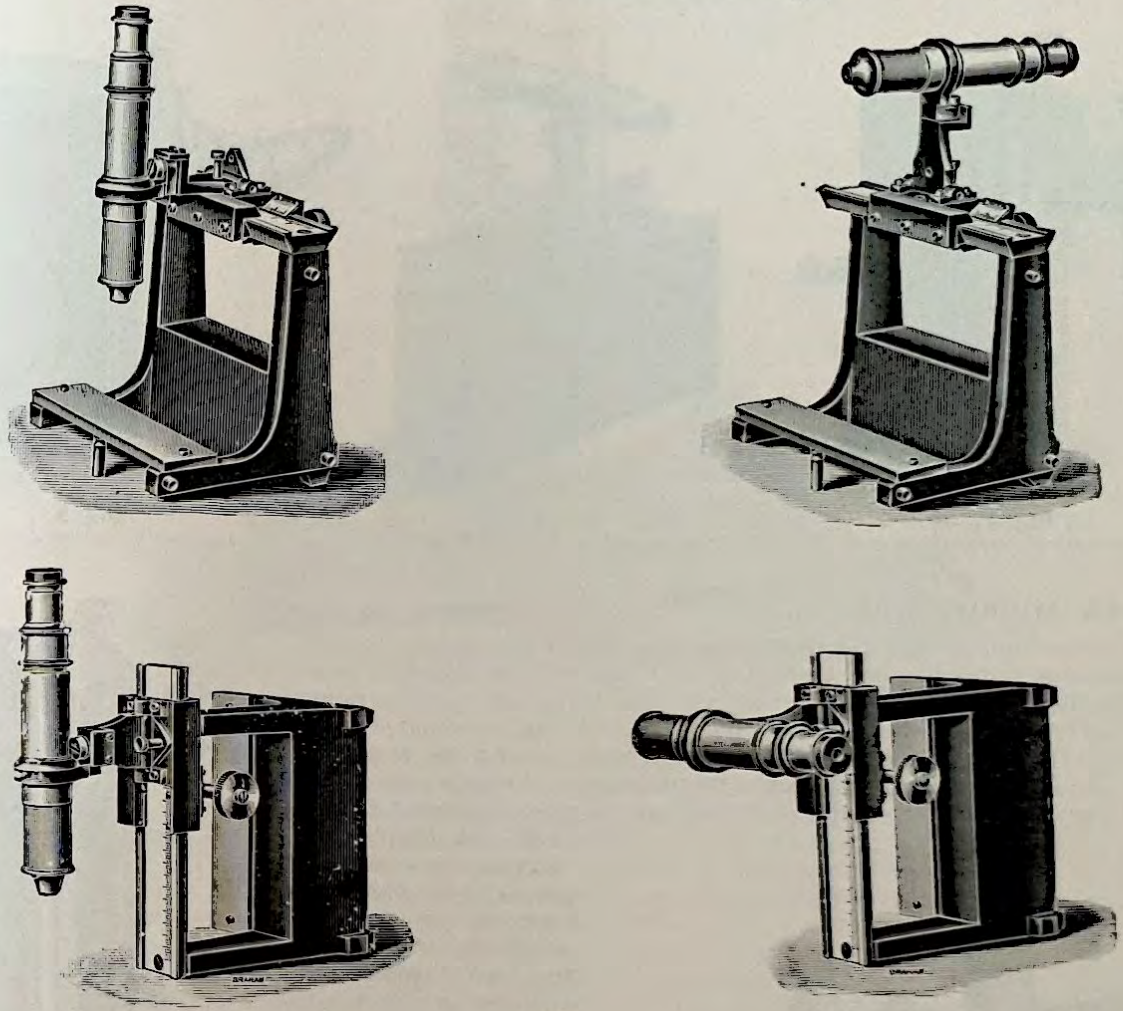
8954



8955

8954	**Vernier Microscope,** suitable for taking measurements to ·1 mm. The Microscope is fitted with Eyepiece, Crosswires, and a 2-in. Objective is mounted on a Spring Clutch Bracket and can be used horizontally or vertically. The Scale is 10 cm. long and is graduated into millimetres, with Vernier	£3	0 0
8955	**Vernier Microscope,** similar to above, but fitted with Micrometer screw, fine adjustment and spring Clutch coarse adjustment. The Microscope can be used horizontally or vertically. The Scale is 10 cm. long and graduated into millimetres, with Vernier which reads to $\frac{1}{100}$th mm.	4	10 0

Wilson's Vernier Microscope



8957

=8957 **Vernier Microscope,** latest pattern. The Vernier Microscope is of sound construction, and can be used in either of the four positions as illustrated, viz., the microscope vertical with the reading either horizontal or vertical, or with the microscope horizontal with the reading either horizontal or vertical.

The Slide is of Gun-metal, and the carriage is actuated by a fine screw-nut by rack and pinion as shown in the illustrations, and carries a Vernier reading to ·05 mm. The microscope is provided with a 3-inch objective and cross wires, and is mounted on a knuckle joint in similar manner to Microscope No. 8962, and has a run of about 10 cm.

	Price without Case	nett	£5	10	0
=8958	Case		0	10	0
=8959	Additional Objectives (Second Quality)	each	0	12	0
=8960	Telescope Object Glass		0	15	0
=8961	Glass Micrometer Scale, $\frac{1}{20}$ mm., to take the place of cross wires		0	5	6

Wilson's Vernier Microscope

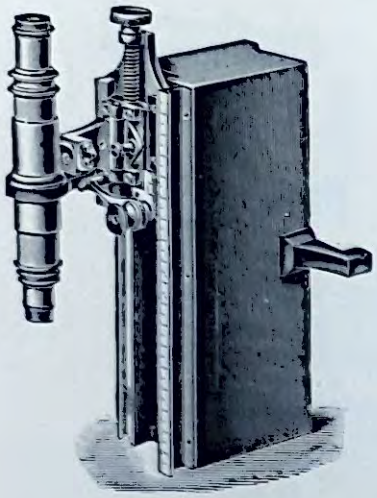


Fig. 1.
Axis vertical, Scale vertical.

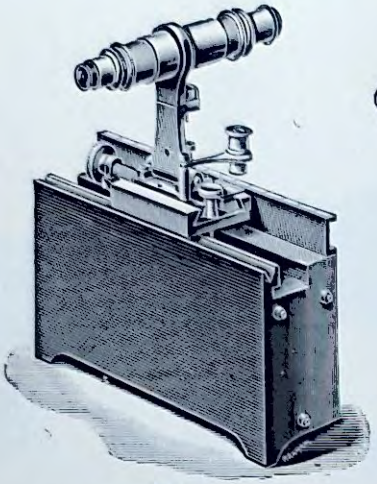


Fig. 2.
Axis horizontal, Scale horizontal.

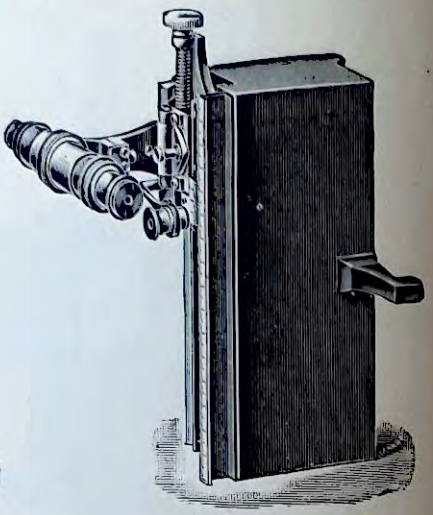


Fig. 3.
Axis horizontal, Scale vertical.

VERNIER MICROSCOPE No. 2.

The construction of this instrument has been somewhat altered, but its essential features are retained. Instead of the V and Plane as shown, a Gun-metal Dovetail Slide is mounted on the Cast Iron Bed. A Carriage, carrying the Microscope and a Vernier, moves along the Slide and is actuated by a fine screw. The Vernier reads to ·02 mm. on a Scale about 5 cm. available length. The Microscope is carried on a projecting arm, knuckle-jointed by which it can be set in the six different positions shown with respect to the Scale. A Diaphragm carrying cross wires is placed at the common focus of eyepiece and objective. One objective, one eyepiece and a reader are supplied with the instrument.

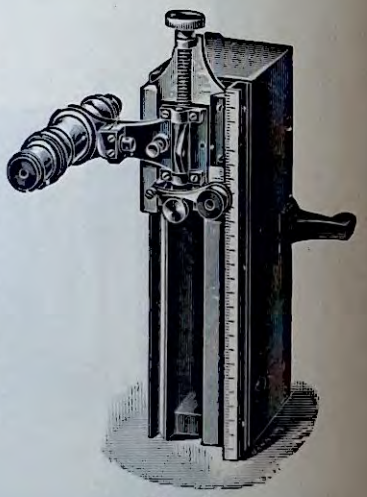


Fig. 4.
Axis horizontal,
Scale vertical, second position.

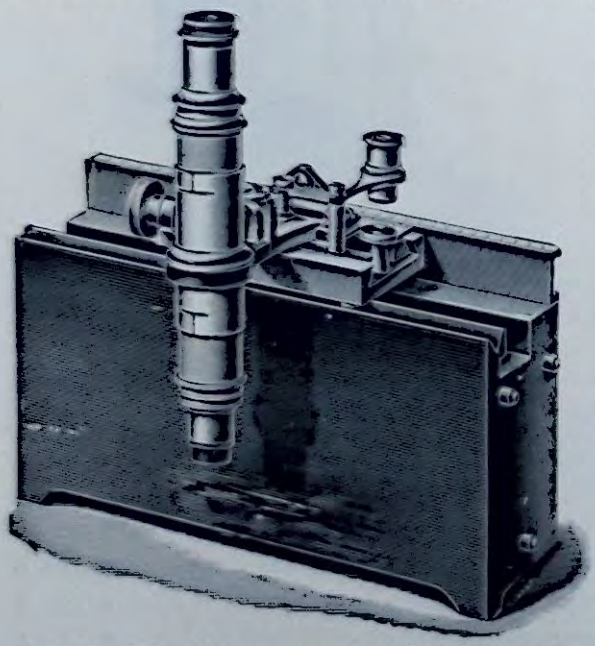
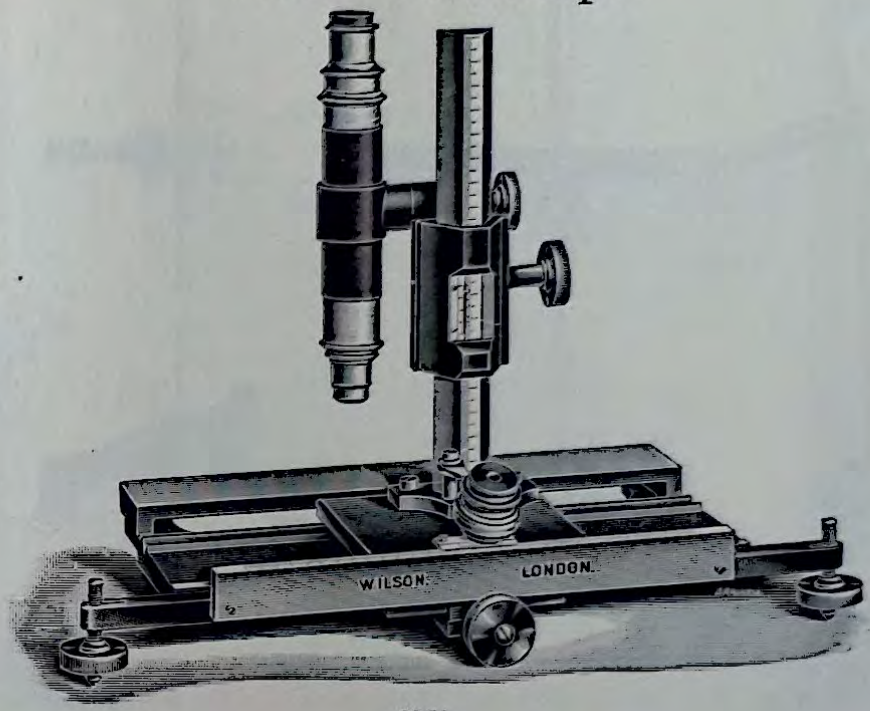


Fig. 5.—Axis of Microscope vertical, Scale horizontal.

=8962	Price without Case ... nett	£7	10 0
=8963	Case	0	14 0
=8964	Divided on silver to ·01 mm. ...	0	15 0
=8965	Glass Micrometer Scale, to take the place of cross wires	0	5 6
=8966	Micrometer Eye-piece, reading to 1/400 mm. for 1 cm.	4	5 0
=8967	Telescope Object Glass	0	15 0
=8968	Objectives, 1in., 2in., 3in., or 4in., each	0	18 0
=8969	Vertical Illuminator	0	10 0

Vernier Microscopes



8971

Vernier Microscope No. 1. This instrument consists of a horizontal and a vertical slide, along which the scales, about 16 cm. long, are engraved. The horizontal carriage carries the vertical slide and vernier. The vertical carriage carries the microscope and a vernier. Both carriages are actuated by a fine screw for fine adjustment—coarse adjustment being done by hand. If desired, both carriages can be actuated by rack and pinion, as shown in the illustration. At an extra cost both carriages may be provided with rack and pinion coarse adjustment and fine screw fine adjustment. The microscope rotates in a vertical plane, and can be clamped in any position—the horizontal and vertical positions are marked. At the common focus of eyepiece and objective a diaphragm with cross wires is placed. By substituting a telescope object glass for the objective the instrument can be used as a reading telescope or as a short range Cathetometer.

One Objective, one Eye-piece and a Reading Glass are supplied with the instrument.

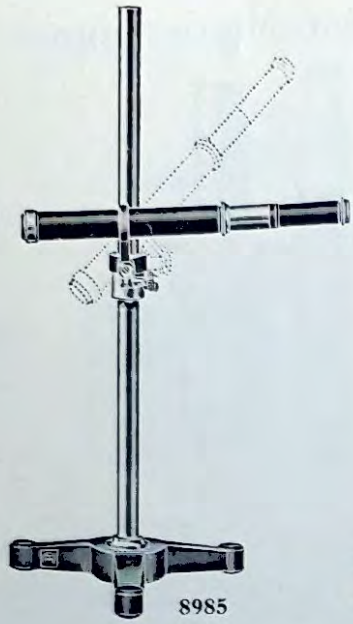
=8971	Price in Case, scales reading ·1 or ·05 mm. ... ... nett	£10	0	0
=8972	With scales reading to ·02 or ·01 mm. on Silver	12	7	6

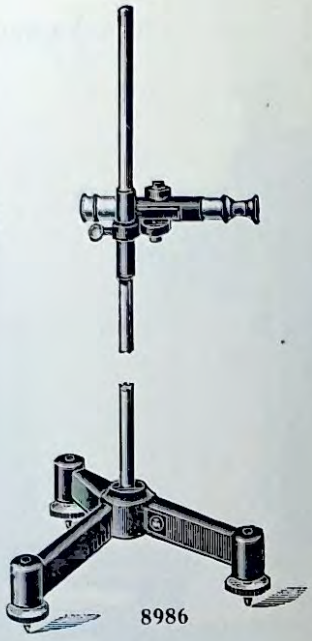
Accessories

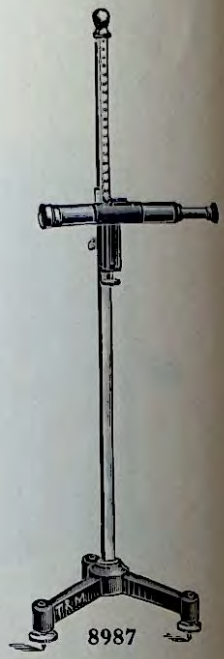
=8973	Glass Micrometer Scales, reading with 2 in. objective, the size of objects to ·02 mm.	£0	5	6
=8974	Rack and Pinion coarse adjustment to both slides in addition to screw fine adjustment	3	5	0
=8975	Telescope Object Glass	0	15	0
=8976	Rack-motion focussing arrangement to body	0	12	6
=8977	Divided circle to axis of Microscope reading to 2°	0	17	6
=8978	Adjustable Circular Level fitted to horizontal slide	0	7	6
=8979	1 in., 2 in. and 4 in. Objective ... ... each	0	18	0
=8980	Vertical Illuminator	0	10	0


8981


8982–4


8985


8986


8987

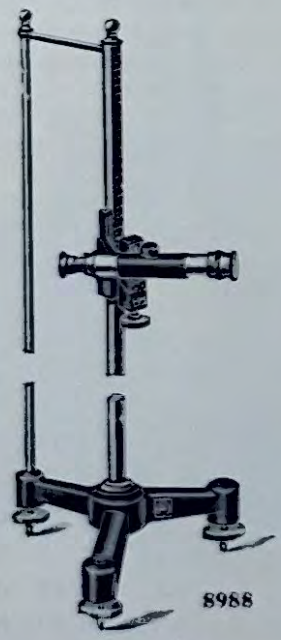
***8981 Cathetometer Telescope.** Simple, fitted with cross wires as supplied with Cathetometer No. 8986 ... ... **£1 2 6**

Reading Telescope

Is designed to satisfy the constant requirements of the worker in the physics laboratory for a telescope having good definition to the edge of the field, and plenty of light.

It is furnished with cross lines which may be focussed by the Eye-piece, and is capable of focussing objects as near as 20 in., also at infinity.

A Stand can be provided with adjustment for height and tilt on a solid circular base.
Maximum height 18 in., closing to 10 in.


8988

PRICES

= **8982 Reading Telescope** ... ... nett **£0 17 6**

= **8983 Stand** for same ... ... ,, **0 15 0**

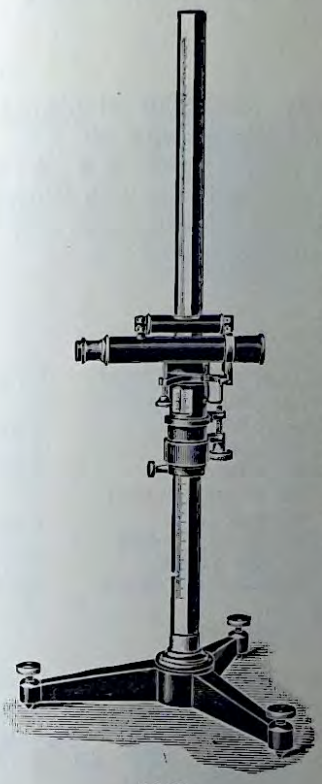
= **8984 Reading Telescope and Stand** together ... ... ,, **1 10 0**

=***8985 Reading Telescope** on Iron Tripod Base, with stout Brass Rod. The Telescope has a focal length about 3 ft., and can be raised or lowered, also rotated in a vertical or horizontal plane **3 5 0**

=***8986** Cathetometer, Table form, Telescope with cross wires, focal length from 4 to 10 ft., mounted on Stand with Tripod Foot and Levelling Screws, with Cross Level to telescope **3 17 6**

=***8987** Ditto, Sliding Telescope with cross wires, focal length 2 to 20 feet, with horizontal and perpendicular movement, Micrometer Screw Adjustment, Cross Levels, mounted on Square Brass Pillar, 30 in. high, with Scale divided into millimetres to 300 mm.; on Tripod Foot with Levelling Screws, cheap form, but accurate **7 10 0**

***8988** Ditto, as above, Superior Make, but with Duplex Pillar **8 10 0**



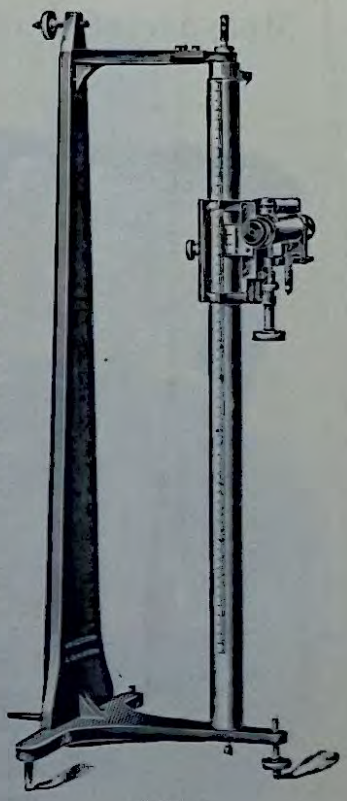
8989

=8989 **Cathetometer.**

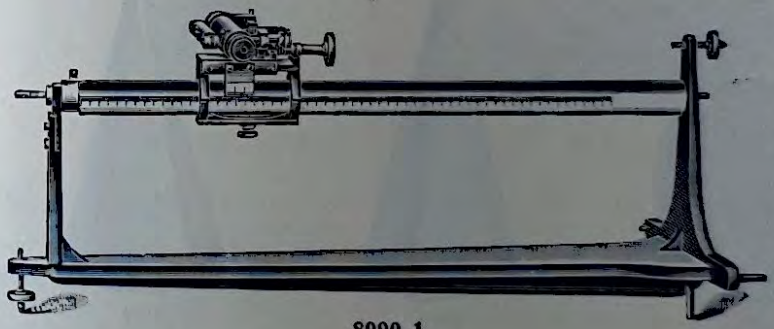
The Pillar is a square section, mounted on an Iron Tripod provided with three Levelling Screws. The Scale, which is engraved on one side of the Pillar, is ½ metre long, sub-divided into ½ mm., and read by Vernier to ·02 or ·01 mm. Two sockets slide along the bar, one of which is clamped to the bar; the other carries the Vernier and Telescope.

The Telescope is moved vertically by a fine screw, and is provided with a level, cross wires, and sliding focussing tube; it can be set horizontally by a fine adjusting screw, and is rotatable round the pillar.

Price, with 50 cm. range, reading to ·02 mm. or ·01 mm. ... nett **£10 0 0**



8990–1



8990–1

Cathetometer, Student's.

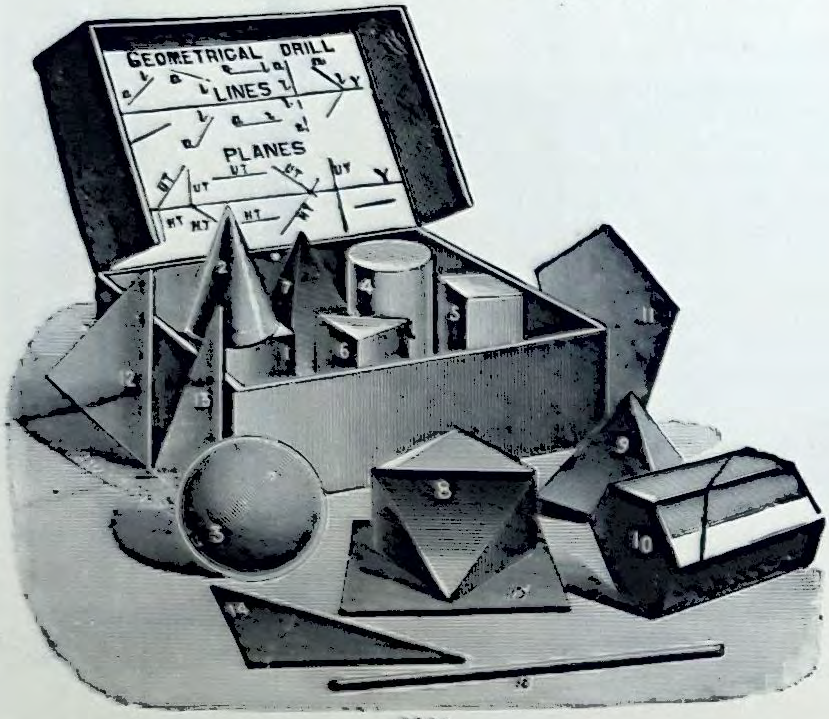
This Cathetometer has been specially designed for the use of Students. It is strongly constructed, and not easily deranged.

It consists of a Stout Brass Bar, hexagonal in section and straight, which swings between two hardened steel centres, and can be clamped in any position in azimuth.

A Millimetre Scale runs almost the entire length of the Bar. A Carriage slides along the Bar and is provided with a feather way, spring and clamp. One face of the Carriage is formed into a dovetail slide, along which, for a convenient distance, the Telescope travels, being actuated by a fine micrometer screw. The position of the Telescope is read by means of a Vernier attached to the Telescope support. The Telescope has a focal length of about seven inches, and a clear aperture of $\frac{15}{16}$, and is provided with level and cross wires, and is adjustable horizontally. It can be focussed from infinity to within three feet. The construction of the Stand is such that the instrument can be used either vertically or horizontally.

=8990	Price, with 50 cm. range, reading to ·02 mm. or ·01 mm. ... ... nett	**£12**	**0**	**0**
=8991	,, ,, 1 m. ,, ,, ,, ,, ... ,,	**19**	**0**	**0**
=8992	Rack motion to Telescope (extra) ... ... ,,	**0**	**17**	**6**

Measurement of Areas, Volumes, Mathematical Instruments, Drawing Models, etc.



8994

8994 **Solids,** Set of 16, Hardwood, for measurements, etc.
nett **£0 3 9**
In Cardboard Box with Hinged Lid and Elastic Band, containing:—

1. Cube
2. Cone.
3. Sphere
4. Cylinder
5. Square Prism.
6. Triangular Prism
7. Square Pyramid
8. Octahedron
9. Tetrahedron
10. Hex. Prism (section)
11. Pentagon
12. Equilateral Triangle
13. Isosceles Triangle
14. Right-angled Triangle
15. Square
16. Straight Line.

8995 **Zinc Figures,** Geometrical, Set of 12, for finding areas by direct measurement and weighing, per set ... **£0 2 9**



8996



8997



8998



8999

8996 **Rectangles,** Hardwood.

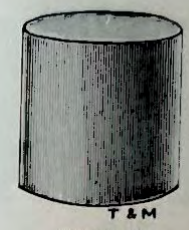
1×1×½	2×1½×1	2×2×1	3×2×1	3×3×1½	4×4×½	4×2×2	in.
1 6	**3 0**	**3 3**	**4 6**	**5 0**	**4 0**	**7 0**	per doz.
		4×3×2	5×5×½	5×5×½	5×5×1	5×5×1½	in.
		9 6	**3 6**	**5 0**	**6 0**	**9 0**	per doz.

8997 **Discs,** Hardwood, 1 in. thick. Diameter

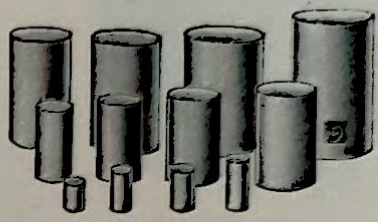
2	3	4	6	8	in.
3 9	**6 0**	**7 6**	**15 0**	**22 6**	per doz.

8998 **Pyramids,** Hardwood, Square, Triangular or Hexagon Base, 4 in. high, 3 in. base. Per doz. **£0 18 0**

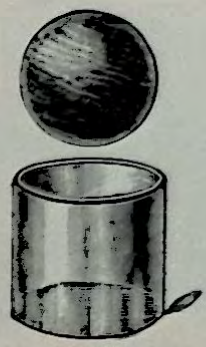
8999 „ „ Round Base ... ... „ **0 16 0**



9000–2



9004



9005

9000	**Cylinders,** Hardwood, accurately turned	3×1 cm.	3×3 cm.	1½×⅝ in.	1½×1½ in.		
		5/0	5/0	5/6	7/0	per doz.	
9001	,, Boxwood	6/6	7/0	7/6	10/0	,,	
9002	,, Ebony	8/3	8/3	10/0	12/6	,,	
				Hardwood	Boxwood		
9003	,, length, 10×4 cm.			6/6	10/6	per doz.	
9004	,, Boxwood, Set of 12, various heights and diameters ... ...per set				£0	7	0
9005	,, Tin, Hollow, with one end closed, for use with Boxwood Ball, suitable for spheres 1½×1½ in. or 3×3 cm. ... ... per doz.				0	5	0



9006–13

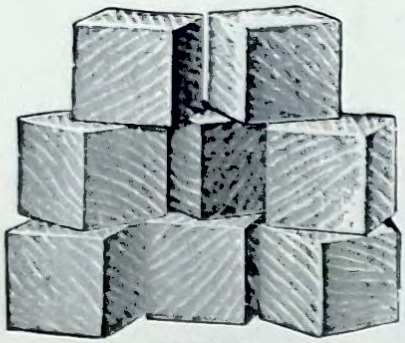


9014

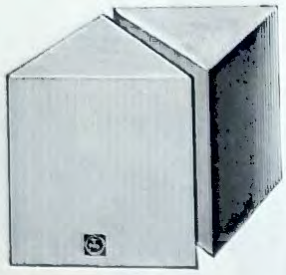


9015–18

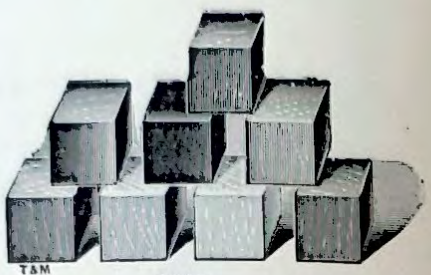
9006	**Cylinders,** Metal, accurately turned	...Size	3×1 cm.	4×1·6 cm.	3×3 cm.				
	Aluminium		8d.	10d.	1/6	each			
9007	,, Brass		7d.	10d.	1/6	,,			
9008	,, Copper		8d.	10d.	2/3	,,			
9009	,, Glass		—	9d.	—	,,			
9010	,, Iron		6d.	9d.	1/6	,,			
9011	,, Lead		8d.	11d.	1/9	,,			
9012	,, Tin...		1/1	1/6	2/6	,,			
9013	,, Zinc		9d.	11d.	1/10	,,			
9014	**Cylinders,** Metal, Set of 6, Aluminium, Brass, Copper, Iron, Lead and Zinc, complete in box.	Size	1½×⅞	3×1 cm.	3×3 cm.				
			5/3	4/3	10/6	per set			
9015	**Cones,** Hardwood, accurately turned.		1½×1½ cm.	3×3 cm.	1½×1½ in.				
			5/0	6/6	8/0	per doz.			
9016	,, Boxwood		6/9	8/0	9/6	,,			
9017	,, Ebony		8/3	10/0	11/6	,,			
9018	,, Brass		1/6	2/9	3/9	each			



9019–22



9023



9026

			3×3 cm.	1½×1½ in.	
9019	**Cubes,**	Hardwood, accurately finished	6/6	8/0	per doz.
9020	,,	Boxwood...	8/0	9/6	,,
9021	,,	Brass	2/6	3/9	each

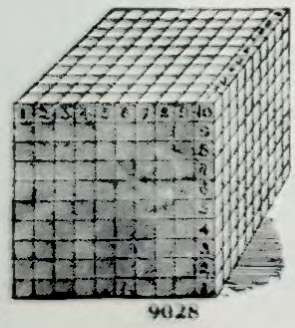
			1	2	3	in. sides.	1	2	4	10	cm. sides
9022	,,	Hardwood ...	2/6	9/0	12/6	per doz.	1/6	2/0	3/9	28/6	per doz.

9023	,,	,, 3 in., cut diagonally to make two Right-Angle Prisms, each 1/8, per doz.	£0	18 0
9024	,,	,, 10 cm. sides, cut into six slabs ... ... each	0	3 6
9025	,,	,, Centimetre and decimetre ... ... per set	0	2 6

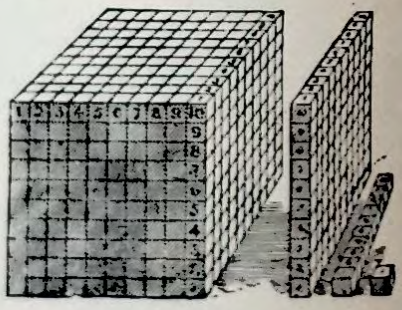
			1 cm.	2 cm.	1 in.	diam.
9026	,,	Various Hardwoods.				
		Ash	2/6	3/3	5/0	per doz.
		Beech	2/3	3/0	4/0	,,
		Boxwood	2/6	3/3	6/6	,,
		Ebony...	3/6	5/6	8/0	,,
		Mahogany	2/6	3/3	6/6	,,
		Oak	2/6	3/3	6/0	,,
		Poplar...	2/6	3/3	6/0	,,
		Satinwood	2/6	3/3	6/0	,,
		Teak	2/6	3/3	6/0	,,
		Walnut	2/6	3/3	6/0	,,



9027

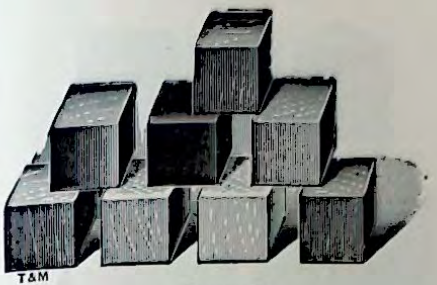


9028

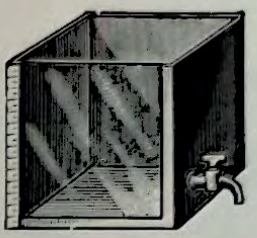


9029

9027	**Cube,**	Hardwood, 10 cm. sides, cut into six pyramids ... ... each	£0	8 6
9028	,,	,, 10×10×10 c.m., divided into centimetre squares on one side ,,	0	5 0
9029	,,	,, 10×10×10 cm., divided into centimetre squares, the top series of squares when removed giving $\frac{1}{10}$th, $\frac{1}{100}$th and $\frac{1}{1000}$th of the whole cube... each	0	8 0



9030–40

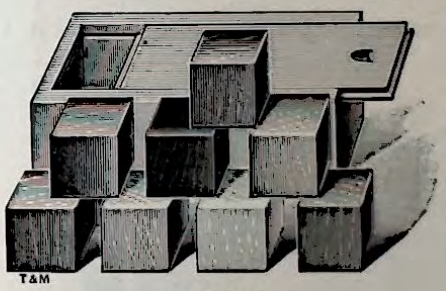


9042

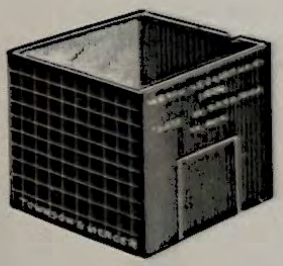


9043

		Sides	1 cm.	2 cm.	1 in.	
	Cubes, Metal, Marble, Glass, Cork, etc.					
9030	,, Aluminium		1/0	1/6	2/0	,,
9031	,, Brass		1/0	1/4	1/9	,,
9032	,, Copper		1/0	1/6	2/0	,,
9033	,, Iron		1/0	1/4	1/9	,,
9034	,, Lead		1/0	1/6	1/10	,,
9035	,, Tin		1/6	2/3	2/9	,,
9036	,, Zinc		1/0	1/4	1/10	,,
9037	,, Glass		9d.	1/0	1/2	,,
9038	,, Cork (compressed)		3d.	6d.	8d.	,,
9039	,, Marble		1/0	1/8	2/0	,,
9040	,, Paraffin Wax		1/0	1/4	1/8	,,
9041	**Cubes,** Sets of 6, Aluminium, Brass, Copper, Iron, Lead and Zinc, in Box		5/6	8/9	11/0	per set
9042	**Cube,** Hollow, Cubic Decimetre, one side Glass, with Brass Centimetre Scale attached with Tap				£0 8 6	each
9043	**Cubes,** Metal, one Cubic Centimetre, Set of 12—Zinc, Tin, Copper, Iron, Nickel, Silver, Lead and Alloys, Brass, Bronze, and Aluminium Bronze, numbered 1 to 12, with Reference Table, giving weight in grammes and Specific Gravity. Fitted in Leather Case, complete				3 0 0	



9044–5



9048

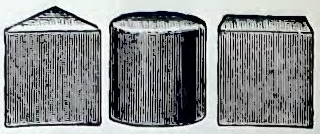


9050–53

		Sides	1 cm.	2 cm.	4 cm.	1 in.	
9044	**Cubes,** Wood, Set of 8, in Wood Box, consisting of Ash, Beech, Boxwood, Mahogany, Ebony, Oak, Poplar and Walnut.		2/4	3/0	5/6	5/0	per set
9045	**Cubes,** Set of 5 Wood Cubes, consisting of Boxwood, Mahogany and Walnut, and two of Ebony.	Sides		2 cm.	4 cm.	1 in.	
				3/6	4/6	4/0	,,

		Capacity	1 cubic centimetre.	1 cubic inch.	1000 cubic centimetres.	
9046	,, Tin, Hollow		9d.	10d.	1 3	each
9047	,, Brass, Hollow, to hold 1 c.c., accurately adjusted				each £0 2 6	
9048	,, 10 × 10 × 10 cm., with sides divided into centimetres, millimetres and relative weights ...				0 2 6	
9049	,, Brass, Hollow, 2 cm., accurately made, fitting in Brass Box, to prove Archimedes principle ...				0 4 6	

		Diameter	1½ cm.	3 cm.	1½ in.	
9050	**Spheres,** Hardwood		4 6	6 6	8 0	per doz.
9051	,, Boxwood		7 6	9 0	10 6	,,
9052	,, Ebony		8 0	10 0	12 0	,,
9053	,, Brass		9d.	1 9	2 6	each



9062



9057

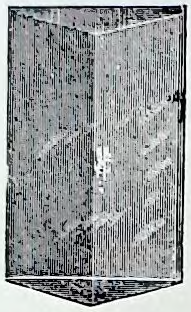




9054



9055–6



9058–9



9060–1

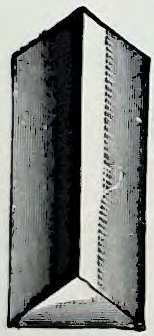
9054	**Sphere,** Hardwood, 10 cm. diameter and Glass Cylinder to fit same											...per set	£0	5	0
9055	,, Hardwood									Diameter		2 in.	4 in.		
												9/0	32/0	per doz.	
9056	,, Steel									½	⅝	¾	⅞	1 in.	
										2d.	4d.	6d.	9d.	1/0	each
										1/9	3/0	5/0	7/6	10/6	per doz.
9057	,, Hard and Soft, 3 cm. diameter												per pair	£0	1	3
9058	**Prism,** Boxwood, height 5 cm., base 3½×2½ cm. ... ... each **1/2,**												per doz.	0	12	6
9059	,, Brass ... ... ,, **2/6,**												,,	1	7	6
9060	**Pyramid,** Triangular Boxwood, height 5 cm., base 2½ cm. ... ,, **11d.,**												,,	0	10	0
9061	,, ,, Brass ... ... ,, **2/0,**												,,	1	2	6
9062	**Prisms,** Hollow, Brass, Set of 3, 1½ in. high												...per set	0	8	6



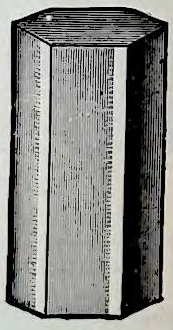
9063–4



9065–6

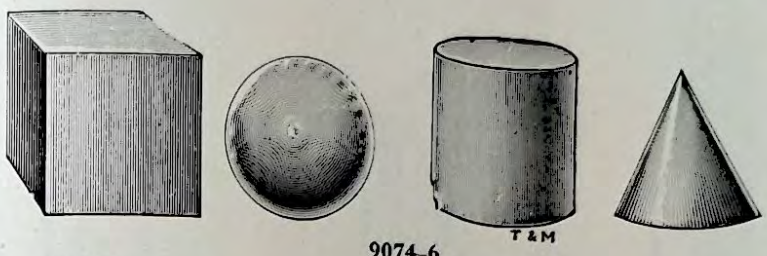


9067–71

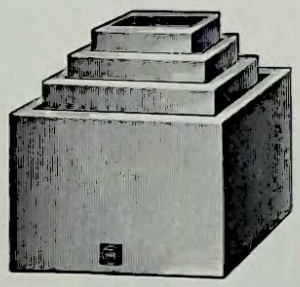


9072

9063	**Pyramid,** Square, Base Boxwood, height 1½ in., base 1½ in. ... each **1/0,**												per doz.	£0	10	6
9064	,, ,, ,, Hardwood ,, ,, ... ,, **9d.,**												,,	0	7	6
9065	,, Rectangular Base, Boxwood, height 2 in., base 2×1½ in. ,, **1/0,**												,,	0	10	6
9066	,, ,, ,, Hardwood, ,, ,, ,, **9d.,**												,,	0	7	6
9067	**Prism,** Triangular Hardwood, 3×3 cm., or 1½×1½ in. ... ... ,, **9d.,**												,,	0	7	6
9068	,, ,, Boxwood, 1½×1½ in. ... ... ,, **1/0,**												,,	0	10	6
9069	,, ,, Brass ... ... each													0	2	6
9070	,, ,, Boxwood, height 5 cm., base 2½ cm. ... each **1/0,**												per doz.	0	10	6
9071	,, ,, Brass, ,, ,, ,, ... each													0	2	6
9072	,, Hexagonal, Boxwood, height 1½ in., base 1½ in. ... each **1/2,**												per doz.	0	12	6
9073	,, Pentagonal, Boxwood, height 1½ in., base 1½ in. ... ,, **1/4,**												,,	0	14	6



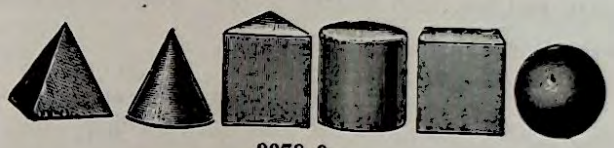
9074–6



9077

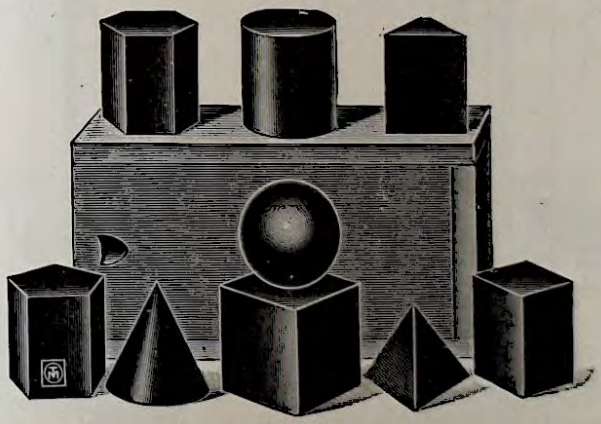
Solids.

		3×3 cm.	$1\frac{1}{2}\times1\frac{1}{2}$ in.	
9074	Set of 4 Hardwood, consisting of Cube, Cone, Sphere and Cylinder	**2/0**	**2/9**	per set
9075	Ditto, of Boxwood	**2/9**	**3/6**	,,
9076	Ditto, Hardwood, consisting of Cube, Cone, Cylinder and Sphere, 5 cm.×5 cm., per set			**£0 4 6**
9077	Set of 4 Hardwood Boxes for measurement of Capacity, as supplied to the London County Council Schools, etc., internal measurements, $4\frac{1}{2}\times3\frac{1}{2}\times2\frac{1}{2}$ in., 6×5×4 in., 6×5×5 cm., 12×10×8 cm. ... ... per set			**0 6 6**



9078–9

9078	**Set of Regular Solids,** in Hardwood, consisting of Cylinder, Cone, Sphere, Cube, Rectangular Prism, Triangular Prism, maximum dimensions 3 cm. ... per set	**£0 5 0**
9079	Ditto, ditto, in Brass ... ... ,,	**0 15 0**
9080	Set of Regular and Irregular Shaped Pieces of Metal ... ... ,,	**0 2 0**



9081–4



9085

9081	**Solids,** Set of 10 Hardwood, 2 in. high, 2 in. base, Cube, Cylinder, Cone, Triangular Prism, Pentagonal Prism, Octagonal Prism, Rectangular Prism, Hexagonal Prism, Sphere and Tetrahedron, in Wooden Box ... ... per set	**£0 9 6**
9082	Ditto, ditto, Set of 10 in Ebony, 2 in. high ... ... ,,	**0 12 6**
9083	Ditto, Set of 9, Ebony, 3 cm. high, 3 cm. base, as above set, with Cone, in Wooden Box ... ... per set	**0 15 0**
9084	Ditto, Set of 9, Brass, 3 cm. high, 3 cm. base, as above, in Wooden Box... ,,	**1 10 0**
9085	**Displacement Vessel, The "Eureka,"** Zinc with side Tube of Brass (*vide* Kerr's Elementary Physics) ... ... each **1/3**, per doz.	**0 13 6**

Specific Gravity Bottles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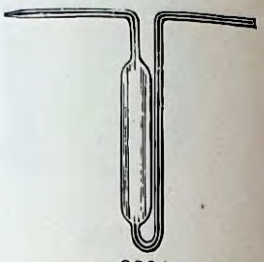
9088



9089


9090


9091

9087 **Specific Gravity Bottles,** with Drilled Stopper, not adjusted, for teaching purposes.

Capacity	10	25	50	100 gm.
	11d.	**1/0**	**1/2**	**1/4** each
	10/6	**11/0**	**13/0**	**14/6** per doz.

9088 **Specific Gravity Bottles,** with Slotted Stopper, unadjusted, each **9d.**, per doz. **£0 8 0**

(F) **9089** **Specific Gravity Bottle,** with Drilled Stopper.

Capacity	5	10	20	25	50	100 gm.
	3/0	**3/0**	**3/6**	**3/6**	**4/0**	**5/0** each

9090 **Specific Gravity Tube,** Sprengel's, for Oils, with Suction Tube.

Capacity	10	20	30 c.c.
	3/0	**3/6**	**4/0** each

9091 **Specific Gravity Tube,** Nicol's ... ...

Capacity	5–10	15–25	30–50 gm.
	1/6	**2/0**	**2/6** each


9092


9093


9004


9096

9092 **Dilatometer,** for the determination of the co-efficient of cubical expansion (as Edser's heat) ... ... each **9d.**, per doz. **£0 8 0**

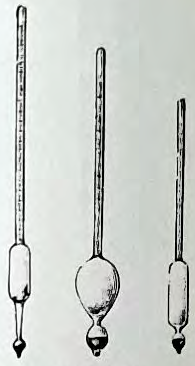
9093 **Weighted Glass Bulb,** for demonstrating the expansion of liquids (*vide* Edser's heat) ... ... each **1/0**, per doz. **0 10 6**

9094 **Volumenometer,** for use with Graduated Burette, consisting of a Stoppered Glass Tube with index mark on the Capillary tube ... ... price **0 2 0**

9095 Ditto, complete with I.R. Pressure Tubing, Burette and Stand **0 12 9**

9096 **Simple Hydrometer,** cosisting of a rectangular piece of wood 15 cm. long divided every centimeter and weighted at one end ... ... each **10d.**, per doz. **0 9 0**

(F) Foreign manufacture.



9097–9



9100–9102



9103–4

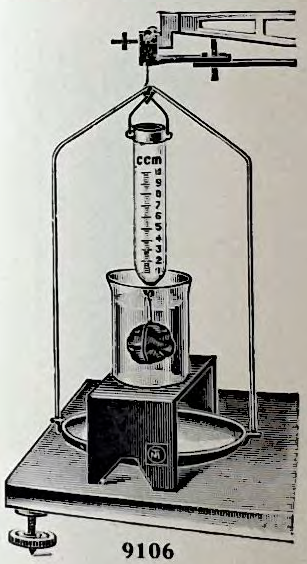


9105

(F) 9097	**Hydrometer,** Specific Gravity, 700–1000	each	£0	3	3
(F) 9098	,, ,, ,, 1000–2000	,,	0	3	3
(F) 9099	,, ,, ,, Universal, 700–2000	,,	0	4	3
9100	,, Nicholson's, for taking Specific Gravity of Solids heavier than Water, Jap. Tin	,,	0	2	4
9101	,, large size, Japanned Tin	,,	0	2	8
9102	,, smaller size, Nickel-plated	,,	0	6	9

(For Immersion Jars, refer to "General Apparatus.")

9103	**Archimedes' Apparatus,** Brass Cylinder and Bucket with Hooks, to show that a floating body loses weight, and the loss is equal to the weight of the volume of the Liquid displaced	each	£0	5	0
9104	Ditto, Smaller size and cheaper make	,,	0	2	9
9105	Ditto, New Pattern, best finish	,,	0	6	0



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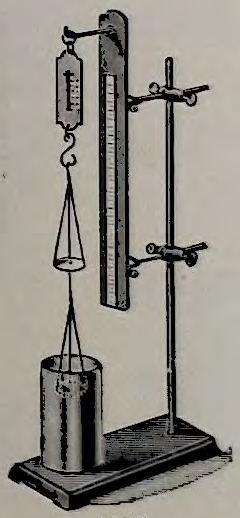
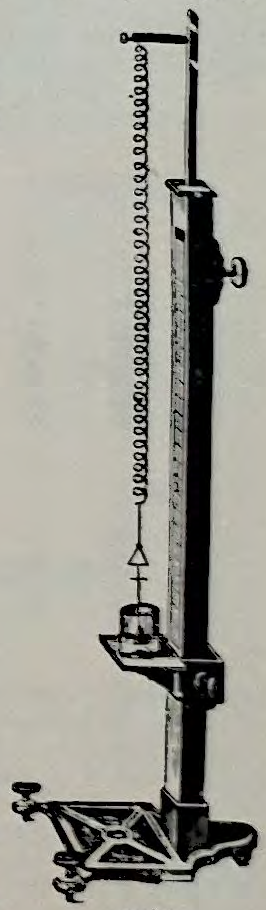


9107

9106	**Specific Gravity Tube,** designed by G. H. West, B.Sc., consisting of a Glass Tube graduated 10 c.c. in $\frac{1}{10}$ths, with Hook at bottom for suspension, and fitted with light metal Clamp and wire to attach to stirrup of balance	each	£0	1	9
9107	**Balance,** Jolly's Simple, on Iron Stand, with Boxwood Scale, for School Work		1	2	6
(F) 9108	**Balances,** Jolly's, on Iron Tripod Foot, with Levelling Screws, Mirror Glass Scale, divided in millimetres, complete with Set of Springs		3	15	0

(F) Foreign manufacture.



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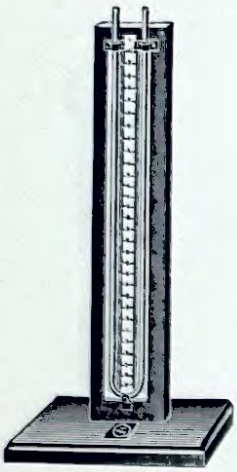
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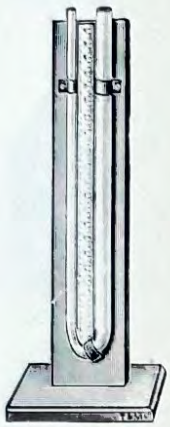
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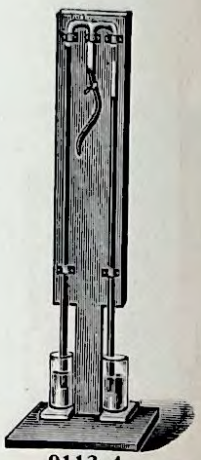
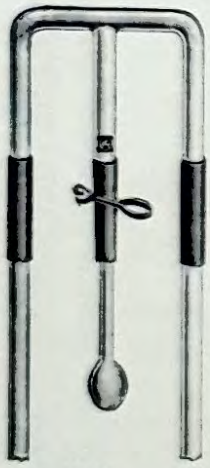

9113–4

9109	**Communicating Vessel,** U-tube, with Limbs of equal diameters ... ... each	£0	0	10
9110	Ditto, ditto, on Polished Wood Stand with graduated Scale ... ... ,,	0	7	9
9111	Ditto, ditto, with Limbs of unequal diameters, 18 in. long ... ... ,,	0	2	0
9112	Ditto, as above, with Boxwood Scale, divided into centimetres and millimetres, mounted on Polished Wood Stand ... ... each	0	8	6
9113	**Hare's Apparatus,** for comparison of Specific Gravities of Liquids, with Beakers, Blocks, India-rubber Tubing and Mouthpiece complete on Polished Stand, with Graduated Scale ... ... each	0	10	6
9114	Ditto, without the Wood Blocks and Beakers ... ... ,,	0	8	6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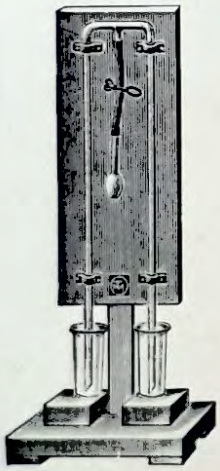
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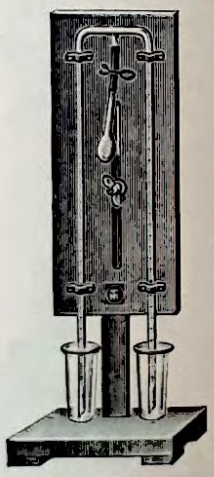
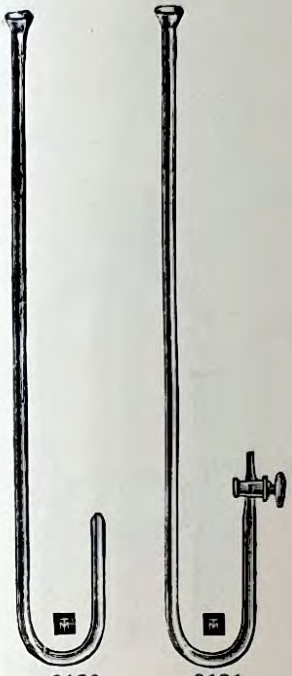

9118–19

9115	**Hare's Apparatus,** Glass Tubes complete with Mouthpiece, India-rubber Connection Mouthpiece and Clip ... ... each	£0	2	0
9116	Ditto, Glass T Tube only ... ... each **10d.,** per doz.	0	9	0
9117	**Hare's Apparatus,** with Tubes graduated into millimetres, on Polished Stand, with Blocks and Beakers complete	0	14	6
9118	**Hare's Apparatus,** for comparison of Specific Gravities of Liquids, with Graduated Tubes in millimetres, India-rubber Tubing and Mouthpiece, complete on adjustable Teak Stand	0	15	0
9119	Ditto, ditto, as above, but with Plain Glass Tubes	0	12	0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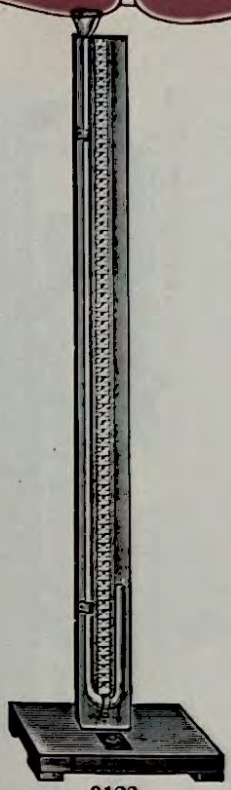
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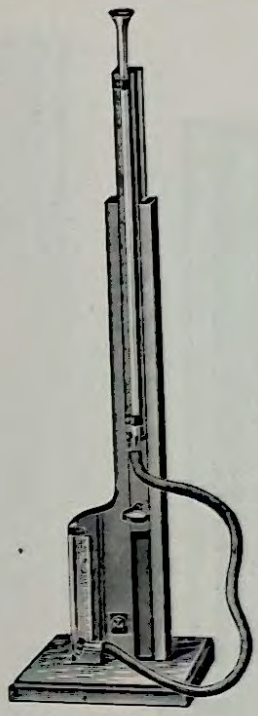
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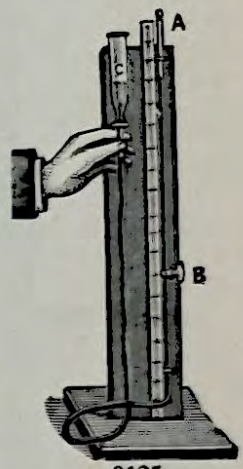

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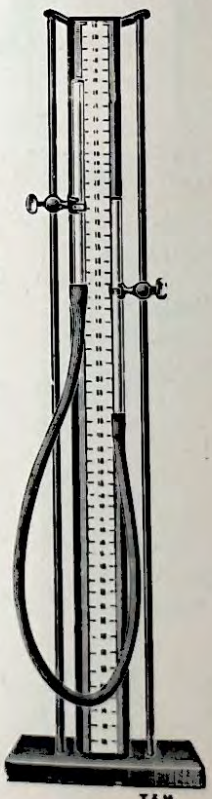


9126

9120 **Boyle's Law Tubes,** with funnel top. Each 1/6, per doz. **£0 16 6**

9121 Ditto, ditto, with funnel top and stop-cock ... ... each **0 5 6**

9122 **Boyle's Tube,** on board, with Boxwood Scale, divided into millimetres ... **0 10 0**

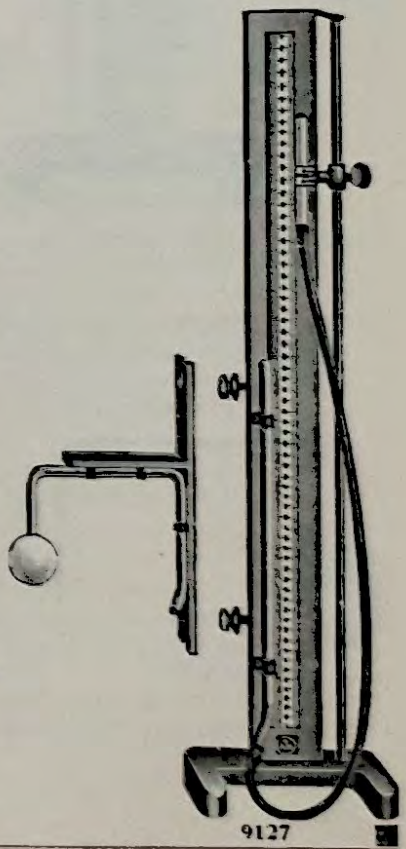
9123 Ditto, with divided Scales, on Polished Wood Stand **0 12 0**

9124 **Boyle's Tube,** with adjustable Reservoir Tube and Short Limb fitted with Box-wood Scale **0 18 6**

9125 **Boyle's Law Apparatus,** Mariotte's modified form, to illustrate Boyle's Law for both increased and diminished pressure. For increased pressure (up to about 800 mm.) air is enclosed beneath stopcock B. For diminished pressure B is open and air enclosed beneath the stopper A. C is a Mercury Level Bulb to adjust to the pressure required ... **1 7 6**

9126 **Boyle's Law Apparatus,** with Tubes sliding on Steel Rods with Clamps, graduated Scale, mounted on Teak Base, as shown **1 2 6**

9127 **Boyle's Law Apparatus,** new pattern adjustable Reservoir, Boxwood Scale graduated in mm., fitted with Jolly's Air Bulb Attachment, which can be removed when not required **1 17 6**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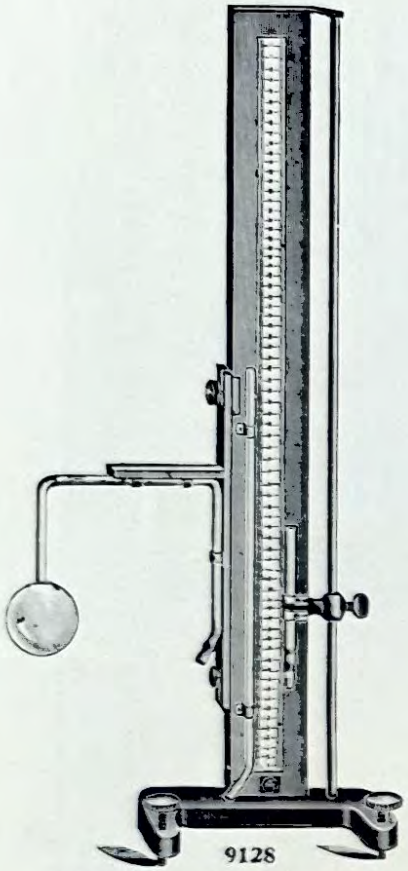

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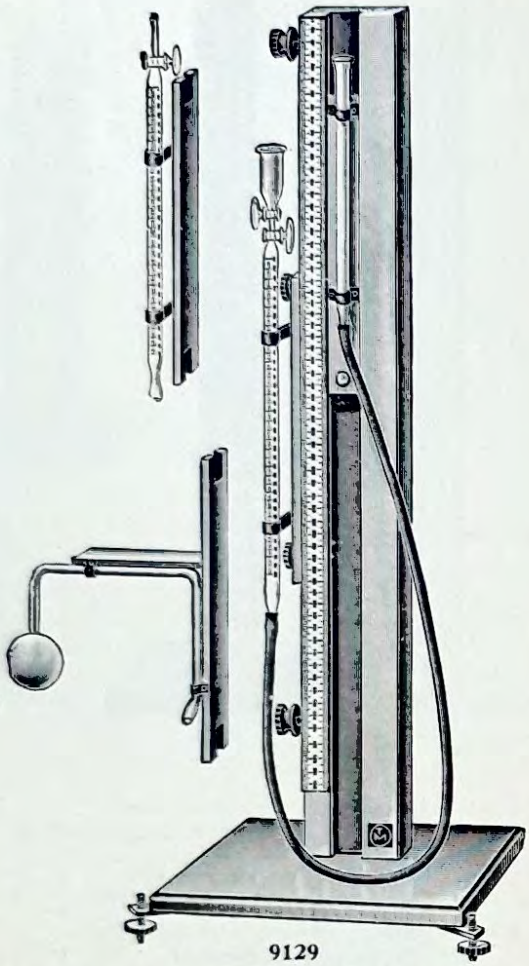

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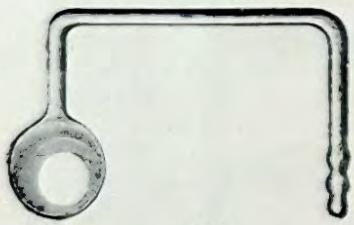
9132

9128 **Boyle's Law Apparatus,** large size, superior finish, fitted with Jolly's Air Bulb, which can be removed when not required, mounted on Teak and Iron Stand with Brass Levelling-screws, with Pressure Tubing complete **£2 10 0**

9129 **Boyle's Law Apparatus,** "College" pattern on solid Teak Stand, with Brass Levelling-screws and fittings, Graduated Tube, with Funnel and two Stopcocks, Graduated Tube with one Stopcock, Jolly's Air Bulb, each with separate fitments as illustration **4 10 0**



9133



9134

9130 **Tubes,** Vapour Tension, graduated 50 c.c. in $\frac{1}{10}$ths, with two Stopcocks .. each **0 9 0**

9131 **Tubes,** Vapour Tension, fitted with Steam Jacket and I.R. Corks ... ... each **0 12 6**

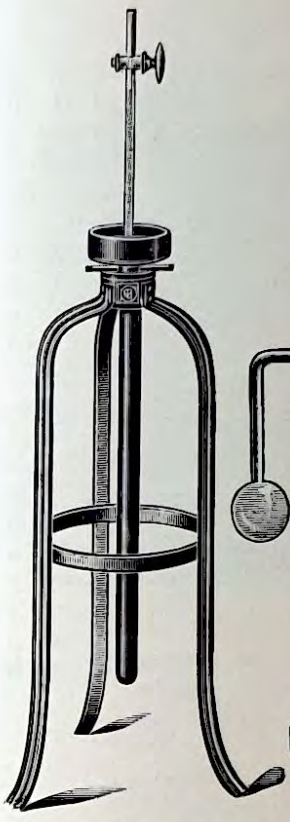
9132 **Jolly's Apparatus Tube,** graduated 0–35 cm. in mms., with Tap at top each **0 6 6**

9133 Ditto, Air Bulb Tubes, for use on Boyle's Law Apparatus ... ... ,, **0 2 0**

(F) **9134** **Mercury Reservoirs,** Stout Glass.

Capacity	150	250	400	500	750	1000 c.c.
	1/8	**1/10**	**2/4**	**2/6**	**3/6**	**4/6** each

(F) Foreign manufacture.



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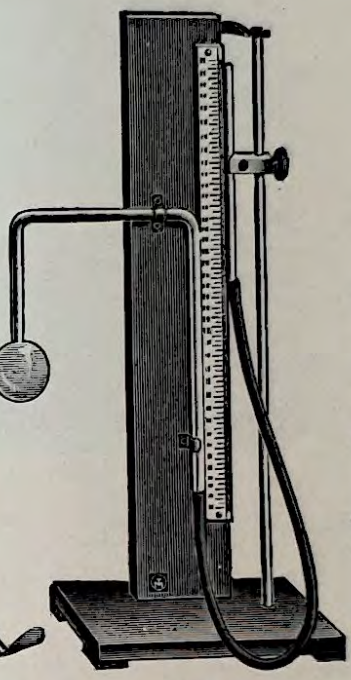

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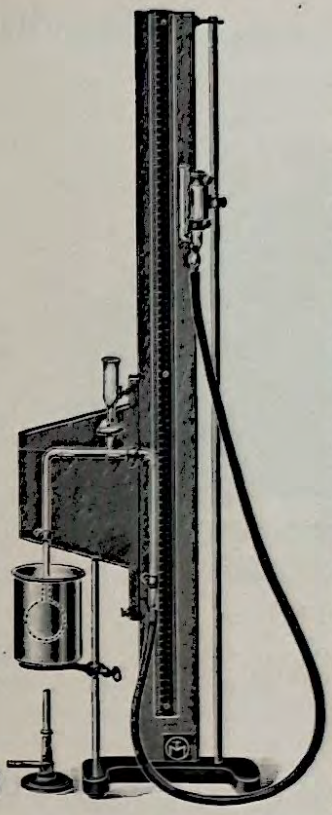

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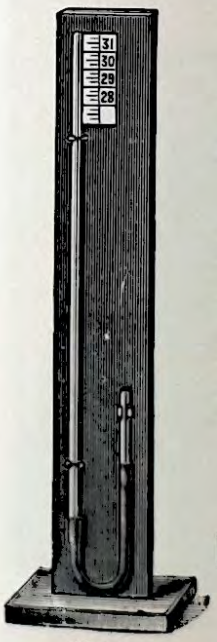


9143



9144-7

9135	**Boyle's Law Apparatus** for pressure less than the atmospheric, consisting of a Graduated Tube with Stopcock, stout Iron Outer Tube with Stand complete	£2	5	0
9136	**Jolly's Constant Volume Air Thermometer,** simple form, with Boxwood Scale	1	5	0
9137	**Constant Volume Air Thermometer** on Teak Stand with heavy Iron Base with Copper Vessel, I.R. Pressure Tubing, etc., complete as illustrated	3	3	0
9138	**Barometer Tubes,** closed at one end ... per doz. **12/6,** each	0	1	2
9139	Ditto, closed at one end, with Bulb and Bend ... „ **22/6,** „	0	2	0
9140	**Barometer Tubes,** Syphon with Bulb and Bends, as used in wheel Barometers ... ... each **2/3,** per doz.	1	4	0
9141	Ditto, ditto, ditto, Bunsen's, Graduated in millimetres ... each	0	10	6
9142	Ditto, ditto, ditto, filled with Mercury ... ... „	1	10	0
9143	**Barometer** model, with metal scale on Blackwood Stand „	0	12	6
9144	**Mercury Trays,** lacquered wood, 12 in. square; useful to prevent waste of mercury. each	£0	3	0
9145	Ditto, ditto, 15 in. square „	0	5	6
9146	Ditto, ditto, solid Teak, 16×16×1½ in. each	£0	8	6
9147	„ „ „ „ 24×16×1½ in. each	£0	12	6

Sundries

9150	**Aluminium Foil,** ·0035 in.	per oz. **8d.,**	per lb.	**£0 8 0**
9151	**Bristles,** Hog	per bundle	nett	**0 1 0**
9152	**Boxes,** Pill, Cardboard	per doz. **4d., 6d.,** and		**0 0 8**
			$12\frac{1}{2} \times 10$	25×20 in.
9153	**Cardboard,** white both sides	per sheet	**3d.**	**6d.**
		per doz.	**2/0**	**4/0**
9154	**Emery Cloth,** assorted	per quire		**0 3 6**
9155	**India-Rubber Bands,** assorted	per box **1/0** and		**0 1 6**
9156	**Lead Sheet**	per lb.	Nett	**0 1 0**
9157	Ditto, Shot, assorted	per lb.	,,	**0 1 0**
9158	**Needles,** Knitting, assorted	per doz.	,,	**0 0 6**
		Length 2	$2\frac{1}{2}$	in.
9159	**Pins,** Blanket	... **2/0**	**3/0**	per gross
9160	Ditto, Ordinary, assorted	per packet	Nett	**£0 0 2**
9161	**Paraffined Paper**	per quire	,,	**0 0 9**
9162	**Sand or Glass Paper,** assorted	per quire	,,	**0 2 0**
9163	**Solder**	per stick **3d.,** per lb.	,,	**0 2 6**
9164	**Tape**	per length	,,	**0 0 3**
9165	**Thread,** White or Black	per reel	,,	**0 0 4**
9166	**Tin Foil,** No. 3	per lb.	,,	**0 5 0**
9167	,, ,, Cheaper quality	per lb.	,,	**0 3 0**

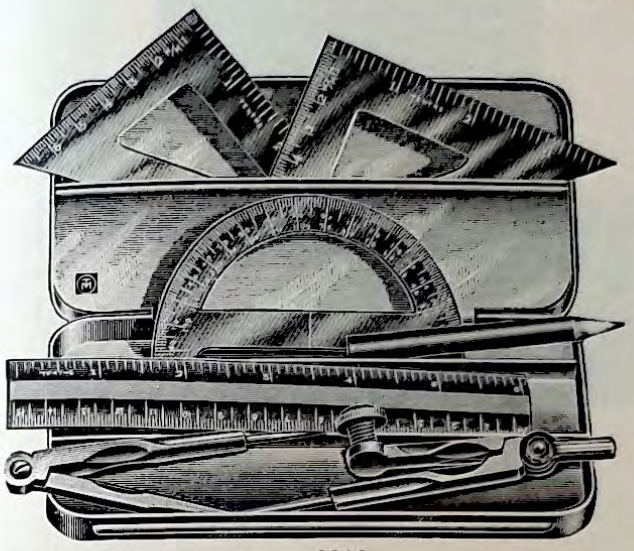
Chemicals

9168	**Aniline Colours,** Blue, pure soluble	per oz.	Nett	**£0 1 3**
9169	,, ,, Magenta	,,	,,	**0 2 0**
9170	**Bichromate Salt** for Batteries	per lb.	,,	**0 1 9**
9171	**Copper Sulphate**	per lb.	,,	**0 0 6**
9172	**Glycerine**	per lb.	,,	**0 1 3**
9173	**Gold Leaf**	per book	,,	**0 3 0**
9174	,, ,, (Dutch Metal)...	per book	,,	**0 0 9**
9175	**Iron Filings**	per lb.	,,	**0 0 6**
9176	**Magnetic Iron Ore**	specimens from, each		**0 1 6**
9177	**Marble**	per lb.	Nett	**0 0 2**
9178	**Mercury** (price varies with market)	per lb.	,,	**0 8 0**
9179	**Oiled Silk,** for Pump Valves, etc., Best Quality	per $\frac{1}{4}$ yd., in box	,,	**0 2 0**
		per $\frac{1}{2}$ yd., in box	,,	**0 3 9**
9180	**Olive Oil**	per oz. **3d.,** per lb.,	,,	**0 2 3**
9181	**Potassium Bichromate,** Crystals	per lb.	,,	**0 1 0**
9182	**Sal Ammoniac** (Crushed, for Batteries)	per lb.	,,	**0 1 0**
9183	**Sand,** Silver	per 14lb.	,,	**0 1 0**
9184	**Shellac,** best Orange	per oz. **4d.,** per lb.	,,	**0 4 0**
9185	**Vaseline**	per lb. tin	,,	**0 1 9**
9186	**Wax,** Yellow (Beeswax)	per oz. **3d.,** per lb.	,,	**0 3 3**
9187	Ditto, White, Paraffin, M.P-t. 125F.	per lb.	,,	**0 0 9**
9188	Ditto, Soft Red	per oz. **5d.,** per lb.	,,	**0 4 6**

(Full List of Chemicals and Reagents forwarded post-free on application.)

We shall be pleased to quote for any special apparatus on receipt of full particulars.

Mathematical Instruments.



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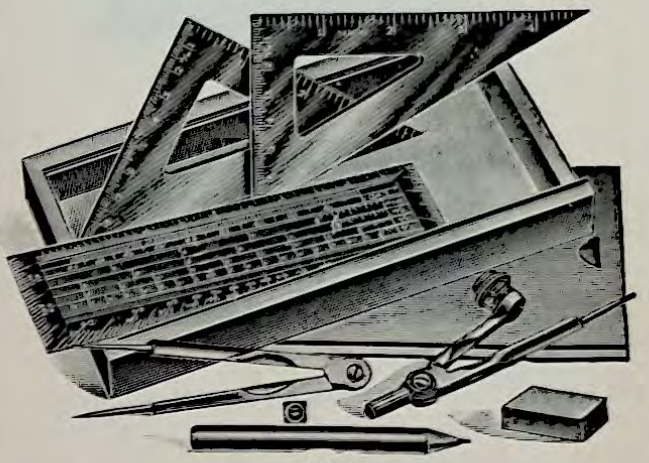
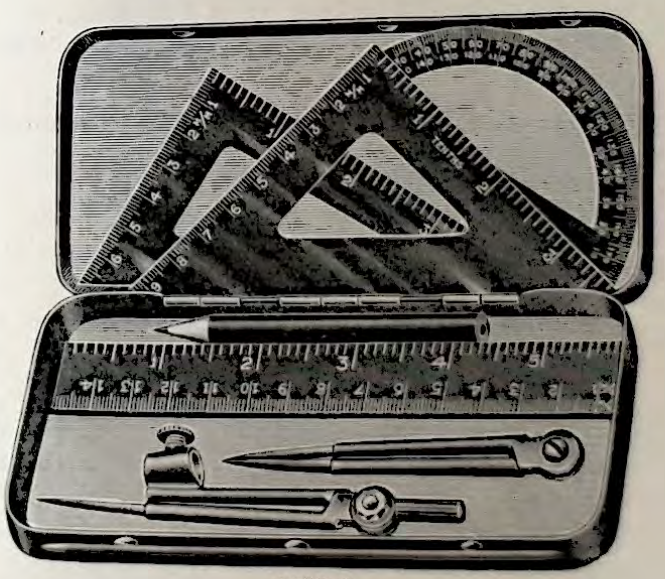


9201

9200 **Student's Set of Geometrical Instruments,** in plain Tin Box; consisting of Helix Compass, Divider, Protractor, Nickelled Set Squares marked 10ths and mms., 60°, 5 in.; 45°, 4 in.; Boxwood Rule, polished, Double Bevelled, marked 10ths and mms., Pencil and Rubber.
Each **2/3,** per doz. **£1 1 0**

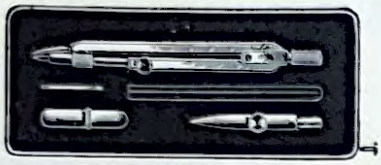
9201 **Student's Set of Geometrical Instruments,** in Polished Wood Box, consisting of Helix Compass, Divider, Boxwood Protractor 6 in., with 4 Plotting Scales, and with Chord and Diagonals and 6 in. of each Scale of 10ths, $\frac{1}{8}$ths, and mm. Nickelled Set Squares, marked 10ths and mms., 60°, 5 in.; 45°, 4 in.; Pencil 6 in. and Rubber ... ... each **3/3,** per doz. **£1 16 0**



9202–3

9202 **Student's Sets of Geometrical Instruments,** in Varnished Tin Box as illustrated; containing Brass Tubular Compass with bow top, Boxwood Rule, 6 in., polished, double bevelled, marked mms. and 10ths with angles on back; Brass Tubular Divider, Bright Steel Protractor, Bright Steel Set Square, 45°, 4 in., marked mms. and 10ths; Bright Steel Set Square, 60°, 5 in., marked mms. and 10ths; Blacklead Pencil, India Rubber, each **1 4,** per doz. **£0 14 6**

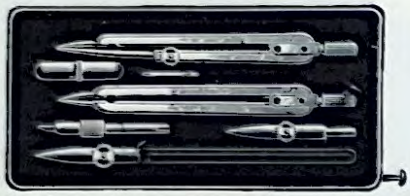
9203 Ditto, ditto, in Varnished Tin Box as illustrated but with divisions; containing Brass Tubular Compass with bow top, Brass Tubular Divider, Boxwood Rule, 6 in., polished, double bevelled, marked mms. and 10ths with angles on back; Bright Steel Protractor, Bright Steel Set Square, 45°, 4 in., marked mms. and 10ths, Bright Steel Set Square, 60°, 5 in., marked mms. and 10ths; blacklead Pencil, India Rubber.
each **1/6,** per doz. **£0 16 6**



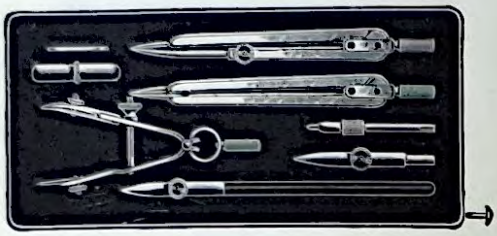
9204



9206



9208



9210

DRAWING INSTRUMENTS, "New Style"

In Velvet-lined "Barlock" Pocket Cases, accurately adjusted, beautiful finish, amazingly good value.

*9204	Polished Brass	per set	£0	2 6
*9205	Nickel-plated	complete	0	3 0
	Contents of above form now Pencil, Bow Pen, Ruling Pen, Divider, Lead Case and Key.			
*9206	**Ditto, ditto,** Polished Brass	complete	0	3 6
*9207	Nickel-plated	the set	0	4 0
*9208	Polished Brass	,, ,,	0	5 0
*9209	Nickel-plated	complete	0	5 6
*9210	Polished Brass	,,	0	7 6
*9211	Nickel-plated	the set	0	8 0

*9212 Brass at **7/6**, and **9213** (Nickel-plated at **8/-**) are similar Sets with **Pencil**, Spring Bow, instead of Pen ditto.

The above Sets are also supplied fitted in Polished Magazine Cases (Loose Tray, Hook Fastenings, etc.), with addition of 6-in. Protractor, pair of Pearwood Set Squares, HH Pencil, India-rubber and Four Safety Drawing Pins, at an extra cost of **2/6** each.



9214

DRAWING INSTRUMENTS, "New Style" Set for Technical Schools, handy design, beautiful finish.

*9214	Elegant Pocket Case ("Bar-Lock" or Rod Fastening, etc.), containing needle-pointed Bow Compasses, with Pen and Pencil Points and Lengthening Bar; Divider; Drawing Pen; Case for reserve Leads; Drawing Pins, etc. Brass instruments	each	£0	8 6
*9215	Ditto, ditto, Nickel-plated Set	,,	0	9 6
*9216	As No. 9214, but Superior Quality Brass instruments	each	0	10 6
*9217	Ditto, ditto, but Electrum instruments	,,	0	13 6
*9218	Ditto, ditto, but in Snap Case, Electrum	,,	0	15 0

Sets as above, plus Spring Bows

*9219	Pocket Case containing Set as in No. 9214, with addition of excellent Needle-pointed Spring Bow Compass, which combines in itself Spring Bow Pen, Pencil and Divider, Brass	each	0	12 6
*9220	Ditto, ditto, but Nickel-plated, etc.		0	13 6


9221


9222


9223


9224

9221 **Dividers,** Brass, 4-in. Round Leg Dividers, with patent Nut, Round Points. Per doz. **4/6**, per gross **£2 7 6**

9222 Ditto, ditto, Square Leg, with patent Nut, Round Points ... ...

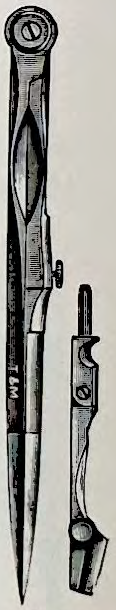
4	5	in. long
7/6	**8/9**	per doz.

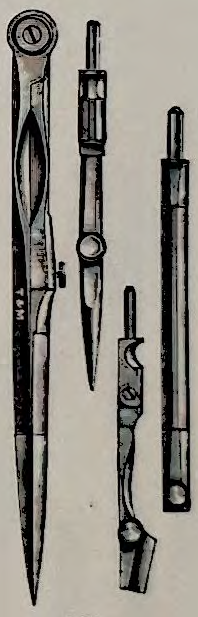
(F) **9223** Ditto, Good quality, for School use, with Triangular Points ... ...

4	4¾	5½	in. long
8/6	**10/6**	**11/6**	per doz.

(F) **9224** **Compasses,** good quality, with fixed Pencil Holder ... ...

4¼	5½	in. long
11/0	**12/6**	per doz.


9225


9226


9227


9228

(F) **9225** **Compasses,** with Replaceable Pencil Holder and Divider ... | 4¾ **17/6** | 5½ **21/0** | in. long per doz.

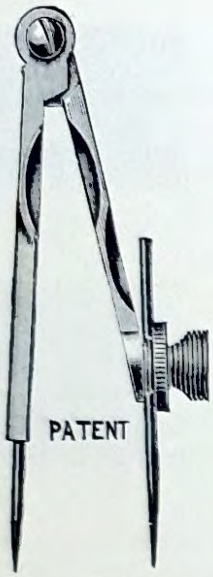
(F) **9226** Ditto, with Replaceable Pen, Pencil Holder, Divider and Lengthening Bar | 4¾ **26/0** | 5½ **30/0** | in. long per doz.

(F) **9227** Ditto, Fixed Pencil Point, for ordinary Lead Pencils, length 4½ in., each **7d.**, per doz. **£0 6 6**

(F) **9228** Ditto, Universal, with Pen, Pencil Holder and Divider, length 5 in.... ... each **0 1 6**

(F) Foreign manufacture.





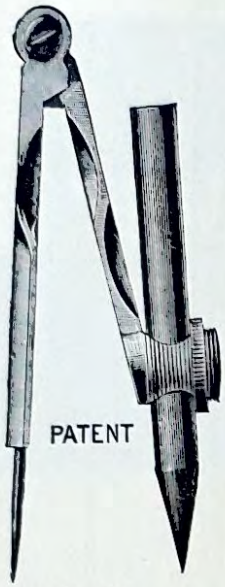




Fig. I.——————**9230**——————Fig. II.

9229

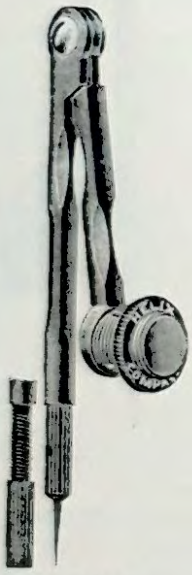
9231

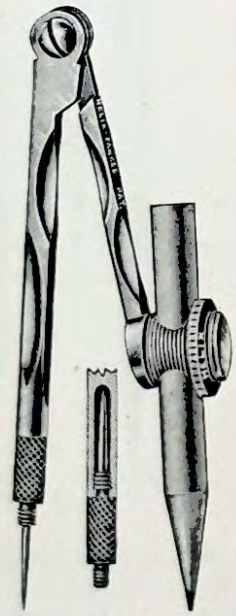
9229 **Compasses,** Brass, with 4-in. Round Legs and tightening Nut ... ... each **6d.,** per doz. **£0 5 6**

9230 **Compasses,** Universal Patent, The "Helix," to take either small compass or ordinary pencil. Length 4 5 in,

9231 Ditto, ditto, with Bow Top ... **6/6** **8/0** per doz.
7/6 **8/9** „









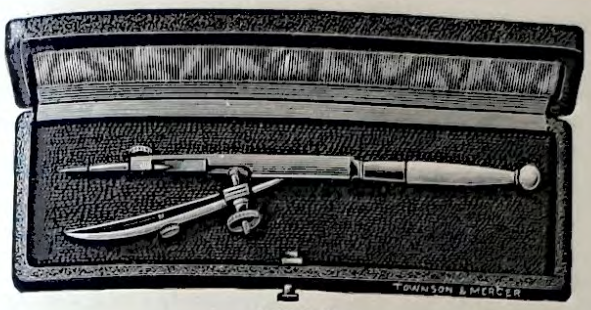
9232 9233 9234 9235

9232 **Compasses,** 4-in. Brass, with Round Legs, tightening Nut and Bow Top... ... each **7d.,** per doz. **£0 6 6**

9233 Ditto, ditto, "Helix" Safety, with fixed Screw Cap to protect point for carrying in pocket. each **10d.,** „ **0 9 0**

9234 Ditto, ditto, "Helix" Fawkes Safety Point ... ... „ **10d.,** „ **0 9 0**

9235 Ditto, ditto, "Helix" Universal, with Reversible Pen and Divider Point... „ **1/6,** „ **0 14 6**



9236–8



9239



9241

(F) 9236	**Compasses,** Spring Bow, Bone Handle, for Pen or Pencil, either pattern			each	£0 3 6
(F) 9237	Ditto, ditto, ditto, for Pen, with nutted screws and for Pencil riveted screws			,,	0 4 0
9238	**Cases,** Imitation Morocco, for above ... ... To take	1	2	compasses	
		2/0	2/6	each	
9239	**Spring Bow Sets** in Pocket Cases, containing set of three Spring Bows, Ring pattern; Pens and Pencil, needle pointed; Electrum				£0 12 6
9240	Ditto, ditto, ditto, larger size				0 15 0
9241	Ditto, ditto, ditto, "Bolt and Nut" Set				0 17 6
9242	Ditto, ditto, ditto, better quality				1 7 6



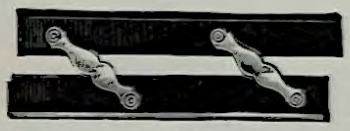
9243



9244



9245



9247



9246

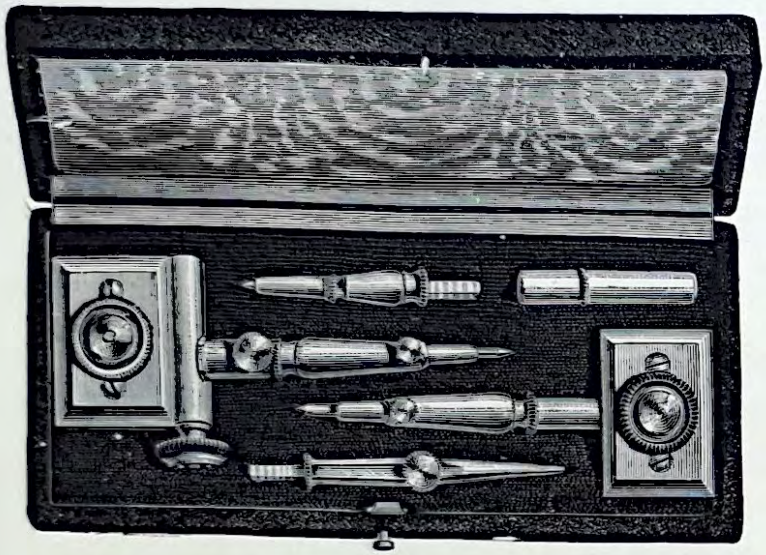
9243	**Compasses,** Wood, for blackboard use. Length	12	15	18	24	in.	
	Ordinary quality	2 6	3 0	3 6	4 6	each	
9244	Ditto, best quality, with rounded legs	3 6	4 0	4 9	5 9	,,	
9245	Ditto, ditto, ditto, with non-slip Chalk Holder ...	4 3	5 0	5 9	6 6	,,	
9246	**Protractors,** Stewart and Gee's, Silvered Engraved Dial, 7½ in. diameter, with Brass Arm mounted on Polished Mahogany Base, for dividing Circles ...						£1 2 6
9247	**Parallel Rules,** Hardwood, with Brass Bars, 6 in. ... each	9d.,	per doz.				0 8 0
9247/1	,, ,, Ebony, ,, ,, ... ,,	1/2,	,,				0 12 6

(F) Foreign manufacture.



9248

9248 **Beam Compass,** Students' form, two Brass Slides with Steel Points and Lath complete ... ... each **£0 5 6**



9249



9250–1

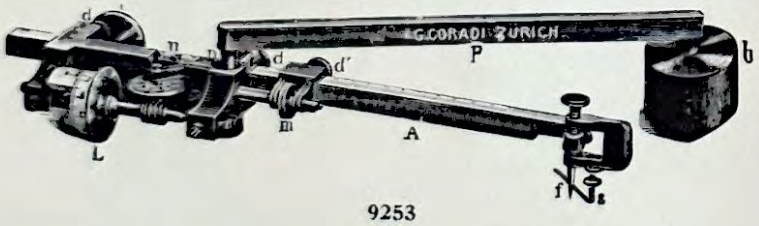


9252

(F) **9249** **Beam Compass,** Superior Quality, adapted for fixing on Flat Drawing Rules, with Pen and Pencil Points, and adjusting Screw, complete, in Case **£2 0 0**

		Length	4¼	5½	in.
(F) **9250**	**Ruling Pens,** with Wood Handles		**1/0**	**1/2**	each
(F) **9251**	Ditto, Bone Handles, Superior Quality		**1/9**	**2/0**	,,

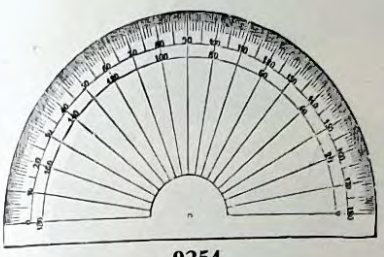
(F) **9252** **Dotting Wheels,** with three Interchangeable Wheels and Bone Handle, length 5½ in. **£0 5 6**



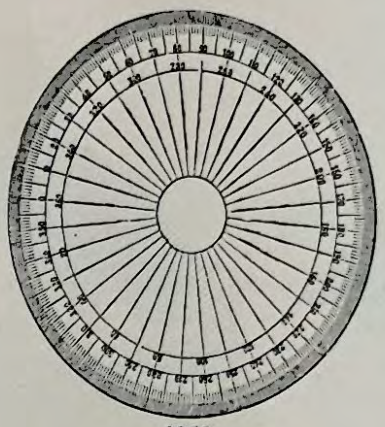
9253

(F) **9253** **Planimeter, Amsler's,** Electrum Metal for computing areas in several units, English and Metric, in Case ... ... Price **£5 15 0**

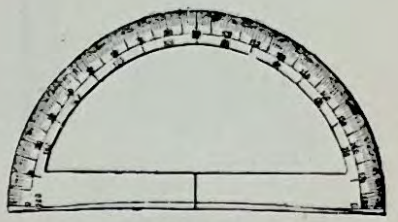
(F) Foreign manufacture.



9254



9259



9255–8

(F) **9254** **Protractors,** Celluloid, non-inflammable, semi-circular, divided into degrees, two rows of figures ... ... Diameter $3\frac{1}{8}$ $3\frac{1}{2}$ 4 in.
8/0 **9/0** **10/6** per doz.

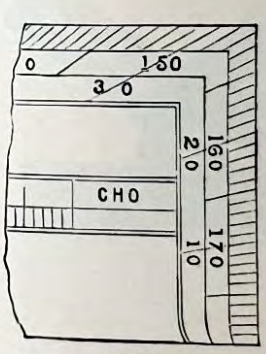
9255 **Protractors,** Brass, semi-circular, divided into degrees, two rows of figures.
Diameter $3\frac{1}{8}$ $3\frac{3}{4}$ in.
3/6 **6/0** per doz.

9256 Ditto, ditto, ditto, strong English make, one row of figures, 3 in. diameter.
each **5d.,** per doz. **£0 4 0**

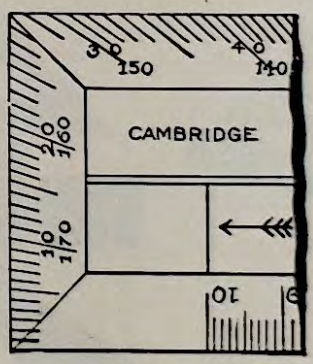
9257 Ditto, ditto, ditto, strong English make, two rows of figures, 3 in. diameter.
each **6d.,** per doz. **0 5 6**

9258 Ditto, as above, with Bevelled Edge, $3\frac{3}{4}$ in. diameter ... each **11d.,** per doz. **0 9 6**

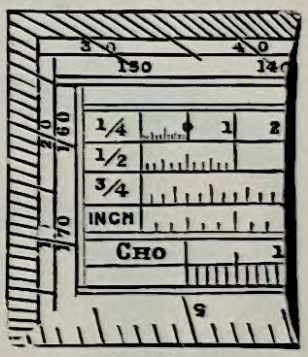
(F) **9259** Ditto, Circular, Celluloid, non-inflammable, with two scales divided in $\frac{1}{2}$-degrees.
Diameter 12 cm. 13 cm. 16 cm.
2/6 **3/6** **4/6** each



9260



9261



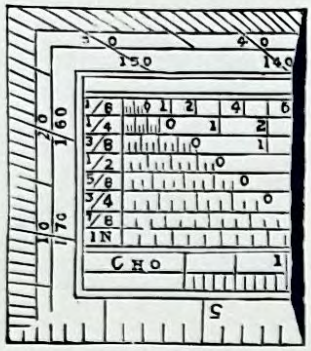
9262

9260 **Protractor,** 6-in. chords on front, $\frac{1}{8}$ths and $\frac{1}{10}$ths one edge, and millimetres and centimetres other edge on back ... ... each **8d.,** per doz. **£0 7 0**

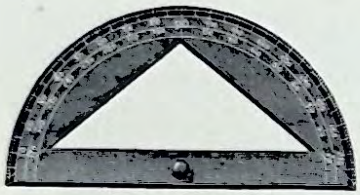
9261 Ditto, 6-in., the "Cambridge," millimetres, centimetres and decimetres on front; $\frac{1}{8}$ths one edge, $\frac{1}{10}$ths other edge at back ... ... each **10d.,** per doz. **0 8 0**

9262 **Protractor,** 6-in., four scales, chords and $\frac{1}{10}$th on front, millimetres and centimetres one edge, $\frac{1}{8}$ths other edge, and diagonal scales 1 in. and $\frac{1}{2}$ in. on back.
each **10d.,** per doz. **0 8 0**

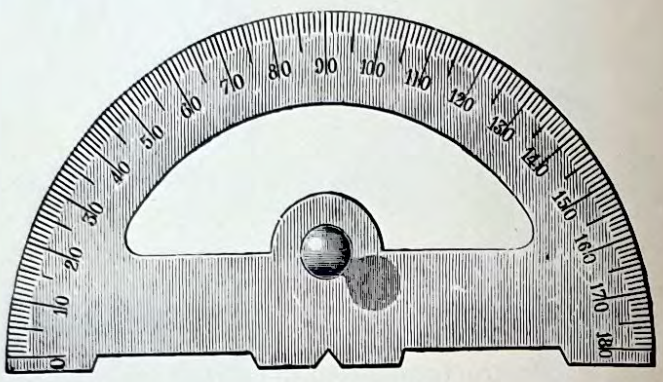
(F) Foreign manufacture.



9263

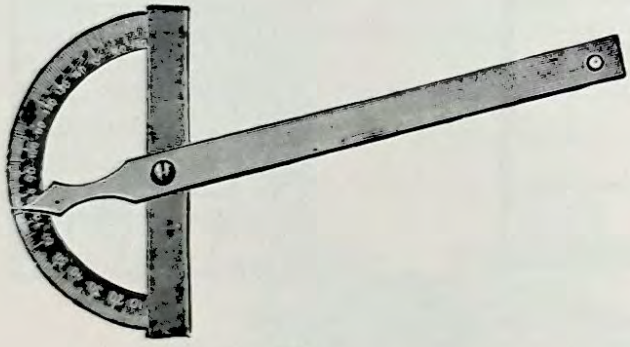


9264

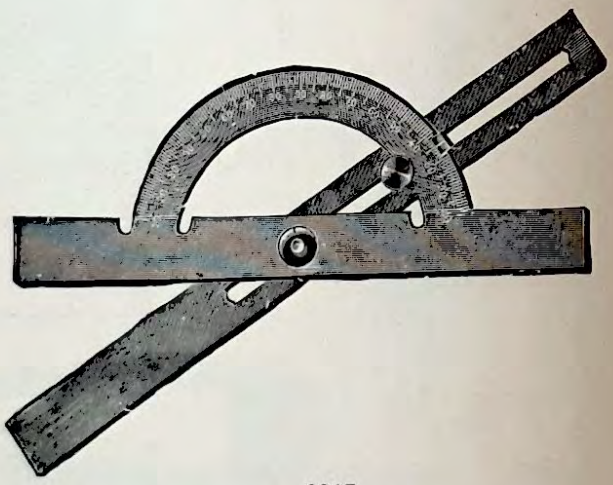


9265

*9263	**Protractor,** 6-in., 8 scales and chords, and $\frac{1}{10}$ths on front, 6 plotting scales and diagonal scales 1-in. and $\frac{1}{2}$-in. on back ... ... each **1/2**, per doz.	**£0**	**12**	**0**
9264	**Blackboard Protractor,** Polished Hardwood with knob, 14 in. dia.	**0**	**6**	**0**
(F) *9265	Ditto, ditto, cheaper make	**0**	**4**	**0**



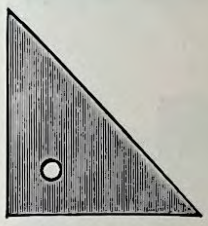
2966



9267

(F) **9266**	**Protractor,** Steel, Nickel-plated, diameter of circle 8 cm., length of arm 12 cm., divided into single degrees ... ... each	**£0**	**6**	**6**
(F) **9267**	Ditto, Steel, Nickel-plated, diameter of circle 15 cm., divided into single degrees, length of arm 20 cm. ... ... each	**1**	**7**	**6**

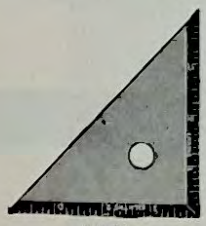
(F) Foreign manufacture.



9268



9269



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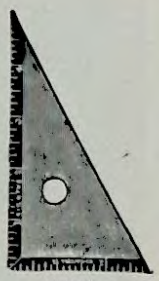


9275

(F) **9268** **Set Squares,** genuine Pearwood. Length 4 $4\frac{3}{4}$ $5\frac{1}{2}$ $6\frac{3}{8}$ $7\frac{1}{8}$ 8 in.
Angle 45° ... ... **1/9** **2/3** **3/0** **4/0** — — per doz.

(F) **9269** Ditto, ... ,, 60° ... ... — — **1/9** **2/6** **3/6** **4/6** ,,

9270 Ditto, Hardwood **Angle** 45° ... ... Length 4 5 in.
1/9 **2/6** per doz.

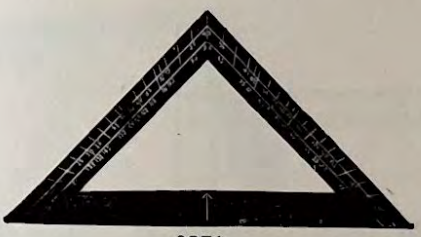
9271 **Angle** 60° ... ... Length 5 6 in.
1/9 **2/6** per doz.

(F) **9272** Ditto, superior quality Vulcanite. Length 4 5 6 7 in.
Angle 45° ... ... **7/6** **10/0** **12/0** **17/6** per doz.

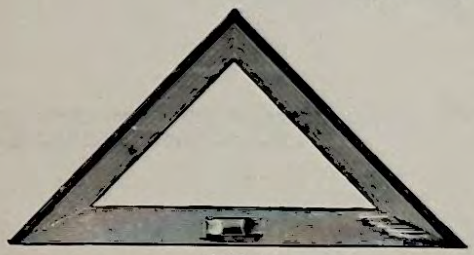
(F) **9273** Ditto, ditto. Length 4 5 6 7 8 in.
Angle 60° ... ... **6/0** **7/0** **8/0** **10/0** **12/0** per doz.

9274 Ditto, Wood, extra thick with Bevelled Edges, marked in inches and $\frac{1}{8}$ths.
Angle 45° ... ... Length 4 5 in.
3/6 **5/6** per doz.

9275 Ditto, as above **Angle** 60° ... ... Length 5 6 in.
3/6 **5/6** per doz.



9276



9277–8

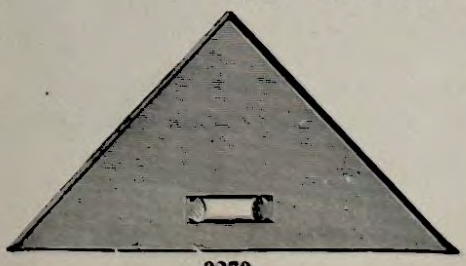
9276 **Set Squares** for Blackboard, with Angles, Hardwood, Polished, 45°, 12 in. ... ... each **£0 5 0**

9277 **Set Square,** Polished Hardwood, Framed, for Blackboard use.
Angle 45° ... Length 15 18 in.
4/6 **5/0** each

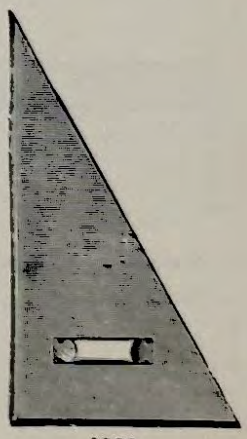
9278 Ditto, as above **Angle** 60° ... Length 18 21 in.
4/6 **5/0** each

9279 **Set Square,** for Blackboard use, plain Hardwood.
Length 9 12 in.
Angle 45° ... **3/0** **3/6** each

9280 Ditto
Length 12 15 in.
Angle 60° ... **3/0** **3/6** each

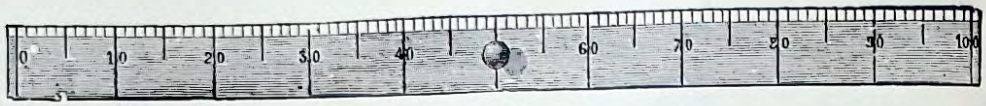


9279



9280

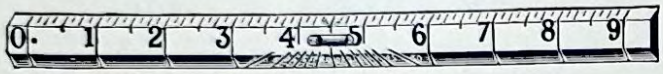
(F) Foreign manufacture.



9281



9282



9283

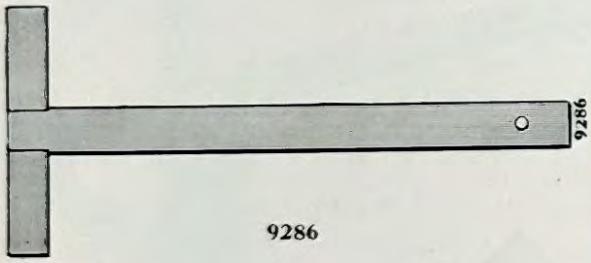


9284–5

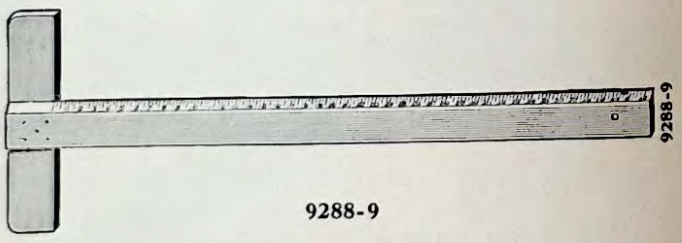
(F) **9281**	**Ruler,** for Blackboard use, Plain Hardwood divided into centimetres, 1 m. long					**£0**	**4**	**0**
		36	42	48	54	in.		
9282	,, ,, ,, with Single Bevel ...	**3/6**	**4/0**	**5/0**	**6/0**	each		
9283	**Rulers,** for Blackboard use, Double Bevel, 36 in. long, Scale 4 in. to 1 in., marked with Angles					**£0**	**6**	**0**
9284	Ditto, ditto, marked in inches and centimetres, with Angles, length 40 in.... each					**0**	**5**	**6**
9285	Ditto, ditto, with Brass Handle					**0**	**6**	**0**



9287



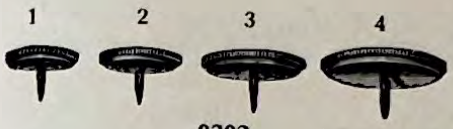
9286



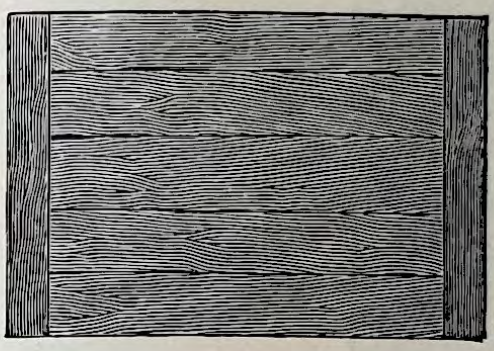
9288-9

		Length 12	15	18	24	in.	
(F) **9286**	**T-Squares,** Genuine Pearwood	**1/0**	**1/2**	**1/3**	**1/9**	each	
9287	,, Graduated, 36 in. long, marked in inches and centimetres, with Angles each					**£0**	**6**	**0**
9288	,, with Bevel painted yellow, 42 in. long, graduated into ¼ in. ,,					**0**	**6**	**6**
9289	,, ,, ,, ,, ,, 48 in. long					**0**	**8**	**6**

(F) Foreign manufacture.



9292



9290



9291

	Length	35	40	45	50	55	60	cm.
	Width	25	30	32	35	40	45	,,

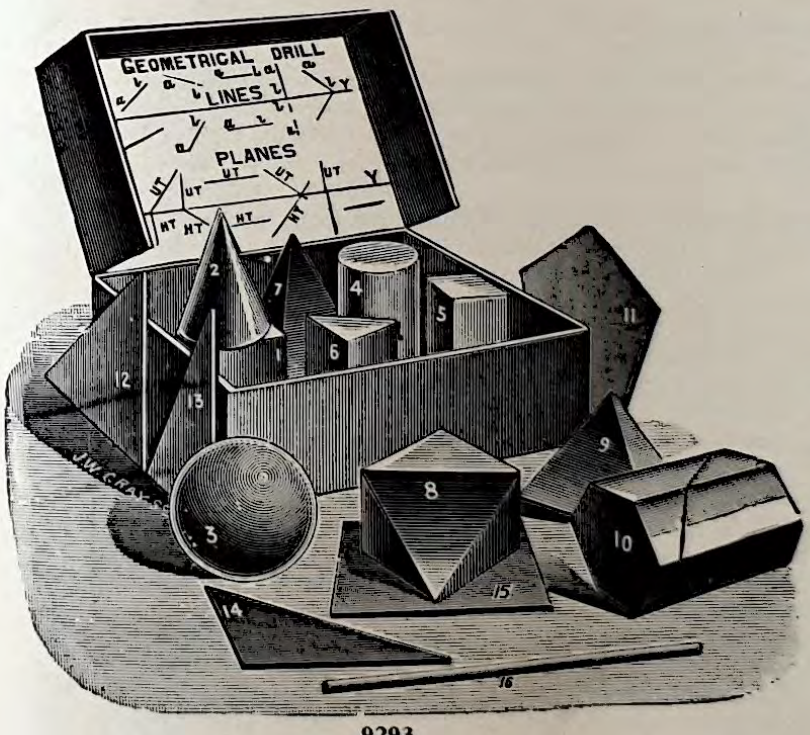
(F) **9290** **Drawing Boards,** best quality, with Clamped Ends... **2/4** **3/0** **4/0** **5/0** **6/0** **7/0** each

(F) **9291** **Special School Sets,** the Drawing Board is fitted at back as illustration, with T-Square divided Rule, two Set Squares and Pencil File.

Size	40 × 30	50 × 35	60 × 45 cm.
	9/0	**11/0**	**14/9** each

9292 **Drawing Pins,** best quality, with Brass Heads, the illustrations are actual size.

Nos.	1	2	3	4	
	3d.	**4d.**	**5d.**	**6d.**	per doz.
	2/9	**3/9**	**4/6**	**5/6**	per gross



9293

(F) Foreign manufacture

Geometrical Models

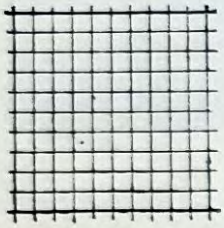
9293 The "Pupil's" Set of Geometrical Models, designed for the use of Students in Practical Plane and Solid Geometry, comprising 16 accurately finished Models and Figures in Hardwood, as illustrated. Box, with Hinged Lid and Elastic Band, complete ... ... nett **£0 3 9**

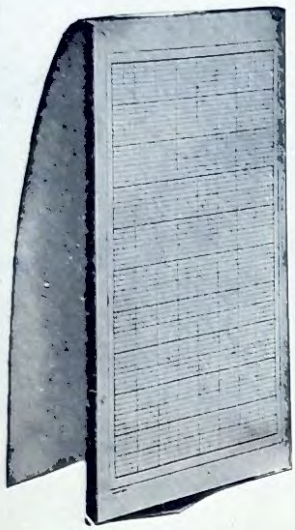
CONTENTS.

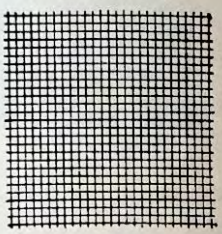
1. Cube
2. Cone
3. Sphere
4. Cylinder
5. Square Prism
6. Triangular Prism
7. Square Pyramid
8. Octahedron
9. Tetrahedron
10. Hex. Prism (section)
11. Pentagon
12. Equilateral Triangle
13. Isosceles Triangle
14. Right-angled Triangle
15. Square
16. Straight Line

9294 Geometrical Models, Set of 7, accurately cut, Cube, Cone, Cylinder, Square Pyramid, Triangular, Rectangular and Hexagonal Prism, in Cardboard Box... ... ... nett **£0 5 0**

Sectional Pads and Papers

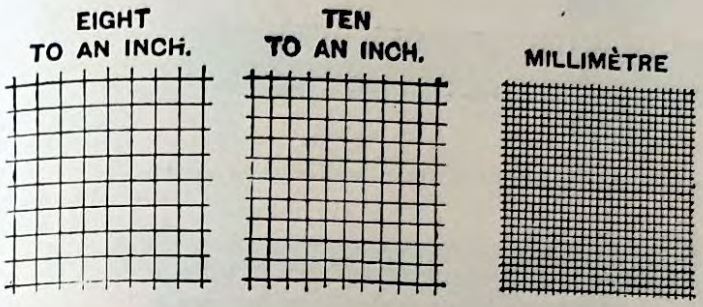






9295	**Sectional Pads,** printed blue one side, cream wove paper, fastened top edge to strong board, with cover 10×8 in., printed in millimetre, ½ and 1 centimetre squares both sides, 50 leaves, 10×8 in. ... ... each, nett	£0	1	0
9296	Ditto, ditto, 100 leaves, 10×8 in. ... ... ,, ,,	0	1	9
9297	**Sectional Pads,** containing 50 leaves ruled inches and $\frac{1}{10}$ths both sides, 10×8 in. ,, ,,	0	1	0
9298	Ditto, ditto, 100 leaves ... ... ,, ,,	0	1	9
9299	**Sectional Pads,** printed in Faint Green on White Paper and made up into pads of 50 sheets with flap cover, ruled inches, ½'s and $\frac{1}{10}$ths, size 12×9½ in. ... each, nett	0	5	0
9300	Ditto, ditto, as above, size 12×19 in. ... ... ,, ,,	0	9	6
9301	**Sectional Pads,** as above, ruled metric scale, size 12×9½ in. ... ... ,, ,,	0	5	0
9302	Ditto, ditto, size 12×19 in. ... ... ,, ,,	0	9	6
9303	**Sectional Pads,** printed in Bistre on Thin Transparent Paper and made up into pads of 50 sheets with flap cover, ruled inches, ½'s, and $\frac{1}{10}$ths, size 12×9½ in. ... each, nett	0	4	0
9304	Ditto, ditto, size 12×19 in. ... ... ,, ,,	0	7	6
9305	**Sectional Pads,** as above, ruled metric scale, size 12×9½ in. ... ... ,, ,,	0	4	0
9306	Ditto, ditto, size 12×19 in. ... ... ,, ,,	0	7	6
9307	**Sectional Pads,** printed in Red on Natural Tracing Paper and made up into pads of 50 sheets, with flap cover, ruled inches, ½'s and $\frac{1}{10}$ths, size 12×9½ in. each, nett	0	8	0
9308	Ditto, ditto, size 12×19 in. ... ... ,, ,,	0	15	0
9309	**Sectional Pads,** as above, ruled metric, size 12×9½ in. ... ... ,, ,,	0	8	0
9310	Ditto, ditto, size 12×19 in. ... ... ,, ,,	0	15	0
9311	**Science Note Books,** ruled $\frac{1}{10}$th inch squares with thicker line at every 5th square. Size 8×6½ in., 32 pages, stout coloured covers ... ... per gross, nett	1	2	6
9312	,, 8×6½ ,, 32 ,, ditto, with exercise on alternate pages ,, ,, ,,	1	2	6
9313	,, 8×6½ ,, 56 ,, ditto, ditto, marble covers ... ... per doz., nett	0	4	6
9314	,, 9×7 ,, 48 ,, ditto, ditto, manilla covers ... ... ,, ,, ,,	0	5	0
	Physics Note Books, accurately printed from plates on alternate pages showing millimetres and centimetres, opposite page ruled, exercise and margin for notes.			
9315	Size 8×6½ in., 32 pages, stout coloured cover ... ... per gross, nett	1	2	6
9316	,, 8×6½ ,, 56 ,, stiffened marble cover... ... ... per doz., nett	0	4	6
9317	,, 8×6½ ,, 128 ,, strongly bound, cloth up back, stiff boards ,, ,, ,,	0	10	0

Sectional and Tracing Papers



9319 **Sectional or Squared Paper,** English make, accurately ruled into inches and $\frac{1}{10}$ths, the inch lines thickened.

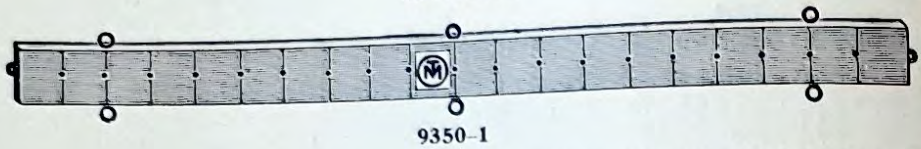
Size approx. 9×7 10×8 in.
8d. **9d.** per quire nett
8/0 **10/6** per ream nett

9320 Ditto, ditto, divided into centimetre and millimetre squares, the 1 cm. and $\frac{1}{2}$ cm. lines thickened.
Size approx. 23×18 25×20 cm.
9d. **1/0** per quire nett
10/6 **12/6** per ream nett

9321	**Sectional or Squared Paper,** cream wove, superior quality, scaled one side, grey, size 23×18 in., ruled either in $\frac{1}{8}$ths or $\frac{1}{10}$ths	per quire nett	£0	2 6
		per ream nett	2	0 0
9322	**Curve Paper,** 8¾×5½ in., ruled 1 in. squares, one side and divided in half inches and $\frac{1}{10}$th in. by red and blue lines	per ream nett	0	6 0
9323	Ditto, ditto, 23×18 in., ruled as above	„ „	1	17 6
9324	**Physics Paper,** 8×6½ in., ruled alternate pages, 1 in., $\frac{1}{2}$ in. and $\frac{1}{10}$ in. squares one side and exercise and margin the other, printed from machine engraved plates.	per ream nett	0	7 6
9325	**Physics Paper,** 12×9¼ in., ruled in 1 in., $\frac{1}{2}$ in. and $\frac{1}{10}$ in. squares, both sides.	per ream nett	1	2 6
9326	**Physics Paper,** 10×8 in., ruled in centimetre, $\frac{1}{2}$ centimetre and millimetre squares one side and exercise the other	per ream nett	0	12 6
9327	**Diagram Paper,** ruled $\frac{1}{10}$th squares with $\frac{1}{2}$ in. and 1 in. divisions in red and blue both sides, 9×7½ in.	per ream nett	0	8 0
9328	Ditto, ditto, 18½×15 in.	„ „	1	2 6
9329	**Sectional Paper,** English scales, in rolls of 10 yards×26 in., scale measurement 24 in., ruled $\frac{1}{10}$ths Green on Drawing Paper	per roll nett	0	10 6
9330	Ditto, ditto, ruled $\frac{1}{10}$ths Bistre on Drawing Paper	„ „	0	10 6
9331	Ditto, ditto, ruled $\frac{1}{10}$ths Grey on Drawing Paper	„ „	0	10 6
9332	Ditto, ditto, ruled $\frac{1}{10}$ths Brown on Tracing Paper	„ „	0	15 0
9333	Ditto, ditto, ruled $\frac{1}{20}$ths Brown on Tracing Paper	„ „	0	15 0
9334	Ditto, ditto, ruled $\frac{1}{10}$ths Brown on Tracing Cloth	„ „	2	10 0
9335	Ditto, ditto, ruled $\frac{1}{20}$ths Brown on Tracing Cloth	„ „	2	10 0
9336	**Sectional Paper,** metric scale, ruled Bistre, in rolls of 11 yards × 30 in., scale measurements 27 in.	per roll nett	0	9 0
9337	Ditto, ditto, ruled Green	„ „	0	9 0
9338	Ditto, ditto, „ Blue	„ „	0	9 0
9339	Ditto, ditto, „ Grey	„ „	0	9 0
9340	**Sectional Paper,** metric scale, ruled Bistre on stout Drawing Paper, as above.	per roll nett	0	10 6
9341	Ditto, ditto, ruled Green	„ „	0	10 6
9342	Ditto, ditto, „ Blue	„ „	0	10 6
9343	Ditto, ditto, „ Grey	„ „	0	10 6
9344	**Sectional Paper,** metric scale, as above on Tracing Paper, ruled Brown	„ „	0	15 0
9345	Ditto, ditto, as above but on Tracing Cloth, ruled Brown ...	„ „	2	10 0

Mechanics, Pneumatics, Hydrostatics

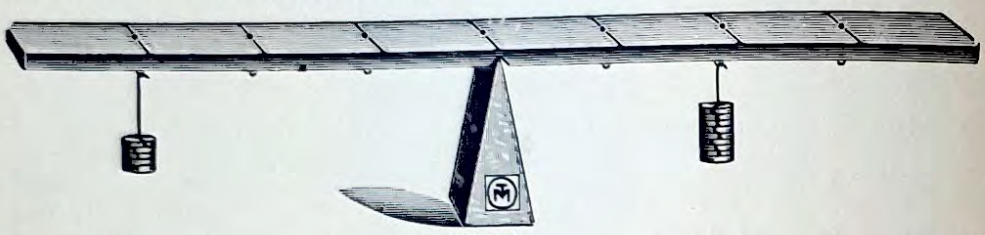
LEVERS.



9350–1

9350 **Lever,** Simple form, for suspension; Polished Oak, divided into twenty parts, with holes for weights. Length 3 ft. ... ... each £0 4 6

9351 Ditto, as above, of Polished Mahogany. Length 3 ft. ... ... ,, 0 5 6



9352–4

9352 **Lever,** with Wedge-shaped Fulcrum; Polished Oak, 4 ft. × 2 in. × $\frac{5}{8}$ in. thick, divided into eight equal parts, with Brass Rings below for suspension, without weights ... ... each 0 7 6

9353 Ditto, as above, of Polished Mahogany ... ... ,, 0 9 6

9354 Ditto, as above, of Polished Oak, complete with Set of $\frac{1}{10}$ lb. Weights ... ... per set 0 15 6

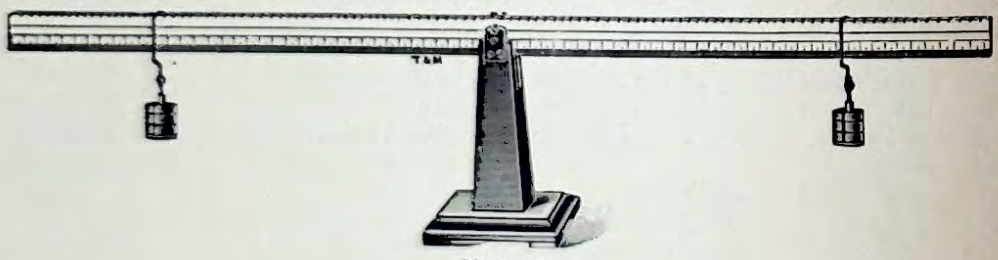
9355 Ditto, Boxwood, 1 metre long, graduated in inches and millimetres, with Wedge-shaped Fulcrum, without weights ... ... each 0 3 9



9356

9356 **Lever,** with movable fulcrum, Polished Boxwood, 1 metre long, divided in centimetres and millimetres on one edge and inches and tenths on the other, with holes drilled every 2 cm. and Hook and Pin adjustment for Fulcrum and Weight Supports ... ... each 0 5 9

9357 Ditto, ditto, cheaper quality, with plain Wooden Lath ... ... ,, 0 2 9

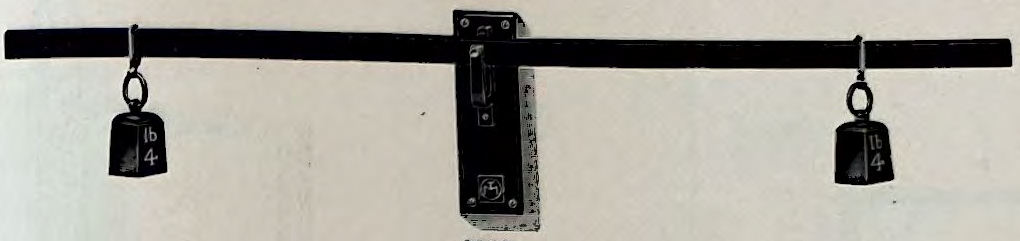


9358–60

9358 **Lever,** with fixed Knife Edge Fulcrum, Polished Boxwood, 1 metre long, divided in centimetres and millimetres on one edge and inches and tenths on the other, with notches cut every centimetre; mounted on Polished Oak Pillar and Base ... ... each 0 12 6

9359 Ditto, on Base as above, with Set of sixteen Slotted Weights, each $\frac{1}{10}$ lb., and two Carriers, as Fig. 9373 ... ... per set 1 0 0

9360 Ditto, as above, $\frac{1}{2}$ metre long, with ten Slotted Weights and two Carriers, each weighing $\frac{1}{20}$ lb. ... per set 0 8 6



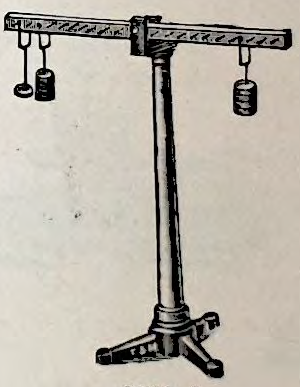
9362



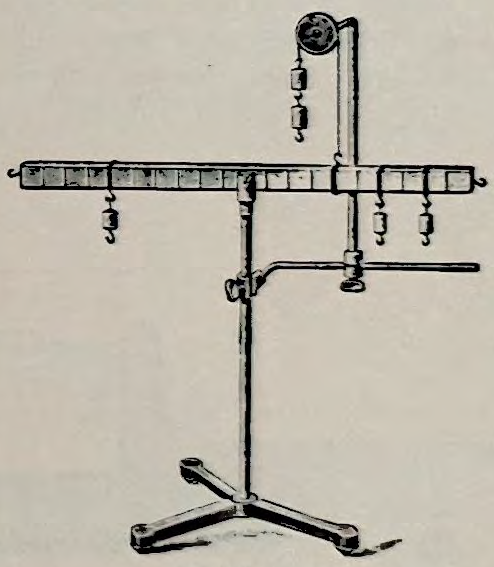
9361

9361 **Lever,** Boxwood, 1 metre long, divided in centimetres and millimetres on one edge and inches and $\frac{1}{10}$ths on the other; mounted on Teak support with knife edge, with Scale Pans and Suspenders complete **£0 7 9**

9362 **Lever,** Hardwood, 5 ft. long, $1\frac{1}{2} \times \frac{3}{4}$ in. with the upper edge divided every 1 in., the fulcrum being removable and can be adjusted into any of the holes, which are drilled every 6 inches, and is fitted into an Iron Bracket with Hardwood Base Plate **1 5 0**



9363-4

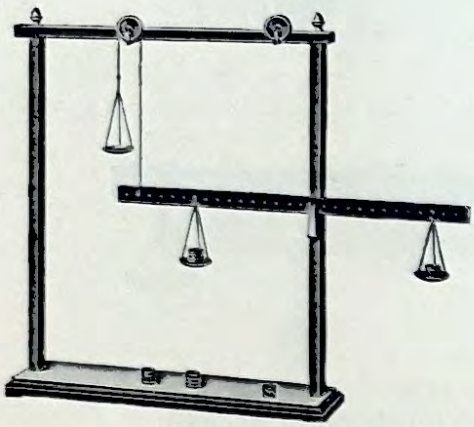


9365

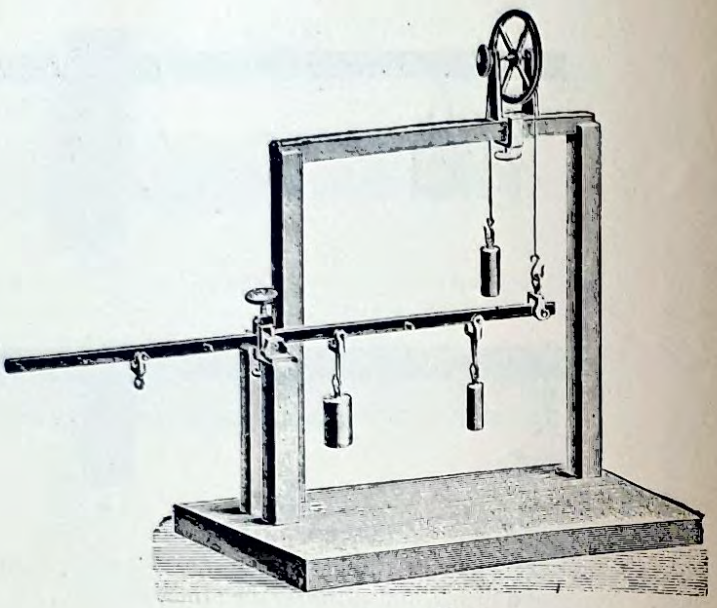
9363 **Lever,** Brass, 2 ft. long, divided into twenty equal parts, with Side Pins for Weights, mounted on Iron Stand with Tripod Foot, complete with sixteen Slotted Weights, each $\frac{1}{10}$ lb. **£1 10 0**

9364 Ditto, Polished Wood, and Stand, as above, with sixteen Slotted Weights, complete **1 4 0**

9365 **Lever,** 2 ft. long, mounted on Stand, with Pulley and ten Weights, $\frac{1}{10}$ lb. ... **1 10 0**



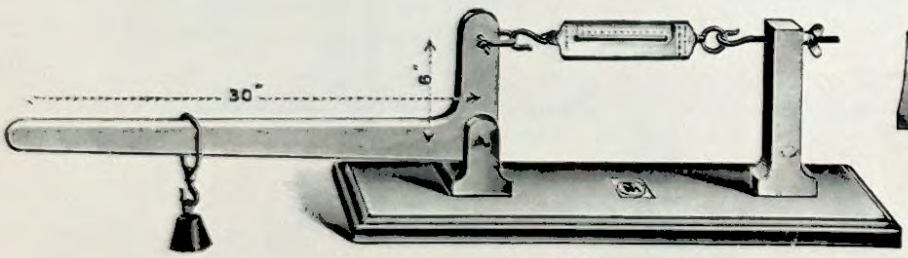
9366



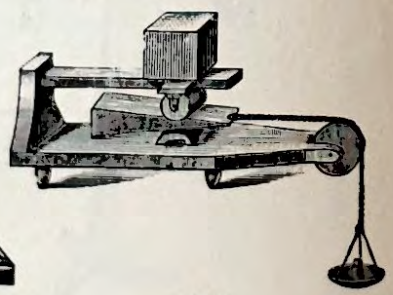
9367

9366 **Lever,** mounted in Frame, for Lecture Experiments; Polished Teak, 3 ft. high, fitted with Bracket to support Boxwood Lever of 1 metre in length, divided and holed every inch, complete with two Bracket Pulleys, three Scale-pans and Weights **£2 10 0**

9367 **Lever, Frick's,** Polished Brass, with Aluminium Pulley, mounted on Polished Mahogany Stand, complete with twelve Weights **5 0 0**



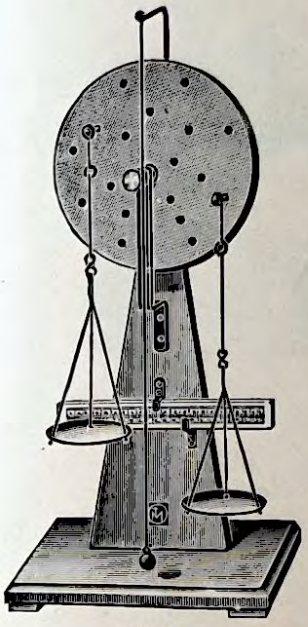
9368



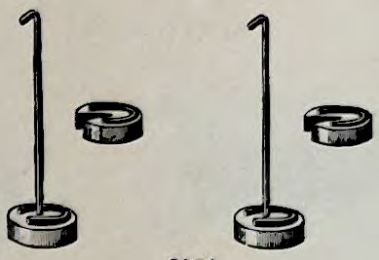
9369

9368 **Lever,** Bell Crank, Hardwood Lever, the Power Arm being 30 in. long, and Weight Arm 6 in. long between Fulcrum and Point of attachment, mounted on Polished Base 30×9 in., with Pillars and Screw Adjustment to Spring Balance, including Balance ... ... each **£1 7 0**

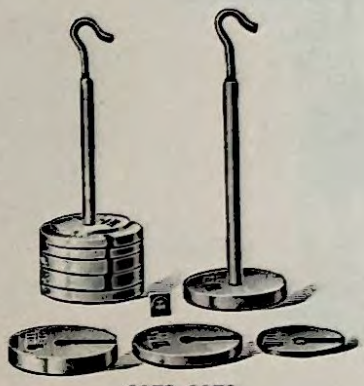
9369 **Wedge Apparatus,** Polished Mahogany, with Brass Rollers and Scale Pan ... **1 10 0**



9370



9371

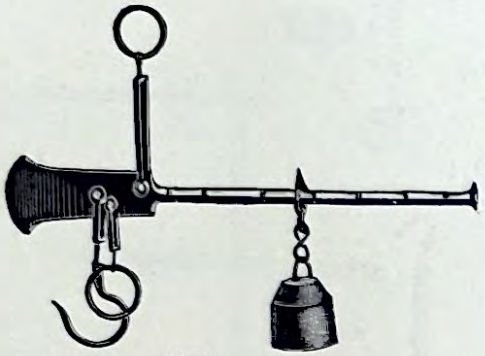


9372–9379



9380

9370	**Moments' Apparatus,** to verify the Law of, comprising Circular Disc with holes, mounted on Wooden Stand with Plumb Bob, Glass Scale, Pegs and Scale Pans, as "Schuster and Lee's Intermediate Course of Practical Physics" ... ... each	**£1 7 6**
9371	**Lever Weights,** Brass, Slotted, Set of 16, each $\frac{1}{10}$ lb. (four of which are fitted with bent suspension rod), provided with Knife Edges ... ...per set	**0 12 0**
9372	Ditto, Brass, Slotted, Set of 16, each $\frac{1}{10}$ lb. (four of which are fitted with Carriers with hooks) ... ...per set	**0 11 0**
9373	Ditto, Iron, as above ... ... „	**0 8 0**
9374	**Brass Slotted Weights,** for Levers, etc., $\frac{1}{10}$ lb. ... ... per doz.	**0 8 0**
9375	„ „ „ „ $\frac{1}{20}$ lb. ... ... „	**0 8 0**
9376	„ „ „ „ $\frac{1}{100}$ lb. ... ... „	**0 8 0**
9377	**Iron Slotted Weights,** $\frac{1}{10}$ lb. ... ... „	**0 6 6**
9378	**Brass Carriers** for above Weights, $\frac{1}{10}$ lb. ... ... „	**0 12 6**
9379	**Iron Carriers,** with Hook ... ... „	**0 9 0**
	For Iron Slotted Weights for Monochords, etc., see Nos. 10903, etc.	
9380	**Scale Pans,** Brass, with Silk Cords and Hook ... ... each **10d.,** per doz.	**0 9 0**
9381	„ „ Horn „ „ „ Diameter 6 7 8 9 cm.	
	1/2 1/4 1/6 1/8 each	
9382	**Pins and Hooks,** 6 of each, in Wood Slide Lid Box	**£0 1 3**
9383	**S Hooks,** Brass ... ... $\frac{3}{4}$ 1 $1\frac{1}{4}$ $1\frac{1}{2}$ in.	
	6d. 9d. 1/0 1/3 per doz.	
9384	**Cord,** about $1\frac{1}{2}$ mm. diameter ... ... per hank	**£0 1 3**
	thin thick	
9385	Ditto, Green Silk ... ... per doz. yards **1/0 1/6**	



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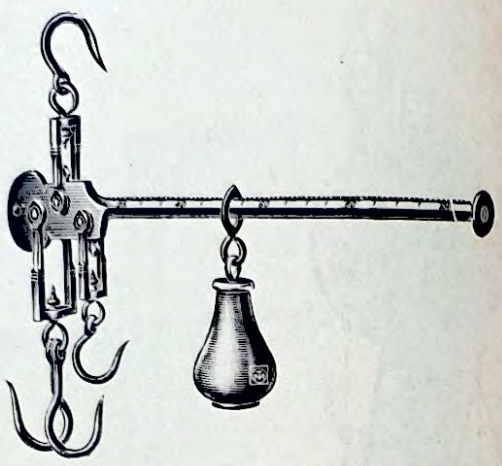


9388

9386 **Steelyard,** Roman, Iron, with Double Hooks and Fulcrums, giving two Mechanical advantages, and Sliding Weight on Graduated Arm ... ... each **£0 12 0**

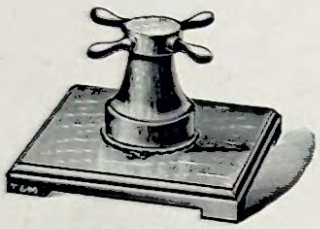
9387 Ditto, ditto, Polished Wood, with Brass Scale-pan, Weight and Fittings, with single Fulcrum ... ... each **0 8 0**

9388 Ditto, ditto, Best quality, Iron Lever supported on Knife Edge, to weigh to 50 lb. ,, **1 5 0**

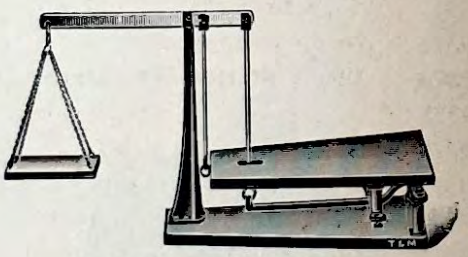
9389 Ditto, Danish, Steel, with Movable Steel Knife Edge Fulcrum, Brass Supporting Hooks and Weight of Constant Value ... ... each **0 10 6**



9390



9391-91/1



9391/2

9390 **Lever Letter Balance,** Brass, application of a Bent Lever of the first order.

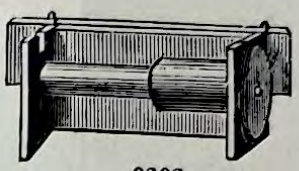
To carry	50	100	250	gm.
	2/6	**3/0**	**5/6**	each

9391 **Model of Capstan,** with Polished Hardwood Drum, and Levers, mounted on Blackwood Base ... ... each **£0 12 6**

9391/1 Ditto, with Boxwood Drum and Brass Levers, mounted on Polished Mahogany Base ,, **0 15 0**

9391/2 **Model of Weighbridge,** can be used as ordinary Balance ... ... ,, **2 0 0**

Wheel and Axle



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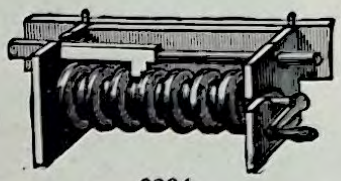

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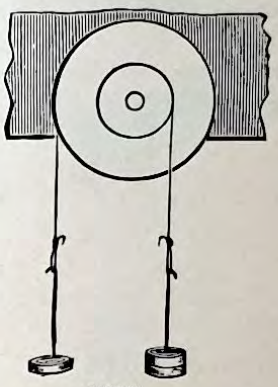
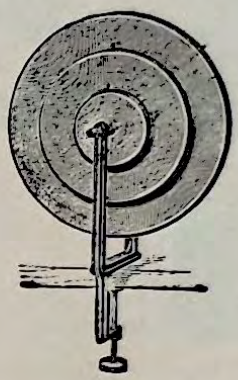


9392



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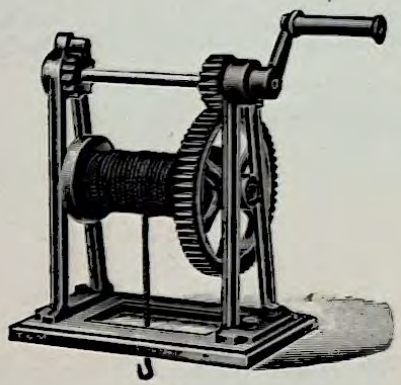
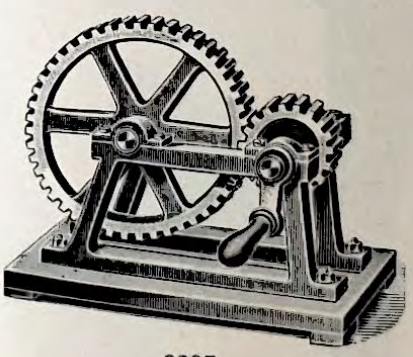


9396

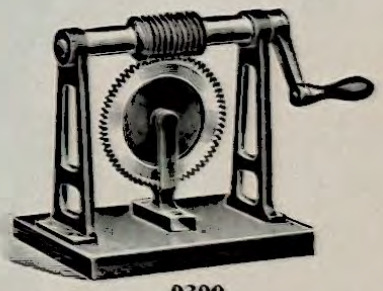
9392	**Wheel and Axle,** Simple form, Polished Wood, with Brass Spindle, diameter of Wheels 3 in. and 6 in. ... ... each	£0 3 0
9393	Ditto, Compound, or Chinese, in Wood Bracket, with Bracket for support ,,	0 16 6
9394	Ditto, as Fig. 9393, together with Flat Thread Screw, complete with one Bracket ...	1 12 6
9395	Ditto, with three Wheels mounted on one Axle, the diameters being as 1, 2, 3, with Iron Clamp, complete ... ... each	1 0 0
9396	Ditto, Winch, Working Model, application of Compound Wheel and Axle, Iron Wheels, Boxwood Drum, Pawl and Ratchet, and Crank Handle, mounted in Iron Frame and Base ... ... each	1 15 0



9397

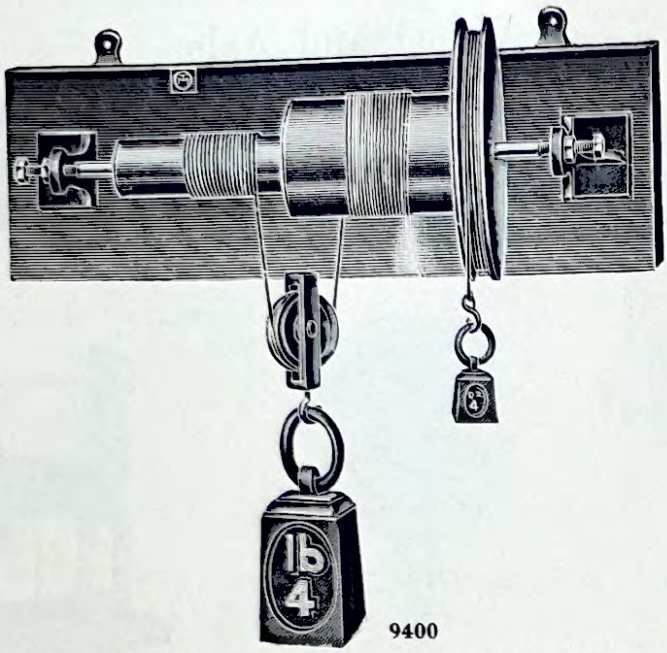


9398



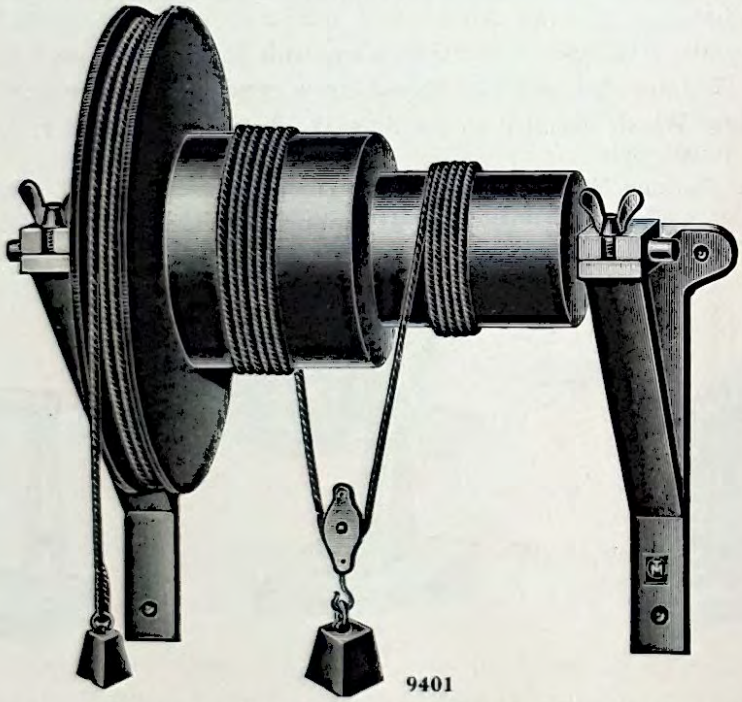
9399

9397	**Spur Wheels,** of Metal, with External Tooth Contact, on Polished Hardwood Base	£1 12 6
9398	**Bevelled or Mitre Gear Wheels,** with Metal Pillar, mounted on Polished Hardwood Base...	1 15 0
9399	**Endless Screw,** Model, of Metal, on Polished Hardwood Base	1 7 6



9400

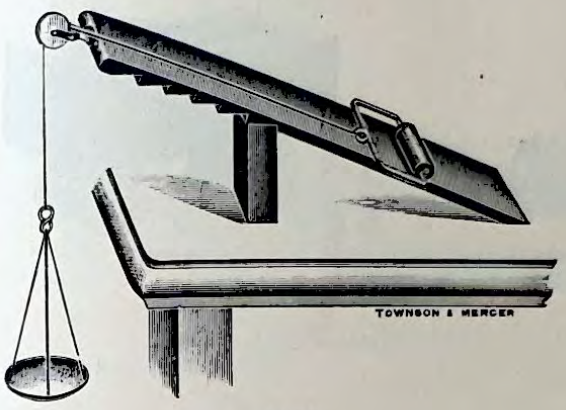
9400 **Wheel and Axle,** Compound, diameter of Wheel 6 in., diameter of Axle 3 in., mounted on Iron Brackets with Steel Centre Rod, with Adjusting Screws fitted on Teak Board with Single Pulley Block and Cord complete... ... ... **£1 8 6**



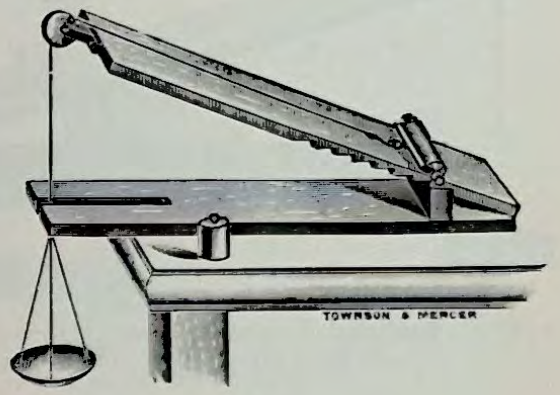
9401

9401 **Wheel and Axle,** Compound or Differential, Polished Hardwood, with Steel Spindle, Wheel 12 in. diameter × 1½ in. wide, the Axles being 5 in. long × 5⅜, and 3⅜ in. diameter respectively, complete on Iron Wall Brackets (*vide* Well's "Mechanics," Fig. 53), with Cord, Pulley Block and Scale-pan **£2 17 6**

Inclined Plane, Wedge and Screw



9402

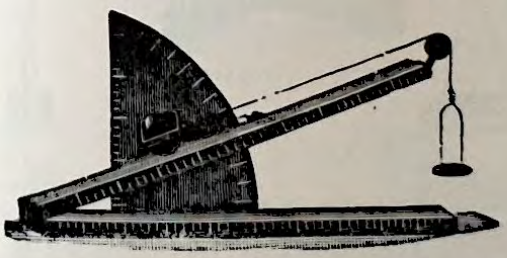


9403–4

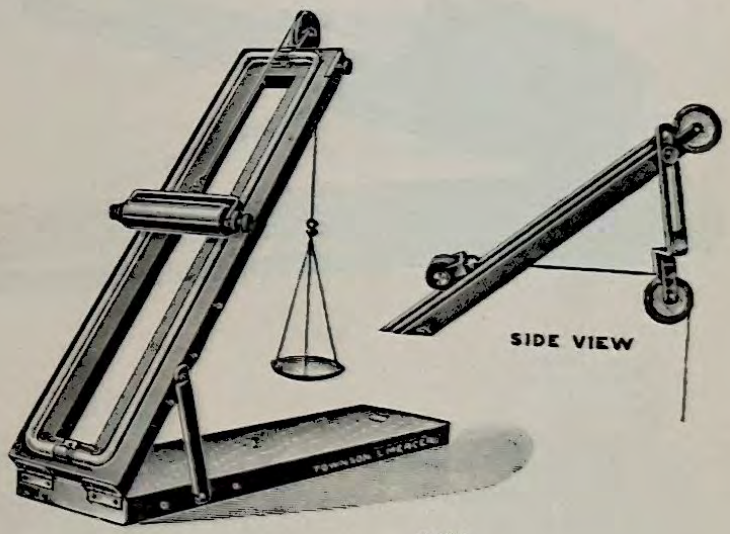
9402 **Inclined Plane,** Simple form, with Block to alter Gradient Angle, Pulley and Metal Roller with two Wires, one being for use when application of Power is parallel to base of the Plane **£0 10 6**

9403 Ditto, with two Polished Boards hinged together; the one forming the Plane has fixed Pulley, and is grooved on underside to suit angle block, with Brass Roller having Set Screw Adjustable Bearings and Scale Pan **0 15 0**

9404 Ditto, as above, Polished Mahogany **1 1 0**



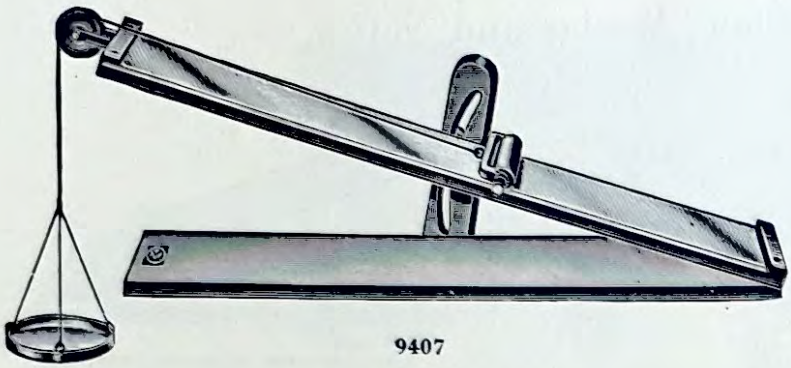
9405



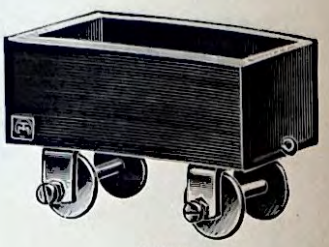
9406

9405 **Inclined Plane,** Polished Mahogany, with Graduated Quadrant and Scales... ... **£1 12 6**

9406 Ditto, designed by W. J. Woodhouse; Polished Mahogany, with Brass Support and Pegs to vary the angle of inclination. Friction is reduced to a minimum by using glass as a track, so that the point of contact is very small; the centre of the Plane is cut away to allow application of Power parallel to the Base by means of the extension arm and pulley **1 18 6**



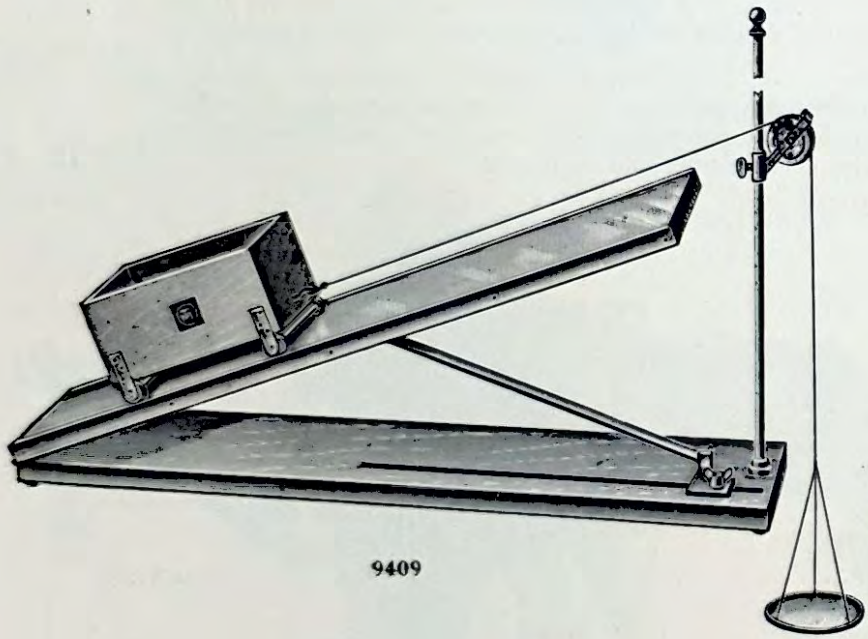
9407



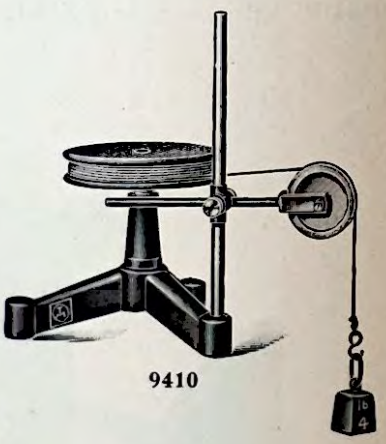
9408

9407 **Inclined Plane,** Polished Mahogany, fitted with Aluminium Pulley, heavy Brass Roller Plate Glass surface, and Scale-pan, complete ... ... each **£1 15 0**

9408 **Carriage,** Polished Teak, mounted on frictionless wheels for use with Inclined Planes each **0 7 0**



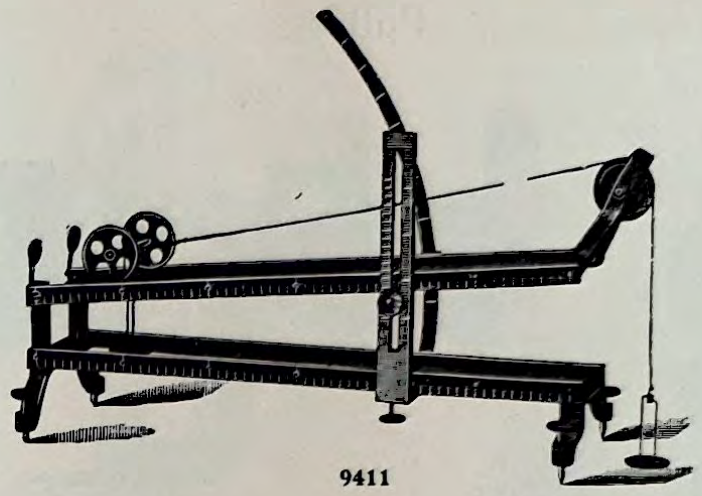
9409



9410

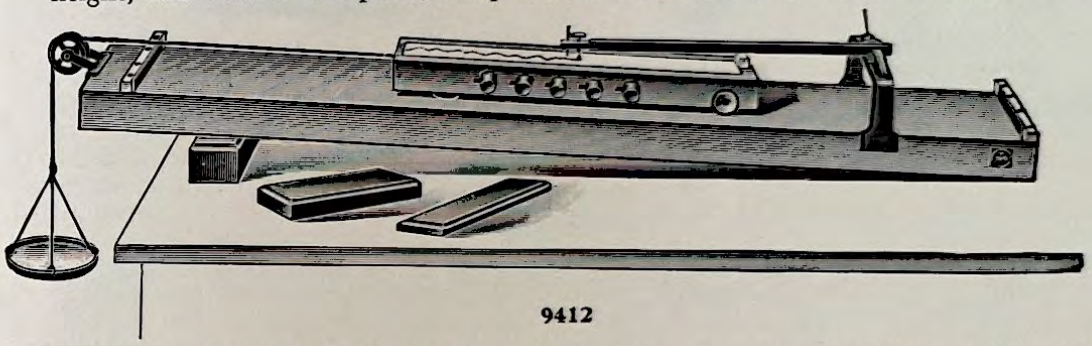
9409 **Inclined Plane,** 30 in. long × 7 in. wide, and 1 in. thick, having one of its faces covered with a sheet of glass. One end of the board is hinged to a stout base-board, and the other is raised by a hinged stay and sliding winged nut and bolt. The upright stay bears a grooved Aluminium Pulley, with Steel Cones running in Steel Bearings, with very little friction, which is adjustable to the centre line of the plane. A small box trolley, about 7½ × 5 in., running on Brass or Aluminium Wheels with Steel Spindles, and a Brass Scale-pan is also provided (*vide* Wells' "Practical Mechanics," Fig. 15) **£2 15 0**

9410 **Model Screw Jack,** the top being fitted with Hardwood Pulley Wheel, 6 in. dia., Side Pulley, Aluminium, 2 in. dia., with ball bearings, on Heavy Iron Stand **1 10 0**



9411

9411 **Inclined Plane,** Bertram's, made entirely of Iron and Brass, graduated to measure the length, height, and base of the plane; complete, with Roller, Pulley and Scale Pans ... **£6 15 0**

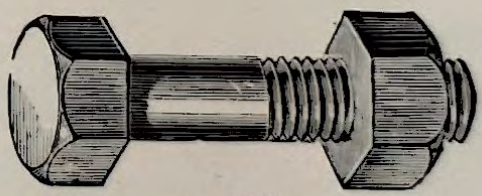


9412

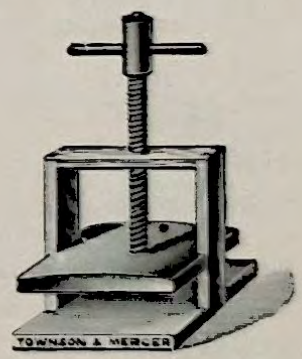
9412 **Fletcher's Trolley and Inclined Plane Apparatus,** consists of a Plane and long Trolley on Wheels, Vibrator and Brush, Pulley Wheel, Jockey, Scale Pan and Brass Weights for loading the Trolley, etc. ... ... price **£4 17 6**



9413



9414



9416

9413	**Wedge and Split Block,** Stained Blackwood, bound with Rubber Bands, Wedge 6×3½ in., Block 7×4 in.	**£0**	**5**	**6**
9414	**Screw, Model,** Iron ... ... per doz.	**0**	**2**	**0**
9415	Ditto, Wood, about 18 in. long × 2½ in. diameter ... ... each	**0**	**7**	**6**
9416	**Screw Press Working Model,** Hardwood, application of the Screw	**0**	**12**	**6**

Pulleys

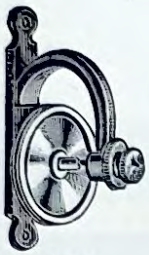

9420

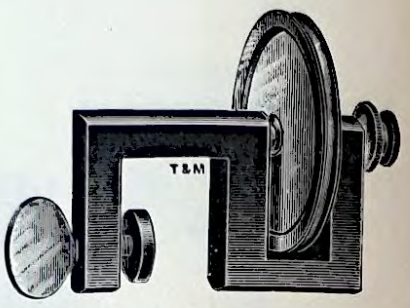

9422


9423

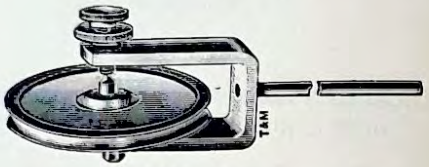

9425–9430


9424


9435

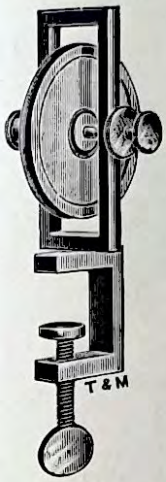


9436–7

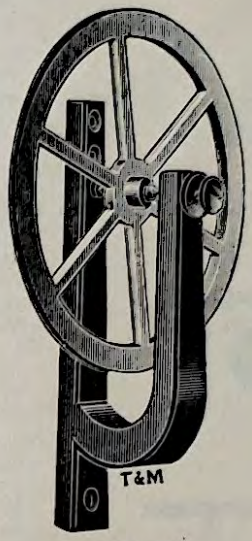


9438–41

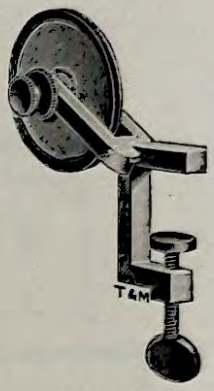
9420	**Pulleys,** Boxwood,	Single Sheave,	1½ in. diameter	**1/0** ...	2½ in. diameter,	each	£0	1	3
9421	„	„	Double	„	„	„	**1/6** ...	„	„	0	2	0
9422	„	„	Triple	„	„	„	**2/0** ...	„	„	0	2	9
9423	„	„	„	„	Long Shape		**2/3** ...	„	„	0	2	9
9424	„	„	„	„	Differential	...	...	„	„	0	3	9
9425	**Pulleys,** Brass, with Steel Bearings and Adjusting Screws to same, well turned and finished.											
			Single Sheave ...	...	...	...	...	...	...	each	£0	2	6
9426	„	„	Double	„	...	...	...	...	...	...	...	„	0	4	6
9427	„	„	Triple	„	...	...	...	...	...	...	...	„	0	6	0
9428	„	„	„	„	Long Shape ...		....	...	...	...	...	„	0	6	6
9429	„	„	„	„	Differential ...		...	...	...	...	per pair		0	16	0
9430	**Pulleys,** Aluminium, with Steel Cones running in Adjustable Steel Bearings, highest finish, very little friction.											
			Single Sheave ...	...	...	...	...	...	...	each	£0	2	9
9431	„	„	Double	„	...	...	...	...	...	...	...	„	0	5	0
9432	„	„	Triple	„	...	...	...	...	...	...	...	„	0	7	0
9433	„	„	„	„	Long Shape		...	...	...	...	...	„	0	7	0
9434	„	„	„	„	Differential ...		...	...	...	...	per pair		0	17	6
9435	**Pulleys,** Aluminium, Steel Cone Bearings, Adjusting Screw with Locking Nut, both having Milled Edge mounted in Iron Frame, for fixing at any angle to the Board ea.										£0	5	0
9436	Ditto, ditto, as above, in Heavy Brass Frame with Clamp to fix to Board or Table										„	0	5	0
9437	Ditto, ditto, as above, in Iron Frame ... ... „											0	4	6
9438	Ditto, ditto, 2 in. diameter, Steel Cone Bearings, Adjusting Screws with Locking Nuts, both having Milled Edges, mounted on Brass Frame, with Steel Rod for fitting to retort stand, etc., by means of an Iron Boss ... ... each											0	3	9
9439	Ditto, as above, with Brass Wheel... ... ... „											0	3	6
9440	Ditto, Aluminium, 1½ in. diameter, Steel Cone Bearings, Ordinary Adjusting Screws in Brass Frame, with Steel Rod ... ... each											0	3	6
9441	Ditto, ditto, 1-in. Wheel ... ... „											0	3	0



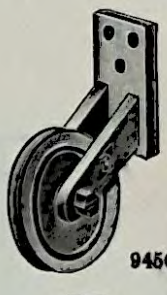
9442–3



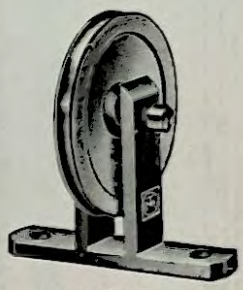
9446–7



9444–5

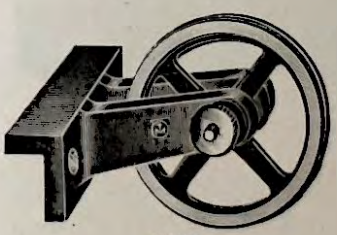


9450–1



9448–9

9442	**Pulleys,** Aluminium, Steel Cone Bearings, Adjusting Screws with Locking Nuts both having Milled Edges, mounted in Brass Frame, with Clamp ... ... each	£0	8	0
9443	Ditto, ditto, with Ball Bearings ... ... ,,	0	10	6
9444	Ditto, ditto, another form	0	7	0
9445	Ditto, ditto, with Ball Bearings	0	9	6
9446	Ditto, ditto, 5 in. diameter, Steel Cone Bearings, in Strong Iron Bracket, suitable for Attwood's Machines, etc. ... ... each	0	13	6
9447	Ditto, ditto, 3 in. diameter ... ... ,,	0	8	6
9448	Ditto, ditto, 1½ in. diameter, Steel Cone Bearings, with Adjusting Screws in Brass Frame, for Inclined Planes, etc. ... ... each	0	3	6
9449	Ditto, Brass, 1 in. dia., with Steel Cone Centre and Adjusting Set Screws, in Iron Frame each	0	2	6
9450	Ditto, Aluminium, 1½ in. dia., with Steel Cone Centre and Adjusting Set Screws in Brass Frame ... ... each	0	3	6
9451	Ditto, ditto, 1 in. dia.	0	2	6



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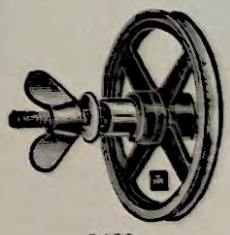

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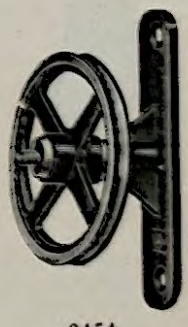
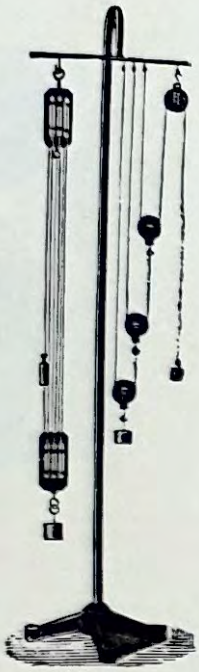


9454

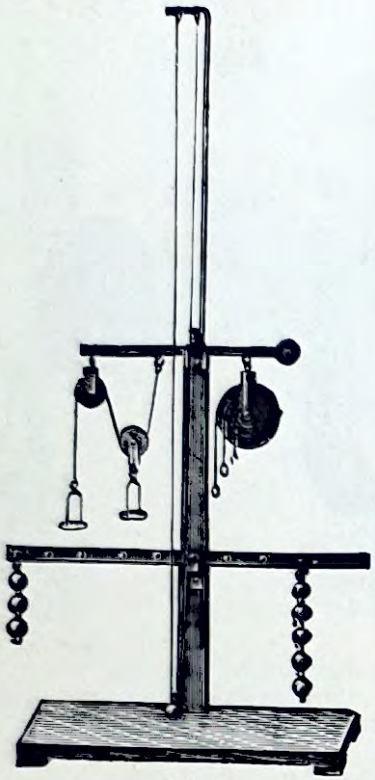
9452	**Pulleys,** Aluminium Wheels, Ball Bearings for Inclined Planes, etc. ... ... each	£0	5	6
9453	Ditto, ditto, suitable for Parallelogram of Forces, Boards, etc. ... ... ,,	0	5	6
9454	Ditto, ditto, ,, ,, ,, ,, ... ,,	0	5	6



9455



9456



9457

9455 Pulleys, Differential, Model of Weston's, Brass, with Endless Chain and Weight, mounted on Iron Stand... ... ... **£1 10 0**

9456 Ditto, Boxwood, in Wooden Frames, two systems arranged on Iron Stand with Tripod Foot, including Weights **1 10 0**

9457 Set of Apparatus, for demonstrating the Principle of the Lever, Wheel and Axle, etc., mounted on Polished Wood Stand, with Weights, complete ... **2 5 0**



9458



9459



9460



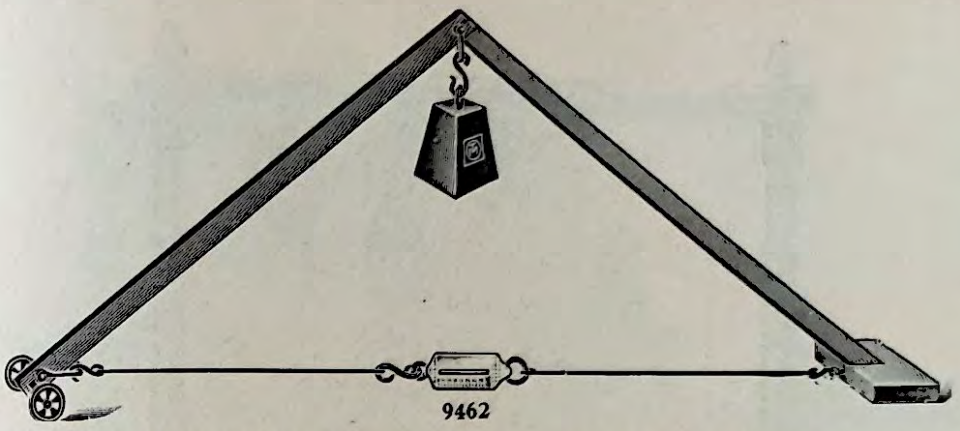
9461

Pulleys, Iron, with Hook, mounted in Mild Steel Blocks, with divisions between each sheave, giving extra support to the spindles.

		Size of Sheave	$2\frac{1}{2}\times\frac{3}{8}$	$3\frac{1}{2}\times\frac{1}{2}$	$4\times\frac{5}{8}$	$4\frac{3}{4}\times\frac{3}{4}$	$5\times\frac{7}{8}$	6×1	in.
9458	... ...	One Sheave	**5/0**	**6/0**	**7/6**	**10/6**	**13/0**	**15/0**	each
9459	Ditto	Two Sheaves	**7/0**	**10/0**	**11/6**	**14/6**	**19/0**	**22/0**	,,
9460	Ditto	Three ,,	**9/0**	**11/6**	**14/6**	**19/0**	**25/0**	**29/0**	,,

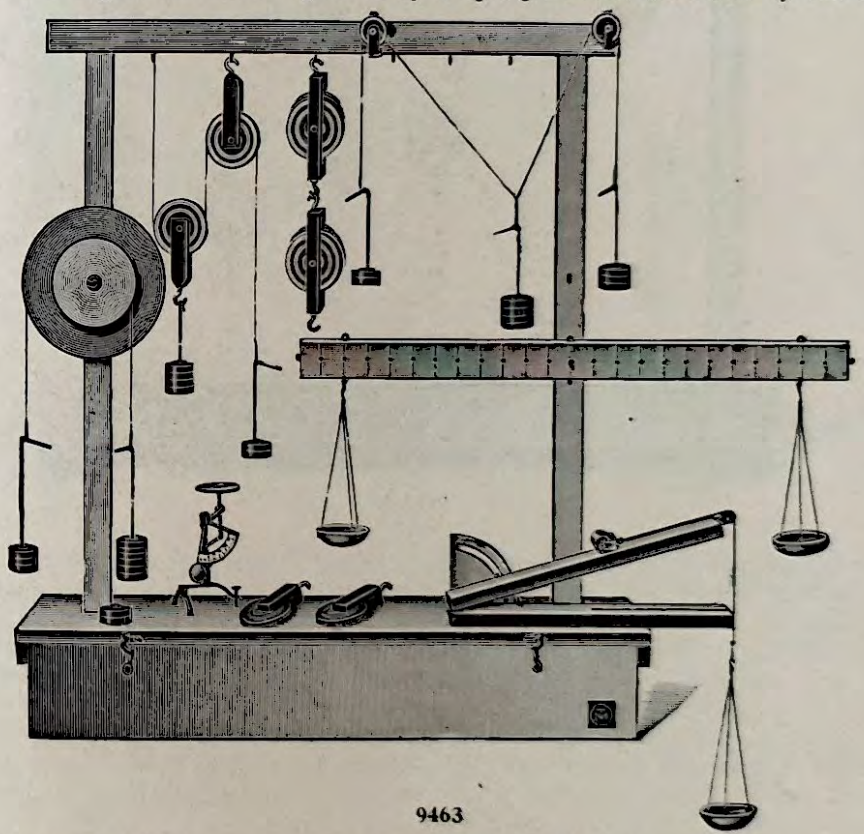
9461 Ditto, Weston's Differential, Iron in Malleable Cast Iron Frames with 30 feet of Endless Chain to raise Weight—

Tested to ...	5	10	cwt.
With Guides	**£1 12 6**	**£1 16 6**	per set



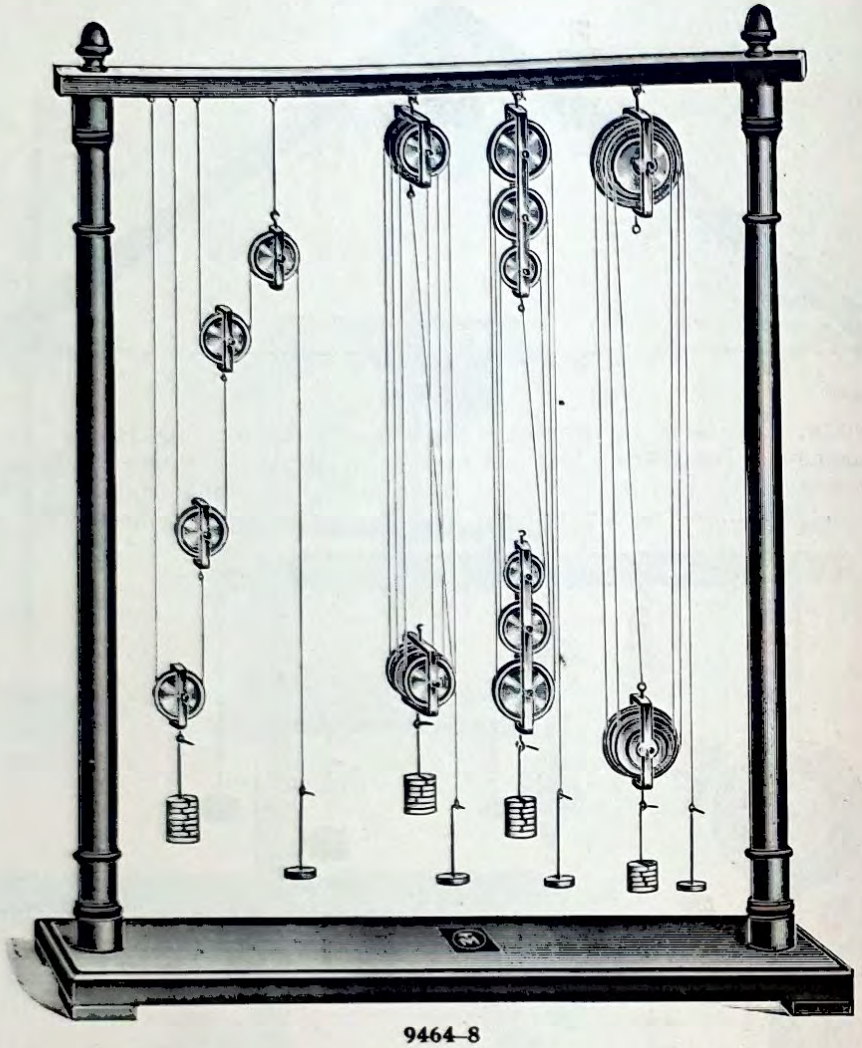
9462

9462 **Roof Truss,** Apparatus to determine the forces acting on the Beams, tie, etc. Teak Frame fastened by a loose-fitting bolt and nuts with Stirrup Hook for the Weights. The Frame is supported at one end by a Wooden Block and at the other end by a wheeled Trolley. The force acting on the tie is registered by a Spring Balance connected by cords **£0 18 6**



9463

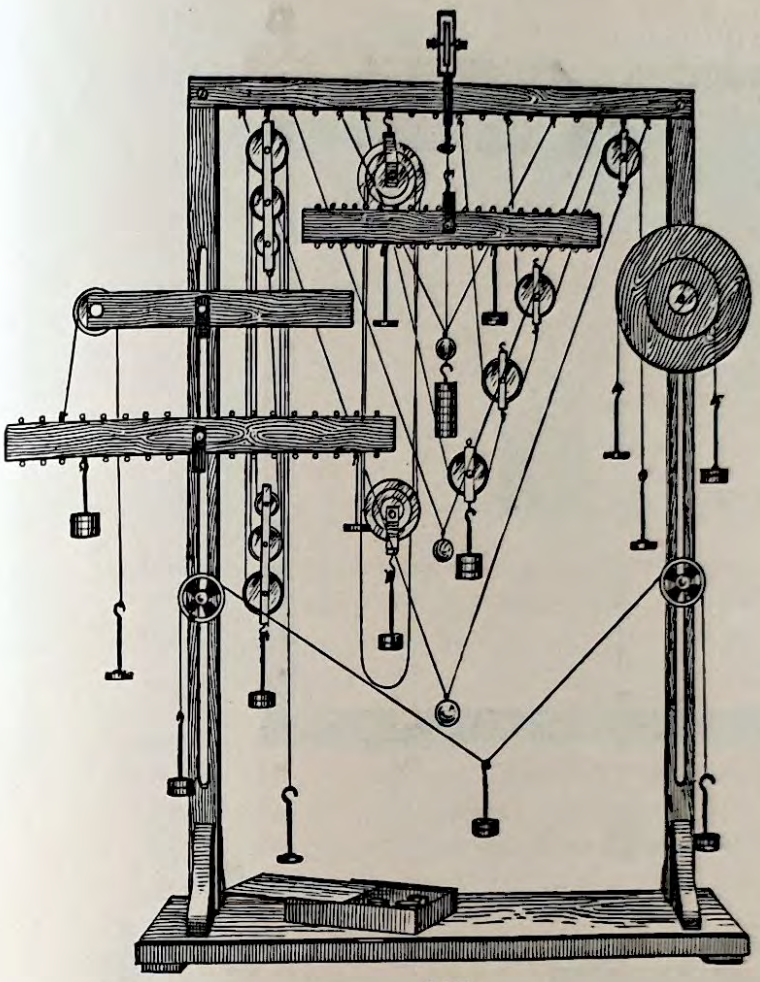
*9463 **Experimental Set,** for demonstrating the principles of Mechanics, consisting of 2-ft. Lever divided into 24 equal divisions, with movable fulcrum for demonstrating the three orders of Levers, and Horn Pans showing the simple balance; 50-gm. Balance showing bent lever, simple wheel and axle; four single and two triple Pulleys illustrating the three systems; two Aluminium Bracket Pulleys for parallelogram of forces; Inclined Plane with Arc Adjustment and Brass Roller; Portable Frame with Screw Eyes for support of the various apparati, the whole packing into a Stained and Polished Cabinet; complete as illustrated **£3 5 0**



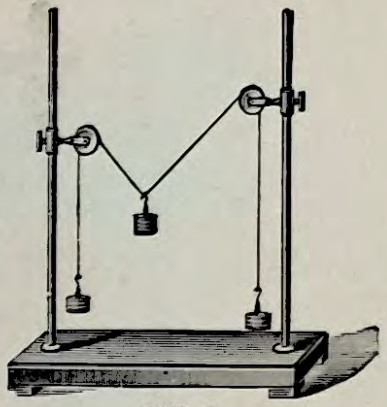
9464–8

9464	**Pulleys, Systems of,** Brass, with Steel Cones running in Steel Centres, highest finish, very little friction. Four Single, two each Triple, Triple Long-shape and one pair of Differential Pulleys, mounted in Stained Hardwood Frame with Turned Pillars, 3 ft. high, 2 ft. 6 in. wide, complete with Hooks and Silk Cord (without Weights)	**£4**	**7**	**6**
9465	Ditto, ditto, but with 3 Single, 2 each Triple Side by Side and Long-shape, with Hooks and Cord (without Weights)	**3**	**2**	**6**
9466	Ditto, ditto, Boxwood, four Single, two each Triple, Triple Long-shape and one each Triple and Double Differential Pulleys, mounted in stained Hardwood Frame, with Turned Pillars, 3 ft. high, 2 ft. 6 in. wide, complete with Hooks and Silk Cord (without Weights)	**2**	**17**	**6**
9467	Ditto, ditto, Boxwood, four Single, two each Triple, Triple Long-shape, and one each Triple and Double Differential Pulleys, mounted in Stained Blackwood Frame, with Square Pillars 3 ft. high, 2 ft. 6 in. wide, complete with Hooks and Silk Cord (without Weights)	**2**	**5**	**0**
9468	**Pulley Frame** only, for Nos. 9464 and 9466	**1**	**10**	**0**
9469	„ „ „ „ No. 9467...	**0**	**16**	**6**

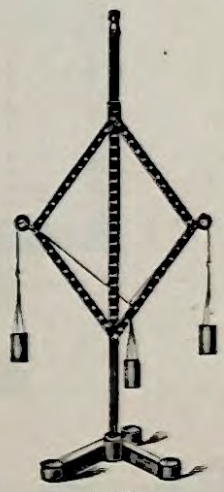
For Weights for use with the above, see under Nos. 9371, etc.



9470



9471-2



9473

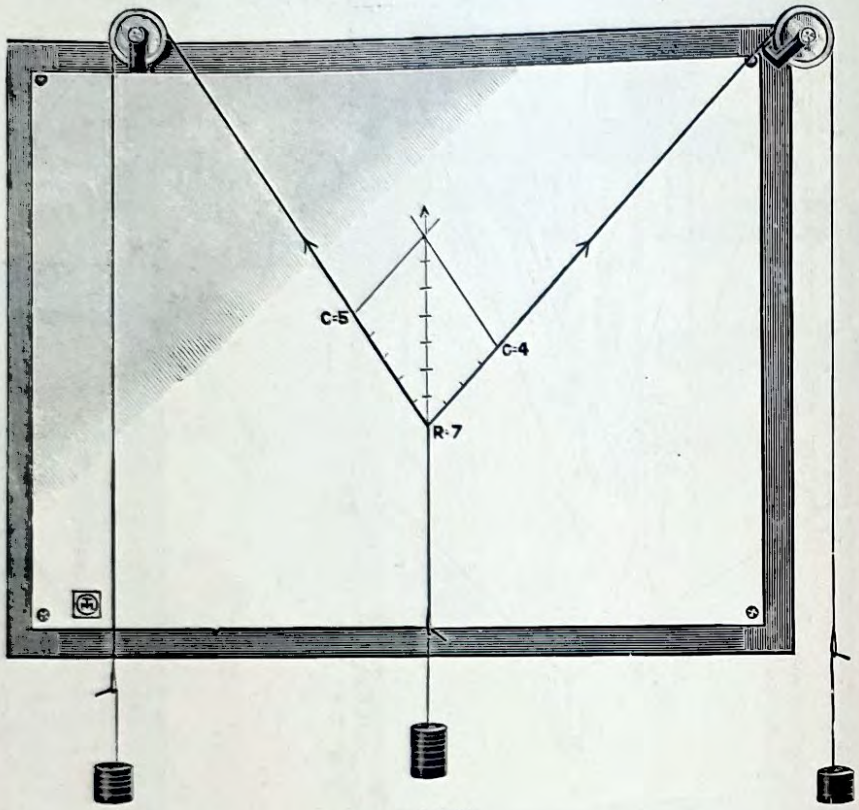
9470 **Apparatus for Demonstrating the Laws of Mechanics,** consisting of Polished Mahogany Stand, height 3 ft., width 2 ft., 2 Triple Pulleys, 2 Differential ditto, 4 Single ditto, 2 Pulleys to show Parallelogram of Forces with ball bearings. All Pulleys of Aluminium. Lever Arm, Lever with fixed fulcrum, Lever with adjustable ditto. Wheel and Axle, 4 Pendulums, 20 Slotted Weights and Carriers, with Cord and fittings complete **£7 15 0**

9471 **Parallelogram of Forces Apparatus,** Gravisande's, two adjustable Pulleys mounted on Iron Pillars, with Polished Hardwood Base, complete with twelve Weights and Carriers **1 2 6**

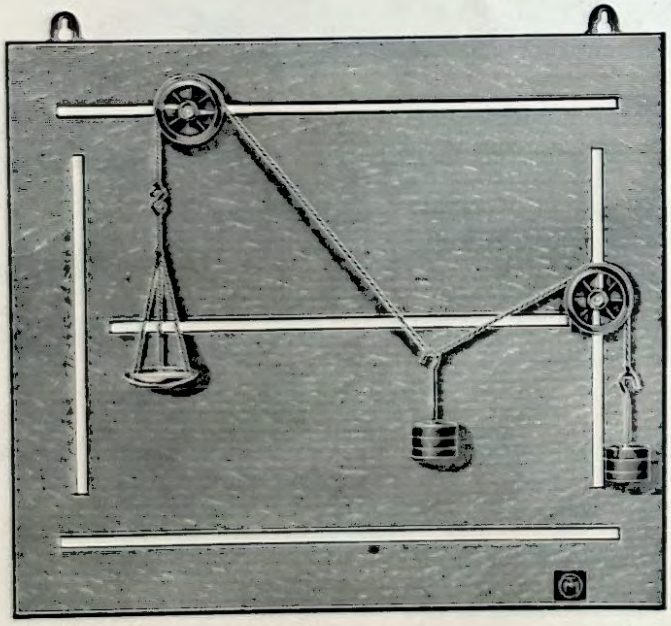
9472 Ditto, as above, best make, with Brass Pulleys and Pillars, mounted on Polished Mahogany Base, complete with Weights and Carriers... ... ... **1 7 6**

9473 **Parallelogram of Forces Apparatus,** Frick's, Polished Brass with Pulleys mounted on Iron Upright with Tripod Foot. The four Arms are bored at equal distances and are adjustable to coincide with different component forces, the Upright being also divided and thus giving the Resultant direct... ... ... **2 2 0**

Parallelogram of Forces



9474



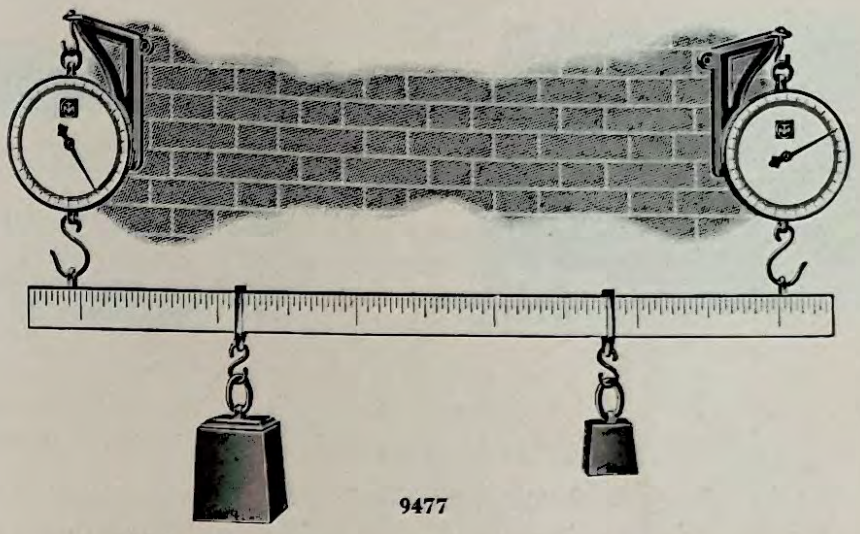
9476

9474 Parallelogram of Forces Apparatus, two Aluminium Pulleys with Steel Cones and Bearings, very little friction, mounted in Brass Frames with Clamps for attaching to Board, Board 31×23 in., complete with Wall Brackets, but without Weights **£1 7 6**

9475 Ditto, Polygon of Forces Apparatus, with four pulleys (*vide* Wells' "Mechanics," Fig. 18) **£1 15 0**

9476 Parallelogram of Forces Apparatus, consisting of Force Board, five-ply, with Slots, size 20×17 in., with Wall Brackets and two Aluminium Pulleys with Ball Bearings (but without Weights) **£1 2 6**

Stress, Strain, and Elasticity



9477

9477 **Apparatus,** to determine the Reaction at the Supports of a Beam. Hardwood Beam, 5 ft. long by 2 in. by 1 in., divided into inches, with two Rider Hooks, two Circular Spring Balances, reading 40 lb. by 2 oz., with two Wall Brackets complete (*vide* Wells' "Mechanics") **£3 10 0**

9478 **Apparatus,** to determine Beam Deflection, Knife-edges mounted on two Heavy Iron Stands, with Tripod Feet and Levelling Screws, Rod of Tool Steel, 3½ ft. by ½ by ¼ in., Sliding Rider and Hook with Scale-pan for weights. The deflection is measured by a pointer in front of an adjustable Silvered Glass Scale, divided into mm.; mounted on Iron Stand with Tripod Foot and Levelling Screws **3 15 0**



9479

9479 **Crane Apparatus** to determine forces acting on the Jib, Tie-rod, etc., of a simple Crane when loaded. The Compression Balance reads 14 lb. by 1 oz., and the Tension Balance 8 lb. by 2 oz. (*vide* Wells' "Mechanics" page 19) ... **£2 10 0**

9480 Ditto, ditto, as above, but with Hinged Backboard, with Plates to fix to wall, thus allowing Jib to be set at different angles. The Compression Balance reads 28 lb. by 2 oz., and the Tension Balance 20 lb. by 4 oz. (*vide* Wells' "Mechanics") ... **£3 5 0**



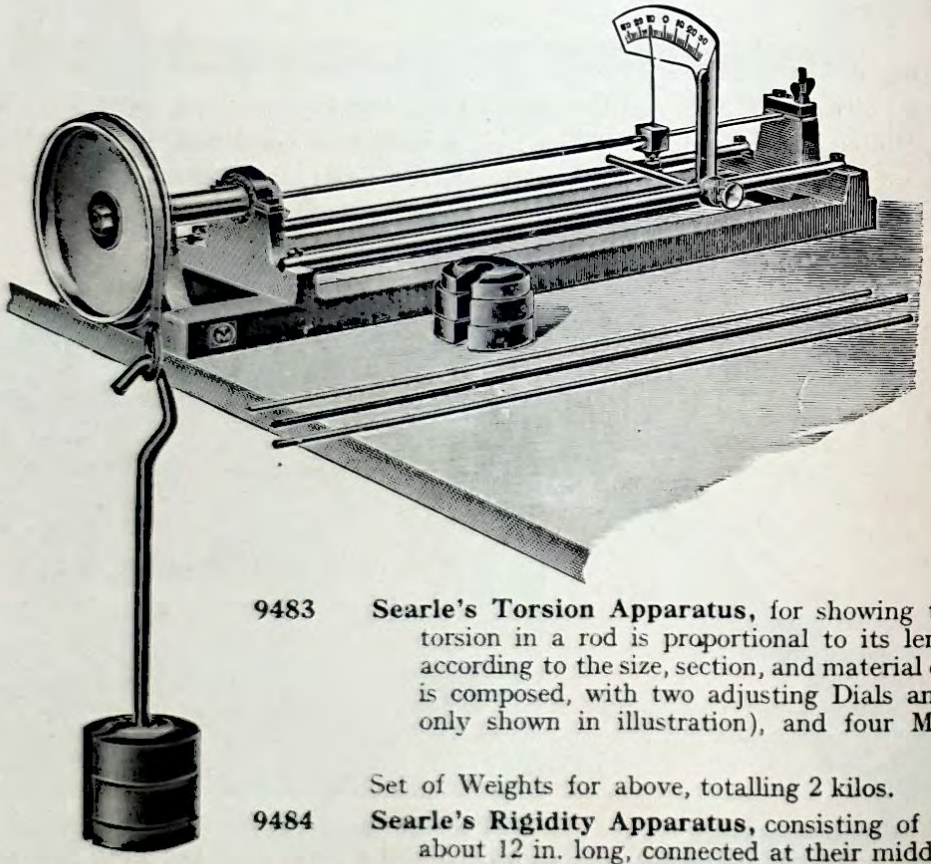
9481–2

9481 **Tubular Compression Balance,** Polished Brass Tubes with Socket ends, Steel Pointers, for experimental work in Mechanics.

No. 15	to indicate	6	lb.	× 4	oz.	...	...	...	...	...	each	£0	12	6
,, 16	,,	10	,,	× 4	,,	...	...	...	...	...	,,	0	17	0
,, 17	,,	6	,,	× 8	,,	...	...	...	...	...	,,	0	12	0
,, 18	,,	10	,,	× 8	,,	...	...	...	...	...	,,	0	12	6
,, 19	,,	20	,,	× 8	,,	...	...	...	...	...	,,	0	17	6

9482 Ditto, as above, graduated in Kilogrammes.

No. 21	to indicate	5	kilos.	× $\frac{1}{10}$	kilos.	...	...	...	...	...	each	£0	17	0
,, 22	,,	8	,,	× $\frac{1}{10}$	,,	...	...	...	...	...	,,	1	2	6
,, 23	,,	10	,,	× $\frac{1}{10}$	,,	...	...	...	...	...	,,	1	7	0
,, 25	,,	12	,,	× $\frac{1}{4}$	,,	...	...	...	...	...	,,	1	4	0
,, 26	,,	15	,,	× $\frac{1}{4}$	,,	...	...	...	...	...	,,	1	7	9
,, 27	,,	20	,,	× $\frac{1}{4}$	,,	...	...	...	...	...	,,	1	11	6



9483

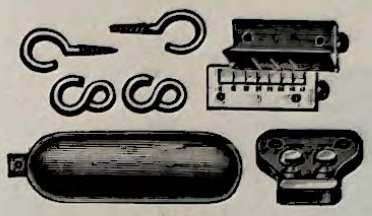
9483 **Searle's Torsion Apparatus,** for showing that the angle of torsion in a rod is proportional to its length, and varies according to the size, section, and material of which the rod is composed, with two adjusting Dials and Pointers (one only shown in illustration), and four Metal Rods. **£5 0 0**

Set of Weights for above, totalling 2 kilos. ... **0 9 6**

9484 **Searle's Rigidity Apparatus,** consisting of two Metal Bars about 12 in. long, connected at their middle points by the wire under test, and provided with Hooks for suspension. **£0 15 6**



9485



9486

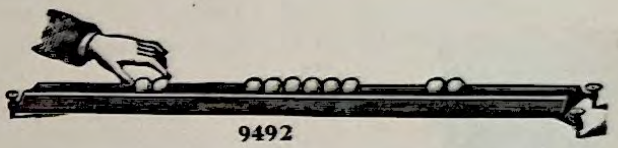


9487

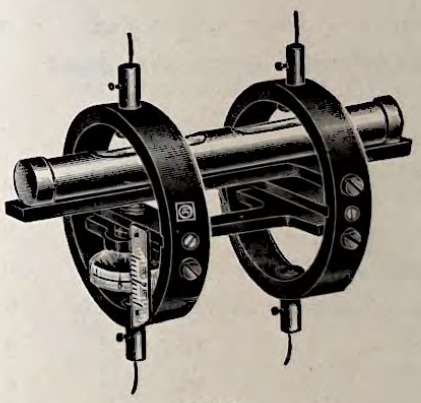
9485 **Modulus of Elasticity of a Wire,** Young's, Brass Plate with 70 mm. Scale, with Vernier reading to $\frac{1}{10}$ mm., both having clamping attachments at back. Complete with Clamp for two Wires. **£0 17 6**

9486 Ditto, ditto, as above, with two each S Hooks, Screw Hooks and Weights **1 2 0**

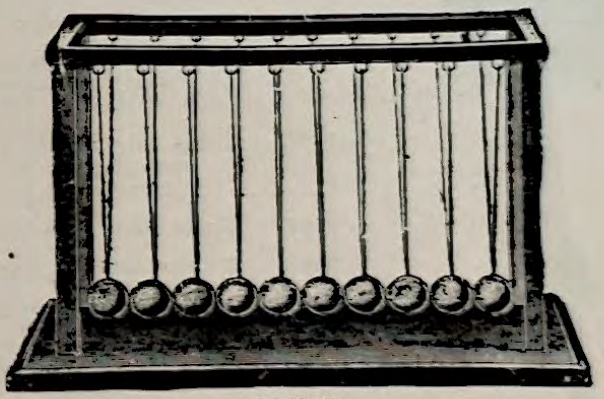
9487 Ditto, ditto, as No. 9496, complete in Polished Wood Box **1 5 0**



9492



9488



9490-1

9488 **Searle's Apparatus,** for determining Young's Modulus by stretching a wire ... **£3 17 6**

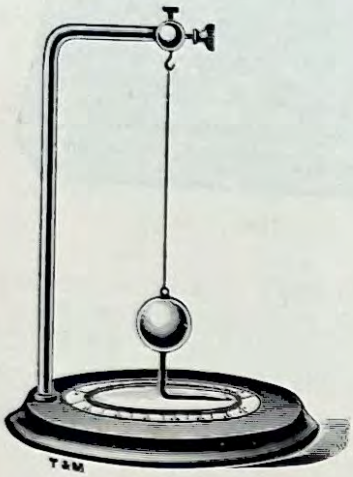
9489 **Wires,** for Young's Modulus of Elasticity Apparatus.

S.W.G.	20	22	24	26	28	30	
Copper	2/10	2/10	3/0	3/0	3/3	3/6	per lb.
Brass	2/9	2/10	3/0	3/3	3/6	3/9	„
Steel	2/10	3/0	4/0	5/0	7/6	10/0	„

9490 **Elasticity Apparatus,** with ten Boxwood Balls, doubly suspended, mounted on Wooden Frame on Base **£1 1 0**

9491 Ditto, ditto, as above, but with five Boxwood Balls **0 14 0**

9492 Ditto, ditto, Tyndall's Percussion Apparatus, 1 metre long, with Levelling Screws, and ten Boxwood Balls **£1 1 0**



9493



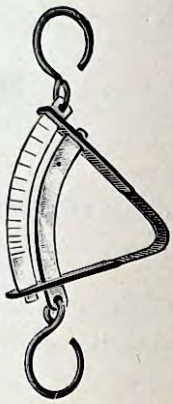
9494



9495



9496



9498



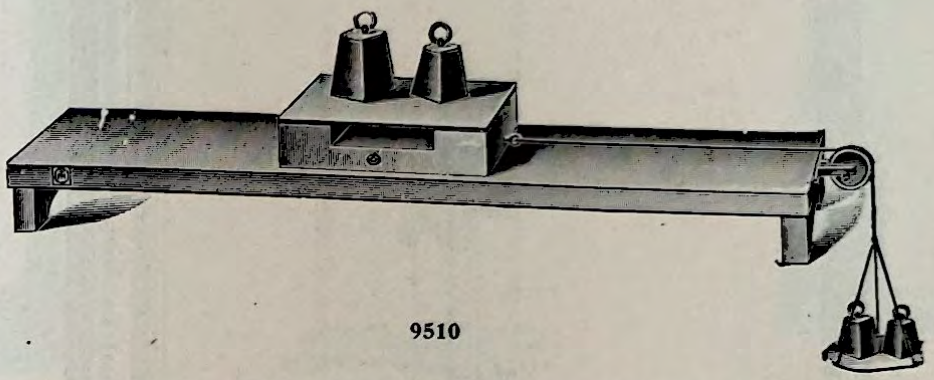
9499-9504



9509

9493	**Torsion Apparatus,** to illustrate the Laws of Torsion, Brass Ball with Index, Graduated Circle, Pillar with Adjustment for Ball, mounted on Circular Mahogany Base	£0 18 6
9494	**Spring Balance,** as described in Watson's "Physics," without stand	0 2 0
9495	**Dynamometer and Spring Balance Combined,** with Clips for holding Plain Card Scales, for Calibration by the Student, with two Scale Cards	0 3 0
9496	Ditto, Rintoul's, provided with Adjustment by which the spring can be re-set should it become permanently elongated (*vide* Rintoul's "Introduction to Practical Physics")	0 4 6
9497	**Scale Pans** with Cords, for above ... ... each **10d.**, per doz.	0 9 0
9498	**Dynamometer,** V-shape, with Scale reading to 30 lbs.	0 18 6
9499	**Steel Spiral Springs,** 4½ in. long, $\frac{3}{16}$ in. diameter, each **5d.**, per doz.	0 4 6
9500	Ditto, ditto, 12 in. long, ¼ in. diameter ... ... ,, **8d.**, ,,	0 7 0
9501	Ditto, ditto, 10 × ½ in.... ... ... ,, **9d.**, ,,	0 8 0
9502	Ditto, ditto, 10 × $\frac{3}{16}$ in. ... ... ,, **10d.**, ,,	0 9 0
9503	**Steel Spiral Springs,** to stretch 10 in. with 1 lb. ,, **9d.**, ,,	0 8 0
9504	Ditto, to stretch 10 in. with 5 lb. ... ... ,, **10d.**, ,,	0 9 0
9505	**Steel Spiral Springs** as used in Spring Balance No. 8730, to weigh 100 × 1 gm. ... ... each **5d.**, per doz.	0 4 6
9506	Ditto, ditto, to weigh 250 × 5 gm. ... ... ,, **8d.**, ,,	0 7 6
9507	**Rubber Cord,** Square ... ... $\frac{1}{8}$ **1/2** $\frac{3}{16}$ **1/0** ¼ **1/0** in. thick per oz.	
9508	**Rubber Cord,** Round ... ... **1/3** **1/1** **1/1** ,,	
9509	**Apparatus** to determine "G," consisting of Plain Teak Board, fitted with Wooden Pendulum and Sliding Weight, as Gregory and Simmon's Book ... ... each	£1 2 6

Friction



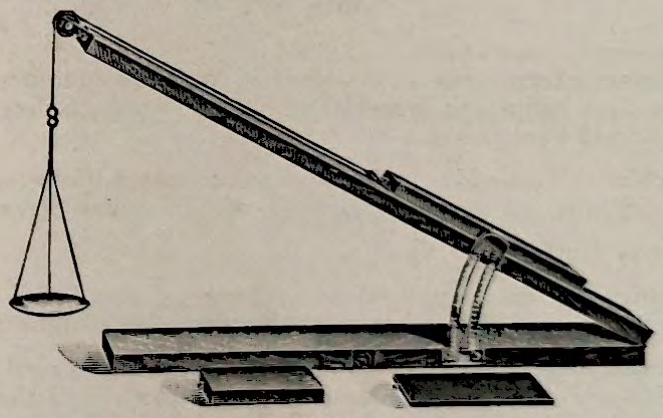
9510

9510 **Friction Board,** 30 in. long by 7 in. wide by 1¼ in. thick, with true-planed upper surface and shaped cross-pieces on the underside at either end. Adjustable Steel Cone centred Aluminium Pulley. The Slider, 9 in. by 6 in. by 1¼ in. thick, is of the same material as the Plane, and the surfaces vary in area in the proportion of 2 to 1, fitted with Scale-pan and Cord, complete (*vide* Wells' "Practical Mechanics").

Pine.	Beech.	Oak.	Mahogany.
16/6	**17/6**	**18/6**	**18/6**

9511 **Sliders,** as above, with Hook for attaching Cord.

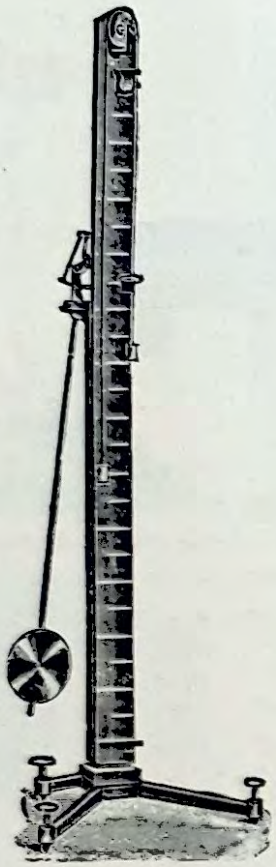
Pine.	Beech.	Oak.	Mahogany.	Walnut.
5/6	**6/0**	**6/0**	**7/0**	**7/0**



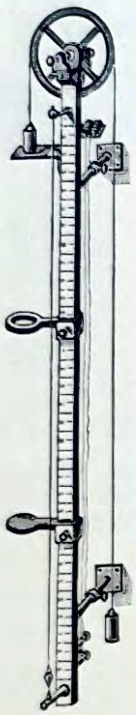
9512

9512 **Friction Apparatus,** consisting of Inclined Plane, Polished Teak, with planed upper surface 24 in. long, with divided arc. Wood Blocks 8 in. by 3 in. and 4 in. by 3 in., and Metal 4 in. by 3 in. **£1 0 0**

Falling Bodies



9514-5



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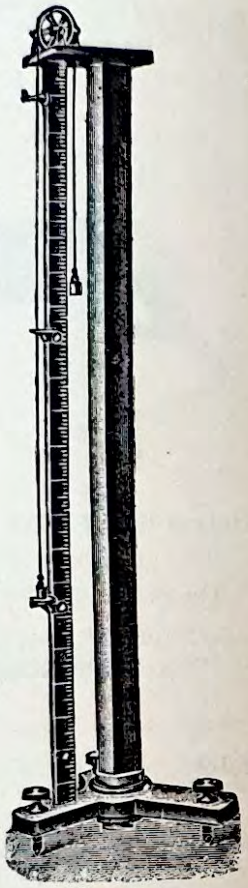
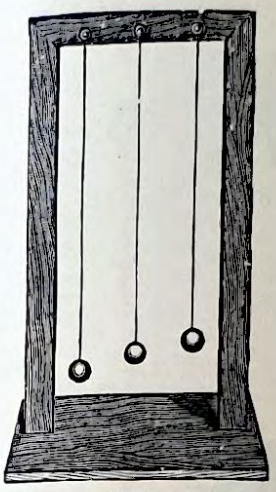
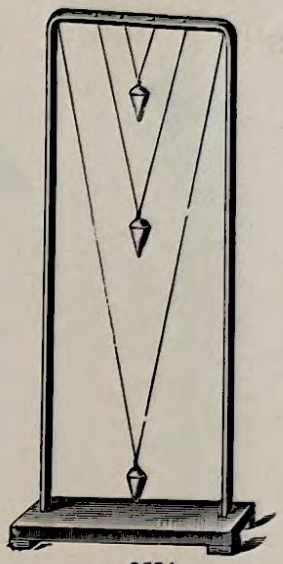


9517-8

9513	**Attwood's Machine**, cheap form, as described in Watson's "Physics," with Solid Pillar, 6 ft. × 3 in., Adjustable Wheel, three Sliding Fittings, Riders and Weights, mounted on Tripod Foot...	£6 0 0
9514	**Attwood's Machine** (Weinhold's modification), Graduated Boxwood Scale, two metres long, mounted on strong Iron Stand, with Levelling Screws	8 0 0
9515	Ditto, with Seconds Pendulum	9 0 0
9516	**Attwood's Machine,** to fix to wall; made of Square Brass Tube, with Electric Release, Plumb Bob and Scale, two metres long, graduated into centimetres ...	7 0 0
9517	**Attwood's Machine,** Mahogany Stand, two metres long, with Boxwood Scale divided into centimetres and millimetres; Aluminium Wheel with Steel Cones and Steel Bearings, Weights in three parts and six Riders of various weights, mounted on Iron Tripod foot with Levelling Screws	10 10 0
9518	**Attwood's Machine,** Solid Mahogany, best make, two metres long with Boxwood Scale divided into centimetres and millimetres, Aluminium Wheel mounted on Friction Wheels, Electrical Release Arrangement, Weights and Riders, Pendulum, etc., mounted on Iron Base, with Levelling Screws. The upper parts enclosed in Glass Case	17 10 0



9520



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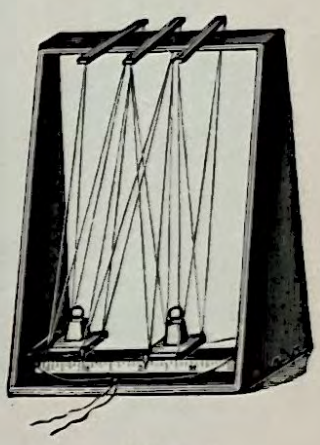
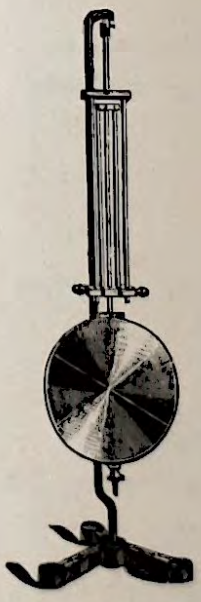


9522

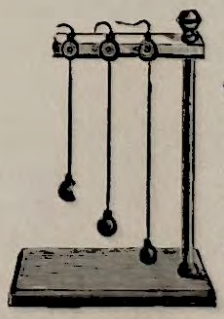
9519	**Pendulum Apparatus,** simple form, with Lead Ball on Metal Stand ... each	£0	3	0
9520	„ „ with Adjusting Pegs, mounted in Blackwood Stand, with three Balls: Brass, Wood and Lead	0	9	0
9521	„ „ Improved form, three Brass Plumb Bobs, with double suspension, mounted on Polished Mahogany Base ...	0	17	6
9522	„ „ Hick's Ballistic, for experiments on matter in relation to motion (*vide* Watson's "Physics")	1	17	6



9523



9524



9525-6

9523	**Pendulum,** Compound or Compensation, 1 metre long, with nine Rods, Brass and Iron alternately	2	10	0
9524	Ditto, 24 in. long, with five Rods, mounted on Stand with Tripod Foot	2	0	0
9525	Ditto, four Brass Balls with Adjusting Pegs, Mahogany Top Rail and Metal Pillars, mounted on Polished Mahogany Base ...	0	18	6
9526	Ditto, with three Balls: Brass, Lead and Wood	0	16	0



9527



9528



9529

9527 **Pendulum Apparatus,** Schuster & Lee's, fitted with two adjustable Mirror Scales, Pendulum Bob with adjustable Holder, complete on Teak Stand ... ... each **£1 1 0**

9528 Ditto, Compound, consisting of Steel Bar, 1 metre long, bored every 5 cm. with removable Knife Edge and Bracket Support **0 17 6**

9529 Ditto, Simple, consisting of Iron Ball which is suspended by Wire Holder with Steel Knife Edge and Bracket Support **0 15 0**



9531

9530 **Lead Balls,** with Ring for suspension, for Pendulum Experiments.

Diameter	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$	1	$1\frac{1}{4}$	in.
	2/3	**2/9**	**3/3**	**4/0**	**6/0**	per doz.

9531 **Plumb Bobs,** Brass Lacquered, with Steel Points.

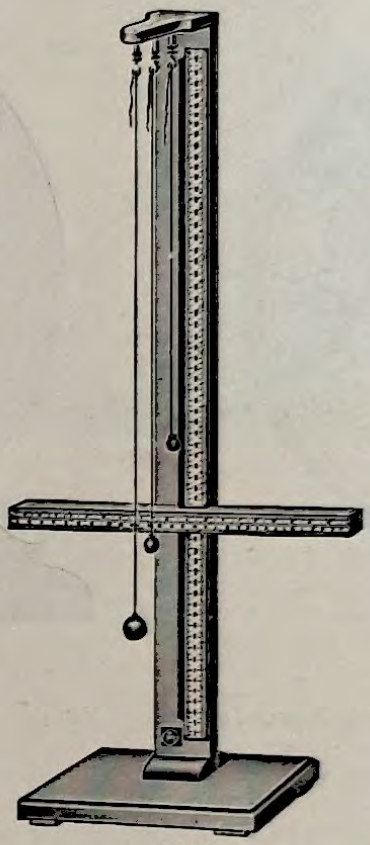
Diameter	$\frac{7}{8}$	1	$1\frac{1}{8}$	$1\frac{1}{4}$	$1\frac{3}{8}$	in.
	1/6	**1/8**	**2/0**	**2/6**	**3/0**	each



9532-3



9534



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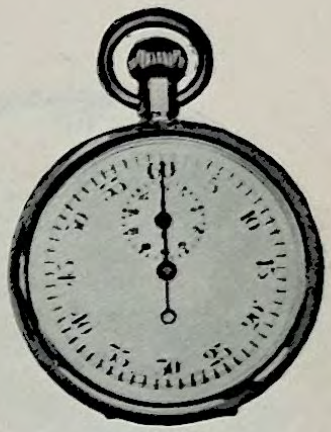

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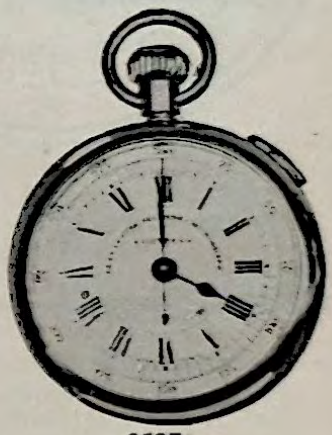
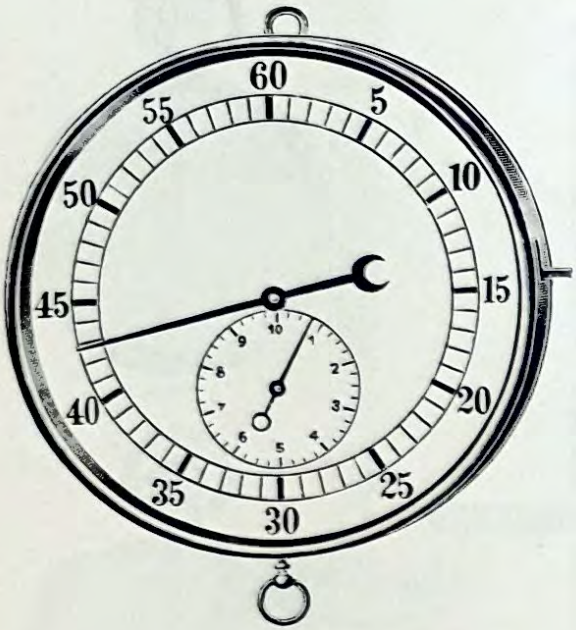


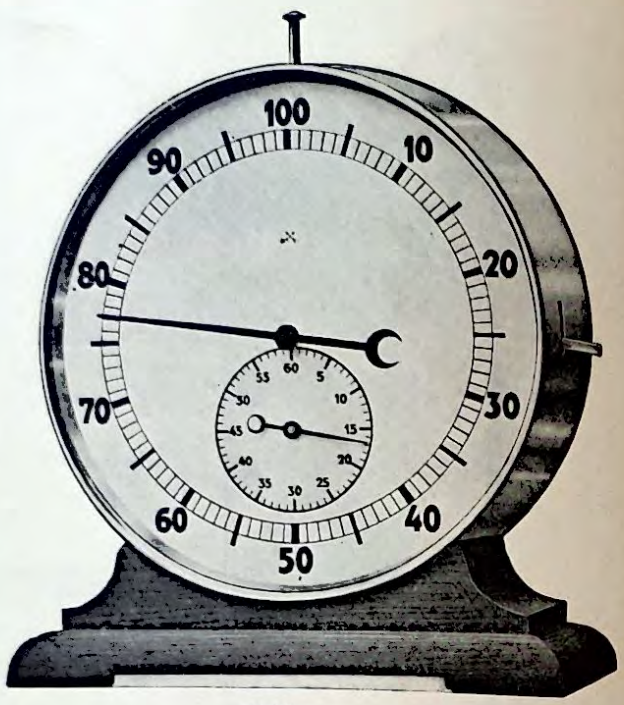
9537

9532	**Pendulum Apparatus,** Kater's Reversible Brass Bar, with Bracket to screw to wall	**£2 2 6**
9533	Ditto, as above, with Bar divided into centimetres	**2 15 0**
9534	Ditto, ditto, with Reversible Brass Bar, length 48 in., with two sets of movable Knife Edges, two sets of Weights, complete with Bracket Support ...	**2 17 6**
9535	**Pendulum Apparatus,** Solid Teak, 1 metre high, fitted with three Pin Vice Clamps, three Brass Pendulums of different weights and Horizontal Adjustable Amplitude Scale	**1 15 0**
(F) **9536**	**Stop-Watch,** Keyless Chronograph, dial graduated up to 30 minutes, reading in $\frac{1}{5}$ seconds, with triple action for start, stop and return to zero; best make and accurate	**1 10 0**
(F) **9537**	Ditto, cheap form, ordinary chronograph, reading hours, minutes and seconds in $\frac{1}{5}$ths. Start and Stop Action	**0 10 6**

(F) Foreign manufacture.



9548



9549

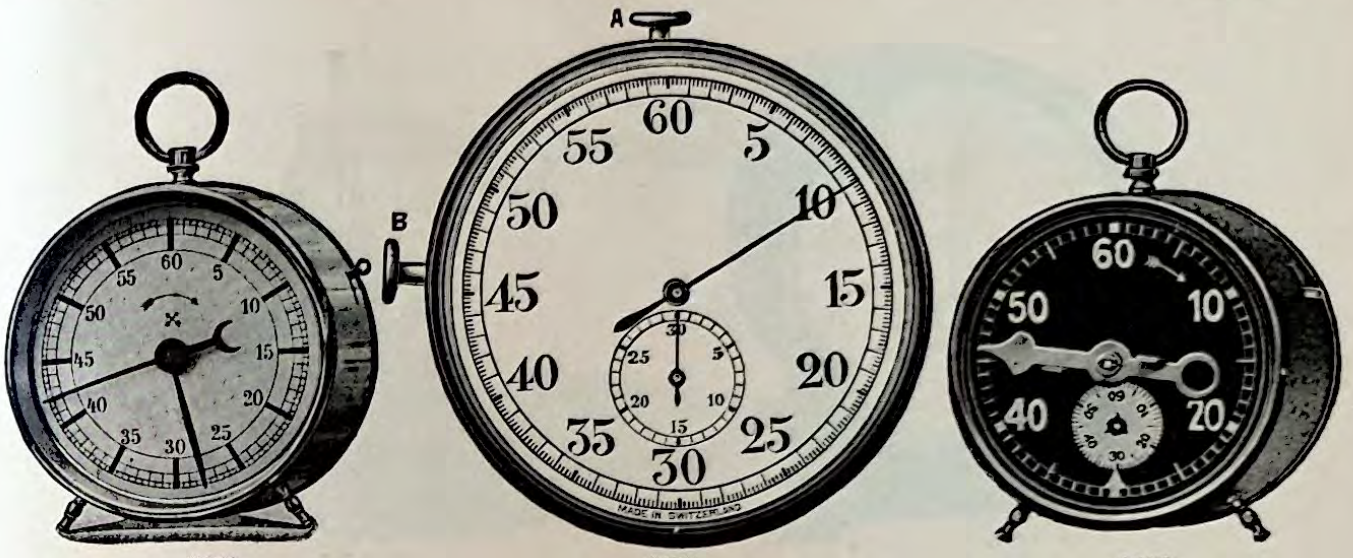
(F) **9548** **Large Seconds Stop-Recorder** with Minute Circle inside. Diameter of Dial 8 in. For spaces of 1 to 60 seconds and of 1 to 10 minutes. Frosted Black Brass Case. For technical, photographic and for sports purposes. The Large Dial allows the reading of the seconds also at longer distances and by several persons at the same time. The Small Dial inside registers the minutes **£1 2 6**

Directions: The winding is done with the Key at the back. The Checker is started by the lifting upwards of the side lever. A pressure downwards of the same lever will stop the recorder. By pulling the lower Ring, both hands are brought back to the starting point.

(F)***9549** **Large Stop Clock.** Diameter of Dial 8 in. For the one-hundredth part of a minute. For checking spaces of time from a hundredth part of a minute and from 1 to 60 minutes. Frosted Black Brass Case, Oak Base. It is specially suitable to check the exposure of Gaslight and other sensitive papers and is therefore a necessity for Photographers. Also for the technical and scientific observation of time spaces under 1 minute which must be recorded in decimals. The size of the dial admits the reading of the seconds also at longer distances (with yellow light for at least 3 yards) so that the common use of the Checker is possible at the same time by several persons **1 5 6**

Directions: The winding is done by the fixed Key at the back. The Checker is started by the lifting of the side Lever upwards. A pressure downwards of the same lever will stop the Recorder. Thus it can be stopped or set in motion again at any time. Both Hands will be brought back to the starting point by a deep pressure on the top button.

(F) Foreign manufacture.



9551 9550 9552

(F) ***9550 Stop-Watch for Laboratory Use**

A reliable precision instrument with a first-class anti-magnetic lever movement, runs for 14 hours. Indispensable for Scientific Laboratories, Technical Institutes, Workshop Time Control, etc. The unavoidable defects in the usual class of Stop Watches, with the constantly recurring expensive and troublesome repairs have led us to design and patent this trustworthy type, with a first-class lever movement specially for use in Laboratories, Test Rooms, etc. It can, of course, be used for any class of Stop-Watch Work.

To ensure certain and constant accuracy, each element of Winding, Stop Action and Zero setting is arranged as an independent unit. The new patented Stop Action, simple in design, can be used continuously for days on end without damage, and is absolutely positive through pressure on knob A, which is specially shaped for that purpose.

Starting, as already mentioned, is effected by knob A, which is intended to require a slight extra pressure at the starting moment. A second pressure on knob A stops the watch. A third starts it again, and so on. A test can therefore be interrupted as often as required, and so the total test time summated with all interruptions automatically deducted from the count. Pressure on knob B operates the Fly-back Action.

The Watch is wound by the thumb-nut C at the back of the case and runs for 14 hours.

For regulating the Watch an aperature covered by a slide will be found at the back of the case. The regulator underneath the slide is moved to the left (–) to slow, to the right (×) to advance the rate ... **£1 10 0**

(F) ***9551 Laboratory Stop Clock** in Nickelled Zinc Case. The checker serves for observations in the dark-room for photographic, or in the laboratory for technical purposes. each **£0 12 6**

DIRECTIONS

The winding is done with the key at the back, in the direction of the arrow. It is started by pressing down the slide lever. Pulling this lever upwards will stop the Checker. The gong of the Checker can be stopped or set in motion at any desired time. The setting of the minute hand to 60 is effected by the regulating button on the back in the direction of the arrow on the dial. The setting of the large seconds hand on 60 is done by the right side regulating button on the back, also in the direction of the arrow on the dial, but it must be pulled out for this purpose, as far as it will go.

(F) ***9552 Time Checker,** with Stop-lever; goes for 60 minutes, with signal after finishing time and rotating seconds disc; in metal case white lacquered. This clock is very useful for Hospitals, Chemical and Photographic Industry, Checking of all kinds of technical processes. each **£0 S 6**

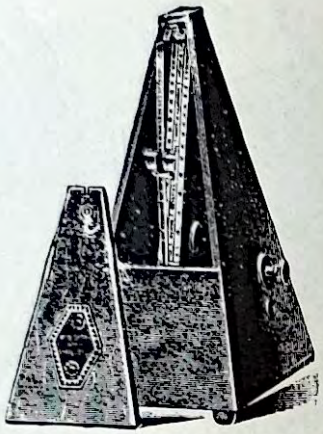
DIRECTIONS

The setting of the hand will wind the movement and the signal. To obtain a loud and long signal turn the hand to 60 and then back to the desired time. The signal is given when the hand returns to 60. The hand can be turned either forward or backward, but not beyond the figure 60. The side lever in connection with the turning seconds dial allows to use this Checker as a stop Recorder for short spaces of time.

(F) Foreign manufacture.



9553



9554–5

*9553	**Laboratory Stopclock,** well finished in stout Enamelled Metal Case, with start and stop, side lever action		£1 7 6
(F) 9554	**Metronome,** in Polished Wood Case	each	0 16 6
(F) 9555	Ditto, ditto, with Bell	„	1 1 0

Inertia



9560



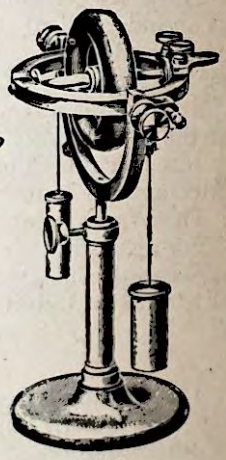
9562



9563



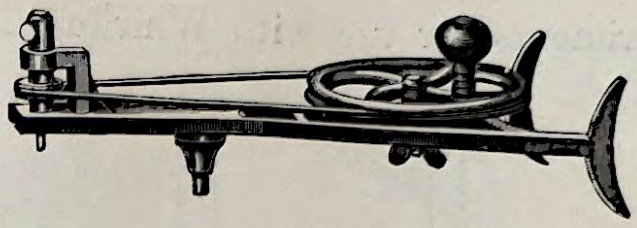
9564



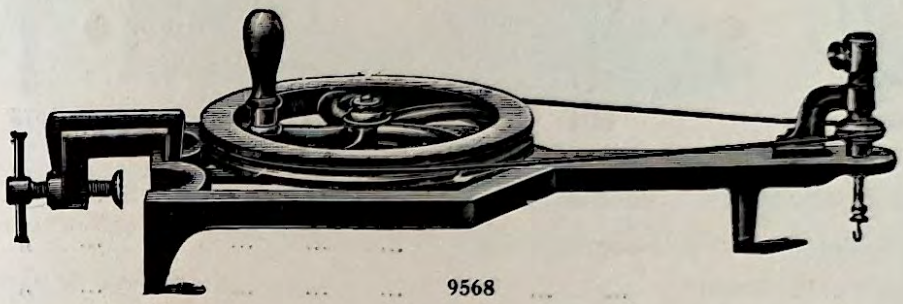
9565

9560	**Inertia Apparatus,** Brass Pillar and Ball mounted on Mahogany Stand, for illustrating Inertia at rest		£0 9 6
9561	**Gyroscope,** simple form, for Student's use	each	0 2 6
9562	„ Medium size, on Brass Pillar and Iron Tripod Foot		1 15 0
9563	„ Fessel's, with Sliding Weights, mounted on Bronzed Iron Foot ...		2 2 0
9564	„ best make, with removable Lug on outer ring		2 0 0
9565	„ „ with removable Lug, complete with two unequal Weights		4 4 0

(F) Foreign manufacture.



9566-7

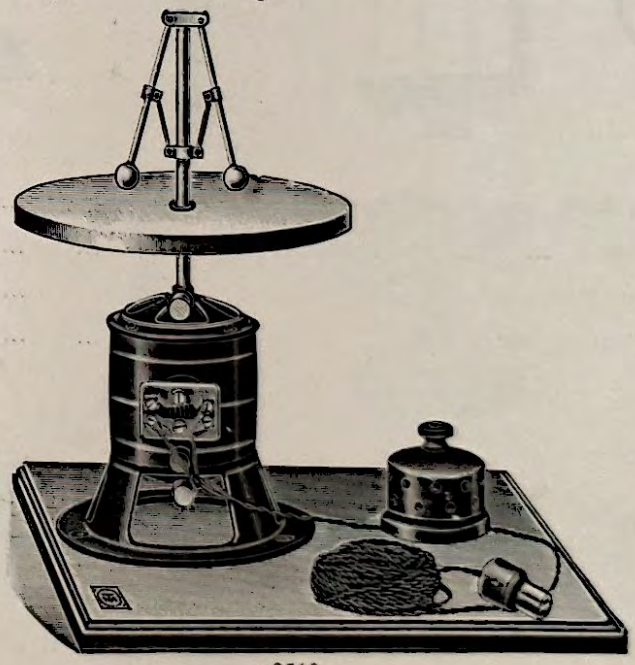


9568

9566 **Whirling Table,** Centrifugal Apparatus, Cast Iron Frame, made to stand either vertical or horizontal, with Wheel adjustable to take up any slackness of the driving belt **£2 5 0**

9567 Ditto, Smaller size, cheaper make **1 12 6**

9568 Ditto, Extra Large size, superior finish, with Clamp for holding vertically to table, with well-turned Spindle and Bearings **3 12 6**



9569

9569 **Whirling Table,** Electrical, with Speed Regulator, Flexible Wire Leads and Wall Plug or Bayonet Catch Lamp Plug, which can be connected to the ordinary Lamp Holder; mounted on Polished Mahogany Base. Direct Current Motor for 110 220 volts
£7 10 0 £8 5 0 each

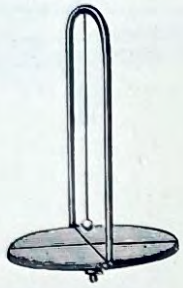
Experiments for use with Whirling Table



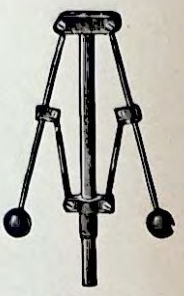
9570



9571



9572

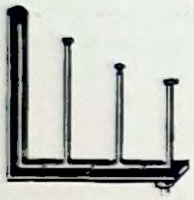


9573

9570	**Brass Elastic Rings,** to illustrate the flattening of the Earth at the Poles...	each	£0 10 6
9571	**Centrifugal Ring,** with Automatic Catch	„	0 12 6
9572	**Foucault's Pendulum**	„	0 15 0
9573	**Watt's Governor**	„	0 17 6



9574



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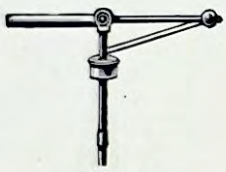

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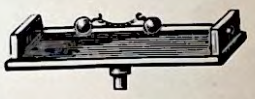


9577

9574	**Semi-circular Ring,** with two Balls	each	£0 8 6
9575	**Level Apparatus**	„	0 11 6
9576	**Ball,** with Weight attached	„	0 15 0
9577	**Brass Balls,** two, sliding on rod	„	0 12 0



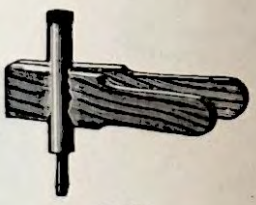
9578



9579



9580

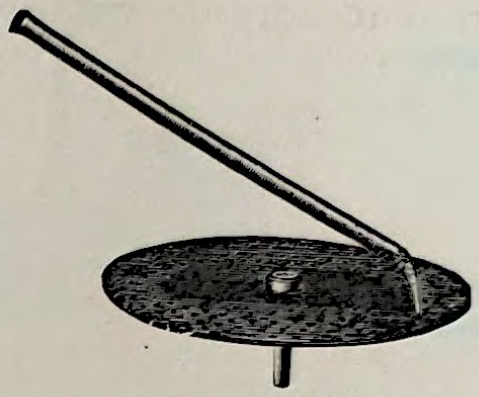


9581

9578	**Bertram's Precipitating Apparatus**	each	£0 15 6
9579	**Two Tubes,** mounted on Supports	„	0 9 0
9580	**Glass Globe,** for Liquids	„	0 8 6
9581	**Brass Tube and Friction Board,** for showing Tyndal's Heat Experiment	„	0 8 6


9582


9583

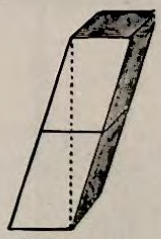

9584


9585

9582	**Savart's Toothed Wheels,** Set of four, for Sound experiments	each	**£0**	**17** **6**
9583	**Rotating Mirror,** for Sound experiments	4×4	5×5	in.
		21/0	**25/0**	each
9584	**Syren Disc,** Brass, with four rows of Holes, for use with Whirling Table	each	**£0**	**12** **6**
9585	**Newton's Colour Disc,** 9 in. diameter, mounted on Metal Plate	„	**0**	**6** **0**

Centre of Gravity

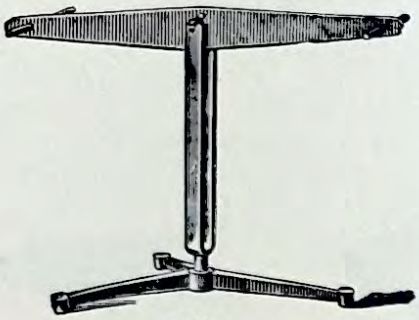

9586


9588


9590


9591

9586	**Centre of Gravity Plate,** Japanned Iron (marked one side), with Strings, showing method of determining Centre of Gravity	**£0**	**2**	**6**
9587	Ditto, Board, with Cords	**0**	**2**	**0**
9588	**Parallelopipeds,** Blackwood, each Block 9×4×2 in.	**0**	**5**	**0**
9589	**Leaning Tower**	**0**	**4**	**6**
9590	**Centre of Gravity Apparatus,** Horseshoe form, on Stand	**0**	**12**	**6**
9591	„ „ „ Metal Balls, on Stand	**0**	**7**	**6**



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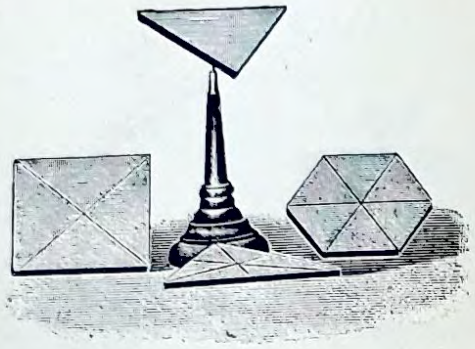


9593



9594

9592	**Gantzer's Apparatus,** Iron Lever, the axis of which may be fixed in, below or above the centre of gravity; mounted on Iron Stand, with Tripod Foot	£1 5 0
9593	**Centre of Gravity Apparatus,** consisting of 4 Metal Plates fitted with Pivot Cap and Stand complete	1 1 0
9594	,, ,, ,, Equilibrist, on Stand	0 4 6
9595	,, ,, ,, Double Cone and Inclined Plane, Polished Whitewood Cone and Hardwood Plane ...	0 10 6
9596	**Cone,** Hardwood, 5 in. high × 4 in. base, for showing Stable, Unstable and Neutral Equilibrium	0 2 0
9597	Ditto, ditto, Cylinder and Inclined Plane; diameter of Cylinder, 6 in.	0 15 0



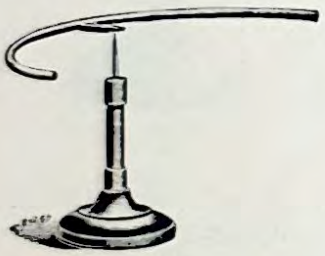
9595



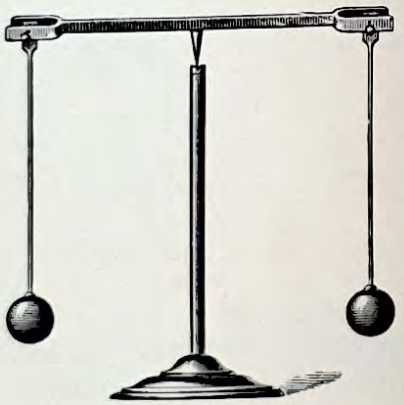
9596



9597



9598

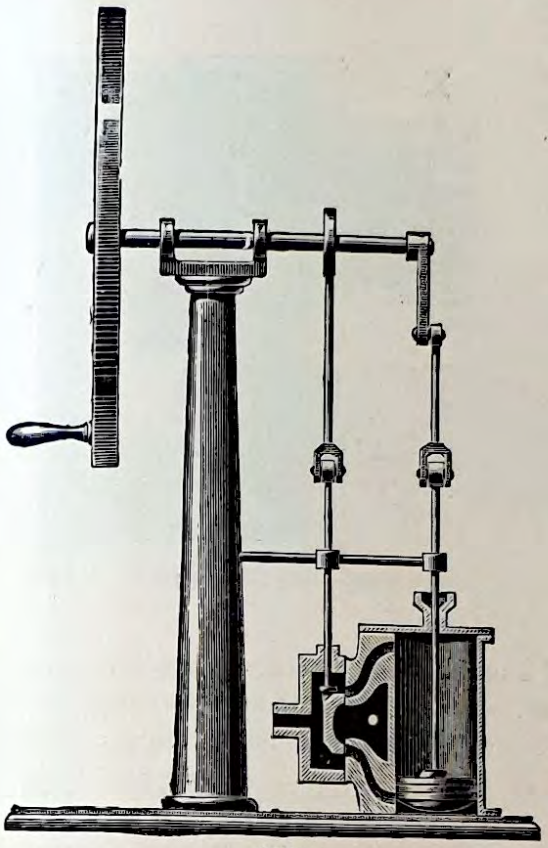


9599



9600

9598	**Centre of Gravity Apparatus,** for showing the Centre of Gravity of the Arc of a Circle	£0 10 6
9599	**Bock's Equilibrium Apparatus,** Metal Beam with two Brass Balls mounted on Stand. The system is in stable equilibrium if all its parts are rigidly connected, but equilibrium can be made unstable by simply loosening the connecting screws	0 17 6
9600	**Stability Apparatus,** Model of Vessel, with Movable Weight on Mast	0 8 6



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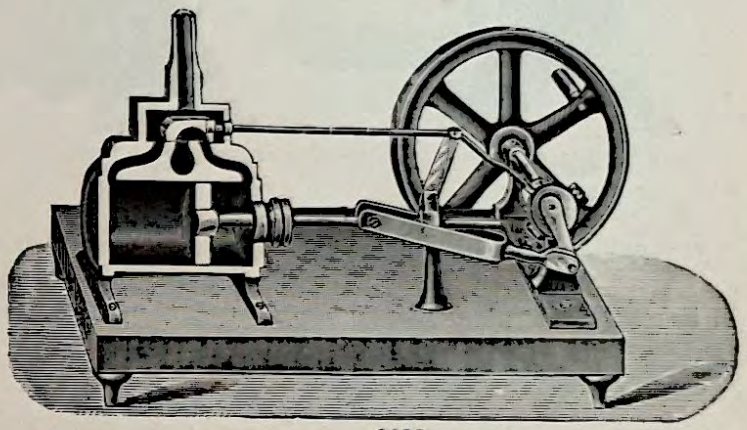
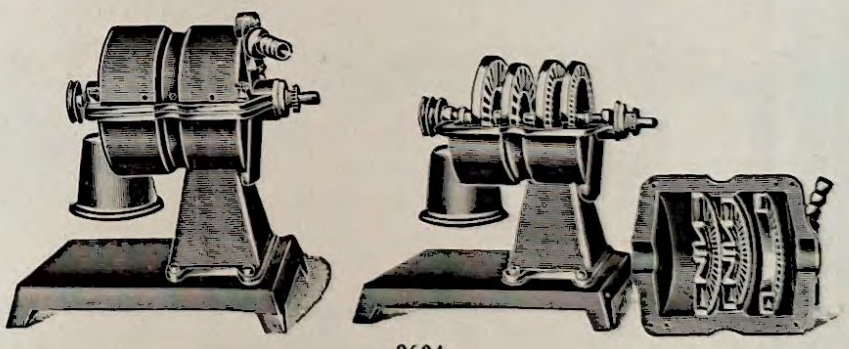


9603

(F) **9601** **Sectional Model of Steam Engine,** with vertical Cylinder, mounted on Polished Mahogany Base **£4 10 0**

(F) **9602** Ditto, ditto, fitted with Throttle Valve and Governors **5 10 0**

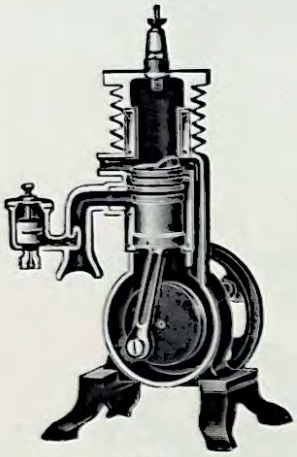
(F) **9603** Ditto, ditto, Metal, with horizontal Cylinder, mounted on Polished Mahogany Base **3 5 0**



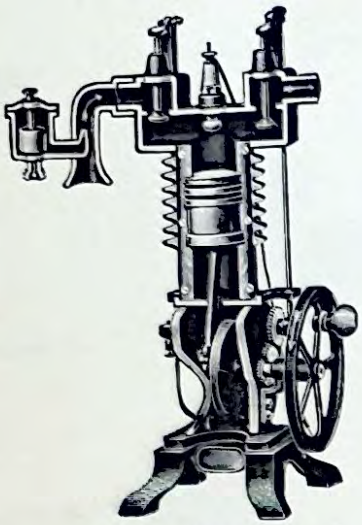
9604

(F) **9604** **Steam Turbine,** Demonstration Model. Separable Model, if taken apart the moving wheels and the fixed wheels with their blades are plainly visible. The Steam Turbine may be actuated either by steam or compressed air. The Case and Ground Plate are made of Cast Iron, the Wheels are made of Gun-metal. Full description sent with each Model **£18 0 0**

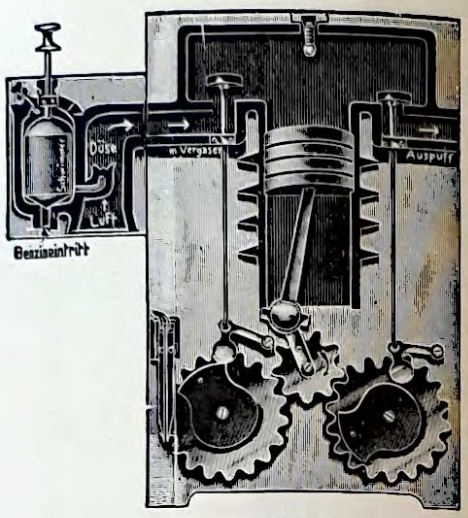
(F) Foreign manufacture.



9605



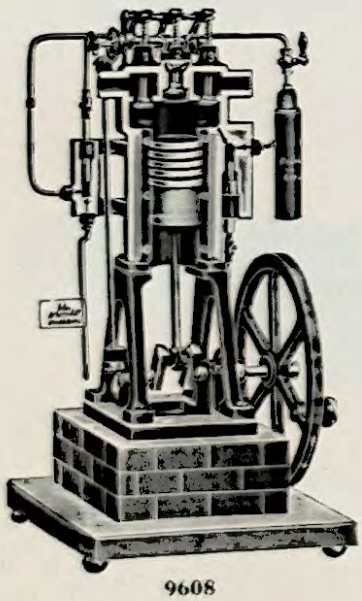
9606



9607

(F) **9605** **Sectional Model of a Two-stroke Cycle Petrol Engine,** made of Metal. The Model shows the sectional Cylinder with plunger vapouriser. The Ignition is shown by the lighting up of a small electric lamp. The outer parts are painted white. Full description sent with each model ... ... price **£5 10 0**

(F) **9606** **Sectional Model of a Four-stroke Cycle Engine,** made of Metal. The Model shows the vertical section of the cylinder with its plunger. The valves work automatically by hit and miss arrangement and have spring pressure. The Ignition is demonstrated by the lighting up of a small electric lamp. The outer parts are painted white... price **£6 17 6**



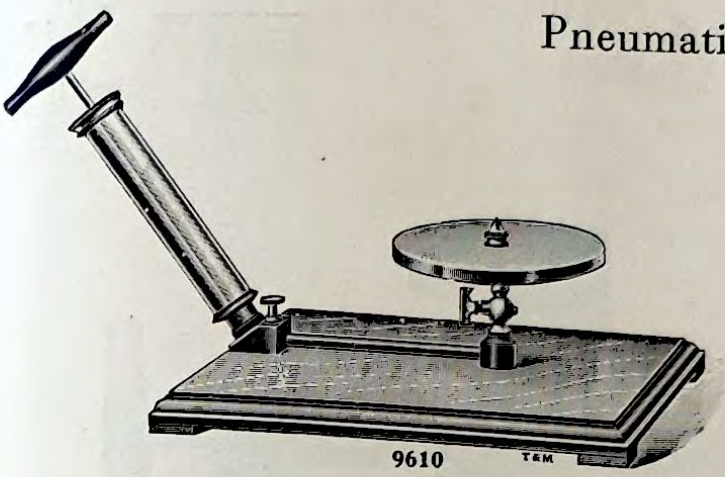
9608

(F) **9607** **Flat Model of the Four-stroke Cycle Engine.** This Model is made of Wood and Metal, and shows in an extraordinarily plain way the different functions of the petrol engine from the inlet of the petrol to the exhausting of the gas. The model is lacquered with different colours. The ignition is demonstrated by the lighting up of a small electric lamp. Price of Model, with Vapouriser **£5 0 0**

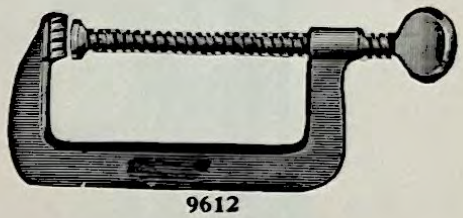
(F) **9608** **Sectional Model of a Kerosine Diesel Engine,** made of Metal. The model shows the vertical section of the cylinder, the plunger, all the working valves, the fly-wheel, and the outer parts are painted white. The model is about 45 cm. in height ... ... price **£12 10 0**

(F) Foreign manufacture.

Pneumatics



9610



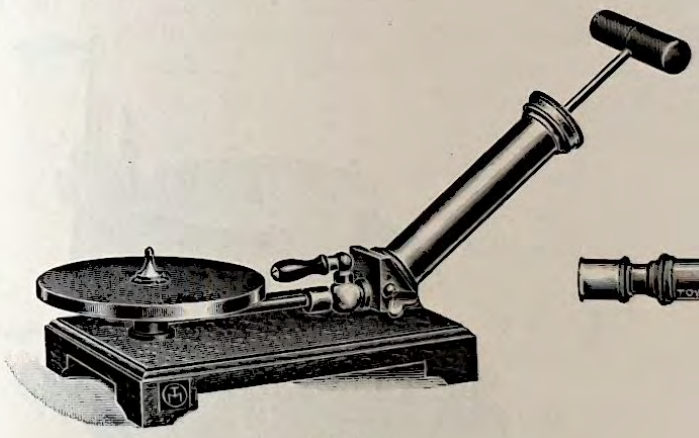
9612

9610 **Air Pump,** with Brass Barrel, Stopcock and Inlet Valve, mounted on Polished Mahogany Stand.

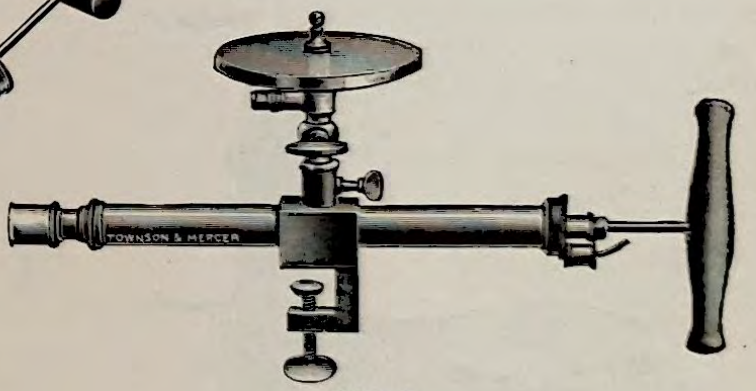
Size of Barrel ...	6×1	7×1¼	8×1½	8×1½	in.
„ Plate ...	4¼	5	5¾	7	„
	£2 0 0	**£2 7 6**	**£2 12 6**	**£2 17 6**	each

9611 Ditto, ditto, with Plate 4¼ in., without stopcock **£1 15 0**

9612 **Clamp,** Malleable Iron, strong ... ... each **3/0, 3/9** and **4/6**



9613



9614-5

9613 **Air Pump,** as supplied to the L.C.C., etc. Brass Barrel, 8×1½ in., diameter of Plate 7 in., on Polished Teak or Mahogany Base **£2 18 6**

9614 **Air Pump,** Tate's, Double Action, with strong Brass Clamp to fix securely on Table, Brass Barrel 16×1½ in., Plate 7 in. diameter, with Stopcock, Inlet Valve, Side Branch for Gauge and Spanner. **£5 2 6**

9615 Ditto, fitted with 8-in. Plate **5 7 6**



9616

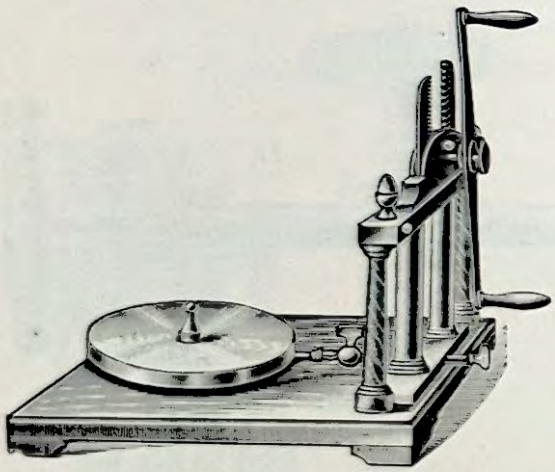


9617–8

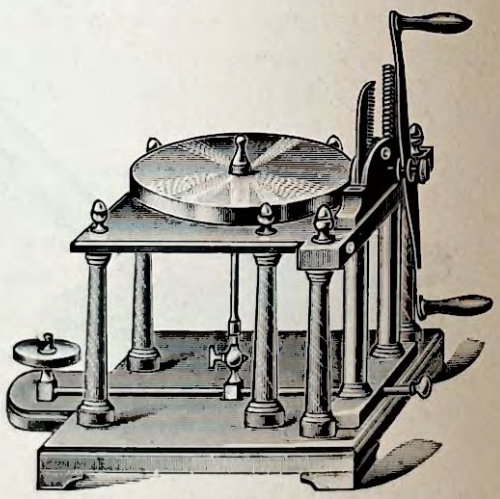
9616 **Air Pump,** Foot Pattern, as supplied to the L.C.C., etc. Size of Brass Barrel 8×1½ in. For exhausting and condensing **£1 10 0**

9617 **Air Pump,** Tate's, Double Action, Brass Barrel, 16×1½ in., Stout Brass Plate, 7 in. diameter, with Stopcock, Inlet Valve and Side Branch for Gauge, mounted on heavy Solid Iron Base, complete with Spanner **5 5 0**

9618 Ditto, fitted with 8-in. Plate **5 10 0**



9619

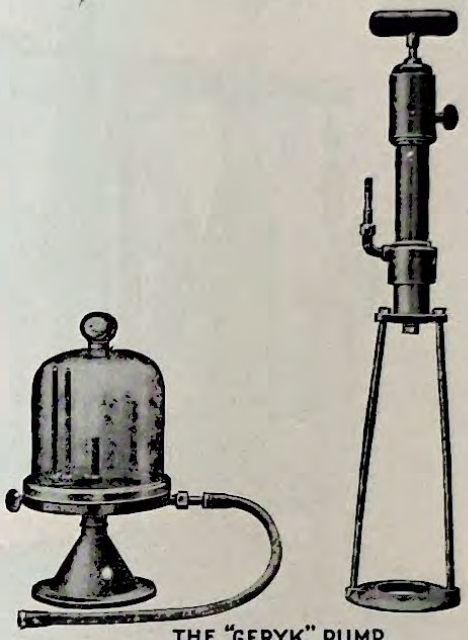


9620

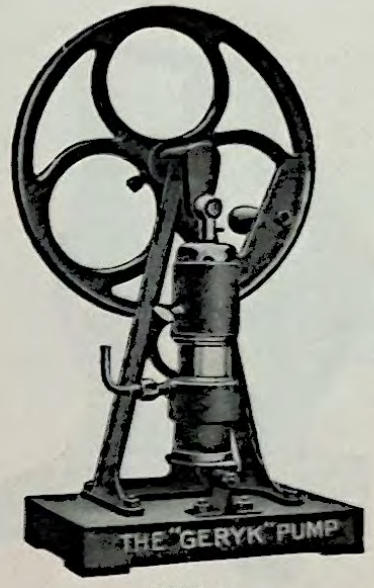
9619 **Air Pump,** Double Barrel, with Stopcock and Brass Double Lever Handle, on Polished Mahogany Stand. Diameter of Plate ... 7 8 in.
£9 10 0 **£10 10 0** each

9620 Ditto, Double Barrel, with Gauge Plate, Stopcocks, and Brass Double Lever Handle, mounted on Polished Mahogany Stand with metal-cored Pillars.
Diameter of Plate ... 8 10 in.
£15 0 0 **£16 0 0** each

The "Geryk" Vacuum Pump



THE "GERYK" PUMP.
9621–2
Portable Type—No. 5 and No. 6 size.



9623–4

VACUUM PUMP, PORTABLE TYPE

This Pump has been designed to meet the demand among Schools, Laboratories, etc., for a cheap Vacuum Pump. The Pump is precisely the same as that of the well-known "Geryk" Vacuum Pump, and is capable of giving the same vacuum, *i.e.*, one-fiftieth of a millimetre off perfect. Owing to the vertical pull, these Pumps are quite easy to work. They are extremely light and portable, these advantages being effected by dispensing with the more elaborate rotary motion of the original "Geryk."

9621 No. 5 size, as illustrated, with 1½ in. diameter Cylinder × 4 in. Stroke, including Spare Charge of Oil. Not including Vacuum Plate ... ... nett **£4 0 0**

9622 No. 6, with longer stroke to make pump double size, including Spare Charge of Oil. Not including Vacuum Plate ... ... nett **5 0 0**

For Vacuum Plates for the above see page 196.

NEW PATTERN "GERYK" VACUUM PUMP, ROCKER TYPE, FLEUSS' PATENTS

The Pump illustrated above is a cheaper and lighter type of pump which will no doubt be exceedingly useful in Schools and Laboratories where a Pump is not required for continuous use. This pattern imparts to the Pump a rocking motion.

The degree of vacuum obtainable is better than 1 mm. off perfect. In fact, under the best conditions, it is possible to obtain one-fiftieth of a millimetre.

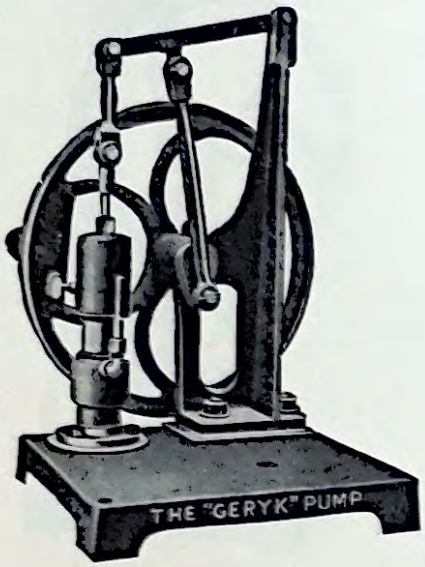
It is essential that the Pump is connected to the apparatus to be exhausted by Flexible Tubing.

9623 No. 7 size (1½ in. diameter × 4 in. Stroke) ... ... nett **£5 15 0**

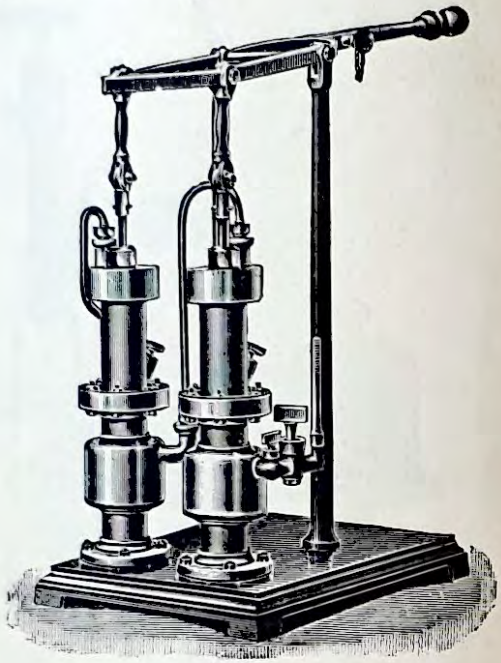
9624 No. 8 size (2 in. diameter × 4 in. Stroke) ... ... „ **7 0 0**

9625 Tubing—Special Rubber Compound ... ... per foot **0 1 6**

"Geryk" Air Pumps



9627–30



9631

DESCRIPTION.

The introduction by us of the "Geryk" Vacuum Pump over twenty years ago opened up an entirely new method of producing high vacua. The inventor of these pumps was the first to produce a practicable fine mechanical vacuum pump. Continuous improvements have been made from time to time, and we have now succeeded in making pumps that will give a vacuum far superior to that obtained by the earlier pumps. Our single cylinder pattern will give a vacuum of $\frac{1}{50}$ of a millimetre off perfect, whilst with our "R. L." type a vacuum of ·00001 of a mm. can be obtained; in fact under favourable conditions, one millionth of a millimetre has been frequently obtained.

There is practically no limit to the size in which the "Geryk" Pump can be made, and the largest pumps give results equal to the smaller sizes. Operations requiring a very high vacuum are thus made possible on a large scale.

The "Geryk" Pump is not a highly complicated machine liable to be constantly out of order. On the contrary, it is exceedingly simple, and does not require the attention and "nursing" needed by mercury pumps.

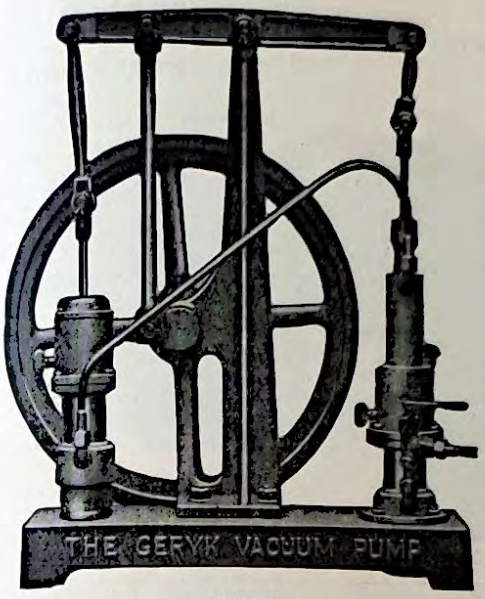
Each "Geryk" Pump has to stand a very severe vacuum test before being despatched from our Works.

"Geryk" Air Pumps. Fleuss Patents.

9627	No. 0 Size, as illustrated. This Pump has a 1½ in. diameter Cylinder by 4 in. stroke...	£7	0	0
9628	No. 1 Size. This Pump has a 2 in. diameter Cylinder by 4 in. stroke	8	10	0
9629	No. 2 Size. Diameter, Cylinder 2 in. Stroke 10 in.	16	0	0
9630	No. 3 Size. Diameter of Cylinder, 2½ in. Stroke 10 in.	18	0	0
	These Pumps are capable of giving a vacuum of $\frac{1}{50}$ of a millimetre off perfect. Suitable for Schools and Laboratories.			
9631	**"Geryk" Air Pump,** Duplex No. 1, as illustrated. This pump has two 2-in. Cylinders by 5 in. stroke Specially designed for the production of high vacua. Eminently suitable for Crookes' and Geissler Tube Phenomena. Suitable for advanced Laboratory work.	17	10	0

Vacuum Pump Accessories.

9632	**7-inch Brass Vacuum Plate** fitted with Screw Plug for regulating the admission of air, length of India-rubber Tube for connection to Pump, and removable Brass Tube for connection to apparatus other than a Bell Jar. All mounted on Cast Iron Stand	2	0	0
9633	**8-inch Brass Vacuum Plate,** fitted as above	2	5	0
9634	**9-inch Brass Vacuum Plate,** fitted as above	3	0	0
9635	**Oil-sealed Stopcock**, ready for connecting to Nos. 0, 1, and 2 Pumps ... ... each	0	13	0
9636	**Special India-rubber Vacuum Tubing,** suitable for No. 0, 1 and 2 "Geryk" Vacuum Pumps, per ft.	0	2	9
9637	**Can** containing one pint of **Special Oil** (eminently suitable for high vacua)	0	2	3
9638	Ditto, one half-gallon ditto	0	5	0



9643-6

DUPLEX "GERYK" VACUUM PUMPS, Connected in Parallel

These Duplex Pumps are specially designed for the production of high vacua in factories, a very large number having been sold for this purpose. They require far less power to drive than any other description of vacuum pump. These pumps are connected in parallel and will give a vacuum of 1/50th of a millimetre off perfect.

The pumps are made in sizes up to a capacity of 100 cubic feet per minute, or larger if required. They are fitted between "A" frames, and fast and loose pulleys are supplied. Prices on application.

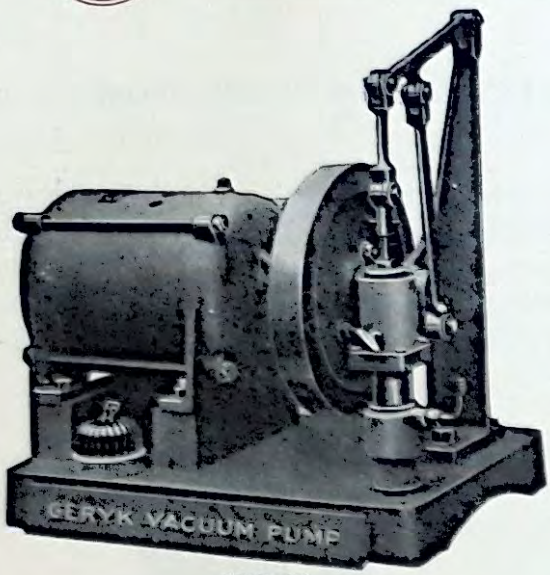
The following are some of the standard sizes manufactured by us, but we shall be pleased to quote for other and larger sizes on receipt of full particulars of requirements.

	Ref. No.	Dia. of Cylinders inches	Stroke inches	Speed revs. per minute	Piston Displacement per minute cubic inches	Current Price £	s.	d.
9639	10	2	5	100	2,500	**16**	**0**	**0**
9640	12	2	10	100	5,600	**30**	**0**	**0**
9641	14	2½	10	100	8,820	**35**	**0**	**0**
9642	16	3	10	100	12,700	**48**	**0**	**0**

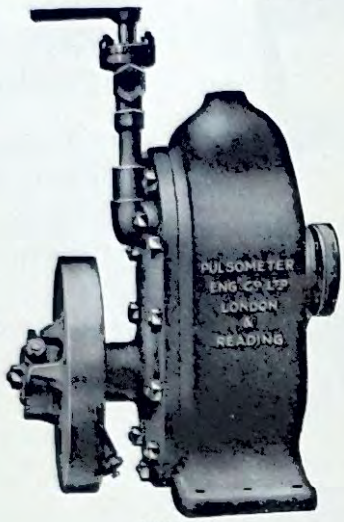
HIGH VACUUM PUMP: The "GERYK" SPECIAL, with Oil-Sealed Stopcocks

This type of pump was invented for producing a vacuum comparable with the highest known. Each pump is tested before despatch to a vacuum of not less than 1/100,000th of a millimetre of barometric reading, measured on a commercial McLeod gauge. A vacuum of ½-millionth of a millimetre is frequently obtained. The same high efficiency is obtainable with these pumps irrespective of size.

	Ref. No.	Dia of Cylinders inches	Stroke inches	Speed revs. per minute	Piston Displacement per minute cubic inches	Current Price £	s.	d.
9643	11	2	5	100	1,250	**20**	**0**	**0**
9644	13	2	10	100	2,800	**33**	**0**	**0**
9645	15	2½	10	100	4,410	**38**	**0**	**0**
9646	17	3	10	100	6,350	**50**	**0**	**0**



9647-59



9660-64

MOTOR-DRIVEN "GERYK" VACUUM PUMPS, Fleuss' Patents.

The prices given below include suitable continuous current motors up to 250 volts, with reduction gearing, all mounted on the same baseplate. A starting switch is also supplied.

Delivered free in the United Kingdom, or F.O.B. London, Liverpool or Southampton.

Packing extra, as shown.

When ordering please state voltage.

	Ref. No.	Dia. of Cylinders inches	Stroke inches	Speed revs. per minute	Piston Displacement per minute cubic inches	Current Price £	s.	d.
9647	0	1½	4	100	700	**24**	**0**	**0**
9648	1	2	4	100	1,250	**25**	**10**	**0**
9649	2	2	10	100	2,820	**36**	**0**	**0**
9650	3	2½	10	100	4,410	**40**	**0**	**0**
9651	4	3	10	100	6,360	**50**	**0**	**0**
9652	10	2	5	100	2,500	**36**	**0**	**0**
9653	11	2	5	100	1,250	**39**	**0**	**0**
9654	12	2	10	100	5,600	**53**	**0**	**0**
9655	13	2	10	100	2,800	**56**	**0**	**0**
9656	14	2½	10	100	8,820	**58**	**0**	**0**
9657	15	2½	10	100	4,410	**61**	**0**	**0**
9658	16	3	10	100	12,700	**62**	**0**	**0**
9659	17	3	10	100	6,350	**72**	**0**	**0**

"GERYK" HIGH VACUUM PUMPS, Rotary Pattern.

To meet the demand for a high efficiency Rotary Vacuum Pump, we have brought out the type illustrated. Some of the advantages of these pumps are given below.

HIGH VACUA.—Single stage pumps will give a vacuum of 1/50th of a millimetre off perfect (measured on a McLeod gauge), and when connected in series ·00007 of a millimetre is frequently reached. **The large workshop pumps give a vacuum equally as good as that obtained by the smaller sizes.**

COMPACTNESS.—The 3-in. size pump only occupies 10¼ × 7¼ × 12 in. high and weighs 28 lb.

FAST RUNNING.—These pumps can be run at a speed of from 500 to 600 revolutions per minute.

DURABILITY.—The automatic oil injection enables the working parts to run continuously in a film of oil, thereby reducing friction to a minimum. The pumps are designed so as to automatically take up any wear.

LARGE DISPLACEMENT.—The volume swept by a 3-in. pump is over 2 cubic feet per minute when running at 600 r.p.m.

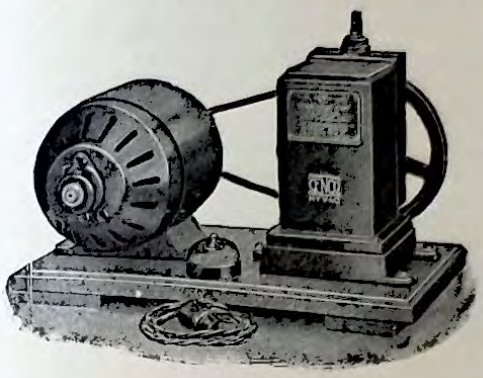
ADAPTABILITY.—They can be adapted for use as a pressure pump for moderate pressures or for a vacuum and pressure combined; they can also be supplied suitable for desiccation and distillation at a small extra charge.

SINGLE STAGE PUMPS Belt Drive, as illustrated

	Size	Displacement per minute, cubic feet	Speed revs. per minute	Price £	s.	d.
9660	3	2	600	**20**	**0**	**0**
9661	4	5·3	600	**30**	**0**	**0**
9662	6	14	600	**40**	**0**	**0**
9663	8	30	500	**60**	**0**	**0**
9664	12	110	300	**135**	**0**	**0**

The "Hyvac" Two-Stage Rotary Oil Pump

New improved model with metal oil trap and valves



9666-70

Produces a Vacuum of 0.001 mm. without Preliminary or Backing Pump

In the latest type of this unique pump the glass oil trap provided on earlier models, and designed to prevent oil rising into the high vacuum system, is replaced by a metal trap integral with the pump casing. The inlet tube at the top of the trap is corrugated to take first-grade vacuum tubing, and is surrounded with an annular channel allowing the joint to be sealed with oil, mercury, vacuum wax, etc. This improved model is also fitted with all-metal ball valves, thus rendering the pump practically indestructible.

Advantages of the Hyvac

COMPACTNESS AND PORTABILITY.—The total space occupied by the pump and electric motor, fixed on baseboard, is 18 in. × 9 in. only.

IDEAL FOR LECTURE-DEMONSTRATIONS.—The whole unit can be lifted with comfort, placed on the lecture table and set to work at once by switching on the current.

SILENT WORKING.—This important feature enables experiments to be performed during the actual delivery of lectures.

SPEED.—The evacuation of large tubes to demonstrate the various types of electric discharge from atmospheric pressure to Cathode and X-ray Vacua can be shown in a few minutes.

EXTREMELY HIGH VACUA.—10^{-8} mm. can be obtained with the addition of a simple and inexpensive mercury vapour pump of glass, fused quartz or steel.

ROBUSTNESS.—There is nothing to break, wear, or fail in use in any part of the pump.

RELIABILITY.—Research workers will appreciate the advantage of being independent of bulky reciprocating pumps, unreliable water pumps, and fragile rotary mercury pumps.

UNAFFECTED BY MERCURY VAPOUR.—The pump interior is free from brass, white metal packings, etc., which disintegrate when exposed to mercury vapour from condensation pumps.

ECONOMY.—No further expense is necessary after first outlay. Pump being entirely of metal, wear is practically nil.

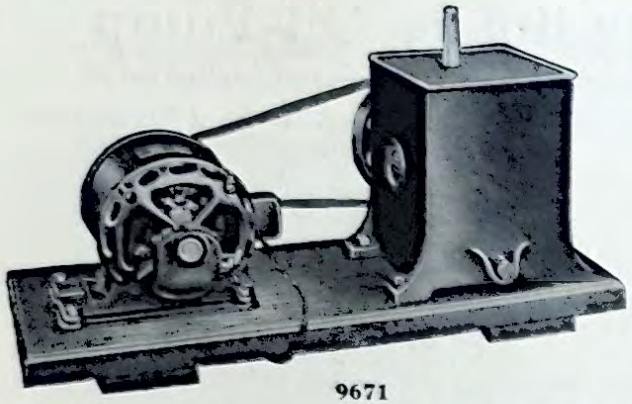
Specification

Degree of vacuum, mm.	0·001	Speed of operation, r.p.m. ...	200 to 500
Capacity in cubic inches of free air per minute	350 to 850	Size of pulley, inches	7
Size of pump, inches	5⅛×5½×9¼	Weight of pump only, pounds	18½
		Amount of oil required, ounces	25

Prices

(F) **9666**	**Hyvac Pump,** complete with Metal Trap, fitted with inlet nipple corrugated to take I.R. tubing, 7-in. Pulley grooved for 5/16 in. belt, supply of special Oil and full directions for working	**£16 15 0**
(F) **9667**	**Hyvac Pump,** complete as above, but mounted on Polished Hardwood Base with Switch, 5 ft. connecting Cable, Adapter for lamp holder, and specially wound constant speed direct current Electric Motor (⅛ h.p.), ready for immediate use: 100–120 volts D.C.	**27 0 0**
(F) **9668**	Ditto, 200–240 volts D.C.	**27 10 0**
(F) **9669**	Ditto, but with Alternating Current Motor (50 cycles): 100–120 volts A.C. ...	**25 10 0**
(F) **9670**	Ditto, 200–240 volts A.C. ... ... (Kindly state voltage when ordering, and where alternating, state periodicity).	**26 0 0**
	National Physical Laboratory Certificate of performance (if required)	**30 0** extra.

(F) Foreign manufacture.



9671

Type B (Two-Stage) (Type A (Single-Stage)

ROTARY VACUUM PUMPS OF LARGE CAPACITY.

Improved Models (Oil Immersed). (Types A and B).

Designed for the production of High Vacua and for the rapid exhaustion of large volumes.

These Rotary Pumps have many excellent features not possessed by reciprocating pumps or the older patterns of rotary oil pumps.

Both A and B types work directly from atmospheric pressure and do not need "backing" pumps.

They are entirely automatic and need no attention whatever.

Ball type non-return valves are fitted to both patterns. These valves are practically indestructible and do not require refitting or replacement.

The pumps are entirely immersed in oil. This feature prevents leakage of air into the high vacuum. All parts liable to friction are constantly bathed in oil and therefore are free from wear or undue heating.

Advantages

COMPACTNESS AND PORTABILITY.—The total space occupied by pump and motor fixed on base-board is only 30 × 12 in. for Type A, and 31 × 16 in. for Type B. If necessary, the complete outfit can be moved to suit the work in hand. Owing to the perfect balance, smooth action and consequent freedom from vibration, special foundations are quite unnecessary.

CLEANLINESS.—These pumps are not liable to discharge oil when working, and may be installed where cleanliness is essential.

HIGH CAPACITY AND EFFICIENCY are associated with both of these pumps. At the normal speed of rotation, and at atmospheric pressure, the displacement of air in Type A amounts to 86 litres per minute. The efficiency of the pump is such that its overall pumping speed (Gæde's definition) from 760 mm. down to 2·5 mm. is more than 57 litres per minute. In Type B, which rotates more slowly than Type A, the displacement is 67 litres per minute. The performance of this pump is characterised by the remarkable pumping speeds even at low pressures. For instance, between the pressures 7×10^{-3} mm. and 10^{-3} the speed of the pump is of the order of 14 litres per minute.

Specifications

	Type A.	Type B.
Degree of vacuum, mm. of mercury	0·02	0·0001
Displacement of air at normal pressure, litres per minute	86	67
Ditto, cubic feet per minute	3	2·4
Dimensions of containing tank, width	205 mm. 8 in.	205 mm. 8 in.
,, ,, breadth	236 ,, 9¼ ,,	340 ,, 13⅜ ,,
,, ,, height	280 ,, 11 ,,	323 ,, 12¾ ,,
,, overall, width	275 ,, 10¾ ,,	300 ,, 11⅞ ,,
,, ,, breadth	335 ,, 13¼ ,,	450 ,, 17¾ ,,
,, ,, height	353 ,, 14 ,,	400 ,, 15¾ ,,
Speed of rotation, revolutions per minute	450	350
Size of Pulley, face and diameter, mm.	35 × 200	35 × 300
,, ,, ,, inches	1⅜ × 8	1⅜ × 12
Power required for driving (approx.) horse power	0·33	0·30
Weight of Pump only, kilograms	39·5	65
,, ,, pounds	87	143
Amount of Oil required, kilos	4·7	9·7
,, ,, pints	8·5	17

Prices

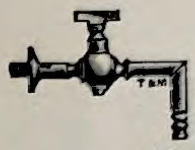
(F) **9671**	**Rotary Pump, Type A** (Single Stage), with Pulley as specified, and full directions for use		£22	0 0
(F) **9672**	**Rotary Pump, Type B** (Two Stage), with Pulley as specified, and full directions for use		40	10 0
(F) **9673**	**Rotary Pump, Type A,** mounted on Polished Hardwood Base with Slide Rails, Pulleys, Belt, etc., and specially wound constant speed direct current Motor (⅛ h.p.), ready for immediate use		35	15 0
(F) **9674**	Ditto, but with alternating current Motor (50–60 cycles)		35	5 0
(F) **9675**	**Rotary Pump, Type B,** mounted on Polished Hardwood Base with Slide Rails, Pulleys, Belt, etc., and specially wound constant speed direct current Motor (⅛ h.p.), ready for immediate use		54	5 0
(F) **9676**	Ditto, but with alternating current Motor (50–60 cycles)		53	15 0
	(Starters are not needed with the motors specified, as they are specially wound for starting with a simple switch).			
9677	**Oil,** specially pure. Free from dissolved gases and moisture. Sufficient for filling type A	per can	£1	10 0
9678	Ditto, sufficient for filling type B	,,	3	0 0
9679	**Oil,** cheaper grade. (When using this Oil in type B pump, the highest vacuum cannot be attained until the pump has been working for some time). Sufficient for filling type A ;	per can	0	10 6
9680	Sufficient for filling type B	,,	1	0 0

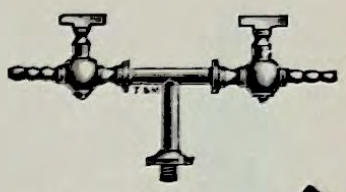
(F) Foreign manufacture.


9682–3

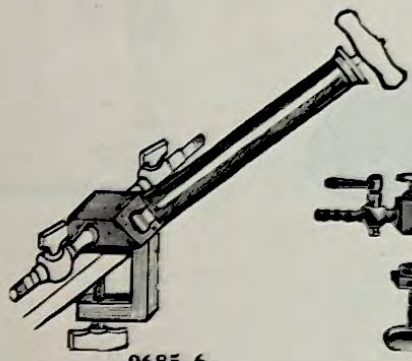

9684

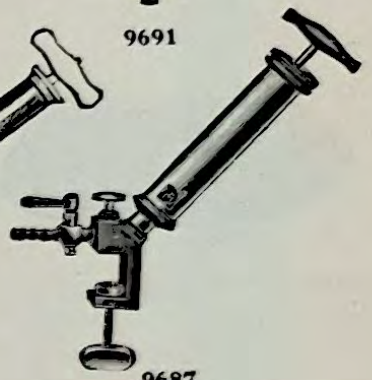

9689


9690


9691


9688


9685–6


9687

9682	**Brass Syringe,** Exhausting, best make	Length of Barrel	5	7	8	in.
		Diameter ...	1	1½	1½	,,
			11/6	**16/6**	**21/6**	each
9683	,, Condensing	Length of Barrel	5	7	8	in.
		Diameter ...	1	1½	1½	,,
			11/6	**16/6**	**21/6**	each
9684	,, Exhausting and Condensing, best make.	Length of Barrel	5	7	8	in.
		Diameter ...	1	1½	1½	,,
			16/0	**21/0**	**26/0**	each

9685 ,, Exhausting and Condensing, 8×1½ in., with two Stopcocks, and Heavy Clamp to fix to Table, for Organic Analysis **£1 18 6**

9686 ,, as above, 7×1 in. **1 12 6**

9687 ,, with Clamp, size of Barrel 8×1½, as supplied to Wye College, etc. **1 8 6**

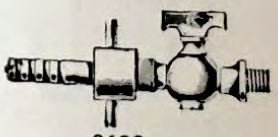
9688 **Exhausting Plate,** Brass, with Stopcock and Connection for rubber tubing, mounted on Iron Tripod Foot.

Diameter of Plate	5	6	7	8	10	in.
	27/6	**30/0**	**37/6**	**42/0**	**55/0**	each

9689 **Connector,** Brass, to screw to Plate of Pump for Rubber Tube connection ... ... each **£0 3 6**

9690 ,, ,, with Stopcock ,, ,, ,, ,, ,, ... ,, **0 7 6**

9691 ,, ,, T-shape, with two Stopcocks ,, ,, ,, ... ,, **0 12 6**


9692


9693


9694


9695

9692 **Connector,** with Tap and Union ... ... each **£0 9 0**

(F) 9693 **Receivers,** with Knob at top and Welt at bottom, accurately ground.

Height to Shoulder	6	9	7	12	7½	8	9	in.
Diameter Outside ...	4	4	5	5	5½	6½	8	,,
	3/6	**4/0**	**5/0**	**6/0**	**6/6**	**7/0**	**9/0**	each

(F) 9694 Ditto, Open, welted top and bottom, accurately ground.

Height to Shoulder ...	6	9	7	7½	8	9	in.
Diameter Outside ...	4	4	5	5½	6½	8	,,
	3/6	**4/6**	**5/6**	**6/6**	**7/0**	**9/0**	each

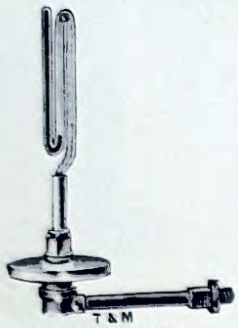
(F) 9695 Ditto, with Stopper ground in, welted top and bottom, accurately ground.

Height to Shoulder	7	7	8	9	in.
Diameter Outside	5	5½	6	7	,,
	5/9	**7/6**	**8/6**	**10/6**	each

(F) Foreign manufacture.



9696–7



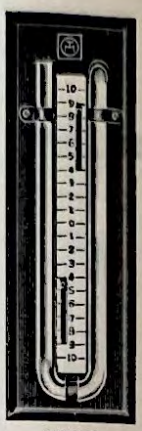
9698–9700



9701

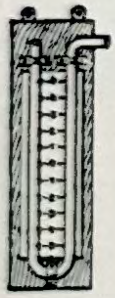


9702



9703

9696	**Tubing,** Pressure or Vacuum, best red vulcanized rubber. Diameter inside ...	$\frac{1}{8}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{3}{16}$	$\frac{5}{16}$
	,, outside ...	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{7}{16}$	$\frac{5}{8}$	$\frac{3}{4}$
		2/0	**3/6**	**3/3**	**2/9**	**2/6**	**4/6**	**6/6** per yd.
9697	Ditto, with 1 ply of Canvas for greater pressure. Diameter inside ...	$\frac{3}{16}$		$\frac{1}{4}$		$\frac{5}{16}$		
	,, outside ...	$\frac{1}{2}$		$\frac{1}{2}$		$\frac{3}{4}$		
		3/6		**3/9**		**5/6** per yd.		
9698	**Vacuum Gauge,** Syphon form, with Brass Fittings, to fit Air Pumps							**£0 5 0**
9699	**Arm** for above							**0 5 6**
9700	Ditto, ditto, with Brass Plate							**0 10 0**
9701	**Vacuum Gauge,** with Silvered Metal Scale enclosed in Glass Jacket, with Stopcock, complete							**0 15 6**
9702	Ditto, with Boxwood Scale, on Stand							**0 8 6**
9703	**Manometer,** Syphon Gauge, mounted on Board, with Sliding Boxwood Scale ...							**0 10 0**



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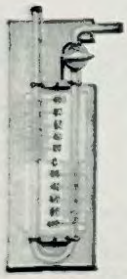
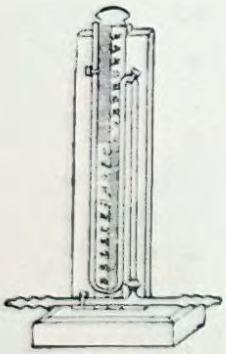


9705



9706



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9708



9709

9704	**Manometer,** on Board, with Milk Glass Scale, with divisions either in inches or millimetres ... ... each	**£0 7 3**
9705	Ditto, fitted with Stopcock	**0 10 0**
9706	Ditto, for Vacuum Apparatus; mounted on Polished Wood Stand, with Milk Glass Scale and Stopcock ... ... each	**1 6 6**
9707	**Manometer,** Syphon form, closed one end ... ... ,,	**0 1 3**
9708	,, ,, ,, open both ends ... ... ,,	**0 1 3**
9709	,, ,, ,, closed one end, with extra limb ... ... ,,	**0 1 8**



9710



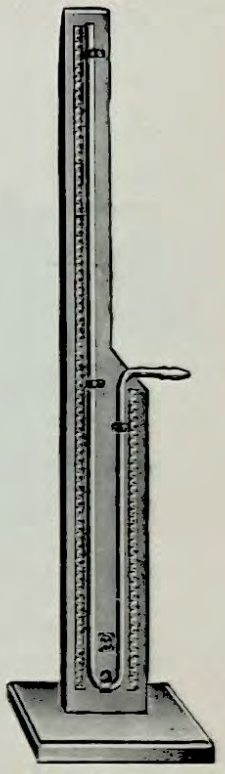
9712



9713



9714



9711

9710 **Vacuum and Pressure Gauge,** with Movable Scale, mounted on Board. If used as a Vacuum Gauge connect to the upper end; if for Pressure Gauge connect at the Bulb end. Price with Mercury, complete **£1 8 6**

9711 **Manometer,** with Scale, 1 metre long, Zero in Centre, short Limb with Scale ½ metre long, on Teak Stand. **£1 1 0**

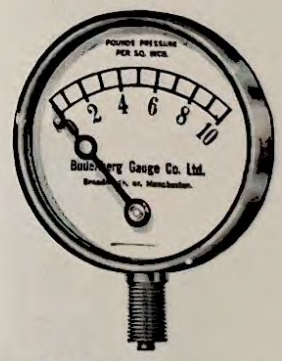
(F) **9712** **Ring,** Bourdon's, with Stopcock, for showing the action of Metal Barometers and Manometers ... **£3 3 0**

(F) **9713** **Model of Air Pump,** Glass, for Lecture use each **£0 5 3**

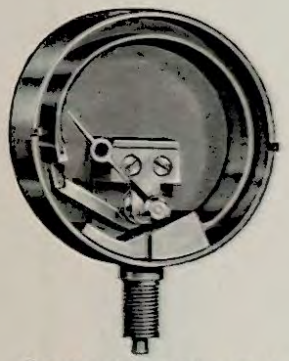
(F) **9714** **Model of Exhausting and Condensing Pump** each **£0 5 0**

"SIMPLEX" PRESSURE GAUGES.

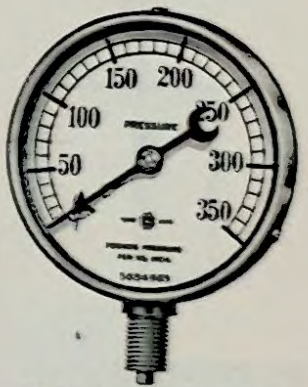
For Air, Gas, Oil, Water, etc.



9715—Eccentric Scale.



Interior view of **No. 9715** (dial removed).



9716—Concentric Scale.

"Simplex" Gauges. Diameter of Dial, inches	1	1½	2	2¼	2½	3
Size of connecting thread	¼ in. dia. 26 per in.	⅛ in. Gas			¼ in. Gas	
9715 Prices with Brass Bezel and Painted back	*10 0	*8 6	*9 6	*11 6	13 0	14 0
9716 " " " "	—	—	—	14 6	16 0	*17 0
Extra for Nickel-plated Rim ...	1 0	1 0	1 0	1 0	1 0	2 0

*We Stock these Gauges in the following sizes and pressures:—
9715, 1 in. and 1½ in.—40, 80, 120, 150, and 200 lbs. per sq. inch; also 30 in. Vacuum.
Ditto, 2 in.—7, 10, 20, 30, 60, 100 and 150 lbs. per sq. inch; also 30 in. Vacuum.
Ditto, 2¼ in.—10 lbs. and 20 lbs. per sq. inch.
9716, 3 in.—10, 20, 30, 60, 80, 100, 120, 150, 200 and 300 lbs. per sq. inch; also 30 in. Vacuum.

(F) Foreign manufacture.

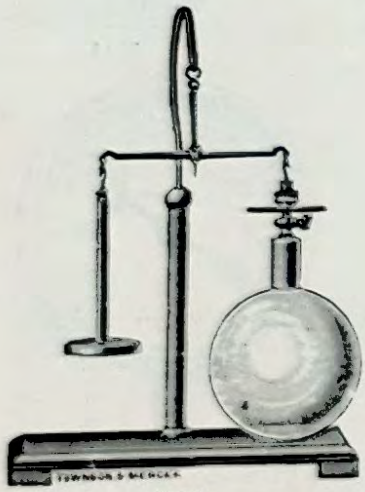

9718


9719


9720


9721

9718	**Baroscope,** with Glass Ball and Adjusting Weight, mounted on Brass Stand			**£0 10 6**
9719	„ with Glass Ball and Brass Adjusting Weight, Graduated Scale on Brass Stand			**0 18 6**
9720	**Glass Globe,** Weight of Gases, capacity about 1000 c.c., fitted with Brass Stopcock, Hook, and extra Brass Screw Connector for attaching to Air Pump, for estimating Specific Gravity of Gases			**0 10 6**
9721	Ditto, with two Stopcocks and Hooks for suspension.	Capacity	1000	2000 c.c.
			13/6	**15/0** each


9722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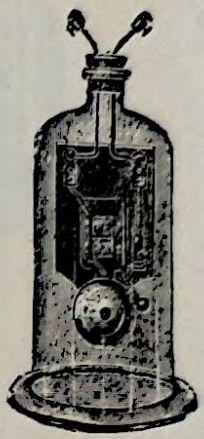
9722	**Glass Globe,** Weight of Gases; capacity about 1000 c.c., fitted with Brass Stopcock, Hook and extra Brass Screw Connector for attaching to Air Pump; mounted on Balance, with Mahogany Base and Counterpoise, for estimating Specific Gravity of Gases	**£1 8 6**
9723	**Barometer Tube,** and Accurately Ground Brass Plate with Stuffing Box, for use on Pump, showing the mercurial column depends on the Atmospheric Pressure	**0 7 6**
9724	Ditto, with Glass Receiver, Rubber Stopper and Mercury Trough	**0 7 6**
(F) **9725**	**Receiver,** Glass, 36 in. high, for Torricellian Experiments	**0 15 0**

(F) Foreign manufacture.



9726



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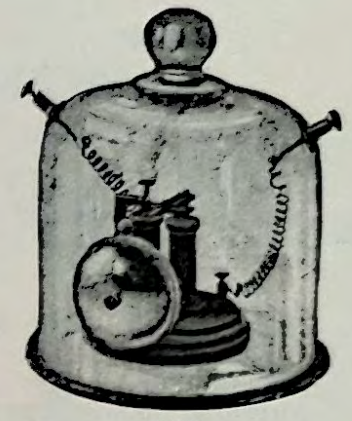

9728

9726	**Model of Diving Bell,** consisting of Pulley, with Cord in Metal Frame for suspending Bell Jar, Outlet Tube with Stopcock, and Outer Glass Vessel	£1 10 0
9727	**Bell Experiment,** Glass Receiver, fitted with Bell Push and Dry Cell, to show that Air is essential to Sound	0 16 6
9728	Ditto, ditto, with large Glass Receiver, superior finish	1 12 6



9729



9730



9731



9732

9729	**Bell Experiment,** Simple form	£0 8 6
9730	Ditto, with Clockwork Action	1 1 0
9731	**Bladder and Lead Weight,** Expansibility Apparatus; two concave Wood Blocks, Iron Frame, mounted on Mahogany Base	0 13 6
9732	**Hand or Bladder Glass,** with ground Flange top and bottom	0 2 6
9733	**India Rubber Sheet,** for use with above ... ... per square foot	0 2 6

Pneumatics


9735


9736


9737


9738


9739


9740/1

9734	**Bladders,** India Rubber, for showing Elasticity of Air under diminished Pressure per doz.	£0 1 0
9735	**Apple Cutter**	0 4 6
9736	**Mercurial Shower, Filter Cup,** with ground Ring; can be used with Apparatus No. 9732	0 5 6
9737	Ditto, ditto, another form, with Porous Cup fitting on Glass Cylinder, ground at bottom to fit Air-pump Plate, and with curved Tube to prevent loss of Mercury	0 9 6
9738	**Water Shower,** Upward Pressure Apparatus, strong Japanned Tin, with Handle	0 3 6
(F) 9739	**Intermittent Syphon,** Tantulus Cup, Glass, which upon filling immediately empties itself by means of the Syphon ... ... each	0 2 6
9740	**Fountain in Vacuo,** Simple form	0 1 6
9740/1	Ditto, stout Glass, with Brass Mounts	0 6 0


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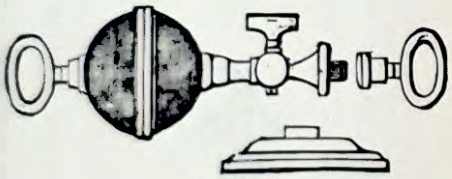
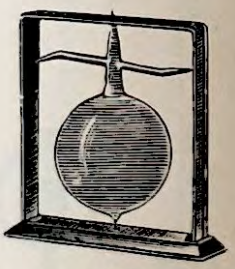

9745–6


9747

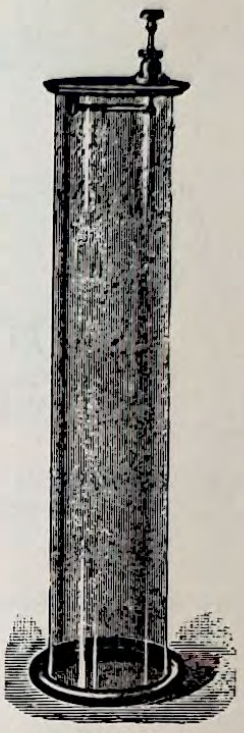
9741	**Fountain in Vacuo,** Hero's, with Stopcock and Metal Basin ... ... each	£0 10 6
9742	Ditto, height 16 in., with Stopcock and Brass Foot, ground flat at bottom ...	1 5 0
(F) 9743	**Breaking Squares,** Light Glass, for crushing by atmospheric pressure each **1/0,** per doz.	0 10 0
9744	**Metal Cylinders,** for crushing ... ... „ **1/3,** „	0 14 0
9745	**Magdeburg Hemispheres,** Iron, accurately ground, with Stopcock and two Handles. Diameter of Sphere 3¼ 4¼ in. **15/6** **18/6** each 2½ 3¼ in.	
9746	Ditto, ditto, Brass, accurately ground, with Stopcock and two Handles	**18/0** **21/6** each
9747	**Rotating Glass Globe,** revolving under Air Pump when the pressure is reduced, in Brass Frame ... ... each	£0 10 6

(F) Foreign manufacture.


9748


9749


9752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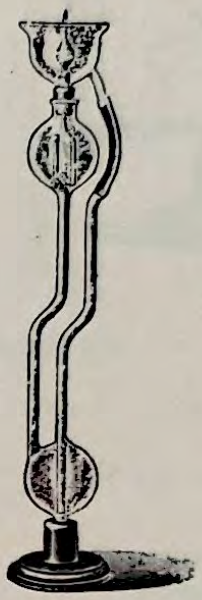
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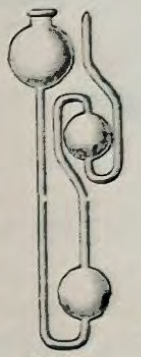
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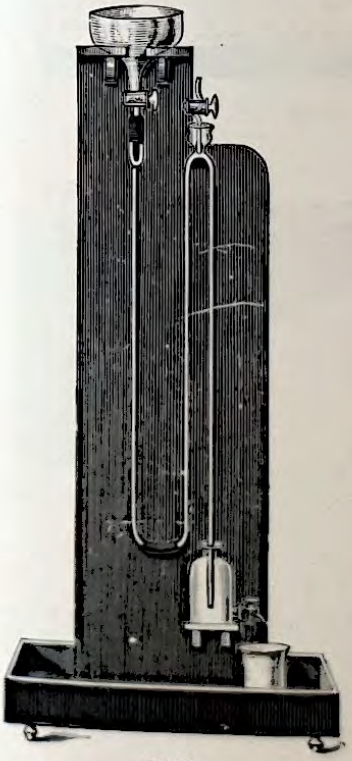
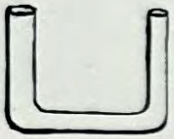

9758

	9748	**Guinea and Feather Experiment,** Glass Tube, about 36×1½, with Brass Mounts and Stopcock	**£1**	**5** **0**
	9749	Ditto, ditto, Brass Plate, with ground under surface, and Stuffing Box to Releasing Rod, with 2	3 falls **24/0**	**28/6** each
	9750	Ditto, ditto, another form (without Cylinder, as shown)	**£1**	**2** **6**
	9751	**Tall Glass Cylinder,** for above, accurately ground both ends, 16 in. long, 3 in. diameter at top, 4 in. at bottom	**0**	**10** **6**
	9752	**Tallow Holder,** Mahogany, with Screw, for greasing edges of Glass Receivers, etc., previous to use with Air Pump	**0**	**1** **6**
(F)	**9753**	**Fountain,** Hero's, mounted on Wooden Base ...	**0**	**10** **0**
(F)	**9754**	Ditto, ditto, unmounted	**0**	**5** **0**
	9755	**Fountain,** Hero's, with two stout Glass Reservoirs, Brass Basin, 12 in. diameter, and Fittings, mounted on Iron Foot, best finish, height about 1¼ metres	**4**	**15** **0**
(F)	**9756**	Ditto, ditto, Simple form, mounted on Wood Base	**0**	**7** **6**
	9757	Ditto, ditto, Simple form	**0**	**5** **0**
(F)	**9758**	**Sprengel's Pump,** mounted on Wood Stand, with one-fall Tube	**5**	**10** **0**
(F)	**9759**	Ditto, ditto, with three-fall Tube	**6**	**15** **0**

(F) Foreign manufacture.

Hydrostatics and Hydraulics



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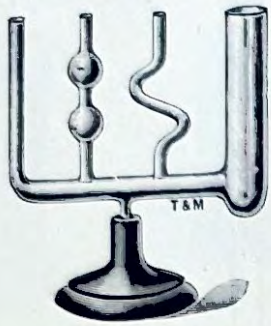
9762



9764–5



9766

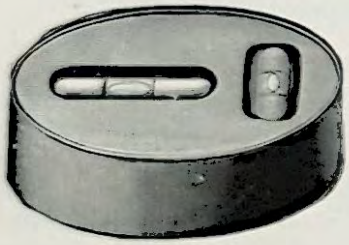
9760	**Apparatus,** Glass, with two Branches, to show that Water finds its own level in Communicating Vessels ... ... each	£0	1 3
9761	Ditto, as above, mounted on Polished Wooden Foot ... ... ,,	0	2 6
9762	Ditto, Glass, with three Branches ... ... ,,	0	1 6
9763	Ditto, as above, mounted on Polished Wooden Foot ... ... ,,	0	2 9
9764	Ditto, Glass, with four Branches ... ... ,,	0	2 3
9765	Ditto, as above, mounted on Polished Wooden Foot ... ... ,,	0	5 0
(F) **9766**	Ditto, Glass, another form, with five Branches ... ... ,,	0	6 6



9767



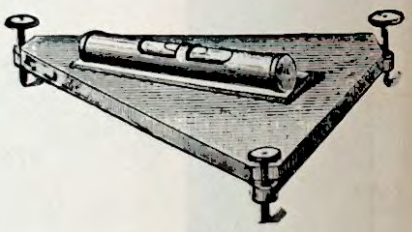
9768



9771



9769

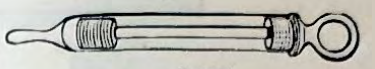


9772

		Length	4	5			in.
9767	**Level,** Spirit, Brass, in Case, best quality		2/9	3/6			each
9768	,, ,, Brass Plate on Polished Wood Base.						
		Length about	4	6	8	10	in.
			1/0	1/4	1/9	2/3	each
9769	,, ,, Brass, in Leather Case, for Balances, etc., length 2½ in., ... each					£0	2 0
9770	,, ,, Brass, cheaper quality, without case, length 2½ in.... ... ,,					0	1 3
9771	**Cross Spirit Level** for adjusting Balances, mounted in Nickelled Brass Case ,,					0	6 6
9772	**Tripod Levelling Stand,** Polished Mahogany, with Brass Spirit Level, complete ,,					0	12 6

For other Spirit Levels, see Page 102.

(F) Foreign manufacture.



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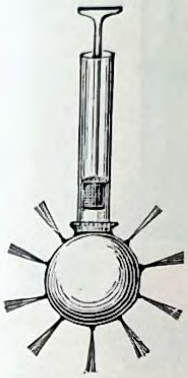

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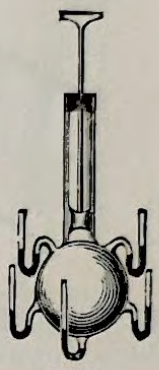

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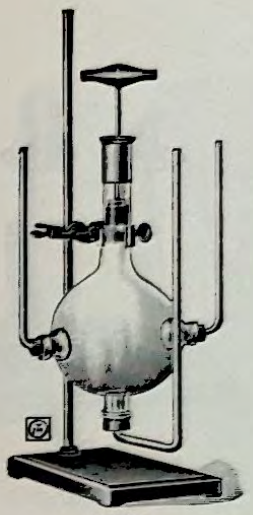

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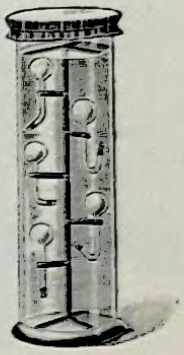


9776

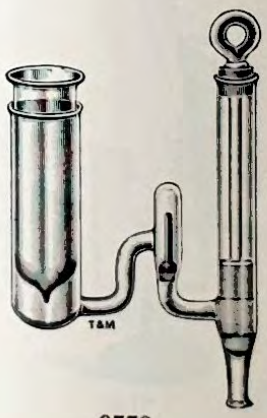
(F) **9773** **Fluid Pressure Apparatus,** Glass, to show Pressure in all directions of a Liquid, each **£0 5 0**

(F) **9774** ,, ,, ,, ,, ,, ,, ,, of a Gas .. **0 7 6**

9775 ,, ,, ,, Glass Globe, about 6 in. diameter, with Side Tubes and Piston mounted on Heavy Iron Stand, with Clamp... ... ... each **1 5 0**

(F) **9776** **Fluid Pressure Apparatus,** to show Pressure in all directions, new Pattern... ,, **0 10 0**

		Capacity	½	1	2	oz.
9777	**Syringes,** Glass, with Cork Tops		**4/0**	**5/6**	**8/0**	per doz.



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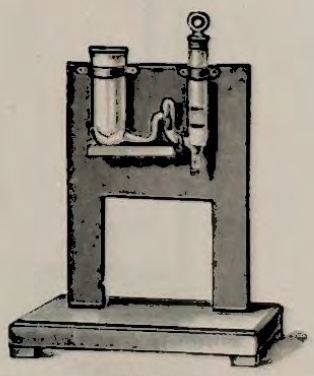

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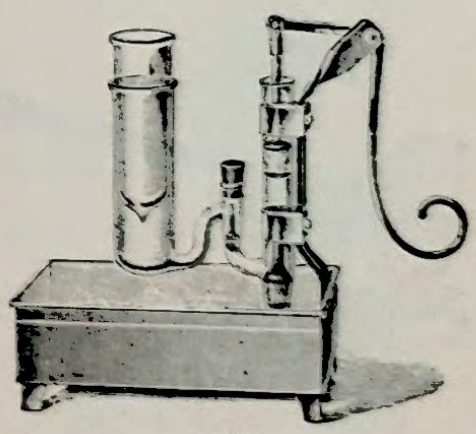


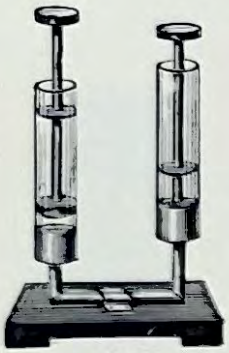
9780

(F) **9778** **Hydrostatic Press,** Bramah's, Glass Model ... ... each **£0 4 6**

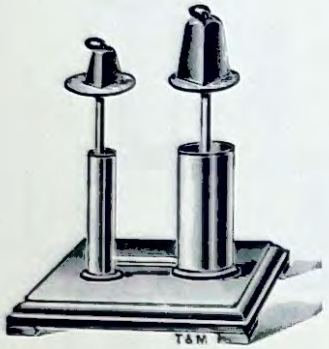
9779 Ditto, as above, with Zinc Reservoir and Suction Tube, mounted on Wooden Stand .. **0 12 6**

9780 Ditto, with Brass Fittings and Reservoir, mounted on Iron **0 18 6**

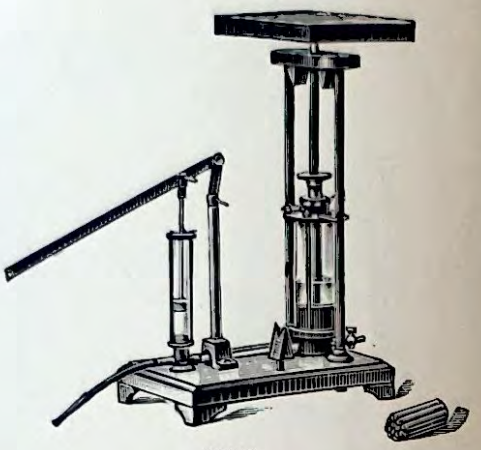
(F) Foreign manufacture.



9781



9782



9783

9781 **Apparatus,** to show the Pressure of Liquids, two Metal Cylinders (Glass Cylinders are shown), 1⅛ in. diameter, fitted with Metal Discs, mounted on Mahogany Stand ... ... each **£1 5 0**

9782 **Hydrostatic Press,** Apparatus to show the principle, two Unequal Metal Cylinders, ¾ in. and 1¼ in. diameter respectively, fitted wtih well-fitting Pistons and Metal Discs, mounted on Mahogany Stand ... ... each **2 2 6**

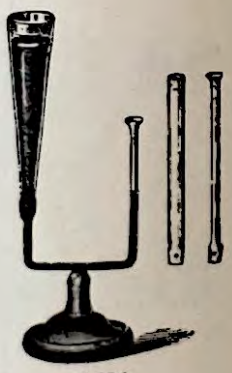
9783 **Hydrostatic Press,** Bramah's, with Removable Metal Cylinders and well-fitting Leather Pistons (Brahma's Collar), divided Lever Handle, Safety Valve, Knife Edges for Breaking Bars, and Weight Platform, mounted on Polished Mahogany Base. Complete with twelve Breaking Bars ... ... each **4 16 6**



9784



9785



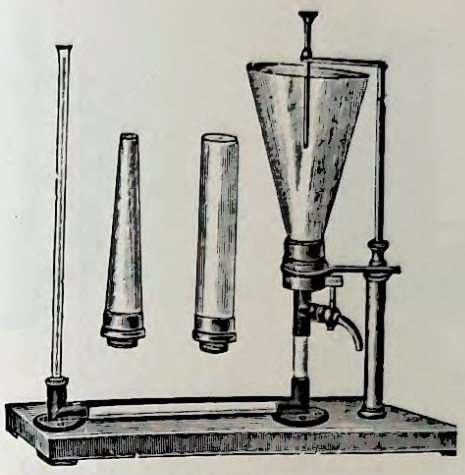
9786

9784 **Hydrostatic Press,** Heavy Cast Iron, partly nickelled, can be worked from any side, the holder of the Lever revolving round the axis of the Pump **£12 10 0**

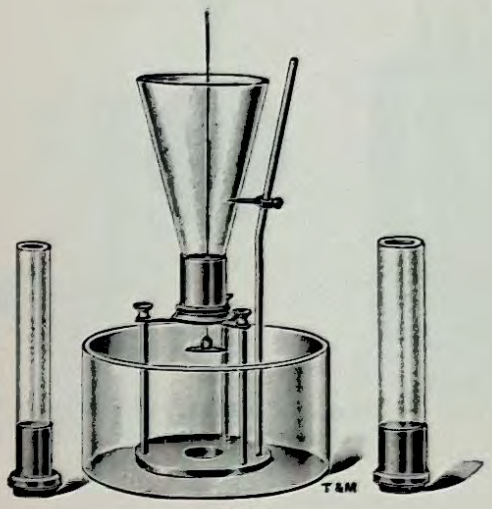
9785 **Hydrostatic Bellows,** Mahogany Boards 12 in. diameter, with Leather Bellows and Metal side Tube, 6 ft. high, with Funnel **3 10 0**

(F) **9786** **Haldat's Apparatus,** simple form, to show that the pressure depends on the height of the column of liquid and not upon the shape or capacity of the vessel; three different-shaped Tubes ground in, with side hole at bottom for emptying. The pressure is indicated by a column of mercury **0 10 6**

(F) Foreign manufacture.



9787



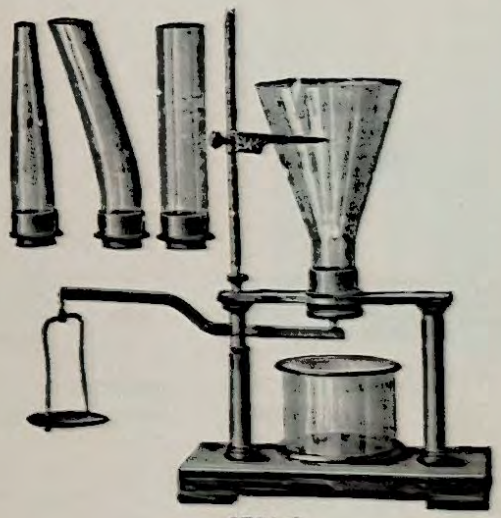
9788

9787 **Haldat's Apparatus,** as above, Superior make, with three Vessels of different shape, adjustable Index, Stopcock for emptying, mounted on Polished Wood Base ... **£5 10 0**

9788 **Pascal's Apparatus,** to show that the pressure of a liquid on the base of a vessel depends on the area of that base, and the height of the column of liquid it supports, and not on the shape or capacity of the vessel. Three Glass Vessels of different shapes, mounted in Ground Brass Collars, with Screw for attachment, Ground Brass Column Plate, Trough and Index, mounted on Brass Stand **3 5 0**



9789–90



9791–2

9789 **Pascal's Apparatus,** another form. Three Glass Vessels, mounted in Ground Brass Collars screwed for attachment to arm, Ground Brass Plate on Weight Lever with Pan, Trough and Column Index, mounted on Metal Stand **£3 15 0**

9790 Ditto, as above, with four Vessels **4 2 6**

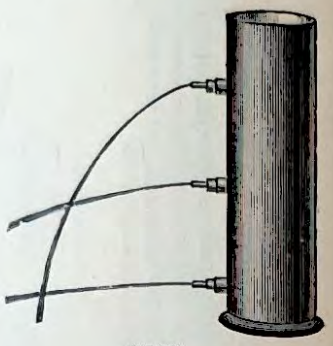
9791 Ditto, as above, large size, with three Glass Vessels, mounted on Mahogany Base **4 4 0**

9792 Ditto, ditto, ditto, with four Vessels **4 15 0**

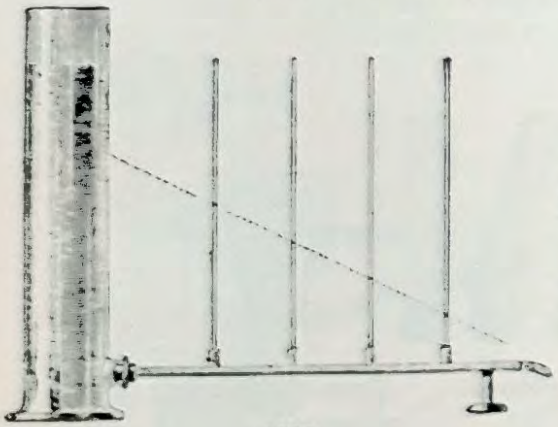

9793–4


9795


9797


9798

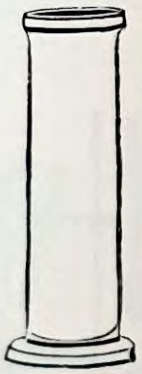
9793	**Upward Pressure of Liquids Apparatus,** to demonstrate; Glass Cylinder, with ground Flange, open at both ends, with ground Metal Disc and Cord attached to close the bottom of the Tube, complete with Cylindrical Glass Jar to contain water	£0	6	6
9794	Ditto, ditto, consisting of Glass Cylinder, Metal Disc and Glass Jar only ... each	0	5	0
9795	**Floating Brass Ball,** Floating in Cold Water and Sinking in Warm Water ...	0	10	6
9796	Ditto, Glass, ditto, ,, ,, ,, ,, ,, ,, ...	0	4	6
9797	**Lateral Pressure Apparatus,** Glass Vessel, with Side Tube, mounted on Pine Board	0	3	0
9798	**Spouting Jar,** 20×6 in., Japanned Tin, for demonstrating Torricelli's Experiment, fitted with Tubes and Corks ... ... each	0	9	0


9799


9800


9801


9802


9803

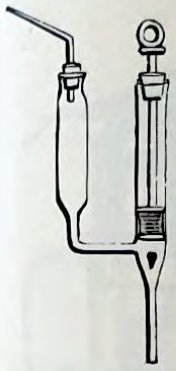

9804


9805

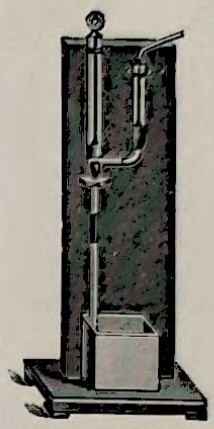

9806

(F) 9799	**Apparatus,** to show decrease of pressure along a horizontal tube	£1	5	0
(F) 9800	**Cartesian Figure,** Black Glass ... ... each	0	0	6
(F) 9801	,, ,, ... ,,	0	0	8
(F) 9802	,, ,, in Cage ... ... ,,	0	1	4
(F) 9803	**Tall Stout Glass Jar,** for above, with India-Rubber Sheet ... ... each	0	2	6
(F) 9804	**Lift, or House Pump,** Glass Model ... ... ,,	0	3	6
9805	,, ,, with Rubber Tube and Trough, mounted on Wooden stand ... each	0	11	6
9806	,, ,, Glass Barrel, 8×1¼ in. diameter, heavy Brass Fittings with Trough, mounted on Mahogany Stand	1	12	6

(F) Foreign manufacture.



9807



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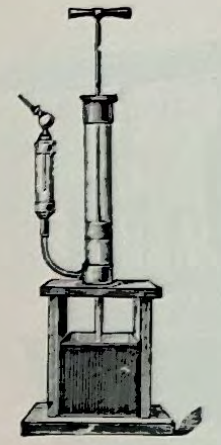

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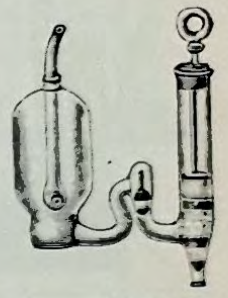


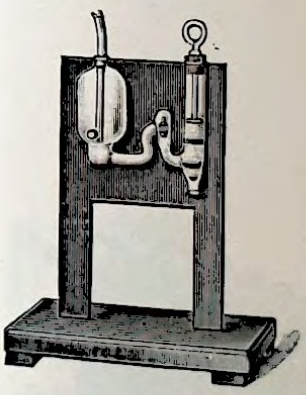
9810

(F) **9807** **Force Pump,** Glass Model ... ... each **£0 4 0**

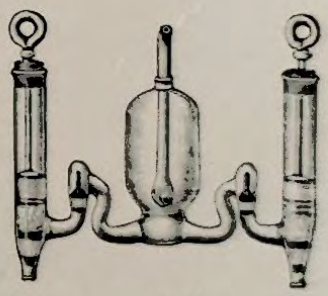
9808 Ditto, ditto, with Rubber Tube and Trough, mounted on Wooden Stand „ **0 12 0**

9809 Ditto, ditto, Glass Barrel, 8×1¼ in. diameter, heavy Brass Fittings, with Trough, mounted on Mahogany Stand, with Ball-jointed Jet **1 15 0**

(F) **9810** Ditto, ditto, Glass Model, Single Action ... ... each **0 4 0**



9811



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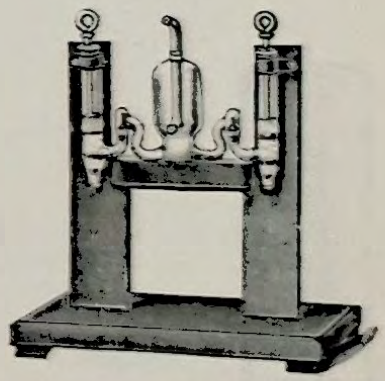


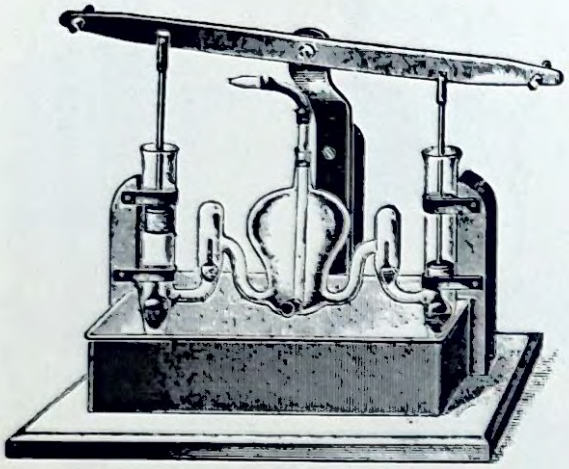
9813

9811 **Force Pump,** Glass Model, with Rubber Tube and Trough, mounted on Wooden Stand ... ... each **£0 12 6**

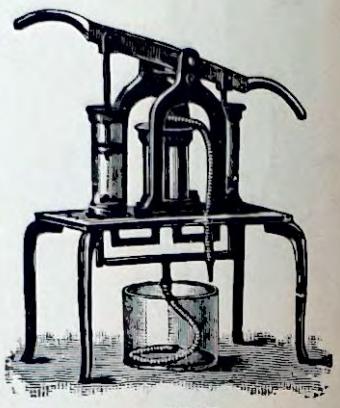
(F) **9812** „ „ Glass Model, Double Action, unmounted ... ... „ **0 10 0**

9813 „ „ „ „ with Rubber Tubing and Trough, mounted on Wooden Stand ... **0 18 0**

(F) Foreign manufacture.



9814



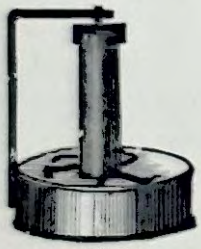
9815

9814 **Force Pump,** Glass Model, Double Action, or Model Fire Engine, Double Lever Handle, Brass Fittings, Japanned Tin Cistern, mounted on Base **£1 10 0**

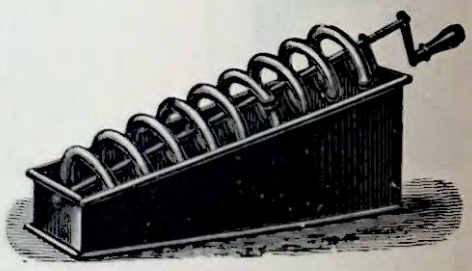
9815 Ditto, ditto, best make, mounted on Bronzed Iron Stand, with stout Brass Fittings **3 7 6**



9816



9817



9818

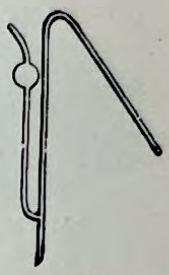
9816 **Barker's Mill,** Japanned Tin, Agate Centre, as supplied to the L.C.C. Educational Department, to show the Lateral Pressure of Liquids **£0 12 6**

9817 Ditto, ditto, with Japanned Tin Trough, 8 in. diameter **0 12 6**

9818 **Archimedean Screw,** with Glass Spiral, mounted on Japanned Tin Cistern ... **0 18 6**



9819



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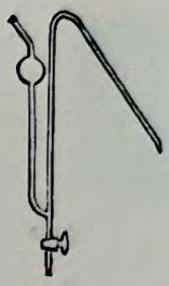
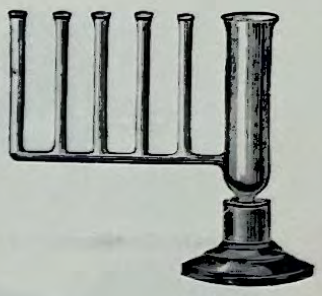


9821



9822

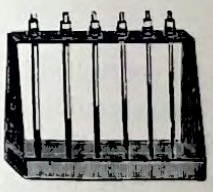


9823

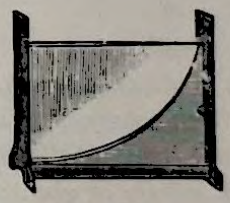
9819	**Syphons,** Glass	30 **6d.**	40 **8d.**	50 **1/0**	cm. long each	
9820	,, With Suction Pipe	**2/3**	**2/10**	**3/3**	,,	
9821	,, With Suction Tube and Stopcock	**5/6**	**6/0**	**6/6**	,,	

(F) **9822** **Intermittent Syphon,** Tantulus Cup, Glass, which upon filling immediately empties itself by means of the Syphon ... ... each **£0 2 6**

(F) **9823** **Capillarity Apparatus,** Glass Vessel, with five Side Tubes of different Capillary Bores, mounted on Wooden Foot ... ... each **0 3 0**



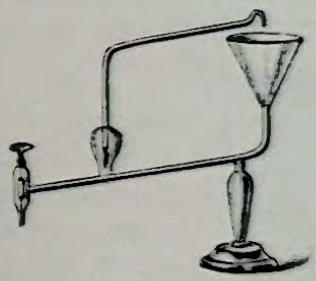
9824



9825



9826



9827



9828

9824 **Capillarity Apparatus,** Set of Six Tubes, mounted in Japanned Tin Frame each **£0 4 0**

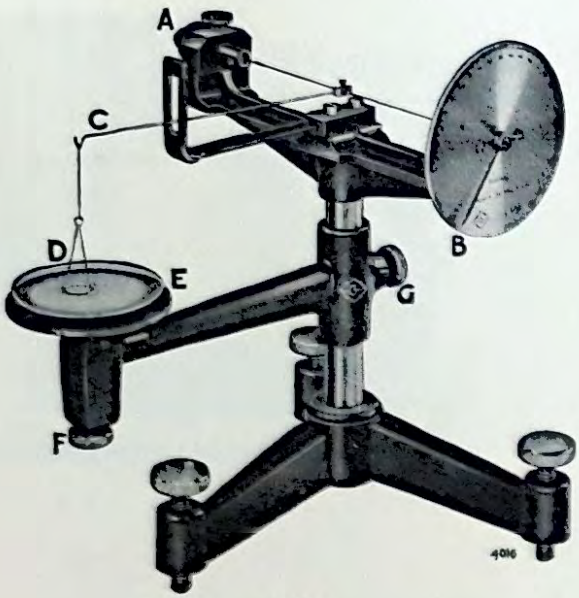
9825 ,, ,, Two Glass Plates, ,, ,, ,, ,, **0 3 6**

(F) **9826** **Adhesion Plates,** of Plate Glass, 3¾ in. diameter, with Handles per pair **0 8 0**

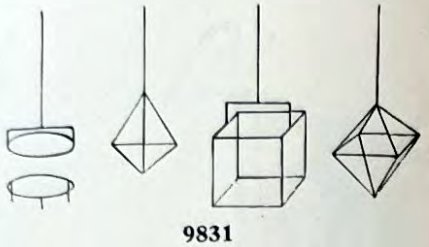
(F) **9827** **Hydraulic Lever,** or Ram, Glass Model **0 9 6**

9828 **Bottle,** with four liquids of different Specific Gravity, which do not mix ... **0 5 0**

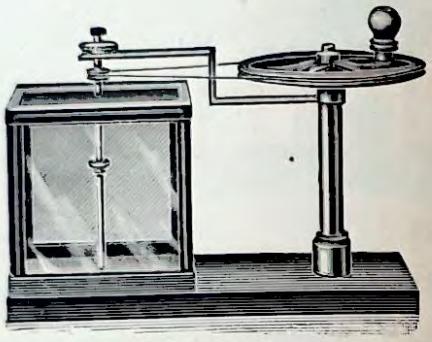
(F) Foreign manufacture.



9830



9831



9832

SURFACE TENSION APPARATUS

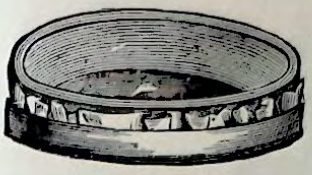
The Apparatus illustrated in No. 9830 was designed by Dr. P. L. du Noüy for the measurement of the surface tension of liquids by the ring method. A complete determination may be made in about 20 seconds, and measurements made to a high degree of precision. The fact that only a small quantity (1 c.c.) is required of the liquid under test renders the instrument useful for tests on fluids which are only available in small quantities. The instrument may be readily standardised for relative measurements by the use of pure water at 18°C.

The Apparatus consists essentially of a Stand provided at the top with a fine steel wire stretched between end supports. One end of the wire is clamped at A, and the other is attached to a worm-wheel controlled by a thumb-screw. To the worm-wheel is also attached a pointer B, which moves over a metal scale graduated in degrees (0–180). To the middle of the wire is clamped a hollow light steel lever C, with a small hook in the outer end. A stirrup D, attached to this hook, carries a loop of platinum-iridium wire with a periphery 4 centimetres in length. The watch glass, or other vessel containing the liquid under test, is placed on the platform E and raised by means of the adjusting screws F and G until the platinum loop just makes contact with the liquid. The pointer B having been previously set at zero, the torsion of the wire is gradually increased by means of the thumb-screw controlling the worm-gear, until the loop of wire just breaks away from the liquid. The reading in degrees on the scale is then converted directly into dynes per centimetre by a simple calculation based on the value of pure water at the same temperature.

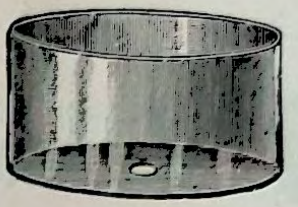
£18 0 0

9831 **Plateau's Wire Figures,** for demonstrating the tension of the surface of liquids, Set of five, in Box **0 12 0**

9832 **Plateau's Apparatus,** for showing the rotation of an oil Bubble in dilute alcohol ... **2 5 0**



9833



9834



9835–7

9833 **Dialysers,** Graham's, consisting of Gutta Percha Rings and Parchment Paper to fit.

Diameter ...	10	15	20	cm.
	3/6	**5/0**	**7/6**	each

(F) **9834** **Strong Glass Basins,** suitable for above, to take Gutta Percha Rings.

Diameter ...	20	23	25	30	cm.
Depth ...	10	10	12	12	,,
	2/6	**3/6**	**4/0**	**5/6**	each

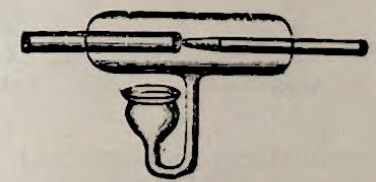
(F) **9835** **Dialysers,** Bell-shaped, Glass, with 2 Flanges. Diameter inside $7\frac{1}{2}$ 10 $12\frac{1}{2}$ cm.
1/3 **1/6** **1/8** each

(F) **9836** **Cylindrical Jars,** without feet, for above ... ... 16×10 22×12 26×15 cm.
1/4 **1/8** **2/9** each

9837 **Parchment Paper,** cut into squares ... ... 15 20 25 30 cm.
1/0 **1/6** **1/9** **2/3** per doz.



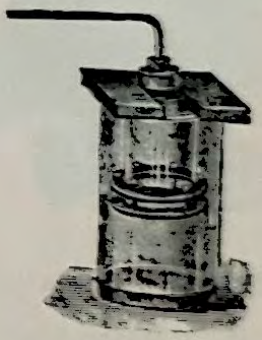
9839



9838



9840



9841

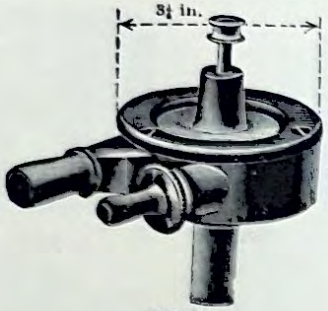
9838 **Apparatus,** to show Aspirating Action of Currents of Air, made entirely of Glass, with Manometer Tube **£0 3 6**

9839 Ditto, another form **0 2 6**

9840 **Endosmometer,** Dutrochet's, Glass Vessel with Bladder and Graduated Tube, outer Vessel with Lid **0 9 6**

9841 Ditto, Weinhold's, with horizontal Tube **0 10 6**

(F) Foreign manufacture.



9842–4

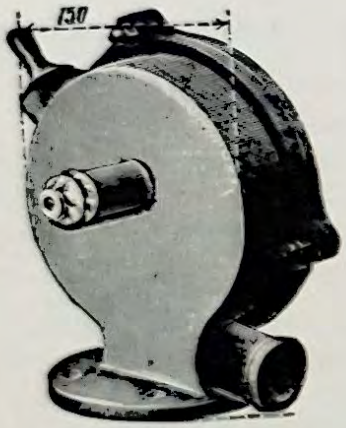


9843

(F) **9842** **Turbine,** Water Wheel, for use with stirring, Centrifugal Apparatus, and other Laboratory purposes; Water Wheel 2½ in. diameter, turning 2,500 to 4,000 times per minute according to "head" of water available **£0 16 6**

(F) **9843** Ditto, with Boss Head cast on **0 18 6**

(F) **9844** **Turbine,** Water Wheel, 2¾ in. diameter, turning at same rate, but requiring more water and consequently giving greater power **1 1 0**



9845



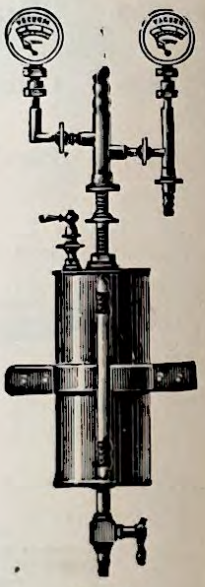
9846



9847



9848



9849

(F) **9845** Ditto, Vertical form, 2¾ in. Wheel **£1 3 9**

(Larger and more powerful Motors, prices on application, stating requirements.)

(F) **9846** **Water Blast,** with Bronzed Cylinder, Air Outlet, Gauge Tube and Water Regulating Tap, Brass parts Nickel-plated **1 10 0**

(F) **9847** ,, with Detachable Pump and Union Joint to Air Outlet ... **2 0 0**

(F) **9848** ,, with Bronzed Cylinder, Air Outlet with Union Joint, Gauge Tube and Water Regulating Tap, and Nickel-plated Vacuum Gauge **3 0 0**

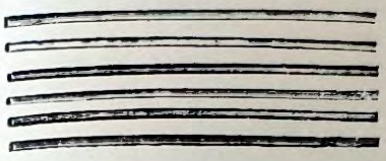
(F) **9849** Ditto, as above, but with Vacuum and Pressure Gauges, complete with Bracket for fixing to wall **4 10 0**

These apparatuses, with a simple and adjustable air pump, exhaust 20 litres of air per minute, at an air pressure of about three atmospheres, consuming about 10 litres of water.

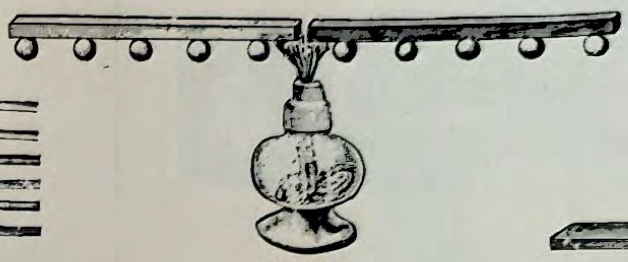
Large Water Stream Blowers for blowing tables and smelting furnaces for chemical and physiological laboratories, with two and three injectors. Prices on application, stating requirements.

(F) Foreign manufacture.

Heat



9860



9865–6



9863–4

9860	**Rods,** for Conduction, Brass, Iron, Wood, Copper, Glass and Bone, 12×⅛ in. per set	£0 1 6
9861	Ditto, Iron, 12×⅛ in. ,, ,, ,, ,, ,, per doz.	0 1 6
9862	Ditto, Copper ,, ,, ,, ,, ,, ,, ,,	0 2 6
9863	**Bar,** Compound, of Copper and Iron, to show the difference in conductivity of Metals, with cavity at each end for wax, etc. ... ... each	0 3 6
9864	Ditto, smaller size	0 1 6
9865	**Conductivity Apparatus,** to compare degree of conductivity of Heat in bars of Copper and Iron, with 10 Wooden Balls to be attached by wax	0 6 9
9866	Ditto, on Polished Mahogany Stand, with Spirit Lamp	0 12 0



9868–9



9867

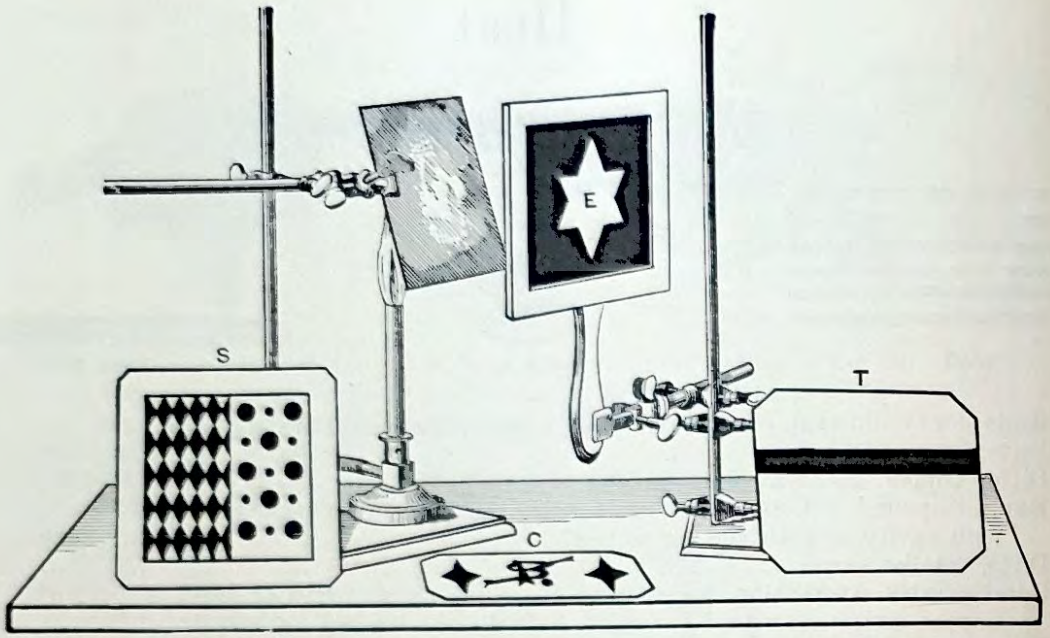


9870



9872

9867	**Conductivity Apparatus,** Tyndall's, consisting of a Compound Bar of Copper and Iron, with Arm for heating, complete with Spirit Lamp and 10 Wooden Balls to be attached by wax, for comparing degrees of conductivity	£0 13 6
9868	**Wood and Brass Cylinder,** to show the different conducting powers of Brass and Wood, large size	0 3 0
9869	Ditto, smaller size	0 2 0
9870	**Apparatus,** to show the conductivity of Metals; comprising Zinc, Iron, Copper and Brass Bars, fitted to Mahogany Ring	0 5 6
9871	Ditto, Large size, mounted on Polished Mahogany Stand, complete with Spirit Lamp	1 1 0
9872	**Apparatus,** to show conductivity of Metals, consisting of a board on which are four grooves in which Wires of Copper, Brass, Iron, and German Silver are fastened. The grooves are filled with Paraffin Wax	0 5 0



Conductivity and Radiation of Heat

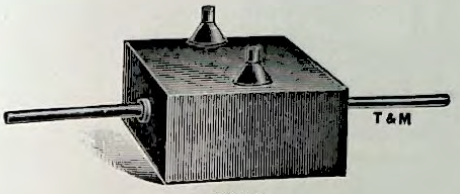
Apparatus designed by WALTER JAMIESON, B.Sc. (London) A.M.I.E.E.

1. Temperature gradient of a wire heated at one end.
2. The Relative Conductivities of Metals.
3. Determination of Relative Conductivities of Flannel, Cotton, and Linen.
4. Comparison of Conductivity of Wood along and across the grain.
5. Conductivity of Liquid and Gases.
6. To show that radiant heat travels in straight lines.
7. To show that rays of heat cast shadows in a similar manner to those cast by rays of light.
8. To show that radiant heat may be reflected and focussed.
9. To show that metallic surfaces reflect and black surfaces absorb radiant heat, and to determine the absorptive powers of various surfaces (quantitative) such as chalk, lead oxide, etc.
10. To show the difference between "luminous and non-luminous heat." The absorptive powers of differently coloured fabrics (Franklin's experiments easily and strikingly shown).
11. Radiative powers of various surfaces.

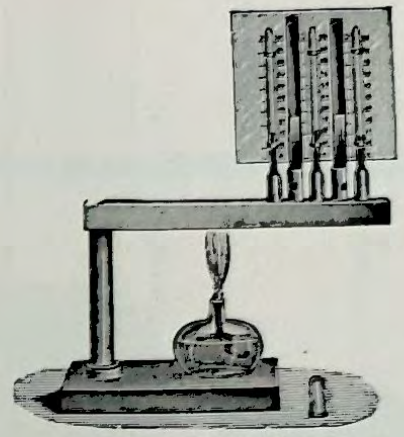
See "Practical Physics," Second Year Course, by James Sinclair, Esq., M.A., B.Sc. (Lond.)—(Bell & Sons).

Sheets of Sensitive Paper—Medium or ex-Sensitive.

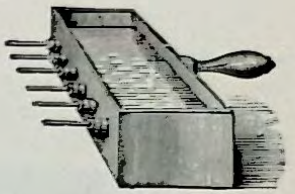
9873	7 × 5½ in. ... ... per doz. nett	£0	3	9
9874	11 × 3½ in. ... ... ,, ,,	0	3	9
9875	**Radiating Screens** ... ... each nett	0	5	6
9876	**Cloth** ... ... per doz. pieces, nett	0	2	0
9877	**Metallic Powder** ... ... per bottle, nett	0	2	0
9878	**Dead Black Paint** ... ... ,, ,,	0	1	6
9879	**Medium for Metallic Powder** ... ... ,, ,,	0	1	6
9880	**Copper, Brass, and Iron Wires,** specially drawn, for Conductivity Experiment, per set of three, **1/0**; per doz. sets, nett	0	10	0



9882

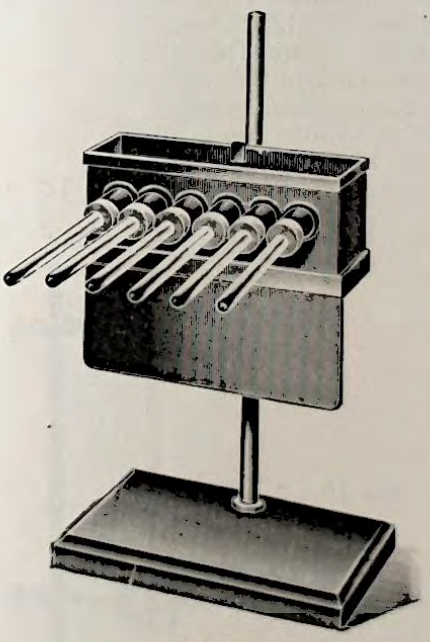


9883

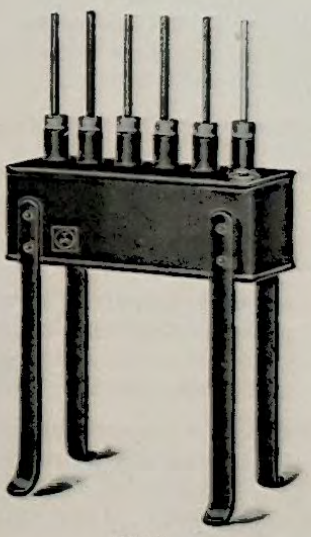


9884–6

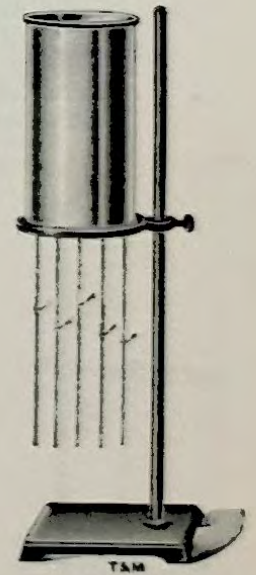
9882	**Conductivity Apparatus,** consisting of Lead and Iron Cylinders 15 × 1 cm., fitted to opposite faces of hollow metal steam heater, etc. (*vide* Glazebrook's "Heat," Expr. 43)		**£0**	**7**	**6**
9883	Ditto, to show the transmission of Heat, consisting of a Metal Bar, with Transparent Scales and three Thermometers, for use with Lantern		**2**	**0**	**0**
9884	Ditto, Ingenhouz's Trough, Japanned Zinc, 3 Holes, fitted with Metal Rods, complete ...	each	**0**	**6**	**0**
9885	Ditto, ,, ,, ,, ,, 6 ,, ,, ,, ,, ...		**0**	**8**	**0**
9886	Ditto, ,, ,, Stout Copper, with 6 Rods, complete		**0**	**16**	**6**



9887

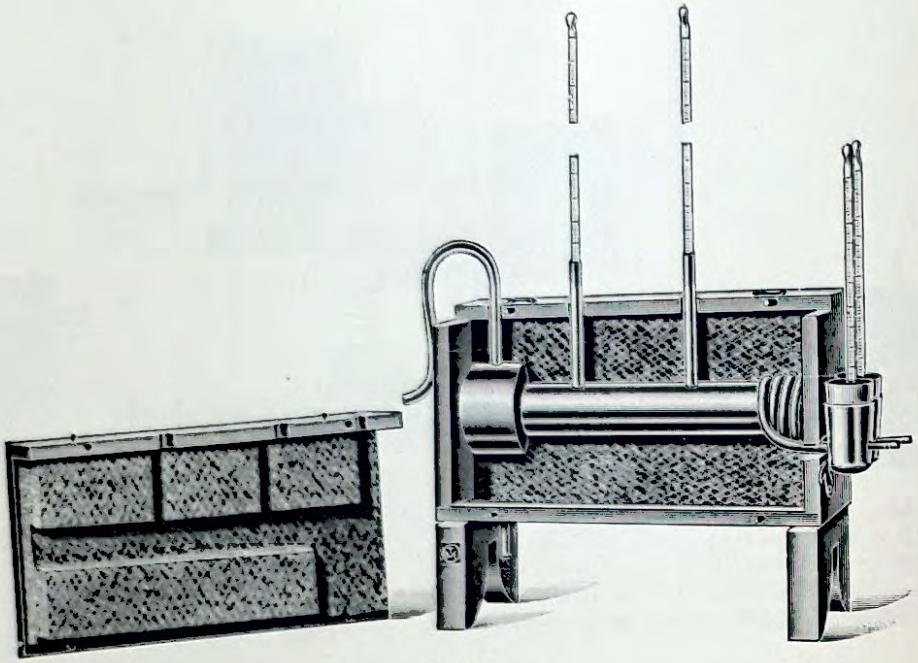


9888



9889

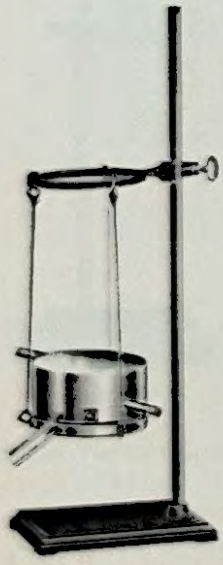
9887	**Conductivity Apparatus,** Ingenhouz's, mounted on Stand, with Screen and Metal Rods, complete, each	**£1**	**0**	**0**
9888	Ditto, ditto, Vertical Pattern, with 6 Rods, complete	**0**	**12**	**6**
9889	Ditto, comprising Cylindrical Copper Vessel, with five rods, Iron, Zinc, Brass, Copper and German Silver, 15 cm. × 2·5 mm., each provided with a small Index, which, as the wax melts, slides down the rods. (*vide* Edser's "Heat")...	**0**	**15**	**6**
9890	Ditto, as above, but with three Rods, and without Stand	**0**	**6**	**6**



9891

9891 **Searle's Apparatus** for the absolute measurement of the thermal conductivity of copper. The apparatus consists of a Copper Bar 1½ in. diameter by 12 in. long, having a Steam Jacket for heating it from a boiler at one end and a Spiral Tube at the other for a stream of water to flow through. Sockets are provided for the insertion of thermometers for taking the temperature of the bar at two points, and also of the cooling water. In Teak Case packed with felt, with removable front for showing the construction, complete with two Thermometers 10–110°C. in 1/2's and two ditto, 10-110°C. in 1/5ths **£6 12 6**

9892 Ditto, as above, but without the Thermometers **6 2 6**



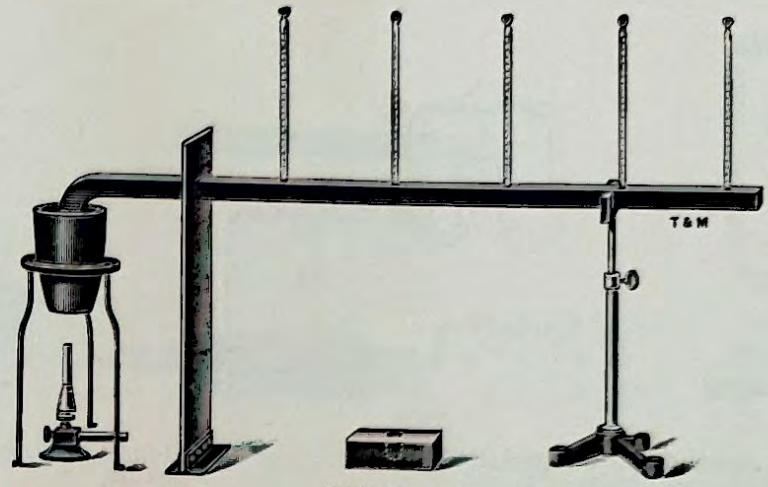
9893

9893 **Lee and Chorlton's Apparatus** for comparing the conductivities of thin layers of materials, without Thermometers **£2 10 0**

9894 **Robson's Apparatus** for determining the melting point of alloys, with Thermometer but without Burner (Robson's "Practical Exercises in Heat") **1 4 0**



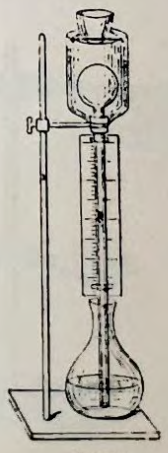
9894



9896–7

Conductivity Apparatus. Forbes' Bar, consisting of Screen, Stand, Tripod, Crucible, and Bar of Iron, 40 in. × 1 in. × 1 in., with holes $\frac{3}{16}$ in. diameter, drilled 6 in. apart. An extra piece of the same bar 3 in. long, with one hole, is supplied for determining curve of cooling.

9896	Without Thermometers and Burner	£2 0 0
9897	With Thermometers and Burner, complete, graduated 0–50° Centigrade in $\frac{1}{5}$ths ...	3 10 0



9898



9899

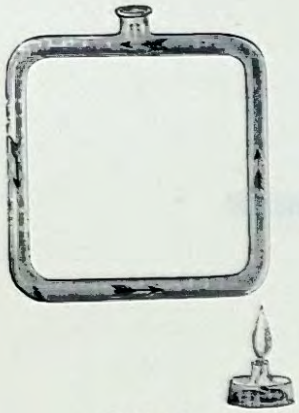


9900

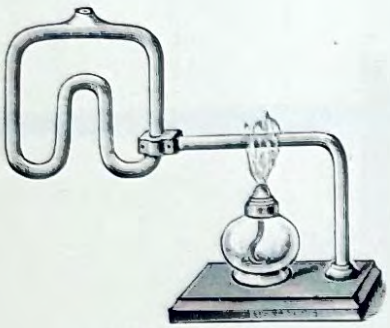


9901

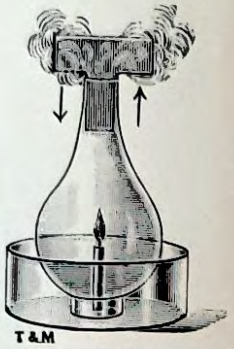
9898	**Conductivity Apparatus,** consisting of Bell jar container, Air Thermometer with Boxwood Scale, Tripod for capsule, complete on Stand (*vide* Glazebrook's "Heat") each	£0 11 6
9899	**Conductivity Apparatus,** for liquids, with sensitive Thermometer, in Cylindrical Glass Vessel with Container on top for the heated substance ... ... each	0 9 6
9900	**Convection Apparatus,** consisting of Flask, Reservoir, bent Tubes, fitted with Corks, as illustration (*vide* Glazebrook's "Heat") ... ... each	0 5 6
9901	Ditto, as supplied to the London County Council, etc. ... ... „	0 4 6



9902–3

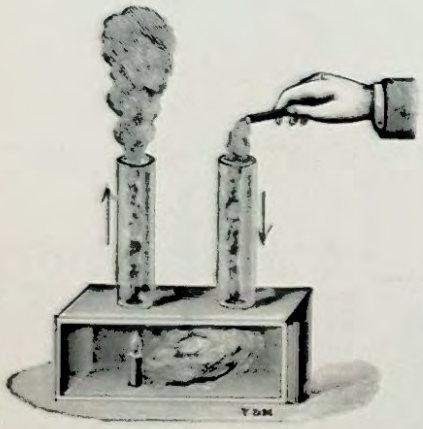


9904

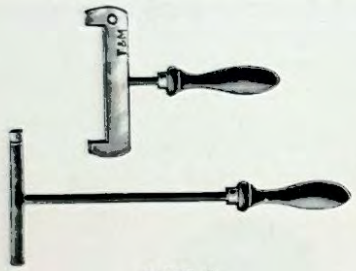


9905

9902	**Convection Apparatus,** rectangular Glass Tube, about 14×10 in., for showing the convection of heat in Water ... ... each	£0 5 0
9903	Ditto, Small size ... ... „	0 3 0
9904	Ditto, for Lantern use, to show the circulation of Water by heating, with Spirit Lamp each	0 15 0
9905	**Convection Apparatus,** Glass Tube, with Metal T-shaped Screen and Glass Trough (*vide* Glazebrook's "Heat") ... ... each	0 2 6



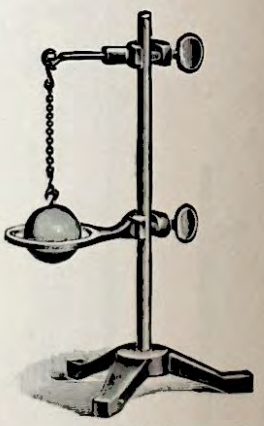
9906



9907–8



9909–10



9911–12

9906	**Ventilation Apparatus,** Polished Wooden Box, with sliding Glass Front and 2 Glass Chimneys, for demonstrating the ventilation in Mines	£0 7 6
9907	**Brass Gauge and Bar,** Expansion Apparatus, with two Handles complete ...	0 5 6
9908	**Iron Gauge and Iron Bar,** complete as above	0 4 9
9909	**Gravisande's Ball,** Simple form, with 1 in. Brass Ball and Polished Wood Handle	0 3 3
9910	„ „ Large size, with 1½ in. Brass Ball, etc.	0 4 9
9911	„ „ on Iron Tripod Stand, with 1 in. Brass Ball	0 6 0
9912	„ „ „ „ „ 1½ in. „	0 8 6



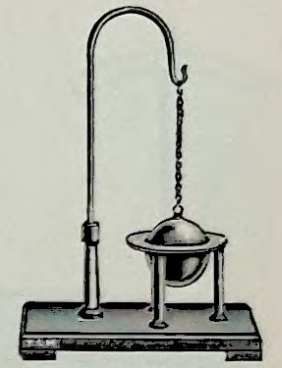
9914–15



9917–8



9919–20



9916

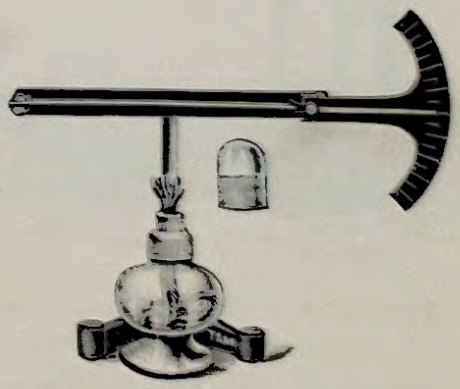
9914	**Gravisande's Ball,** on Brass Tripod, with 1-in. Ball... ... ... each	£0	5	0
9915	,, on heavy brass Tripod, with 2-in. Brass Ball, as supplied to the London County Council, etc. ... ... each	0	10	6
9916	Ditto, ditto, mounted on Polished Mahogany Stand, with Brass Pillar, diameter of Ball 2½ in. ... ... each	0	17	6
9917	**Compound Bar of Brass and Iron,** 12×¾ in., to show curvature resulting from unequal expansion, without Handle ... ... each	0	2	3
9918	Ditto, ditto, of Copper and Iron, 12×¾ in. ... ... ,,	0	2	3
9919	,, ,, of Brass and Iron, 15×1½ in., with Polished Handle ... ... ,,	0	7	6
9920	,, ,, of Copper and Iron, 15×1½ in. ... ... ,,	0	7	6
9921	,, ,, of Brass and Iron, 12×1¼ in., with Handle, ordinary make ... ,,	0	4	6
9922	,, ,, of Copper and Iron, 12×1¼ in. ... ... ,,	0	4	6



9923

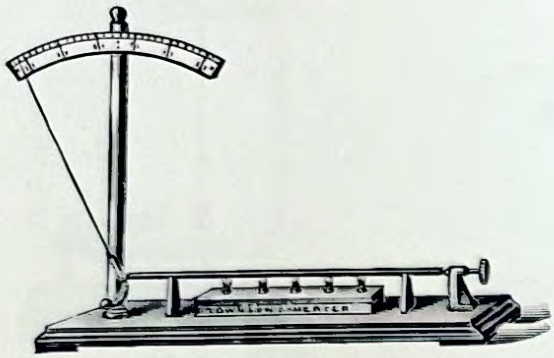


9924

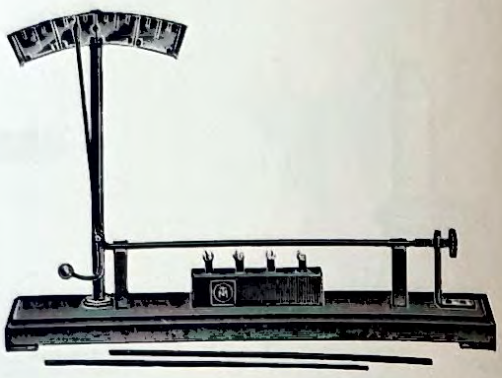


9925

9923	**Compound Bar** of Copper and Iron, 12×1¼, rivetted together at ends only, for showing unequal expansion ... ... each	£0	4	0
9924	**Compound Bar** of Brass and Iron, with Graduated Arc and Index Needle ,,	0	15	0
9925	Ditto, with Graduated Arc, Index Needle, Lamp and Stand ... ... ,,	1	1	0

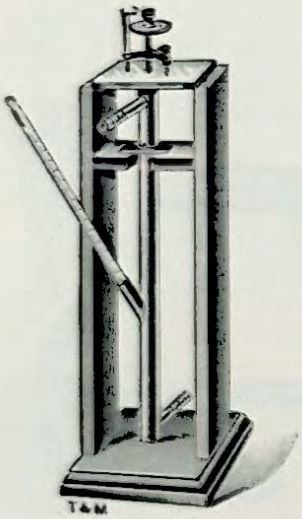


9926

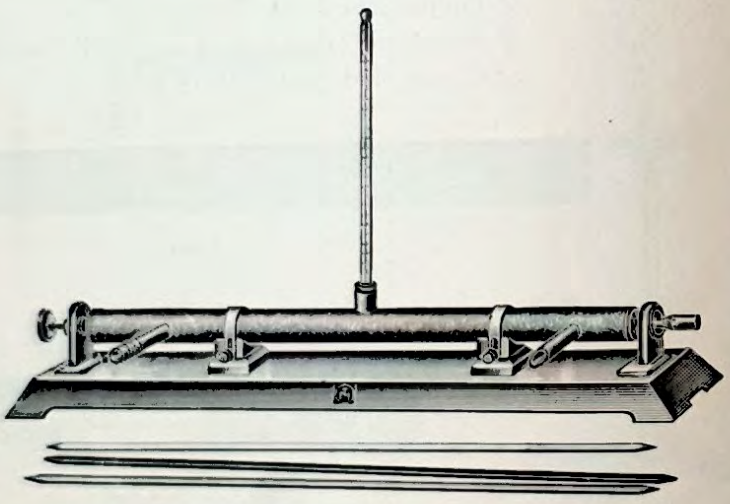


9928

9926	**Pyrometer,** Ferguson's, with 3 Rods of different Metals, to show expansion, with Brass Graduated Arc, and a 5-wick Burner, on Polished Mahogany Stand...	complete	**£1**	**12** **6**
9927	Ditto, as above, but fitted with Gas Burner	,,	**1**	**14** **0**
9928	Ditto, cheaper pattern, with 3 Rods and Spirit Burner, on Polished Stand	,,	**0**	**17** **6**

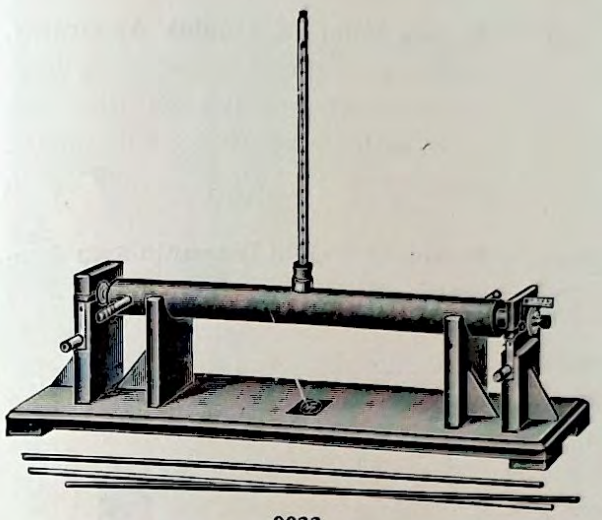


9929–30

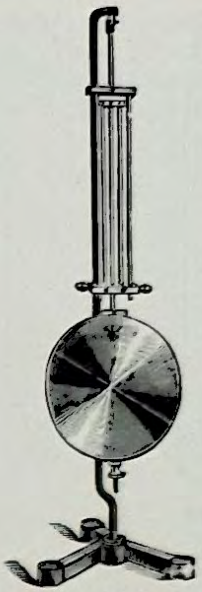


9932

9929	**Pyrometer,** Pullinger's, 1 metre long, on Oak Stand, with Brass Tube, with inlet and outlet for steam and tube for Thermometer		**£1**	**8** **6**
9930	Ditto, with Spherometer and Thermometer, complete		**2**	**0** **0**
9931	**Extra Tubes** for above, of Brass, Copper, Iron, Zinc...	each	**0**	**8** **6**
9932	**Apparatus,** for the co-efficient of Linear Expansion, Brass Steam Jacket, covered with felt, fitted with tubulure for Thermometer, Adjusting Screw, and Micrometer Gauge on Iron Base, with Copper, Brass and Iron Rods but without Thermometer		**1**	**15** **0**



9933



9934



9935

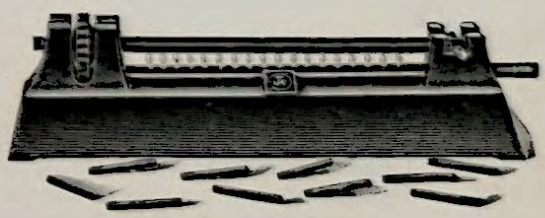
9933 **Apparatus,** for the co-efficient of Linear Expansion; new pattern, with Brass Jacket, covered with felt, fitted with Spherometer and Terminals for Electrical contact; on Mahogany Stand, with 3 Rods, Iron, Brass and Copper **£2 7 6**

9934 **Compensation Pendulum,** 24 in. long, 5 Rods, mounted on Iron Stand ... **2 0 0**

9935 ,, ,, 1 metre long, Brass and Iron alternately, with 9 Rods **2 10 0**



9936



9937

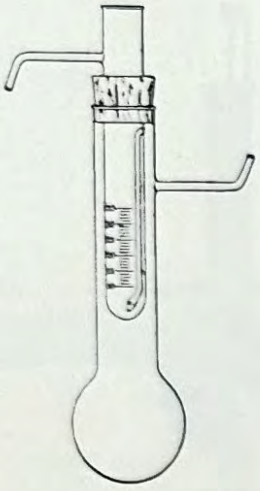
9936 **Apparatus,** to show the force of contraction or expansion of Solids, with Trough for spirit and 12 Bars to be broken ... ... each **£0 12 6**

9937 **Apparatus,** best finish, for contraction or expansion, with Gas Burner, complete .. **0 18 6**

9938 **Bars,** Cast Iron, for ditto ... ... per doz. **0 0 8**



9939



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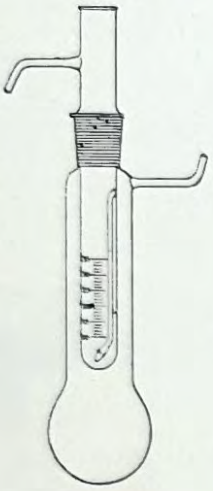
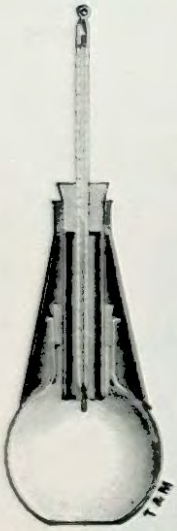


9941

9939 **Boiling Point of Liquids Apparatus,** consisting of two Glass Tubes, the inner one having a hole in the side fitted with Corks and Outlet Tube, but without thermometer **£0 3 6**

(F) **9940** **Molecular Weight Determination Apparatus,** McCoy's **0 12 6**

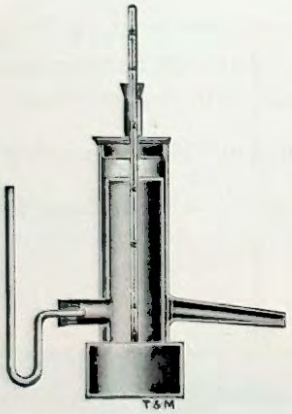
(F) **9941** Ditto, ditto, ditto, with ground joints **0 15 6**



9942-3



9944



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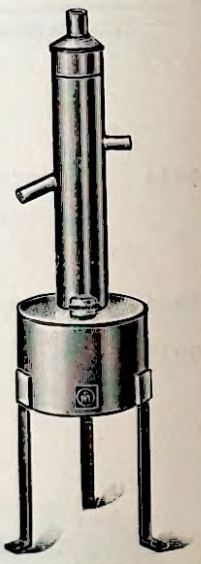
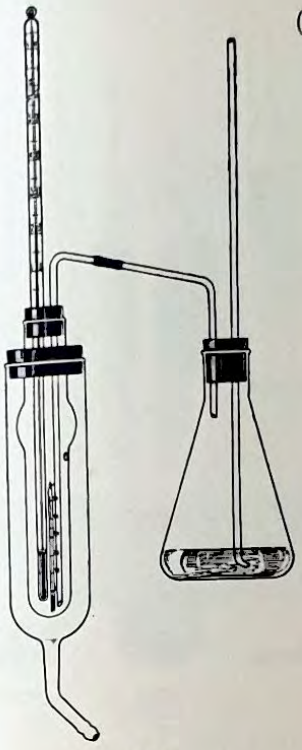


9949

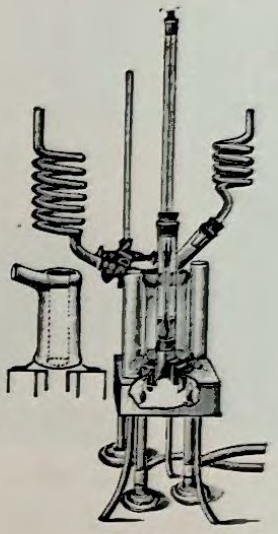
9942	**Conical Cover Japanned Tin,** for the determination of the Boiling Point of a thermometer (*vide* Glazebrook's "Heat"), complete with Flask and Corks	**£0 3 9**
9943	**Conical Cover** only	**0 2 6**
9944	**Hypsometer,** Glass, consisting of an inner tube 40 cm. long and 1 cm. bore; the tube opens at its upper end inside a larger tube 32×4 cm. bore, fitted with cork at the upper end through which the thermometer projects, so that the bulb and half of the thermometer is enclosed in the inner tube without thermometer	**0 3 9**
9945	**Regnault's Apparatus,** for determining the Boiling Point; Japanned Tinplate, without thermometer	**0 5 6**
9946	Ditto, large size	**0 10 6**
9947	Ditto, Stout, Copper	**0 14 6**
9948	Ditto, ,, ,, large size	**1 5 0**
9949	Ditto, made of Copper, mounted on three Iron Legs, as illustration	**1 1 0**

(F) Foreign manufacture.



9950

(F) **9950** **Landsberger's Molecular Weight Determination Apparatus,** consisting of Graduated Bulb Tube, Jacket Tube, with Side Tube, Leading Tube, Flask, and connections (*vide* Dr. Walker's "Introduction to Physical Chemistry"), the set **£1 2 6**



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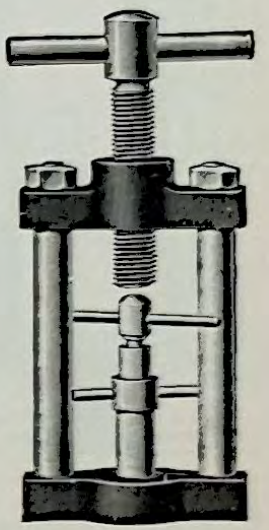


9952



9953–4



9955



9956



9957

(F) **9951** **Apparatus,** Beckmann's, for the determination of Boiling Point, improved form. Thermometer, graduated into $\frac{1}{100}$th degrees; Asbestos Air Bath, with sight holes; Quadrupod for ditto; Glass Steam Jacket; Boiling Tube with Platinum Wire fused in; Two Spiral Condensers; Garnets, Glass Beads, Pipette, Asbestos Paper; Price, complete **£3 12 6**

9951/1 As above, but complete with Porcelain Steam Jacket **4 10 0**

9952 **Pastille Press,** newest form, extra **1 7 0**

9953 **Regnault's Apparatus,** for determining the Freezing Point, Strong Zinc Vessel, perforated bottom, and with Holder at top for Thermometer ... ... each **0 7 6**

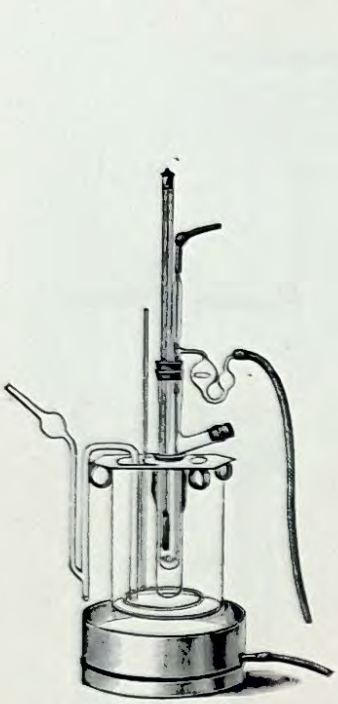
9954 Ditto, Stout Copper... ... .. **0 12 6**

9955 **Solidification Apparatus,** Retardation of Point of, small size on Stand, for lantern use ... ... each **0 12 6**

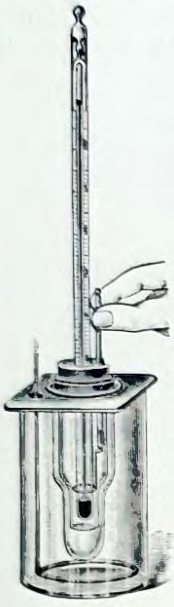
(F) **9956** Ditto, large size, without Stand **0 7 6**

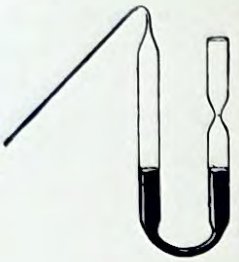
9957 **Change of Volume** on Solidification, Apparatus to demonstrate (*vide* Ganot's "Physics") ... ... each **0 5 6**

(F) Foreign manufacture.


9958


9960


9961


9962

9963

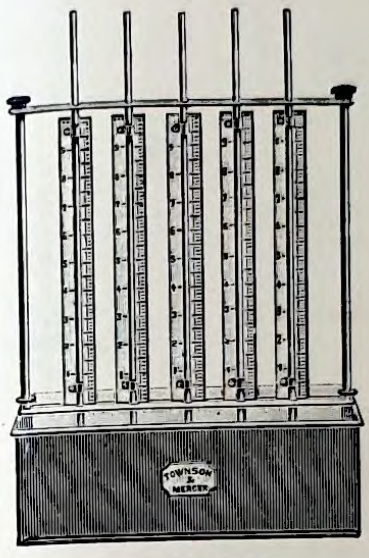

9964–5


9966

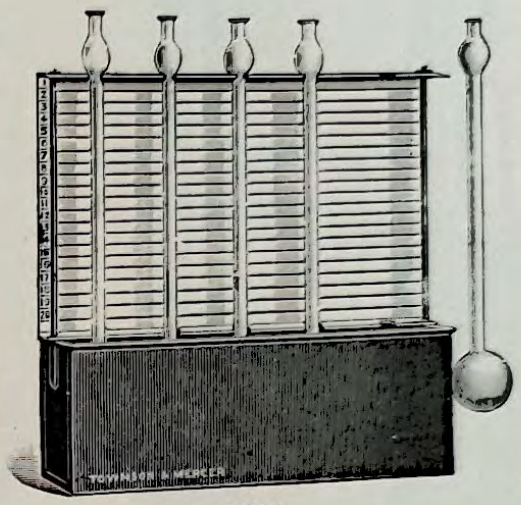

9967

(F) **9958**	**Apparatus,** Beckmann's, for the determination of Freezing Point—consisting of Thermometer graduated into 1/100th degrees, Glass Outer Vessel with Metal Cover and Bath, Nickel Stirrer for Outer Vessel and different Glass Parts. Price complete	£3 10 0
	Platinum Stirrer for Inner Vessel. (Price according to weight of Platinum.)	
9959	**Reading Lens** for Thermometers	0 8 6
(F) **9960**	**Apparatus,** Friedenthal's, for the determination of Freezing Point. Cooling Bath with Wood Cover, Nickel-plated Stirrer and Freezing Tube, with Rubber Stopper	0 17 6
	Thermometer for the Cooling Bath, —20 to +40 deg. C. in 1/1-degrees ...	0 6 6
	Ring Stirrer of Glass Rod for the Freezing Tube...	0 0 8
	Thermometer, graduated into 1/100th degrees	1 5 0
(F) **9961**	**Apparatus,** Drucker's, for the estimation of Freezing Point. Cooling Bath with Nickel-plated Cover and Stirrer	0 12 6
	Freezing Tube with Cork Ring and Inner Tube	0 3 6
	Stirrer for the Freezing Tube...	0 0 8
	Or ditto, fitted with Platinum Ring ... ... Price on application	
	Thermometer, graduated to 1/100th degree	1 5 0
9962	**Expansion of Water** on Solidifying. Bunsen's Method of determining (see Edser's "Heat") ... ... each	0 1 9
9963	**Mousson's Apparatus,** to show that under pressure Ice can be made a liquid...	1 15 0
9964	**Iron Bottle,** with Screw Stopper, either shape ... ... each	0 1 6
9965	**Set of Six Bottles,** with one Stopper ... ... per set	0 7 0
9966	**Iron Bomb,** with Screw Stopper ... ... each	0 2 6
9967	**Flask,** with neck graduated to show percentage change of volume on melting. With neck graduated 25 c.c. in 1/10ths. Capacity of flask 250 c.c. ... each	0 4 0

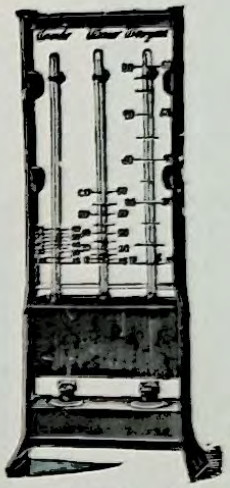
(F) Foreign manufacture.



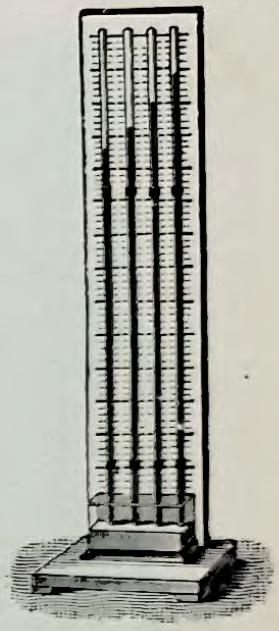
9970



9971



9972



9973

9970 **Apparatus,** to show the difference of expansibility of fluids, consisting of a Set of 5 Bulb Tubes, with Boxwood Scales, graduated into $\frac{1}{10}$ in. Japanned Trough to hold hot water, and Brass Supports **£1 7 0**

9971 **Apparatus,** to show the difference of expansibility of fluids; consisting of a Set of 5 Capillary Bulb Tubes, fitted with Japanned Tin Scale and Trough **1 1 0**



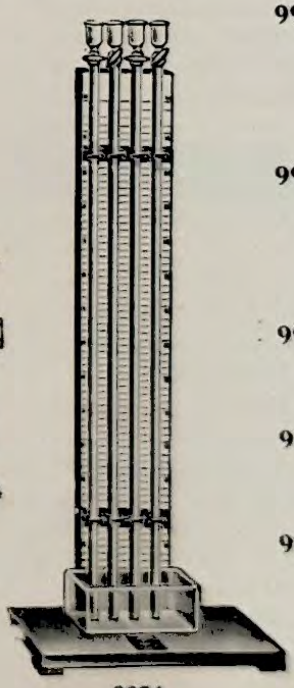
9975



9976



9974



9974

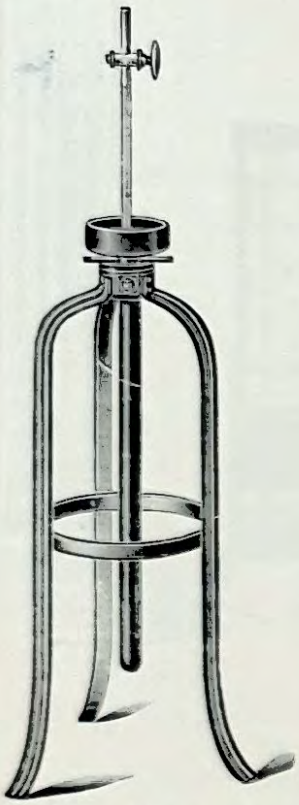
9972 Ditto, smaller size, for projection with three thermometers, filled with Water, Alcohol and Mercury, adjusted so that the columns of liquids have equal heights at 15°C. ... **£1 7 6**

9973 **Apparatus,** to show the elasticity of Vapours; mounted on Polished Wood Stand, with 4 Barometer Tubes, easily detachable, and Divided Scale and Trough **£1 10 0**

9974 Ditto, as above, but Barometer Tubes fitted with Stopcocks, as illustration **£2 10 0**

9975 **Apparatus** for measuring pressure of saturated Water Vapours at different temperatures below 100° C. **£1 5 0**

9976 **Curved Pipette,** for introducing Ether, etc., into Barometer Tubes each **£0 0 6**



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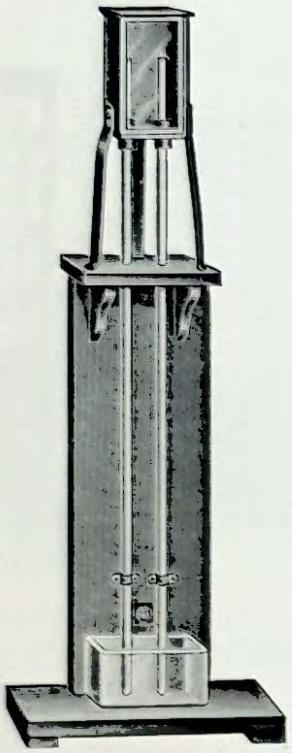

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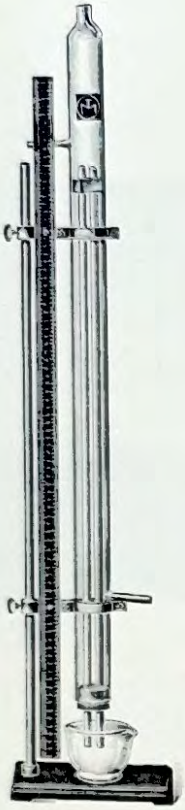

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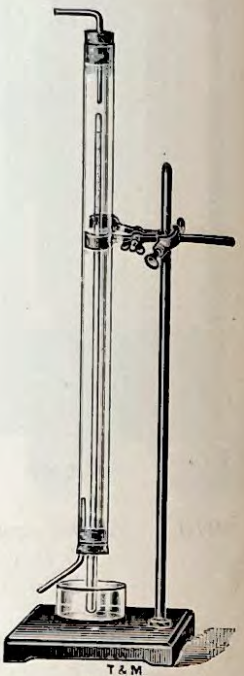

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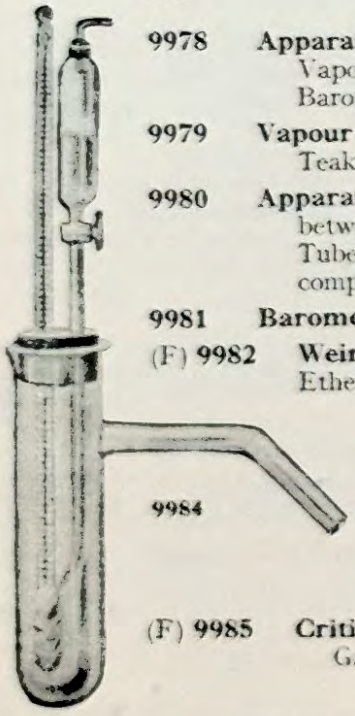


9978 **Apparatus,** to show maximum of pressure of saturated Vapours, mounted on Iron Tripod Stand, with graduated Barometer Tube with Stopcock **£2 5 0**

9979 **Vapour Pressure,** Aqueous; Regnault's Apparatus on Teak Stand (see Poynting and Thomson's "Heat") ... **1 10 0**

9980 **Apparatus,** for pressure of Aqueous Vapour, Dalton's Method, between Zero and 100°C., consisting of two Barometer Tubes, on Stand, with Boxwood Scale and Glass Trough complete, as illustrated **1 12 6**

9981 **Barometer Tubes,** only for use with above per pair **0 4 0**

(F) **9982** **Weinhold's Apparatus,** for measuring the tension of Ether, so-called Steam Barometer **0 12 6**

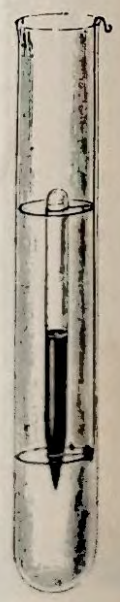
9983 **Water Vapour Apparatus,** Pressure of (*vide* Glazebrook's "Heat"), complete with Stand, Clamp, and Glass Dish ... **0 14 0**

9984

9984 **Ramsay's and Young's Apparatus,** for Vapour Pressure of a liquid as described in Ostwald's "Physico-Chemical Measurements" **0 15 0**

(F) **9985** **Critical Temperature Apparatus,** for Vapours and Gases **0 7 6**

(F) Foreign manufacture.



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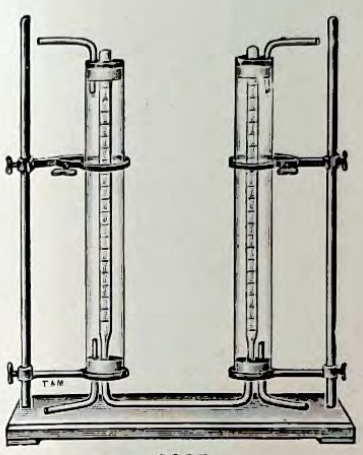

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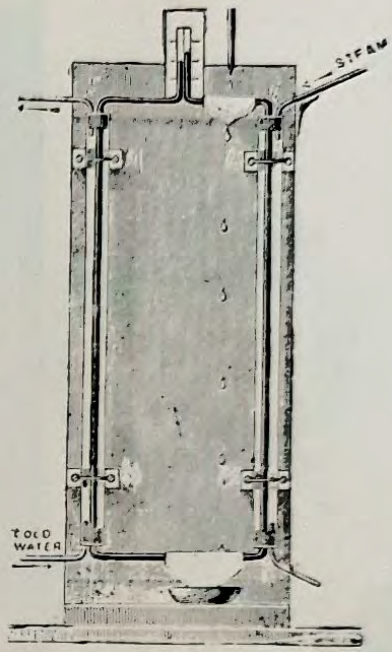

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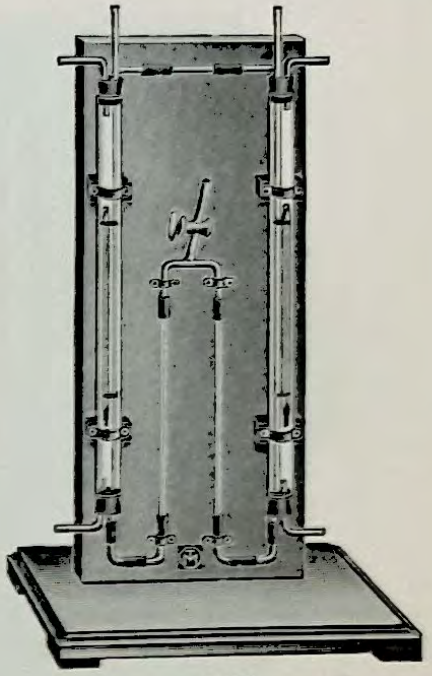


9989

9987 **Weinhold's Apparatus,** for demonstrating the co-efficient expansion of Mercury, complete with Metal Frame and Fittings, on Polished Mahogany Base **£1 12 6**

9988 **Dulong and Petit's Apparatus,** for co-efficient of Absolute Expansion of Mercury (*vide* Edser's "Heat") **1 12 6**

9989 **Apparatus,** to determine co-efficient of Cubical Expansion of a liquid; Regnault's Method, consisting of 2 Tubes, 60 cm. × 6 cm. Thermometers are attached to each tube, complete on Teak Stand (see Robson's "Heat") **2 12 6**



9990



9991



9992



9993

(F) ***9990** **CO-EFFICIENT OF EXPANSION OF GASES APPARATUS.** Reg. No. 539,752.

Designed by J. W. YATES, A.R.C.Sc., B.Sc., of Strand School, London.

A simple apparatus for the determination of the Co-efficient of Expansion of Gases by means of the displacement of Sulphuric Acid.

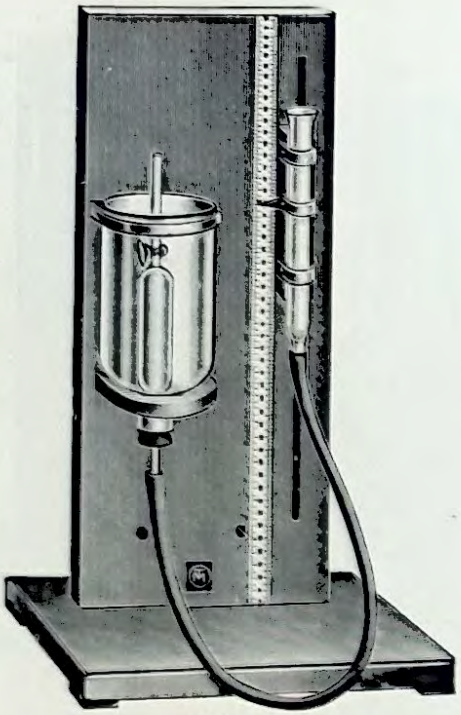
Advantages.—Large volume of Gas. Volumes deduced from weights. Simple, compact, and easily manipulated. Can be readily used for various Gases. The strong Sulphuric Acid has no appreciable vapour pressure at 100°C., and also removes all water vapour from the air ... ... each **£0 6 0**

9991 **Weinhold's Apparatus,** to show the expansion of Gasses at constant volume **0 12 0**

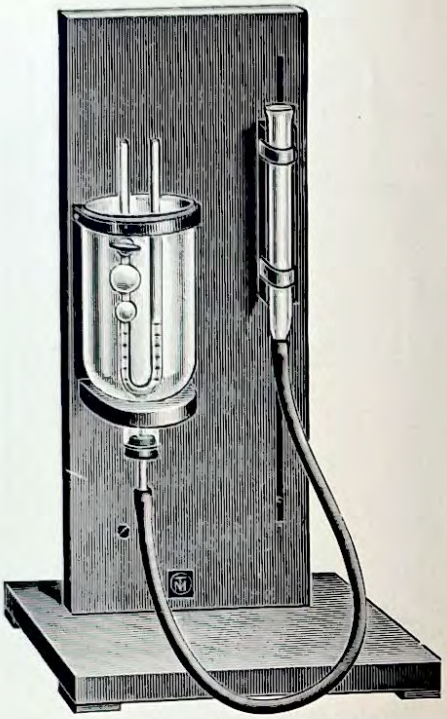
(F) **9992** Ditto, ditto **0 10 6**

9993 **Apparatus, Co-efficient Expansion of Air** at constant pressure, consisting of a Cylindrical Vessel, fitted with rubber tubing and clip, as illustration. (*Vide* Edser's "Heat") ... ... each **0 1 2**

(F) Foreign manufacture.



9994



9996

9994 **Apparatus,** for measuring the pressure of co-efficient of a Gas, consisting of a Bulb about 200 c.c., fitted with pressure tubing, etc., on Teak Stand, as illustrated. (See Edser's "Heat," for advanced students) **£1 18 6**

9995 **Spare Parts.** Cylindrical Bulb with Stopcock **0 6 6**
Water Jacket **0 3 6**

9996 **Apparatus,** for determining the co-efficient of expansion of air at constant pressure, consisting of one U tube closed above by a Stopcock, which has also a T joint and is connected by means of pressure tubing, on Teak Stand, as illustrated. (See Edser's "Heat," for advanced students)... ... ... **2 2 0**

9997 Spare Parts Graduated U tube with Stopcock **0 10 0**
Levelling Tube **0 0 8**
Water Jacket **0 3 6**

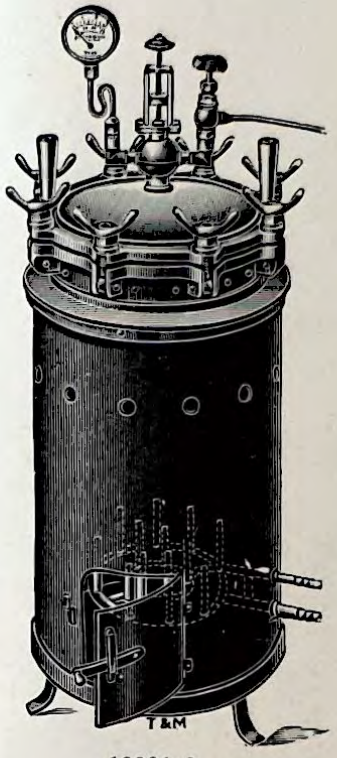


9998 9999 10000

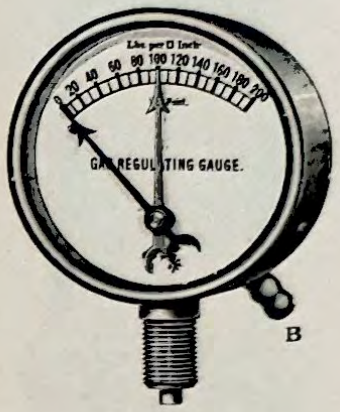
9998 **Marcet's Steam Apparatus,** Papin's Digester with Copper Boiler for showing experiments with Steam, with Thermometer, complete **£3 5 0**

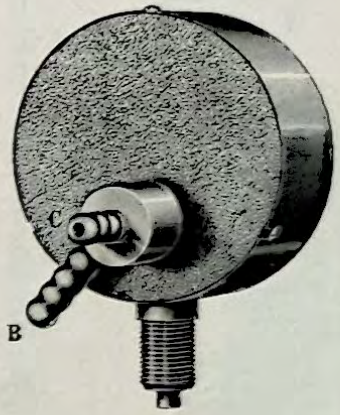
9999 Ditto, ditto, with Stout Brass Boiler, fitted with Barometer Tube, Boxwood Scale and Thermometer, complete ... **4 10 0**

10000 Ditto, ditto, Stout Brazed Copper, Brass Cover, Safety Valve and Manometer, with Stopcock on Iron Stand ... **6 10 0**



10001-3





Front view Back view

Gauge, as fitted to Autoclaves Nos. **10002–10005**

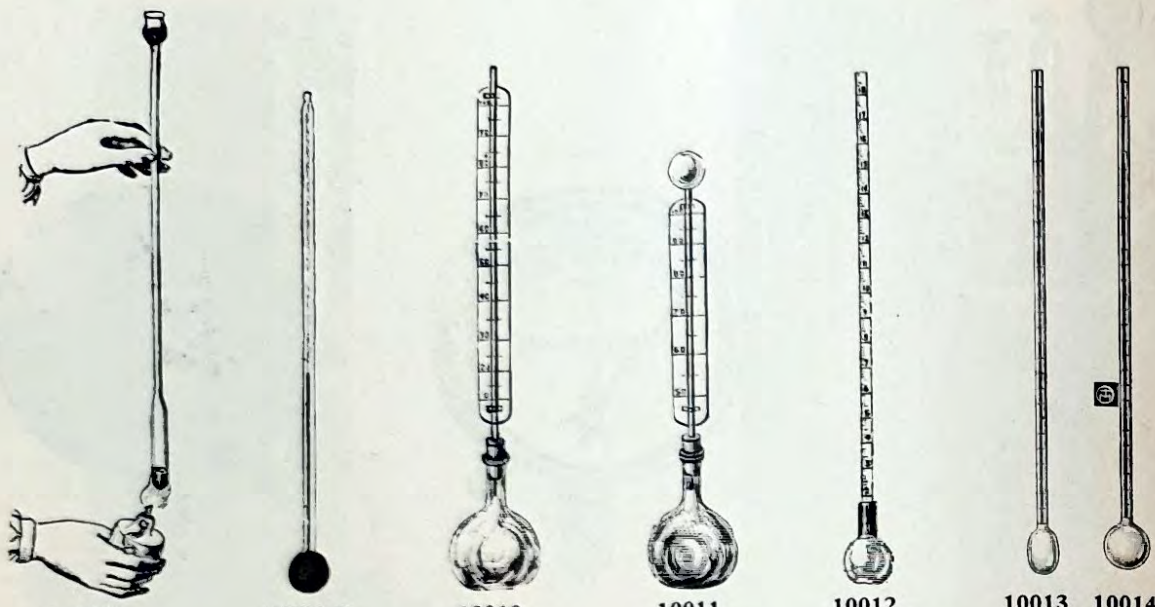
AUTOCLAVES, CHAMBERLAND'S

For steam sterilising under a pressure of 3 atmospheres, with heavy brazed Copper Boiler with Brass Wire Sieve and Gun-metal Cover fitted wth Pressure Gauge. No. 10002 is fitted with an attachment which automatically regulates the flow of gas when the desired temperature is reached. No. 10003 is fitted with blast petroleum (paraffin) Burners instead of the Gas Burners.

	Size No.	1		2		3		4		5	
	Int. Depth of Boiler... ...	16		24		33		43		53	cm.
	Int. Dia. of Boiler	12		19		25		34		46	,,
*10001	With Gas Burners	£15 7 6		£16 15 0		£23 0 0		£29 0 0		£47 0 0	
*10002	With Automatic arrangement for Gas	16 2 6		17 12 6		24 0 0		30 0 0		48 0 0	
*10003	With Petroleum Burners ...	15 17 6		17 7 6		23 15 0		30 0 0		48 0 0	

Autoclaves, as No. 10001, fitted with Hinged Cover.

	Size No.	1		2		3		4		5	
	Int. Depth of Boiler	16		24		33		43		53	cm.
	Int. Dia. of Boiler	12		19		25		34		46	,,
*10004	With Gas Burners	£18 7 6		£20 10 0		£27 10 0		£36 10 0		£59 0 0	
*10005	With Automatic arrangement for Gas	19 2 6		21 7 6		28 10 0		37 10 0		60 0 0	
*10006	With Petroleum Burners ...	18 17 6		21 2 6		28 5 0		37 10 0		60 0 0	



10007 10008–9 10010 10011 10012 10013 10014

10007	**Thermometer Tubes,** with Funnel top for filling, Plain Stem, 9 in. long; Bulb about ½ in. diameter ... ... per doz.	**£0**	**4**	**6**
10008	Ditto, filled with Mercury ... ... each **1/6,** ,,	**0**	**15**	**0**
10009	Ditto, filled with Spirit ... ... ,, **1/0,** ,,	**0**	**10**	**6**
10010	**Thermometer,** Model, with Flask, Tube, and Boxwood Scale attached each	**0**	**4**	**6**
10011	Ditto, Air, consisting of Flask, Tube with Bulb, and Boxwood Scale attached ,,	**0**	**5**	**0**
10012	**Thermometer,** Model, Rintoul's, consisting of a Capillary graduated in millimetres, fitted to a small Flask ... ... each **2/0,** per doz.	**1**	**2**	**6**
10013	**Dilatometer Tubes,** with Cylindrical Bulb and Capilliary Tube 30 cm. long, graduated in millimetres ... ... each **1/9,** per doz.	**0**	**18**	**9**
10014	Ditto, ditto, with Round Bulb ... ... ,, **1/9,** ,,	**0**	**18**	**9**



10015



10016–7

10015 **Apparatus,** to determine the relation between the volume and temperature of a gas at constant pressure (Charles's law), as described in Robson's "Practical Exercises in Heat"; with Thermometer complete **£0 16 6**

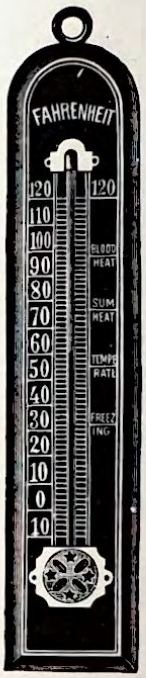
Thermometers, Anschutz, Milk Glass Scale, about 13 cm. long, in—

Nos.	1	2	3	4	5	6	7
	10° to 60°	40° to 110°	90° to 160°	150° to 220°	200° to 270°	250° to 310°	300° to 360°
(F) **10016** Graduated into ½°	**7/3**	**7/3**	**10/0**	**11/3**	**14/0**	**16/6**	**18/0** each

(F) **10017** **Set of 7 Thermometers,** as above, in ½ths, fitted in velvet-lined Leather Case **£4 17 6**

(F) Foreign manufacture.

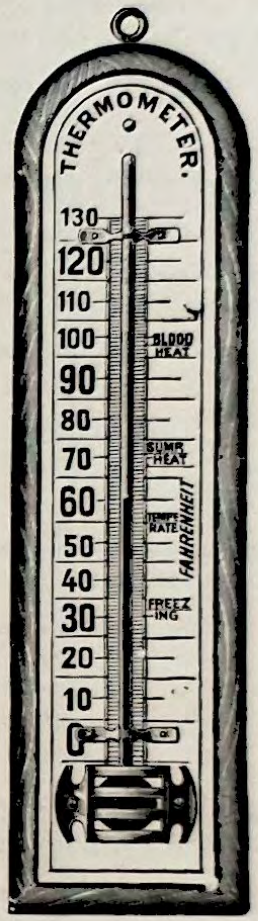
Thermometers



10020



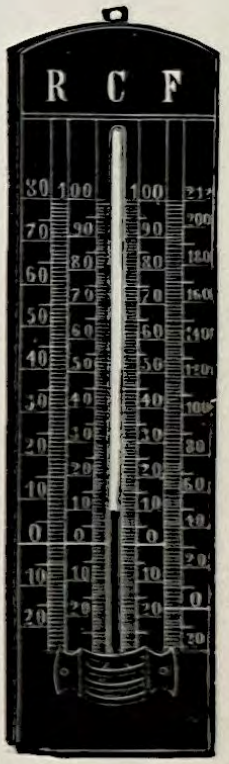
10021–3



10025



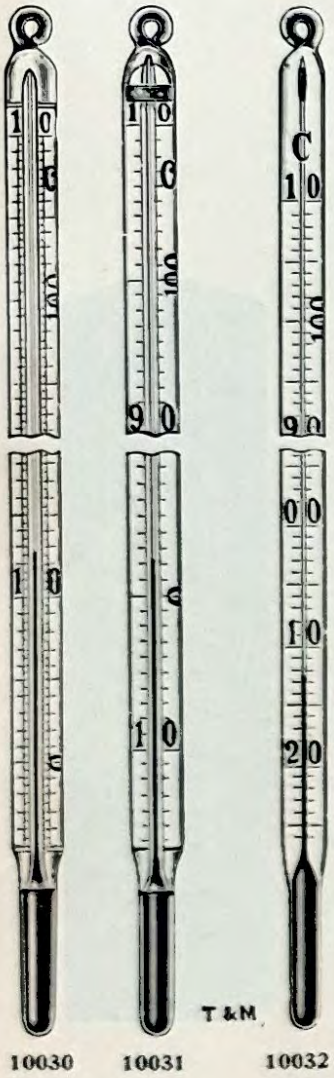
10026



10027

(F) **10020**	**Thermometer,** engraved on Wood, Polished, Oval Top, about 8 in. long	each	£0	1	0
(F) **10021**	,, Ditto, Boxwood Scale	,,	0	1	3
10022	,, Boxwood Scale, 130°F. mercury column	,,	0	2	3
10023	,, ,, ,, 240°F. ,, ,, ...	,,	0	3	0
10024	,, ,, ,, with Double Scale F. and C., 8 in. mercury column	each	0	3	0
(F) **10025**	,, Polished Oak with Enamelled Glass Scale, about 8 in. ...	,,	0	7	6
10026	,, White Porcelain House and Sick Room, double scale, 10 in.	,,	0	4	6
(F) **10027**	,, Comparison, showing Centigrade, Fahrenheit and Réaumur Scales, mounted, 10 in. long	each	0	3	6

(F) Foreign manufacture.



10030 10031 10032

(F) **10030** **Thermometer,** Jena Normal Glass, Narrow, to pass through Cork, Paper Scale, enclosed in Glass Tube, about 7 mm. diameter, in Case

150°	240°	400°	**Fahrenheit.**	110°	200°	**Centigrade.**
1	1	2	degrees.	1	1	degrees.
2/0	**2/0**	**2/6**	each.	**2/0**	**2/6**	each.
22/0	**22/0**	**26/0**	per doz.	**22/0**	**27/0**	per doz.

F) **10031** **Thermometer** for Chemical use, Jena Normal Glass, Milk Glass Scale, enclosed in Glass Tube, 7 mm. diameter, in Case.

150°	240°	400°	600°	**Fahrenheit.**	110°	200°	360°	**Centigrade.**
1	1	2	2	degrees.	1	1	1	degrees.
2/4	**2/6**	**3/0**	**3/9**	each.	**2/6**	**3/0**	**3/9**	each.
25/-	**26/-**	**33/-**	**41/-**	per doz.	**27/-**	**33/-**	**41/-**	per doz.

(F) **10032** **Thermometer** for Chemical use, Jena Normal Glass, Narrow Stem, about 5 mm. diameter, with small Bulbs, graduated on Solid Stem, enamelled back, in Case.

150°	240°	400°	600°	**Fahrenheit.**	110°	200°	360°	**Centigrade.**
1	1	1	2	degrees.	1	1	1	degrees.
2/6	**2/7**	**3/2**	**4/3**	each.	**2/7**	**3/0**	**4/3**	each.
26/0	**28/0**	**34/0**	**47/6**	per doz.	**28/0**	**34/0**	**47/6**	per doz.

✓ **10033** **Thermometer** for Chemical use, British made, Narrow Stem, about 5 mm. diameter, with Small Bulbs, graduated on Solid Stem, enamelled back, in Case.

150°	240°	400°	600°	**Fahrenheit.**	110°	200°	360°	**Centigrade.**
1	1	1	1	degrees	1	1	1	degrees.
3/0	**3/3**	**3/4**	**4/9**	each.	**3/0**	**3/4**	**4/9**	each.
32/0	**36/0**	**37/6**	**54/0**	per doz.	**32/0**	**37/6**	**54/0**	per doz.

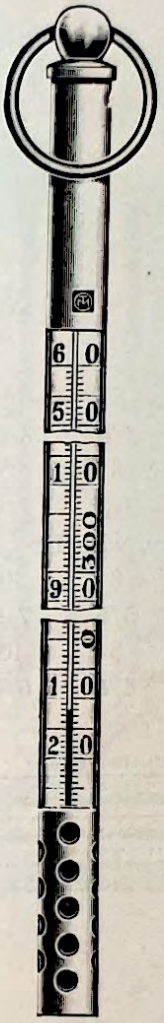
(F) **10034** **Thermometers,** Jena Normal Glass, Paper Scale, enclosed in Glass Tube about 7 mm. diameter for Physical Work.

0° to 110°C. in 1 degrees	...	each **2/10**;	per doz.	**32/6**
0° to 50°C. in 1 ,,	...	,, **4/0**	,,	**45/0**
0° to 100°C. in 1 ,,	...	,, **5/0**	,,	**55/0**

(F) **10035** **Thermometers,** Jena Normal Glass, graduated on Solid Stem, with enamelled back, finely divided for Chemical and Physical Work.

		0° to 50°	50° to 100°	50° to 150°	0° to 100°C.	
	In 1th degree	**4/6**	**5/3**	**6/3**	**6/3**	each
(F) **10036**	,, In 1th ,, ...	**5/3**	**6/3**	**8/6**	**7/6**	,,

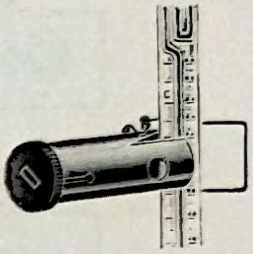
(F) Foreign manufacture.



10037–8



10039



10042



10040

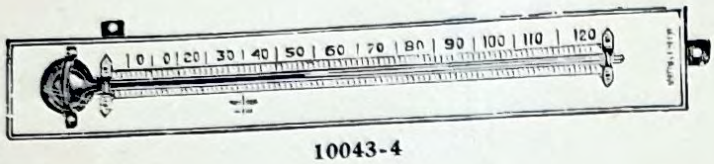


10041

Thermometers, protected by Brass Cases with Screw Tops.

		150°	240°	400°	600°		110°	200°	360°	Centigrade
		½	½	½	¾	Fahrenheit.	½	½	½	degrees
10037	With Milk Glass Scale	**7/0**	**7/3**	**7/6**	**8/3**	each	**7/0**	**7/3**	**8/3**	each
10038	With Enamelled Scale	**7/6**	**7/9**	**8/0**	**8/9**	„	**7/6**	**7/9**	**8/9**	„
(F) **10039**	Ditto, Lecture. 1 metre long, for Lecture Theatre use, 10°–150°C., each 10° being marked with distinctive colour, the same being plainly visible to the whole of the class									**£1 12 6**
(F) **10040**	Ditto, Beckmann's, for Freezing or Boiling Method, reading 0–6°C. each degree, divided into 1/100ths ... ... each									**1 5 0**
(F) **10041**	Ditto, ditto, as above, but provided with an Auxiliary Scale at top, as illustrated „									**1 7 6**
***10042**	**Magnifier,** for above ... ... „									**0 8 6**

(F) Foreign manufacture.

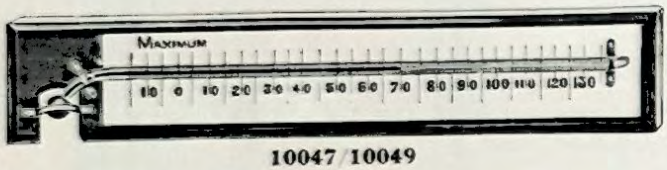


10043-4

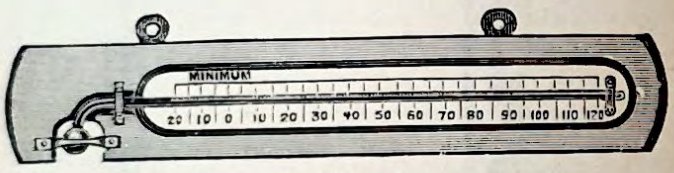


10045-6

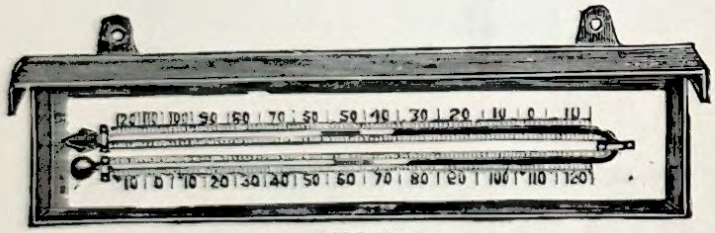
			8	10	in.
10043	**Thermometer,**	Maximum, Self-Registering Boxwood Scale	**2/6**	**3/0**	each
			8	10	in.
10044	,,	Minimum	**2/3**	**2/9**	each
10045	,,	Maximum, Self-Registering, Boxwood Scale, better quality, with Bent Bulb.			
			8	10	in.
			5/6	**7/0**	each
			8	10	in.
10046	,,	Minimum, ditto, ditto	**4/6**	**6/0**	each



10047/10049

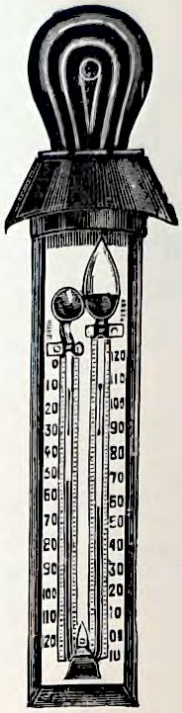


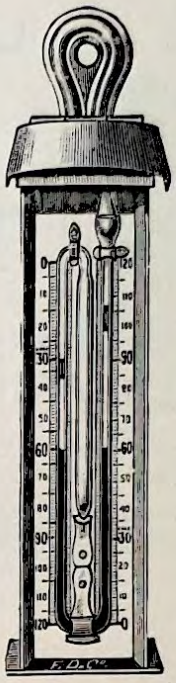
10048/50

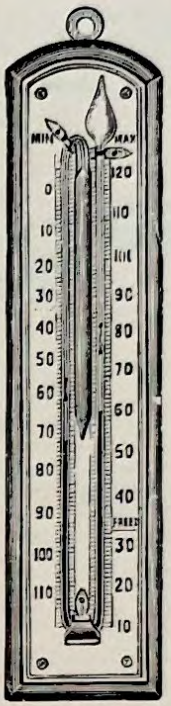


10051

10047	**Thermometer,**	Maximum, Opal Scale, Hand Painted, Divided Tube, mounted on Solid Oak or Mahogany back, standard pattern, 14 in. each	**£1**	**5**	**0**
10048	,,	Ditto, smaller size ... ... ,,	**0**	**16**	**6**
10049	,,	Minimum, Opal Scale, Hand Painted, Divided Tube, mounted on Solid Oak or Mahogany back, standard pattern, 14 in. each	**1**	**2**	**6**
10050	,,	Ditto, smaller size ... ... ,,	**0**	**15**	**6**
10051	,,	Maximum and Minimum, in Japanned Tin Case, with Boxwood Scale.			
			8	10	in.
			10/9	**12/6**	each

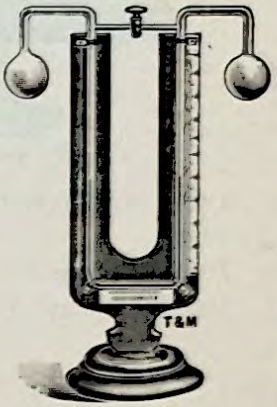

10053


10054–5


10056


10057

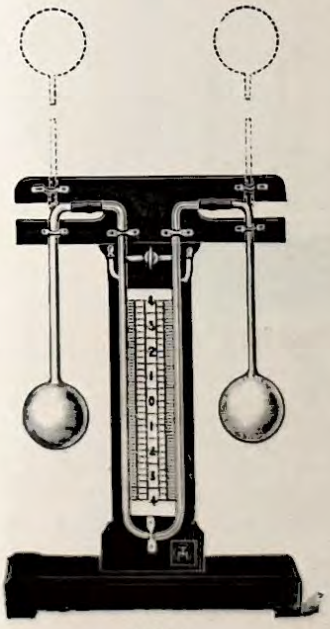

10059



10060

10053 **Thermometer,** Maximum and Minimum, Boxwood Scale, in Japanned Tin Case, with grooved Magnet ... ... 8 in. **6/6** 10 in. **8/6** each

10054 ,, Maximum and Minimum, standard pattern, Opal Scale, Engine Divided Tubes, in White Japanned Metal Case, with Magnet, 10 in. **£1 1 0**


10061

10055 **Thermometer,** ditto, as above, but in Copper Case **1 5 0**
N.P.L. Certificates for above at an extra of ... each **0 10 6**

10056 **Thermometer,** Sixe's, Maximum and Minimum, Boxwood superior finish, with bevelled edges, with Magnet, complete. 8 in. **7/6** 10 in. **10/6** each

(F) **10057** **Thermometer,** Differential, Leslie's, on Stand, each **£0 5 6**

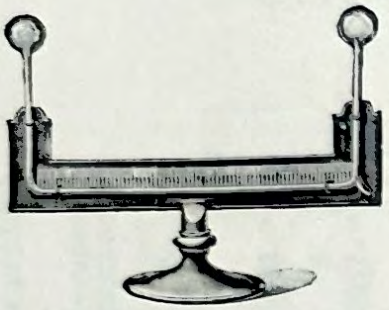
(F) **10058** Ditto, Leslie's Milk Glass Scale, Polished Stand ,, **0 7 9**

(F) **10059** Ditto, ,, ,, ,, with Stopcock ,, **0 10 6**

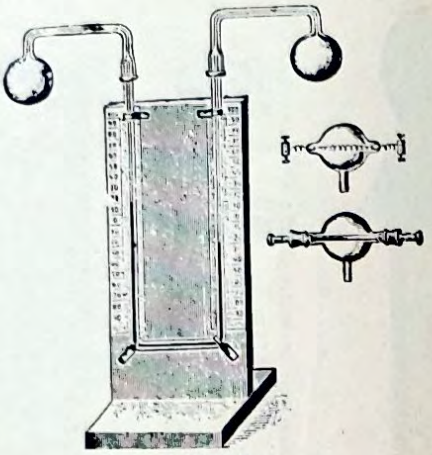
10060 **Thermometer,** Matthieson's Differential Air, with Glass Stopcock and Pendant Bulbs, on Polished Wood Stand ... ... each **0 15 6**

10061 **Thermometer,** Leslie's Differential Air, with Glass Stopcock; the bulbs can be turned up or down as required, being connected by pieces of pressure tubing. Milk Glass Scale. Large size for lecture purposes ... ... each **1 5 0**

(F) Foreign manufacture.

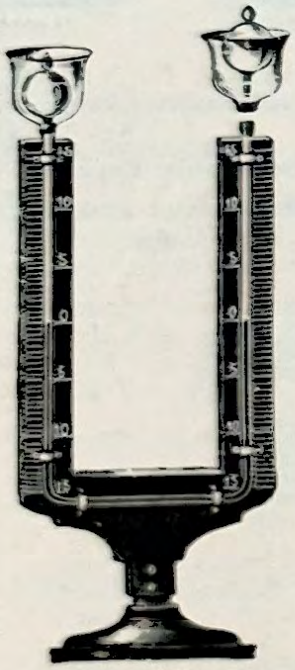


10062



10063–5

(F) **10062**	**Differential Thermometer,** Rumford's, on Wooden Stand, with Opal Scale...	**£0**	**15**	**0**
(F) **10063**	,, ,, with Interchangeable Glass Bulbs, ground to fit...	**1**	**12**	**0**
10064	**Glass Bulb,** fitted with Bismuth and Antimony Rods, for Peltier's experiment...	**0**	**18**	**9**
10065	**Nickel Spiral** for Electric Heat experiments	**0**	**15**	**0**



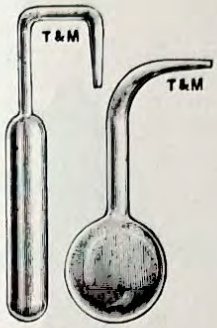
10066



10067

(F) **10066**	**Thermometer,** Differential, Shumann's. The Bulbs of Thermometers are surrounded by two Glass Cups for containing the liquid used in the experiment	**£1**	**5**	**0**
(F) **10067**	,, Spiral, Breguet's, of three different Metals, Silvered Metal Scale divided into degrees, mounted on Stand, with Glass Shade, height 6 in. approx.	**2**	**15**	**0**

(F) Foreign manufacture.



10068 10072



10069-70

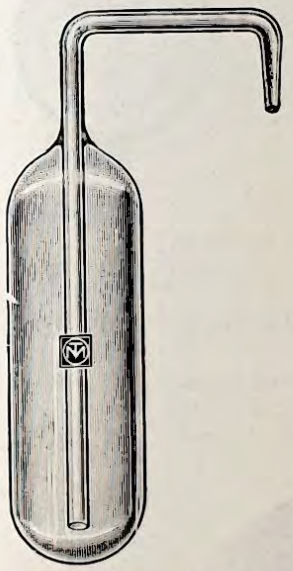


10074

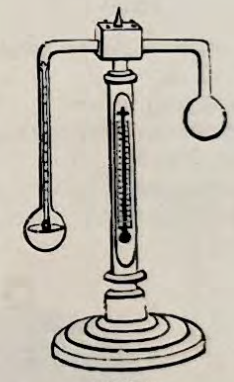


10071

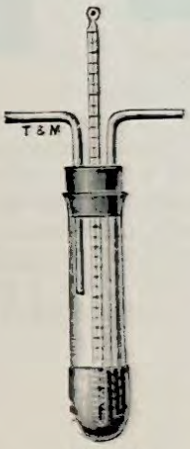
10068	**Weight, Thermometer** ... ... each **5d.**, per doz.	**£0**	**4**	**3**
10069	**Metal Stand only,** for above ... ... each	**0**	**1**	**9**
10070	**Weight, Thermometer,** another form ... ... each **5d.**, per doz.	**0**	**4**	**6**
*10071	,, ,, designed by J. W. Yates, Reg. No. 704593 ... ,, **2/0,** ,,	**1**	**1**	**0**
10072	,, ,, another form ... ... ,, **3d.**, per doz.	**0**	**2**	**9**
10073	**Weight, Thermometers,** pure, Fused Silica Ware, 100 mm. long, as No. 10068 each nett	**0**	**3**	**0**
10074	,, ,, for determining the Cubical Expansion of a Solid as described in Edser's book on "Heat" ... ... each	**0**	**3**	**6**



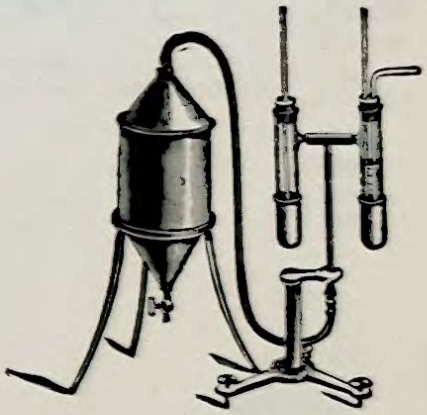
10075



10076



10077



10078

***10075 APPARATUS TO DETERMINE THE EXPANSION UNDERGONE DURING THE FREEZING OF WATER.** Designed by J. K. KING, M.A., The College, Plymouth.

Method of using.—Fill the apparatus ¼th full of mercury and weigh. Then invert the apparatus and fill the remaining ¾ths with water; this is done by simply attaching small bore rubber tubing and sucking out the air, then opening under water. In this way the apparatus is nearly filled; then place—still inverted—in a beaker of water, in which it is boiled, and allowed to cool; this will generally complete the filling. There is now a small amount of water in the capillary, which may be neglected; or which may be easily expelled by warming very gently (but not sufficiently to lose any mercury). Weigh again; this gives the weight of water. Now warm sufficiently to fill the capillary with mercury and dip the tube end under mercury in a crucible or thimble beaker, cool apparatus with ice-cold water. Remove beaker of mercury and freeze, starting from the top (this is done by filling the beaker with ice and gradually adding alternate layers of salt and ice to the top, finally transferring to a good freezing mixture), the mercury now overflows and is caught in a clean counterpoised crucible and weighed.

Price ... each nett **1/2,** per doz. **£0 12 6**

(F)	10076	**Hygrometer,** Daniel's, on Polished Wood Stand, with Opal Scale ... ... each	**0**	**17**	**6**
	10077	,, Regnault's, with Solid Silver Cup and Thermometer ... ... ,,	**0**	**8**	**0**
	10078	,, ,, with stout Solid Silver Cups and stout Copper Aspirator, complete with Thermometers, graduated in ¼ths	**5**	**5**	**0**
	10079	,, ,, Cheaper make, with Zinc Aspirator and Stand, without levelling screws	**3**	**5**	**0**

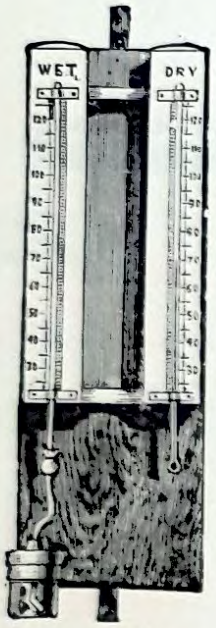
(F) Foreign manufacture.



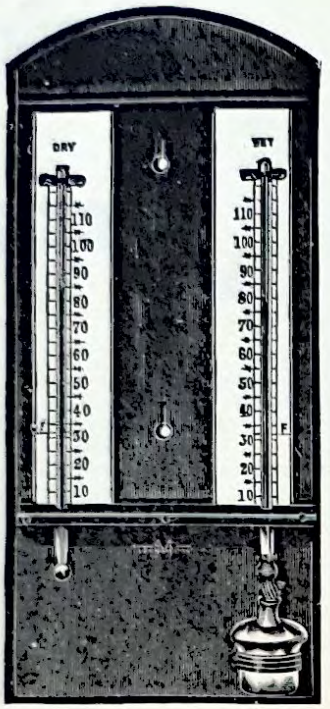
10081–2



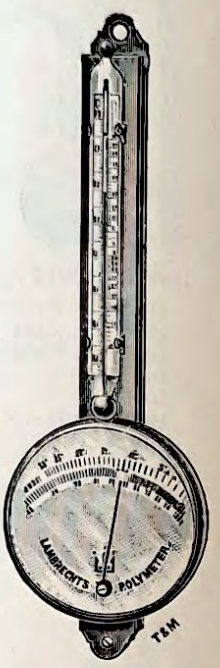
10083



10084

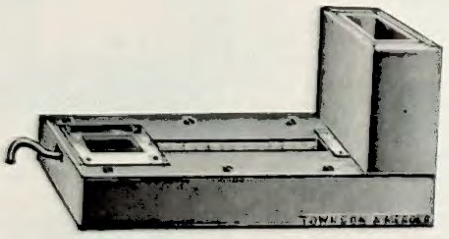


10085



10086

10081	**Hygrometer,** Mason's, Wet and Dry Bulb, with wide Boxwood Scale, in Japanned Frame, 10 in. ... ... each	**£0**	**9**	**0**
10082	,, ,, Zinc Scale, in wide Japanned Frame ... ... ,,	**0**	**10**	**6**
10083	,, ,, Boxwood Scale, for School use, simple form ... ,,	**0**	**7**	**3**
10084	,, Porcelain Scales on Polished Oak Board	**1**	**5**	**0**
10085	,, Mason's, Standard pattern, Opal Scale and Engine Divided Tubes, on Polished Oak or Mahogany Board, large size, superior finish ... ... each	**2**	**5**	**0**



10087



10088

(F) **10086**	**Polymeter,** Lambrecht's, mounted in Brass, with Card Scale	**£2**	**0**	**0**
10087	**Hygrometer,** Dine's, for showing the Dew Point by direct observation ...	**3**	**0**	**0**
(F) **10088**	**Hygroscope,** Spiral, Mitthoff's	**0**	**11**	**0**

For other Hygrometers, etc., see pages 534 to 538.

(F) Foreign manufacture.

Specific Gravity Bottles



10090



10091



10092



10093

10090 **Specific Gravity Bottles,** with drilled Stopper, not guaranteed, for teaching purposes.

Capacity	10	25	50	100 gm.
	11d.	**1/0**	**1/2**	**1/4** each
	10/6	**11/0**	**13/0**	**14/6** per doz.

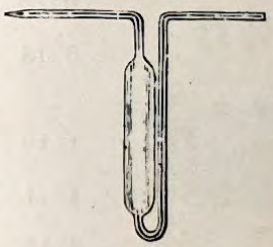
(F) **10091** „ „ „ with drilled Stopper, carefully adjusted, with capacity and temperature etched on same.

Capacity	5	10	20	25	50	100 gm.
	3/0	**3/0**	**3/6**	**3/6**	**4/0**	**5/0** each

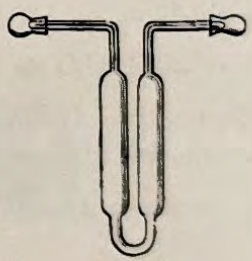
10092 „ „ „ with Brass Counterpoise, in Japanned Tin Case.

	25	50	100 gm.
	7/0	**8/0**	**9/0** each

10093 **Specific Gravity Flask, Chancel's,** to estimate Specific Weight of gases...each **£0 10 6**



10094



10095



10096



10097

10094 **Specific Gravity Tube,** Nicol's, for the Specific Gravity of Liquids.

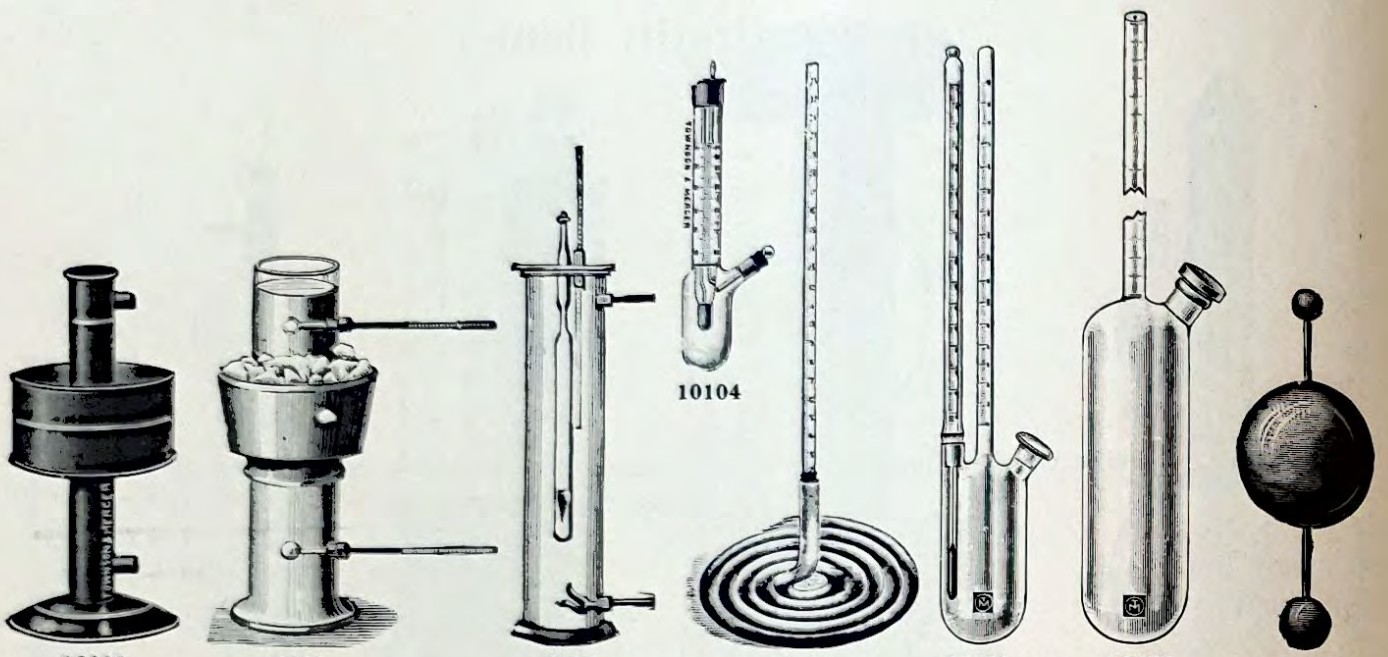
	5–10	15–25	30–50 gm.
	1/6	**2/0**	**2/6** each

(F) **10095** „ „ „ Sprengel's, for Oil ... ... 10 20 30 gm.
3/0 **3/6** **4/0** each

10096 **Dilatometer,** for the determination of the co-efficient of Cubical Expansion (as Edser's "Heat") ... ... each **9d.,** per doz. **£0 8 0**

10097 **Weighted Glass Bulb,** for demonstrating the Expansion of Liquids (*vide* Edser's "Heat") ... ... each **1/0,** per doz. **0 10 6**

(F) Foreign manufacture.



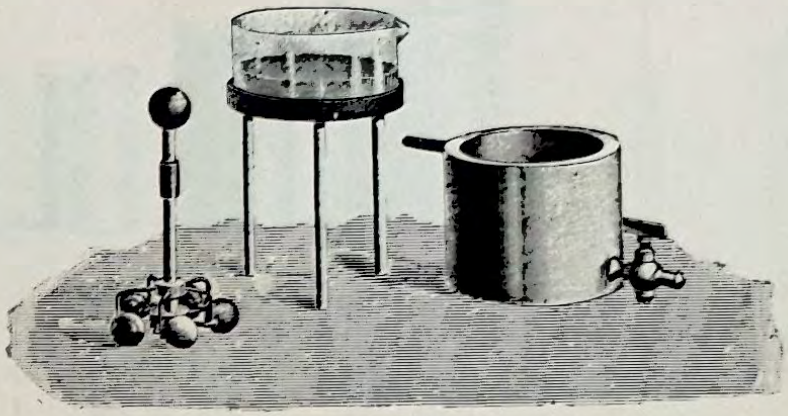
10098 10102 10103 10104 10105 10106 10107 10108

10098	**Hope's Water Density Apparatus;** Japanned Tin Cylinder and Circular Trough; height 20 in., diameter of trough 8 in.		**£0**	**10**	**0**
10099	Ditto, complete, with two Thermometers		**0**	**15**	**0**
10100	Ditto, Japanned Tin, cheaper make; height 12 in.		**0**	**8**	**0**
10101	Ditto, complete, with two Thermometers and I.R. Corks		**0**	**13**	**0**
10102	Ditto, Glass Cylinder, with Copper Trough, two Thermometers, graduated on stem, with Spherical Bulbs in ½ degrees, and fitted with I.R. Corks		**1**	**10**	**0**
(F) **10103**	**Hofmann's Apparatus,** to show the maximum density of Water		**1**	**1**	**0**
(F) **10104**	Ditto, new form, for Lantern use		**0**	**15**	**0**
10105	**Maximum Density of Water Apparatus,** consisting of a Coil of Lead Composition Tubing and graduated Glass Scale, in mm., as illustration (see Glazebrook's "Heat")		**0**	**5**	**6**
(F) ***10106**	Ditto, for Lantern use, designed by Mr. J. W. Yates	each	**1**	**2**	**6**
(F) ***10107**	**Apparatus.** Co-efficient of Expansion of a Liquid, designed by Mr. J. W. Yates	,,	**0**	**5**	**6**
10108	**Water Float,** Brass Ball, Floating in Cold Water and Sinking in Warm Water	,,	**0**	**7**	**6**
10109	,, ,, Glass, weighted with shot	,,	**0**	**4**	**6**

(F) Foreign manufacture.

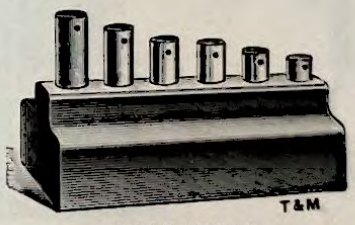


10114



10116

10111	**Balls,** Set of Five different Metals (Copper, Brass, Iron, Lead and Zinc), of equal size, with Hook, per set	£0	4	0
10112	,, ,, ,, ,, ,, well turned ... ... ,,	0	5	6
10113	,, ,, ,, ,, ,, of equal weight, well turned ... ... ,,	0	6	6
10114	**Tyndall's Apparatus,** to show the Specific Heat of Metals, complete, with Five Balls of different Metals, Hook, Plate of Wax, and Tripod Stand...	0	9	6
10115	**Wax,** Cake of, for ditto ... ... each	0	0	5
10116	**Tyndall's Apparatus,** for showing the Specific Heat of Metals, with Five Balls of different Metals, new pattern, complete with Heating Vessel, Wax Plate, Glass Vessel and Tripod	2	5	0

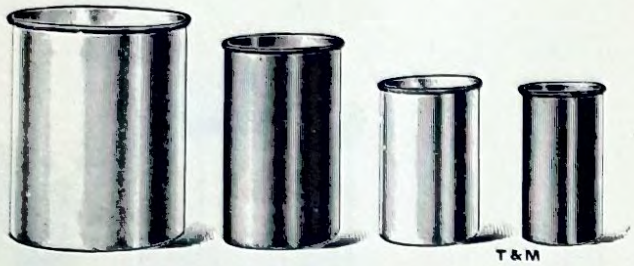


10119–10122



10123

10117	**Cylinders,** Set of, Copper, Tin, Lead, Iron, Zinc, Brass, Cork and Wood, 1½×⅝ in., per set	£0	4	6
10118	,, Metal, 1¼×½ in., Brass, Iron, Copper, Zinc, Aluminium and Lead ,,	0	5	0
10119	,, ,, Set of Copper, Brass, Lead, Iron, Zinc, Aluminium, 4×1·6 cm. diameter, equal volume, with holes drilled for suspension, in Mahogany Block, complete	0	6	6
10120	Ditto, ditto, of equal weight	0	10	6
10121	**Cylinders,** Metal, of equal weight 100 grammes, with holes drilled for suspension, in Polished Mahogany Block, per set of 4	0	9	0
10122	,, ,, ... ,, 6	0	11	6
10123	**Calorimeter,** vacuum jacketted glass vessel. Internal dimensions, approx. 6·5×5 8 6	10×8 14 6		cm. each



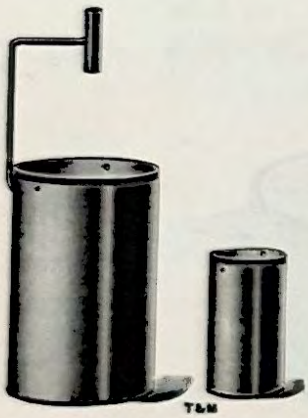
10124–5

10124 **Calorimeters,** Copper Spun, without seam.

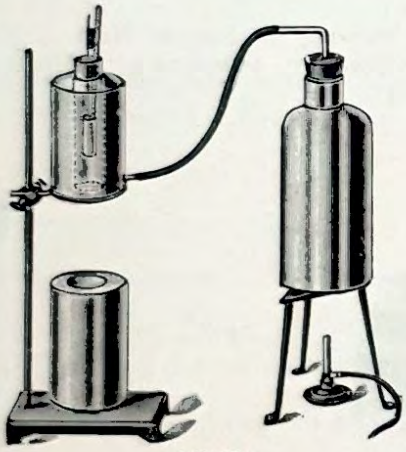
3×1½	3×2	4×2½	4×3	4×3½	5×4	
1/0	**1/3**	**1/9**	**2/3**	**2/6**	**3/0**	each

10125 **Calorimeters,** Aluminium Spun, without seam.

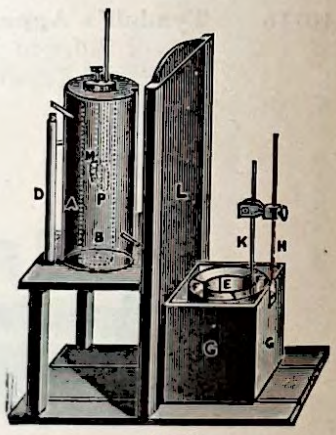
3×1	3×1½	3×2	4×2½	4×3	4×3½	
9d.	**10d.**	**1/0**	**1/3**	**1/6**	**1/8**	each



10126



10127



10130

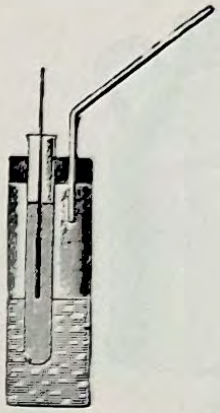
10126 **Calorimeter,** Copper, in pairs, one supported inside the other, with Thermometer Support... ... ... per pair **£0 5 0**

10127 „ Tin Can (1 gallon capacity), with Copper Steam Heater, two Spun Copper Calorimeters and Stands, without Bunsen Burner ... **1 5 6**

10128 **Steam Heater** only, as above, Stout Copper **0 12 6**

10129 „ Japanned Tin **0 6 6**

10130 **Calorimeter,** as described in Glazebrook and Shaw's "Heat," on Polished Mahogany Stand, with Thermometer, graduated in ⅛ths **4 10 0**



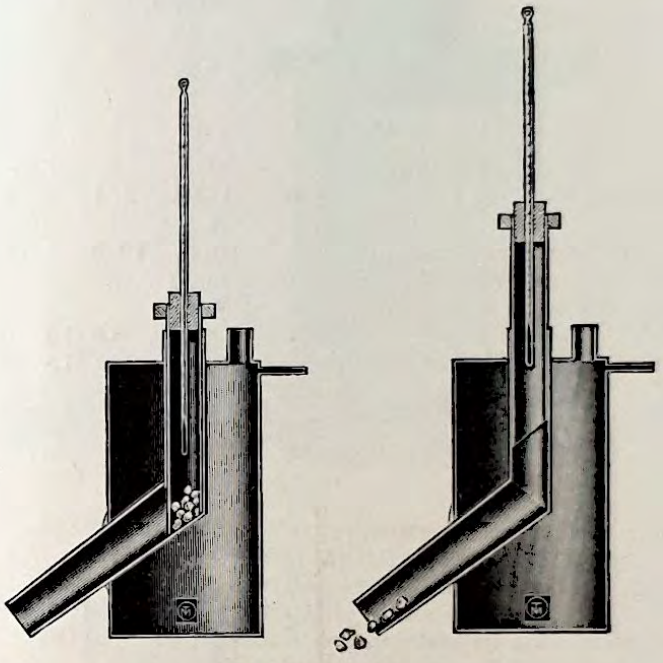
10132–3



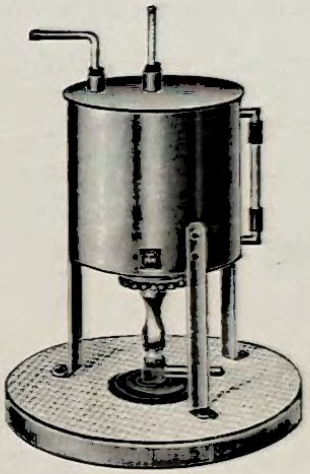
10134



10135



10131



10136–7

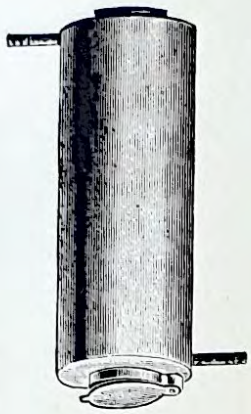


10138–41

10131	**Steam Heater,** New Pattern (*vide* "Practical Physics," second year's course, by James Sinclair, M.A., B.Sc.), consisting of Metal Vessel with sliding tube with insulated Handle. Price, with Brass Tube and Copper Jacket, without thermometer ... ... each	£0	15	0
10132	**Steam Heater,** consisting of Tin Outer Vessel, 6×2 in., fitted with inner tube of Copper, 6×1 in., and Outlet Tube for escape of steam (*vide* Schuster and Lee's "Practical Physics," Figs. 31 and 32, 1896 edition) ... ... each	0	4	6
10133	Ditto, as above, but fitted with stout Glass Tube, 6×1 ... ... „	0	3	6
10134	**Steam Trap** for latent heat of Steam ... ... each **1 0,** per doz.	0	10	6
10135	„ another form ... ... „ **1 0,** „	0	10	6
10136	**Steam Heater,** of stout Copper, fitted with inlet and outlet Tubes and Water Gauge. Size of Boiler 6×6, mounted on Uralite covered Base, complete with rose Burner	1	17	6
10137	**Steam Heater,** with Brazed Joints and Burner complete	2	5	0
10138	„ fitted with Water Gauge, inlet and outlet Tubes, of stout Copper. 1 litre capacity ...	0	12	0
10139	„ „ „ „ „ „ „ 2 „ „ ...	0	15	6
10140	„ „ „ „ „ „ „ 3 „ „ ...	0	17	6
10141	Ditto, ditto, ditto, Brazed Joints ... ... 3 „ „ ...	1	5	0



10143

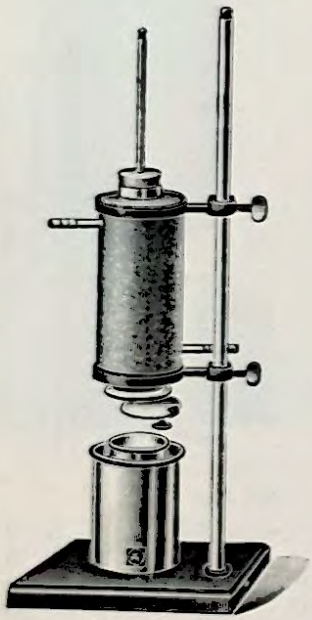


10145

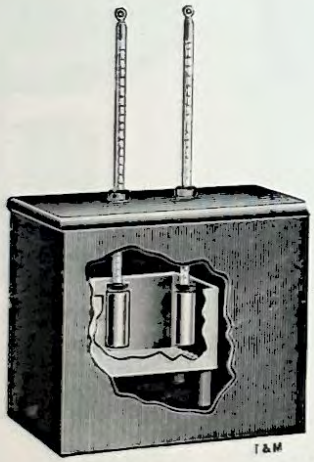
		Capacity	1	2	4	litre
10143	**Bottles, Tin,** Stout, for use as Steam Generators		**1/0**	**1/4**	**2/3**	each
		Capacity	½	1	2	litre
10144	**Bottles, Copper,** Stout, without Handle, for use as Steam Generators		**7/6**	**10/0**	**12/6**	each

10145 **Steam Heater,** of Copper, with inner Brass Jacket of 25×3·75 cm. dia., the inner Cylinder is closed at the top by a Cork, the lower by a Sliding Disc of Metal (as Robson's "Practical Exercises") **£0 15 0**

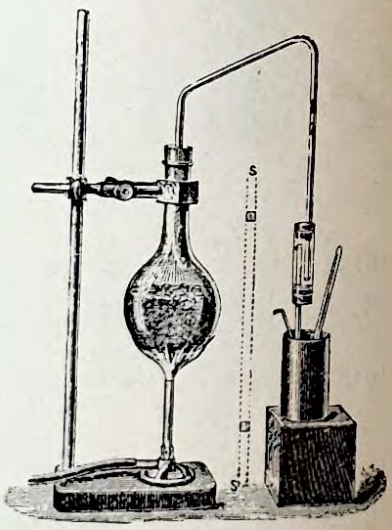
10146 Ditto, ditto, covered with felt, with 2 spun Copper Calorimeters and Stand complete **1 15 0**



10146



10147–8

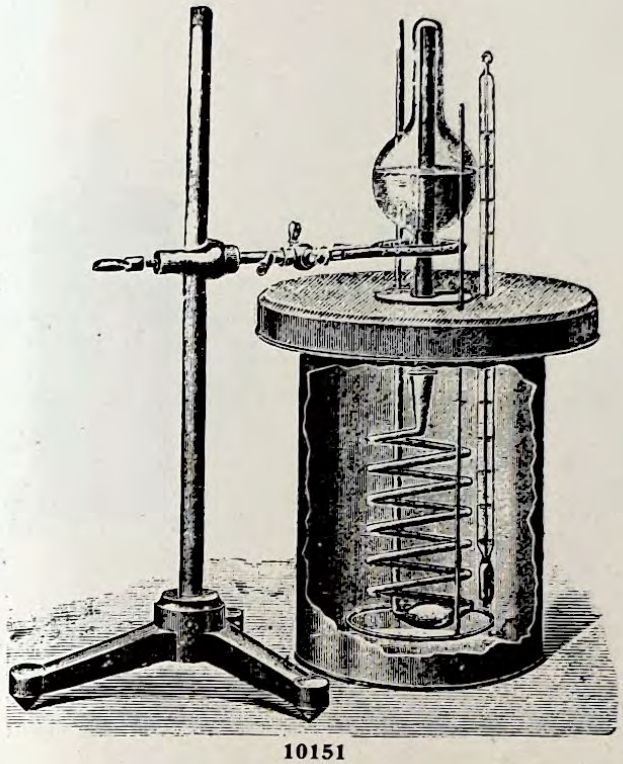


10149

10147 **Specific Heat of Liquids,** cooling method, consisting of 2 Aluminium Calorimeters, 2×1 in., fitted with 2 Thermometers minus 10—50° Centigrade in half degrees, and Corks, Zinc Trough on Supports contained in an outer Zinc Trough, felt lined, with holes for Thermometers (*vide* Robson's "Practical Exercises in Heat") **£1 7 6**

10148 Ditto, price without Thermometers **1 1 0**

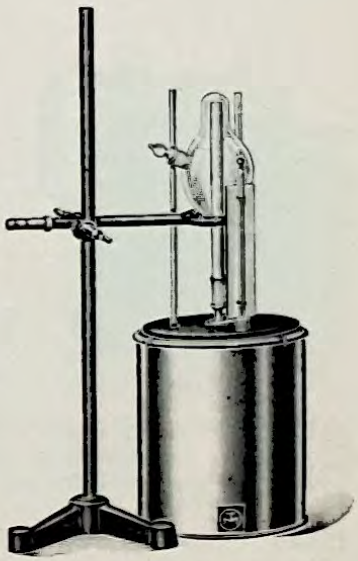
10149 **Latent Heat of Steam Apparatus,** comprising Heater with Corks and Tube Connections, Steam Trap, Calorimeter, Iron Stand and Clamp (*vide* Jones' "Sound, Light and Heat"), with Burner complete **0 15 0**



10151



10152

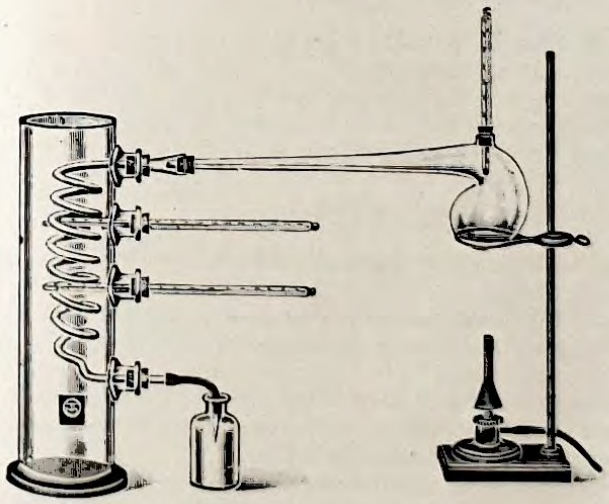


10153

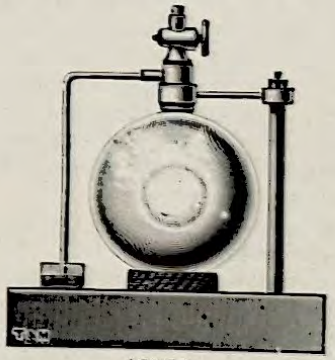
10151 **Berthelot's Apparatus,** Latent Heat of Steam, to determine, consisting of Glass Vessel, heated by Ring Burner, with Spiral and Tube, Calorimeters, Thermometer, Water Jacket and Stand, complete **£3 15 0**

(F) **10152** **Glass Spiral** only, for above **0 14 0**

10153 **Berthelot's Apparatus,** cheaper make, with two Copper Calorimeters, Burner and Stand, but without Thermometer **2 2 0**



10154



10155

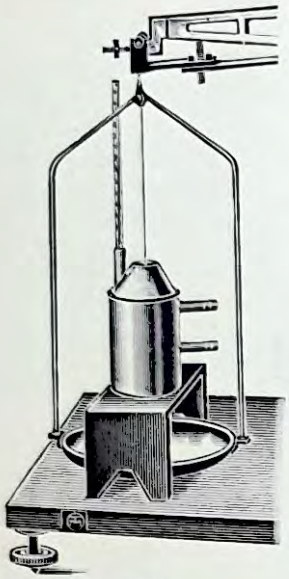
10154 **Depretz Apparatus** for determining the Latent Heat of Vapour, complete as illustrated **£2 10 0**

10155 **Clement and Desorme's Apparatus,** for determining the specific heat of Gases at constant volume **3 10 0**

(F) Foreign manufacture.



10167



10168



10169



10170

10167 **Steam Heater,** Robson's, consisting of Copper Vessel with two inner Brass Tubes, brazed, with Steam Outlet Tube and Screw Cap, coated with thick felt... ... **£1 10 0**

10168 **Steam Calorimeter,** Dr. Jolly's Method, comprising Copper Vessel with inlet and outlet, and Aluminium Pan **0 10 6**

10169 **Lavoisier and Laplace's Ice Calorimeter,** comprising three Concentric Zinc Vessels on stout Tripod Stand **2 15 0**

10170 **Steam Heater for Calorimetry,** improved form. Designed by A. Beresford Ryley, M.A.

The Steam Heater consists of a Copper Cylinder, fitted with movable Handles and with a Cork carrying a somewhat thick Glass Test Tube. An aperture in the Cylinder for the escape of steam can easily be closed by means of a Sliding Door, so that after the substance in Test Tube has been heated for a sufficient time the opening may be closed, and the substance delivered into a Calorimeter without loss of heat, and without any leakage of water from the heater, which is fitted, as a further precaution, with a shield to catch any drops of water if by any chance the aperture is not quite closed.

The Advantages of this Form of Steam Heater :

1. It is quite simple and its body is unbreakable.

2. The Test Tube which contains the substance to be heated, instead of being of thin glass, which is liable to be broken by rough handling, is made of thick glass, almost unbreakable. This test tube need not be removed from the cork, since the weight of the substance is not directly ascertained, but indirectly, by weighing the Calorimeter, the contained water and the substance in question at the end of the experiment. This is a distinct advantage in the case of bodies in a finely divided condition, which are liable to adhere to the glass of the test tube.

3. It can easily be held in the hand by wrapping a pocket handkerchief round the handles (a difficulty in the majority of heaters).

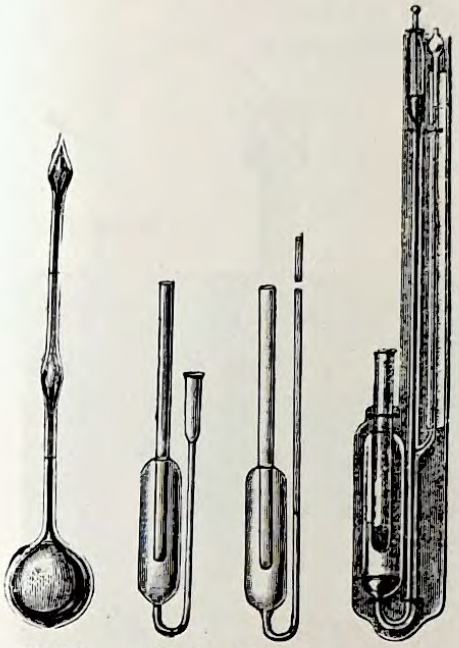
4. The apparatus being perfectly water-tight, there is no leakage or any mess on the benches (usually associated with experiments involving the use of a steam heater).

5. It gives most accurate results, as the substance is delivered into calorimeter practically without loss of heat, for after the closing of the aperture, the flame is removed, and since the temperature of substance in Test Tube does not fall for 25 seconds, there is plenty of time to pour it into the Calorimeter.

Care should be taken that the Test Tube fits the Cork tightly, and that the Cork fits the Cylinder. The Heater itself should be heated over wire gauze on a tripod, thus preventing the handles from becoming too hot. The amount of water to be put in the Heater is shown by a line outside the Cylinder.

After allowing the contents of the Test Tube to be in contact with the steam from boiling water for five or six minutes, the opening may be closed by putting the left hand on the Cork to steady the apparatus, and by pushing up the Sliding Door by means of a coin held in the right hand.

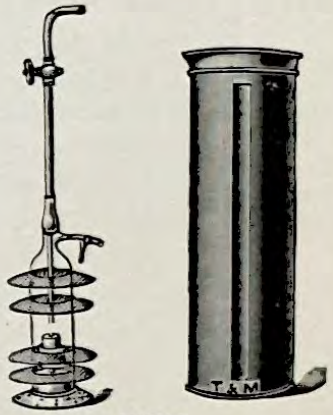
Made in Stout Copper ... ... each, nett **£0 9 0**



10172 10173 10174 10175



10176



10177

(F) 10172	**Calorifier, Andrew's,** Specific Heat of Liquids				**£0**	**19**	**6**
			Small	Medium	Large		
10173	**Bunsen's Calorimeter,** Glass	each	**2/9**	**3/3**	**3/9**		
10174	Ditto, with Tube graduated into millimetres ...	,,	**5/0**	**6/6**	**7/0**		
(F) 10175	Ditto, mounted on Board, with Scale graduated into millimetres, and special filling arrangement				**£1**	**5**	**0**
10176	**Calorimeter,** Lewis Thompson's, for determining the Heating Power of Coal, complete in Mahogany Case, with Instructions				**6**	**5**	**0**
	Spare Graduated Glasses, for use with above				**0**	**11**	**6**
	Copper Furnace, Tube Brazed				**0**	**3**	**0**
	,, Combustion Cylinder, with Tap				**0**	**17**	**6**
	Clutch Base				**0**	**7**	**6**
	Thermometer, in Case				**0**	**12**	**6**

The Lewis Thompson Calorimeter has been adopted by most of the Railway and other Companies as the standard by which to determine the relative commercial value of Coals. It is also employed in the Naval Departments of the British and Foreign Governments.

PRINCIPLES ON WHICH THE CALORIMETER IS BASED

First, that the latent heat of steam is equal to 967°F.; and secondly, that coal burned in pure oxygen evolves the same amount of heat as when perfectly burned in atmospheric air. The correctness of these data have been demonstrated, but their elucidation here would occupy too much space.

Instructions on application.

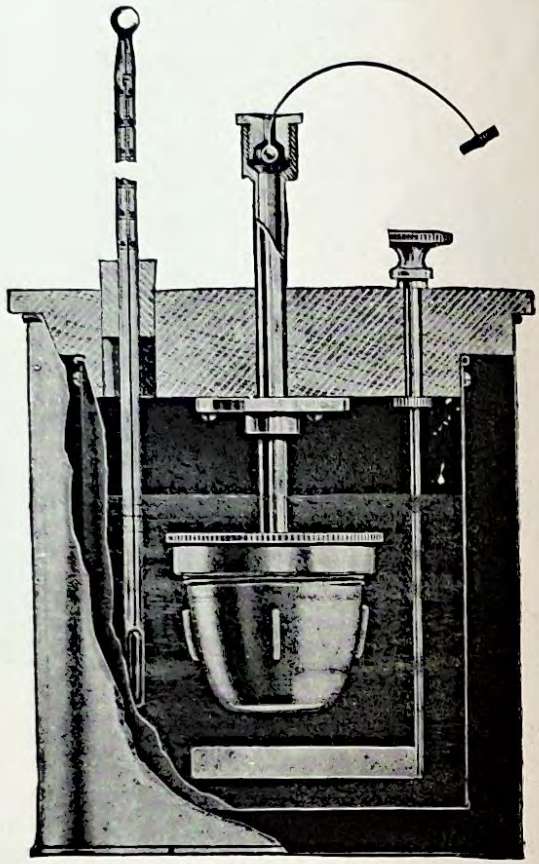
10177	**Calorimeter,** William Thompson's, for the determination of the Heating Power of Fuels by direct combustion in Oxygen, with delicate Thermometer (see "Journal of the Society of Chemical Industry," November 29th, 1886)	**£2**	**2**	**6**
	Extra Thermometers for above	**0**	**9**	**6**

Platinum Crucible for above, weight about 0·2 oz., at market price of platinum.

(F) Foreign manufacture.

A COMPLETE AND SIMPLE CALORIMETER

10178 Roland Wild's Calorimeter, for estimating the heating value of solid fuels. This apparatus is of the sodium peroxide type, and consists of a Combustion Chamber suspended from the Cover by a Conduit, which is furnished with a Valve. There is a well-made Copper Water Vessel, inside an Outer Vessel, heavily nickelled, forming an Air Jacket, which effectually prevents absorption and radiation, thus rendering the rise in temperature of the water an absolutely true guide to the heat given off by the fuel. An agitating Paddle or Stirrer, and a best quality sensitive Thermometer, divided into $\frac{1}{10}$ths and easily read in $\frac{1}{20}$ths, are also provided.



10178-9

Brief Instructions

(a) Place stated amount of water in water vessel, and of dried fuel (with proper amount of sodium peroxide), into the crucible, which screw firmly home.

(b) Stir water until temperature is constant, and note same.

(c) Heat a piece of nickel wire to redness, drop same through valve opening and draw valve home, agitate water by stirrer. Note highest temperature.

The rise in temperature multiplied by 1000=calorific value in B.Th.U.'s of the coal.

The calorific value ÷ 967=evaporative power per lb. of the coal.

Example:—Water, 51°; rise 13·15° Coal value, 13,150 B.Th.U. Evap. Power per lb., 13·6 $\left(\frac{13{,}150}{\cdot 967}\right)$

10178 Complete, as illustrated, with sensitive Fahrenheit thermometer (40–100° in $\frac{1}{10}$ths), nickel wire, certificate of water value, and instructions ... ... nett **£6 6 6**

(It may happen that an intending user has no apparatus for crushing, drying and weighing the coal and sodium peroxide, or measuring the water to be placed in water vessel. We therefore provide):—

10179 Calorimeter, as 10178, but with Balance of novel design in Case and with Special Weights for Coal and Sodium Peroxide weighing. For drying the fuel a well-made Copper Oven, with Gas Burner or Spirit Lamp is provided. In addition there are Mortar and Pestle, Camel-hair Brush, Tweezers, Watch Glass, Sieve, Scoop, and 1,000 c.c. glass water-measuring vessel. Price complete ... ... nett **13 4 0**

Sodium Peroxide, in 1 lb. tins (enough for above 36 tests) **0 4 6**

A COMPLETE AND SIMPLE CALORIMETER

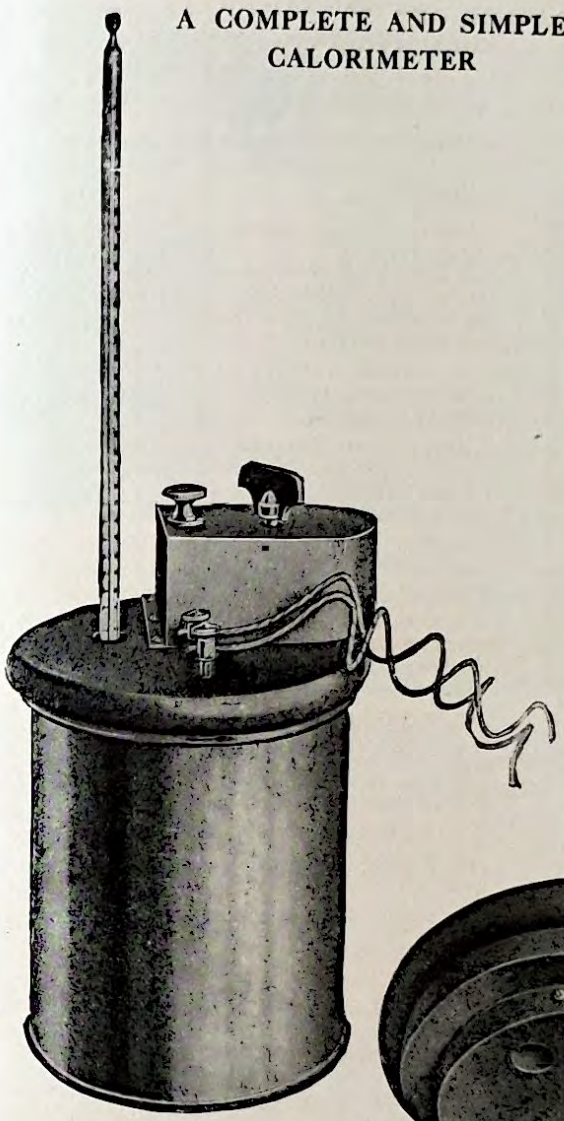
10180 **Calorimeter,** Roland Wild improved form, for Electrical Firing and Hand Stirring, with sensitive Fahrenheit Thermometer (40 to 1000 in $\frac{1}{10}$ths), Nickel Wire, certificate water value and instructions
nett **£8 5 0**

10181 **Set of Apparatus,** as 10179, but with the Calorimeter No. 10180 arranged for Electrical Firing and Hand Stirring
nett **£15 2 6**

10182 **Calorimeter,** No. 10180, with Thermometer, a Sensitive Balance reading to 1 milligramme, with knife edges and planes, pan arrestment and beam support; in glass case with levelling screws and a box of weights in velvet-lined case with Forceps, 1 Bunsen Burner, 1 Desiccator, 2 Porcelain Crucibles and Lid, pair Crucible Tongs, 2 Watch Glasses, 2 Sieves, Wire for supporting crucibles, Copper Oven with Thermometer, Stand and Burner, Mortar and Pestle, Camel-hair Brush, Tweezers, Scoop and Glass Measuring Vessel of 1000 c.c. mechanical capacity, complete with instructions.
nett **£29 1 0**

10183 **Calorimeter,** No. 10180, arranged for Electrical Firing and Mechanical Stirring, complete with instructions nett **£11 11 0**

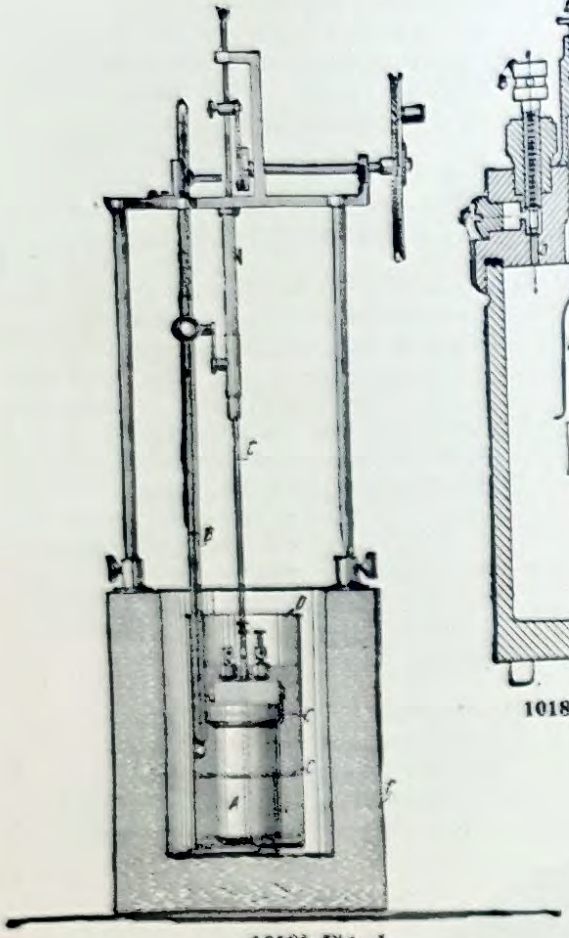
10184 **Set of Apparatus,** as No. 10182, with Calorimeter as No. 10183 ... ... **£32 7 0**



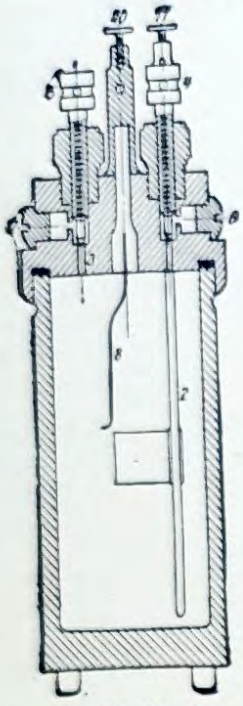
10183–4
Roland Wild Calorimeter with Electrical Firing and Mechanical Stirrer.



10183 Showing the Calorimeter Bomb, removed from Water Vessel.



10185 Fig. 1.



10185 Fig. 2.

10185 Calorimeter, Berthelot-Mahler Bomb, with Dr. Krocker's modification of the Combustion Bomb... **£50 0 0**

Note.—The above price is approximate and is subject to variations in the market price of platinum.

The apparatus comprises the following parts:

1. The Bomb, lined inside with enamel, with insulated Platinum Pole, a Platinum Tube reaching down to the bottom of the Bomb, and a small Clay Dish.

2. A Socket to receive the Bomb while the lid is being screwed down. The Socket may be screwed to a table.

3. A Pressure Gauge on a Stand with oxygen supply pipe with connection pieces to fit, Oxygen Cylinder at one end and Lid of the Bomb at the other.

4. Two narrow nickel-plated Tubes, with Connection Screws to connect with the lid of the Bomb.

5. One double-ended Spanner with square mouth to fit the rim of the Bomb Lid. Two smaller Spanners, one Valve Tightening Pin, Fuse-wire and spare Lead Washers.

6. A Briquetting Press.

7. A nickel-plated Copper Water Vessel.

8. An Insulating Jacket, consisting of a Copper Vessel with double walls.

9. A Stirring Apparatus for hand or power.

10. A Thermometer graduated by $\frac{1}{100}$°C. with test certificate.

11. Sliding Lens for reading Thermometer.

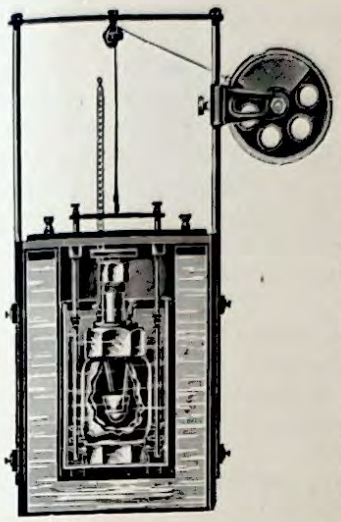
The Bomb, Fig. 2, consists of a nickel-plated Steel Vessel with a lid tightly screwed down, and of a capacity of about 300 c.c. The lid has across its centre a reinforcing web, through which the gas supply and exhaust passages are carried. The passage 1, continued by the platinum tube 2, is used to introduce the oxygen, whereas the passage 3 serves as exhaust for the combustion gases. Both passages can be closed by valve screws 4 and 5 respectively. For removing the atmospheric air contained in the Bomb, the second valve screw 5 is opened for a short while, during the admission of the oxygen. By doing so it is possible to ascertain at the same time whether the passages are choked or not. Before the Bomb is placed into the Water Vessel, the passages in the sides of the lid must be closed by means of the plug screws 6 and 7.

Through the centre of the lid is carried the insulated platinum pole wire 8. This wire and also the platinum tube have each a short platinum socket around which the fuse wire is wound. 9 is the platinum dish, or the clay dish in industrial outfits.

10 and 11 are two small binding screws for the electric wire conductor.

It should be particularly pointed out that no special force need be exerted in screwing down the lid; only the two joint surfaces, the lead washer in the lid, and the rim of the vessel should be always kept clean and in a perfect condition. Also the closing of the valve requires a small force only. Attention must furthermore be paid to see that the screw threads are free of all foreign bodies; it is advisable to slightly grease the screw threads and the joint surfaces before assembling the various parts.

10186	**Extra Parts and Accessories** for above Calorimeter.			
	Thermometer, Beckmann's graduated in $\frac{1}{100}$°C.			£2 0 0
	N.P.L. Certificate for same	extra		1 15 0
	Silica Crucibles	each		0 3 0
	Platinum Crucibles, approximate weight 0·25 oz., at current price.			
	Silica Capsules, flat bottom, 1 in. diameter, $\frac{1}{2}$ in. high			0 2 6
	Lead Washers	each 1/3,	per doz.	0 13 9
	Nickel Fuse Wire		per reel	0 0 8
10187	**Series Resistance** for Ignition from Lighting Circuit, D.C. or A.C., up to 250 volts, with adjustable Rheostat, Fuses and Switch mounted on Insulated Base			2 7 6



10190

10190 MAHLER-COOK BOMB CALORIMETER APPARATUS

It is high class, reliable and absolutely safe. Every detail of its construction has been carefully worked out by Engineers with many years' experience of high-pressure apparatus, and it may with confidence be considered to offer great advantages over similar apparatus previously and now available.

DESCRIPTION OF THE APPARATUS

Bomb

The bomb, of some 650 c.c. capacity, is made of mild forged steel of the highest quality, its thickness and shape being carefully designed to ensure a high limit of safety. The inner surface is coated with a special enamel to protect the steel against corrosion. The bomb is also supplied in stainless steel, not enamelled internally, the price being the same for both types.

The cover which carries the valve for the introduction of the oxygen, is provided with the "Cook" insulated Firing Plug, and platinum or nickel supports for the crucible and ignition wire, and is thickly gilt on its inner surface. This cover is connected to the main vessel by a powerful hexagon nut and special spigot joint, which allows the nut to be screwed up without turning the cover, and avoids tearing the lead joint. This design affords a simple and highly efficient means of mounting and dismounting the apparatus.

When desired an additional valve and outlet to the cover can be supplied.

The complete bomb is test to 250 atmospheres (3,750 lb. per square inch) before leaving the works, and is absolutely safe.

Pressure Gauge. Gradual Release Valve

To prevent sudden rush of oxygen into gauge and bomb.

Calorimetric Vessels

A double-walled copper vessel insulated on the outside with a thick layer of felt forms the enclosure for the calorimeter. It is surmounted by a framework holding a universal pulley for the stirring gear, and is provided with an aluminium cover and mounted on cast-iron base. The whole arrangement is neatly and solidly constructed.

The bomb, when prepared and charged with gas, is placed in an inner copper vessel containing 2,500 c.c. of water. This copper vessel is nickel-plated and insulated at the bottom from the surrounding vessel by cork studs.

Stirring Gear

This is made of a simple and efficient form, and is actuated by hand, from any required distance by a cord passing over the pulley mentioned above. If the cord be attached to the large pulley as shown in the illustration, the stirrer may be operated by means of a small motor.

Coal Press

A small screw Coal Press is provided for making the cylinders of compressed coal or other material, the calorific value of which has to be determined.

Thermometers

One Thermometer divided into $\frac{1}{100}$ths of a degree Centigrade and with a range of about 8° is supplied, or alternatively a Beckmann type with adjustable zero ‡ and also a thermometer divided into $\frac{1}{5}$ths of a degree for the preliminary adjustment of the thermometer and for taking the temperature of the outer vessel.

Tapping Key

A Tapping Key or Switch is provided, together with flexible wire connections, for making contact when firing the charge in bomb.

Two Dry Cells for igniting charge in bomb.

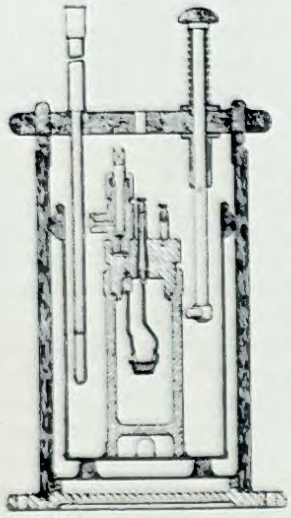
The use of the Battery eliminates troubles due to high voltages, and at the same time the apparatus is self-contained and independent of electric supply. The life of the Battery depends upon the demands made upon it, but ordinarily it should last for two years, and when required we supply spare cells to replace exhausted ones.

Cast-Iron Stand and Two Spanners
Quartz Crucible and Platinum Ignition Wire
Oxygen Cylinder, 20 ft.

Price, complete **£58 0 0**

(Illustrated Pamphlet on application)

10191 THE MAHLER-COOK MINOR BOMB CALORIMETER



10191

The Mahler-Cook Minor Bomb Calorimeter (a sectional view of which is shown) has been introduced to meet the wishes of those in control of Technical Colleges, Science Classes, Schools, Evening Classes, etc., for a smaller, cheaper and less pretentious type of our well-known Mahler-Cook Standard Bomb Calorimeter.

The determination of the calorific or heating value of Fuels and Foodstuffs, etc., has to-day become of vital importance to both the Engineer and the Chemist, and it is safe to say that all large purchases of Coal, Coke, Oil, etc., are made as a result of the values obtained from the combustion of small samples of the fuel in the Bomb Calorimeter.

The importance of frequently testing the heating quality of the Fuel supply will be obvious: to railway companies, shipping companies, mills and factories, and other large steam users, suffering a serious financial loss coupled with unsatisfactory working of the plant should heating value of the fuel purchased fall below the average specified.

For the science master and his students at Schools and Evening Classes, the Mahler-Cook Minor Bomb Calorimeter should be a standard laboratory apparatus, familiarity with its use affording an excellent training for those contemplating entering one of the industrial technical professions.

The Minor is remarkable for the absence of such unnecessary gadgets as rubber joints, automatic valves, springs, water seals, integrating devices, etc., and is offered as a simple, cheap, robust and safe apparatus, particularly suitable for the use of students and of non-technical users, and for those not desiring such a great degree of accuracy obtainable with the Mahler-Cook Standard Bomb Calorimeter.

The Apparatus as illustrated consists of an outer circular copper vessel, approximately 7 in. diameter × 12 in. long, with sheet felt lagging and supported on and by a cast-iron base plate.

Fitted to the top of this copper vessel is an ebonite disc carrying a Beckmann thermometer and a simple form of stirrer with spring return, a hole being drilled in centre of ebonite to admit of the flexible electric ignition wires connecting from Bomb to electric supply.

Enclosed in the outer copper vessel is an inner copper vessel approximately 5½ in. diameter × 9½ in. long, insulated from the outer vessel by means of ebonite studs at upper end and corks at lower end, and with a perforated concentric ring inside the bottom.

The Bomb which stands in the above-mentioned ring is somewhat unique inasmuch as it is machined from a solid bar of the latest high tensile non-corrosive steel alloy with a capacity of approximately 230 c.c., and with machined joint face and screw thread at upper end and a novel but effective arrangement for holding whilst screwing up and making the joint at lower end.

The cover of Bomb is made from a solid bronze pressing screwed fast to fit the Bomb, and arranged for enclosing a lead ring for the joint.

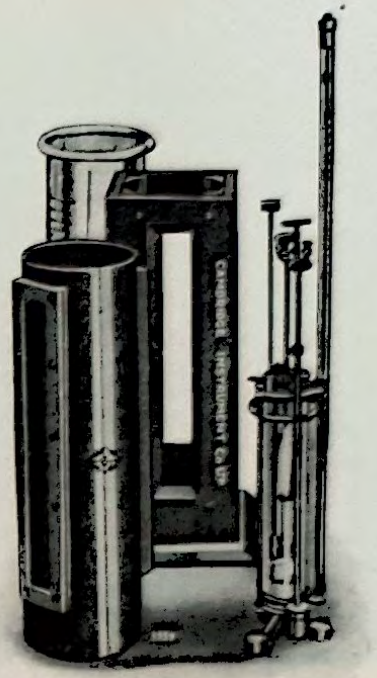
Fitted to the top side of cover is a screw-down valve of bronze with connection for attaching copper tube to Oxygen Cylinder and two terminals, one of which is attached to the Cook insulated ignition plug.

On the underside of the cover are the two Electrodes, one being an extension of the ignition plug with crucible holding ring at lower end, and the other connects with the valve and is drilled at the top end, with a small hole at right angle for the admission of Oxygen.

The Lead ring joint is a feature of this Minor type Bomb, and is easily made, practically permanent, and perfectly tight and safe, repeated making and breaking of the joint having little or no effect, and assuming cleanliness and care is observed the joint will last for several hundred determinations.

The Accessories forming and included in the Mahler-Cook Minor Bomb Calorimeter, consist of and comprise: (1) One Beckmann Thermometer; (2) Gradual Release Valve; (3) Pressure Gauge attached to Gradual Release Valve; (4) Copper Tube and Unions; (5) Coal Briquette Press; (6) Spanner for making Bomb joint; (7) Small Spanner for nuts; (8) Cast-iron Stand for supporting Bomb cover when attaching ignition wire; (9) Cast-iron Holding Plate for Bomb; (10) Tapping Key; (11) Silica Crucible, Spare Lead Ring, Tommy Bare, flexible Electric Wires, one metre of Platinum Ignition Wire. Price **£35 0 0**

In addition to the foregoing, the following are necessary but are supplied as extras if required: Dry Batteries, Accumulators or a Rheostat, and an Oxygen Cylinder.

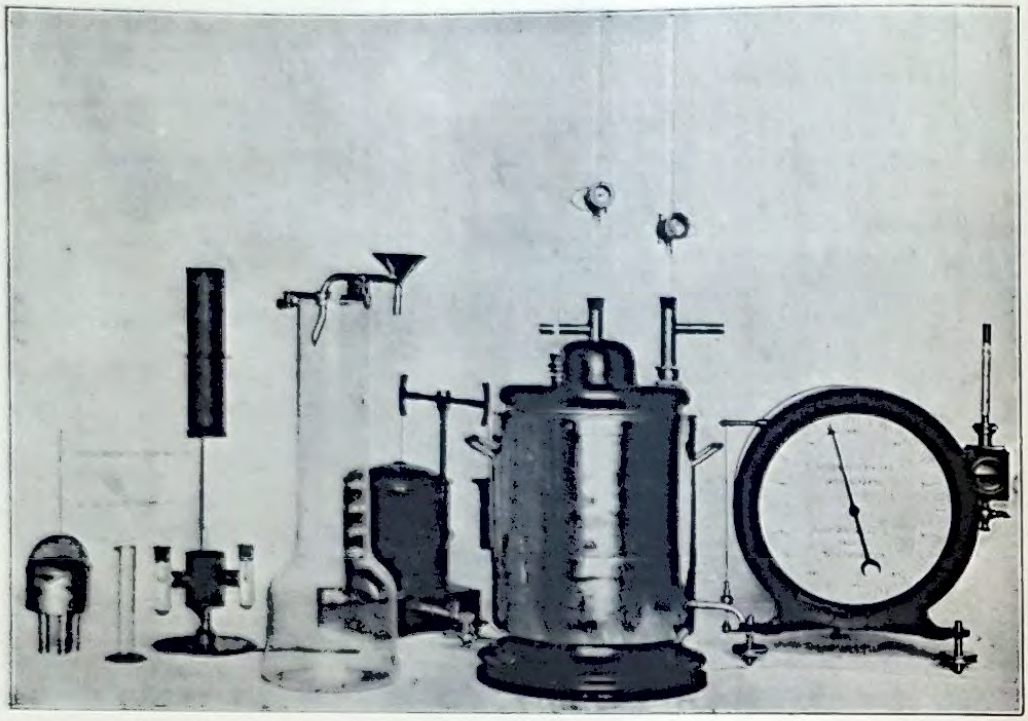


10192

ROSENHAIN FUEL CALORIMETER

This Calorimeter, which is a simple and accurate instrument for the determination of the calorific value of coal and liquid fuel, works on the well-known Thompson principle, a sample of coal or an absorption pellet soaked with the oil under test being burnt in a closed vessel under water. The design and arrangement of the Calorimeter vessel and the combustion chamber renders the operation easy, rapid and certain, and secures that all the heat generated by combustion is directly communicated to the water of the Calorimeter.

10192 **Rosenhain Fuel Calorimeter,** complete outfit, consisting of Calorimeter with Silica Dish and Outer Wooden Case, Coal Compressing Mortar, Glass Measure, two Thermometers (one divided to 0·05°C. and reading from 10–25°C. and one divided to 0·2°C. and reading from 0–50°C.), India-rubber Tubing, Wash Bottle, 4 Coal Briquettes, 4 Absorption Pellets in sealed tubes and 4 pieces of Tinfoil in envelopes. Improved design... ... ... nett **£12 10 0**



10193

10193 BOYS' GAS CALORIMETER, Improved Type, as prescribed by the Gas Referees, 1926.

1	**Boys' Calorimeter,** with Gas Burner, Overhead Funnel, Change-over Funnel, Tube with Diaphragm and 15 ft. Rubber Tube, in accordance with the notification of the Gas Referees, 1926...	£26	0	0
1	**Cylindrical Metal Vessel** to contain the alkaline solution into which the part of the Calorimeter attached to the Wooden Top is to be placed when not in use. (This Metal Vessel is suggested, although more expensive, as avoiding the frequent breakages when glass vessels are used) ...	1	0	0
2	**14-inch Open Scale Thermometers** with Safety Chambers, enamel backs, engraved on stem 0–50°C., reading in tenths of a degree (the extra length of Thermometer gives a more open scale)	0	17	6
	Thermometers, enamel backs, engraved on stem 30–90°F., for taking temperature of Effluent Gas and Room Temperature ... ... each	0	5	0
2	**Adjustable Reading Lenses,** with Spring Clips for attaching to the stems of the Thermometers each	0	8	6
1	**Graduated Glass Vessel,** capacity about 2,400 c.c., for measuring outflow from Calorimeter	1	5	0
1	**Small Graduated Glass Vessel,** capacity about 50 c.c., for collecting condensed water ...	0	6	6
1	**Meter,** Central Dial, $\frac{1}{10}$th of cubic foot per revolution, Dial divided into 100 parts, Dial and Hand protected by a glass, Case made in tinned copper and japanned black, Brass Fittings polished and gold lacquered; well-designed foot and brass Levelling Screws with plumb bob; cast brass water line Sight Box with removable lunette glasses (opal at back, clear glass in front), Thermometer in brass case, porcelain imperishable large Dial with brass bezel finished bright and lacquered; emptying plug, drain from spout, white metal spout, and white metal drum with bell-metal spindle and bearings, inlet and outlet unions	12	10	0
1	**Ventilated Wet and Dry Bulb Hygrometer** with Thermometers reading in degrees Fahrenheit, together with Set of Glaisher's Tables ... ... nett	3	13	6
1	**Balance Governor,** Case japanned black, with Beam balanced on knife edge, with counterbalance Shot Tube; inlet union and outlet tap and connections. A very sensitive and reliable instrument ... ... nett	5	10	0

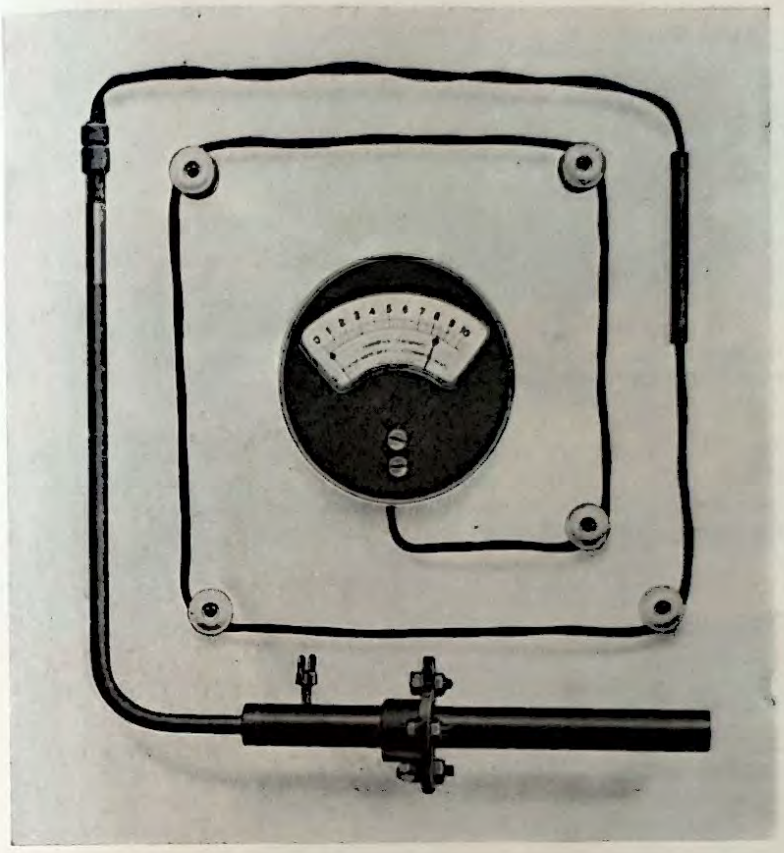


Fig. 1.
Wall Type Indicating Outfit, "Unit" Class, "Resilia" patent.
(About one-sixth full size.)

PYROMETERS

Temperature control is essential to efficiency in all industrial processes using high temperatures; also, in research, accurate measurement is the only road by which progress can be achieved. The instruments described below have special features making them robust in service while of the high accuracy necessary to efficient production or research. In every case the moving coil, which carries the pointer or pen arm, is carried on finely pointed double pivots with jewel bearings; suspension wires or strips, with their liability to breakage and zero changes are not used, and accurate levelling is not required. The fine pivot points are protected under vibration or shocks in all directions by incorporation of the well-known "Resilia" spring mounting.

Thermo-couple Pyrometers make use of the E.M.F., which is developed at a heated junction between two dissimilar alloys. In their simple form they do not require any battery or other external source of current. They are used normally for temperatures up to a maximum of about 1,400°C. industrially, or up to 1,600°C. in special conditions for research work. The type of thermo-couple and the range selected should include the maximum expected, but the more open the scale the easier it is to make accurate readings. Scales as open as 0°–200°C. can be supplied where specially required.

The Thermo-couple Stem, the tip of which is subjected to the temperature to be measured, varies according to the use intended, and, since the use largely governs the type of complete outfit, it is appropriate to select the stems first. Alloys known as "Base Metals" are cheap and are generally employed for temperatures not usually exceeding 1,150°C., and never above 1,300°C. For higher temperatures it is necessary to use the more expensive "Rare Metals," Platinum and its alloys, in which case the industrial maximum is 1,400°C., or 1,600°C. for special research. Stems of similar type are interchangeable, and renewals can be supplied at short notice, but the different types are not interchangeable and should not be used on the same indicator or recorder.

Tube Type Base Metal Stems are used for temperatures normally up to 950°C. but never exceeding 1,050°C. They embody a patent concentric construction and are mechanically very convenient and robust. A stem of this kind, with an outer sheath, is seen in Fig. 1. In this case it is bent to reduce the projection outside a small furnace, but the normal stem for larger furnaces is straight, length 3 ft.

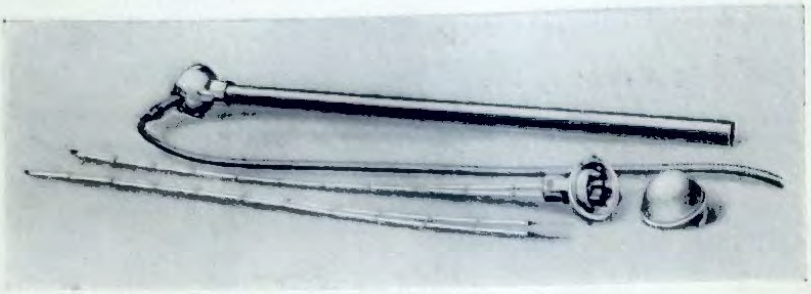


Fig. 2.
Wire Type Base Metal Thermo-couple Stem, with Head, Connector and Compensating Extension.
(About one-twelfth full size.)

Wire Type Base Metal Stems are used particularly for temperatures normally between 850° C. and 1,150° C. but never exceeding 1,300° C. The two alloys are in the form of thick strong wires attached to a "head" in a manner that allows renewal in a few seconds; there are no soldered or brazed joints to make. This type is shown in Fig. 2, complete with head and sheath and also dissembled. Standard length, 3 ft.



Fig. 3.
Wire Type Rare Metal Thermo-couple Stem, Platinum v. Platinum-Rhodium, with internal insulation and Sheath.
(About one-eighth full size.)

Wire Type Rare Metal Stems, as shown in Fig. 3, are attached to a head similar to that of the Base Metals above (Fig. 2), but owing to the high cost of platinum the wires are much thinner and necessarily more delicate. The result in practice is that rare metals are only used for special high temperature work industrially or in research work of very high accuracy where mechanical breakage is not likely. Length varies according to intended use.

Laboratory Stems are usually desired of small size, and are of the wire type with thin wires and an outer sheath of small diameter. These are illustrated in Figs. 4 and 5. A light head is used, clamping the sheath and the compensating extension, the renewal of the thermo-couple wires or the extension is done by a screwdriver in a few seconds; there are no soldered joints to make. Standard length, 1 ft.

Sheaths are necessary in many cases to protect the stems from furnace gases, baths, etc. They vary according to circumstances, from a closed-end tube of welded steel to one of fireclay, quartz or porcelain. For continuous use above 400° C. or short tests above 650° C., an outer sheath should always be used. Some typical sheaths are included in the illustrations and in the selected outfits on pages 265-268, but advice will be freely tendered if the enquiry states fully the conditions of use.

Connector.— In all cases except the Laboratory Stems, the connection between the stem head and the compensating extension is made by a special concentric connector which performs the operation in one movement, protects the actual contacts from corrosion and cannot come loose by pull on the compensating extension. Connectors are seen in Figs. 1 and 2, while the method of attachment to a Tube Type Stem is shown in Fig. 6.

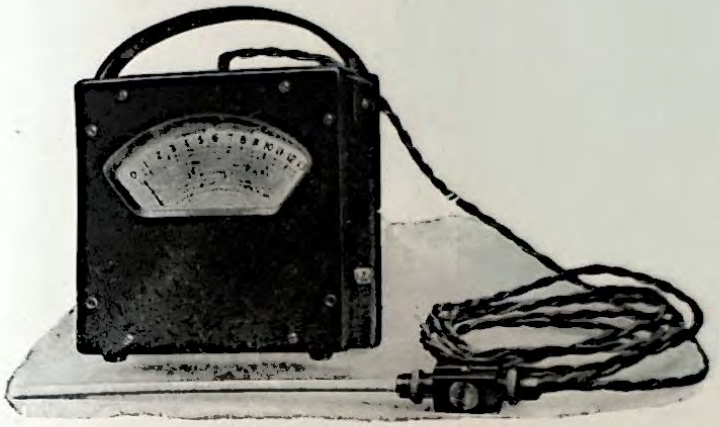


Fig. 4.
Laboratory Type Portable Indicating Pyrometer.
(About one-fifth full size.)



Fig. 5.
Laboratory Type Fixed Indicating Outfit.

Compensating Extension is used to remove the "cold junction" of the thermo-couple from immediate effect of the furnace heat. The point where the thermo-couple alloys join the remainder of the circuit is called the "cold junction," and is the datum or comparison point of the measurement; the indicator or recorder should be set, when disconnected from the stem, to the cold junction temperature. To remove the cold junction to a place where it will be relatively cool and steady, the thermo-couple stem is virtually prolonged by the alloys in the Compensating Extension. In Fig. 1 a two-foot semi-flexible extension is shown, the remainder of the leads being heavy twin stranded copper. In Figs. 4 and 5 the whole lead is compensating extension, thus removing the cold junction to the indicator itself.

For Unit Class Outfits the compensating extension may be up to 30 ft. length; in High Resistance Outfits it may be 120 ft. or more if needed.

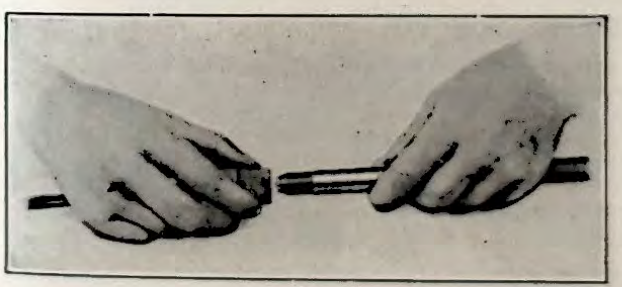


Fig. 6.

Indicators and Recorders all have the patent "Resilia" spring mounting already mentioned. Indicators for fixed use and all Recorders are fully magnetically shielded so that they are not liable to errors which might otherwise be induced by fixing to steel stanchions or near cables carrying heavy currents. All Indicators for fixed use have a red adjustable Index which may be set to any desired point on the scale so that the user can see at a glance whether the desired temperature is maintained.

Unit-Class Indicators.—For single-station outfits with one thermo-couple stem and short leads of fixed length the instrument is specially arranged to withstand severe industrial use; it is virtually as robust as an ordinary ammeter.

For fixed use the circular Wall Type is used as seen in Figs. 1 and 5, with flat scale, very easy to read. For portable use the instrument is as seen in Fig. 4, in hand-polished hardwood case with solid leather carrying handle, equally robust and easy to read. Suitable for Base Metal Stem and Flexible Compensating Extension up to 30 ft. or semi-flexible Compensating Extension, 2 ft., and twin copper cable up to 100 ft.

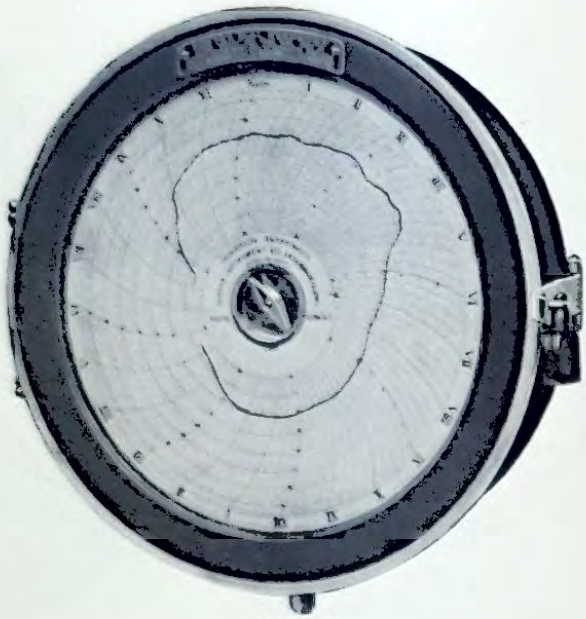


Fig. 7.
Foster Dial Recorder.
(About one-quarter full size.)

Unit-Class Recorders.—These have similar characteristics to the Indicators described above, with the same limits as to stems and leads. They are usually of the Dial type, see Fig. 7, though for special cases the Strip Recorder, Fig. 8, may be similarly calibrated.

High Resistance Indicators.—Where it is desired to work with Stems and/or leads of different lengths and resistances; with switchboards to connect several stems in turn to one Indicator; and for all Rare Metal Stems, high internal resistance is desirable so that small variations in the resistance of the external circuit shall not produce detectable errors. The Wall Type Indicator in this case is of the edgewise type with vertical axis, as shown in Figs. 9 and 10; the latter has a specially long scale, 10 in., and may be fitted with a magnifier allowing extremely fine readings.

For portable use the Indicator is broadly like Fig. 4, but has a specially long scale, 7 in., a knife-edge pointer and an anti-parallax mirror, allowing very fine readings. It is used with the scale horizontal but accurate levelling is not needed. High Resistance Indicators may be calibrated for any one type of stem, and with Compensating Extensions up to 120 ft. or with shorter extensions up to 30 ft., and copper cable up to 600 ft. Even longer lengths can be accommodated by special arrangements and calibration. The actual internal resistance is proportioned to the use in view; internal resistance as high as 4,000 ohms for Base Metal or 1,200 ohms for Rare Metal can be supplied to special order.

High Resistance Recorders.—These have similar characteristics to the Indicators described above, and are always of the Strip Recorder Type. Suitable for all cases of variable lengths of stems or leads, for all Rare Metal Stems and also for all multiple records with automatic commutators (see page 265). The allowable lengths of lead and the figures for internal resistance are as for the High Resistance Indicators above.

Dial Recorder.—This is the simplest and neatest pyrometer recorder; it is of the Unit Class described above, and is shown in Fig. 7. The whole previous record is visible without interrupting the instrument, and it can be read up to the last minute. The record is produced by a stilus which is tapped forward towards the glass every 30 seconds; between the dots it is free to take up its true temperature reading, without friction. The Chart is translucent, and is backed by a sheet of carbon paper, so that the stilus makes a chain of dots on the back of the chart but clearly visible from the front. In practice the dots join up into a continuous line. The chart printing and the record line are all indelible, non-smudging and do not fade. By putting on two charts and carbon papers duplicate records can be made. The chart lasts for 24 hours and is driven by a strong clock wound every day when the new chart is put on.

Strip Recorder.—This is the most perfect recorder made; it has a continuous or "strip" chart lasting one month, replaced in a few seconds. The chart ruling is in two colours, temperature lines in one colour and time in another; it has rectangular co-ordinates and can be read with ease to half of one per cent of the scale. The marking is produced by the intersection of a knife edge on the recording arm and another under the chart, nipping a typewriter ribbon between them and producing a clearly defined dot. In practice the successive dots join into a virtually continuous line. The chart drive has no marginal perforations, therefore there is no trouble of "tearing out" and failure to drive; it is further self-centring. The whole previous record is visible without interrupting the recorder, and the chart may be cut up into sections or kept in one roll, as preferred.

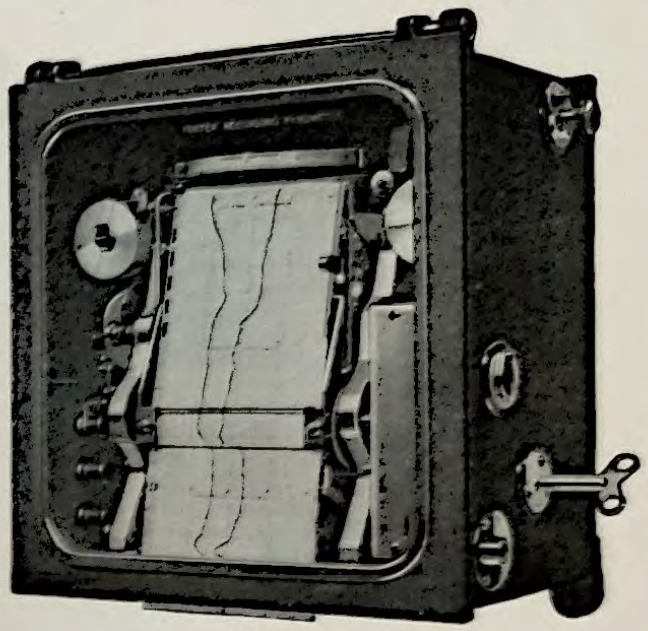


Fig. 8.
Strip Recorder.
(About one-fifth full size.)

By means of the inspection scale and knife edge on the recording arm, the recorder acts also as an indicator for momentary readings. It is used as a single record instrument or, by means of an automatic commutator, for several records of technically related temperatures. The Commutator has double pole contacts of incorrodible rare metals, so there is no danger of bad contacts or of errors due to stray "earths" on the circuits. In the case of multiple records the colour of the ribbon is changed simultaneously with change of the connection from one stem to the next. As many as six records in clearly distinguishable colours may be put on one chart; the example in Fig. 8 shows a double-record instrument. The standard pattern is driven by a double-spring opposed-drive clock, wound every day, but electrical drive not needing winding is supplied to special order where A.C. supply of standardised periodicity is available.

Switchboards are used where it is desired to read the temperatures of several stems in succession on one indicator at a central control position. The indicator in this case is always of the High Resistance class. A typical Switchboard with edgewise Indicator is shown in Fig. 9. The switches are sunk to protect them from dust and are of special construction to give reliable industrial service. The contacts being of rare metals and therefore incorrodible; they are double-pole switches, thus avoiding errors which may arise on single-pole switches with "common return" due to stray "earths" and lastly each pole comprises two contacts in parallel; it is therefore not surprising that these switchboards are more reliable than any others known.

SELECTED OUTFITS.—The assemblies listed in the following pages are those most frequently used for normal industrial and laboratory work. The spares listed separately are important for export use, to avoid delays when renewals are required; they are also advised on continuous home service for the same reasons. Centigrade scales are normally supplied, but Fahrenheit equivalents can be supplied to special order at the same prices. Complete instructions for installation and use are sent with every outfit. Where none of the selected outfits meets the desired conditions, specifications and quotations will be supplied on receipt of full particulars.

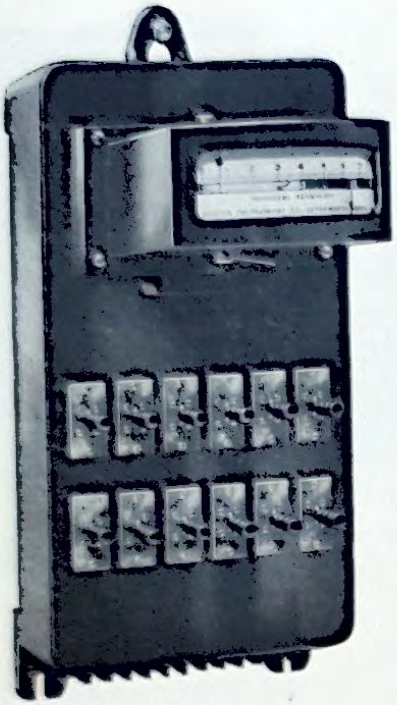


Fig. 9.
Wall Type Indicator, edgewise, with Sunk Type Switchboard.
(About one-sixth full size.)

10194	(A)	**Fixed Indicating Outfit,** for flues, annealing ovens for glass, metal, etc., at low temperatures, with 3 ft. straight tube type Stem, adjustable Flange, Connector, 2 ft. semi-flexible Extension, 30 ft. Cable and Wall Type Circular Indicator, 0–650°C.	**£14**	**4**	**0**
10194/1	(a)	**Spare,** one 3 ft. Stem	**1**	**5**	**0**
10195	(B)	**Portable Indicating Outfit,** for flues, low temperature annealing, etc., with 3 ft. straight tube type Stem, Connector, 12 ft. flexible Extension and Portable Indicator, 0–650°C.	**14**	**5**	**0**
10195/1	(a)	**Spare,** one 3 ft. Stem	**1**	**5**	**0**
10196	(C)	**Recording Outfit,** for flues, annealing glass or metal at low temperatures, etc., with 3 ft. straight tube type Stem, Connector, 12 ft. flexible Extension and Dial Recorder with Charts for 100 days, 0–650°C.	**28**	**10**	**0**
10196/1	(a)	**Spares,** one 3 ft. Stem and additional Charts for 300 days	**2**	**15**	**0**
10197	(D)	**Fixed Indicating Outfit,** for open vats of oil or varnish, white metals, etc., with 3 ft. tube type Stem bent 90°, Clamp Hook, Connector, 2 ft. semi-flexible Extension, 30 ft. Cable and Wall Type Circular Indicator, 0–650°C.	**14**	**9**	**0**
10197/1	(a)	**Spare,** one 3 ft. bent Stem	**1**	**10**	**0**
10198	(E)	**Fixed Indicating Outfit,** for small furnaces, for annealing, tempering, carburising and hardening (not high speed steels), with 3 ft. tube type Stem bent 90°, Clamp Flange, Steel Sheath, Connector, 2 ft. semi-flexible Extension, 30 ft. Cable and Wall Type Circular Indicator, 0–1050°C. (see Fig. 1) ...	**15**	**4**	**0**
10198/1	(a)	**Spares,** two bent Stems and three Sheaths	**5**	**0**	**0**
10199	(F)	**Recording Outfit,** for small furnace, for annealing, tempering, carburising and hardening (not high speed steel), with 3 ft. tube type Stem bent 90°, Clamp Flange, Calorised Steel Sheath, Connector, 12 ft. flexible Extension, Dial Recorder, 0–1050°C. and Charts for 100 days	**30**	**0**	**0**
10199/1	(a)	**Spares,** two bent Stems, three Sheaths and Charts for 300 days	**8**	**0**	**0**

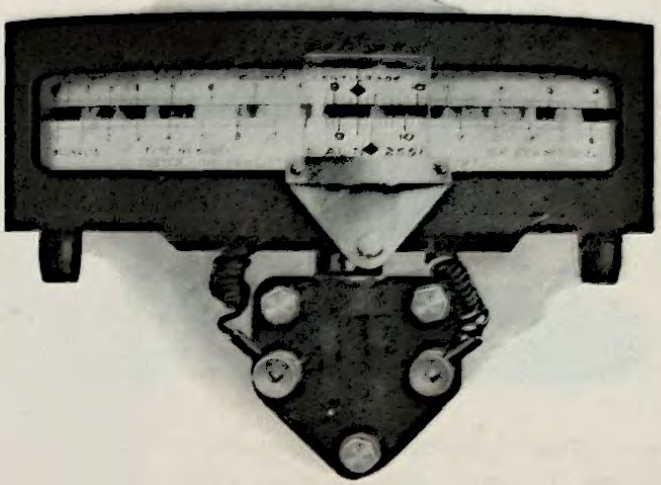


Fig. 10.
Wall Type Indicator, "Resilia" Patent, 10-inch scale, with Swivel Bracket, and Adjustable Magnifier.
(About one-quarter full size)

			£	s.	d.
10200	(G)	**Recording Outfit,** for pottery or brick kilns, with 3 ft. Wire Type Stem, Head, Compound Sheath with renewable Refractory Tip, Clamp Flange, Connector, 30 ft. flexible Extension and Strip Recorder, with Chart for one month ...	**£60**	**10**	**0**
10200/1	(a)	**Spares,** three Stem Renewals, three Refractory Sheath Tips and Charts for 11 months	**11**	**6**	**6**
***10201**	(H)	**Fixed Indicating Outfit** for high temperature furnaces, etc., with 2 ft. Rare Metal Stem, Head, Compound Refractory Sheath with Porcelain Tip, outer Fireclay Sheath, Clamp Flange, Connector, 12 ft. flexible Extension and Wall Type Edgewise Indicator, scaled 0–1400°C.	**21**	**17**	**6**
***10201/1**	(a)	**Spares,** one Rare Metal Stem renewal, one inner Insulation, one inner Porcelain Sheath and one outer Fireclay	**5**	**18**	**0**
***10202**	(J)	**Fixed Indicating Outfit** for specially fine readings, for general high temperature work on small furnaces, with 18 in. Rare Metal Stem, Head, Compound Sheath with Quartz Tip, Clamp Flange, Connector, 30 ft. flexible Extension and Wall Type Edgewise Indicator with 10 in. scale, knife-edge Pointer, anti-parallax Mirror and adjustable Magnifier (see Fig. 10), 0–1100°C. ...	**29**	**17**	**6**
***10202/1**	(a)	**Spares,** one Rare Metal Stem renewal, one inner Insulation and one Quartz Sheath	**3**	**12**	**0**
***10203**	(K)	**Recording Outfit,** for glass tanks, etc., with 2 ft. Rare Metal Stem, Head, Compound Sheath with Porcelain Tip, outer Fireclay Sheath, Clamp Flange, Connector, 60 ft. flexible Extension and Strip Recorder, with Chart for one month, 0–1400°C. (Fig. 8)	**65**	**9**	**6**
***10203/1**	(a)	**Spares,** one Rare Metal Stem renewal, one inner Insulation, one inner Porcelain Sheath, one outer Fireclay Sheath and Charts for 11 months	**10**	**17**	**4**
***10204**	(L)	**Portable Indicating Outfit,** for momentary readings before pouring of Aluminium, Brass and other non-ferrous metals, with 4 ft. Stem, Head, Handle, Connector, 12 ft. flexible Extension and Portable Indicator, 0–1300°C.	**15**	**12**	**6**
***10204/1**	(a)	**Spare,** one 4 ft. Stem renewal	**1**	**7**	**6**

* The prices of these items are subject to variation with change in the market price of Platinum and its alloys.

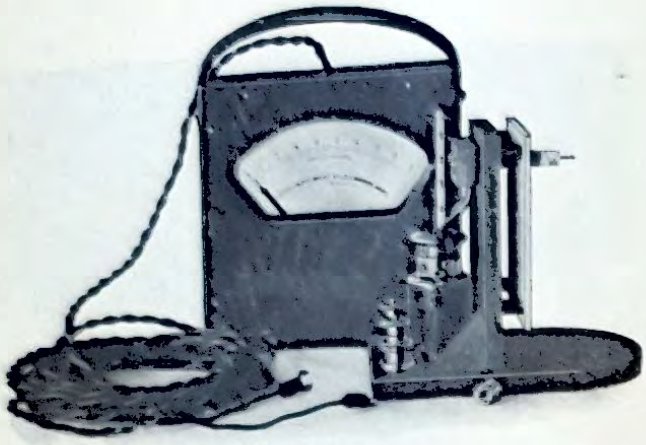


Fig. 11.
Laboratory Type Indicating Pyrometer with Cold Junction Stand.

10205	(M)	**Fixed Indicating Research Outfit,** for small furnaces, etc., with one foot Wire Type Stem, fine wires for quick readings, Light Head, Quartz Sheath $\frac{5}{16}$ in. O.D., 12 ft. flexible Extension and Wall Type Circular Indicator, 0–1300° C. (see Fig. 5)	£13	7	9
10205/1	(a)	**Spares,** three sets of Stem renewals, with internal insulation and outer Quartz Sheaths	1	18	3
10206	(N)	**Portable Indicating Research Outfit,** for small furnaces, etc., with 1 ft. Wire Type Stem, fine wires for quick readings, Light Head, Quartz Sheath, $\frac{5}{16}$ in. O.D., 12 ft. flexible Extension and Portable Indicator, 0–1300° C. (see Fig. 4)	13	17	9
10206/1	(a)	**Spares,** three sets of Stem renewals with internal insulation and outer Quartz Sheaths	1	18	3
10207	(O)	**Portable Indicating Research Outfit,** for small furnaces, etc., with 1 ft. Wire Type Stem, fine wires for quick readings, Light Head, Quartz Sheath, $\frac{5}{16}$ in. O.D., 3 ft. flexible Extension to Cold Junction Stand, 12 ft. flexible Cable therefrom to Portable Indicator, with 7 in. scale, knife-edge Pointer, anti-parallax Mirror, 0–1300°C. (Fig. 11 shows Indicator and Cold Junction Stand, but not stem)	18	5	0
10207/1	(a)	**Spares,** three sets of Stem renewals, with internal insulation and outer Quartz Sheaths	1	18	3
10208	(P)	**Recording Research Outfit,** for small furnaces, etc., with 1 ft. Wire Type Stem, fine wires for quick recording, Light Head, 3 ft. flexible Extension to Cold Junction Stand, 12 ft. flexible Cable to Special High-speed Strip Recorder, Chart speed about 10 in. per hour, 0–1300°C., with Chart Roll for 44 hours approx.	61	6	0
10208/1	(a)	**Spares,** three sets of Stem renewals, with internal insulation, outer Quartz Sheaths and Chart Rolls for 220 hours	4	3	3
***10209**	(Q)	**Portable Indicating Research Outfit,** for small furnaces, etc., with 1 ft. Rare Metal Stem, Light Head, Quartz Sheath, $\frac{5}{16}$ in. O.D., 3 ft. flexible Extension to Cold Junction Stand and 12 ft. flexible Cable to Portable Indicator, with 7 in. scale, knife-edge Pointer, anti-parallax Mirror, 0–1400°C. and in millivolts	20	4	6
***10209/1**	(a)	**Spares,** one Rare Metal Thermo-couple wire renewals, two each Quartz inner insulations and outer Sheaths	3	1	6

* The prices of these items are subject to variation with change in the market price of Platinum and its alloys.

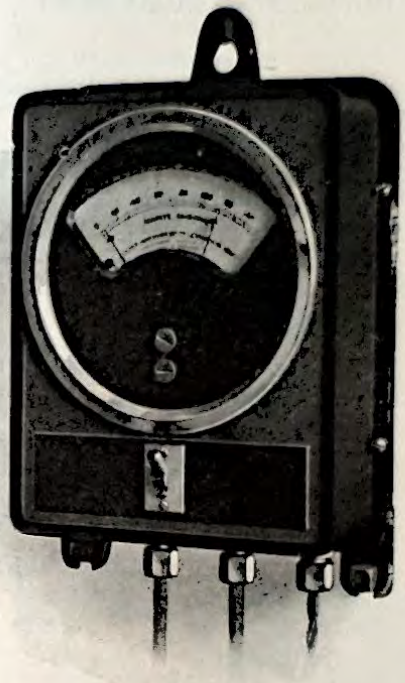


Fig. 12.
Distance Thermometer Indicator. "Sunk" Fitting, with Enclosed Switches.
(About one-quarter full size.)

ELECTRICAL RESISTANCE (Distance) THERMOMETERS

These instruments operate by the change in electrical resistance of a coil of fine wire when that coil changes its temperature. They are particularly adapted for very fine readings of relatively low temperatures with a very open scale. Fig. 12 illustrates the indicating instrument for fine readings over a scale 0–150°F.

The sensitive "bulb" containing the coil of fine wire is enclosed in a bulb chamber broadly like the tube type thermo-couple stem, see page 261, and the same flanges, connectors, and so forth are available.

Usually the indicating or recording instrument is for fixed service, and any of the Wall Type Indicators or Recorders on pages 261 to 265 can be used for Resistance Thermometers with suitable open scales. These thermometers are generally limited to a maximum of 360°C., though they can be specially arranged for higher temperatures if needed.

One of the facilities of this type of instrument is the convenience of reading the temperature of several bulbs in different positions, on one indicator, by means of a switchboard. As this is the most usual form taken by this apparatus, specifications and quotations will be submitted on receipt of particulars.

PORTABLE POTENTIOMETER, or PYROMETER TESTER

(See Fig. 13), specially convenient for temperature measurements with thermo-couples where very fine readings are desired, and also for checking the accuracy of other thermo-couple pyrometers.

The whole of the potentiometer equipment is self-contained in the light and convenient polished hardwood case; it includes sub-divided Slide Wire and Scale, Contact Keys, Rheostats, Battery, Standard Cell and Galvanometer.

The Slide Wire is divided into two portions, the upper part covering the main range, and the lower, on a specially open scale, covers the range for cold-junction setting, thus, having set the lower scale to the cold-junction temperature, the user makes a direct reading on the upper scale thus making pyrometer checking rapid and convenient. Similarly, when working with a thermo-couple whose calibration is given on a separate "graph," direct temperature reading is given by a single reference to the graph; lastly the very open scale of the lower portion may be used as a vernier, working by difference.

The battery is a large dry cell, replaceable (from any oil stores or wireless dealer) in a few seconds; it lasts for a long series of tests. The standard cell is also quickly replaceable and is of the approved "H" form. The galvanometer has double-pivotted patent "Resilia" spring mounting; it is therefore robust and does not need levelling, while the lens window over the pointer allows very fine adjustment. Small cupboards are provided in the lid to contain couples, leads, etc. The contact keys are double-pole with rare-metal incorrodible contacts.

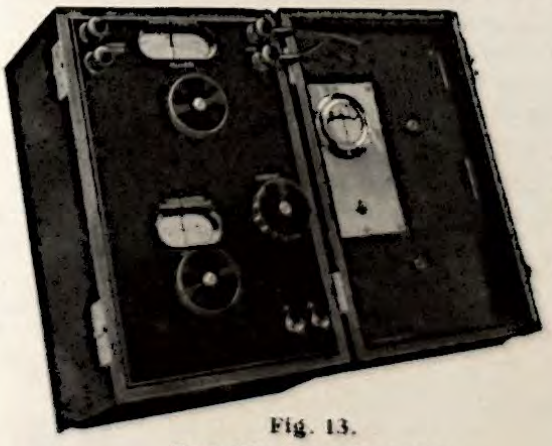


Fig. 13.
Portable Potentiometer.

Portable Potentiometer, complete with self-contained sub-divided Scales, Battery, Standard Cell, Rheostats, Contact Keys, and Galvanometer in hand-polished Hardwood Case, standard range 0–60 millivolts and temperature equivalents for any standard Base Metal Couple. **£28 10 0**

(Other ranges to special order at the same price.)

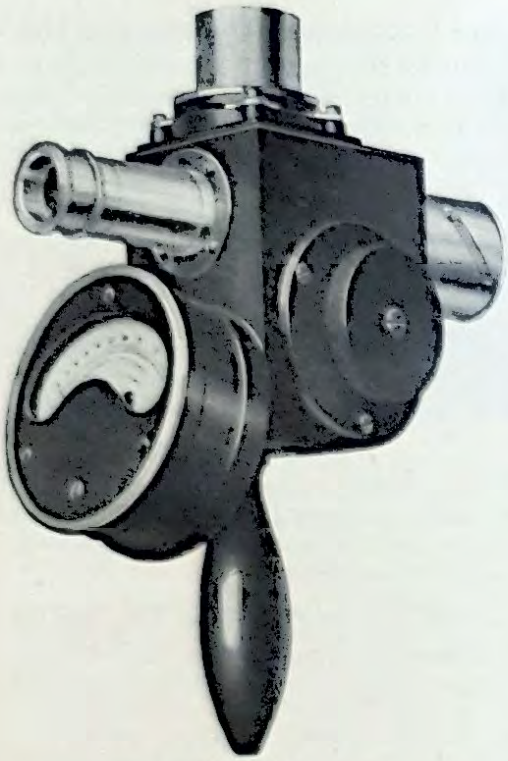


Fig. 14.
Foster Optical Pyrometer, Patent "Lamp-Bridge Unit."
(About half-size.)

OPTICAL AND RADIATION PYROMETERS

For measuring very high temperatures, and for lower temperatures of inaccessible hot bodies, where thermo-couples cannot be applied, instruments working entirely at a distance are used. Optical Pyrometers (see Fig. 14) measure the brightness of the light coming from the hot body, while Radiation Pyrometers (see Fig. 15) use the whole range of heat given out, both visible and invisible. These two instruments have different characteristics, and the choice may be made by the list below:—

Optical

Time to take a reading, about 30 seconds.
Isolated readings, not continuous indicating or automatic recording.
Any temperature above 750°C. (1382°F.), no upper limit.
Small hot body and long working distance.
Convenient for hot bodies "in the open" as well as in the furnace.
Requires pointing, focussing and a simple adjustment to take a reading.

Radiation

Time to take a reading, about 15 seconds.
Continuous indicating or automatic recording as well as isolated readings.
Any temperature above 500°C. (932°F.), no upper limit.
Larger hot body and shorter working distance.
Not so easy to apply to hot bodies "in the open."
After pointing, reading or record is purely automatic.

The Optical Pyrometer illustrated in Fig. 14 is of the "disappearing filament" type. The user looks through the eyepiece and sees a clear image of the furnace or hot body. Superposed on this image is the filament of a small electric lamp, a current from a small portable accumulator heats it to a light-giving stage. The user then varies the current by turning the rheostat handle until the centre of the filament is exactly at the same brightness as the hot body so that it matches and "disappears"; he then reads the temperature directly on the scale of the indicator embodied with the instrument. By a patent construction known as the "Lamp-bridge Unit," the lamp forms one arm of a Wheatstone Bridge, the indicator being the bridge galvanometer; thus the whole of the scale is usefully employed, there is no waste scale space representing the current necessary to heat the filament to visible redness, and the indicator may be conveniently small and light. The lamp and bridge are combined in a unit and reserve interchangeable units can be supplied allowing renewal or checking without recalibration.

Optical Pyrometer, with patent "Lamp-bridge Unit" to any of the scales below, complete with portable Accumulator, polished Hardwood Carrying Case and Solid Leather Shoulder Strap:—

10212 (A)	900–1450°C.	...	...	...	...	...	...	...	...	...	...	£28	0 0
10213 (B)	800–1700°C.	...	...	...	...	...	...	...	...	...	...	29	0 0
10214 (C)	1250–2250°C.	...	...	...	...	...	...	...	...	...	...	29	0 0
10215 (D)	700–1200° and 900–1950°C.	...	...	...	...	...	...	...	...	...	...	32	0 0
10216 (E)	900–1450° and 1250–2250°C.	...	...	...	...	...	...	...	...	...	...	32	0 0

Optional Extras

10217 (F)	Light Telescopic Tripod	...	...	...	...	...	...	...	...	...	...	£2	12 6
10218 (G)	Spare Interchangeable "Lamp-bridge Unit"	...	...	...	...	...	...	...	...	...	...	3	10 0

The Fixed Focus Radiation Pyrometer, so called because the user has no focussing to do, operates by concentrating the radiant heat from the furnace or hot body on to a very small but efficient thermo - couple. The resulting current is used for measurement of the temperature just like it is with a thermo-couple inserted into the furnace, and similar Indicators and Recorders are used (see pages 261 to 265).

For portable use the outfit is as shown in Fig. 15, and the instructions for use may be summarised as "point and read." When combined with a thermo-couple for direct insertion at low temperatures, and a second scale on the Indicator, it is termed an Inspector's Outfit and has a very wide range of use. It is then provided with a light Telescopic Tripod and a Solid Leather Carrying Case (see Fig. 16).

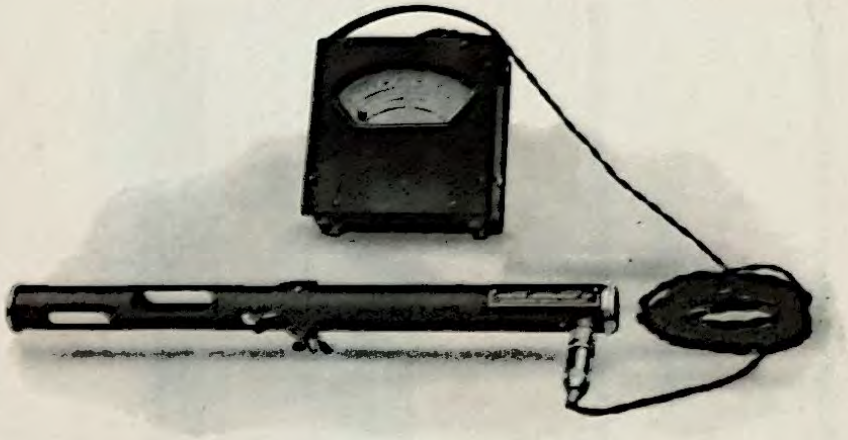


Fig. 15.
Foster Fixed-Focus Radiation Pyrometer, Portable Outfit.
(About one-eighth full size).

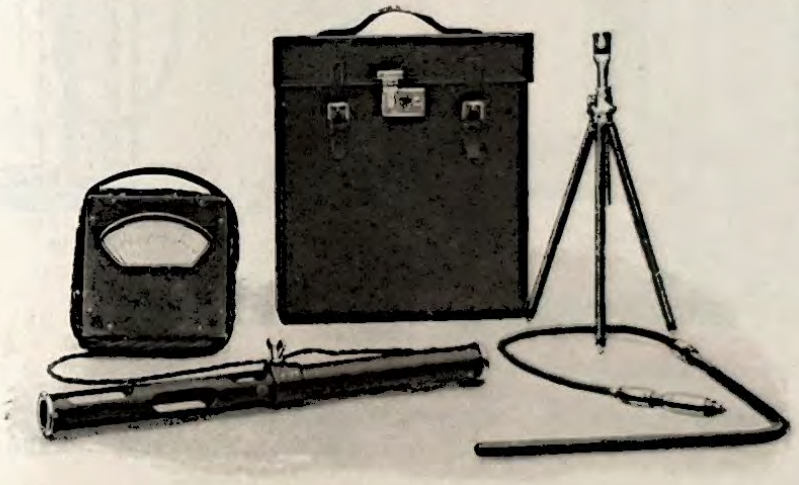


Fig. 16.
Foster Fixed-Focus Pyrometer, Inspector's Outfit.
(About one-tenth full size.)

The Receiving Tube is jointed at the centre to allow access to, and cleaning of a dust-excluding window, which protects the sensitive thermo-couple and the mirror at the rear end of the tube. The front part of the Receiving Tube has ventilation openings and deflecting diaphragms giving further dust protection, and there is also fitted a sighting device to aid the pointing where the hot body is small or the working distance long. The connection is quickly made by the concentric connector as described on page 262.

Portable Fixed Focus Pyrometer, comprising Jointed Receiving Tube with Dust-Protection Window, ventilation openings and diaphragms, Sighting Device, Connector, 20 ft. Flexible Cable and Portable Indicator, "Resilia" spring mounting (see pages 261 to 264, also Fig. 15), complete with instructions:—

10219 (H) 700–1400°C. **£24 0 0**
10220 (J) 800–1600°C. **24 0 0**

Fixed Focus Inspector's Outfit, comprising Jointed Receiving Tube with Dust-Protection Window, Ventilation Openings and Diaphragms, Sighting Device, Connector, 20 ft. Flexible Cable, Stem for lower temperatures, Compensating Extension, Portable Indicator with two scales, as below, Tripod and Solid Leather Carrying Case, complete with instructions:—

10221 (K) 700–1400°C. and 0–1050°C. **£39 0 0**
10222 (L) 800–1600°C. ,, 0–1050°C. **39 0 0**

Recording Outfits are assembled either with the Dial Recorder (see page 264) or the Strip Recorder, page 263; the former being the simpler and cheaper for routine work.

Fixed Focus Dial Recording Outfit, comprising Jointed Receiving Tube with Dust-Protection Window, Ventilation Openings and Diaphragms, Sighting Device, Connector, 30 ft. Cable for fixed installation, Connector at Recorder end, Dial Recorder and 100 Charts, complete with instructions:—

10223 (M) 700–1400°C. **£38 5 0**
10224 (N) 800–1600°C. **38 5 0**



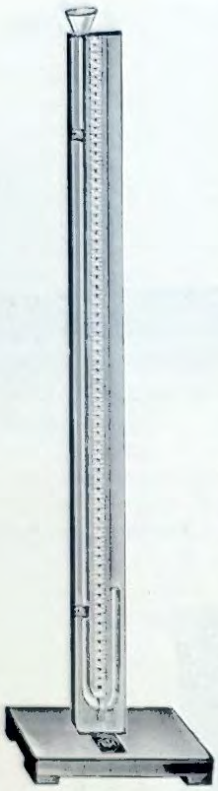
10225



10226



10227



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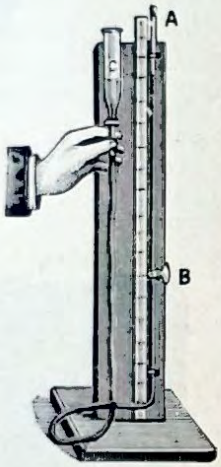

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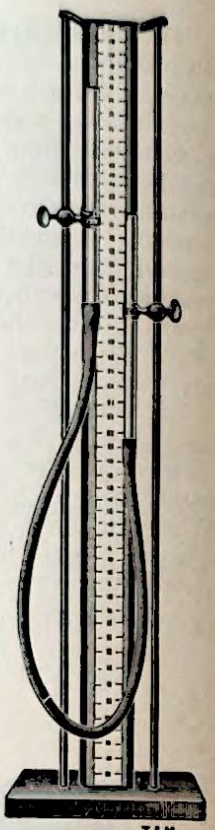

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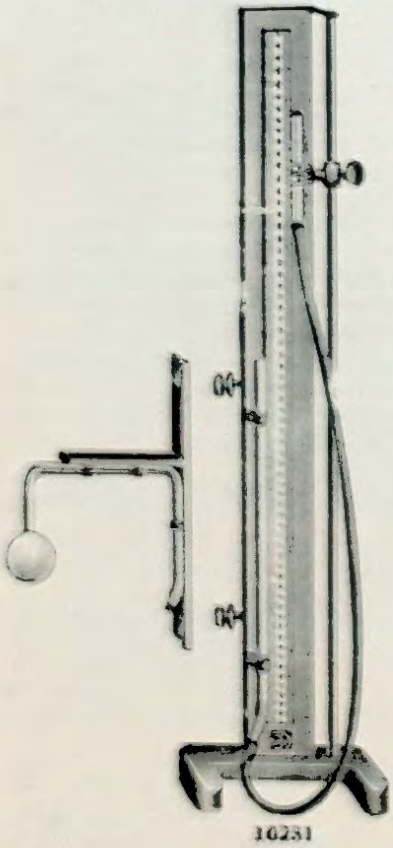
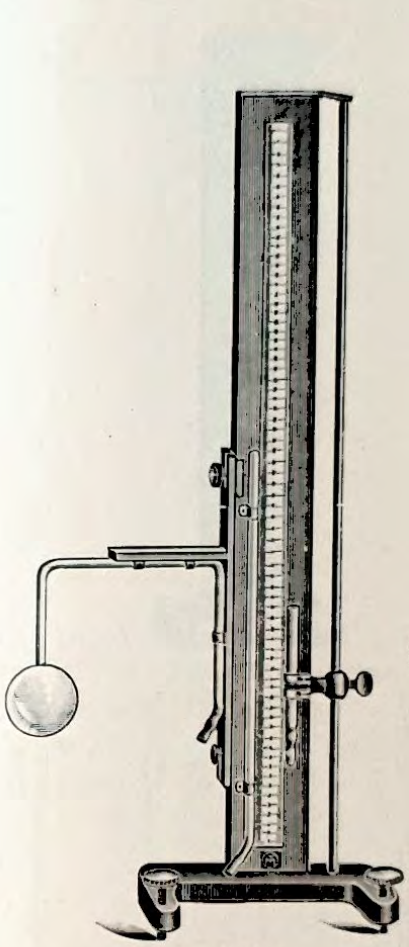


10231

10225	**Boyle's Law Tubes,** unmounted ... each 1/6, per doz.	£0 16 6
10226	Ditto, with Funnel and Stopcock ... ... each	0 5 6
10227	**Boyle's Tube,** on Board, with Boxwood Scale, divided into millimetres ... ... each	0 10 0
10228	Ditto, with Divided Scales, on Polished Wood Stand ,,	0 12 0
10229	**Boyle's Law Apparatus,** Mariotte's modified form, to illustrate Boyle's Law for both increased and diminished pressure. For increased pressure (up to about 800 mm.) air is enclosed beneath stopcock B. For diminished pressure B is open and air enclosed beneath the stopper A. C is a Mercury Level Bulb to adjust to the pressure required	1 7 6
10230	**Boyle's Law Apparatus,** with Tubes sliding on steel Rods with Clamps, Graduated Scale, mounted on Teak Base, as shown	1 2 6
*10231	**Boyle's Law Apparatus,** new pattern Adjustable Reservoir, Boxwood Scale graduated in millimetres, fitted with Jolly's Air Bulb attachment, which can be removed when not required	1 17 6



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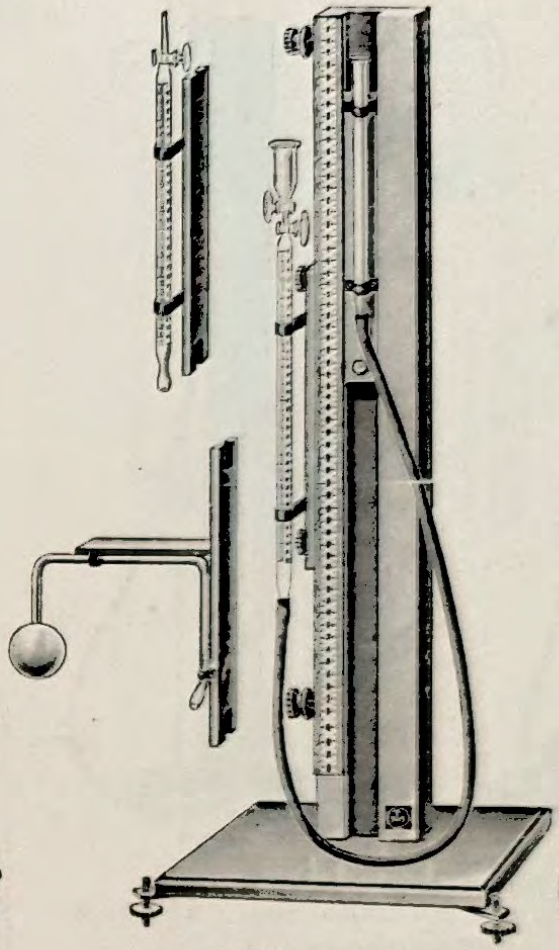

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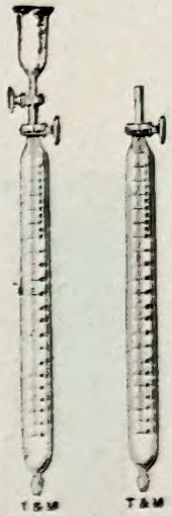

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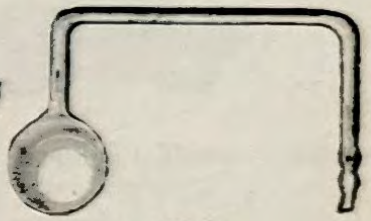
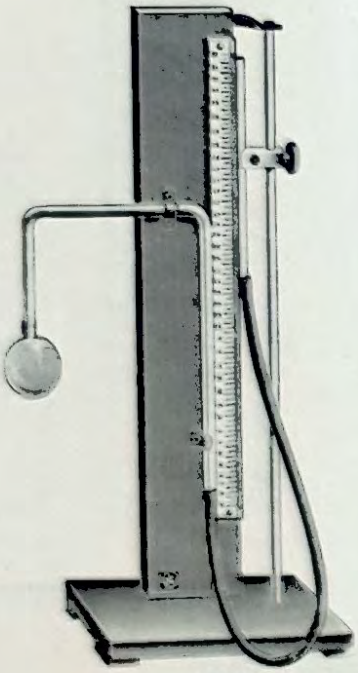


10237

10232	**Boyle's Law Apparatus,** large size, superior finish, fitted with Jolly's Air Bulb, which can be removed when not required, mounted on Iron Stand with Brass Levelling-screws and Pressure Tubing complete			£2	10 0
10233	**Boyle's Law Apparatus,** "College" pattern, on solid Teak Stand, with Brass Levelling-screws and fittings, Graduated Tube, with Funnel and two Stopcocks, Graduated Tube with one Stopcock, Jolly's Air Bulb, each with separate fitments as illustration			4	10 0
10234	**Tubes,** Vapour Tension, with two Stopcocks, 50 c.c., in $\frac{1}{10}$ths	each		0	9 0
10235	**Tubes,** Vapour Tension, fitted with Steam Jacket and I.R. Corks	,,		0	12 6
10236	**Jolly's Apparatus Tube,** graduated 0–35 cm. in millimetres, with Tap at top	,,		0	6 6
10237	Ditto, Air Bulb Tubes, for use on Boyle's Law Apparatus	,,		0	2 0
10238	**Mercury Reservoirs,** Stout Glass.				

Capacity	150	250	400	500 (F)	750 (F)	1000 (F)	c.c.
	1/6	**1/10**	**2/4**	**2/6**	**3/6**	**4/6**	each

(F) Foreign manufacture.



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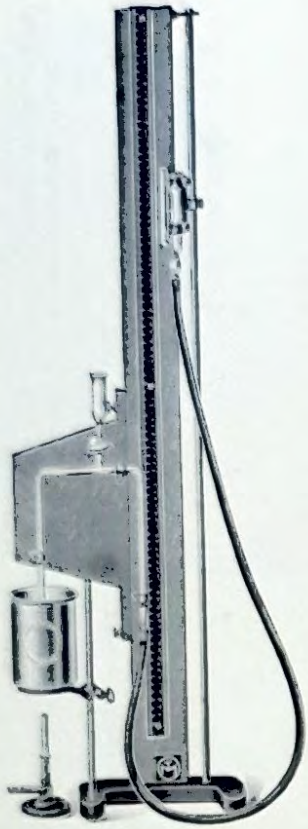

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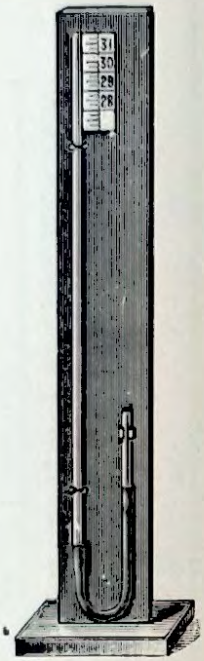
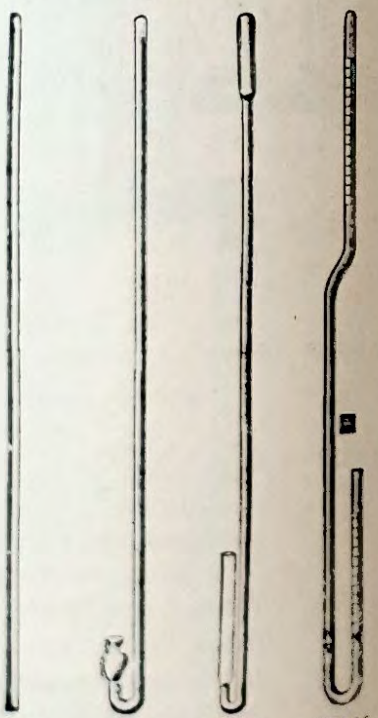


10242

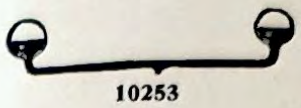
10240	**Jolly's Constant Volume Air Thermometer,** simple form, with Boxwood Scale	£1 5 0
10241	**Constant Volume Air Thermometer** on Teak Stand, with heavy Iron Base, fitted with Copper Vessel, I.R. Pressure Tubing, etc., complete as illustration	3 3 0
10242	**Barometer** Model, with Metal Scale, on Blackwood Stand ... ... each	0 12 6
10243	**Barometer Tubes,** closed at one end per doz. **12/6,** each	0 1 2
10244	Ditto, closed at one end, with Bulb and Bend per doz. **22/6,** each	0 2 0
10245	**Barometer Tubes,** Syphon with Bulb and Bends, as used in Wheel Barometers, each **2/3,** per doz.	1 4 0
10246	Ditto, ditto, Bunsen's Syphon, graduated in millimetres ... ... each	0 10 6
10247	Ditto, ditto, ditto, filled with Mercury „	1 10 0
10248	**Mercury Trays,** Wood, 12 in. square, useful to prevent waste of mercury ... each	0 3 0
10249	Ditto, ditto, 15 in. square ... ... „	0 5 6
10250	Ditto, ditto, solid Teak, 16×16×1½ in. „	0 8 6
10251	„ „ 24×16×1½ in. „	0 12 6



10243 10244 10245 10246



10248-10251



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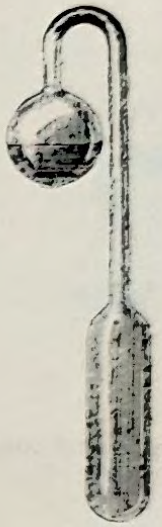
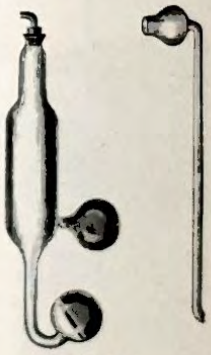


10257



10258

(F) **10253**	**Pulse Glass,** about 25 cm. long, ... each	£0	2 3
(F) **10254**	**Water Hammer** ... ... ,,	0	2 0
(F) **10255**	Ditto, Forked ... ... ,,	0	3 0
(F) **10256**	**Wollaston's Cryophorus** ... ... ,,	0	3 6
(F) **10257**	**Cryophorus,** Weinhold's modification ... ... ,,	0	4 0
10258	**Apparatus** to show Superheating by means of Soap Solution ... ... ,,	0	2 9



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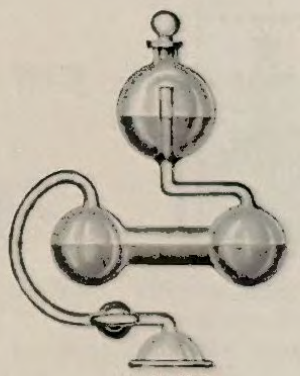

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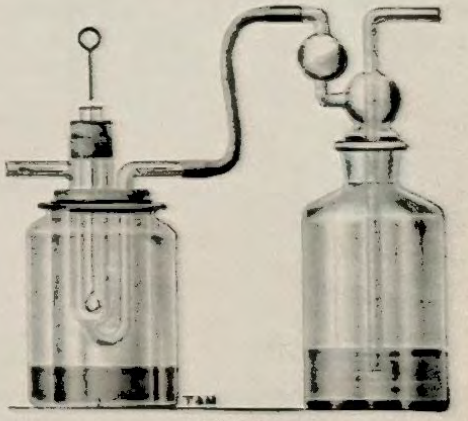


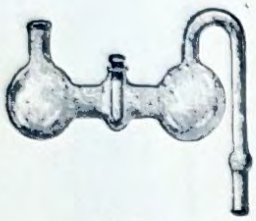
10261

10259	**Cryophorus, Sulphuric Acid,** for freezing Water without the freezing mixture each	£0	6 0
(F) **10260**	**Cryophorus,** Carre's, for use with Air Pump ... ... ,,	0	15 0
(F) **10261**	**Weinhold's Apparatus,** for freezing Mercury, with Wash Bottle complete ...	0	12 0
(F) **10262**	**Ether Thermoscope** (same pattern as No. 10256) ... ... each	0	3 6

(F) Foreign manufacture.



10264



10265



10266

10264	**Carre's Ice Freezing Apparatus,** mounted on Adjustable Brass Stand, with Iron Foot and Thermometer	**£1**	**2**	**6**
10265	Ditto, Glass Parts only	**0**	**7**	**6**
10266	Ditto, another form	**0**	**7**	**0**



10267



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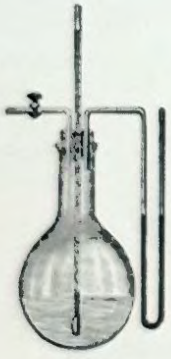

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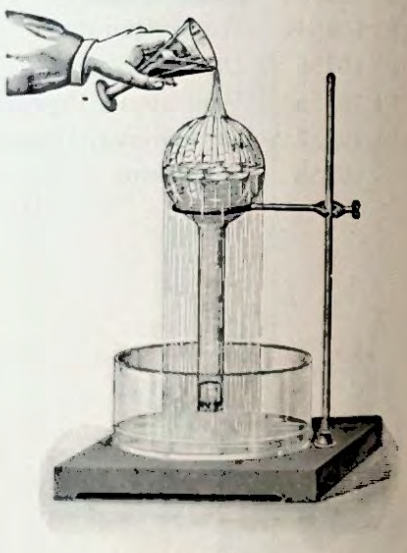


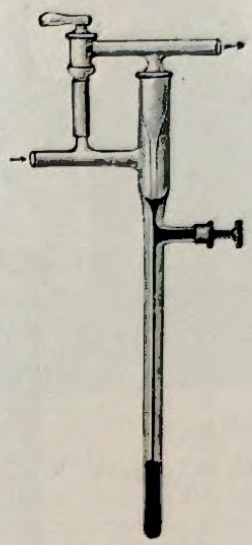
10270

10267	**Apparatus,** to liquefy easily condensable gases by cooling. (Sulphur dioxide, nitrous acid, cyanogen, ammonia.)			
	The gas is passed in the U-tube, which is fitted with a side tube, which passes into the flask-shaped vessel below. The gas liquefies in the U-tube and drips into the flask; the latter is finally sealed off at the constricted portion	**£0**	**8**	**6**
10268	**Freezing Apparatus,** consisting of Bulb to contain water, fitted to Tube to contain ether, fitted with Cork and Delivery Tube	**0**	**2**	**0**
10269	**Franklin's Experiment,** modified to show that water boils below 100°C. Fitted with Manometer and Stopcock. Price without Thermometer ... ... each	**0**	**8**	**0**
10270	Ditto, simple form, Glass Flask, Cork and Basin, without Stand	**0**	**3**	**6**

Gas Regulators



10271



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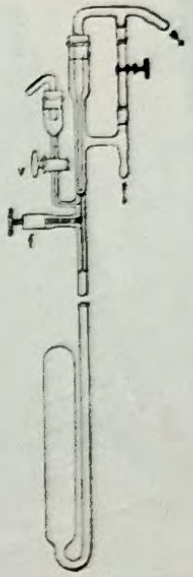

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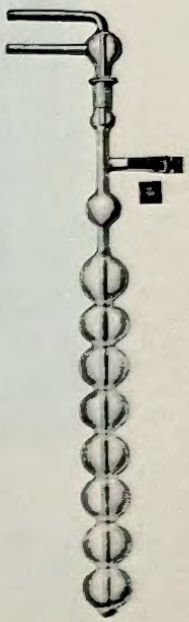
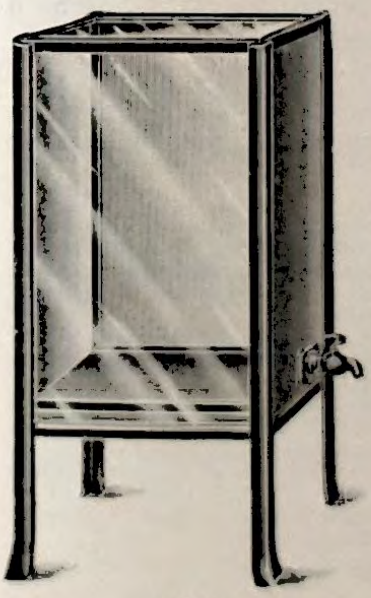


10275

(F) **10271**	**Gas Thermo-Regulator,**	Glass, Reichardt's, for Drying Ovens, etc. ...	£0 9 0
(F) **10272**	,,	,, Reichardt & Muencke's, for Drying Ovens, etc.	0 14 0
(F) **10273**	,,	Ostwald's, for filling with Toluol	0 5 0
(F) **10274**	,,	Ostwald's, with Micrometer Screw Regulator, Stopcock and Mercury Reservoir	0 15 0
(F) **10275**	,,	Dr. Lowry's	0 13 9



10276

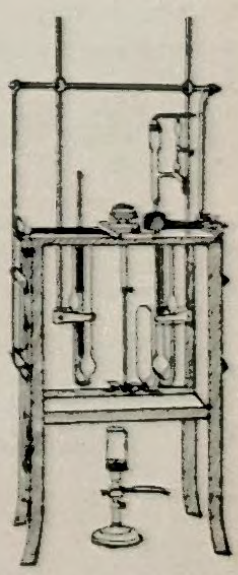
10276 **Thermostat Tanks** of Copper, Tinned, with stout glass sides, ends felt covered and fitted with Stopcock.

Size 18×12×10 in.	£5 10 0
,, 20×16×12 in.	6 10 0

10277 **Thermostat, Oswald,** for determination of Specific Viscosity, comprising Bath with glass front and back with rubber ring joints, sides covered with Linoleum; Stirrer, Tolnol Regulator and Holder, Thermometer Holder, Micro-Burner and two Adjustable Clips for U-tubes.

Without thermometer or tubes **10 0 0**

(F) Foreign manufacture.



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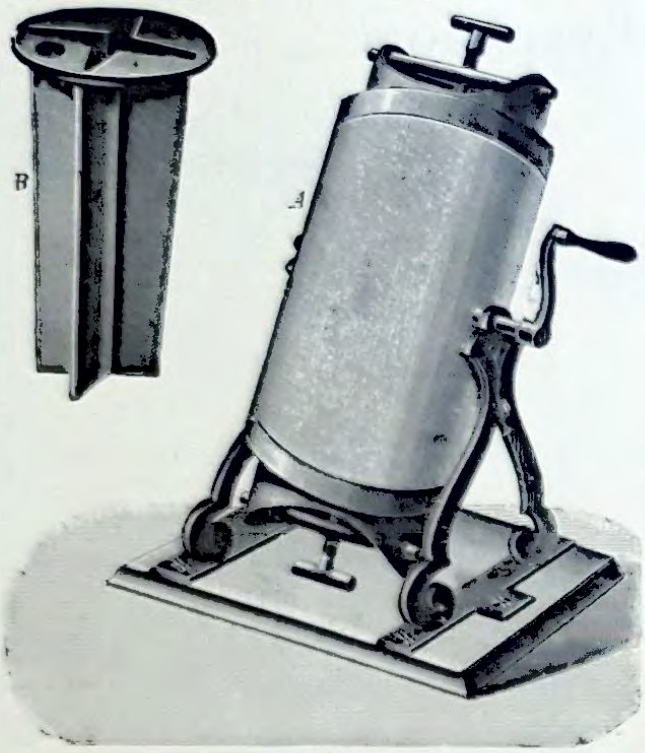

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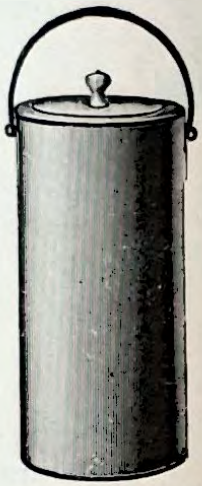


10281

(F) *10279 **Ice Machine,** for the manufacture of small quantities of absolutely pure Ice (Professor Liebreich's system):—
Machine No. 1, producing 1 lb. of Ice in 15 minutes **£3 5 0**
10280 Enamelled Evaporating Boiler for recovering the Nitrate of Ammonia, 16 in. **0 18 9**
(F) **10281** Vessel to keep the Ice when made from melting **0 15 0**
10282 Nitrate of Ammonia ... ... 14 lb. at **8d.** per lb., per cwt. **3 5 0**

6½ lb. of Nitrate of Ammonia and 3 quarts of cold water are used for filling machine.

Quotations for larger sizes on application.

This machine works on the principle that Nitrate of Ammonia on liquefaction absorbs heat from its surroundings. The machine consists of a double-walled Metal Cylinder, turning on two pivots by means of a Crank.

DIRECTIONS FOR USE

Fill the cylinder to be inserted with water (when it is desirable to obtain ice free from germs, freshly boiled distilled water is used) to within ¼ in. of the brim. Then introduce the above Cylinder into the other, making use of the accompanying Stuffing Ring; cover it with the Rubber Plate, closing the machine on this side by tightly screwing on the Cover. Then turn the Cylinder round, pouring in 6½ or 13 lb. (according to size of machine) of crushed nitrate of ammonia and immediately after 3 to 6 quarts of water, quickly screwing down this side of the machine.

Turn the Cylinder slowly by means of the Crank for 15 minutes, then open the cap on the side of the inserted Cylinder and take out the latter, dipping it quickly into warm water (which must be at hand) to loosen the ice, turning the Cylinder upside down. The ice, on being gently tapped, will now fall out in a compact mass.

Pour out the solution remaining, as soon as possible, into a flat dish (for which purpose a large iron enamelled pan will be found most suitable) and expose to a gentle heat (range, etc.), until perfectly dried by evaporation.

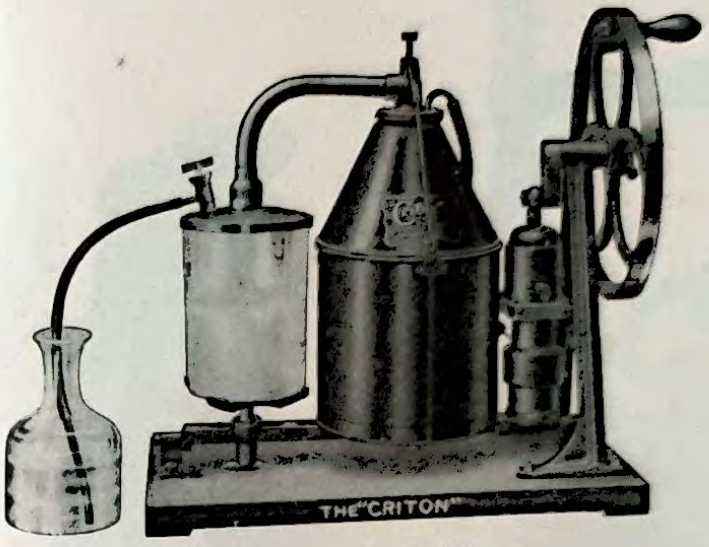
This dried salt can be used again in making ice. The cylinder must, of course, be rinsed out and cleaned.

As on the dissolution of the nitrate of ammonia the temperature falls to about 25°C., we recommend the use of water at a temperature not higher than 15°C., as otherwise no ice will form.

Should, however, the water available be of a higher temperature, it must be first cooled, which can best be done by placing the necessary 3 litres in a large vessel of water, adding some nitrate of ammonia for cooling.

As the nitrate of ammonia necessary for the formation of the ice is invariably reproduced by evaporation, the process of producing the ice, especially as regards its absolute purity, is very cheap and easy.

(F) Foreign manufacture.



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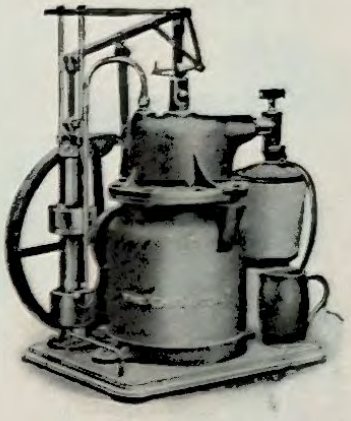

10284

10283 **The "CRITON" Hand Ice Machine** is the latest development in portable freezing machines, and contains many improvements. Its action is based on the principle that water freezes when rapidly evaporated in vacuo with sulphuric acid to absorb the vapour. The success of the system depends upon the perfection of the vacuum, and the thoroughness of agitation of the acid. The "CRITON" is fitted with a highly efficient vacuum pump and a special arrangement for obtaining the maximum agitation. It is undoubtedly the most satisfactory and reliable machine of its kind. It is not a toy, but a machine of practical utility. It is extremely frictionless and easy to turn.

Price of Machine, including Carafe and Vessel for making Block Ice, etc.	nett	£12	0	0
Spare Acid Containers (Absorbers)	each	0	15	0
,, Carafes	,,	0	3	6
,, Ice Jars	,,	0	6	0
Vessel for Icing Wines, etc., in bottles	each	1	2	0
Spare Charge of Special Oil	,,	0	1	9
,, I.R. Suction Tubes	,,	0	3	0
,, I.R. Rings for Ice Jar	,,	0	2	0
,, I.R. Rings for Wine Icer	,,	0	1	6
,, Tin of Compo Grease	,,	0	0	6
,, Vapour Tubes	,,	0	1	0

For India, etc., we can supply a Special Vessel to hold 3 large "Codd's" Soda Water bottles to be cooled at one time ... ... nett £2 8 0

The machine weighs about 48 lb. When charged with acid, about 57 lb.

Shipping Specification:—1 Case, 30 in. × 17 in. × 30 in. (8¾ cubic ft.). Gross 1 cwt. 10 lb. Net 66 lb.

Sulphuric Acid (Clear Commercial Oil of Vitriol; Specific Gravity 1·846 or nearest). The only Chemical required.

"CHAMPION" Hand Ice Making Machine

Will freeze a carafe of water in three minutes or make a block of ice weighing over 4 lb. in half-an-hour or about 8 lb. in one hour, by successive operations. This machine is fitted with rotary movement instead of hand lever, and can be worked easily.

10284	**Machine,** including Carafe, Block Ice Jar, etc.	nett	£26	0	0
	Spare Carafes	each	0	5	3
	,, Block Ice Jars	,,	0	11	3
	,, I.R. Rings for Ice Jars	,,	0	3	0
	,, Charge of Special Oil for Pump	,,	0	1	9

Sulphuric Acid extra. One charge of Acid, 2 gallons required.



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10289



10286



10290



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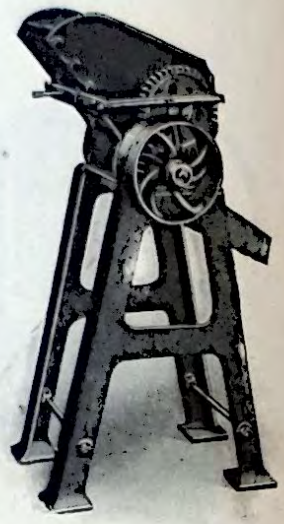
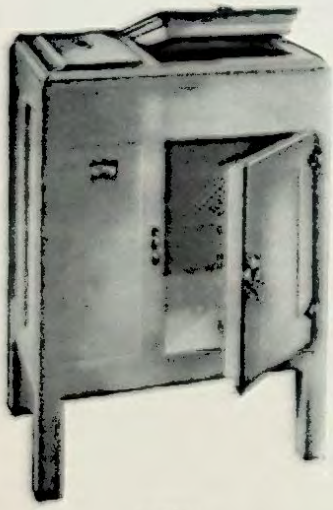


10291-2

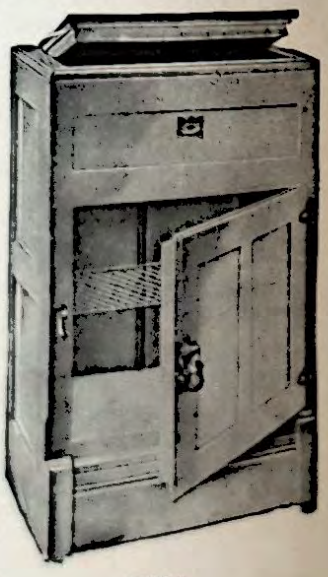
(F)	*10286	**Ice Crushing Machine,** Tinned all over, will break the ice into pieces about ½ in. square ...	£2	10	0
(F)	*10287	**Ice Shaving Machine,** Japanned all over, Hopper 4¼ in.	3	12	6
(F)	*10288	**Ice Chisel** of Wrought Steel ... ... each	0	4	0
(F)	*10289	**Ice Shaver** of Wrought Steel	0	4	0
(F)	*10290	**Ice Hammer** of Wrought Steel ... ... ,,	0	5	0
	*10291	**Improved Ice Breaker,** Feed Hopper 7 in. wide, with Fly Wheel for hand, mounted on Wood Stand ... ... nett	12	10	0
	*10292	Ditto, ditto, Feed Hopper 9 in. wide, with Adjustable Rollers for Crushing fine, medium or coarse, mounted on Iron Stand, with Fly Wheel for hand ... ... nett	20	15	0
	*10293	Ditto, ditto, Feed Hopper 9 in. wide, mounted on Iron Stand for power, with fast and loose Pulleys, 9 in. diameter, speed 150 r.p.m. As illustration ... ... nett	22	0	0



10294

*10294 **Ice Cabinet,** substantial model, having Solid Timber Corner Posts extending right down to form legs. All timber of prime quality, well seasoned and kiln dried. Heavy insulation, super quality galvanised Steel Lining throughout. Fitted with unbreakable Shelves. Exteriors grained Oak and Varnished or White Enamelled, superior Nickelled Hinges and Fasteners. Height 34 in., width 24 in., depth 20½ in.
nett **£5 14 6**

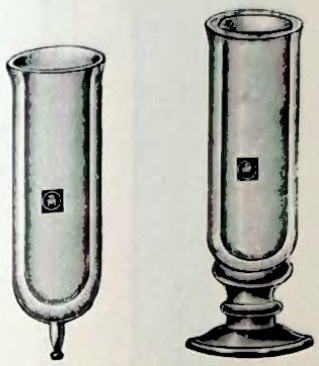
*10295 **Ice Cabinet,** with Containers, are latest enclosed type which positively ensures a continuous circulation of pure dry air at low temperature, and with remarkable low ice consumption. Finished in rich dark Oak, highly Varnished, or superior White Enamel. All mountings of solid Brass, heavily Nickelled. Ice Containers lined with super quality galvanised Steel and Food Compartments finished White Enamelled Steel.
Height 38 in., width 21 in., depth 16 in.
nett **£6 18 0**
Height 41 in., width 24 in., depth 18 in.
nett **£7 17 6**



10295

(F) Foreign manufacture.

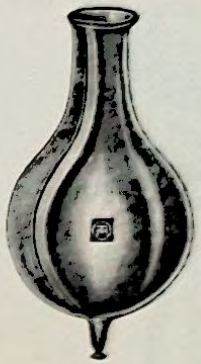
Vacuum Vessels for Liquid Air



10296–10298



10299



10300



10301

Dewar's Vessels, Cylindrical, with double walls, exhausted.

	Length about	110	200	250	300	mm.
	Internal diameter about	35	38	40	60	,,
10296	(a) Unsilvered	**4/0**	**6/0**	**10/0**	**14/0**	each
10297	(b) Silvered	**5/0**	**8/0**	**14/0**	**16/6**	,,
10298	(c) Polished Wooden Foot	**3/0**	**3/3**	**3/6**	**3/9**	,,

Dewar's Flasks, Spherical, with double walls, exhausted.

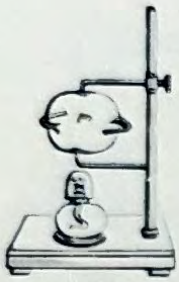
	Capacity about ...	150	250	500	750	1000	2000	c.c.
10299	(a) Unsilvered	**4/0**	**6/0**	**8/0**	**10/6**	**12/6**	**22/6**	each
10300	(b) Silvered	**6/0**	**8/0**	**10/0**	**13/0**	**15/0**	**26/0**	,,
10301	(c) Polished Wooden Foot ... only	**2/8**	**3/0**	**3/3**	**3/9**	**4/0**	**4/6**	,,

Dewar's Flasks, with a vertical unsilvered Strip to permit inspection of contents.

Capacity about ...	125	250	450	750	1000	2000	c.c.
10302	**7/0**	**9/0**	**11/0**	**16/0**	**22/0**	**38/0**	each

Dewar's Cup, with double walls, exhausted. On Glass foot.

	Outside diameter of cup about	70	100	120	mm.
10303	(a) Unsilvered	**5/0**	**8/0**	**10/0**	each
10304	(b) Silvered	**7/0**	**11/0**	**13/0**	,,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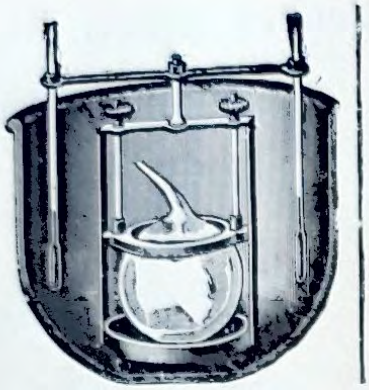
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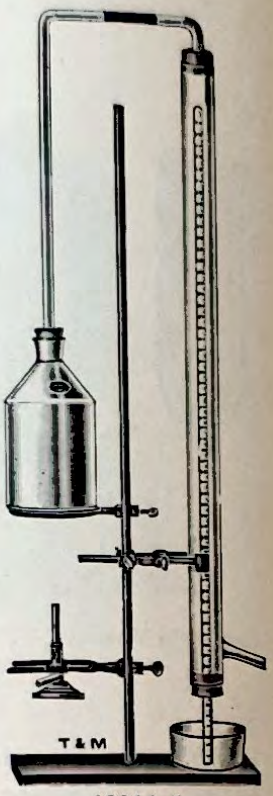
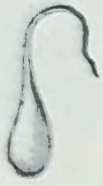


10314–5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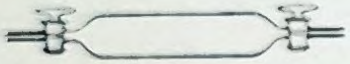
10310


10312


10313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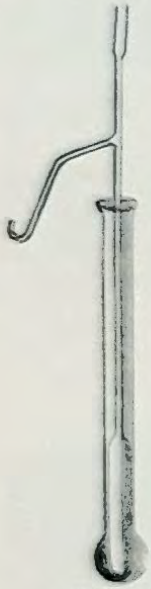
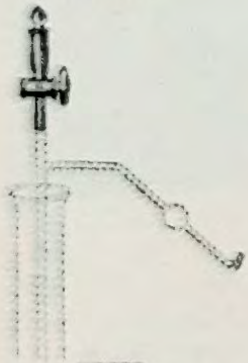
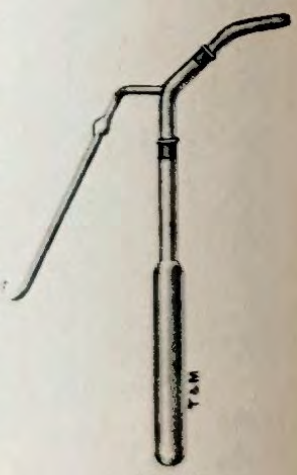

10316–7

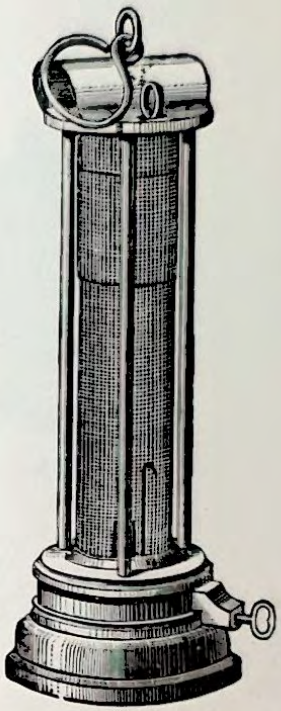

10320

10306	**Eolopile, or Hero's Model Rotatory Steam Engine,** mounted on Stand, with Brass Rod, and Glass Spirit Lamp	£0	10	6
10307	Ditto, Glass Bulbs only ... each, **1/6**; per doz.	0	16	6
10308	Ditto, another form, mounted on Stand, with Spirit Lamp	0	6	6
(F) 10309	**Rupert's Drops,** for showing the brittleness of Glass ... ... per doz.	0	1	6
(F) 10310	**Bologna Vials** ... ... ,,	0	4	6
10311	**Vapour Density Apparatus,** Dumas' improved form. Price, without Thermometers	1	12	6
10312	**Vapour Density Bulbs,** Dumas', each, **8d.**; per doz.	0	7	6
*10313	**Vapour Density Bulbs,** with 2 stoppers, designed by Mr. J. W. Yates, Reg. No. 704542 ... each	0	2	3
10314	**Vapour Density Apparatus,** Hofmann's, Glass part only	0	17	0
10315	Ditto, complete, with large Iron Stand and Clamps, Bunsen's Burner, Glass Dish and Tin Can ...	2	10	0
10316	**Vapour Density Apparatus,** Victor Meyer's, each	0	9	6
10317	**Outer Tubes,** for above ... ... ,,	0	4	6
10318	**Outer Tubes,** as above, but of stout Copper, brazed	1	17	6
10319	**Inner Tubes,** for No. 10316 ... ... each	0	5	6
10320	Ditto, Victor Meyer's, the top part with Stopper and Stopcock	0	7	0
10321	**Tubes,** Stoppered, Small, for use with above, each, **6d.**; per doz.	0	5	0
10322	**Vapour Density Apparatus,** Victor Meyer's, new form ... ... each	0	9	6
10323	**Density of Dry Air, Apparatus for,** 30 × 5 cm., with Stopcocks (*vide* Edser's "Heat") each	0	8	6

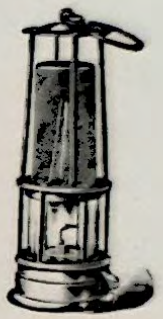
(F) Foreign manufacture.



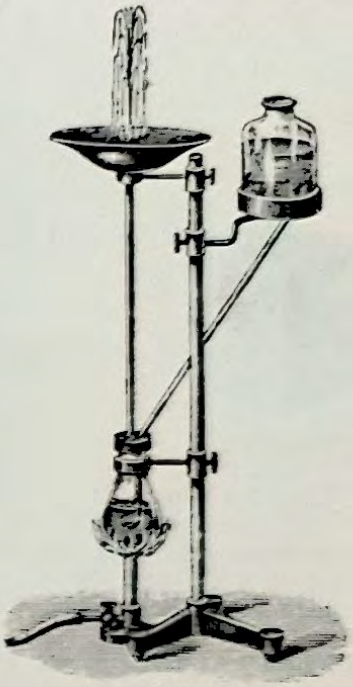
10322



10325

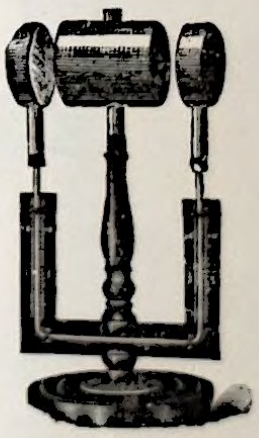


10326

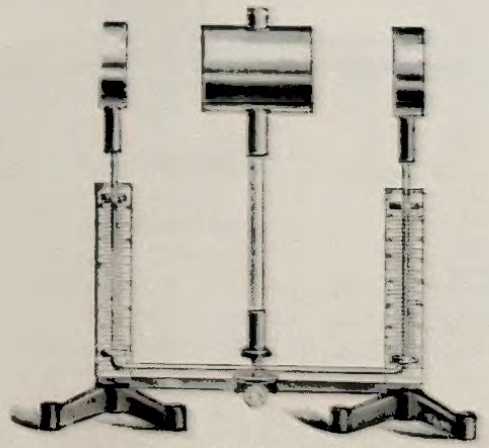


10327

10325	**Safety Lamp,** Davy's, Stout Brass Reservoir ... ... each	£0	12	0
10326	,, ,, Clanny, Stout Brass Reservoir ... ... ,,	0	14	0
10327	**Model Geyser,** to show effect of pressure on Boiling Point, with Burner, on Stand complete, price	2	5	0



10328



10329



10330

10328	**Ritchie's Apparatus,** for showing absorption and radiation of Heat, with Metal Scale	£2	5	0
10329	,, ,, improved pattern, with middle support sliding on Metal Bar ...	3	0	0
10330	**Steam Radiator,** one side dull black, and the other bright, all Brass	0	15	0



10333



10331

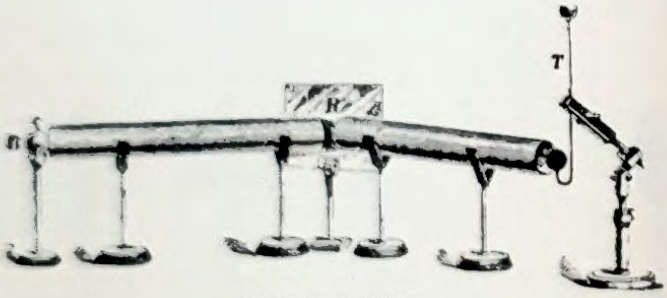


10335

10331	**Two Tin Plates,** for heat absorption, one black and the other bright, a Bismuth Bar is soldered at back of each, with Iron Ball, mounted on three Stands, complete, per set	£0 19 6
	... per pair	0 11 0
10332	**Screens** only, as above, with ledge at back for Phosphorus, etc.	0 1 6
10333	**Leslie's Cubical Tin Canisters,** all sides bright 4-in. sides, **1/4**; 5-in. sides, each	
10334	Ditto, ditto, having one side with polished surface and other sides painted black, dull black and white ... ... 4-in. sides, **1/9**; 5-in. sides, each	0 2 0
10335	**Tinplate Cylinder,** for crushing by atmospheric pressure when the air has been driven out by the steam of boiling water ... ... each, **1/3**; per doz.	0 14 0



10342–3



10336—10340

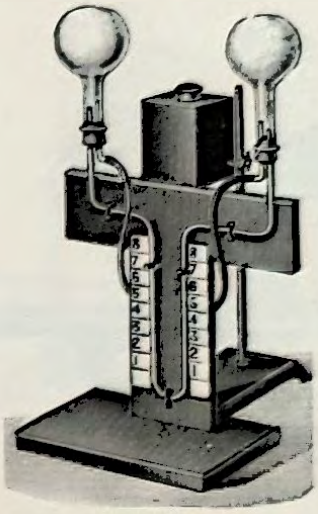


10341

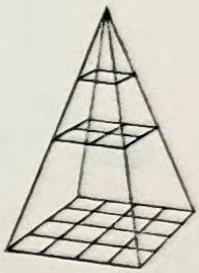
10336	**Radiant Energy, Reflection of,** Apparatus to show that Thermal Radiations are reflected and obey the same laws as Light, consisting of two Tin Plate Tubes, 3 in. diameter, 30 in. long, with four V-shaped supports, polished Tin Plate Reflector, on Stand, with Support	£1 10 0
10337	**Tubes,** Tin, for above ... ... per pair	0 8 6
10338	**Stands,** V-shaped, for above ... ... each	0 3 6
10339	**Ether Thermoscope**	0 3 6
10340	**Adjustable Mahogany Stand** for Thermoscope	0 10 6
10341	**Adjustable Iron Stand,** on Tripod feet	0 7 6
10342	**Iron Balls,** Set of five, 1¼–3 in. diameter ... ... per set	0 7 6
10343	**Copper Balls,** with ring handle, approximate weight ... ... 2 lb.	4 lb.
	each **10 6**	14 6



10345



10346

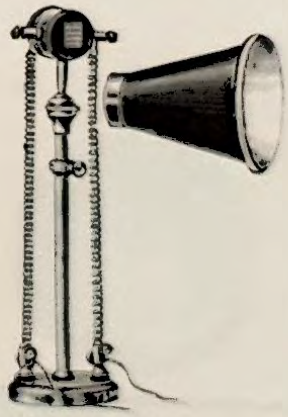


10347

10345	**Tin Plate Screen,** 12×12 in., with air space about 2 cm. wide, to show that in a uniform medium, radiant energy travels in a straight line	£0	8	6
10346	**Metal Canister,** Radiation of Heat, painted one side black, other side bright, with two Flasks and Connections, mounted on two Stands, complete	1	0	0
10347	**Prism,** Pyramid, Wire Model, to illustrate Law of Inverse Squares	0	5	0



10348–9



10351–4



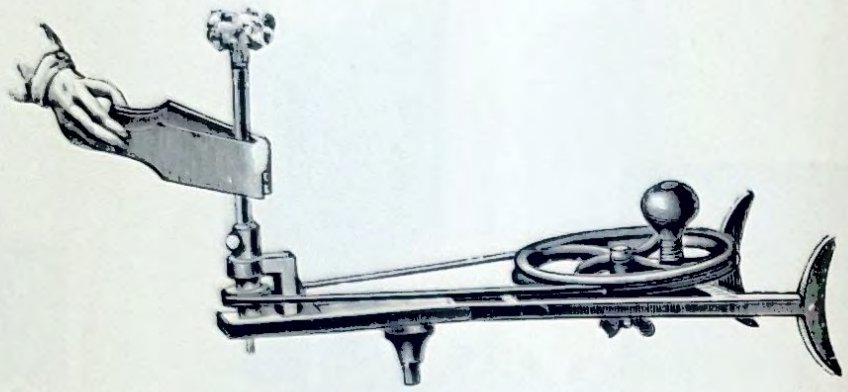
10355



10356

*10348	**Thermopile,** mounted on Brass Stand, with adjustment for height, 12 pairs	£2	0	0
*10349	Ditto ... ... 20 ,, ...	2	14	0
*10350	**Cones,** Silver-plated Copper, for use with above ... ... each	0	10	6
*10351	**Thermopile,** mounted on Brass Stand, best finish, with Ball and Socket Joint, Sliding Tube Adjustment, Terminals and Silver-plated Cone on Brass Base, complete 24 pairs	3	10	0
*10352	Ditto ... ... 40 ,, ...	4	10	0
*10353	Ditto ... ... 54 ,, ...	5	10	0
*10354	Ditto ... ... 80 ,, ...	6	5	0
(F) *10355	**Radiometer,** Crookes', single vane ... ... each	0	7	0
(F) *10356	,, ,, double ,, ... ,,	0	15	0

(F) Foreign manufacture.

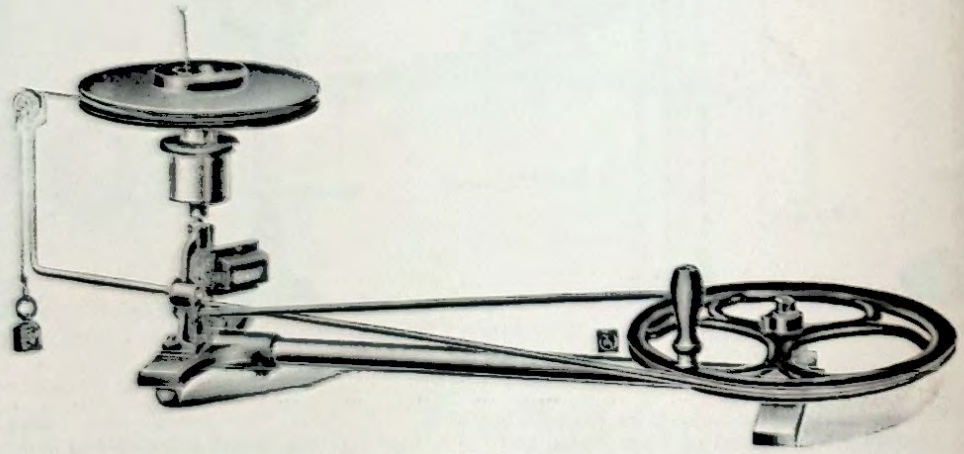


10357–8

10357 **Wheel,** Multipyling, Iron, arranged for Horizontal or Vertical Movements, with Oak Board and Brass Tube for friction **£2 12 6**

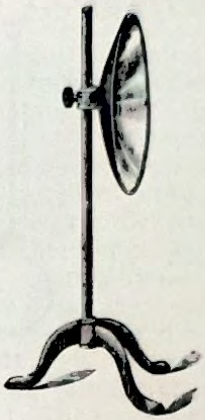
10358 **Brass Tube,** and Oak Boards, only **0 8 6**

10359 **Apparatus** to obtain rough determination of Joule's Equivalent, consisting of a stout Cardboard Tube, 1 metre long, fitted with Corks ... ... each **0 1 3**

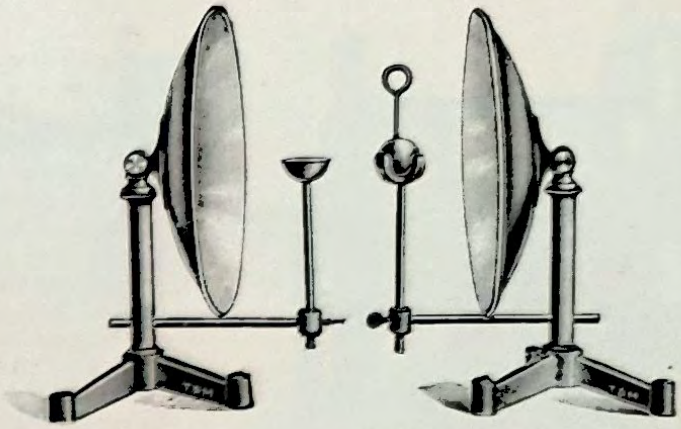


10360

10360 **Searle's Apparatus** for determining the Mechanical Equivalent of Heat, fitted with continuous registering Counter and complete with Hand Wheel **£8 12 6**

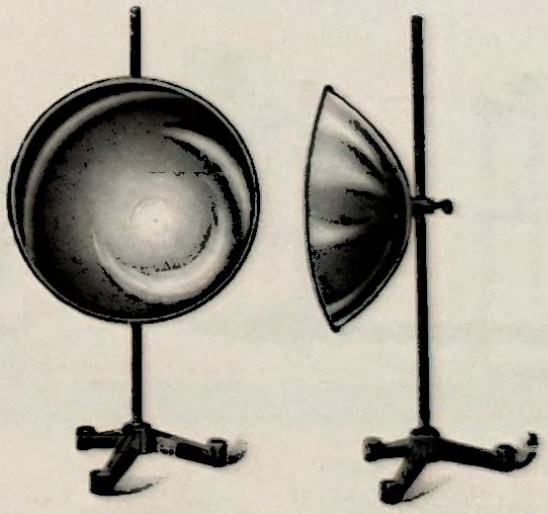


10361–2



10363

			12	15	in.
10361	**Reflectors,** Concave, Planished Tin, mounted on Iron Tripod Stands ...		**34 0**	**40 0**	per pair
10362	,, ,, Copper, Silvered, with Tin Backs, mounted on Iron Tripod Stands.				
			9	12	in.
			47 6	**57 6**	per pair
10363	,, Copper, Silver-plated, 12 in. diam., with adjustable Sponge and Ball Holder, mounted on Iron Stands, with Brass Pillars	per pair	**£6 0 0**		



10364

10364 **Reflectors,** Nickel Silver polished, 14½ in. diameter, depth of Mirror 4½ in., on Stands complete ... ... per pair **£2 12 6**



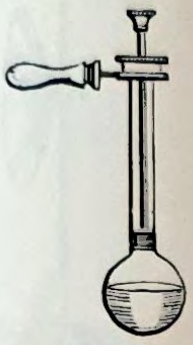
10365



10366



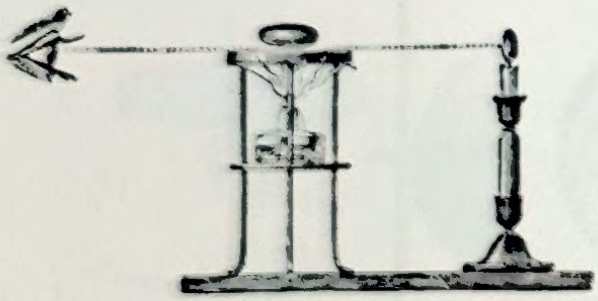
10369



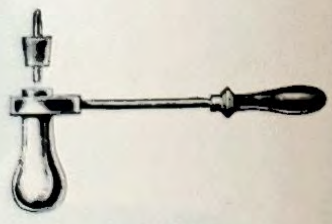
10370

10365	**Fire Syringe,** Brass, with Box at end for holding Amadou ... ... each	£0 10 6
10366	„ with strong Glass Cylinder and Handles ... ... „	1 15 0
10367	**Amadou,** or German Tinder, for use with above ... ... per box	0 0 6
10368	**Fusible Metal** (Rose's or Wood's) ... ... per lb. 15/0, per oz.	0 1 3
10369	**Steam Piston,** Wollaston's, Stout Glass (with Holder) ... ... each	0 3 9
10370	„ „ „ with Stout Glass Bulb and Brass Fittings ... „	0 8 6

Spheroidal State



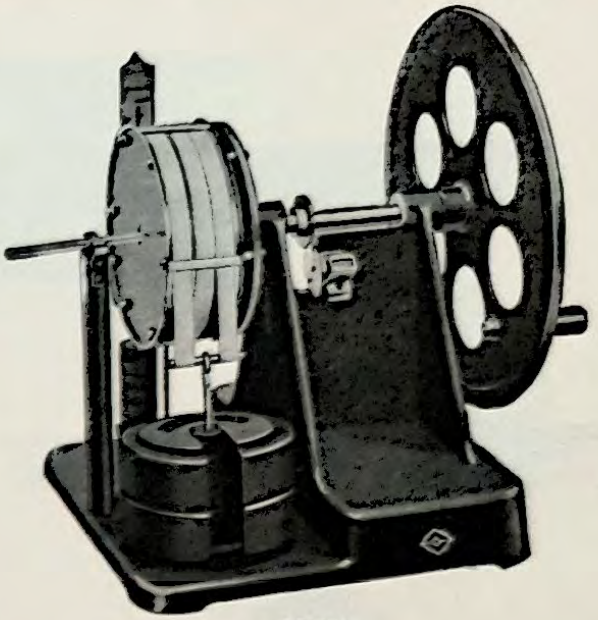
10371–2



10373

10371	**Apparatus,** to show Spheroidal State, Brass Plate only, 15 cm. diameter	£0 3 6
10372	Silver Plate only, 10 cm. diameter	0 10 0
10373	**Copper Flask,** brazed, with Cork and Tube for experiments, in Spheroidal state (capacity about 8 oz.)	0 10 6

CALLENDAR'S MECHANICAL EQUIVALENT OF HEAT APPARATUS

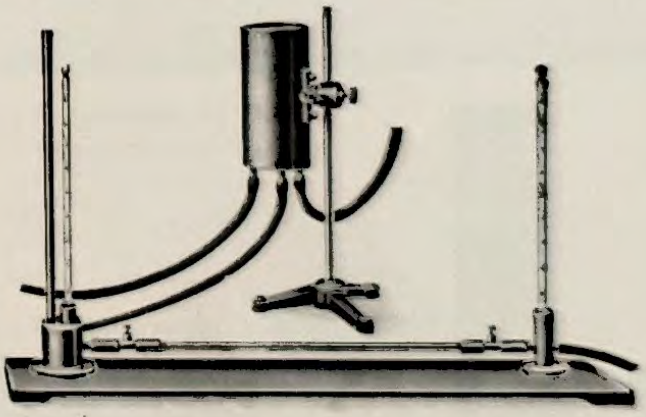


10375

The instrument illustrated in Fig. 10375, was designed by the late Prof. Callendar to provide a convenient means of determining "J," the Mechanical Equivalent of Heat. It is simple in construction and gives accurate results (within 0·5 per cent.) with considerable rapidity, a complete experiment occupying only about ten minutes. Mechanical energy is dissipated by means of friction. A Silk Belt, weighted unequally at either end, rubs on the surface of a rotating Brass Drum or Calorimeter, containing water, and the heat energy developed by the friction is measured by the rise in temperature of the water. The drum is rotated either by hand or by a 1/10 h.p. motor, the number of revolutions being automatically counted. The friction is practically independent of the speed of rotation, and there are no pulley or bearing errors. The motion of the surface of the calorimeter reduces the effect of draughts and convection currents. The rise in temperature of the water is observed by means of a Mercury Thermometer, inserted through an axial opening in the Calorimeter, the bulb of the Thermometer being bent round so that is is fully immersed. Normally, a thermometer range 10° to 30°C. is supplied, but when the apparatus is used in hot climates a thermometer range 25° to 45°C. can be provided. The standard Motor is arranged for 110 volts D.C., but by means of a suitable Resistance can be run from a 220-volt direct-current supply. Motors suitable for other voltages or for alternating current supplies can be supplied to order.

=10375 **Callendar's "J" Apparatus,** with Thermometer and two Velvet Belts (one spare) but without Motor **£13 10 0**

=10376 Ditto, ditto, mounted on Base with 110-volt D.C. Motor, Reduction Gear, Switch and Fuse **25 0 0**



10377

10377 **Callendar and Barnes' Continuous Flow Calorimeter,** for the accurate determination of the electrical equivalent of heat. A stream of water is passed through a narrow tube, inside which is wound a spiral of wire; a known current is passed through this wire and the resistance is determined at intervals during the experiment **3 12 6**

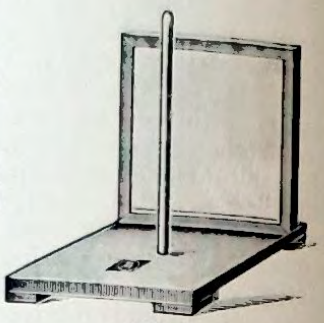
Light



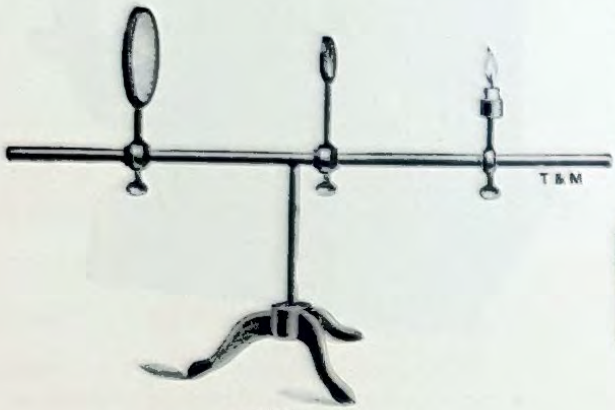
10390–1



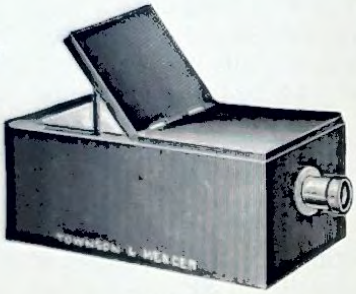
10392



10396



10393

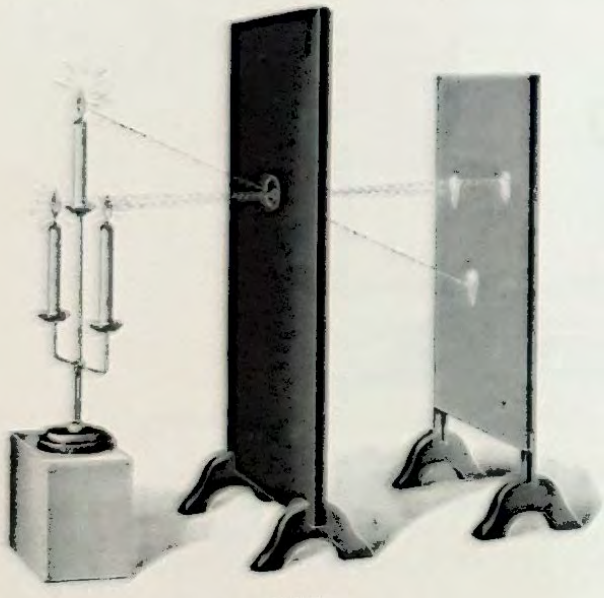


10394–5



10397

10390	**Camera,** Pinhole, Brass, to illustrate images produced by small apertures ...	each	£0	5	6
10391	,, cheaper form, Tinplate	,,	0	2	6
10392	**Pinhole Camera,** in Polished Box		0	6	6
10393	**Apparatus,** for showing image of Candle, by means of a Lens, as described in Roscoe's Science Primer	each	0	15	0
10394	**Camera Obscura,** with adjusting Lens, mounted in stained Blackwood	,,	0	18	6
10395	,, ,, ,, ,, ,, solid Mahogany ...	,,	1	1	0



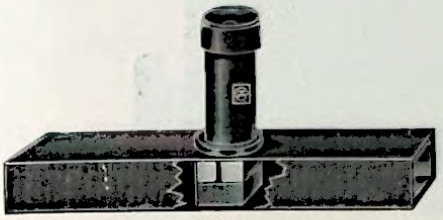
10398

10396 **Photometer,** Rumfords', Polished Mahogany Frame **£0 9 6**

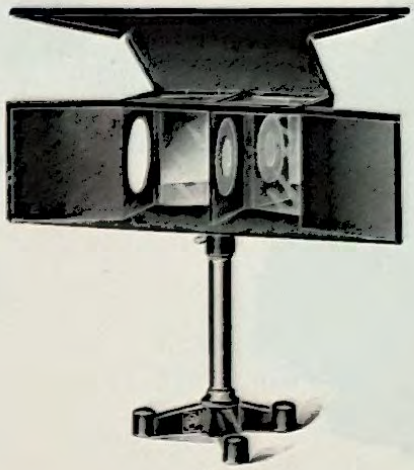
10397 Ditto, ditto, another form, in Plain Mahogany Frame **£0 5 0**

10398 **Apparatus** for Experiments on the Rectilinear of Light, consisting of two Screens, and triple Candle Holder ... **£0 15 0**

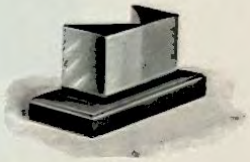
10399 Ditto, ditto, with triple Gas Jet, fitted with Stopcock **£0 17 6**



10400

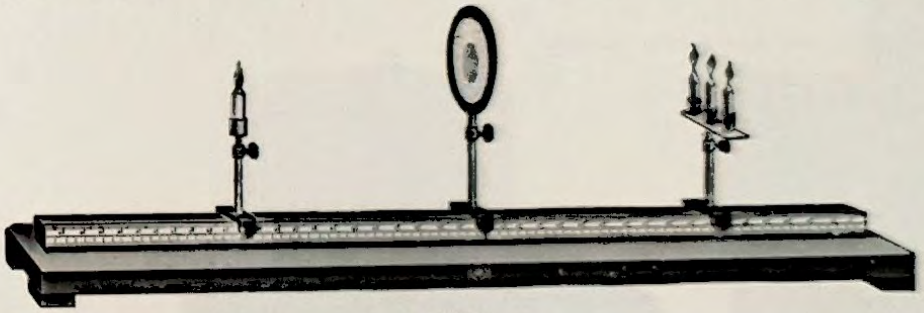


10401



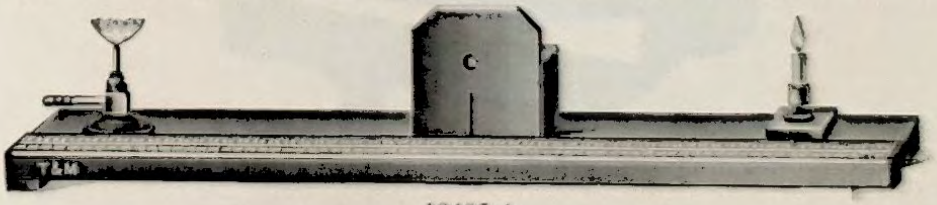
10402

10400	**Lee's Photometer,** consisting of a square Brass Tube fitted with two pieces of ground Glass with Tin Foil between; open both ends and Eye-piece...	£0	10	6
10401	**Bunsen Photometer.** The Grease Spot Screen is enclosed with two Mirrors in a Japanned Metal Box fitted with hinged lid, on adjustable Stand	1	17	6
(F) 10402	**Prism Photometer,** consisting of two Total Reflecting Prisms, mounted on Marble Base	2	15	0



10403

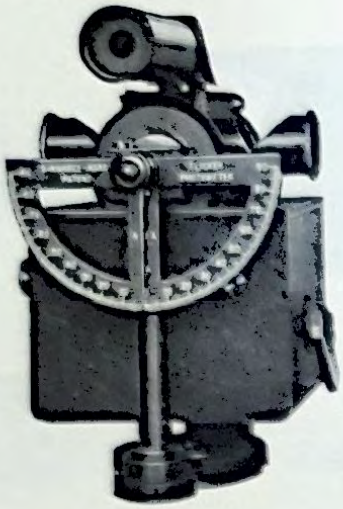
10403	**Bunsen's Photometer,** with Boxwood Scale, mounted on Teak Base, fitted with Grease Disc, Single and Triple Candle Holders, on Brass adjustable Supports	£1	6	0
10404	Ditto, ditto, ditto, but sliding Supports not adjustable in height	1	1	0



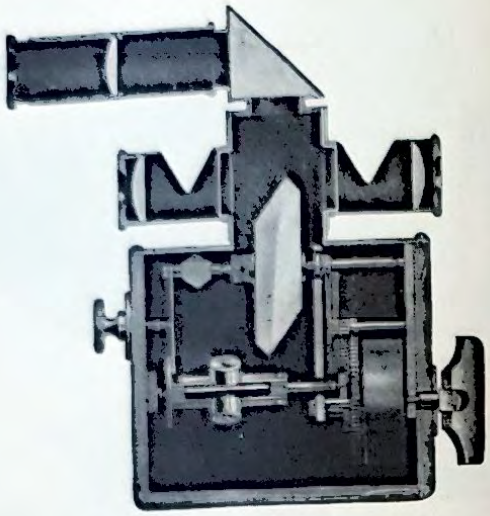
10405-6

10405	**Photometer,** Paraffin Wax, with Burner, Candle Holder, mounted on Polished Mahogany Base with Metre Boxwood Scale (*vide* Clay's "Practical Exercises in Light")	£0	18	6
10406	**Paraffin Wax Photometer** only, as above ... ... each	0	5	0

(F) Foreign manufacture.



10407



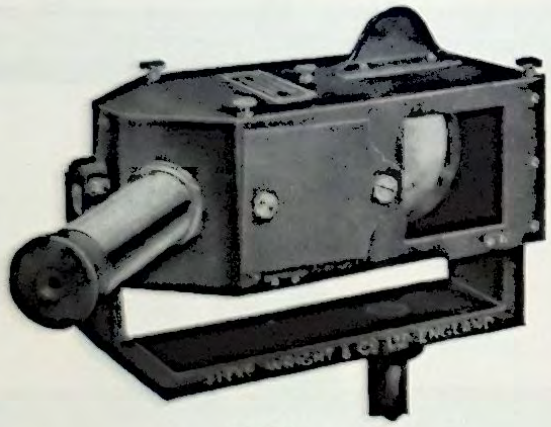
10408

FLICKER PHOTOMETER, SIMMANCE'S PATENT

The standard method of photometry where the colour of the light to be tested differs from that of the standard light. The light rays fall on either side of a Revolving Disc, and equality of intensity is shown by an apparent cessation of the revolutions of the Disc, or, in other words, by absence of "Flicker."

—10407 For angle and horizontal testing **£22 0 0**

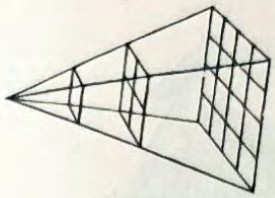
—10408 For horizontal testing only **13 15 0**



10409

—10409 **LUMMER BRODHUN PHOTOMETER HEAD**

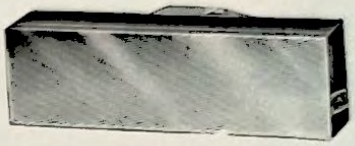
The utmost care is taken in the making and assembling of these instruments, which, in addition to the severe tests imposed, renders this Photometer Head superior to the German product, without in any way departing from the principles involved. The optical system employed gives results of extreme accuracy **£27 0 0**



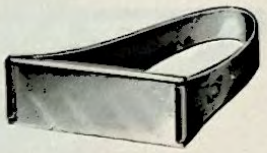
10410



10411



10412

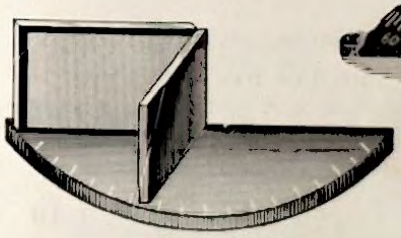


10413

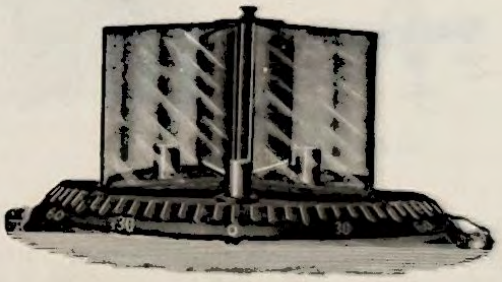
10410	**Prism,** Pyramid, Wire Model, to illustrate Law of Inverse Squares					**£0**	**5**	**0**
		3×1	6×1	6×2	4×3	5×4	
10411	**Strips of Mirror Glass,** Patent Plate ...	**1/6**	**3/0**	**4/6**	**4/9**	**6/6**	per doz.
10412	Ditto, ditto, mounted on Wooden Stand ...	**7/0**	**11/0**	**16/0**	**16/6**	**21/0**	,,
10413	Ditto, ditto, 3×1, with Brass Clip ... ... each, **7d.**; per doz.					**£0**	**6**	**0**



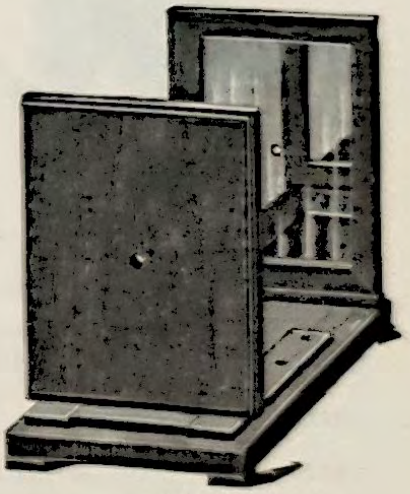
10414



10415

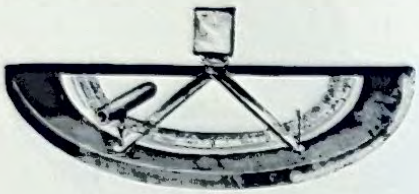


10416



10417

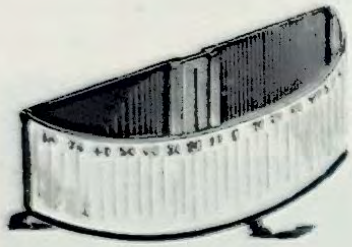
		9×6	10×8	12×10 in.	
10414	Mirrors, Plane, mounted in Mahogany Frame on Stand, as sketch	**8/6**	**10 6**	**17/6**	each
10415	**Angle Mirror,** with Divided Circle, on polished Base			each	**£0 15 0**
10416	,, ,, with Divided Iron Half-Circle			,,	**1 1 0**
10417	**Parallel Mirror,** in Mahogany Frame, sliding on Mahogany Base ...			,,	**1 15 0**



10418



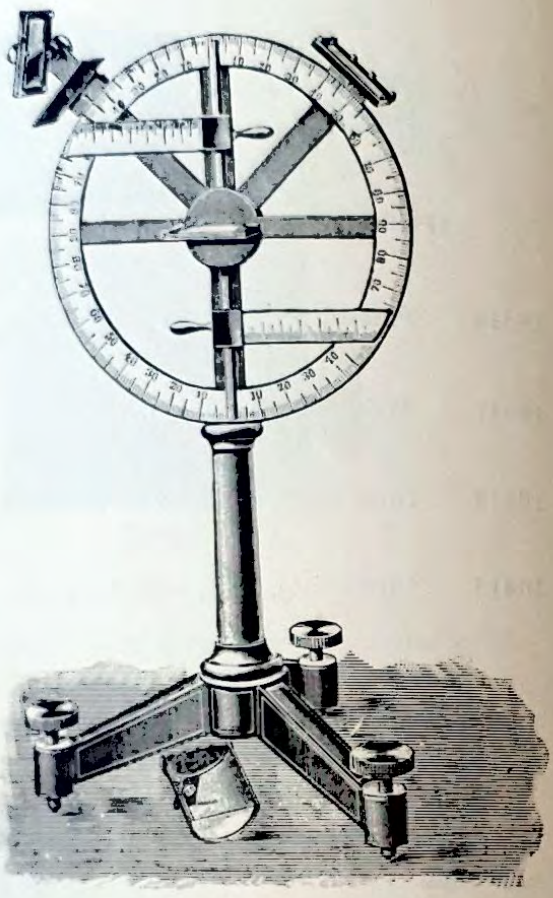
10421



10419



10422



10423

10418 **Reflection Apparatus,** consisting of Plane Mirror, 2×1 in. Two movable arms, one fitted with tube and cross wire and the other with a point, fitted on base with Graduated Circle (*vide* Jones' "Lessons on Heat and Light") **£0 12 6**

10419 **Tray,** Semi-circular, for reflection and refraction, with front entirely of Ground Glass **2 2 0**

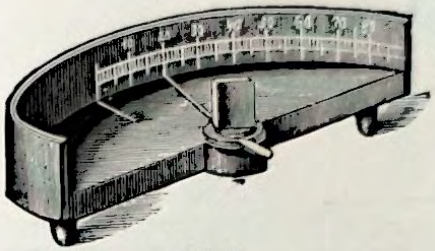
10420 Ditto, ditto, all glass, small size... ... ... **1 10 0**

(F) **10421**	**Trough Refraction,** semi-cylindrical	Diameter	40	60	80	mm.
		Depth ...	25	20	35	mm.
			11 6	**16 0**	**22 6**	each

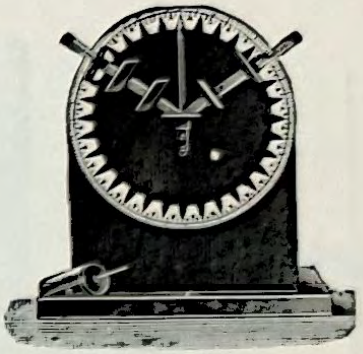
10422 **Reflection and Refraction Apparatus** for the refraction of liquids, with two Mirrors for total reflection and dispersion with the assistance of the Fluorescent Fluid, mounted on Stand **£5 10 0**

(F) **10423** Ditto, ditto, with divided Circle, Glass Trough and Mirrors on Stand, with Levelling Screws for lecture use, complete **12 12 0**

(F) Foreign manufacture.



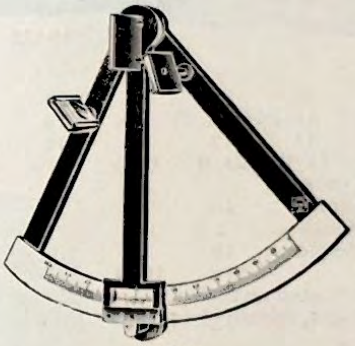
10425



10426

10425 **Reflection Apparatus,** with Revolving Mirror and Divided Circle **£1 7 6**

10426 **Apparatus** for illustrating reflection and refraction of Light, Graduated Circle on Mahogany Stand with two Brass Slides which move round the circumference, Semi-circular Vessel in the centre for Water, with Mirrors and Screens **1 18 6**



10427



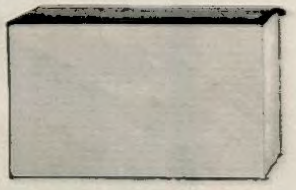
10428

10427 **Sextant,** fitted with Mirrors, etc., Aluminium Frame with Vernier reading to $\frac{1}{10}$th mm. **1 8 6**

10428 **Mirror Sextant,** Brass, with two Dark Glasses, Graduated Arc and Vernier Telescope, reading to 5 minutes **5 5 0**



10429



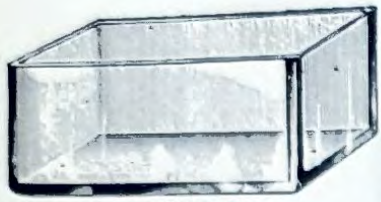
10430



10431

		1	1½	2 in. sq.
(F) **10429**	**Cubes,** Glass, solid	**1 0**	**1 9**	**2 3** each
		$4\times2\frac{1}{2}\times\frac{3}{4}$		$4\times2\frac{1}{2}\times1$ in.
(F) **10430**	**Slabs,** Polished Glass, for Refraction	**2 3**		**3 0** each
(F) **10431**	,, semi-circular, Polished Glass, $3\frac{1}{2}\times1\frac{1}{4}\times\frac{3}{4}$ in. ... ... each			**£0 2 0**

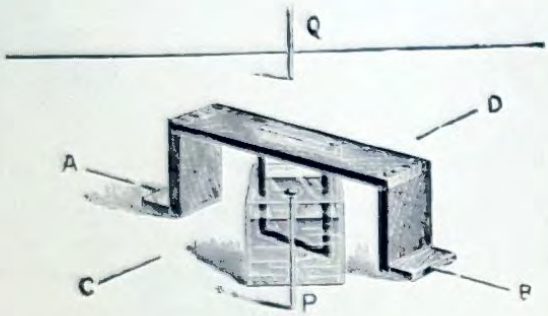
(F) Foreign manufacture.



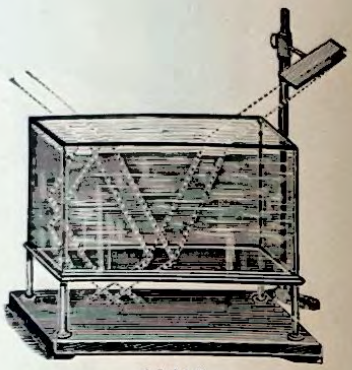
10432-3



10434



10437



10435

(F) **10432** **Polished Rectangular Glass Troughs**, for refraction.

Length	22	22	24	26	28	30	cm.
Width ...	10	11	12	13	14	15	,,
Height...	10	11	12	13	14	15	,,
	13/0	**17/0**	**23/0**	**27/6**	**34/-**	**42/0**	each

(F) **10433** The following sizes are not kept in stock, but can be supplied to order.

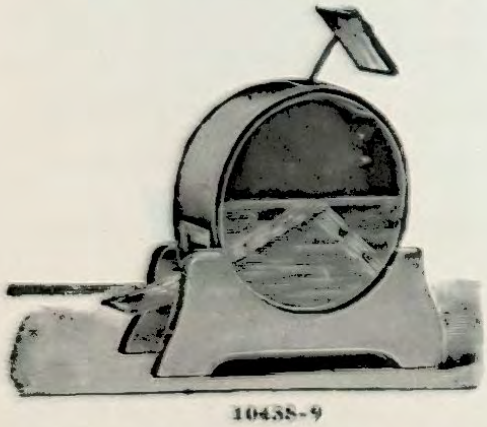
Length	10	11	14	12	cm.
Width ...	4	4	7½	9	,,
Height...	12	16	16	19	,,
	9/0	**10/0**	**11/0**	**12/6**	each

10434 **Reflector**, Mirror, with joint allowing for any angle movement, mounted on Stand... ... ... **£0 12 6**

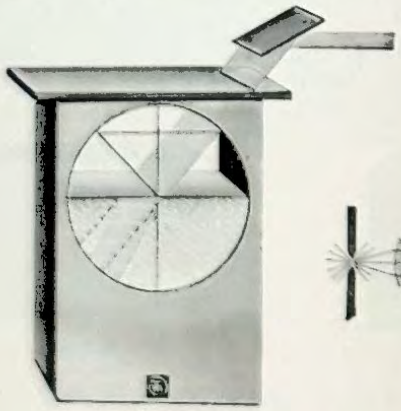
10435 **Rectangular Glass Trough**, for reflection and refraction of Light, mounted on Brass Pillars, on Mahogany Base with adjustable Mirror **3 15 0**

10436 Ditto, ditto, Plate Glass Trough on Metal Supports **3 0 0**

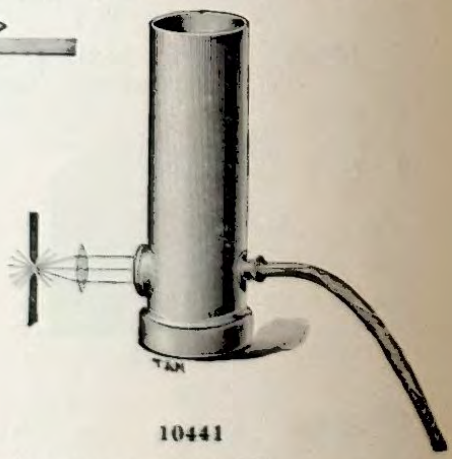
10437 **Apparatus**, to show refractive index, small Glass Tank and parallel sides, with Mahogany Stool, etc. (*vide* Clay's "Practical Exercises in Light") **0 10 6**



10438-9



10440



10441

10438 **Apparatus**, for showing refraction of Light in fluids and total reflection, with Nickel-plated Brass Trough **£3 10 0**

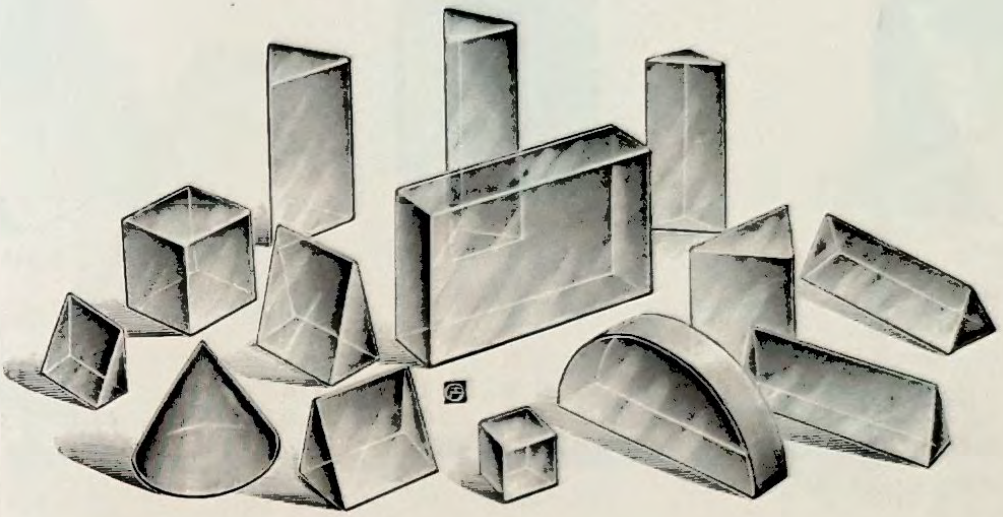
10439 Ditto, cheaper make, stout Japanned Tin **2 10 0**

10440 **Refraction Trough**, as described in Wright's "Physics" **1 5 0**

10441 **Metal Cylinder**, for demonstrating total reflection in a jet of water **0 17 6**

(F) Foreign manufacture.

Glass Prisms





10443–5

(F) **10443** **Prisms,** Glass, Clear Crystal, for Students' use; angle, 60°, 60°, 60°

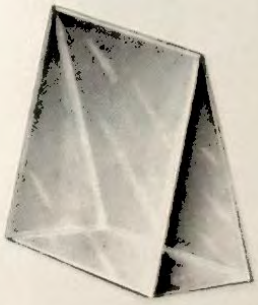
Length	50	25	38	75	88	100	125	mm.
Face ...	20	25	25	25	25	25	25	„
	10d.	**10d.**	**10d.**	**1/0**	**1/6**	**1/8**	**1/11**	each
	9/0	**9/0**	**9/6**	**10/0**	**17/0**	**18/6**	**21/0**	per doz.

(F) **10444** Ditto, ditto.

Length	32	38	50	50	75	88	100	70 mm.
Face ...	32	38	38	50	38	38	38	50 „
	1/2	**1/4**	**1/7**	**2/10**	**1/9**	**2/0**	**2/0**	**2/6** each
	13/0	**15/0**	**17/6**	**33/-**	**20/-**	**22/6**	**23/0**	**28/0** per doz.

(F) **10445** **Prisms,** Glass, large size, angle, 60°, 60°, 60°, for Lecture use.

63×63 mm.	...	...	...	...	...	each	**£0**	**5**	**6**
90×90 „	...	...	...	...	...	„	**0**	**8**	**6**

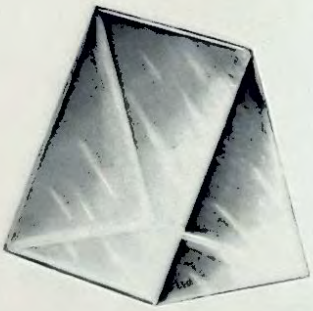


10446

(F) **10446** **Prisms,** Glass, Clear Crystal, for Students' use; angles, 30°, 75°, 75°

Length	25	25	50	75	38	45	50	mm.
Face ...	20	25	20	25	38	45	38	„
	9d.	**10d.**	**1/0**	**1/3**	**1/6**	**1/8**	**1/10**	each
	8/0	**9/0**	**11/0**	**14/0**	**17/0**	**19/0**	**21/0**	per doz.

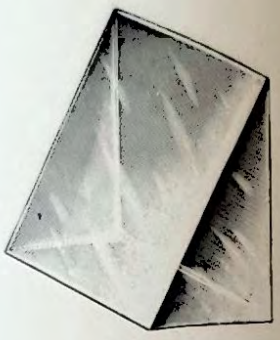
(F) Foreign manufacture.



10447



10448



10449

(F) **10447** **Prisms,** Glass, Clear Crystal, for Students' use. Right angle, 90°, 45°, 45°

Length ...	25	35	40	50	75	38	50	70	mm.
Face ...	25	25	25	35	25	38	38	50	,,
	10d.	**1/0**	**1/1**	**1/3**	**1/6**	**1/10**	**2/0**	**2/9**	each
	9/0	**11/0**	**12/0**	**14/0**	**17/0**	**21/0**	**22/0**	**31/0**	per doz.

(F) **10448** **Prism,** Glass, large size, for Lecture use, 90°, 45°, 45°, 90×60 mm. ... each **£0 6 0**

(F) **10449** Ditto, angles 45°, 75°, 60° ... ... Length ... 38 mm.
Face ... 38 ,,
1/9 each
18/6 per doz.

(F) **10450** Ditto, ditto, angles 90°, 60°, 30°. Face 25 mm., Base 14 mm., Width 38 mm. **1/1** each,
11/6 per doz.

10451 **Prisms,** angles 60°, extra dense glass, optically worked.

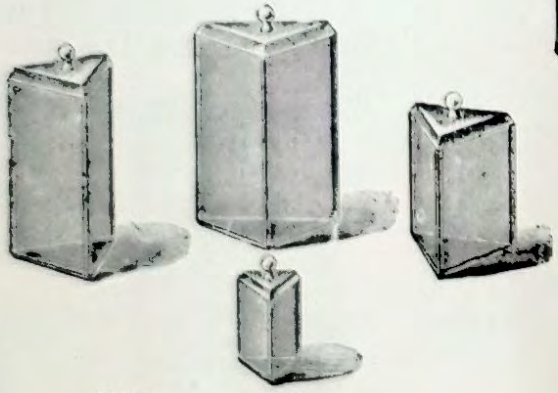
Length	25	32	38	mm.
Face ...	25	32	38	,,
	18/0	**21/0**	**27/6**	each

10452 Ditto, angles 90°, 45°, 45°, extra dense glass, optically worked.

Length	32	38	mm.
Face ...	32	38	,,
	21/0	**27/6**	each

(F) ***10453** **Prisms,** hollow, made of clear white glass, cemented together at 600°C. They resist high temperatures and the destructive influences of water, alcohol, acids, etc.

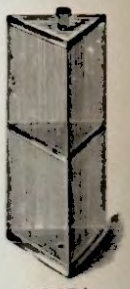
35	40	40	mm.
25	35	45	,,
13/6	**15/0**	**16/0**	each
75	60	90	mm.
35	60	60	,,
18/6	**21/0**	**23/6**	each



10453



10455



10454

(F) ***10454** Ditto, with two compartments, 100×60 mm. **£2 2 0**

(F) ***10455** **Prism,** wedge shape, in pairs of equal shape and size.

100	140	150	180	mm.
40	45	50	45	,,
22/6	**27/6**	**28/6**	**37/0**	each

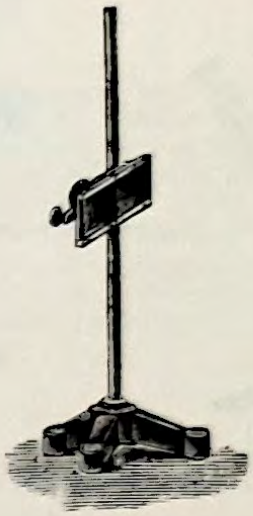
(F) Foreign manufacture.



10458



10460



10461

10457	**Prism,** Camera Lucida ... ... each								**£0**	**7**	**6**
10458	**Camera Lucida.** Wollaston's, mounted on Brass Stand, in Case								**3**	**0**	**0**
		30×40	38×38	43×43	50×50						
10459	Ditto, Fresnel's Bi-Prism, best quality ...	**10/6**	**12/0**	**15/6**	**17/6**						
10460	Ditto, ditto, mounted on Brass Stand with Screen, best quality and finish, each **28/6, 30/0, 35/0,**								**£2**	**0**	**0**
(F) **10461**	Ditto, ditto, ditto, with optically ground Mirrors and micrometer screw adjustment. Size of Mirrors 30×40 40×50 mm.										
		50/0	**60/0**								



10462



10463



10465



10466



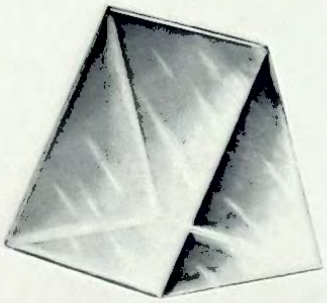
10467



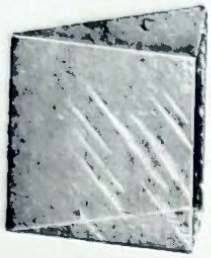
10468

(F) **10462**	**Prism,** Polyprism, four different kinds of glass, 1-in. sides								**£1**	**1**	**0**
(F) **10463**	,, Pyramid, Crystal Glass, to show total reflection								**0**	**15**	**0**
10464	,, Achromatic, of Flint and Crown Glass, optically worked per pair								**1**	**0**	**0**
10465	,, Achromatic, mounted on Brass adjustable Stand, with Swivel Joint each								**3**	**10**	**0**
10466	**Carbon Bisulphide Prisms.** As this pattern bottle has been found unsatisfactory we have discontinued same, and in place of these recommend Prisms No. 10453.										
(F) **10467**	**Carbon Bisulphide Prisms** for Students' use, with polished faces made in one piece ... ... each								**0**	**3**	**0**
(F) **10468**	**Prismatic Bottle,** Cut and polished to contain indigo solution ... ,,								**0**	**4**	**6**

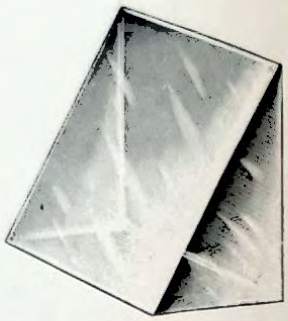
(F) Foreign manufacture.



10447



10448



10449

(F) **10447** **Prisms,** Glass, Clear Crystal, for Students' use. Right angle, 90°, 45°, 45°

Length ...	25	35	40	50	75	38	50	70	mm.
Face ...	25	25	25	35	25	38	38	50	,,
	10d.	**1/0**	**1/1**	**1/3**	**1/6**	**1/10**	**2/0**	**2/9**	each
	9/0	**11/0**	**12/0**	**14/0**	**17/0**	**21/0**	**22/0**	**31/0**	per doz.

(F) **10448** **Prism,** Glass, large size, for Lecture use, 90°, 45°, 45°, 90×60 mm. ... each **£0 6 0**

(F) **10449** Ditto, angles 45°, 75°, 60° ... ... Length ... 38 mm.
Face ... 38 ,,
1/9 each
18/6 per doz.

(F) **10450** Ditto, ditto, angles 90°, 60°, 30°. Face 25 mm., Base 14 mm., Width 38 mm. **1/1** each,
11/6 per doz.

10451 **Prisms,** angles 60°, extra dense glass, optically worked.

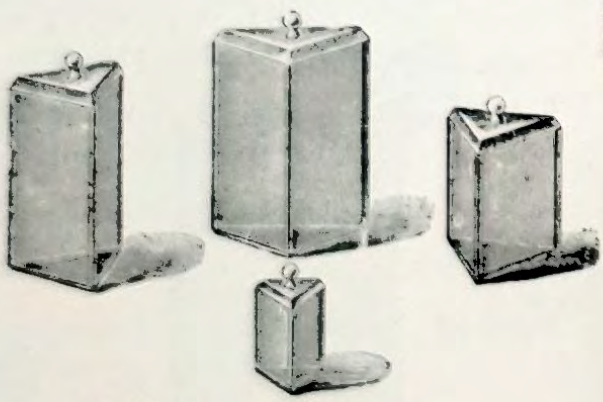
Length	25	32	38	mm.
Face ...	25	32	38	,,
	18/0	**21/0**	**27/6**	each

10452 Ditto, angles 90°, 45°, 45°, extra dense glass, optically worked.

Length	32	38	mm.
Face ...	32	38	,,
	21/0	**27/6**	each

(F) ***10453** **Prisms,** hollow, made of clear white glass, cemented together at 600°C. They resist high temperatures and the destructive influences of water, alcohol, acids, etc.

35	40	40	mm.
25	35	45	,,
13/6	**15/0**	**16/0**	each
75	60	90	mm.
35	60	60	,,
18/6	**21/0**	**23/6**	each



10453



10455



10454

(F) ***10454** Ditto, with two compartments, 100×60 mm. **£2 2 0**

(F) ***10455** **Prism,** wedge shape, in pairs of equal shape and size.

100	140	150	180	mm.
40	45	50	45	,,
22/6	**27/6**	**28/6**	**37/0**	each

(F) Foreign manufacture.



10458



10460



10461

10457	**Prism,** Camera Lucida ... ... each				**£0**	**7**	**6**
10458	**Camera Lucida.** Wollaston's, mounted on Brass Stand, in Case				**3**	**0**	**0**
		30×40	38×38	43×43	50×50		
10459	Ditto, Fresnel's Bi-Prism, best quality ...	**10/6**	**12/0**	**15/6**	**17/6**		
10460	Ditto, ditto, mounted on Brass Stand with Screen, best quality and finish, each **28/6, 30/0, 35/0,**				**£2**	**0**	**0**
(F) **10461**	Ditto, ditto, ditto, with optically ground Mirrors and micrometer screw adjustment. Size of Mirrors	30×40	40×50 mm.				
		50/0	**60/0**				



10462



10463



10465



10466



10467



10468

(F) **10462**	**Prism,** Polyprism, four different kinds of glass, 1-in. sides	**£1**	**1**	**0**
(F) **10463**	,, Pyramid, Crystal Glass, to show total reflection	**0**	**15**	**0**
10464	,, Achromatic, of Flint and Crown Glass, optically worked per pair	**1**	**0**	**0**
10465	,, Achromatic, mounted on Brass adjustable Stand, with Swivel Joint each	**3**	**10**	**0**
10466	**Carbon Bisulphide Prisms.** As this pattern bottle has been found unsatisfactory we have discontinued same, and in place of these recommend Prisms No. 10453.			
(F) **10467**	**Carbon Bisulphide Prisms** for Students' use, with polished faces made in one piece ... ... each	**0**	**3**	**0**
(F) **10468**	**Prismatic Bottle,** Cut and polished to contain indigo solution ... ,,	**0**	**4**	**6**

(F) Foreign manufacture.



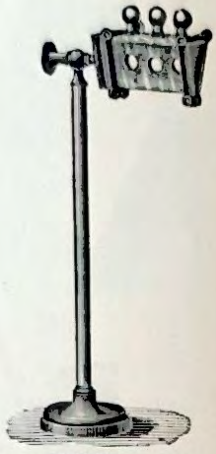
10470–1



10472



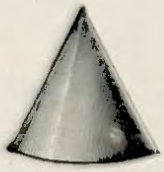
10474



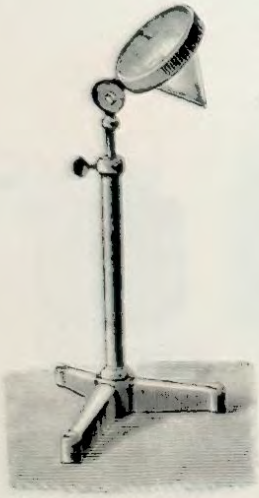
10475

10470	**Glass Prism,** 4 in. long, with Movable Joint, on Stand	£0	9	6
10471	„ „ 4 in. long, with Ball and Socket Joint, mounted on Tripod Stand	0	12	6
10472	**Prism,** hollow, with Adjustable Angle for Fluids, on Brass Stand, with Iron Tripod Foot	3	3	0
10473	„ with Graduated Arc and Adjusting Screws	4	4	0
10474	„ Silbermann's, with Divisions to show that the deviation increases with the increase in the refraction, complete, with two Prisms, for Alcohol and Water	5	10	0
10475	„ Hollow, to hold three different Liquids, on Brass Stand	4	15	0
*10476	„ Nicols' polarizing light, or analysing same, when polarized.			

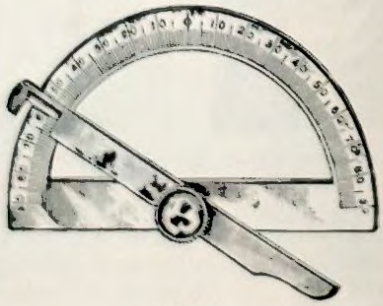
	Diameter	6	8	10	mm.
		18/6	**22/6**	**28/0**	each



10477



10478



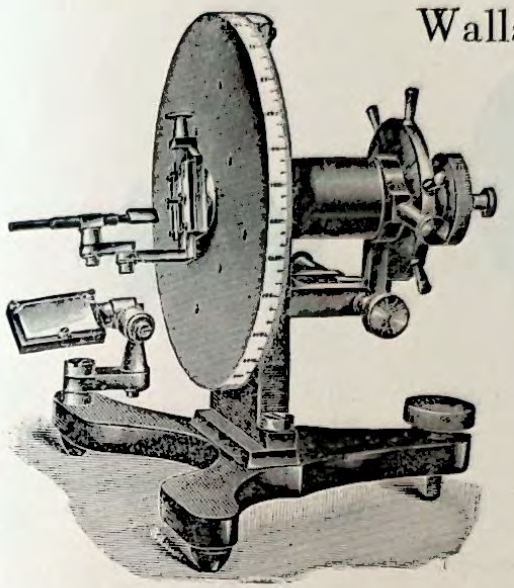
10479

(F) 10477	**Cone,** Glass, for production of Circular Spectrum	£0	3	6
10478	„ „ Mounted on Brass Stand with Tripod Foot	1	8	0
10479	**Goniometer,** Brass, simple form	0	15	0

For other pattern Goniometers, see page 116.

(F) Foreign manufacture.

Wallaston Goniometer



10480

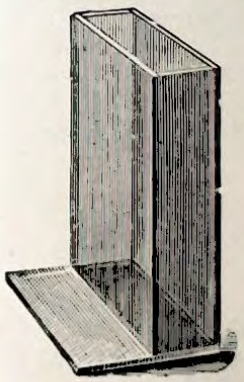
=10480 **Wollaston Goniometer.** With 5-inch Circle, reading by Vernier to 1 minute. Clamp and fine adjustment to Circle. The inner axis, which carries the crystal holder, may be rotated by hand independently of the Circle; and can be clamped to the Circle, when both move together.

Both crystal holder and mirror have complete adjustments. The whole is mounted on cast-iron Tripod, with levelling screw.

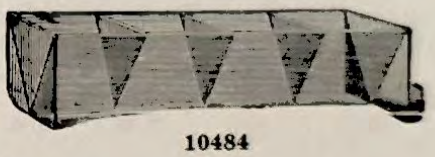
With case **£8 15 0**

=10481 Divided on silver, extra **1 1 0**

=10482 With observing Telescope, instead of mirror, extra **1 12 6**



10483



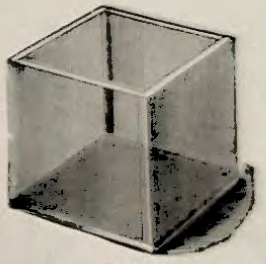
10484



10485



10486



10487



10488

(F) *10483 **Cells,** Glass, Flat, of Clear White Glass, cemented together at 600°C., they resist high temperatures and the destructive influences of water, alcohol, acids, etc.

	55×35×5	55×35×10	80×50×10	100×60×20	mm.
	8 0	**9 6**	**10 6**	**12 6**	each

(F) *10484 **Hollow Prisms,** trough shape, with Cover, each compartment 50 mm. long, 55 mm. wide.

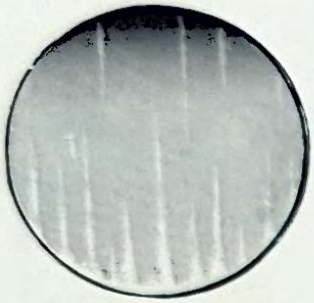
1	2	3	4	compartments
12 6	**21 0**	**27 6**	**35 0**	

	30×20×5	50×20×5	30×20×10	50×20×10	mm.
(F) *10485 **Cells,** Glass, U shape	**6 9**	**8 6**	**7 6**	**10 0**	each
	20×4	30×4	40×4	50×4	mm.
(F) *10486 ,, ,, Circular Shape	**6 6**	**9 6**	**11 6**	**14 0**	each

	30	40	50	60	70	80	mm. sq.
(F) *10487 **Cubes,** Glass, Hollow, with Cover	**6 3**	**7 6**	**8 9**	**10 6**	**15 0**	**17 6**	each

	50×20×5	50×20×10	50×40×10	50×40×20	mm.
(F) *10488 **Cells,** Glass, square shape ...	**10 0**	**10 6**	**11 0**	**11 6**	each

(F) Foreign manufacture.



10490–1



10492–3



10494

10490	**Mirrors,** Glass, Silvered Concave, unmounted. Diameter					50	75	100	mm.
						9d.	**1/2**	**1/4**	each
						8/6	**13/0**	**15/0**	per doz.
10491	Ditto, ditto, Convex					**9d.**	**1/2**	**1/4**	each
						8/6	**13/0**	**15/0**	per doz.
(F) **10492**	Ditto, optically worked, Concave.								
	Diameter	50	50 mm.	7·5	7·5	15	15	cm.	
	Focus ...	20	30	20	30	20	30	,,	
		2/0	**2/0**	**4/0**	**4/0**	**13/6**	**13/6**	each	
(F) **10493**	Ditto, ditto, Convex	**2/0**	**2/0**	**4/0**	**4/0**	**13/6**	**13/6**	,,	
(F) **10494**	Ditto, ditto, optically worked, mounted in Brass Frame, with Boss and Screw for fixing to Rod, Concave or Convex.								
	Diameter	50	50 mm.	7·5	7·5	15	15	cm.	
	Focus ...	20	30	20	30	20	30	,,	
		6/6	**6/6**	**8/6**	**8/6**	**20/0**	**20/0**	each	



10495



10496



10497

10495	**Mirrors,** Concave, Glass, Silvered, on Stands, not optically worked. 6 in. dia. each	**£0**	**9**	**6**
10496	,, Convex ,, ,, ,, ,, ,, ,,	**0**	**10**	**6**
10497	**Mirrors,** Parabolic Nickel-Silver Polished, 14½ in. diameter, depth of mirror 4½ in., on Stands complete ... ... per pair	**2**	**12**	**6**

(F) Foreign manufacture.

Lenses



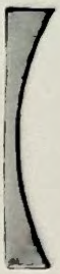
10500–10503



10504–7



10508–9



10510–11

10498 **Lenses,** Clear White Glass, for Students' use, with rough edges, Double Convex,

	40 mm. diameter approx.	10	15	20	26	30	50	cm. focus
		12/6	**11/0**	**7/6**	**7/0**	**7/0**	**6/6**	per doz.
		10	15	20	26	30	50	cm. focus
10499	,, Double Concave ...	**14/0**	**11/0**	**7/6**	**7/0**	**7/0**	**7/0**	per doz.

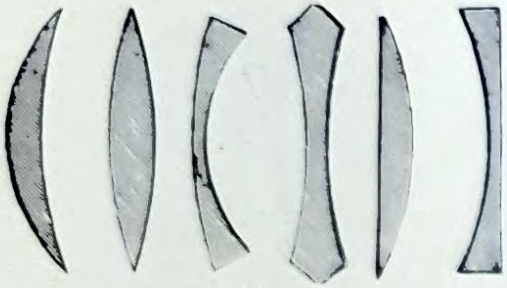
10500 ,, Superior Quality, with ground edges, Double Convex—25 mm. diameter.

		10	15	20	26	30	50	cm. focus
		1/0	**1/0**	**10d.**	**10d.**	**10d.**	**10d.**	each
10501	,, 38 mm. dia.	**1/4**	**1/4**	**1/2**	**1/2**	**1/2**	**1/2**	,,
(F) **10502**	,, 50 mm. dia.	**2/0**	**2/0**	**1/6**	**1/3**	**1/3**	**1/3**	,,
(F) **10503**	,, 65 mm. dia.	**2/6**	**2/3**	**2/0**	**2/0**	**1/9**	**1/7**	,,
(F) **10504**	,, Double Concave, 25 mm. dia.	**1/3**	**1/0**	**1/0**	**1/0**	**1/0**	**1/0**	,,
(F) **10505**	,, 38 mm. dia.	**1/6**	**1/6**	**1/0**	**1/0**	**1/0**	**1/0**	,,
(F) **10506**	,, 50 mm. dia.	**2/3**	**2/0**	**1/9**	**1/6**	**1/6**	**1/6**	,,
(F) **10507**	,, 63 mm. dia.	**3/0**	**2/9**	**2/6**	**2/2**	**2/2**	**2/2**	,,

(F) **10508** ,, superior quality, ground edges, Plano-Convex, 50 mm. dia.

		20	26	30	50	cm. focus
		1/8	**1/6**	**1/4**	**1/4**	each
(F) **10509**	,, 63 mm. dia.	**2/6**	**2/6**	**2/4**	**2/4**	,,
(F) **10510**	,, Plano-Concave, 50 mm. dia.	**2/3**	**2/0**	**1/9**	**1/9**	,,
(F) **10511**	,, 63 mm. dia.	**2/6**	**2/6**	**2/4**	**2/4**	,,

(F) Foreign manufacture.



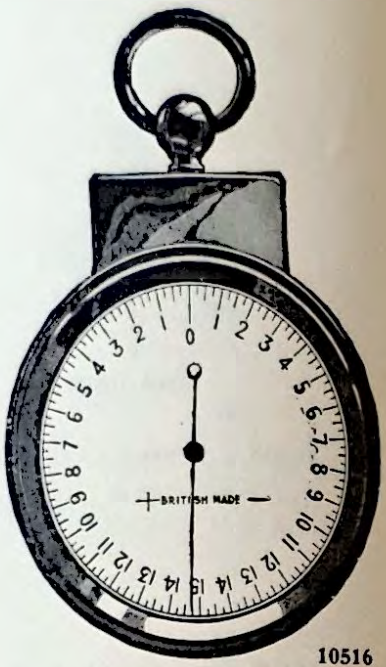
10512



10514 10515



10513



10516

(F) **10512** **Sets of Six Lenses** with ground edges, consisting of Bi-Concave, Bi-Convex, Plano-Concave, Plano-Convex, Converging Concavo-Convex and Diverging Concavo-Convex.

Diameter	38	50	63	mm.	
	9/6	**12/0**	**17/6**	per set.	

(F) **10513** Ditto, ditto, in Velvet-lined Leather Case ... ...

50	63	80	mm.		
15/0	**22/6**	**36/0**	per set.		

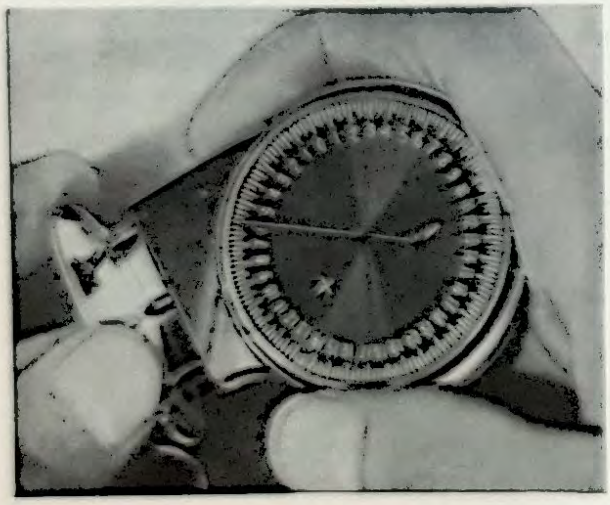
(F) ***10514** **Lens,** Hollow, Bi-Convex, with Hole for filling.

Diameter ...	50	80	100	130	160 mm.
Price ...	**7/6**	**8/6**	**12/0**	**14/0**	**16/0** each

(F) ***10515** Ditto, Hollow, Plano-Convex

Diameter ...	50	80	100	130	160 mm.
Price ...	**7/4**	**8/6**	**12/0**	**14/0**	**16/0** each

10516 **Lens Measurer,** Watch-form with sliding Cap, Nickel-plated, registering up to 15D **£1 2 6**



10517

10517 SCIENTYPE LENS MEASURE

The Scientype lens measure has been created to provide, through an entirely new principle of construction, the following advantages:—

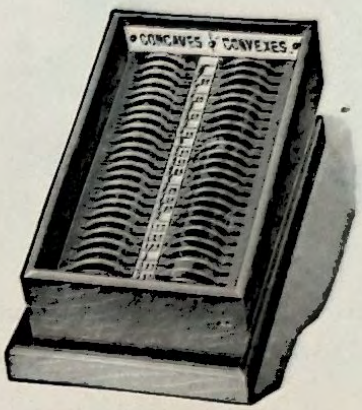
1. **Non-scratching Pins.**
2. **Permanence of accuracy.**
3. **High degree of accuracy.**
4. **Natural grip.**

Non-scratching Pins.—The three legs of ordinary lens measures terminate in points. Consequently, such instruments tend to scratch lens surfaces over which they are moved. A scratch is a serious lens blemish. Partly to overcome this defect and partly to enhance the accuracy, the end of each of the pins of the Scientype model has let into it a truly spherical hardened steel ball. **The Scientype lens measure may therefore be moved about the most delicate lens face with complete confidence that no scratching will result £1 5 0**

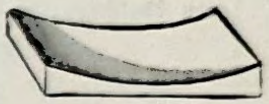
(F) Foreign manufacture.



10520



10519



10521

(F) **10519** **Trial Case of Lenses** in Oak Case, with drop-over Cover containing 24 Bi-Concave and 24 Bi-Convex Lenses of different focal lengths **£2 12 6**

(F) **10520** **Lenses,** Cylindrical, Plano Convex ... ... each **0 4 6**

(F) **10521** Ditto, ditto, Plano Concave ... ... „ **0 4 6**



10522



10523



10524

(F) **10522** **Lenses,** Prismatic, Plano, approximately 40 mm. square each ... ... each **£0 3 9**

(F) **10523** Ditto, ditto, Convex, ditto ... ... „ **0 3 9**

(F) **10524** Ditto, ditto, Concave, ditto ... ... „ **0 3 9**

(F) Foreign manufacture.



10526



10527



10529



10530

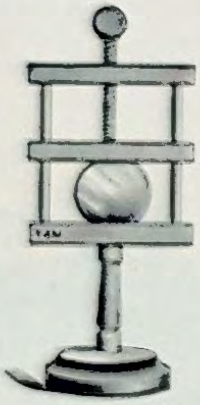


10531

10526	**Lens Holders,** Metal, to take lenses 38 or 50 mm. diameter each **4d.,** per doz.			**£0 3 6**
10527	,, ,, Hardwood, to take lenses 38, 50 or 63 mm. diameter each **1/5,** per doz.			**0 15 0**
10528	,, ,, in Teak, simple pattern without base, to take lenses 38 or 50 mm. each **5d.,** per doz.			**0 4 6**
10529	,, ,, Brass Clip on Polished Wood Base, to take lenses up to 65 mm. each			**0 1 0**
10530	,, ,, Mahogany Rings, with Brass Rods. To hold	38 **1/6**	50 **1/9**	63 mm. lenses **2/0** each
10531	,, ,, Metal, adjustable, for lenses up to 3 in. ... ... each			**£0 3 6**



10532



10533



10534



10535

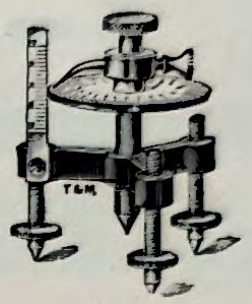


10536

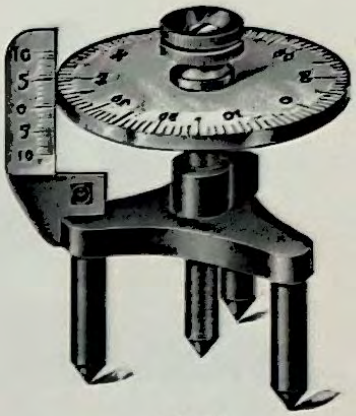
10532	**Lens Holders,** Sexton's, adjustable, Hardwood, taking lenses from 1½ to 3 in. each **2/0,** per doz.	**£1 2 6**
10533	,, ,, ,, with Screw Fittings instead of rubber rings each **2/3,** per doz.	**1 5 0**
10534	,, ,, Brass Sliding Rod, on Iron Foot, with Universal Joint ... each	**0 9 6**
10535	,, ,, Universal, New Form, Brass Sliding Rod on Tripod Foot, with Brass Arms and Cone adjustment, to take lenses up to 3 in.... each	**0 14 0**
10536	,, ,, Universal, improved form, with adjustable Screws, on Polished Brass Telescopic Stand, to take any lens up to 3 in. ... each	**0 15 6**



10537



10538

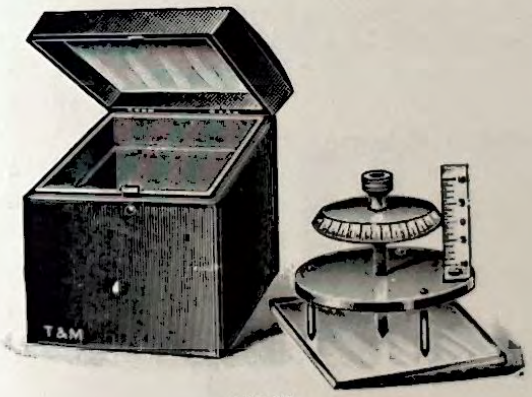


10539

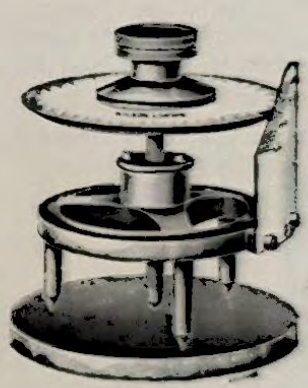
*10537 **Spherometer,** for measuring the curvature of Lenses, reading to $\frac{1}{100}$th mm. each **7/6**, per doz. **£4 5 0**

*10538 ,, Lavelle's improved form, with Index Pointer to facilitate reading each **9/6**, per doz. **5 8 0**

10539 ,, furnished with table to 5 cm. divided into 100 parts by a scale and reads to $\frac{1}{200}$th mm. ... each **0 18 6**



10540



10541

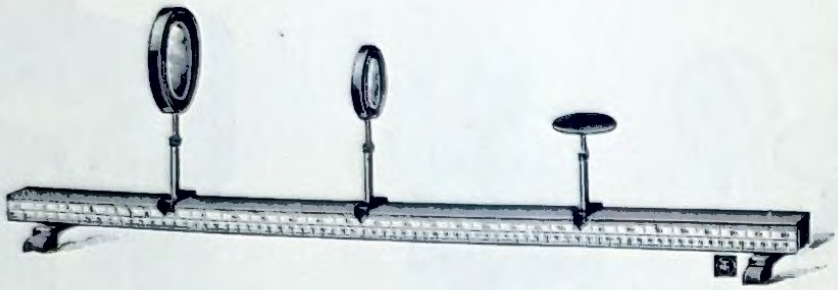


10542

10540 **Spherometer,** best quality and finish, reading 20 mm. to $\frac{1}{200}$th mm., Upright Scale, divided into $\frac{1}{2}$ mms., reading 10 mm. either up or down, bevelled Recording Disc, divided into 100 divisions, in Case, with Glass Trying Plate ... each **£2 0 0**

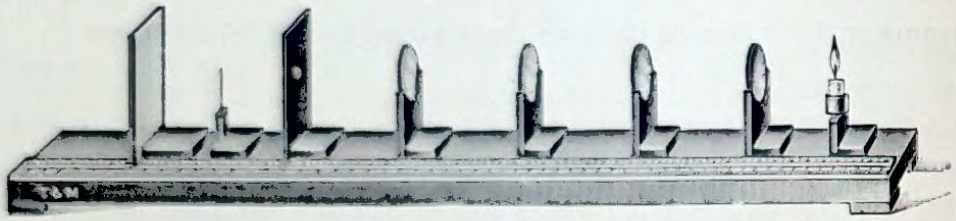
=10541 **Spherometer,** reading to ·001 mm. The screw is carefully calibrated, and any error in the pitch of the screw is compensated by inclining the scale in the required direction, thus ensuring accuracy of reading. A plane glass surface is supplied with each instrument. In Mahogany Case **4 4 0**

10542 **Lever Optical,** comprising Metal Plate with four needle points projecting from the under side, and a Mirror attached to the upper side, each complete in Case each **0 9 6**



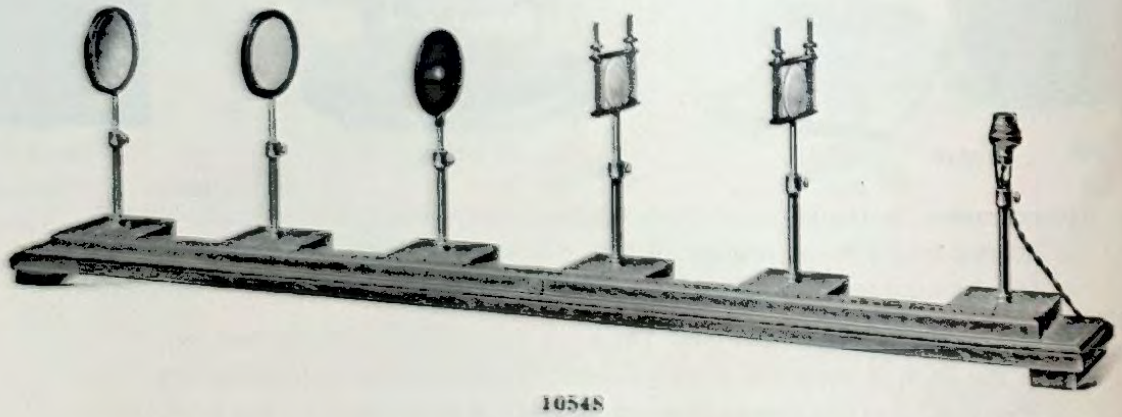
10543

10543	**Optical Bench,** Students', on Teak Base, Boxwood Scale, one metre long, fitted with Candle Holder, Lens Holder and Screen ... ... each	**£0**	**16** **6**



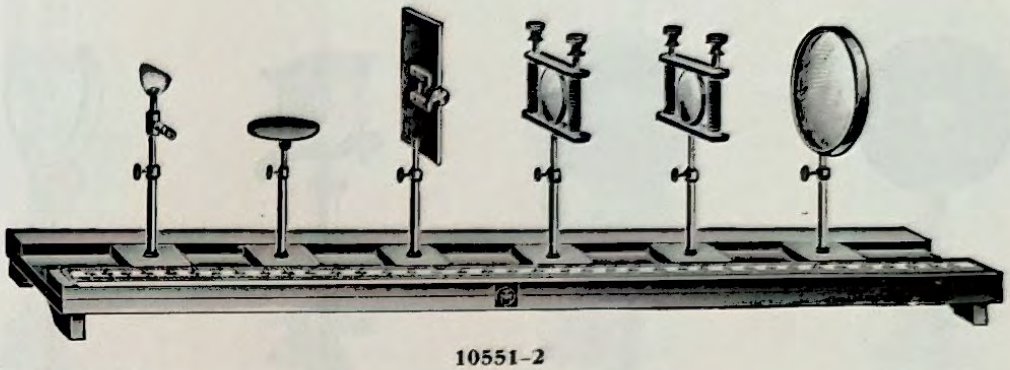
10544–7

10544	**Optical Bench,** for Students' use, 1 metre long, with Boxwood Scale on Hardwood Base, fitted with Candle Holder, Screen, four Lens Holders and Screen with Cross Wires ... ... each	**£1**	**2** **6**
10545	,, ,, with Base 2 metres long ... ... ,,	**1**	**15** **0**
10546	,, ,, Superior finish, 1 metre long, on Polished Mahogany Base with Fittings, as above ... ... each	**1**	**12** **6**
10547	,, ,, with Base 2 metres long ... ... ,,	**2**	**5** **0**



10548

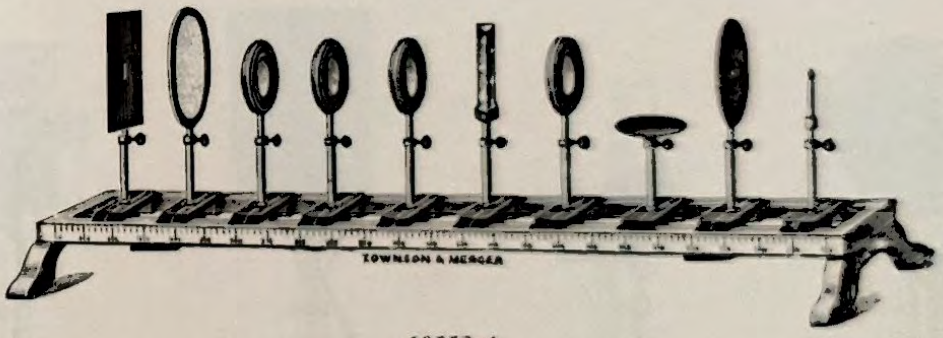
10548	**Optical Bench** on stout Polished Mahogany Base, length 130 cm., with Boxwood Scale 125 cm. long, divided into millimetres, with six Sliders with Mahogany bases, consisting of two adjustable Lens Holders, Ground Glass Screen, Cross Wires, Plane Mirror and Electric Light Holder with cord and plug (or Gas Burner) complete	**£3**	**15** **0**



10551–2

10551 **Optical Bench,** Polished Teak Base with Boxwood Scale, fitted with three adjustable sliding supports, Lens Holder, Ground-Glass Screen, Adjustable Slit, Gas Burner or Wired Socket for Electric Lamp, and Brass Table ... ... each **£3 12 6**

10552 „ „ 2 metres long ... ... „ **4 17 6**



10553–4

10553 **Optical Bench,** Polished Oak, 1 metre long, with Centimetre Scale and ten Sliding Supports, Brass Fittings on Iron Bases, Candle Holder, Prism, four Lens Holders, Table, Screen with Diaphragm Slit, and Ground-Glass Screen ... ... each **£5 10 0**

10554 „ „ 2 metres long, Centimetre Scale, folding at centre, with Fittings complete, as above ... ... each **7 10 0**

Fittings for Optical Bench



10555



10556



10557



10558

The following Fittings for Optical Benches can be supplied with feet of either pattern, as Nos. 10555, 10556 or 10557 at the same price.

10555	**Cross Wires** mounted on Metal Screen on adjustable Brass Support, on Polished Mahogany Base		**£0**	**15**	**6**
10556	**Bunsen Grease Disc** mounted on adjustable Brass Stand		**0**	**14**	**6**
10557	**Adjustable Lens or Mirror Holder,** fitted on new pattern Iron Base with Index, fine adjusting screw, etc., as illustration ... ... each		**0**	**16**	**6**
10558	Ditto, ditto, fitted on base, etc., as illustration ... ... ,,		**0**	**15**	**0**



10559



10560

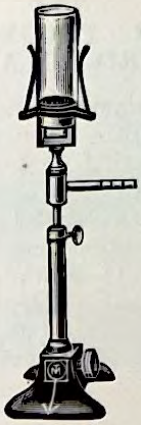


10561



10562

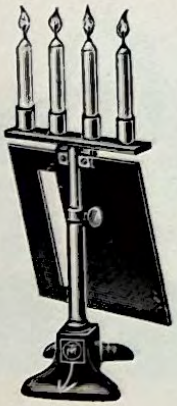
10559	**Adjustable Lens or Mirror Holder** mounted on adjustable Brass Stand ...		**£0**	**15**	**6**
10560	**Incandescent Gas Burner,** with Glass Chimney, on base, etc.		**0**	**12**	**0**
10561	**Adjustable Holder** for Electric Lamp, on Base, etc.		**0**	**11**	**6**
10562	Ditto, Gas Burner on Base, with Index mark, etc.		**0**	**10**	**6**



10563



10564

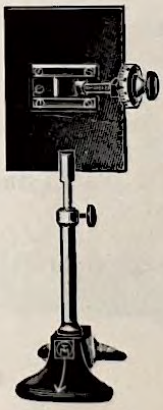


10565–6

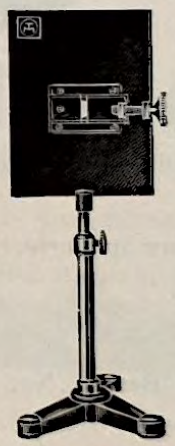


10567

10563	**Adjustable Argand Gas Burner,** with Glass Chimney, on Base, etc. ...	each	**£0**	**12** **6**
10564	Ditto **Candle Holder,** single	,,	**0**	**9** **6**
10565	Ditto, ditto, for four Candles	,,	**0**	**12** **6**
10566	Ditto, ditto, fitted with hinged Metal Screen which will cover three of the candles	,,	**0**	**15** **0**
10567	Ditto, Glass Screen, on Base, etc.	,,	**0**	**11** **6**



10568



10569

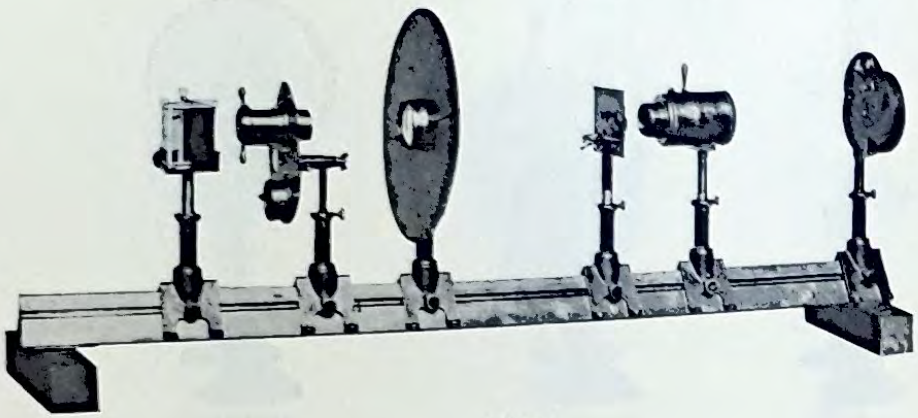


10570



10571

10568	**Adjustable Slit** with divided Micrometer Screw, reading to ·01 mm.	each	**£1**	**15** **0**
10569	Ditto, ditto, without the divided Micrometer Screw	,,	**1**	**7** **6**
10570	**Brass Table** for Prisms, etc.	,,	**0**	**9** **6**
10571	**Iris Diaphragm,** ditto, ditto	,,	**0**	**15** **6**

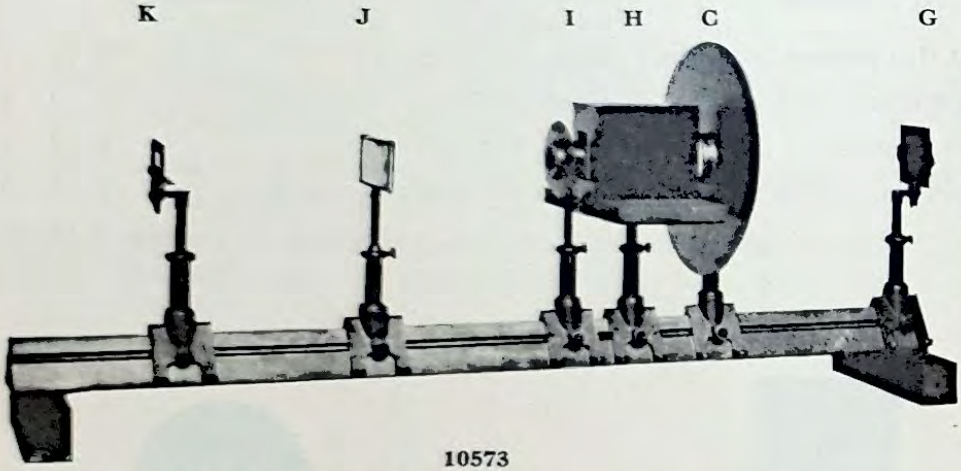


10572

=10572 PROJECTION SPECTRO-POLARISCOPE

A—Triangular Bottle Prism filled with Carbon Bisulphide. B—Rotating Disc, carrying a Nicol Prism used as an analyser, and a small Double Image Prism. C—Projection Lens with Metal Mask. D—Rotating Object Holder. E—Double Image Prism used as a Polariser. F—Rotating Plate of Apertures.

£28 0 0



10573

Scale $\frac{1}{8}$ in.

=10573 PROJECTION SPECTROSCOPE FITTED FOR COLOUR-MIXING EXPERIMENTS

J — Rectangular Double Convex Lens. K—Rectangular Aperture. G—Adjustable Slit. H—Direct Vision Spectroscope Prism. I—Iris Diaphragm.

£23 10 0

=10574 OPTICAL BENCH No. 1

Optical Bench No. 1 is an instrument of enormous possibilities to the Research Worker, Student, Lecturer, and Manufacturers generally.

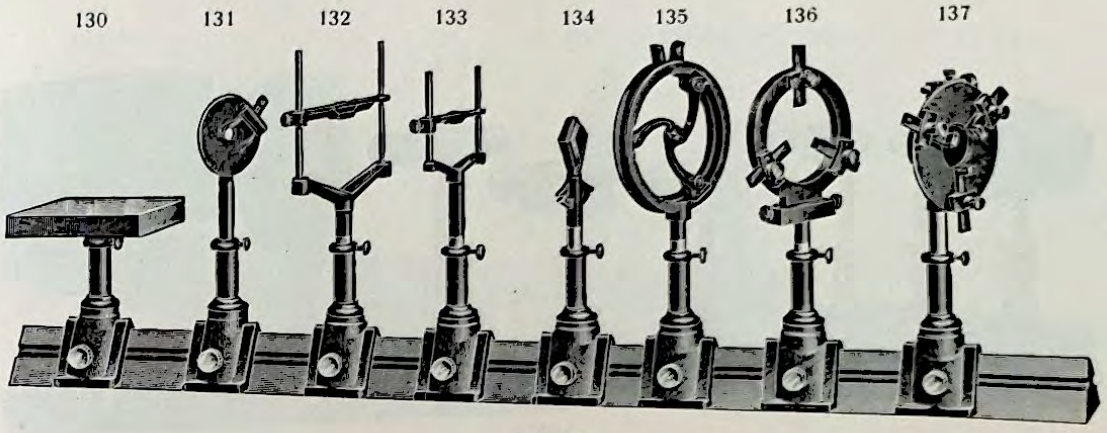
It consists of a Triangular Iron Bar of 60° from $\frac{1}{2}$ to 2 metres long. Upon this are placed Saddles that take the Optical Elements, and when placed in position **are in perfect alignment.**

To enable one to appreciate the apparatus fully, we here illustrate a few of its forms and uses.

The illustrations are photographs of apparatus used by Professor Cheshire in his lectures at The Imperial College of Science and Technology, South Kensington, and are reproduced by his courtesy.

Price of Universal Fittings for No. 1 Bench (No. 10574)

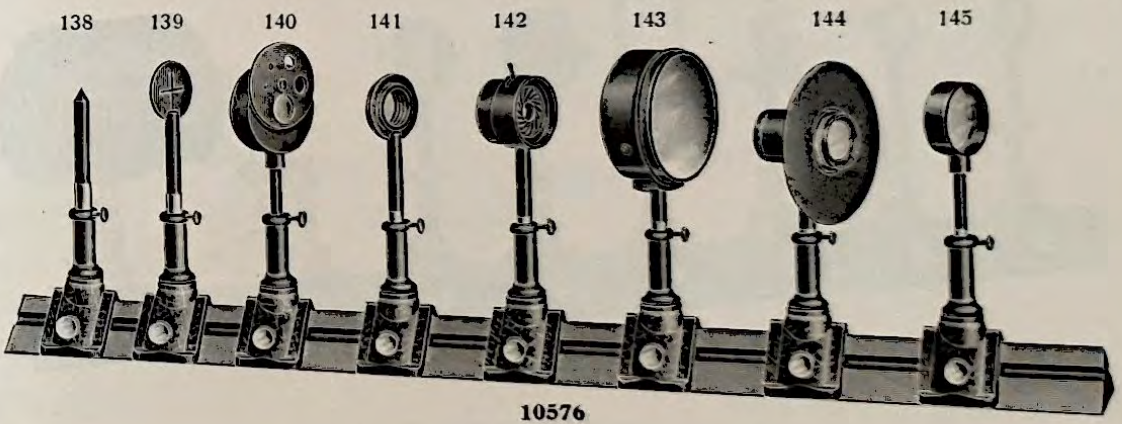
No. 107	1 Metre Optical Bench No. 1	each	£1	18 0
,, 109	2 Metre ditto	,,	6	0 0
,, 110	Saddle Stand (Standard)	,,	0	14 0
,, 111	Saddle Stand with Rack and Pinion for Vertical Adjustment	,,	2	0 0
,, 113	Saddle Stand, Base only	,,	0	10 0
,, 114	Ditto, extra long	,,	0	15 0
,, 115	Table Stand	...	0	10 0
,, 116	Wood Blocks to steady Bench for table use (9 in. × 2 in. × 2 in.)	pair	0	4 6
,, 117	Metal Toe Piece for fixing Bench to baseboard	each	0	3 0
,, 119	Baseboard for 1 Metre Optical Bench	,,	1	4 0
,, 121	,, ,, 2 Metre ,, ,,	,,	2	0 0



10575

UNIVERSAL STOCK FITTINGS FOR OPTICAL BENCH No. 1 and 2
=10575 **Mounted on Stems to fit Saddle Stands**

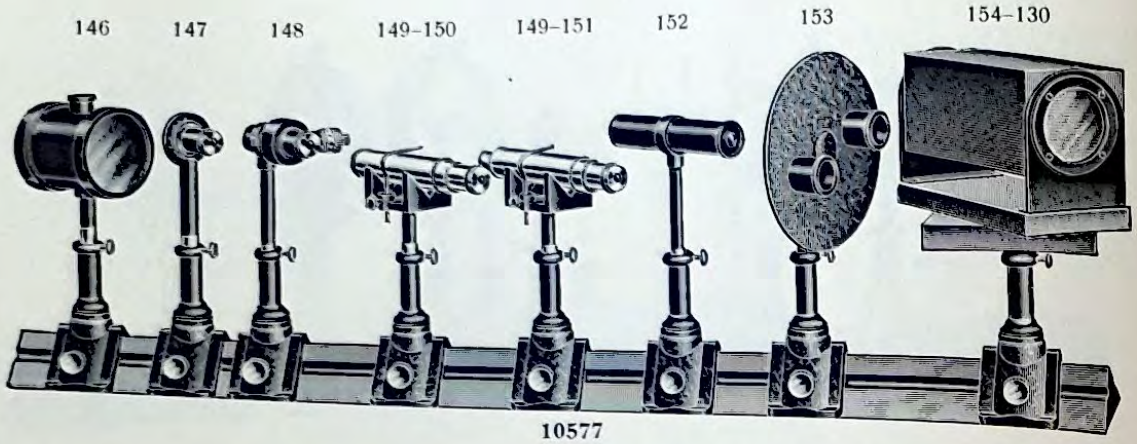
No.				
130	Table ... ... each	£0	8	6
131	Stae Plate with Rotary Movement ... ... ,,	1	0	0
132	Lens Holder, Sliding Grip Max. 10 cm. ... ... ,,	0	15	0
133	,, ,, ,, ,, 5 ,, ... ,,	0	12	6
134	,, ,, Spring ,, ,, 5 ,, ... ,,	1	0	0
135	,, ,, ,, ,, ,, 7·5 ,, ... ,,	1	5	0
136	,, ,, with independent centering adjustment and Cross traverse movement. Max. 7 cm. ... ... each	2	12	6
137	,, ,, with independent centering adjustment and Rotary Vertical movement. Max. 7 cm. ... ... each	3	0	0



10576

=10576

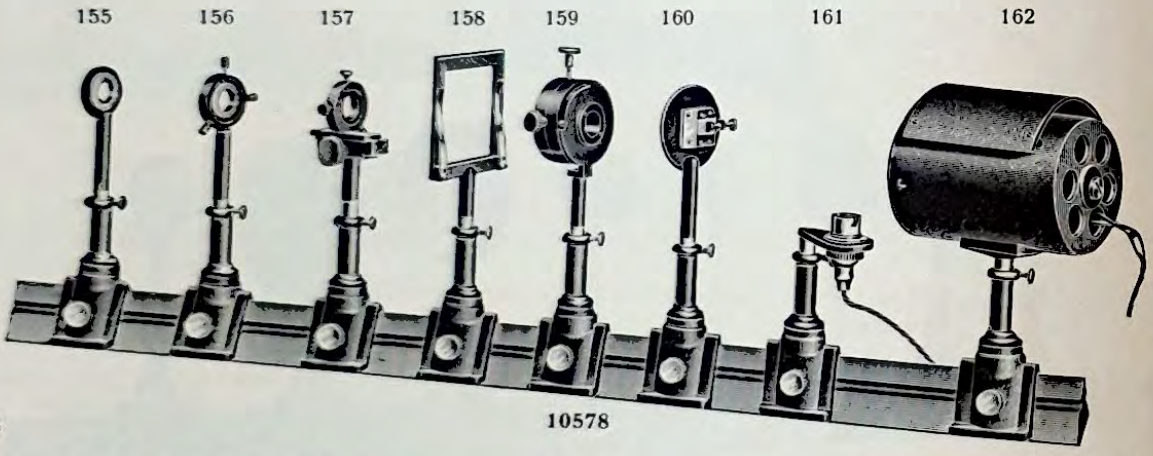
No.				
138	Centering Point ... ... each	£0	2	6
139	Metal Cross Line Diaphragm ... ... ,,	0	12	6
140	Rotary Stops—$\frac{1}{8}$, $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{13}{16}$ ... ... ,,	1	0	0
141	Iris Diaphragm, 4 cm. approx. ... ... ,,	1	10	0
142	,, ,, ,, ,, and Condenser ... ... ,,	2	10	0
143	Condenser, 4 in. diameter ... ... ,,	2	0	0
144	Projection Lens ... ... ,,	2	0	0
145	Focussing Lens, 4 in. focus, 2 in. diameter approx. ... ... ,,	1	5	0



10577

=10577 UNIVERSAL STOCK FITTINGS FOR OPTICAL BENCH No. 1 and 2
(Mounted on Stems to fit Saddle Stands).

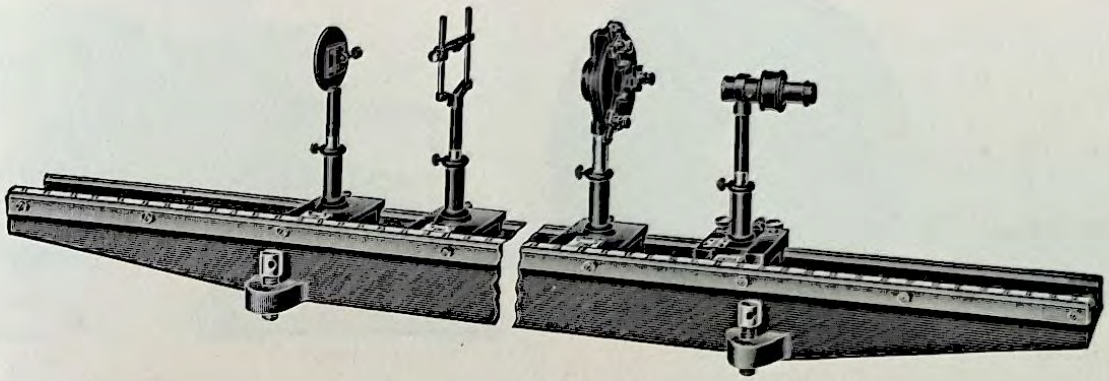
No.					
146	Water Tank	each	£1	10	0
147	Ramsden Eyepiece with X line	,,	1	6	0
148	Micrometer Eyepiece reading to ·01 mm.	,,	6	15	0
149	Vee Support for Telescope...	,,	0	17	0
150	Microscope (without Vee Support)	,,	2	10	0
151	Telescope ,, ,, ,, ...	,,	2	0	0
152	Collimator, 6 in. Focus	,,	2	0	0
153	Nicol Prism used as an analyser, and small double image Prism mounted on a Rotary Disc ...	,,	8	0	0
154	Double Image Prism (2 in. aperture) for Polariser (made from thin glass plates) mounted to rotate along its own axis	each	4	0	0



10578

=10578

No.					
155	Microscope Objective, Screwed Flange	each	£0	12	6
156	,, ,, ,, ,, with screw adjustment for centering	,,	2	0	0
157	,, ,, ,, ,, ,, ,, ,, ,, ,, and Rack and Pinion Focussing	each	5	0	0
158	Glass Screen Holder	,,	0	15	0
159	Double Optical Slit with Rotary Movement	,,	10	0	0
160	Single Optical Slit	,,	2	5	0
161	Electric Lamp Holder	,,	0	12	6
162	Projection Lamp in Metal Body (100 watt)	,,	2	0	0
Prisms.					
167	Hollow Prism 60°, 2¼ in. aperture (with ground-in Stopper)	approx. ,,	3	0	0
168	Direct Vision Spectroscope Prism, 1½ in aperture	,, ,,	10	0	0
169	Nicol Prism, ½ in. aperture	,, ,,	3	0	0
170	Double Image Prism, ½ in. aperture (Rochon's type)...	,, ,,	3	0	0



10580

OPTICAL BENCH No. 2

The Bench consists of a Cast Iron Bed, with half-round and plain section, and made in lengths from ½ to 2 metres, supported by four levelling screws. A millimetre Scale runs the whole length and is read by a Vernier to ·1 mm. The Saddles can be clamped in any position on the bed and are supplied with various adjustments as stated below.

=**10580** **Bench,** as illustrated, consisting of the following fittings:—

1½ metre Optical Bench ... No. 174	1 Lens Holder ... ... No. 137		
3 Saddles ... ... „ 176	1 Lens Holder ... ... „ 133		
1 Saddle ... ... „ 177	1 Slit ... ... „ 160		
1 Micrometer Eyepiece ... „ 148		**£32**	**2**	**6**

No.	**Prices for separate Fitments**			
172	½ Metre Optical Bench No. 2, with millimetre Scale ... ... each	**£4**	**0**	**0**
173	1 Metre ditto, ditto ... ... „	**7**	**0**	**0**
174	1½ Metre ditto, ditto ... ... „	**12**	**0**	**0**
175	2 Metre ditto, ditto ... ... „	**16**	**0**	**0**
176	Saddle, Plain ... ... „	**1**	**10**	**0**
177	Saddle, with fine adjustment Transverse Slide ... ... „	**3**	**0**	**0**
178	Saddle with Rack and Pinion for Vertical adjustment ... ... „	**3**	**0**	**0**
179	Saddle with Rack and Pinion, also Transverse Slide ... ... „	**4**	**0**	**0**

Optical Fittings

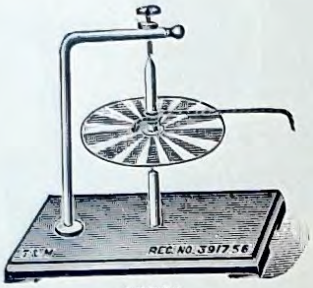
NOTE.—All our Universal Fittings on Pages 313 and 314 are interchangable with this Bench.



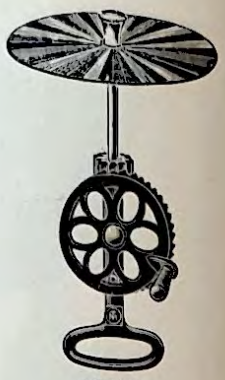
10584



10585

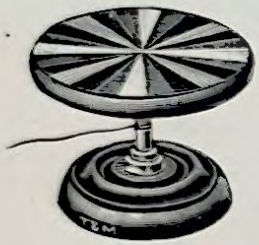


10586



10587

		Sizes	4	5 in.
10584	**Newton's Disc,** Card only...		**6d.**	**8d.** each
10585	**Maxwell's Colour Discs,** consisting of seven cards, separate colours, each having a radial slit; they can be placed over each other and one card with seven colours combined. Price, per set of 8			**£0 2 3**
10586	**Newton's Disc,** registered pattern, on Polished Mahogany Base, with 5-in. Disc...			**0 12 0**



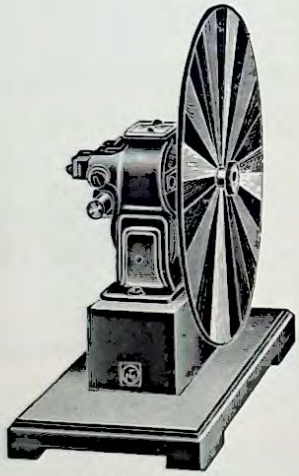
10588



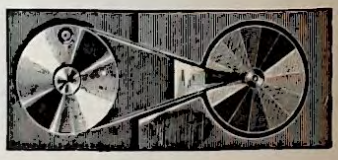
10593



10589-90

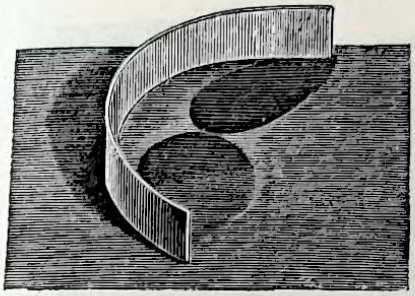


10591-2

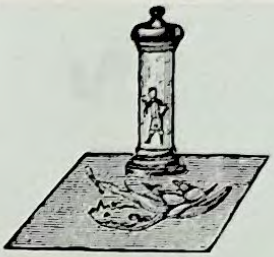


10594

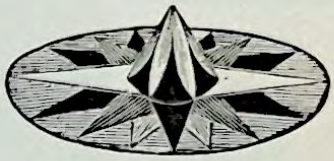
10587	**Newton's Disc,** simple pattern, as supplied to the London County Council, etc.	**£0 7 6**
10588	Ditto, for hand use, with Centrifugal action, with 5 in. Disc	**0 12 0**
10589	Ditto, with Driving Wheel for Hand Power; diameter of Metal Disc, 5 in., mounted on Metal Stand...	**0 12 6**
10590	Ditto, with 9-in. Disc	**0 15 0**
10591	**Newton's Disc,** 9-in. diameter, mounted on Teak Base, with Motor ... each	**1 17 6**
10592	Ditto, ditto, 5-in. Disc, with smaller Motor ... ... ,,	**1 1 0**
10593	Ditto, ditto, 9-in., mounted for Whirling Table ... ... ,,	**0 6 0**
10594	Ditto, ditto, for Lantern use ... ... ,,	**1 8 6**
10595	Coloured Glasses, red, orange, yellow, green, blue, violet, 4×3 inches ... per set	**0 3 0**



10596

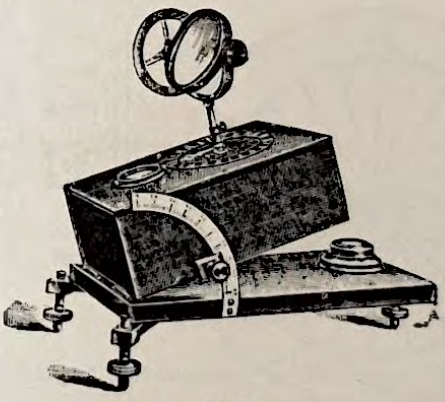


10598



10599

10596	**Mirror,** Semicircular, Glass, Silvered, Concave, for showing Caustic Curve by reflection (*vide* Clay's "Practical Exercises in Light") ... ... each	**£0**	**2**	**6**
10597	Ditto, ditto, Convex ... ... ,,	**0**	**2**	**6**
(F) **10598**	**Cylindrical Mirror,** with four distorted Pictures	**1**	**1**	**0**
(F) **10599**	**Conical Mirror,** ,, ,, ,, ,, ...	**1**	**1**	**0**



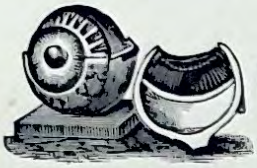
10600



10601

10600	**Heliostat,** with Clockwork in Mahogany Case, best finish, Spirit Level, Levelling Screws, and Divided Circle	**£16**	**0**	**0**
10601	Ditto, ditto, in Polished Brass Cylinder, Graduated Circle and Levelling Screws...	**8**	**10**	**0**

(F) Foreign manufacture.



10602–3



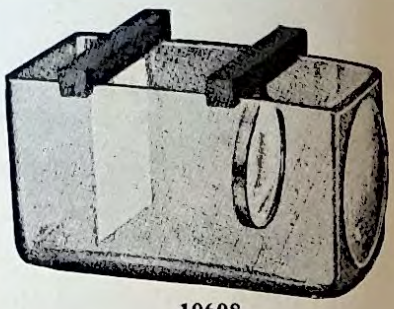
10604



10606

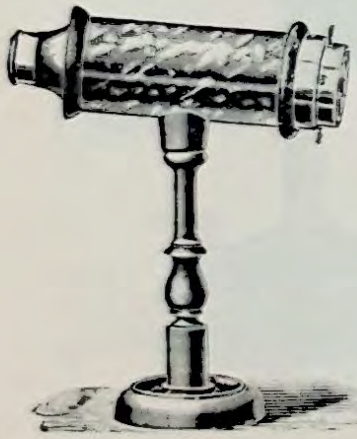


10605

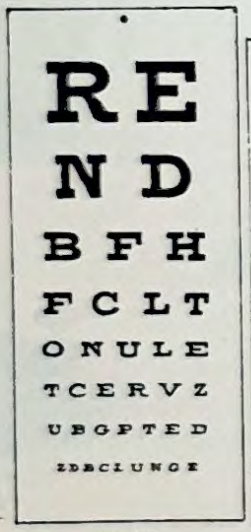


10608

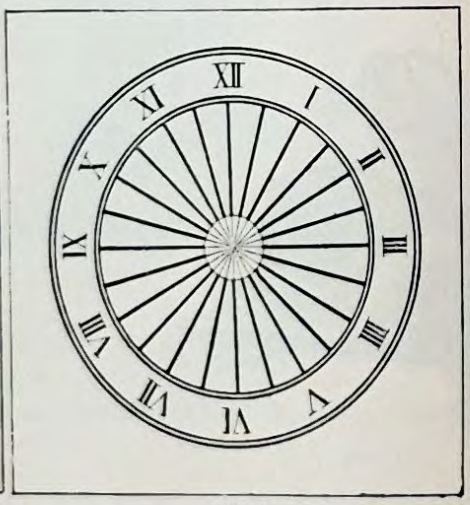
(F) **10602**	**Model of Eye,** by Bock, dissectable, five times enlarged ... ... each	£1	2 6
(F) **10603**	Ditto, ditto, as above, but ten times enlarged ... ... ,,	1	10 0
(F) **10604**	**Eyeball, in the Orbit with Optic Nerve,** enlarged three times natural size, showing attachment of muscles, divisible into cornea, choroida, vitreous body, and crystalline lens (new model)...	2	0 0
10605	**Optical Eye,** to explain Myopy and Presbyopy	1	15 0
(F) **10606**	**Kaleidoscopes,** simple ... ... each	0	2 6
(F) **10607**	,, Brass Case, Nickel-plated, on Stand ... ... ,,	0	15 0
(F) **10608**	**Glazebrooks' Apparatus,** for experiments on the Eye and Vision, consisting of a rectangular Glass Trough, with Capsule cemented forming end (*vide* Glazebrooks' "Light") ... each	1	1 0



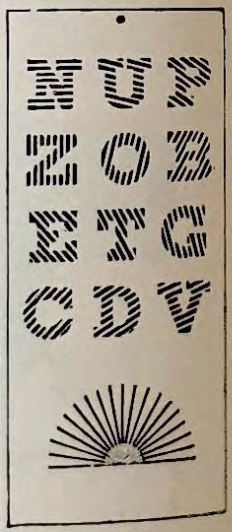
10607



10609



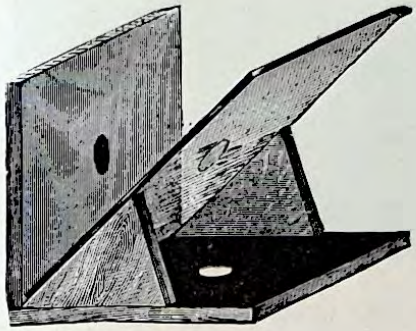
10610



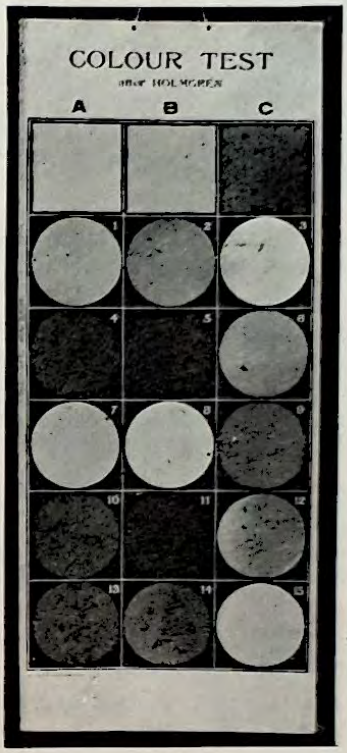
10611

(F) **10609**	**Charts,** mounted on Cardboard for distance tests, size 22 × 9 in. ... ... each, nett	£0	2 0
(F) **10610**	**Astigmatic Clock Dial,** size 20½ × 18½ in. ... ... ,,	0	3 0
(F) **10611**	,, **Chart,** 22 × 9 in. ... ... ,,	0	2 0

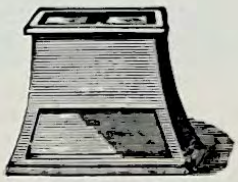
(F) Foreign manufacture.



10612



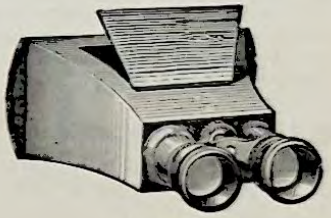
10614



10615



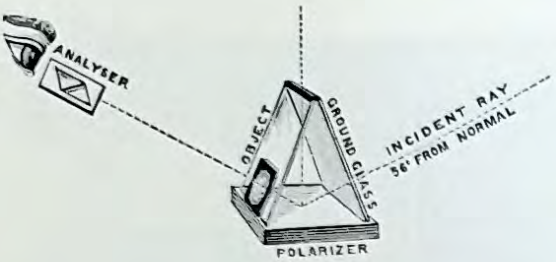
10613



10616

10612	**Apparatus for showing Contrast of Colours,** complete with four coloured Glasses... ... ... each	**£0 17 6**
10613	**Holmgren's** Set of Coloured Wools, for Colour Blindness ... ... ,,	**0 11 6**
10614	**Tests for Colour Blindness.** By means of this Chart the testing of Colour Perception is rendered very simple. The few necessary short rules are printed on the back of the actual chart. Mounted on stout Cardboard, eyeletted and strung, ready for hanging. Approx. size, 21 × 10 in.	**0 4 9**
(F) **10615**	**Stereoscope,** in Mahogany Case, cheap form	**0 11 6**
(F) **10616**	Ditto, with Rack Adjustment, in Rosewood Case	**1 5 0**
(F) **10617**	**Slides,** for use with the above, assorted ... ... per doz.	**0 10 0**

(F) Foreign manufacture.



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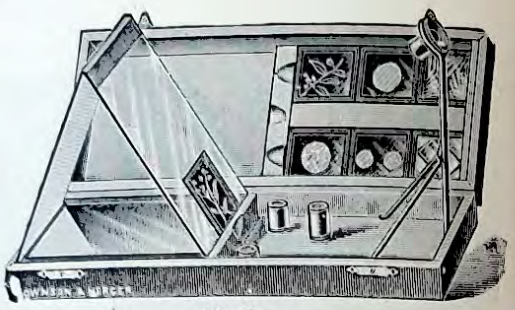


10619

10618 Apparatus to show the Effects of Polarized Light, consisting of items Nos. 1 to 8, as under, with Analyser, complete **£1 15 0**

Instructions for use.

Let the light fall at an angle upon the pile of Glass Plates, giving a clear reflection by means of the Greyed Glass. The objects mentioned below may now be laid on the front slanting Glass and observed through the Analyser at an angle of about 56°, and on revolving the latter the effects will be plainly visible.

(1) Selenite even thickness (even tint) gives two complementary colours, the result of the retardation of the undulation of White Light, the colours only being shown by the Analyser separating them.

(2) Two small discs of Selenite to prove above, each showing its complementary colours alternately.

(3) Benzoic Acid.

(4) Selenite Macle. Crystallographic force exerts great influence in the arrangement of molecules, for instance: Frost on the window pane and shown here by Benzoic Acid, and again by Selenite, as representing Crystals.

(5) Selenite uneven thickness (uneven tint).

(6) Ditto, design. Selenite laminates into all thicknesses, as shown by the above. Various designs can be made by this substance, also Mica, the perfection and beauty being only limited by practice or expense.

(7) Polarizing Pile.

(8) Greyed and Plain Glass.

10619 Educational Polarized Light Apparatus ... ... per set **£2 17 6**

This is intended to encourage the elementary study of that beautiful branch of Optics which has hitherto been so difficult without the aid of elaborate and costly apparatus.

To Use the Apparatus.

Raise wire carrying Brass Eyepiece, and fix it by means of second wire.

Now place Box in such a position that when looking down through the brass tube you see a good reflection of light; next stand the Hinged Glasses on the Reflector like the letter A (the ground glass being farthest from you).

Ordinary light is composed of vibration undulating in all planes, and in this condition it passes through the ground glass and falls on the black glass reflector at an angle of about 56°, but it is only the vibrations undulating horizontally that are reflected, the others passing through and being absorbed by the black back.

When light thus undulates in one plane only, it is called Polarized Light.

On looking through the Brass Eyepiece which contains the Analyser (or in other words a second Polarizer) the field will appear alternately bright and dark as the eyepiece is revolved.

If now the two circles of Selenite (even tints) are placed against the plain glass between the Polarizer and the Analyser on revolving the tube the two complementary colours will alternately appear. This is caused by the Selenite, which is one of the substances that have the property of splitting a ray which undulates in one plane into two distinct rays which undulate at right angles to each other; it follows then that only the set of undulations whose plane coincides with the Analyser can be reflected again by it and then pass out through the hole at the side of the eye tube, the other set of rays passing direct through the Analyser, which therefore, on being revolved alternately, shows the complementary colours at each quarter of a revolution.

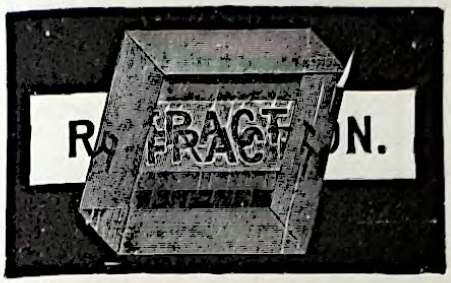
The particular colour of the "even tints" is dependent upon the thickness of the Selenite; this is shown by the "uneven tint," which is a plate of Selenite broken up into an irregular surface, each different thickness showing its particular amount of retardation and therefore colour. The amount of retardation which can be obtained by Selenite is seen by the "Selenite Wedge," which is so ground as to give the three orders of colours in perfect gradation; the red at the thickest side retards thirteen quarter undulations, while the red at the thinnest only retards five quarters.

Various designs, such as birds, flowers, etc., are produced by the selection of suitable colours, which are cut out and joined together.

Not only inorganic but organic substances have the property of double refraction or showing colour in Polarized light, a piece of horn being a typical specimen. The rings surrounding the optic axes of Crystals form a most interesting study, that form named the Uniaxial System is shown by the Calc Spar. The Biaxial System is represented by Nitre, and the circular by Quartz. These crystals are to be slipped on the further end of the brass analysing tube instead of being placed against the glass support, it being necessary that they should be near the eye.

The beautiful effects of crystallizations are represented by Benzoic Acid.

Further objects and experiments can be added to this set if desired.



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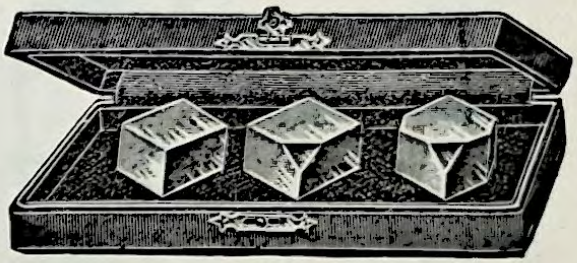
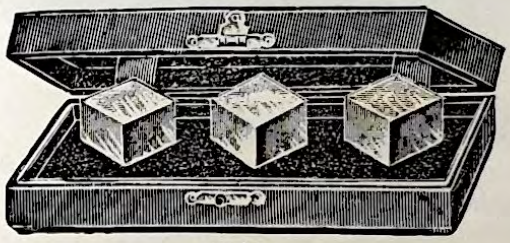


10622

(F) **10620** **Plates,** Uranium, Glass ... ... each, from **£0 5 6**

(F) ***10621** **Rhombs,** of Iceland Spar, selected pieces for showing double refraction „ **0 12 6**

(F) ***10622** „ of Fluor Spar, Set of Three, in Case **5 15 0**



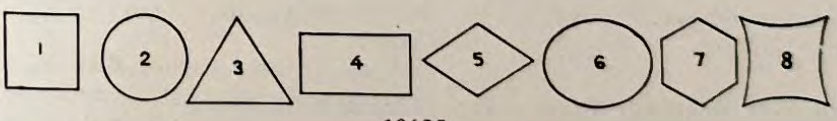
10623



10624

(F) ***10623** **Cubes**—Uranium, Didymium, and Fluor Spar, Set of Three, in Case ... **£2 5 0**

(F) **10624** **Tourmaline Forceps,** or Pincette, consisting of two Tourmalines mounted in two Rings of Silvered Copper, coiled to form a Spring ... ... each **0 17 6**



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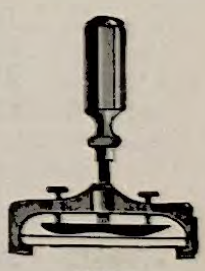


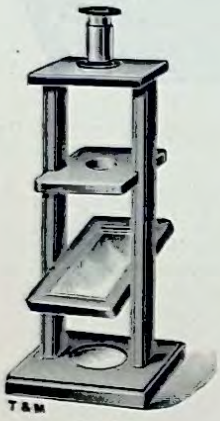
10627

(F) ***10625** **Unannealed Glass,** in eight different forms ... each, **13/6**; per set of 8, **£5 5 0**

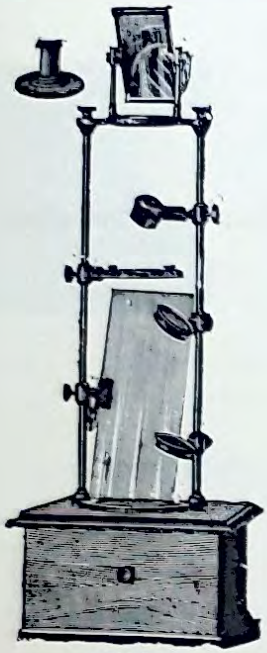
10626 **Presses,** for showing the Polarisation of Glass under pressure **1 7 6**

10627 Ditto, for bending **1 7 6**

(F) Foreign manufacture.



10628



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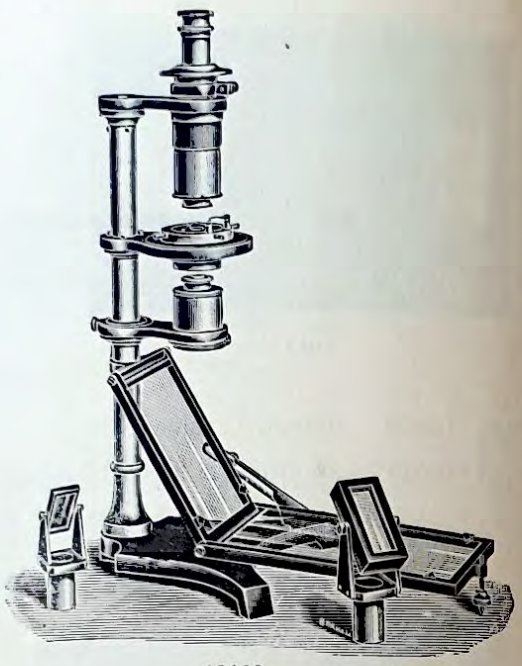


10630

***10628** **Noremberg's Polariscope,** in Polished Mahogany Frame with Nicol's Prism, complete **£2 5 0**

(F) *10629 **Polariscope,** best make, with Nicol's Prism, Double Refracting Prism, Black Mirror, six unannealed Glasses and six Crystals mounted on Mahogany Base, with Drawer... ... ... **12 10 0**

=10630 **Polariscope,** The Polariser consists of two reflecting Glass Plates. Three Analysers are supplied, viz., Nicol Prism, Black Mirror, and a pile of Glass Plates. The Analyser Holder is divided into eight parts 45° apart. The Stage is rotatable, and is divided to degrees. A Metal and a Glass Plate, which fit the Stage, are supplied. The lower arm can be swung out of line with the instrument, when not required, or for the insertion of Lenses, etc. One Illuminating Lens and two convergent Lenses are supplied. Polariser of Glass Plate and Mirror fitted, if desired.

In Case **£13 10 0**
Nicol Prism Polariser, large, with two Illuminating Lenses to render the rays parallel **3 4 0**
Two sets of three highly convergent Lenses **2 8 0**

=10631 **Crystals,** mounted in Cork:—

Ammon. Phosphate.	Brucite (from Texas).	Pot. Bichromate.	
Arragonite.	Calcspar.	Pot. Ferrocyanide.	
Borax.	Nitre.	Quartz.	
		Sodium Nitrate. each	**£0 7 6**

=10632 **Selenite Designs,** mounted in Mahogany Frames, for use with Polariscope:—

Cube	each	**£0 6 3**	Dancing Girl	each	**£2 12 6**
Star	,,	**0 10 6**	Bust of Lady	,,	**1 15 0**
Wild Flower ...	,,	**1 2 0**	Butterfly...	,,	**1 10 0**
Tulip	,,	**1 2 0**	Chameleon	,,	**1 2 0**
Dolphin	,,	**1 2 0**	Bunch of Grapes ...	,,	**1 10 0**
Flag of Iris ...	,,	**1 2 0**	Church Window ...	,,	**1 15 0**
Heartsease ...	,,	**1 2 0**	Parrot	,,	**1 10 0**

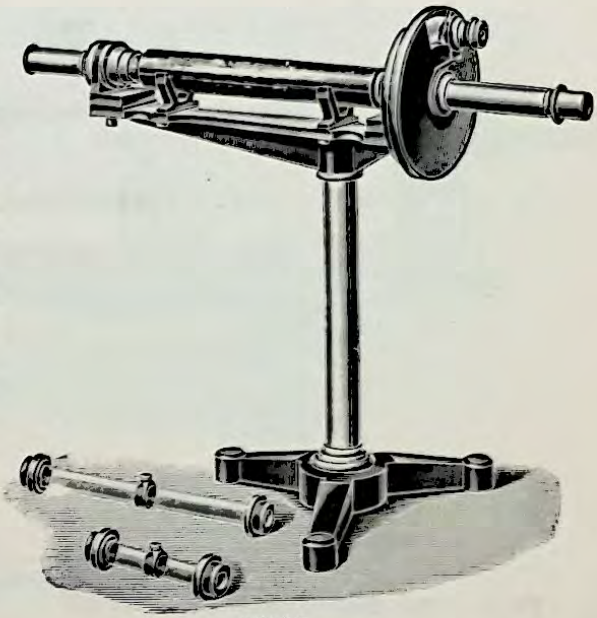
(F) Foreign manufacture.

=10633 Polarimeter

The Polarimeter is constructed on Laurent's half-shadow principle, and is intended chiefly for students' use.

The Polariser consists of a rotatable Nicol Prism, the position of which can be read to one degree by divided arc and index, and a Laurent's half-shadow plate. In front of the Polariser is placed a small chamber for the reception of a liquid colour filter, usually bichromate of potassium. The Analyser consists of a Nicol Prism, carried by a protected divided circle read by vernier to ·1 degree, and an observing Telescope. Two solution Tubes, 10 and 20 cm. long, are supplied—these are placed in a piece of tube which lies concentrically with the axis of the instrument.

Price, in Case **£12 0 0**



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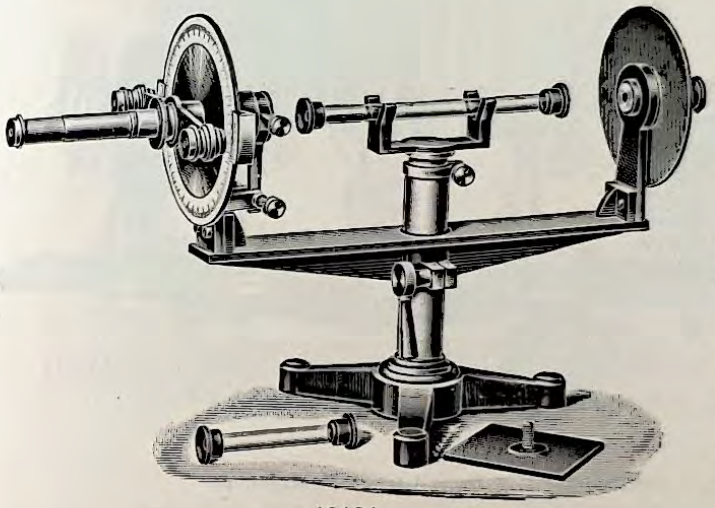


10634

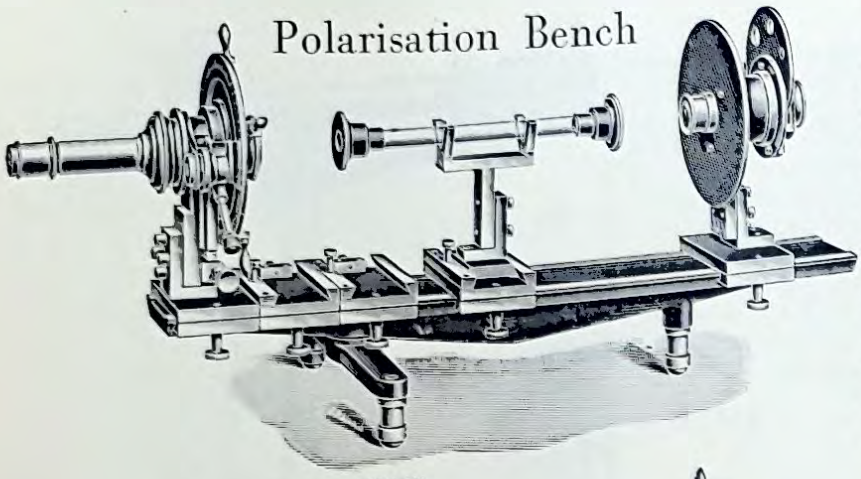
=10634 Polarimeter

This instrument is designed primarily for Teaching purposes, and is so constructed that the various methods of measuring the rotation of the plane of polarisation can be carried out in the same instrument.

It is thus possible to compare the different methods and to show the student any advantage one method may have over another for any specific purpose. The transforming of the instruments from one type to another is rapidly and easily made. Starting with the plain instrument, the accessories listed below can be added, so as to obtain any type of polarimeter or saccharimeter in current use, and this without sacrifice of accuracy. The Polariser and Analyser are mounted at the ends of a strong iron bar, which slides up or down, and can be clamped to a stout vertical pillar, supported by a heavy iron Tripod. A stout Draw Tube slides within the vertical pillar, and can be clamped thereto—it carries the supports for solution tubes, troughs, etc. At one end of the iron bar are fixed the Nicol Prism Polariser and collimating lens; at the other end are fixed the Nicol Prism Analyser and observing Telescope. The Analyser is mounted in a vertical circle read by two opposite verniers to ·01 degree; provided with Clamp and fine adjustment and two small reading Microscopes. Two solution Tubes are supplied with the instrument.

Price, in Case		**£19**	**5**	**0**
Biquartz fitted to the above	extra	**1**	**4**	**0**
Laurent's half-shadow Quartz Plate, with index and graduated arc, fitted to the above ...	,,	**2**	**0**	**0**
Poynting's Quartz Plate, fitted to the above	,,	**1**	**12**	**0**
Lippich two-prism Polariser, fitted to the above	,,	**5**	**12**	**0**
Soleil Quartz Wedges and Compensation Plate, with scale and vernier and rack-motion adjustment, fitted to the above	extra	**8**	**0**	**0**
Solution Tube, 10, 15, 20, 25, 30 cm.	each	**0**	**12**	**0**
Glass Troughs, price according to size.				
Apparatus to convert the instrument into a Wild's Polaristrobometer	extra	**4**	**16**	**0**
Light Filter, to fit over collimating lens	,,	**0**	**12**	**0**

Polarisation Bench



10635

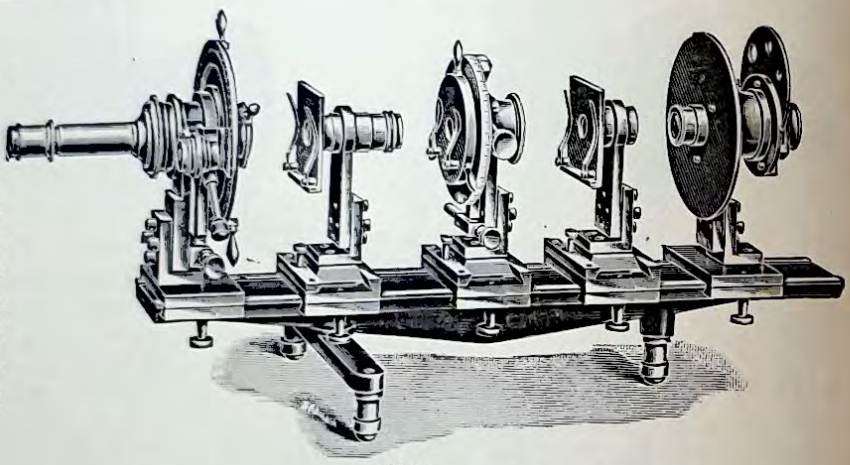
Fig. 1 represents the Bench as a Polarimeter.

=10636 The Bench, including five slides (three of which have transverse slides), Nicol Prism Polariser, Nicol Prism Analyser in divided circle, and supports fitted in the three transverse slides; two solution tubes, 10 and 20 cm., and support for solution tubes.

£19 10 0

=10635 Polarisation Bench.

The Bench is 21 inches (53 cm.) long, of cast iron and supported on three feet. Five carriages slide along the Bench, and can be clamped thereto. The two end slides have only longitudinal motion, and carry the Polariser and Analyser. The other three slides have transverse slides at right angles to the length of the Bench, and carry the various accessories, such as rotating stage, Soleil quartz wedges, solution tubes, Babinet Compensator, ¼-wave plates, Mach's rotating apparatus, etc. Biquartz, Laurent's half-shadow plate, Poynting's plate, etc., fit in the Polariser support. The Analysers are mounted to fit into the centre of a divided circle, read by two opposite verniers to 1 minute, with clamp and fine adjustment. The Polariser is provided with a graduated arc and index.



10636

Fig. 2 represents the Bench as a Polariscope.

A.	Soleil Quartz Wedge and Compensation Plate, with Scale and Vernier and Rack Motion adjustment fitted to the above...		**£8**	**10**	**0**
B.	Biquartz fitted to the above...		**1**	**5**	**0**
C.	Laurent's Half-shadow Plate, fitted to the above		**1**	**10**	**0**
D.	Poynting's Quartz Plate ,, ,, ...		**1**	**10**	**0**
E.	Lippich Two-prism Polariser ,, ,, ...		**5**	**15**	**0**
F.	,, Three- ,, ,, ,, ,, ...		**8**	**5**	**0**
G.	Solution Tubes: 10, 15, 20, 25 and 30 cm.	each	**0**	**12**	**0**
H.	Glass Troughs, price according to size.				
I.	Observing Telescope, fitted to Analyser		**1**	**5**	**0**
J.	Calc-spar Plates, etc., to show the principle of Wild's Polaristrobometer (with this apparatus the analyser is to be used as polariser)		**4**	**5**	**0**
K.	Rotating Stage, with Clamp and Fine Adjustment divided to 5 minutes, with support ...		**4**	**18**	**6**
L.	Black Mirror Analyser, to take the place of the Nicol		**0**	**19**	**6**
M.	Pile of Thin Glass Plates, as analyser, to take the place of the Nicol		**0**	**19**	**6**
N.	Plate of Tourmaline, as analyser		**1**	**2**	**6**
O.	Double image Prism		**1**	**5**	**0**
P.	Pair of Lenses, mounted to give parallel rays		**0**	**16**	**6**
Q.	Two Convergent Lenses		**0**	**16**	**6**
R.	Two Sets of three Highly Convergent Lenses		**2**	**10**	**0**
S.	Red and Blue Glasses, mounted in rotating plate		**0**	**13**	**6**
T.	Babinet Compensator, with extra Nicol and mount, and Adapter, to fit either in front or behind the analyser		**7**	**10**	**0**
U.	Quarter-wave Plate and Stage		**0**	**14**	**0**
V.	Dovetail Slide, with Rack and Pinion Movement, to carry wedges of Quartz, Selenite, etc.		**1**	**5**	**0**
W.	Quartz Wedge		**2**	**2**	**0**
X.	Selenite Wedge		**0**	**16**	**6**

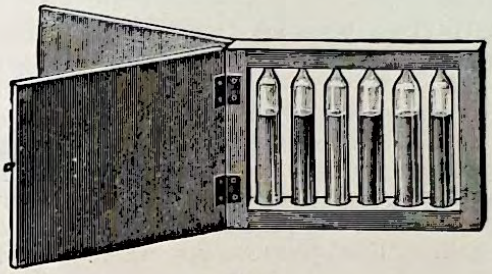


10638



10639

		8	10		in.
(F) **10638**	**Vacuum Tubes,** containing one Phosphorescent Powder ...	**5/0**	**6/0**		each
		12	14		in.
(F) **10639**	Ditto, ditto, containing two Phosphorescent Powders	**8/6**	**10/6**		each



10640



10641

(F) **10640** **Fluorescent Liquids,** in sealed Glass Tubes, 4 in. long.

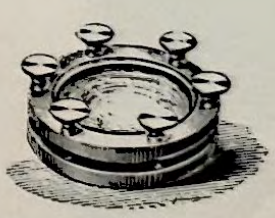
In Sets of	6	8	10	12
	16/6	**22/0**	**27/6**	**31/0**

(F) **10641** **Phosphorescent Powders,** flat Tubes in Case, the phosphorescence being produced by Sunlight or Arclight, and phosphoresces on opening in Dark Room.

Set of	3	5	8 different Colours.
	10/0	**16/6**	**21/6**



10642-3



10644

10642 **Newton's Ring Apparatus,** consisting of 1 each Glass Plates, plane and slightly convex, mounted in Brass Frame with three adjusting screws... ... each **£0 18 6**

10643 Ditto, ditto, but in Iron Frame ... ... ,, **0 16 0**

10644 Ditto, ditto, superior finish in Brass Frame, with six adjusting screws. Size of Plates, 8 cm.... ... ... each **2 2 0**

(F) Foreign manufacture.

The Thorp Diffraction Gratings



Transmission Diffraction Gratings—Moulded replicas of Rowland's Metallic Gratings of 14,438 lines to the inch.

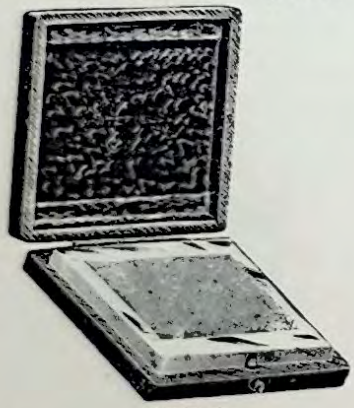
By the ingenuity of Mr. T. Thorp, of Manchester, a method was discovered by which they could be cast in celluloid, and thus could be duplicated at a moderate cost.

This process copy of a Photograph of the Spectrum of Iron obtained from these Gratings by C. P. Butler, Esq., A.R.C.S., Royal College of Science, London, speaks for itself as to the excellence of their performance.

Diffraction Gratings produce a pure spectrum, and are for this reason superior to any arrangement of prisms. The effect of glass upon light, as is well known, is of an irregular character, and thus when light is spread out into a spectrum by means of a glass prism the rainbow colours do not occupy their normal positions. The red is always cramped into much too small a space, and the relative appearance of the other portions of the spectrum vary according to the particular sample of glass of which the prisms are made. In the red end of the spectrum the B group is readily seen with the smaller diffraction spectroscopes, whereas a prism spectroscope requires the use of a train of prisms to resolve it.

Diffraction Gratings spread out or disperse the light into its constituent colours with exactitude in the true ratio of the wave-lengths, and thus measurements made with Diffraction Spectroscopes correspond to definite wave-length values, while measurements made with prismatic spectroscopes are arbitrary, and only apply to the particular instument with which they were made.

These gratings are supplied on parallel plates of glass, and each one has the actual number of lines per inch marked upon it, so that the measurement of the wave-length of light may by their means be accurately determined, and are suitable for work of the highest class, both for visual and photographic, as well as for projection purposes, and give brilliant spectra.



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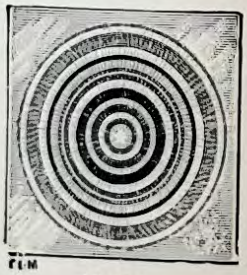


10650

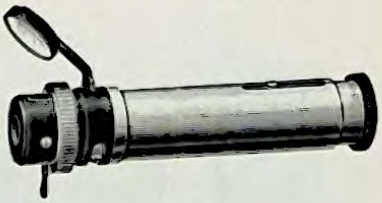
10646	**Plane-Gratings,** in velvet-lined Case, 25×25 mm., mounted on selected Plate Glass ... ... each	**£1**	**13**	**0**
10647	Ditto, Special Quality, Extra Brilliant, 25×25 mm., mounted on Worked Glass each	**2**	**4**	**0**
10648	**Students' Hand Diffraction Grating Replica,** size about ½ in. square, cast in Celluloid from an original Rowland's grating and mounted between two protecting plates of glass. These gratings are not intended for use with spectroscope, but for use in the hand ... ... each	**0**	**3**	**3**
10649	**Stands,** Brass, for above ... ... ,,	**0**	**5**	**6**
10650	**Diffraction Grating,** for Lantern use, 5,000 lines to the inch ... ... ,,	**1**	**10**	**0**



10653



10654



10656

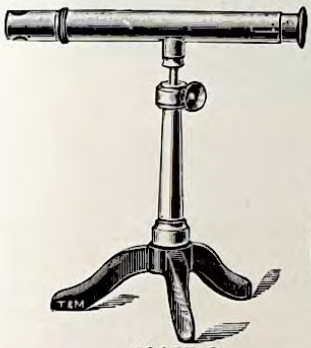
*10652 **Spectroscope,** Pocket, Diffraction, Thorp's ... ... each £1 5 0

*10653 **Spectroscope,** Pocket, Direct Vision, three-element Prism, with fixed slit, in Leather Case. This instrument will show many of the Fraunhofer's lines, etc. each 1 15 0

*10654 **Spectroscope,** Pocket, Direct Vision, with adjustable slit, achromatic Object Glass and three-element Prism, in Case 2 5 0

*10655 **Spectroscope,** Pocket, Direct Vision, with adjustable slit, comparison Prism, achromatic Object Glass and three-element Prism, in Case 2 15 0

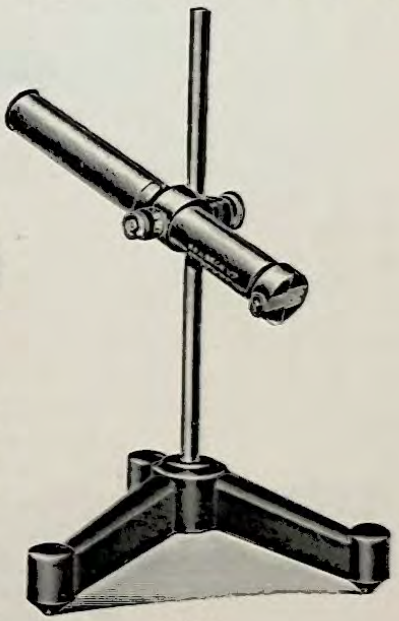
*10656 **Spectroscope,** Pocket, Direct Vision, with adjustable slit, comparison Prism, Mirror, achromatic Object Glass and three-element Prism, in Case 3 3 0



10657–8



10659



10662

*10657 **Spectroscope,** Direct Vision, with fixed slit mounted on Iron Tripod Foot, with Brass Pillar, with adjustment for height £2 7 6

*10658 Ditto, ditto, ditto, larger size 3 2 6

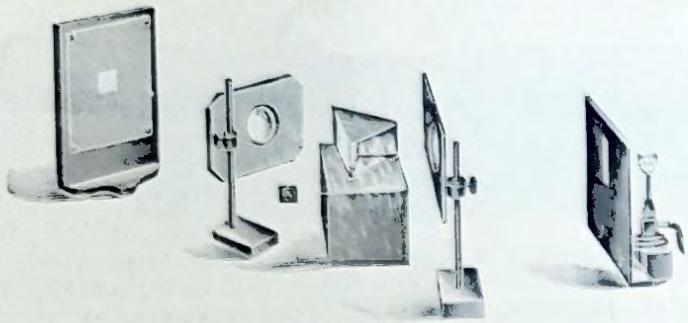
=10659 **Direct-Vision Reading Spectroscope**

This is a small instrument, packing into a case 4½ in. × 2¼ in. × 1⅝ in., which can either be used in the hand or attached to a stand. It has a prism coated with a Thorp replica grating and gives a total dispersion of about 34°. An accurately made adjustable slit is provided and also an indicator which consists of an image formed by the slit and is illuminated by the same source of lights as is being examined by the spectroscope. The Indicator is operated by a milled head, which is divided into 100, the divisions being arbitrary £5 5 0

=10660 **Beck Direct-Vision Reading Spectroscope.** This instrument is similar in principle to No. 10659, but has a Telescopic attachment giving increased magnifying power, and therefore showing the spectrum on a larger scale and increasing the dispersion correspondingly. £6 10 0

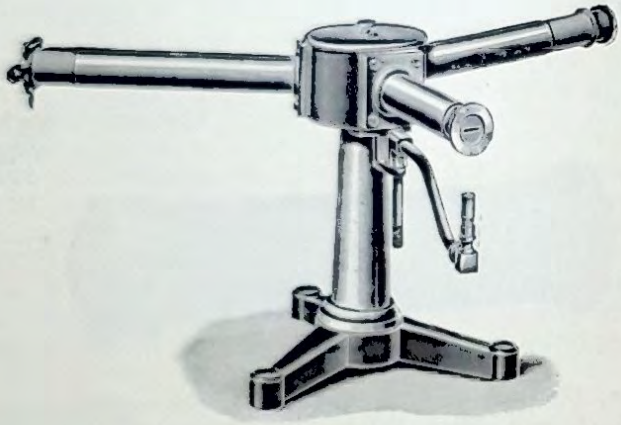
=10661 **Direct-Vision Spectroscope,** with reversion method of reading. This instrument produces two spectra side by side, which are reversed in the direction of their colours on the principle suggested by Professor Hartridge, F.R.S. Upon turning the milled head both spectra move, but in opposite directions. The reading is obtained by setting a particular line in one spectrum against the same line in the other spectrum. This not only gives double the accuracy of setting, but enables the position of an indistinct absorption band to be taken with considerable accuracy. The instrument itself is similar to No. 10660, but is constructed with reversion prisms £9 10 0

=10662 **Table Stand** for use with either No. 10659, 10660 or 10661 ... ... 1 5 0



10664

10664 **Model Spectroscope,** to show construction of, consisting of two Convex Lenses mounted on adjustable Stands. Screen with slit. Screen to receive Spectrum Glass Prism. Wood Block and Gas Burner **£1 1 0**



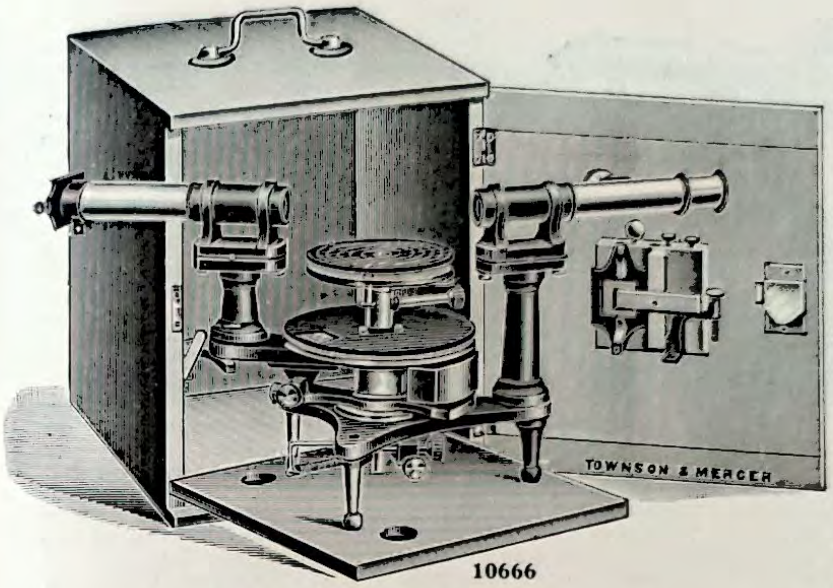
10665

10665 Spectroscope, Kirchoff and Bunsen's.

In this instrument the Telescope, Collimator and Scale Tube are all fixed. The Telescope and Collimator have Object Glasses about 1 in. in aperture and 10 in. focal length. The Telescope is provided with one Huyghenian Eyepiece, with sliding tube adjustment.

The Collimator is provided with an adjustable Slit and Comparison Prism. The Scale Tube is provided with a Photographic Fine Scale, Gas Burner and Achromatic Lens. The Prism is of dense flint glass, 1⅛ in. high, and permanently fixed to the metal box. The instrument is packed in a polished wood case.

Price	**£7 10 0**
With Adjustable Telescope (extra)	**0 15 0**
Rack-motion to either Telescope or Collimator (extra)	**0 15 0**



10666

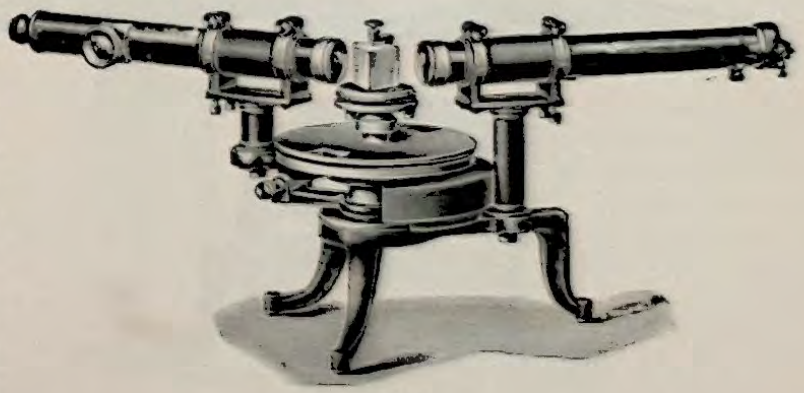
=10666 SPECTROMETER

This instrument was designed to meet the requirements for a cheap, yet reliable, Spectrometer. It has a protected 5-in. circle, read by vernier to 1 minute. The circle and telescope are attached to the outer centre and move together. The Telescope is counterpoised and provided with cross-wires, rack-motion focussing arrangement, clamp and fine adjustment. The Collimator has a protected adjustable slit and clamping ring, so that it can be set for verticality and focal distance once for all. The Prism Table is adjustable by means of three levelling screws, and can be raised or lowered to any convenient height; it can be clamped to the inner centre, which carries the vernier, and which is provided with clamp and fine adjustment. The Object Glasses of both telescope and collimator are about 7 in. in focal length, and have a clear aperture of ⅞ in. Adjustments are provided for setting the optical axes of telescope and collimator at right-angles to the vertical axis of the instrument. One Eyepiece, Grating Holder, Prism Clamp and Reader are supplied with the instrument.

With Case	nett	£9	0 0
Without rack-motion and fine adjustments	,,	7	10 0
With two Verniers (extra)	,,	0	11 6
Rack-motion to Collimator	,,	0	15 0
With 9-in. Telescope and Collimator (extra)...	,,	0	8 6
Comparison Prism attached to Slit	,,	0	11 6
Extra dense flint glass Prism	,,	0	15 0
Ordinary dense flint glass Prism	,,	0	13 6
Crown Glass Prism	,,	0	13 6

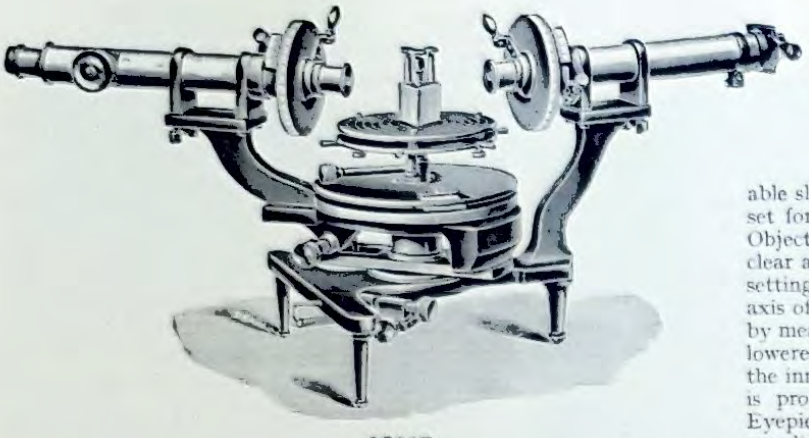
=10667 TABLE SPECTROSCOPE

With 6-in. Protected Circle, reading by two opposite verniers to 1 minute. The Telescope is counterpoised and provided with cross-wires, rack-motion, clamp and fine adjustment. The Collimator is provided with an adjustable slit, comparison prism, and a means for varying the length of the slit. Both Telescope and Collimator have achromatic object glasses of 11½ in. in focal length and a clear aperture of 1¼ in.; they can be set radial or otherwise to the circle. The Prism Table is adjustable by three levelling screws, and rotates on a concentric axis, its movement being read by two opposite verniers to 1 minute; it is provided with a clamp, but not fine adjustment. Two Eyepieces, large crown or dense flint-glass Prism and Reader are supplied with the instrument.



10667

With Case		£15	15 0
Divided to 30 seconds (extra)		0	15 0
Hollow Prism, with 1-in. hole		2	5 0
Rack-motion to collimator		0	15 0



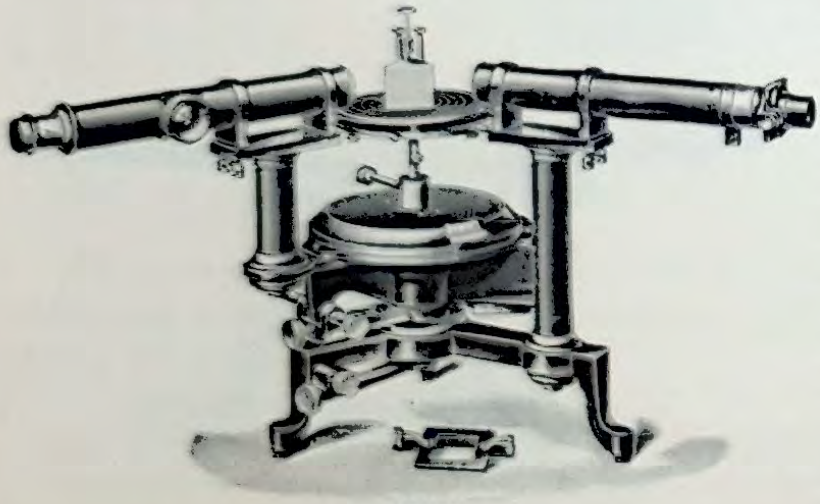
10668

=10668 Students' Spectrometer

The circle of this instrument is about 5 in. diameter, and read by two opposite verniers to 1 minute. The circle and verniers are well protected. The Telescope is counterpoised and provided with cross-wires, rack-motion focussing arrangement, clamp and fine adjustment. The Collimator has a protected adjustable slit, and clamping ring by which the slit can be set for verticality and focal distance once for all. The Object Glasses are about 7 in. in focal length, with a clear aperture of ⅞ in. Adjustments are provided for setting the optic axis at right-angles to the vertical axis of the instrument. The Prism Table is adjustable by means of three levelling screws, and can be raised or lowered to any convenient height; it can be clamped to the inner centre, which carries the verniers and which is provided with clamp and fine adjustment. One Eyepiece, Grating Holder, Prism Clamp, and Reader are supplied with the instrument. The uprights which support the telescope and collimator are thrown out sufficiently to give ample room for the attachment of polarising apparatus. These consist of (1) a Nicol Prism Polariser and Analyser, each mounted on a rotating circle read by Vernier to 5 minutes, and fitting the object ends of telescope and collimator (an adapter is supplied by which the analyser may be attached to the eye end of telescope); (2) a rotating circle, reading to 5 minutes, and fitting the object end of telescope or collimator, to which may be fitted a quarter-wave Plate, Babinet Compensator, etc.; and (3) an extra Nicol and mount for the Babinet Compensator, when used at the eye end of telescope. The Babinet Compensator is fitted with micrometer screw and scale reading to ·01 mm.

With Case	...	...	...	...	£10	10	0
Rack-motion to Collimator, extra	...	...			0	15	0
9-in. Telescope and Collimator, extra		...			0	8	3
Comparison Prism to slit, extra	...	...			0	11	3
Extra dense Flint Glass Prism	...	...			0	15	0
Ordinary dense Flint Glass Prism	...	...			0	13	6
Crown Glass Prism	...	...	...	...	0	13	6
Hollow Prism, ⅛ in. hole	...	...	...		0	15	9
Copy of Rowland's Grating	...	...			1	2	6

Illuminating Attachment to Eyepiece	...				£0	11	3
Plane-parallel Mirror, silvered both sides	...				0	15	0
Nicol Prism Polariser and Analyser, the pair					6	0	0
Divided Circle to 5 mins.	...	...	...		1	10	0
Quarter-wave Plate and Stage	...	...			0	12	0
Babinet Compensator, with extra Nicol and Mount	...	...	...	...	6	15	0
Eyepieces	...	...	...	... each	0	11	3



10669

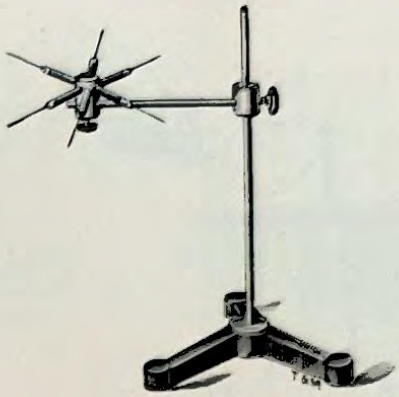
=10669 The College Spectrometer, constructed on similar lines to those of College Spectrometer No. 10670 with the exception of the centre work. In this, the inner axis carries a 5-in. circle and the prism table, while the outer socket carries the telescope and verniers. The circle is well protected and read by two opposite verniers to 1 minute. The Prism Table and Telescope are both provided with clamp and fine adjustment. The Prism Table can be raised or lowered, is adjustable by means of three levelling screws and can be detached from the instrument, and other apparatus used in its place. The Object Lenses of telescope and collimator are achromatic, and have a focal length of 9 inches and a clear aperture of nearly 1 in. The Telescope is provided with rack-motion focussing arrangement and cross-wires; and the optic axis can be set radially and at right-angles to the vertical axis of the instrument. The Collimator is provided with a protected adjustable slit, comparison prism and wedge for reducing the length of the slit; and it can also be set radially and at right-angles to the vertical axis of the instrument. One Eyepiece, Grating Holder, Prism Clamp and Reader are supplied with the instrument.

With Case	...	...	...	...	£15	0	0
Divided on silver, extra	...	...	...		1	10	0
Rack-motion to Collimator	...	...	...		0	15	9
Dense Flint Glass Prism	...	...	...		1	2	6
Crown Glass Prism	...	...	...	...	1	2	6
Extra dense Flint Glass Prism	...	...			1	6	3

Hollow Prism, ⅛-in. hole	...	...	...		£1	7	0
Copy of Rowland's Grating, about 14,500 lines	...	...	...	...	1	2	6
Illuminating attachment to eyepiece	...				0	11	3
Mirror, silvered both sides	...	...	...		0	15	0
Eyepieces	...	...	...	... each	0	11	3



10671



10672



10675–6



10673

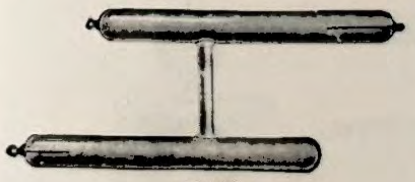
10670	**Glass Tubes,** with Platinum Wire, 2 in. long ... ... each	**£0**	**2**	**6**
10671	Adjustable Stand for above ... ... ,,	**0**	**2**	**9**
10672	**Stand,** Mitscherlich's, with adjustable holder for six glass tubes ... ,,	**0**	**12**	**6**
10673	**Set of Salts** for Spectrum Analysis, consisting of 10 Bottles—Ba, Ca, K, Na, Cs, Rb, Li, Sr, Sn, Tl, and 10 Platinum Wires with Glass Handles, on Polished Mahogany Base	**2**	**2**	**0**
10674	Ditto, ditto, containing 6 Bottles only	**1**	**7**	**6**
(F) **10675**	**Bottles,** for Spectrum Analysis, small flat ... ... each	**0**	**2**	**0**

(F) **10676** Ditto, Long form ... ...

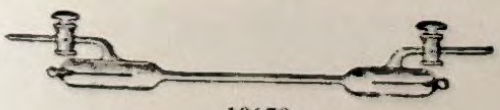
2	5	10	15 cm. long
3 0	**3 6**	**4 6**	**5 6** each



10677–8



10680



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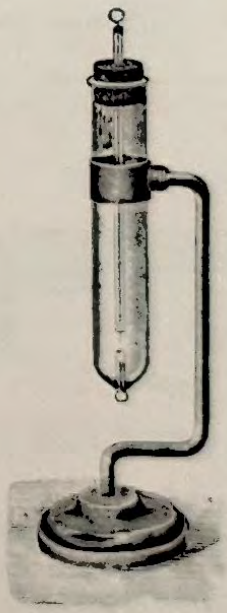


10681–2

(F) **10677 Spectrum Tubes,** containing the following Gases:—
O, H, N, CO_2, H_2O, Cl, HCl, Br, I, Cy, HCy, NO, NO_2... each **£0 5 6**

(F) **10678** Ditto, filled with Argon or Helium ... ... each **1 5 0**

(F) **10679** Ditto, with 2 Stopcocks, for filling with Gases, for Analysis each **0 9 6**

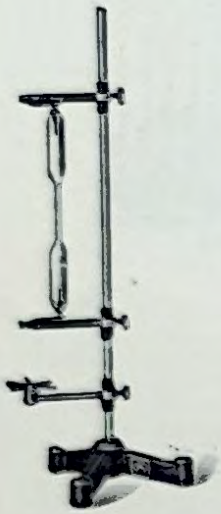
(F) **10680 Spectrum Tubes,** end-on pattern, containing the following Gases:—
O, H, N, CO_2, H_2O, Cl, HCL, Br, I, Cy, HCy, NO, NO_2 each **0 7 6**

10681 Spark Tube, Delachanal and Mermet ... ... each **0 7 6**

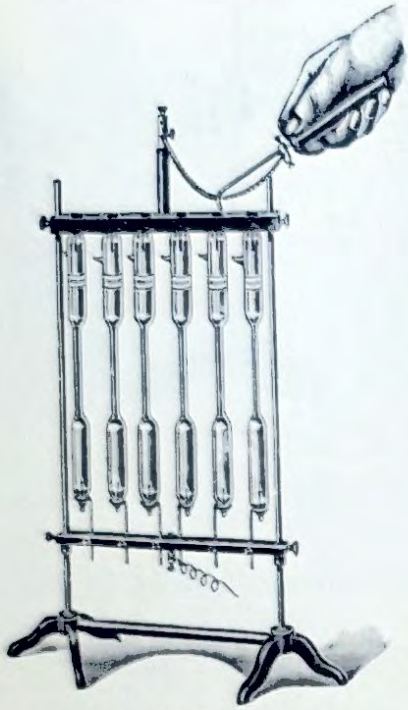
10682 Ditto, ditto, mounted on Stand, complete ... ... each **0 12 6**

(F) **10683 Spectrum Charts,** Stout Paper, size 9×7½ in., giving Spectrums with mm. Scales of Cs, Rs, Ka, Na, Li, Sr, Ca, Ba, Tl, In ... each **0 1 6**

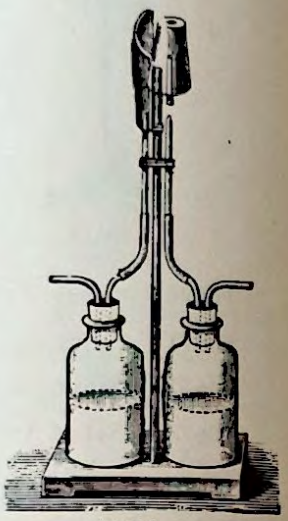
(F) Foreign manufacture.



10684

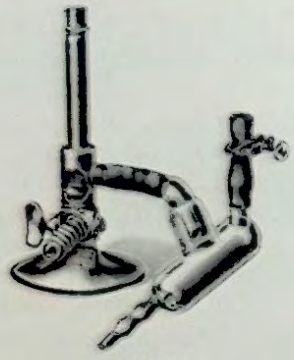


10685



10686

	10684	**Spectrum Tube Stand** with adjustable Clips for making contact and Holder for 6 Platinum Wires	£1 7 6
	10685	**Spectrum Tube Stand** for six tubes, fitted with adjustable Clips for making electrical contact	1 15 0
(F)	**10686**	**Bunsen's Apparatus,** for reversing Sodium Flame	1 5 0



10687



10688



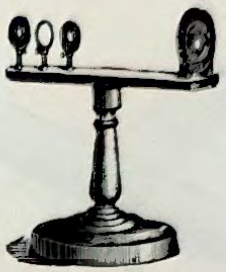
10689

(F)	*10687	**Spectrum Lamp,** Beckmann's, with Atomiser, I.R. Tubing and Clip ...	£0 17 6
(F)	**10688**	**Mercury Spectrum Lamp.** This Lamp generates an intense white light, well adapted for Optical purposes, it is worked by an induction Coil 2½ cm. spark, and requires no water cooling	1 3 0
(F)	**10689**	Ditto, ditto, modified by Lummer & Straubel with mercury	2 17 6
(F)	**10690**	Ditto, ditto, ditto, with Water Cooling Chamber	5 2 6

(F) Foreign manufacture.



10691



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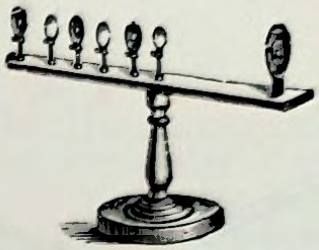

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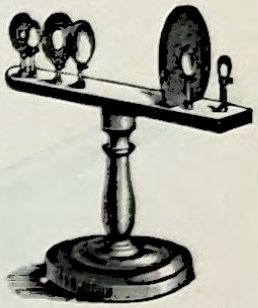
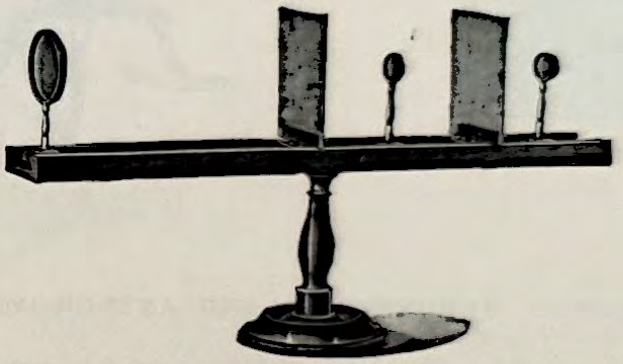


10694

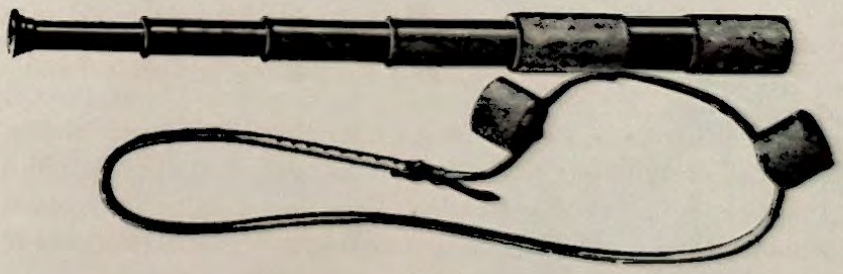
(F) **10691** **Telescope Model,** on Polished Stand, to demonstrate the Galilean Telescope each **£0 17 6**
(F) **10692** „ „ „ „ Astronomical ... „ **1 2 6**
(F) **10693** „ „ „ „ Terrestrial ... „ **1 10 0**
(F) **10694** **Microscope Model,** mounted on Polished Stand ... ... „ **1 7 6**



10695

10695 **Microscope,** Model Weinhold's, illustrating the principles of the different Microscopes and Telescopes, with 4 Sliding Lenses (only 3 shown in illustration), and 2 ground-glass Screens sliding in Grooved Mahogany Base fitted on heavy Iron support **£2 5 0**

Telescopes

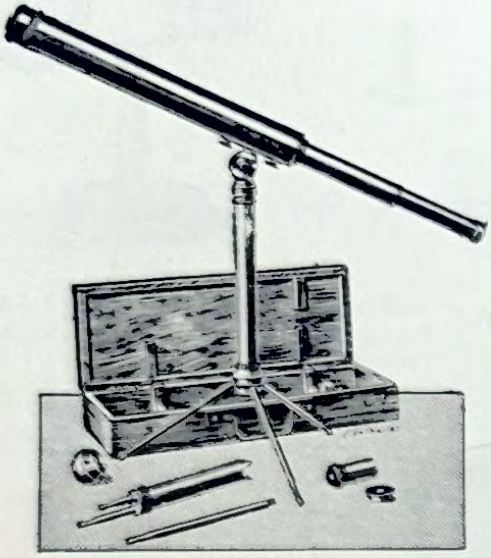


10696

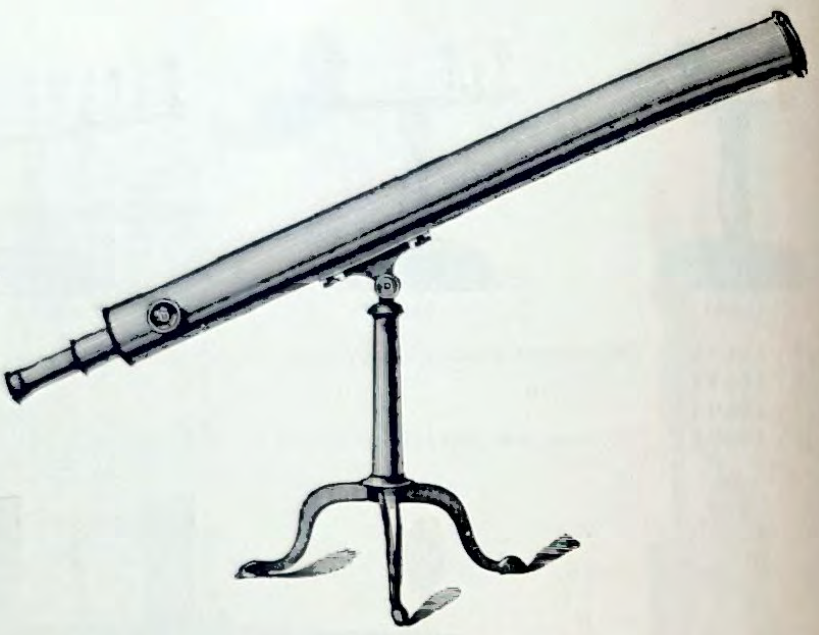
(F) **10696** **Telescopes** (Achromatic); 3 draws, Brass mounts, Morocco sewn, with Caps and Shoulder Straps, with Sunshade, complete:—

Diameter of object glasses	31	36	43	50 mm.
Magnification	14	16	19	22
Price	**45 0**	**60 0**	**80 0**	**130 0** each

(F) Foreign manufacture.



10697–99



10700

ACHROMATIC TELESCOPES, TERRESTRIAL AND ASTRONOMICAL

Best Quality, Brass Body, two draws, Brass Tripod Stand, with one each terrestrial and astronomical eyepiece, complete in polished Wood Case.

		Length in inches. Closed.	Open.	Magnifications, times. Terrestrial.	Astronomical.	
(F) *10697	Object glass, 43 mm. or 19 lines	16	29½	25	50	£6 10 0
(F) *10698	,, ,, 50 ,, ,, 22 ,,	24½	33	35	60	8 10 0
(F) *10699	,, ,, 56 ,, ,, 25 ,,	30	41	45	80	12 7 6

=10700 **Telescope,** Bright Brass Body, with Rack Focussing Adjustment, sliding Object Cell forming Dew Cap, 3 in. Object Glass 39 in. focus, giving excellent definition with Astronomical Eyepieces of plus 80 magnification. Iron Claw Folding Table Stand, finished dull black pillar giving horizontal and vertical motions. Terrestrial Eyepiece plus 40, Astronomical plus 80 equivalent focus 12 mm., in polished Pine Case ... ... nett **£12 15 0**

=10701 **Tripod Stand,** Pine, for outdoor use ... ... ,, **2 7 6**

=10702 ,, ,, Polished Mahogany, for outdoor use ... ... ,, **3 5 0**

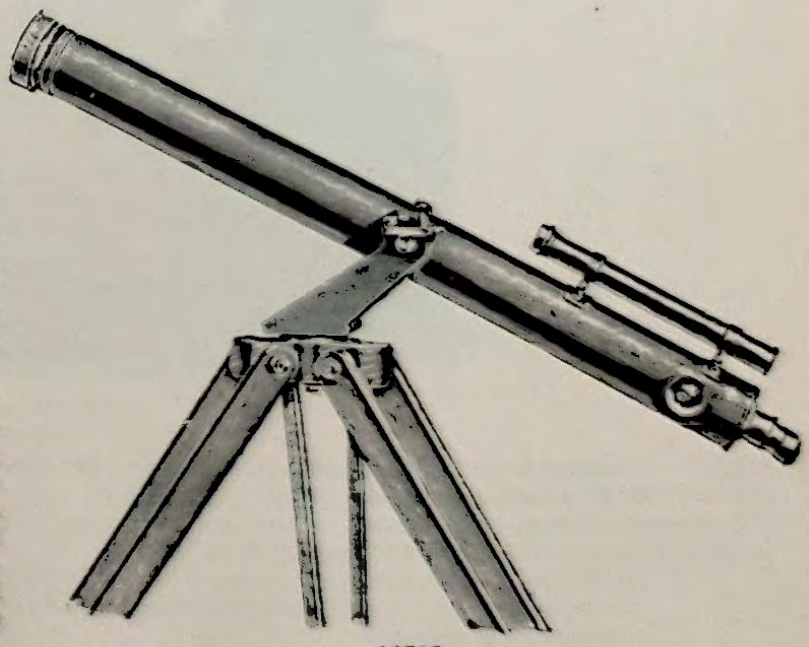
(F) Foreign manufacture.



10704

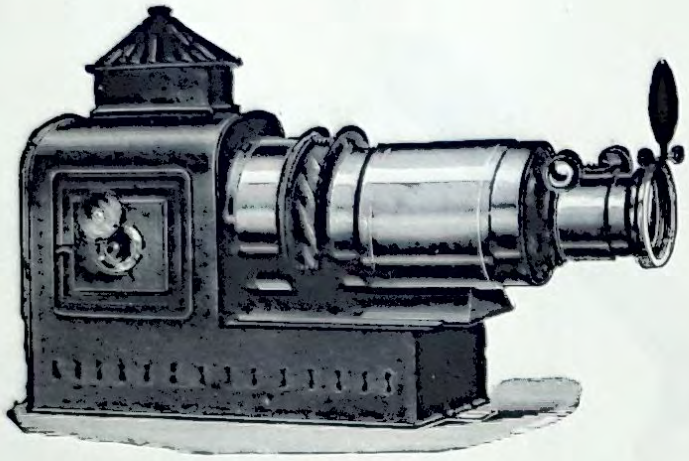
***10704 Educational Telescope.** Specification.—Solid Brass Body-Tube, as illustrated, Rack and Pinion Focussing Adjustment, sliding Draw-Tube, fitted with specially selected 3-in. diameter Object-Glass, an Astronomical Eyepiece of any desired power, with dark glass for solar observation. The whole mounted on a Stand of entirely new design, giving universal movements.

Telescope, complete as above **£12 10 0**



10705

***10705 Telescope,** finished Bright Brass, fitted with Rack Motion and Trunnion Bearings. Object Glass 3¼ in., of superior quality, giving 3 in. clear aperture and corrected to give excellent performance with Astronomical powers 80 and 120. Adjustable Object Cell with Brass Cover, Finder with Cross-wires, 1-in. diameter Object Glass fitted to body of telescope. Eyepieces, Terrestrial plus 40, and Astronomical 80 and 120, with Dark Glass Heads, Open Lath Oak Stand with Solid Oak Head to carry Brass Uprights in Polished Pine Case with baize-lined packings **£27 10 0**



10706

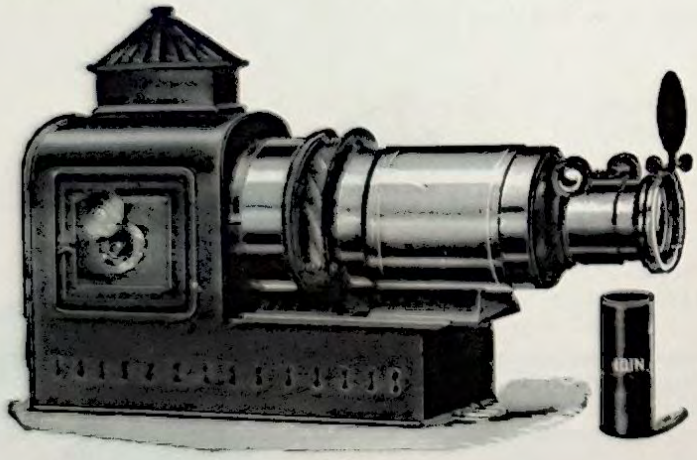
***10706 Russian Iron Optical Lantern, with Circular Open Stage,** Centre 5½ in.

Body.—Made of Russian Iron with Panelled Door fitted with Fibre Handle, and polished and lacquered Brass Eyepiece with Sliding Shutter. There is a Hinged Door at the back, which is panelled and slotted to take the tray when illuminants carried on an upright are used. The Condenser Cell is made of brass, and is firmly attached to the front of the body.

Stage and Front Tube.—Made of Brass, highly polished and lacquered. It has a circular Brass Spring Plate for holding the Carrier in position. The Front Tube slides within the Jacket-Tube, and carries a cast brass flange.

Condenser.—Compound Plano-Convex, 4 in. diameter, Lenses in Spring Cell.

With No. 1 Objective	**£5**	**5**	**0**
„ No. 2 „	**5**	**17**	**6**
Case extra if required	**0**	**14**	**6**



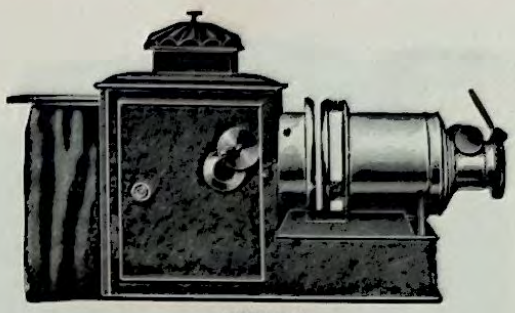
10707

***10707 Russian Iron Optical Lantern, with Circular Open Stage and Telescopic Front,** Centre 5½ in.

Body, Stage, Condenser, Case similar to No. 10706.

Telescopic Tubes (two-draw).—These are constructed so that they are rigid even when fully extended, and are suitable for Lenses not exceeding 9¾ in. focus.

With No. 2 Objective (any focus, 6 in., 8 in., 9¾ in.), Condenser, Cowl	**£6**	**15**	**0**
As above, but with No. 2A Rack Jacket and Lens Cylinder (any focus, 6 in., 8 in., 9¾ in.)	**7**	**10**	**0**
Case extra if required	**0**	**14**	**6**



10708–9

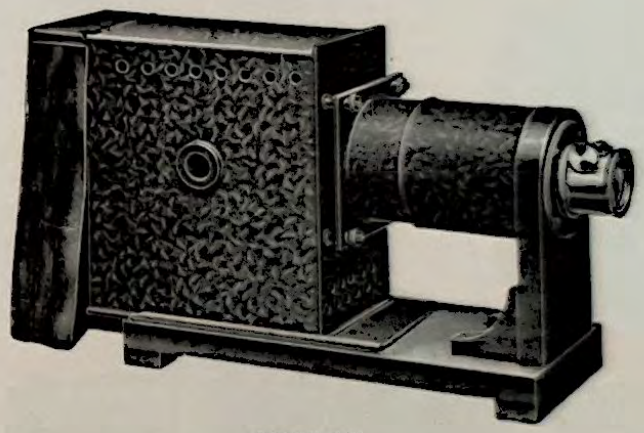
Russian Iron OPTICAL LANTERN, with improved and Ventilating Circular Open Stage. Centre 6½ in.

Body—Made of Russian iron with all openings wired. The side door, which is almost the size of the body, is light-tight when closed. It is fitted with brass eyepiece and sliding shutter. There is a hinged flap at the back, which rests on a sliding rod provided with a black fire-proof curtain. The front is fitted with a brass cell, which is bored with four large holes to ventilate the Condenser.

Stage—Similar to No. 10706, heavier pattern, and fitted with single draw tube (No. 2 Thread).

Condenser—Bi-Convex and Meniscus, 4 in. diameter.

10708	With No. 2 Objective, Condenser, Cowl and Tray	**£6 12 6**
10709	With No. 4 ,, ,, ,, ...	**7 15 0**
	Case extra, if required (similar to No. 10706)	**0 14 6**



10710–12

OPTICAL LANTERN. Centre 6 in.

Body made of sheet metal, fitted with eyepiece, back door curtain and curtain rod.

The front of the body carries the stage and front tube, the slide carrier being held by four brass milled nuts.

Body slides in a tray fixed to the wood base, enabling the focussing to be adjusted in an easy manner.

Body will take any focus lamp up to 500 watts, acetylene jet, scissors arc lamp, etc.

The slide Carrier can be fitted under the base for transport.

To use lenses longer than 8 in. focus, Extension Tubes must be used.

Condenser—4 in. diameter plano-convex lenses in spring cell.

The Lantern, finished in crystalline enamel.

Entirely New Model

10710	With No. 1 Objective, 6 or 8 in. Focus	**£3 5 0**
10711	With No. 2 Objective, 6 or 8 in. Focus	**3 17 6**
10712	With No. 4 Objective, 7 in. Focus	**5 0 0**
	Extra—Carrying Case, with handle	**0 10 6**

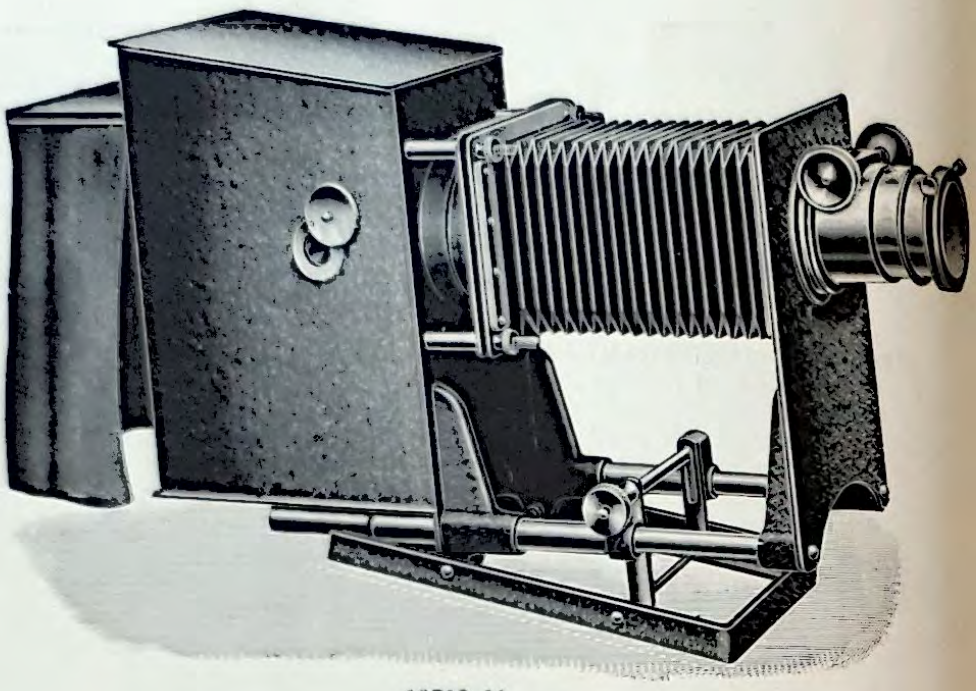
RUSSIAN IRON OPTICAL LANTERN.

Centre 6¾ in. Body constructed of Russian iron, the Condenser and Objective Support being made of aluminium, Stage Plates made of brass, best quality Leather Bellows, Back Door and Black Curtain. The Objective Front (No. 2 Thread) slides in a pair of telescopic brass tubes, allowing for any lenses from 6 in. to 18 in. focus to be used; the Leather Bellows have metal ends, sliding into grooves on the stage plate and front, so that this can be easily removed when required. The Lantern is mounted on a Metal Base and has a Tilting Arrangement which can be locked by means of a large brass milled nut. Base plate, lantern body and lens support best crystalline finish.

Will accommodate any Focuslite Lamp up to 1,000 watts.

Condenser.—Bi-convex and Meniscus, 4½ in. diameter, in spring cell.

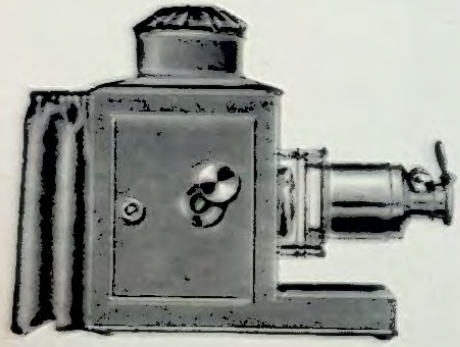
Lantern, when closed, measures 19 in. long, 14½ in. high, 6¾ in. wide.



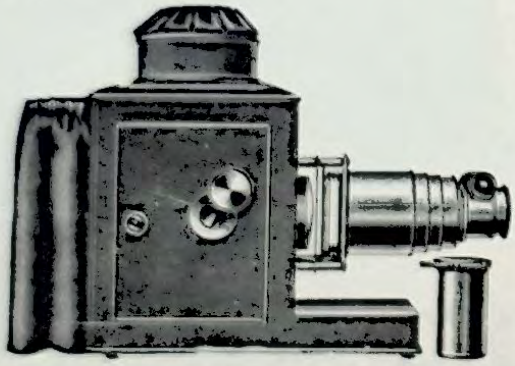
10713-16

PRICES:

*10713	With No. 2 Objective (6 in. to 18 in. focus)	...	...	...	...	...	...	...	...	£8	15	6
*10714	,, No. 4 ,, (7 in. to 18 in. focus)	...	...	...	...	...	...	...	...	9	18	0
*10715	,, Jacket and Cylinder (6 in. to 18 in. focus)	...	...	...	...	...	...	...	...	9	10	6
*10716	,, ,, ,, (7 in. to 18 in. focus)	...	...	...	...	...	...	...	...	10	15	6
	Case, extra if required, wood with leather handle, etc.	...	...	...	...	...	...	...	...	0	17	6



10717-18



10719-21

Russian Iron Optical Lantern with Single Draw Tube

Body—8 in. centre. The front, sides and base are strengthened on the inside with sheet iron, rivetted to the body. Has larger door, and domed top with Iron Cowl. These Lanterns will take any projector type lamp, and also Arc Lamps.

Stage and Front Tubes—All-Brass Ventilated Stage. **Condenser**—Bi-Convex and Meniscus, 4½ in. diameter in Cell.

*10717	Objective, 6 in. focus	...	...	...	...	...	...	...	...	...	...	£10	0	0
*10718	Objective, 7 in. focus	...	...	...	...	...	...	...	...	...	...	11	2	6
	Case extra—wood, with leather handle	...	...	...	...	...	...	...	...	...	...	1	0	0

Single-draw Tube fronts are suitable for Lenses up to 7 in. focus.
Telescopic three-draw Fronts are suitable for Lenses up to 14 in. focus.
Longer focus require Extension Tubes.

Russian Iron Optical Lantern, as above, fitted with Telescopic three-draw Tubes.

*10719	No. 2A Jacket and 2A Lens Cylinder, 6–22 in. focus	...	...	...	...	...	...	...	...	...	...	£12	0	0
*10720	,, 4A ,, 4A ,, 7–18 in.	...	...	...	...	...	...	...	...	...	...	13	5	0
*10721	,, 5A ,, 5A ,, 10–22 in.	...	...	...	...	...	...	...	...	...	...	16	17	6
	Case extra—wood, with leather handle	...	...	...	...	...	...	...	...	...	...	1	0	0

Longer Focus Lenses can be supplied if required, up to 24 in. focus.

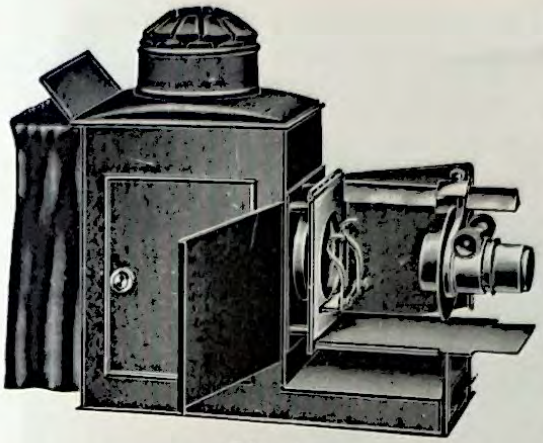


Fig. 1.

10722 DEMONSTRATOR "UNIVERSAL" OPTICAL LANTERN for Horizontal and Vertical Projection. 8 in. Centre

Body.—Made of Russian Iron, and fitted with oblong Dome Top and oval Base Cowl. The Door is large and perfectly light tight, and fitted with brass eyepiece and shutters. It has a knurled fibre handle, and a substantial lever catch. The Eyepiece, whilst being in the optical axis, is placed forward so that the operator is enabled to look back, so to speak, on the carbons or limes. The Back is fitted with a hinged metal flap, and curtain rod with an opaque fireproof curtain. When the lantern is in use the flap rests on the curtains and so prevents leakage of light.

Stage.—The front of the body is fitted with a Brass Plate, bronzed and lacquered, which carries a cell for taking one half of the condenser. A second brass plate, bronzed and lacquered, is fixed to it by brass columns and bolts. To this is hinged, by a long pin with a milled head, another brass plate, carrying the second half of condenser. This Plate is fitted with a long triangular-section polished brass rod, on which the objective slides when using various foci lenses, and is blocked by means of a large clamping screw at the side of the plate which carries the jacket or rack-mount.

On the front foot of the lantern body are fitted two upright Rods on which the mirror rests for horizontal projection as shown in Fig. 1. There are also two grooved projections for the large mirror plate to rest in when used for opaque projections as shown in Fig. 3. There is a Stage Plate with adjustable brass springs, with milled head screws, for taking an ordinary slide carrier or chemical tank.

Hinged to the front plate is a large Mirror, mounted in brass, the back of which forms the foot of the stage when projecting apparatus. Should a higher centre be required, the mirror can be removed by releasing the front catch and withdrawing the hinge pin when the base of the lantern may be used as a table on which to stand the apparatus. The front, to which the light-shield is attached, is threaded to take the jacket or rack-mount.

Vertical Projection.—To alter from horizontal to vertical projection, the stage is pulled forward and raised. The edge of the mirror frame rests on a brass ledge fixed to the front plate. By this means it will be seen that the mirror is brought into position at an angle of 45° with the condenser, the stage plate is removed and the lantern slide plate, which is also keyholed, substituted. This plate has a ridge for taking an ordinary size lantern plate, and is held firmly by a side spring. The adjustable objective mirror is then placed in position. The mirror is hinged to a metal ring and is provided with a long milled head screw for adjusting the angle to a nicety. The side doors can then be closed to prevent any leakage of light as shown in Fig. 2.

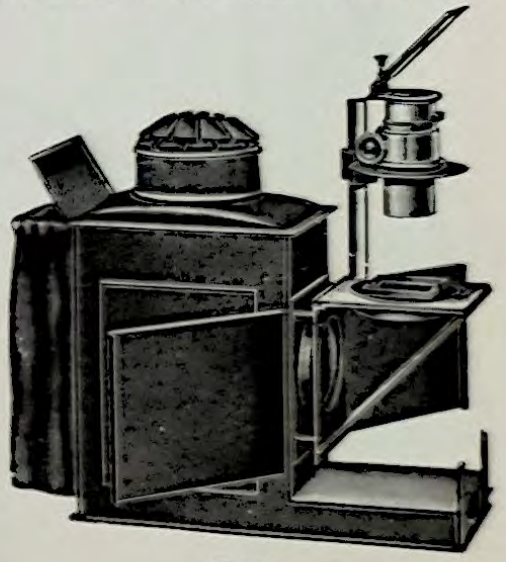


Fig. 2.

Opaque Objects.—In order to exhibit Opaque Objects, the end of the large mirror is placed within the brass grooves on the front foot and the lantern slide plate is removed. The front half of the condenser lens must also be removed. This is held on to the stage plate by studs, and is easily detached by giving the lens cell a twist, which will release the lens. The front part carrying the objective is lowered so as to allow it to be within focal range of the object placed on the table. The table can be raised or lowered and clamped in any position by a binding nut, and is mounted on a heavy iron Stand. The mirror is also adjustable to any angle. As already mentioned, there are two swing side doors attached to the body. When closed they connect the sides of the lantern with the upright mirror, thus enclosing the space occupied by the adjustable table, as shown in Fig. 3.



Fig. 3.

Mirrors.—All the Mirrors are made of English plate glass, very carefully silvered, and are provided with Russian Iron envelope sheaths so as to prevent them getting broken or scratched.

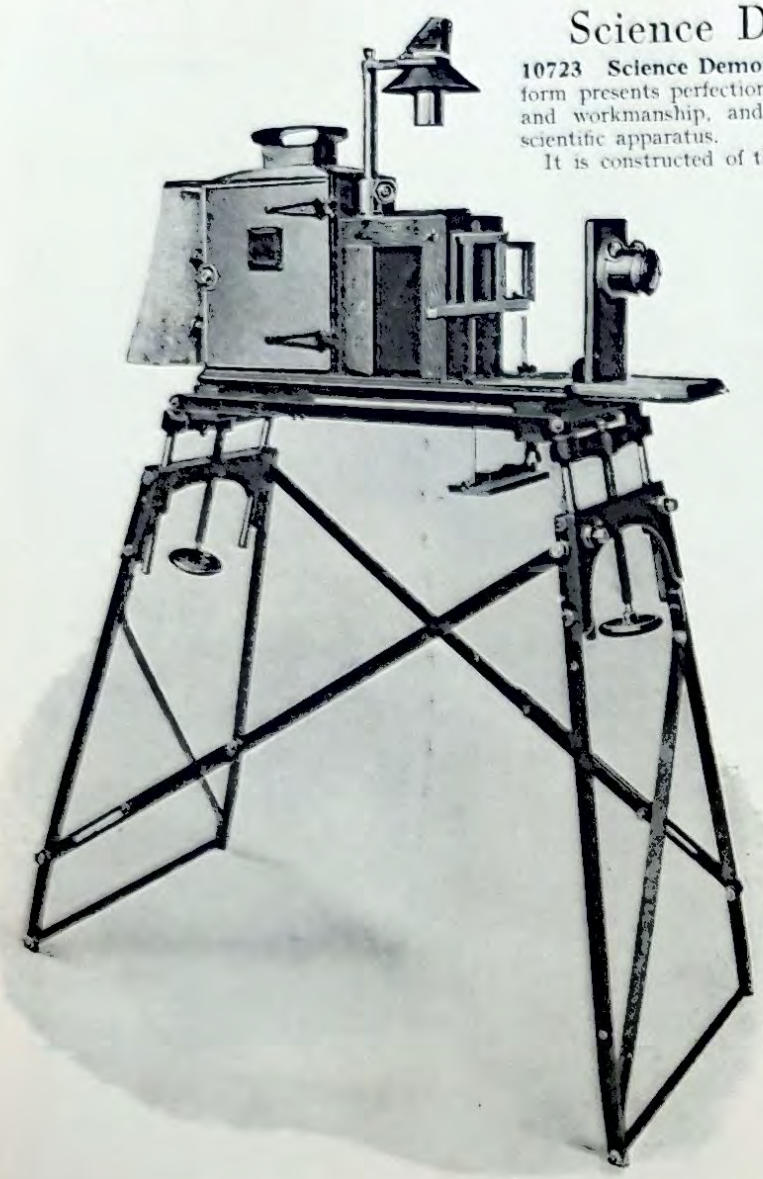
Condenser.—Double Convex and Meniscus, 4¼ in. diameter, but each half mounted in a separate cell. The Meniscus Lens inside the Lantern body is mounted on a brass spring cell. The Double Convex Lens is also mounted in a separate cell.

10722 Demonstrator Science Lantern, complete as specified with No. 4D Lens Cylinder (any focus up to 10 in.), No. 2 Thread, in black wood box **£25 10 0**

Science Demonstrator's Lantern

10723 Science Demonstrator's Lantern in its latest and complete form presents perfection in optical lantern construction, both in design and workmanship, and is suitable for all kinds of projection slides or scientific apparatus.

It is constructed of the best materials obtainable; and the workmanship is of the highest class.



10723

The Objectives now fitted are theoretically designed to give perfect definition, flatness of field, and freedom from colour.

Lamp House is large and allows of high candle-power illuminants; the Door, being full size of the body, allows of easy and full access to the illuminant. It is constructed of a substantial wrought-iron framework, the front, side and door being made of blued sheet steel, asbestos lined. A fireproof Curtain of woven asbestos is also provided.

The Base and Condenser Box is constructed of seasoned Mahogany, French polished.

Condenser Lenses are all removable—the back condenser lens being held in position by means of a bayonet cap, the full-size lamp house door allowing of quick removal.

The Lantern is arranged for both horizontal and vertical projection. When projecting horizontally, the light passes through the condenser lenses and objective in the usual manner. When using the vertical projection, the light, having passed through the back condenser lens, is intercepted by a Mirror swung at an angle of 45°; this is accomplished in a moment by drawing out the mirror hinge knob, which instantly allows the mirror to fall into position. The position is located by a cam stop, which can be adjusted to give the correct angle; the light is then reflected vertically through another condenser lens and objective upon which is mounted an adjustable 90° silvered Prism, which allows the light to be projected on to the screen in coincidence with the horizontal projection.

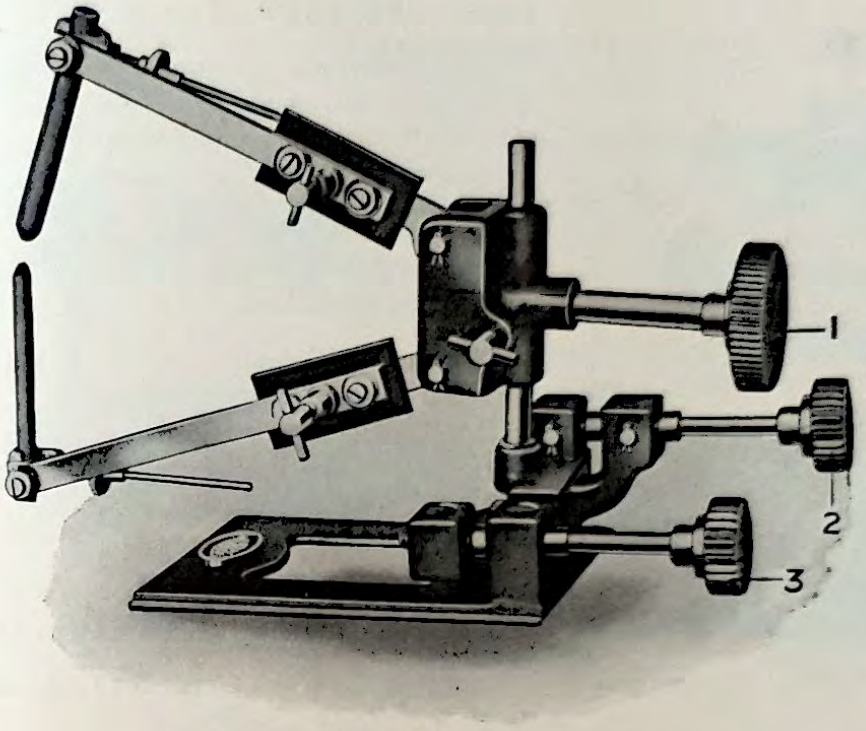
For packing, the front slide is pushed home into the body, and the vertical objective holder racked down into the body, the whole Lantern being very compact. The extreme convenience and adaptability of this Lantern for all kinds of projection will be self-evident.

The Stand is of substantial construction and is mainly constructed of wrought iron. The Legs can be adjusted to any angle and secured by the adjustable struts. A Screw is provided at each end for tilting, raising or lowering, the guide rods can be firmly clamped by set screws.

To fix the Lantern to the stand securely, a pair of Mahogany Clamp Bars are supplied.

	£	s	d
Science Lantern, 4¼ in. Condenser Lenses, silvered Prism to vertical, pair of Kershaw 8 in. focus Objectives, Lock Jacket to horizontal injector jet, revolving and sliding Carriers, Steel Lamp House and woven asbestos Curtain	19	16	0
Travelling Case, made of seasoned White Wood, Polished Black, Steel Corner Plates, Carrying Handles, Lock and Key	2	5	0
Adjustable Iron Stand with pair of **Mahogany Clamp Bars**, for attaching lantern to stand	7	13	0
Front Erecting Prism and Mounting	2	14	0
Reversible Table	0	18	0
Adjustable Clamp	0	5	6
Slit and Prism for Spectrum	3	3	0
Adjustable Mirror, mounted and fitted to Prism frame to obviate swivelling lantern	0	18	0
Opaque Projection, simple attachment	1	16	0

For Arc Lamps for the above lantern see Nos. 10724 and 10727.



10724

10724 SCISSORS ARC LAMP

For Stage Boxes, Spot lights, Lanterns, etc., Scissors Arc Lamps have been proved to be of most convenient form.

The Lamp has been designed on engineering lines—strong, rigid and capable of withstanding hard, continuous service.

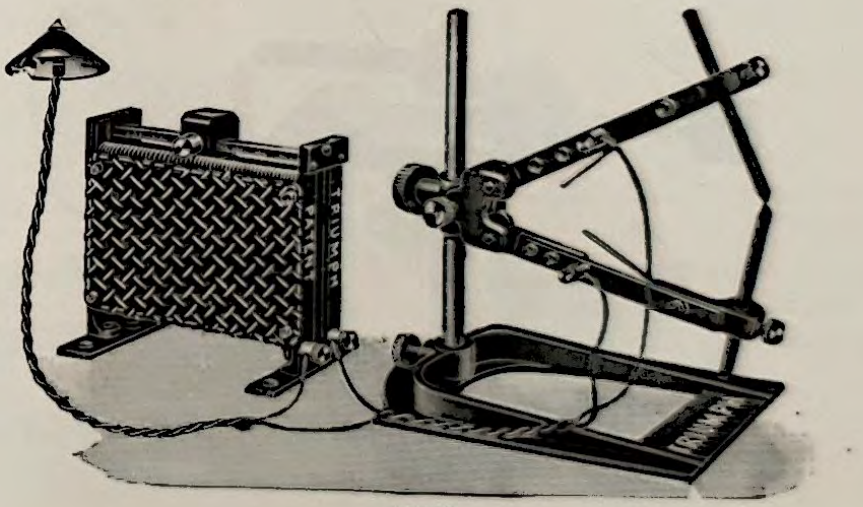
The Scissors Arms are positively fed by a steel worm connected to feed knob (1), Vertical centering (2), and Horizontal centering (3), is provided.

Both Carbon Holders will take carbons up to 14 mm. diameter and can be tilted, making the lamp suitable either for Direct or Alternating currents.

Castings finished in best black enamel, machined parts dull nickel plated.

Approx. weight, 8 lb.

Price, each **£3 10 0**



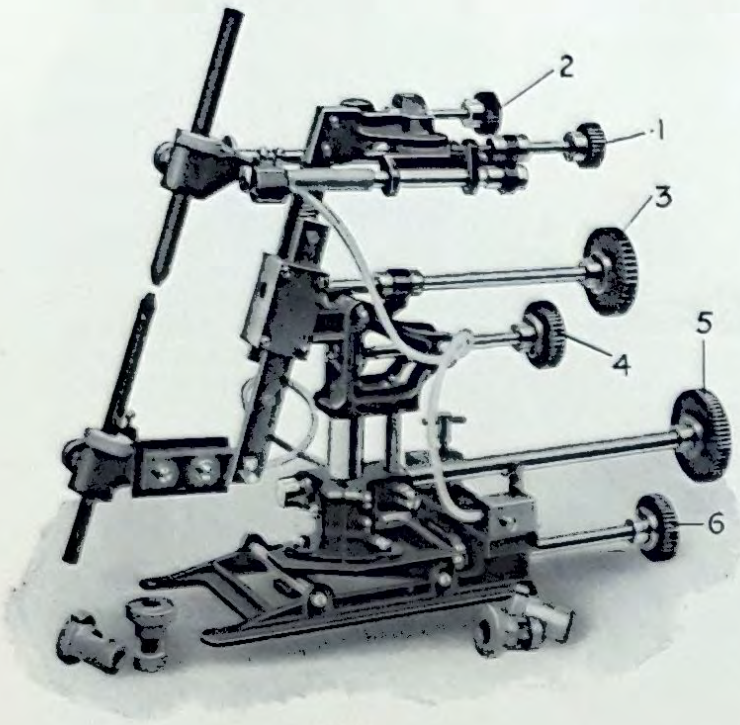
10725

10725 SCISSORS ARC LAMP OUTFIT

This Outfit is designed to enable the Arc Lamp to be used on any ordinary house lighting circuit from 60 to 250 volts.

The Outfit is complete, as illustrated, with Arc Lamp Flex, Adaptor, Resistance and supply of Carbons. 5 mm. and 6 mm. cored for D.C. 6 mm. cored for A.C.

Complete Outfit, as illustrated, on Plain Tray	**£3 7 6**
Complete Outfit, on Mechanical Tray	**4 15 0**
Arc Lamp and Tray only	**1 1 0**



10726

10726 ARC LAMP, Type BL

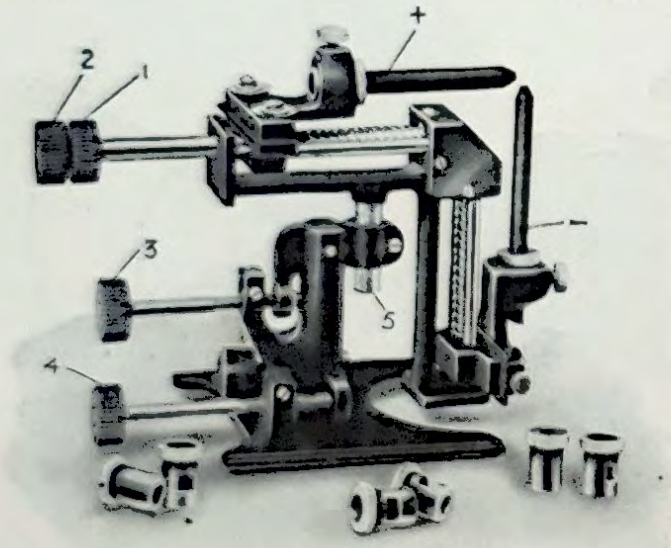
Very substantially constructed to withstand hard, continuous service, most complete in all details and adjustments. Racks and pinions are machine cut from solid steel, capable of carrying up to 50 amperes.

Correct adjustment of the arc crater is provided by the following six movements.

1. Backward and forward movement to top carbon holder.
2. Lateral movement to top carbon holder.
3. Feeding movement, quick and accurate.
4. Tilting movement to lamp.
5. Vertical centering movement.
6. Lateral movement to lamp.

Weight of complete lamp as illustrated is 8 lb.

Price **£7 5 0**



10727

16727 RECTANGULAR ARC LAMP

In this type of Arc Lamp, the positive carbon is horizontal and the negative carbon vertical. Each carbon can be fed separately or simultaneously. Well made of gun-metal and cast-iron, adjustments are provided for horizontal and vertical centering. Suitable for currents up to 15 amperes. Price **£3 10 0**

The Popular Focuslite Outfits



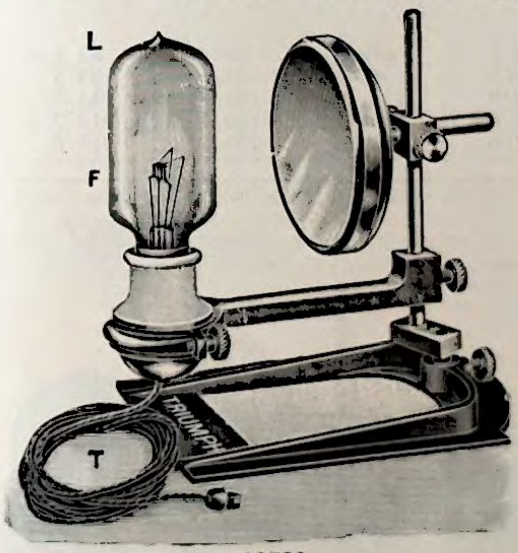
10728

For use on any Circuit without Resistance.

10728 **No. 0 Series.**—The Lamps burn in the position illustrated. The Outfits will be found very useful for home Cinematograph Machines, Optical Lanterns, Enlargers, and numerous other purposes. They can be used off any lighting circuit without a Resistance on alternating or direct current. When ordering it is necessary to state the exact voltage of supply on which it is to be used.

Type of Outfit.	Voltage of Lamp.	Approximate Watts.	Outfit without Lamp. Plain Tray.	Mechanical Tray.
No. 0A ...	12 ...	60 ...		
No. 0C ...	100/250 ...	100 ...	£0 12 6	£2 0 0
No. 0D ...	100/250 ...	250 ...		

For Price of Lamps see page 346.

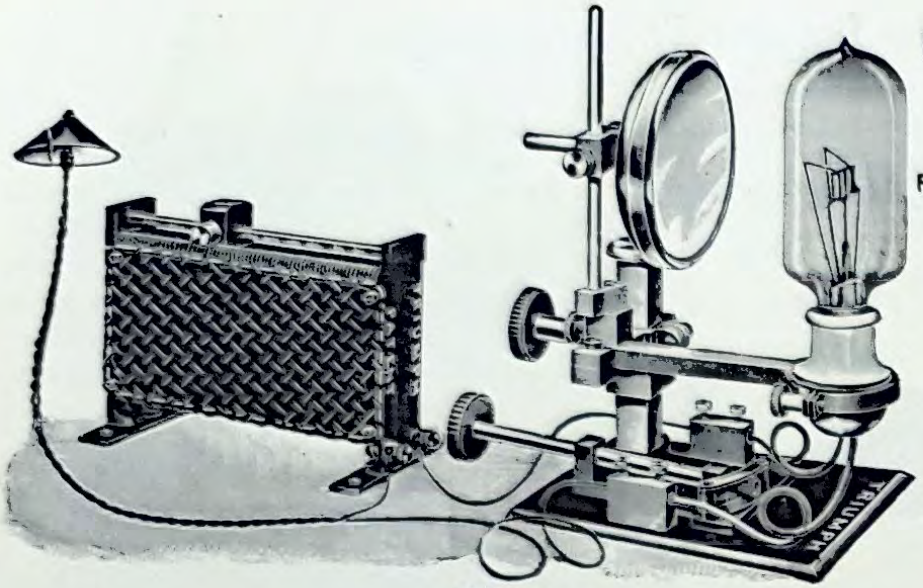


10729

FOCUSLIGHT OUTFITS (C)

10729 **No. 1 Series.** These Outfits are for use direct from the current supply without a Resistance or Transformer. They are particularly suitable for Stage Projectors and Spotlights, but may also be employed for Optical Lanterns and Cinematograph Projectors.

Type of Outfit.	Voltage of Lamp.	Consumption in Watts.	Adjustments. T to F Min.	T to F Max.	F to L	Outfit without Lamp. Plain Tray.	Mechanical Tray.
No. 1A	Any voltage 100/250 can be supplied.	100	4¼ in.	8 in.	2½ in.	£1 2 6	£2 10 0
No. 1B		250	4¼ "	8 "	3½ "	1 2 6	2 10 0
No. 1C		500	4¼ "	8 "	3½ "	1 2 6	2 10 0
No. 1E		1,000	5¼ "	9 "	4½ "	1 8 0	2 16 0
No. 1F ...	30	150	4¼ "	8 "	3 "	1 2 6	2 10 0
No. 1G ...	50	250	4¼ "	8 "	2½ "	1 2 6	2 10 0



10730

10730 "TRIUMPH" FOCUSLITE OUTFIT—"The Universal"

These Outfits have a very fine point of light, and are specially designed for those who desire to possess equipment capable of being used on various electric circuits (A.C. or D.C.) with resistance to regulate the voltage and control the candle power of the lamp. Some clients only need equipment to control low voltages, whilst others require control up to 250 volts. Some require a low power Outfit, and others need a powerful Outfit. The price, therefore, depends on what customers may choose from the table below. We strongly advise a Mechanical Tray for high-power Outfits and in all cases where frequent adjustment is necessary.

Prices and Particulars

Type of Outfit	Voltage of Lamp	Watts	MEASUREMENTS T to F Min.	T to F Max.	F to L	OUTFIT WITHOUT LAMP On Plain Tray 20/120 V.	On Plain Tray 20/250 V.	Mechanical Tray 20/120 V.	Mechanical Tray 20/250 V.
			in.	in.	in.				
No. 2A ...	30	60	3⅛	7	1½	**53/6**	**60/6**	**81/0**	**88/0**
No. 2B ...	30	150	4¼	8	3	**61/0**	**68/6**	**88/6**	**93/6**
No. 2C ...	30	300	4¼	8	3	**74/0**	**114/0**	**101/6**	**141/6**
No. 2D ...	30	600	6¾	9	4	**111/6**	**182/6**	**139/0**	**210/0**
No. 2E ...	30	900	6¾	9	4	**157/6**	**237/6**	**185/0**	**265/0**

NOTE.—No Adapter is supplied with No. 2C. No Adapter or Cable is supplied with No. 2D and No. 2E, as these Outfits cannot be used off lighting circuits as illustrated.

The lowest efficient working pressure is 20 volts and the **Maximum** pressure at which the lamp must be run is 30 volts. The resistances are marked for all voltages, allowing for 25 volts at the lamp.

The life and candle power varies according to the pressure at which customer works.

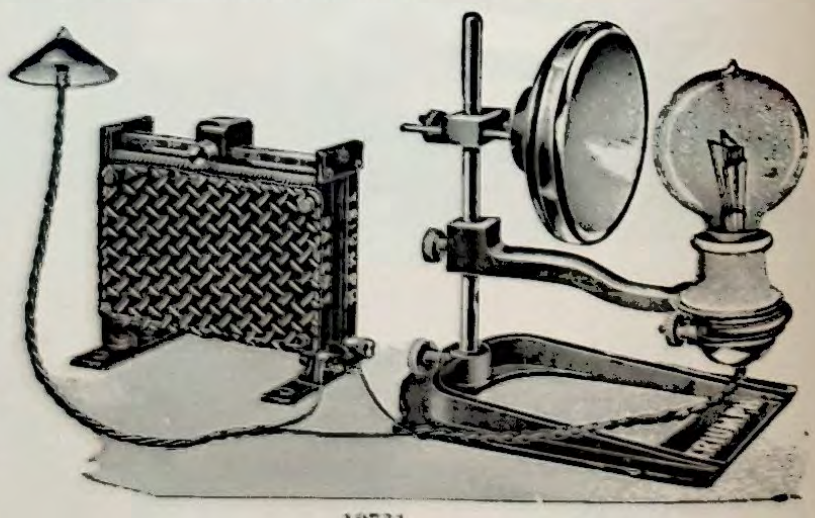
10731 FOCUSLITE OUTFITS (C)

These Outfits are recommended to those who require a powerful concentrated light which can be used on any ordinary house lighting circuit without risk to the installation.

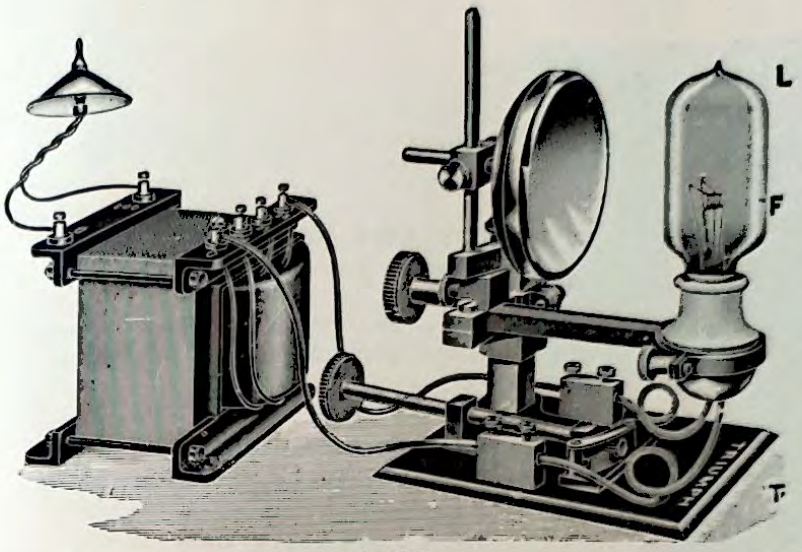
The Bulb is only 3 in. diameter, and thus enables the Outfit to be used in almost any lantern body.

The Resistance is our well known Triumph pattern with Roller Contact, which enables the 5A Lamp to be used on any circuit from 50 to 250 volts, and the 5B on any circuit from 110 volts to 250 volts.

Type of Outfit	Voltage of Lamp	Watts	Measurements T to F Min.	T to F Max.	F to L.	Outfit without Lamp On Plain Tray	Outfit without Lamp Mechanical Tray
			in.	in.	in.		
No. 5A	80/85	250	4½	6½	1½	**63/6**	**91/0**
No. 5B	100/110	250	4½	6½	1½	**59/0**	**86/6**



10731



10732

10732 FOCUSLITE OUTFITS (C), No. 6 (Transformer) Series. Specially designed for Alternating Current only.

Great economy is effected by employing low Voltage, high Amperage Lamps with concentrated filaments, and a special Transformer to reduce the Voltage to that required by the Lamps, and this is accomplished without any appreciable loss of current.

One of the special features is that every set, except those marked with a star, can be employed off ordinary Lamp Holders. Another advantage is that those persons possessing one of the higher power Outfits, can always employ any of the lower power Lamps with the Outfit. For example, a person possessing a No. 6B Outfit can also use No. 6A Lamps. Each Transformer is provided with three tappings, and this enables the brilliancy of the illuminant to be decreased or increased to suit various requirements.

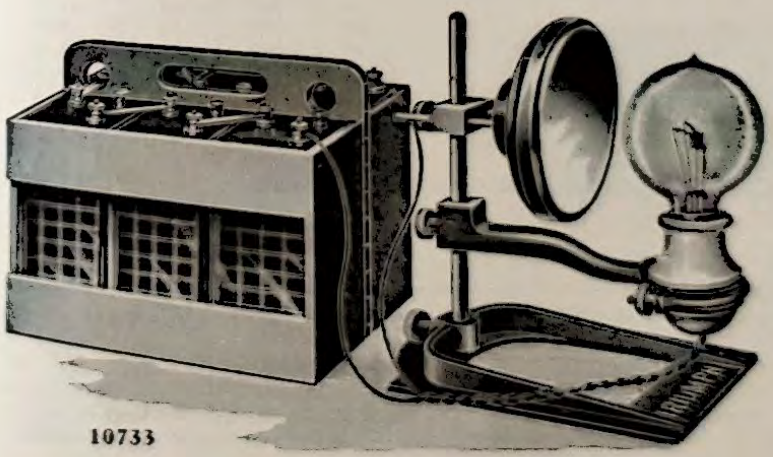
Whenever Alternating Current is available, we strongly advise the use of these sets, and particularly draw attention to the very high candle-power obtainable from the low current consumption, as shown by the scale below.

Type of Outfit	Type of Lamp		Approx. Current Consumption on		Measurements T to F			Outfit without Lamp	
	Volts	Amps	100/110 Volts	200/250 Volts	Min.	Max.	F to L	On Plain Tray	Mechanical Tray
6.A	30	5	1½ amps	¾ amp	4½ in.	8 in.	3 in.	**77 6**	**105 0**
6.B	30	10	3 ,,	1½ ,,	4¾ ,,	8 ,,	3 ,,	**90 6**	**114 6**
6.C	30	20	*6 ,,	3 ,,	6½ ,,	9 ,,	4 ,,	**119 0**	**144 6**
6.D	30	30	*9 ,,	4½ ,,	6½ ,,	9 ,,	4 ,,	**160 0**	**187 6**

All above prices are for 50/100 periods. 25 periods plus 20 per cent.

Important.—It is absolutely necessary when ordering to state the exact Voltage and Periodicity (if under 50) of the Current on which the Outfit is to be employed. Twelve feet of Flex is supplied to connect Mains to Transformer, and six feet of Cable to connect Transformer to Outfit. Other sizes of Transformers can be supplied on receipt of data.

For price of Transformers only, see page 424. For price of Lamps, see page 346.



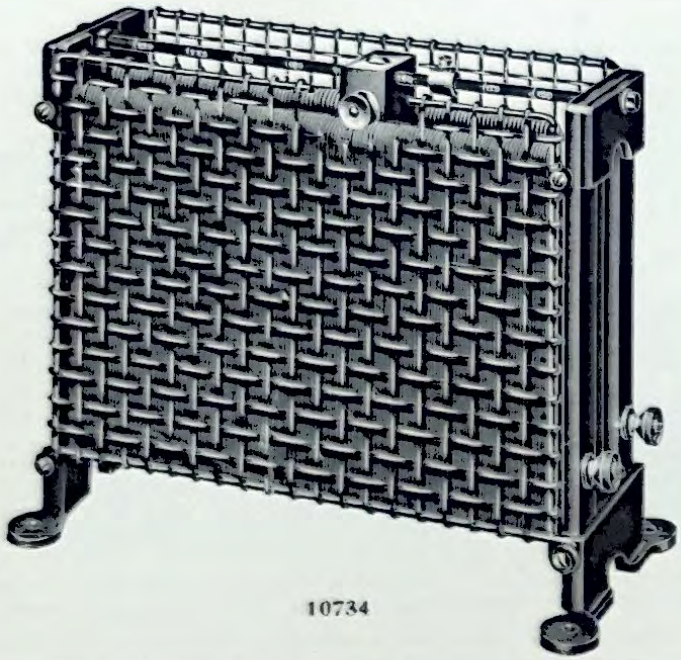
10733

10733 FOCUSLITE OUTFITS (C), No. 3 (Accumulator Series).

These Outfits are designed for those who have no electric current or who prefer to run off batteries.

Our Accumulators are supplied complete in strong teak cases and suitable for 4 to 5 hours run after each charge.

Type of Outfit	Voltage of Lamp	Watts	Measurements T to F Min.	Max.	F to L	Outfit without Lamp: On Plain Tray	Mechanical Tray	Price of Accumulator (N)
			in.	in.	in.			
No. 1A	6	24	4½	7	1½	**23 6**	**50 0**	**50 0**
No. 1B	12	60	4½	7	1½	**23 6**	**50 0**	**85 0**
No. 1C	12	100	4	8	2	**26 6**	**54 0**	**150 0**
No. 1D	25	300	4½	9	3	**26 6**	**54 0**	**300 0**



10734

10734 PORTABLE RESISTANCES for Focus Lamps (Patent No. 26361/1913)

Composed of an Iron Frame, asbestos covered, wound with best quality Resistance Wire, fitted with Brass Bar across the top, on which runs our Patent Roller Contact and Rocker Bearings. A Wire Guard is fitted to each side of Resistance.

Regulating		Maximum Carrying Capacity and Approximate Resistance in Ohms											
From	To	Ohms	2 Amps	Ohms	2 Amps	Ohms	5 Amps	Ohms	10 Amps	Ohms	20 Amps	Ohms	30 Amps
Volts	Volts												
30	120	45	**30/0**	—	—	18	**37/0**	9	**45/0**	50	**85/0**	3	**130/0**
30	250	110	**37/6**	—	—	45	**45/0**	22	**85/0**	11	**155/0**	9	**210/0**
50	250	110	**37/6**	55	**40/0**	45	**45/0**	22	**85/0**	11	**155/0**	—	—
100	250	75	**37/6**	40	**40/0**	30	**45/0**	15	**80/0**	—	—	—	—

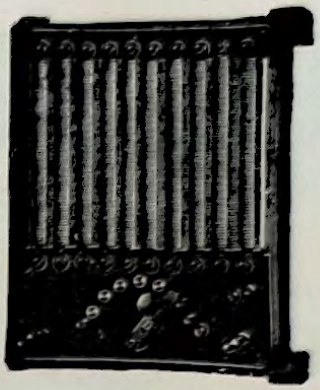
10734/1 **PRICES AND PARTICULARS OF FOCUSLITE LAMPS.**
When Ordering, please state exact Voltage, Wattage, and Series No. of Lamp.

Suitable for Outfit	Voltage	Amps	Watts	Height of Filament Centre	Price	Suitable for Outfit	Voltage	Amps	Watts	Height of Filament Centre	Price
				in.						in.	
6.A	12	5	60	—	**4/6**	2.B	30	5	150	4½	**12/6**
6.C	100/250	—	100	—	**10/9**	2.C	30	10	300	4½	**21/0**
6.D	100/110	—	250	—	**20/0**	2.D	30	20	600	6½	**38/0**
6.D	200/250	—	250	—	**22/6**	2.E	30	30	900	6½	**38/0**
1.A	100/110	1	100	4½	**10/9**	3.A	6	4	24	3½	**4/6**
1.A	200/250	—	100	4½	**12/0**	3.B	12	5	60	3½	**4/6**
1.B	100/110	—	250	4½	**20/0**	3.C	12	8	100	4	**11/3**
1.B	200/250	—	250	4½	**22/6**	3.D	30	10	300	4½	**21/0**
1.C	100/110	—	500	4½	**26/0**	5.A	50	4¼	250	4½	**17/6**
1.C	200/250	—	500	4½	**26/0**	5.B	100/110	2½	250	4½	**20/0**
1.E	100/250	—	1000	6½	**33/6**	6.A	30	5	150	4	**12/6**
1.F	30	5	150	4	**12/6**	6.B	30	10	300	4	**21/0**
1.G	50	4¼	250	4½	**17/6**	6.C	30	20	600	6½	**38/0**
2.A	30	2	60	3½	**7/6**	6.D	30	30	900	6½	**38/0**

All above Lamps are fitted with standard E.S. caps, except Nos. 1.E., 2.D, 2.F, 6.C, 6.D, which have G.E.S. caps. Height of filament centre is measured from bottom of lamp holder to centre of filament.

NOTICE.

To help our customers in selecting the correct size Focuslite lamp, under favourable conditions, it is advisable to allow at least **5 watts per square foot** of screen surface for standard size slide Projection and **7 watts per square foot** of screen surface for standard size cinematograph Projection. Extra wattage must be allowed for densely coloured slides or tinted films, also extra long throws.



10735

10735 ARC REGULATING RESISTANCES

(When ordering, exact voltage must be stated).

Wall Type Regulating

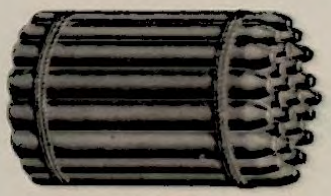
Amps	Volts 60–75	Volts 100–120	Volts 200–220	Volts 230–250
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
5—15	2 15 0	3 3 0	4 10 0	5 0 0
5—20	3 0 0	3 10 0	5 0 0	5 10 0
10—30	3 7 6	3 18 0	5 12 6	6 5 0
10—40	3 15 0	4 10 0	6 15 0	7 10 0
20—50	4 0 0	4 15 0	8 5 0	9 0 0
20—60	4 7 6	5 15 0	10 12 6	11 0 0
30—70	4 10 0	6 5 0	12 0 0	13 2 6
30—80	4 17 6	6 12 6	13 17 6	15 0 0
30–100	6 0 0	8 5 0	16 10 0	19 5 0

Duplex and Dissolving Resistances for fading and controlling two arc lamps, Parallel type with change-over switches, 75 per cent on above prices; Rotary type 100 per cent on above prices.

10736 Wall Type (Non-Regulating)

Amps	60–75 Volts	100–110 Volts
	£ s. d.	£ s. d.
10	1 17 6	2 12 6
15	2 0 0	2 15 0
20	2 2 6	2 17 6
25	2 5 0	3 0 0

Amps	200–220 Volts	230–250 Volts
	£ s. d.	£ s. d.
10	3 17 6	4 10 0
15	4 10 0	4 17 6
20	4 15 0	5 0 0
25	5 5 0	5 10 0

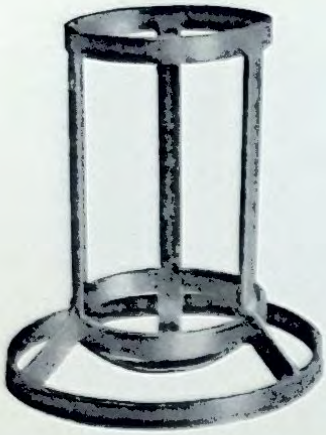


10737

Arc Lamp Carbons. These carbons are unequalled for light and steadiness. The arc burns absolutely without noise and settles down immediately on striking or re-striking.

For Direct Current. Price per 25 pieces.

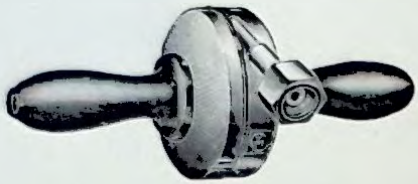
		Cored Positive Carbons.			Solid Negative Carbons.		
10737	Solid Negative Carbons. Diam.	5	6	7	8	10	12 mm., 6 in. long
	Price per 25 Carbons ...	3 6	4 0	4 6	4 9	5 0	5 9
10738	Cored Positive Carbons. Diam.	6	7	8	10	12	14 mm., 6 in. long
	Price per 25 Carbons ...	4 0	4 6	4 9	5 0	5 9	6 9



10743-4



10740



10745

10739 **Compressed Oxygen or Hydrogen** in Cylinders as in No. 10740, per cubic foot. nett **£0 0 4**

Note.—Rent is charged on all Cylinders after the first fortnight as follows:—

1/3 per week on Cylinders up to 20 cubic feet.
1/6 " " " 40 and 60 cubic feet.
2/6 " " " 80 and 100 cubic feet.

As the rent is charged on all cylinders by the manufacturers after the first *fortnight*, will customers make a special note of the conditions as to the return of cylinders.

10740 **Cylinders for Compressed Oxygen**, with Valve.

Capacity	10	20	40	60	80	100	cubic feet
	45/0	**55/0**	**90/0**	**115/0**	**130/0**	**160/0**	each

10741 Fittings for above—Tap, Union and Key ... ... nett **£0 11 6**

It should be noted that these Cylinders are solid drawn, and much safer than the cheaper lap-welded variety so often supplied, which are not reliable.

10742 **Hemp Covers**, for above. Capacity

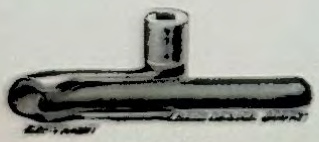
10	20	40	60	80	100	cubic feet
7/6	**8/6**	**12/6**	**18/6**	**21/6**	**25/0**	each

10743 **Cylinder Stand**, suitable for 10 and 20 ft. cylinders, without covers... ... nett **£1 2 6**

10744 Ditto, ditto, for 40 ft. ditto ... ... ,, **1 6 6**

When ordering, please state the capacity of Cylinder, and if fitted with Hemp cover.

10745 **Metal Box**, Nickel-plated, for production of solid CO_2, with Jet and Coupling nett **1 17 6**



10746-7



10748

10746 **Folding Lever** Cylinder Valve Key, steel throughout. This is the key usually employed to open and close the valves of gas cylinders. Black **£0 3 0**

10747 Ditto ... ... Nickel-plated **0 3 6**

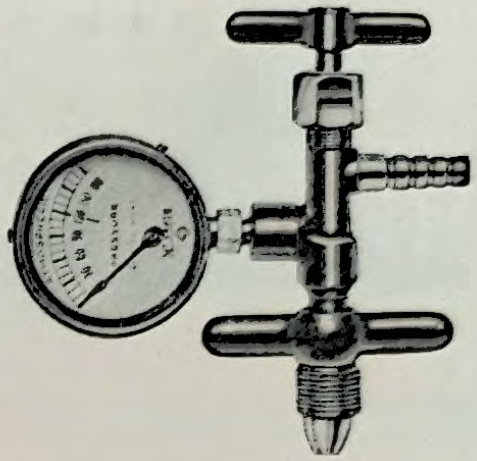
10748 **Gland Nut Spanner.** This spanner is useful for tightening up the Gland Nut of the Cylinder Valves when a leakage of gas is observed... ... ... nett **0 1 6**

10749 **Valve Key**, Wooden Handle ... ... ,, **0 4 6**

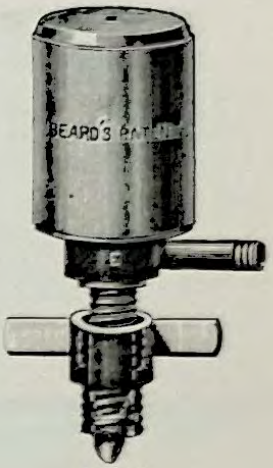
10750 Ditto, All Steel (Black) ... ... ,, **0 3 0**



10751



10752-3



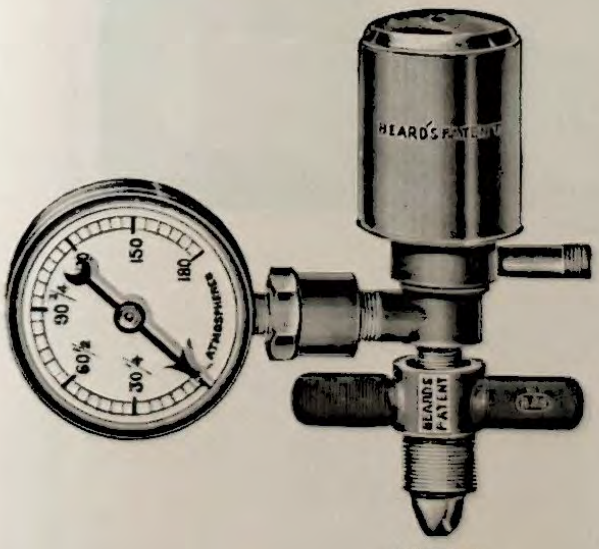
10754

10751 **Nipple and Union for Cylinder Valves.** This connection is sent out with hired Cylinders unless a Fine-Adjustment Valve is ordered. To connect with the Cylinder Valve screw the Union into Valve Socket. Provided the Valve Socket is in good condition and clean, it is only necessary to tighten up the Union by hand in order to make a perfectly gas-tight joint. Care must be taken to see that the Union is screwed to the correct hand for the Cylinder on which it is used ... ... nett **£0 4 6**

10752 **Fine Adjustment Valve, with Gauge.** These Valves are generally used in connection with the inhalation of Oxygen direct from Cylinders. The flow of gas is easily controlled by these fittings, which have a very sensitive adjustment and consequently are superior to the Nipple and Union (No. 10751), which embodies no controlling device. They give a more delicate means of adjusting the flow of gas from the Cylinder than the ordinary Cylinder Valve. After they are connected to the Cylinder Valves the latter may be left open and all subsequent regulation can be effected by the Fine-Adjustment Valve. Care must, however, be taken to see that no leakage of gas occurs either in the Socket or round the Spindle of the Cylinder Valve. Care must also be taken to see that the Union is screwed to the correct hand for the Cylinder on which it is used... nett **£2 0 0**

The Cylinder Valve should be closed as an additional precaution against leakage when the Cylinder is put out of use for any considerable time.

10753 **Fine-Adjustment Valve,** as No. 10752, without Gauge **£0 12 6**



10755-6

10754 **Beard's Gas Regulator** (Patent), fitted with Patent Reversible Coupling ... ... nett **£1 13 6**

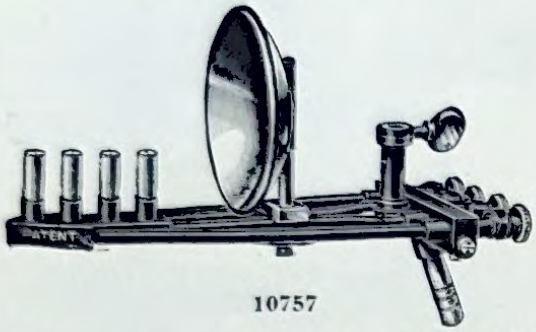
The reversible coupling will connect Brin's Bull-nose Cylinder Valves, and when reversed will connect the ½ in. or male threaded Cylinder Valves, thus obviating the use of extra loose Connectors.

10755 **Beard's Gas Regulator,** with Branch and Coupling for 3-in. gauge ... each nett **£2 2 0**

10756 **Pressure Gauge** for above —

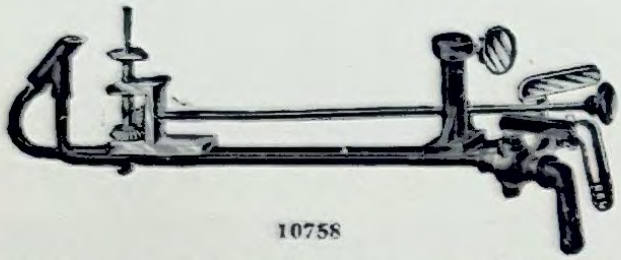
2½	3	in. gauge
£1 5 0	**£1 10 0**	each nett

Lantern Jets

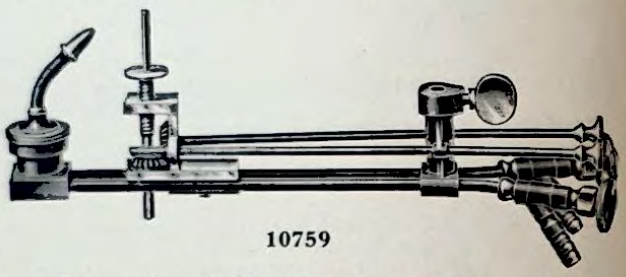


10757

10757 **Acetylene Jets,** with 4 Burners complete, with Double Back Reflector and separate Screw-down Valves, which are much superior to the usual Taps ... each **£1 0 0**



10758



10759

***10758** Blow-through Jet, well made, highly finished and thoroughly reliable, complete with Lever Taps, Cog Wheel, Lime Turner, etc. ... ... each **£1 5 0**

***10759** Oxy-hydrogen High-Pressure Chamber Jet, improved pattern, with fine adjustment taps in place of the ordinary turn-off form. With backward and forward adjustment of the Lime ... ... each **1 10 0**



10763



10760–1



10764

***10760** **Limes,** The "Excelsior" Trilby, size 1½ × 1 in., in Airtight Tins of 1 doz. per tin **£0 4 0**

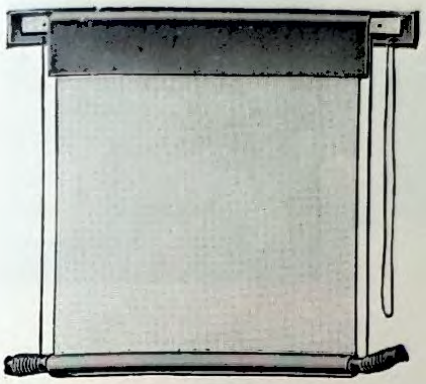
***10761** ,, "Excelsior" Trilby Cinematograph, 1½ × 1¼ in., 6 limes in tin ... ,, **0 3 0**

***10762** ,, "Nottingham Hard," 1½ × ⅞ in., 12 limes in tin ... ... ,, **0 4 0**

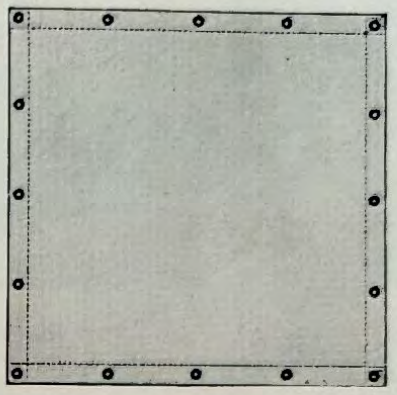
***10763** ,, "Mabor." These limes are unaffected by moisture, and are practically indestructible. Can be carried in the pocket. Made in two usual sizes, 1 in. and 1¼ in. diameter, packed six limes in a box—1 in. diameter **0 2 6**
1¼ in. ,, **0 3 6**

***10764** **Thorium Pastilles** give a splendid light and will last for at least twelve to fifteen lectures if handled carefully. 20 × 15 mm. ... ... each **0 2 6**
20 × 20 mm. ... ... ,, **0 3 0**

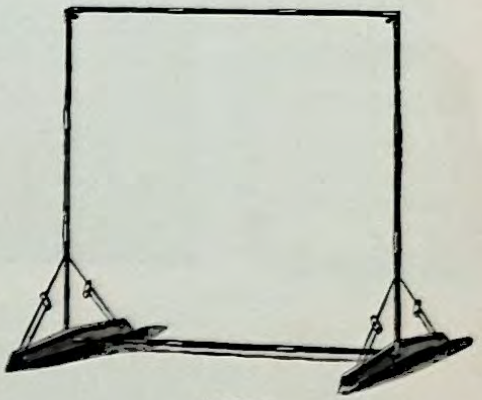
Lantern Screens and Screen Stands



10765



10766



10767

10765 **Screens, Stout Canvas,** mounted on Laths and Rollers with Iron Pulleys and strong Cords. On top of the Lath a cover of American Cloth is arranged for use when Screen is rolled up and protects same.

6	8	9	10	12	14	15	16 ft. sq.
50/0	**70/0**	**84/0**	**100/0**	**150/0**	**200/0**	**230/0**	**260/0**

10766 **Screens.** Hemmed all round and eyeletted.

Best Calico 6	7	8	9	10	12	14	16	18	20 ft. sq.
16/0	**20/0**	**27/0**	**33/0**	**39/0**	**48/0**	**72/0**	**92/0**	**125/0**	**135/0**

Above 12 ft. are joined with wide width in centre.

10767 **Screen Stands.** Each set of Screen Supports consists of 4 metal Angle Pieces, Pine Rods as per List, pair of Supports with Guy Ropes and Cleats, complete in Black Wood Boxes.

(Elevators extra, as per List).

When ordering please state whether 1 in. or 1¼ in. Rods are required.

SIZES AND PRICES.

No.	Size of Screen	Each Frame consisting of Pine Rods as under	1-in. Rods	1¼-in. Rods
1	6 ft. × 6 ft....	4 4-ft. and 4 2-ft.	£3 15 0	£4 2 6
2	8 ft. × 8 ft....	8 4-ft.	4 5 0	4 15 0
3	10 ft. × 10 ft....	8 4-ft. and 4 2-ft.	4 18 6	5 10 0
4	12 ft. × 12 ft....	12 4-ft.	5 5 0	5 15 0
5	14 ft. × 14 ft....	12 4-ft. and 4 2-ft.	—	6 10 0
6	16 ft. × 16 ft....	16 4-ft.	—	7 5 0
7	18 ft. × 18 ft....	16 4-ft. and 4 2-ft.	—	8 5 0

EXTRAS.

Elevators, consisting of 2 T pieces and 2 2-ft. rods	17 6	20 0
,, ,, 2 T pieces and 2 3-ft. ,, ...	18 6	21 0
Angle Pieces (per pair)	10 0	11 0
T Pieces (per pair)	15 0	17 0
2-ft. Rods with Brass Ferrules	4 0	5 6
3-ft. ,, ,, ,, ,, ...	5 0	6 6
4-ft. ,, ,, ,, ,, ...	6 0	7 6
6-ft. ,, ,, ,, ,, ...	7 0	8 6
2-ft. Elevator Rods (per pair)	2 6	3 6
3-ft. ,, ,, ,, ...	3 6	4 6
4-ft. ,, ,, ,, ...	4 0	5 0
Cleats (per set of 4)	1 6	1 9

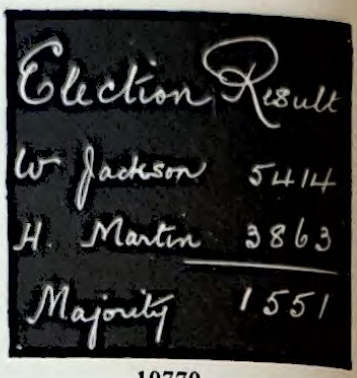


10768





10769

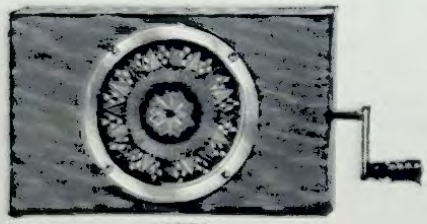


10770

*10768 **Combination Cover Glass and Spot Binder.** Makes the neatest possible lantern slides. The Cover Glasses are well-selected thin glass, and the Binders are made with the best African gum. The spots will also be found most useful for writing on the title, numbering, etc., and also for showing the right way for placing in the lantern. This combination will be found a great boon to lantern slide makers, being always at hand and ready for use. Slides may be mounted and finished ready for exhibition at a moment's notice. Price per box (12 covers) **£0 2 0**

*10769 **Lantern Slide Binding Outfit,** containing everything necessary to complete 50 Lantern Slides. A very useful outfit, containing 50 Cover Glasses, a box each Binding Strips, Assorted Masks, numbered Spots, and a bottle of white ink; the lot packed in draw box with divisions and brass handle so that it is useful for storing the slides when finished; price **£0 7 6**

*10770 **Diagram Plates,** for showing Diagrams, Drawings, Writings, etc., in the Lantern. These plates are prepared with a black ground, so that any notice or design can be made by means of a needle or other sharp point. 12 plates in box **£0 1 6**



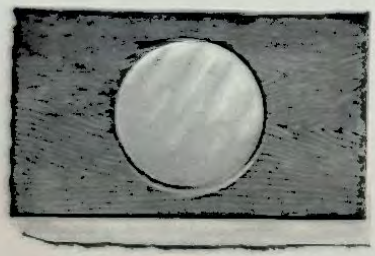
10773

*10771 **Notice Lantern Plates,** for Writing Announcements as Lantern Slides, coated with Gelatine. Price Plain, per box, 12 plates **0 1 6**
Price Coloured, per box, 4 plates, metal carrier and point **0 1 6**

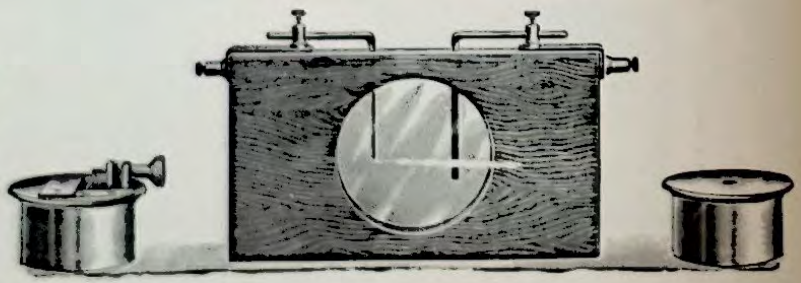
*10772 **Ink for Lantern Slides. White.** For naming Lantern Slides; useful for ruling and decorating Photo Mounts ... ... Price per bottle **0 0 9**
Black. For writing on plain glass; useful for making notice slides, etc. ... Price per bottle **0 0 9**



10772



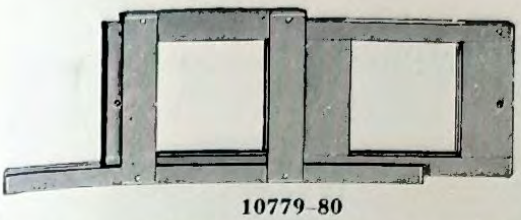
10775



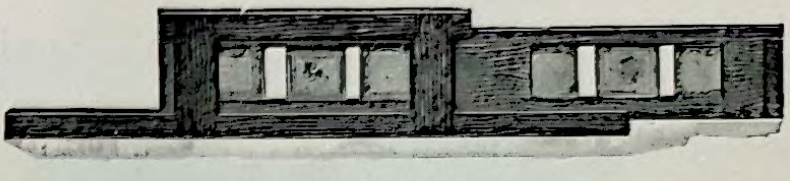
10777 10776

10778

*10773 **Chromotropes,** hand coloured. Double Motion Rackwork. 24 different designs ... ... each **£0 15 0**
*10774 Extra designs ... ... per pair **0 6 0**
10775 **Chemical Trough.** Made in unpolished Mahogany, 7 × 4 in., with circular opening 3 in. diameter. Provided with two Glasses and separated by stout india rubber ... ... Price **0 5 6**
10776 **Electrolytic Tank.** Fitted with Terminals and Copper Electrodes **0 15 0**
10777 **Parallel Beam Nozzle.** Brass with adjustable Slit **1 5 0**
10778 **Pencil Beam Nozzle,** with circular opening **0 7 6**

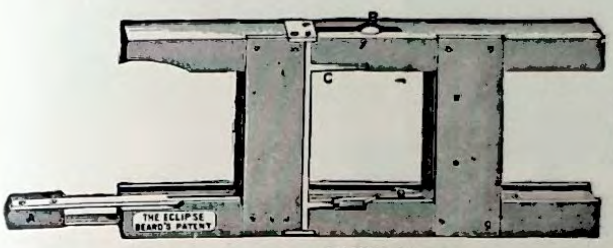


10779–80

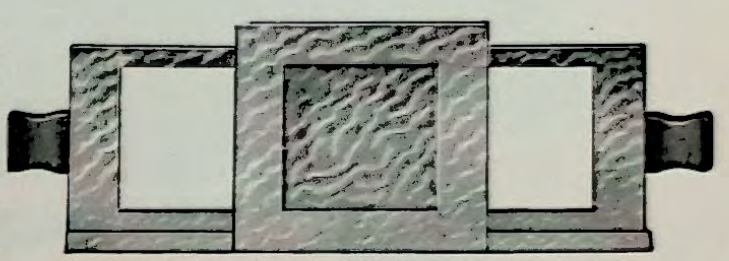


10781

*10779	**Slide Carrier,** ordinary lightning pattern, in Mahogany, for 3¼ × 3¼ (8·3 × 8·3 cm.) slides. Price, each	£0 3 0
*10780	Ditto, in Mahogany, with lifter ... ... ,,	0 4 0
*10781	**Micro Slide Carrier.** Made of unpolished Mahogany, well finished, to carry 3 × 1 in. microscopic slides, it is of the double sliding pattern and intended for use with any projection microscope	0 4 0



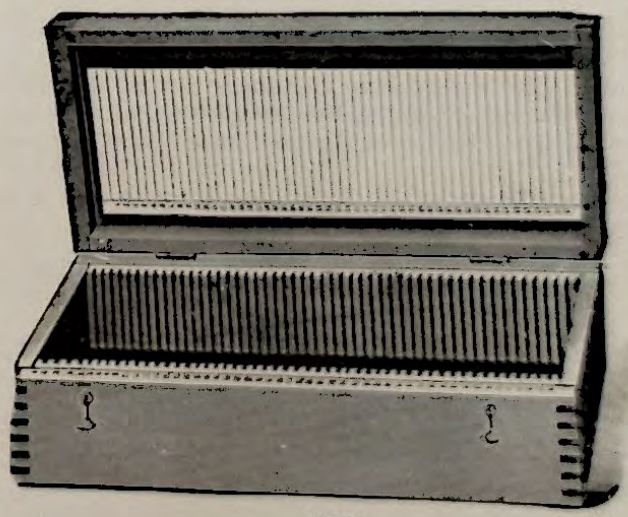
10782–3



10785

Beard's Patent Eclipse. Constructed to give dissolving effect to a single lantern and at the same time centring all slides being inserted and withdrawn from one slide:—

*10782	Ordinary pattern ... ... each	£0 15 6
*10783	Ditto, Brass-faced ... ... ,,	0 17 6
*10784	Special pattern, for slides 3¼ × 3¼ (8·3 × 8·3 cm.) to 3¼ × 4¼ (8·5 × 10 cm.) ... ... ,,	1 0 0
*10785	**Solid Brass or Nickel Slide Carrier,** with Light Cut-off and strong Fibre Handles at each end	0 15 0



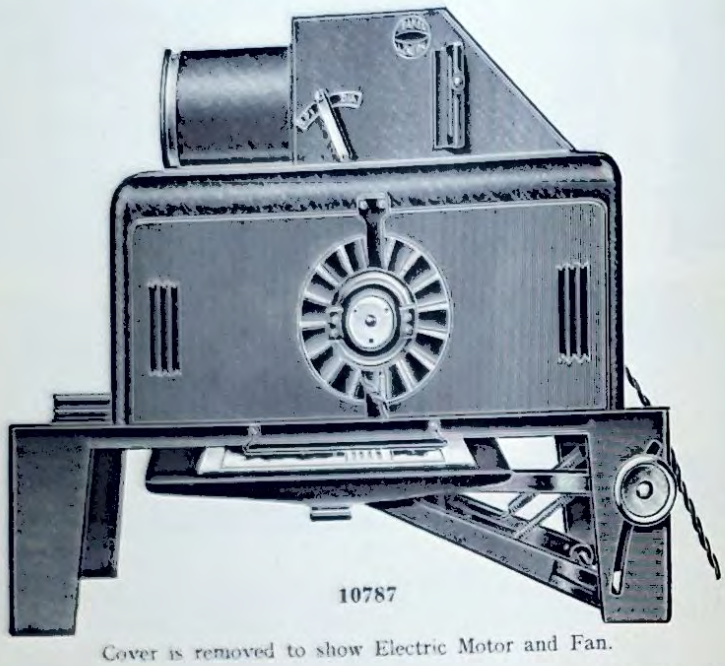
10786

10786 **Lantern Slide Boxes,** Polished Pine, with dovetail corners, numbered grooves, and a Tablet in lid for reference.

For 24	50	100	slides
4 6	5 6	9 0	each

Baker's "British" Epidiascope

BRITISH MANUFACTURE.



10787

Cover is removed to show Electric Motor and Fan.

10787 The "British" Epidiascope is the result of wide experience gained over a long period of manufacturing this class of projection apparatus, and also extensive experimental work. It is claimed that in simplicity of action, workmanship, design, brilliancy of projected image, the "British" Epidiascope is far in advance of any competitive model. Furthermore, the price is lower than any other make of Epidiascope embracing the same features.

The principal advance in design is the utilisation of the same objective for the dual purpose of epi- and diascopic projection, resulting in the very finely corrected qualities of the episcopic objective being available for the projection of lantern slides. This outstanding feature is not to be found in any other Epidiascope.

It is fitted with a highly efficient exhausting Electric Fan; two 500-watt Lamps are used, silvered on the back.

A Pointer of new design enables attention to be directed to different parts of the picture. Above the pointer is an observation window.

Subjects up to 6 in. × 6 in. can be projected direct, but there is also a movement of 17 in. in one direction, and unlimited movement in the other.

Objects as thick as 5 in. can be placed on the platform, and their surfaces projected.

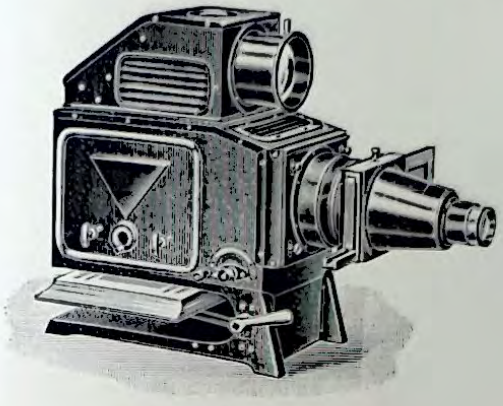
Two Switches are supplied, and one lamp can be switched off when the Epidiascope is being used for projecting lantern slides.

Full particulars of a micro projection apparatus for use with the Epidiascope will be sent on application.

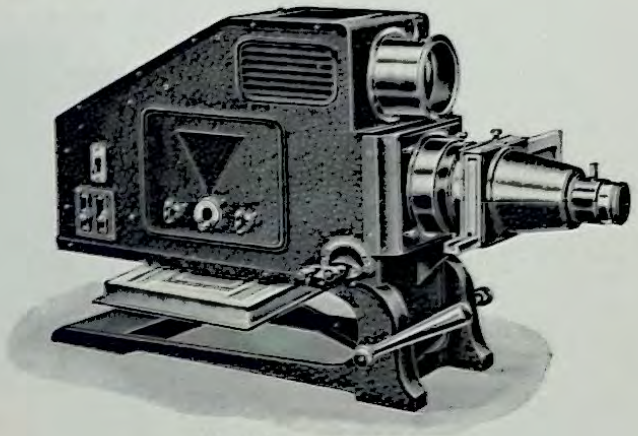
Prices

Baker's "British" Epidiascope, complete with Fan		£36	0 0
Lamps, 100 to 250 volts	each extra	2	0 0
Adjustable Resistance		2	15 0
Strong Travelling Case		2	12 6
8 ft. square opaque Screen on roller		3	10 0
6 ft. „ „ „ „		2	10 0
8 ft. „ silvered „ „		5	0 0
6 ft. „ „ „ „		3	0 0
Pulleys and Cords		1	1 0
Rigid Pine Table Stand, with tilting top		2	15 0

Edwards' Epidiascopes (Models 2 and 3)



Model 2. 10788–89



Model 3. 10890–91

The interest raised by the excellent performance of these instruments at the New Year Exhibitions was due to the fact that they now set a new standard for brilliance of results and convenience in operation.

Special attention is called to the open design of the base, which allows very large maps, etc., to be exhibited portion by portion. Another unique feature is that the Episcopic and Diascopic Lenses project pictures of the same size in exactly the same position on the screen. Actual size projected at one time, 6¾ in. × 6¾ in.

The Ventilation is exceptionally good, and although an efficient cooling fan can be supplied with the instrument or fitted later, the fan is not generally necessary.

Other advantages are:—

Door provided with side flaps, thus providing a shaded opening large enough for handling objects on the Episcopic Stage.

Movable inspection window, also useful for inserting pointer.

The illumination for Model 2 is provided by one 500-watt lamp, that for Model 3 by two 500-watt lamps, and Model 4 by three 300-watt lamps.

No one-lamp Epidiascope can give results comparable with those from two lamps efficiently used, and for opaque projection two lamps are in general desirable, as pictures can then be shown in a fair amount of light providing the screen itself is in shadow.

The extra cost of upkeep of two lamps is negligible. Twice the light is provided, and should one lamp fail the lecturer may proceed without interruption.

However, for fairly dark rooms and average sized classes the one-lamp model is quite adequate, and besides being less expensive it has the advantage of light weight and is, therefore, easily portable.

(F) **10788**	**Edwards' Epidiascope, Model 2** (1 lamp), with first quality lenses for both Episcopic and Diascopic projection, Slide Carriers, Flexible Connecting Cord	**£29**	**10**	**0**
(F) **10789**	**Edwards' Epidiascope, Model 2** (1 lamp), as specified above but with second quality lenses	**25**	**12**	**6**
(F) **10790**	**Edwards' Epidiascope, Model 3** (2 lamps), with first quality lenses for both Episcopic and Diascopic projection, Slide Carriers, Flexible Connecting Cord	**44**	**0**	**0**
(F) **10791**	**Edwards' Epidiascope, Model 3** (2 lamps), as specified above but with Cooling Fan	**50**	**10**	**0**
(F) **10792**	Lamps, 500-watt projection type, suitable for above instruments ... each	**1**	**5**	**0**

(F) Foreign manufacture.

Edwards' "Globe" Projector



10793

Designed on an entirely new principle, and using ordinary electric lamps.

This instrument makes a new departure in the design of Opaque Projectors. The illumination is provided by three ordinary 100-watt gas-filled lamps of any good make, and the whole of the interior surface reflects the light on to the bottom of the apparatus. The projection aperture is of circular shape, 5 in. diameter, this area proving sufficient for the majority of objects, such as book illustrations, flowers, minerals, etc. A special Holder is provided for post-cards, photographs, and loose prints.

Unique Features

Objects to be projected are placed under the instrument.

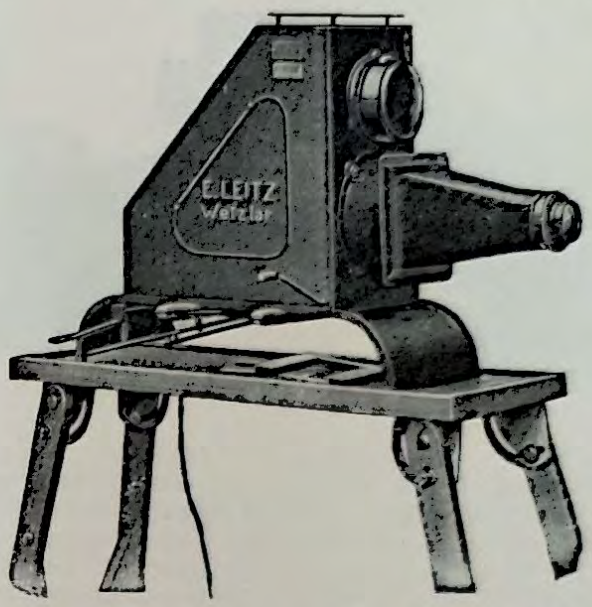
Completely darkened rooms are not necessary, and brilliant pictures up to 5 ft. diameter can be projected about 9 ft. from the screen, or a well-whitened wall surface may be used.

The apparatus can be readily connected to any lighting circuit and no resistances are required.

Ordinary Gas-filled lamps are used.

(F) **10793**	**Edwards' "Globe" Projector** (3 lamps) for Episcopic projection, with aperture 11 × 11 cm., good quality lens, silvered Mirror and 3-metre length of Flex, without lamps										**£11**	**12**	**6**
	Base support for "Globe" Projector										**0**	**12**	**0**
	Post-Card Holders										**0**	**3**	**0**
	Lamps (ordinary gas-filled type) each										**0**	**3**	**6**
	Collapsible Self-supporting Screen, silver or white surface, 50 × 75 cm.										**2**	**7**	**6**
	Ditto, 75 × 100 cm.										**3**	**2**	**6**
	Ditto, 100 × 130 cm.										**4**	**9**	**0**

Optical Projection Apparatus for Schools



THE MOST BRILLIANT SINGLE LAMP EPIDIASCOPE

The Epidiascope in these days is the acknowledged Universal Optical Projection Apparatus for use in Schools and Colleges, Literary, Geographical and Scientific Societies, Hospitals and other Institutions.

Opaque pictures are reproduced on the screen with astounding brilliancy, and the same applies to lantern slides of every kind, including English, Continental, and American sizes. Stationary film pictures, as well as microscopic preparations, can also be projected. The quality of the screen picture, the marginal definition, the optical colour correction and crispness of the screen pictures, are of the highest order.

The design affords effective protection from heating.

Expenditure on filament lamps is small, as the lamps are robust and last a long time.

The apparatus connects to any domestic electricity supply circuit (the latter being provided with a fuse blowing at 5 amperes).

The apparatus is completely enclosed and of a convenient and elegant design.

It can always be relied upon to function properly and cannot fail.

It is guaranteed for 5 years.

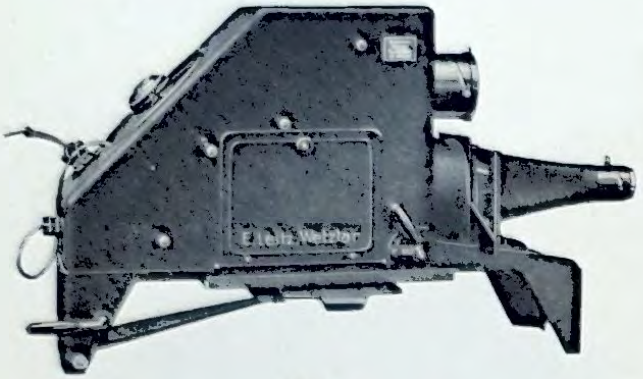
It is extremely simple to manipulate.

(F) **10794** **Epidiascope Vc,** Economic to work, easy to handle, best Leitz Optical components, Object size 6½ × 6½ in., diameter up to 4¼ × 3¼ in., Metal Casing, 110-volt filament Lamp, Reflector, movable Counter-Mirror, Plane Mirror, Diascope Condenser 155 mm. diameter with conical fitting and carrier post-card changer, six Wooden Changing Frames, Flexible Wire 20 in. long, and "Epis" anastigmatic Projection Lens, F/4·0, 400 mm. focal length for episcopic projection. "Dimax" anastigmatic Projection Lens, F-250 mm. for diascopic projection, Press-button when ordered with epidiascope supplied as part of the short flexible wire, Flexible twin wire 10 ft. long, with Coupling and Plug complete, ready for use **£35 4 6**

(F) **10795** **Epidiascope Vc,** as above, but without the arrangement for projecting lantern slides and available for projecting opaque objects only **£25 12 0**

(F) Foreign manufacture.

Leitz New Model Type Vh Epidiascope with Cooling Device



10796

(F) **10796** **Epidiascope Vh "400."** An unsurpassed school apparatus, astounding intensity, low price, firm and substantially made, screen distance 5–8 m. (16–26 ft.). Single-lamp, consisting of a Metal Casing, 110-volt filament Lamp, Reflector, two side auxiliary Mirrors, movable Counter-mirror, surface silvered Projection Mirror, automatic change-over, Cooling Fan, Switch for Motor and Lamp, Diascope Condenser, 155 mm. diameter, conical fitting for diascope, Objectives and Slide Carriers, post-card Changing Frame, Episcopic Stage, six lantern slide Changing Frames, together with "Epis" anastigmatic Projection Lens, F/4, 400 mm. focal length, for episcopic projection, and "Dimax" anastigmatic Projection Lens, 250 mm. focal length, for diascopic projection. Flexible Wire, 10 ft. long, with Coupling and Plug, Hard-glass Plate for flattening paper objects; complete, ready for use **£45 0 0**

(F) **10797** **Epidiascope Vh "500."** Apparatus of great intensity for moderately long screen distances. For screen distances of 7–10 m. (23–33 ft.), with highest-grade Objectives and all other advantages of a single-lamp apparatus. Equipped with two anastigmatic Projection Lenses, 500 mm. focal length, for episcopic projection, and 330 mm. for diascopic projection, including 10 ft. flexible twin wire and hard-glass plate **£64 2 6**

(F) **10798** **Epidiascope Vh "600."** An inexpensive Epidiascope for the school hall, for screen distance of 9–12 m. (30–40 ft.), great intensity, simplicity itself in serving, equipped with two anastigmatic Projection Lenses of 600 mm. focus, for episcopic projection, and 400 mm. focus or diascopic projection, including flexible wire and hard-glass plate **£83 12 6**

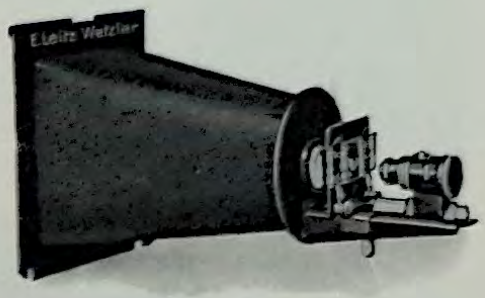
ACCESSORIES for the Vh Type

Resistance for 220 volts, including Flexible Conductor and Plugs			**£1 7 0**
Transformer for 220 volts (for use with A.C. only), including Flexible Conductor			**3 6 0**
Wooden Table, to fold up for Vh "400" and Vh "325," with filling device			**3 1 0**
Wooden Table, heavy design, without adjustments, for Vh "500" and Vh "600"			**3 6 0**
500-watt Filament Lamp for 100, 110, 115, 120, 125, 130, or 220 volts			**1 17 6**
Spare Post-card Changer...			**0 6 6**
Post-card Changing Slide, with Glass Plate			**0 19 6**
Carrying Case for Epidiascope Vh "325"			**4 19 0**
Ditto for Epidiascope Vh "400"			**4 19 0**
Ditto for Epidiascope Vh "500"			**6 1 0**
Protecting Dust Cover for Epidiascope Vh, best Canvas. For Epidiascope Vh "400" ...			**1 0 0**
,, ,, Vh "500" ...			**1 2 0**
,, ,, Vh "600" ...			**1 4 6**
Ditto with Chain and Lock, additional cost			**0 7 0**
Curtain for screening off stray light when changing the episcopic object, each side			**0 7 0**

(F) Foreign manufacture.



Model Vf



Micro Attachment.

(F) **10799** **Small Epidiascope Vf,** an optical lantern for short screen distances; the epidiascope par excellence for small schoolrooms and for use in the home. For connection to any main, powerful lens of best quality, object size 5¾ × 5¾ in. diameter to 4 × 3¼ in., Metal Casing with 110 volt filament Lamp, Reflector, movable Counter-mirror, Plane Mirror above the objective, Diascope Condenser of 120 mm., Wooden Frames, two each 3¼ × 3¼ in. and 4 × 3⅛ in., with conical fitting and carrier; post-card Changer, flexible twin Wire, 20 in. long, and "Epis" anastigmatic Projection Lens, F/3·6, 325 mm. focal length for episcopic projection and 190 mm. focal length for diascopic projection. Press Button in twin wire, flexible Conductor, 10 ft. long, with Coupling and Plug complete, ready for use. **£31 3 0**

(F) **10800** Small Episcope Vf, but without diascopic arrangement **24 7 6**

(F) **10801** Diascope Attachment to the Epidiascope Vf for subsequent addition **6 10 0**

(F) **10802** Front Attachment for the projection of stationary 24 × 18 mm. film pictures, equipped with a projection lens of the highest grade of 64 mm. focus ... **6 2 0**

ACCESSORIES for Types Vc and Vf

The Micro-Projection Front Attachment is furnished with the Leitz micro objectives Nos. 1 and 2, and screen magnifications up to ×300 are attainable, furnishing faultlessly bright and sharp pictures of a sufficiently large size. Micro-projection front attachments should be used at a screen distance not exceeding 8 m. (26 ft.). With Leitz Achromatic Objectives Nos. 1 and 2 ... ... **£7 13 0**

Resistance required with supply voltages exceeding 130 volts, with flexible Conductor and Plugs **1 7 0**

Transformer, to be recommended on a 220 volt A.C. circuit **3 6 0**

Wooden Table to fold up, table top 36 × 12¼ in., for the reception of the apparatus; table top inclinable, with intermediate shelf for depositing objects **3 1 0**

Wooden Table to fold up, with inclinable top 34 × 12 in., with intermediate shelf for Vf ... **2 9 6**

Spare Filament Lamp, 100, 110, 115, 120, 125 or 150 volts, for Vc, Vf **1 17 6**

Post-card Changer with glass plate for easily and quickly changing the objects **1 4 6**

Carrying Case for the Epidiascope Vc, together with Front Attachments and Resistance, light and strong, made of plywood, fitted with Lock and Key **4 19 0**

Carrying Case for Epidiascope Vf **4 2 6**

Canvas Dust Cover for the Epidiascope Vc **1 0 0**

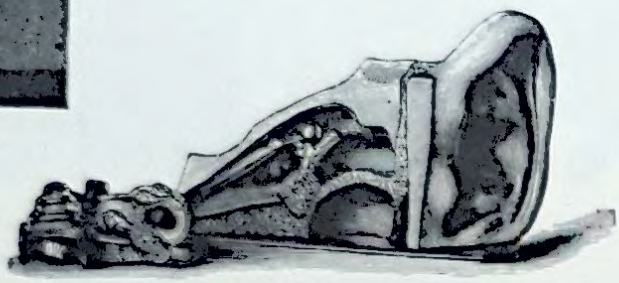
Canvas Cover for Epidiascope Vf **1 0 0**

(F) Foreign manufacture.

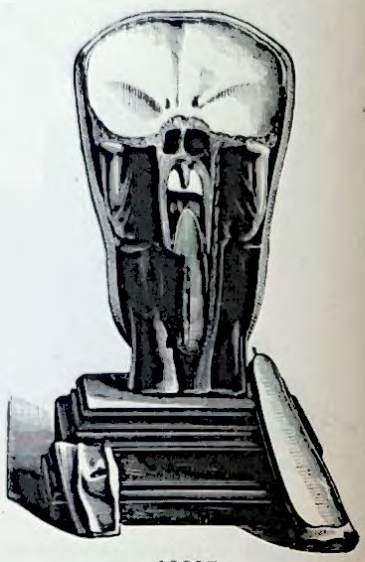
Sound



10805–6

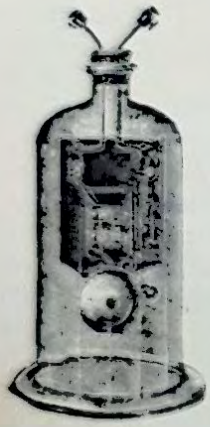


10803–4



10807

(F) 10803	**Model of Ear,** five times natural size, mounted on base	£1 2 6
(F) 10804	Ditto, ten times natural size, mouted on base	1 17 6
(F) 10805	**Larynx, natural size,** with muscles, divisible into 2 sections	0 12 6
(F) 10806	**Larynx, with Tongue,** divisible into 5 sections	0 19 6
(F) 10807	**Model of Larynx,** made to open at the back, for view of nose and throat ...	1 15 0



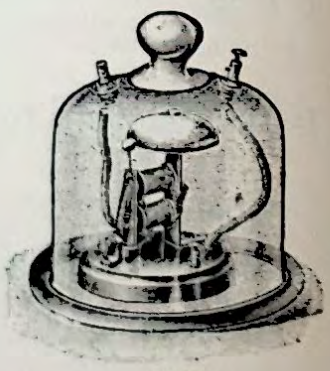
10808



10810



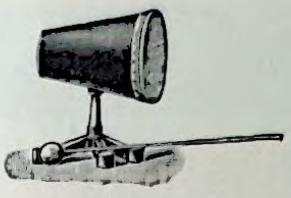
10811



10809

10808	**Bell Experiment,** to show that Air is essential to Sound, consisting of a Glass Receiver, fitted with Bell, Push and Dry Cell	£0 16 6
10809	**Bell Experiment,** with Receiver, larger and superior finished	1 12 6
10810	Ditto, with Clockwork Driving Gear	1 1 0
10811	Ditto, Simple form	0 8 6

(F) Foreign manufacture.



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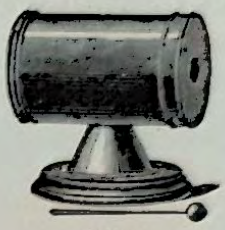
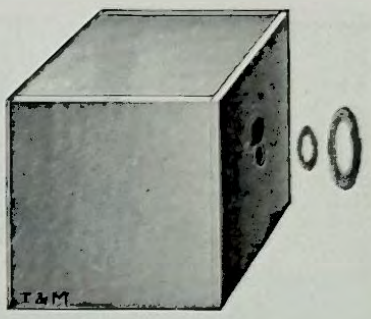
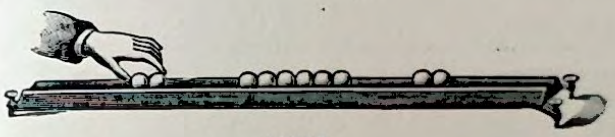


10813



10814

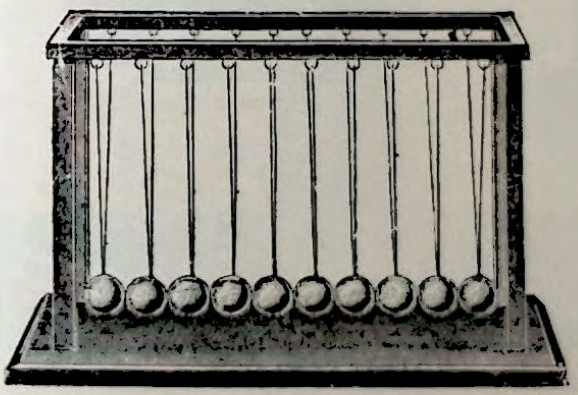
10812	**Concussion of Air Apparatus,** for showing the difference between the Propagation of Air and Sound in Air	£1 2 6
10813	Ditto, Large size, Polished Brass	1 7 6
10814	**Box,** for Vortex Rings, size 20 × 20 × 20 in.	0 16 6



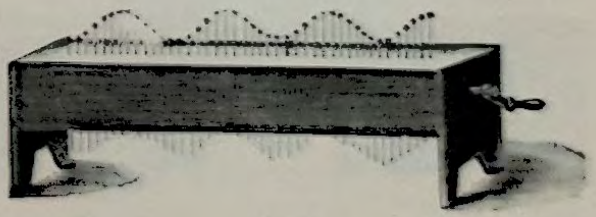
10815



10816

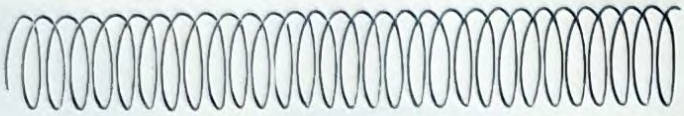


10817

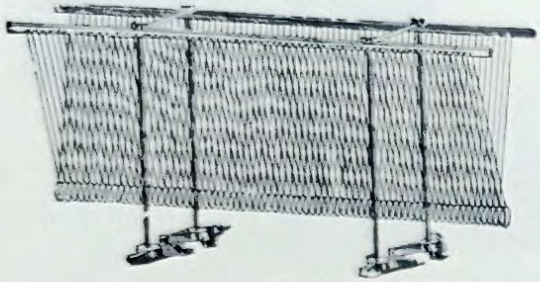


10818

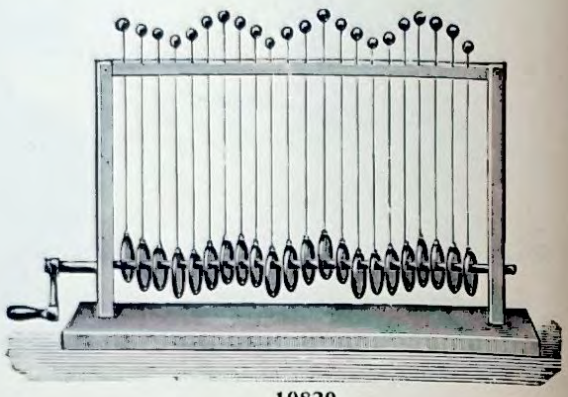
10815	**Percussion Apparatus,** Tyndall's, 1 metre long, with ten Boxwood Balls and Brass Levelling Screws	£1 1 0
10816	Ditto, small size, without Levelling Screws	0 10 6
10817	Ditto, with ten Boxwood Balls	1 1 0
10818	**Wave Apparatus,** Eisenlohr's, illustrating Undulating and Oscillating Waves ...	5 5 0



10821

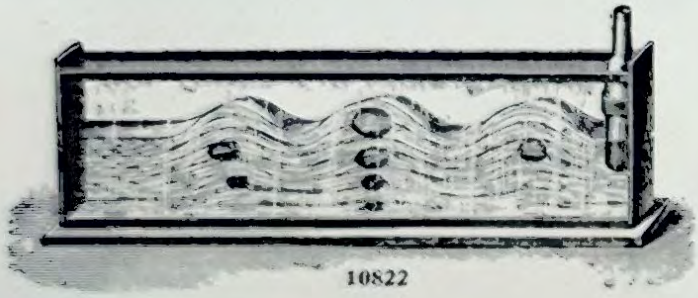


10819

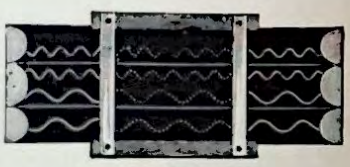


10820

*10819	**Wave Apparatus,** Weinhold's, 2 metres long, for Progressive, Reflected and Stationary Waves, mounted on four Iron Stands	£5	10	0
*10820	Ditto, Powell's, for demonstrating progressive transverse waves, with Square Brass Uprights on Mahogany Base	4	15	0
10821	**Brass Wire Spiral,** 3 cm. dia., for demonstrating Wave Motion	0	2	0



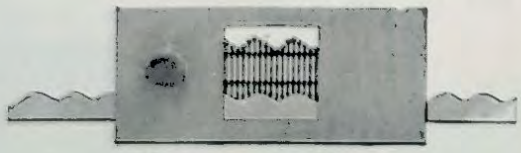
10822



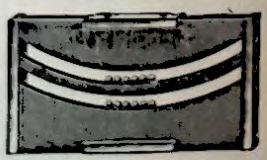
10824



10825



10826



10827

10822	**Trough,** Stained Black Wood with Plate Glass Front, 4 ft. × 6 in. × 6 in.	£1	17	6
10823	Wood Block with Handle, for use with above	0	3	6
10824	**Wright's Wave Slide,** for showing the motion of Light and Sound Waves and retardation of Wave Vibrations	1	15	0
10825	**Dorman's Sound-Wave Slide,** for showing the motions of particles in a sound wave, four lines of wave motion are shown travelling outwards at right angles to each other as from a bell; for Lantern use	0	17	6
10826	**Woodward's Interference Wave Slide,** showing two wave surfaces upon the screen; when in the same phase they reinforce, and when in opposite phase they destroy one another	1	17	6
10827	**Percussion Ball Slide,** for Lantern use	1	5	0

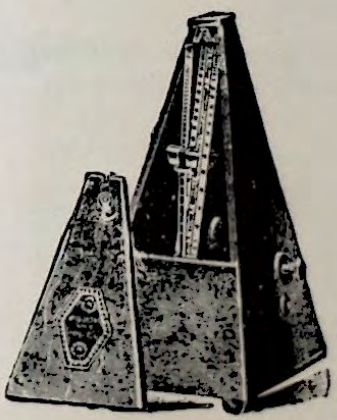


10828–10831

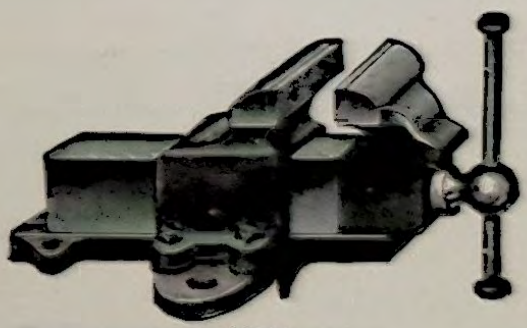


10832

10828	**Tubes,** Japanned Tin, 36 × 4 in. ... ... each	**£0**	**5** **6**
10829	Ditto, Plain ... ... ,,	**0**	**4** **3**
10830	Supports for above Tubes ... ... ,,	**0**	**3** **6**
10831	Cone-shaped End Pieces, for above Tubes, Japanned Tin ... ... ,,	**0**	**3** **6**
10832	**Speaking Trumpet,** Japanned Tin ... ... ,,	**0**	**6** **6**
10833	**Ear Trumpet,** Japanned Tin ... ... ,,	**0**	**10** **6**



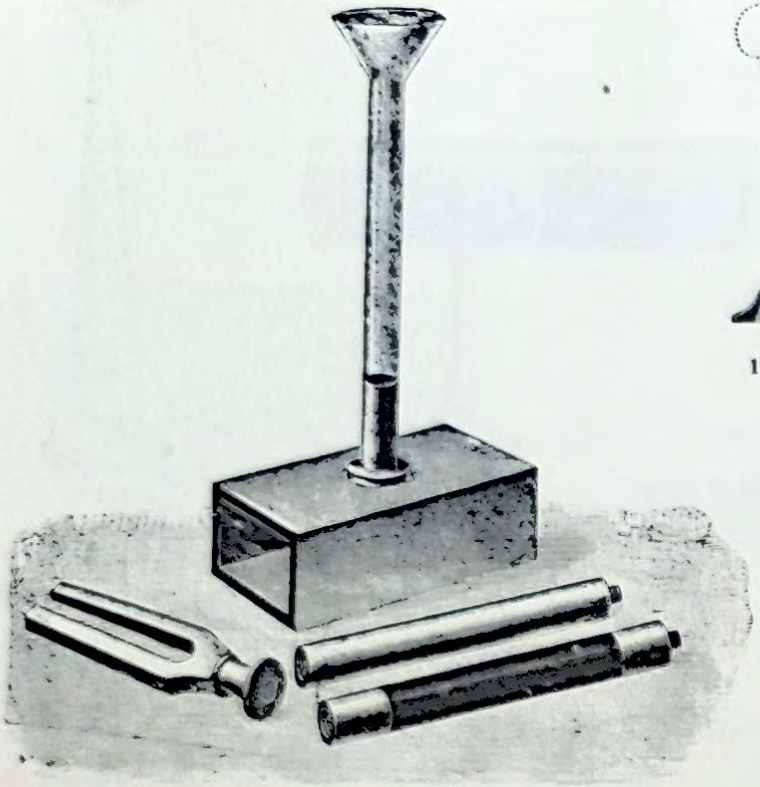
10834–5



10836

(F) **10834**	**Metronome,** for Velocity of Sound Experiments	**£0**	**16**	**6**			
(F) **10835**	Ditto, with Bell	**1**	**1**	**0**			
10836	**Vices,** heavy pattern ... ...Length of Jaws	2½	3	3½	4	in.	
	Larger sizes supplied to order.	**12/6**	**15/6**	**22/6**	**30**	**0**	each

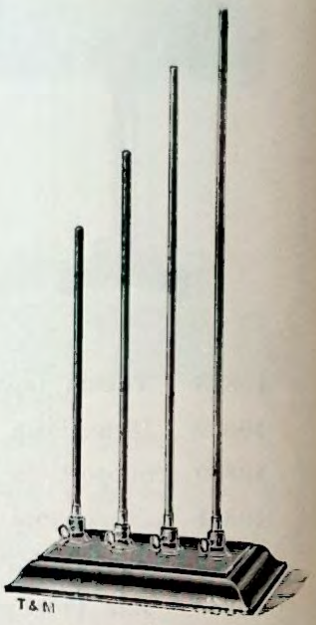
(F) Foreign manufacture.



10837



10840



10839

10837	**Tyndall's Apparatus,** for demonstrating the propagation of sound in liquids and solids; consisting of Tuning Fork, Resonance Box and Fittings, as illustrated...	**£2 12 6**
10838	Ditto, ditto, cheaper pattern	**1 12 6**
10839	**Apparatus,** to demonstrate Longitudinal Vibration, consisting of four Wooden Rods, tuned to one Chord, mounted on Metal Stand	**0 18 6**
10840	**Vibrating Wire,** on Stand	**0 2 6**

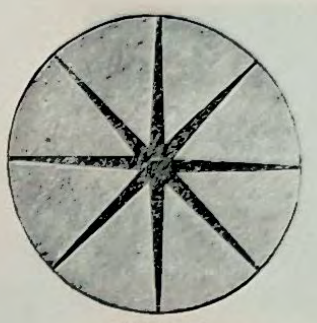


10841

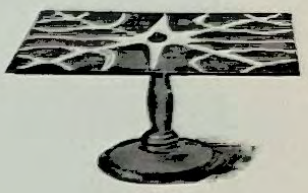
10841	**Vibration Apparatus,** to demonstrate, consisting of an adjustable steel strip 2 ft. long, on Teak Base with Glass Plate and Brush complete	**£1 5 0**



10842-3



10842-4

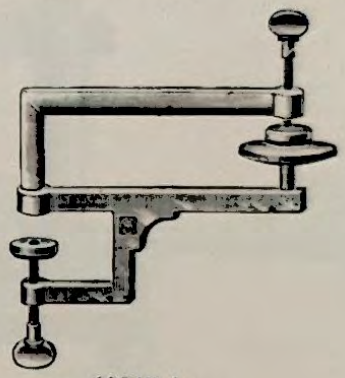


10845

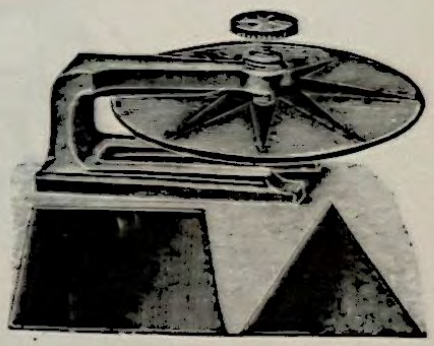
10842	**Chladni's Plates,** Brass, 8 in. Square, Round and Triangular ... each	**£0**	**7**	**6**
10843	„ „ 12 in. ... ... „	**0**	**17**	**6**
10844	„ Glass, 12 in. diam., Round, polished, with hole in centre for fixing ... ... each	**0**	**10**	**6**
10845	„ Square, 12 in. Brass, mounted on Heavy Metal Foot ...	**1**	**2**	**6**



10846



10847-8

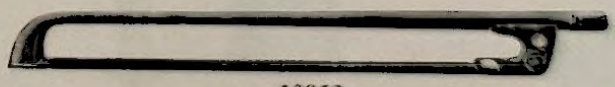


10849

10846	**Chladni's Plate,** Round Brass, mounted on Heavy Metal Foot	**£1**	**2**	**6**
10847	**Clamp,** Gun Metal, for holding Chlandi's Plates, as Nos. 10842-4	**0**	**17**	**6**
10848	Ditto, Iron, same pattern as above	**0**	**11**	**6**
10849	**Chladni's Plates,** set of 3 Metal and heavy Iron Clamp, complete	**1**	**12**	**6**



10850



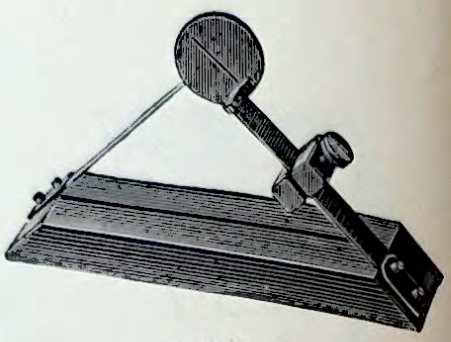
10852

(F) **10850**	**Violin Bow,** for use with Chladni's Plates ... ... each	**£0**	**5**	**6**
(F) **10851**	**Cello Bow,** „ „ „ ... ... „	**0**	**11**	**6**
(F) **10852**	**Bass Bow,** „ „ „ ... ... „	**1**	**0**	**0**

(F) Foreign manufacture.



10853

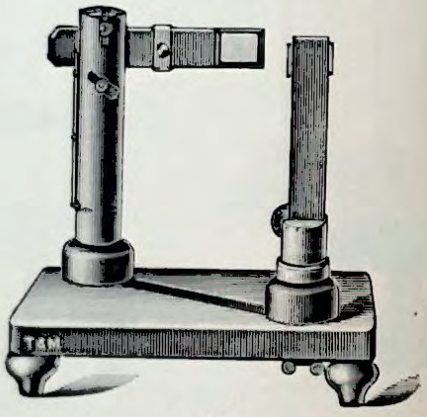


10854

10853	**Chladni's Apparatus,** with four Glass, four Wood, and four Metal Plates of different forms, Screw Clamp, Violin Bow, and Bottles containing Sand and Resin, in Wooden Box, complete	£2 17 6
10854	**Apparatus,** Pfaundler's, to show Lissajou Curves	2 12 6



10855

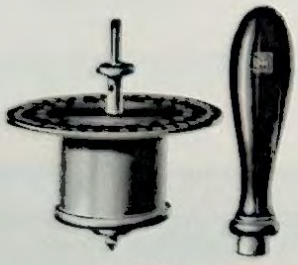


10856

(F) 10855	**Apparatus,** to show Lissajou Curves, complete with Wheels for obtaining the ratios 20, 24, 30, 36, 40, 48, 50 and 60	£12 10 0
(F) 10856	Ditto, with two Vibrating Mirrors on Steel Rods	3 10 0



10857



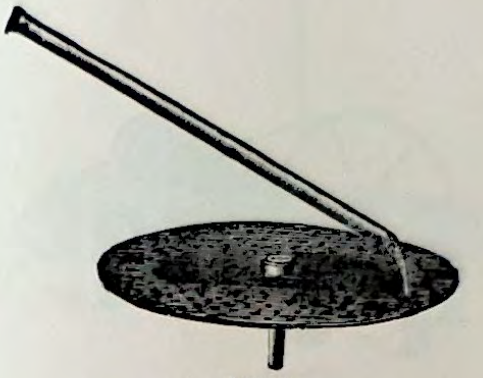
10858



10859

10857	**Toothed Wheel, and Syren Disc,** Brass, with two rows of holes, on Polished Mahogany Base	£0 12 6
10858	**Syren Disc Top,** Brass, with two rows of holes and toothed edge	0 8 6
10859	Ditto, for use with Whirling Tables (Set of four)	0 17 6

(F) Foreign manufacture.



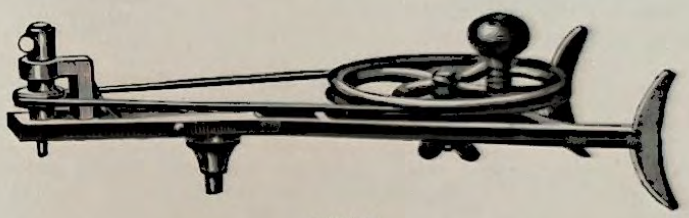
10860



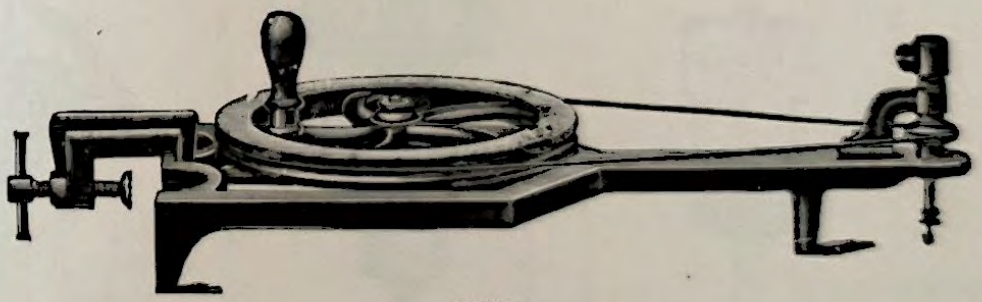
10861

10860 **Syren Disc,** Brass, with four rows of Holes, for use with Whirling Table ... **£0 12 6**

(F) **10861** **Syren Disc,** Appelt's, with twenty-two rows of Holes, to work with Whirling Table **1 17 6**



10862



10863

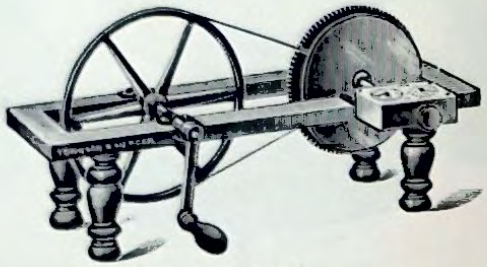
10862 **Whirling Table,** Centrifugal Apparatus, Cast-Iron Frame, made to stand either vertical or horizontal, with Wheel adjustable to take up any slackness of the driving belt **£2 5 0**

10863 **Whirling Table,** Extra Large Size, superior finish, with Clamp for holding vertically to table, with well-turned Spindle and Bearings **3 12 6**

(F) Foreign manufacture.



10864



10865-6

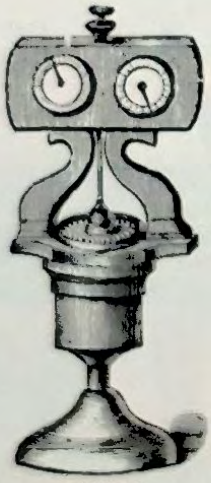
10864	**Syren Disc,** with four rows of holes and toothed edge, diameter 6 in., on Whirling Table complete	£1 7 6
10865	**Savart's Toothed Wheel Apparatus,** with two Wheels, fine and coarse, on Polished Mahogany Stand, with Indicator	4 10 0
10866	Ditto, ditto, ditto, without Indicator	4 0 0



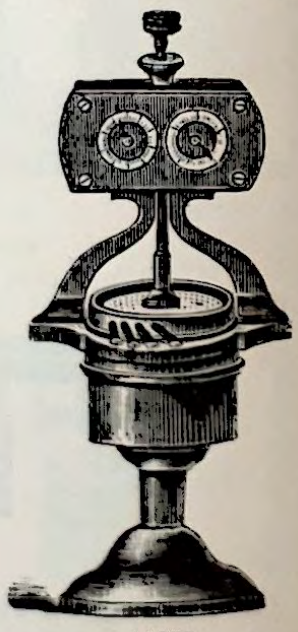
10867



10868



10869



10870

10867	**Syren,** Simple form, Cagniard-Latour's	£1 12 6
10868	,, with Indicator, for giving number of revolutions	4 0 0
10869	,, with Double Indicator and Glass Back, with arrangements for throwing out of gear	6 0 0
10870	,, Dove's, with Double Indicator and four rows of Holes; each row can be opened separately	12 10 0



10873



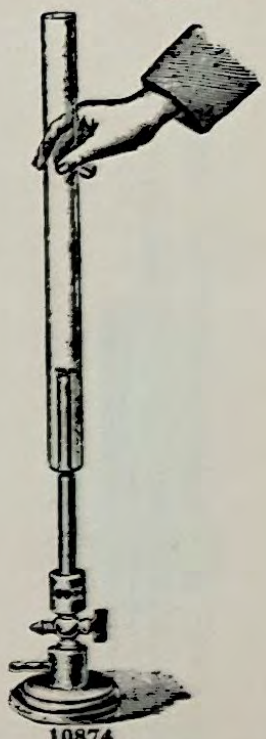
10871



10872

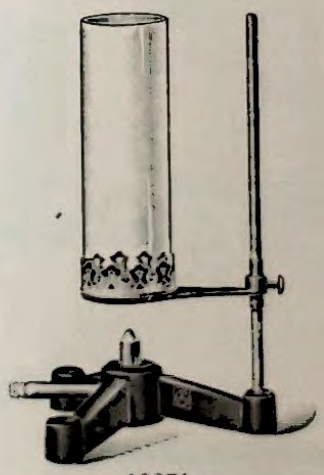


10875



10874

10871	**Simple Pinhole Burner**	£0 2 9
10872	**Sensitive Flame Burner,** with Stopcock and adjustable Wire Gauze	0 10 0
10873	**Rijkes Tube.** If a wire-gauze diaphragm is put about one-third the length of the tube from the bottom end and is made red-hot by a small gas flame a loud note is sounded when the tube is removed from the flame	0 7 6
10874	**Apparatus for Singing Flame,** complete with three Glass Tubes	0 17 6
10875	Ditto, Koenig's, with Brass Funnel, Gauze and Stand complete	1 15 0



10876



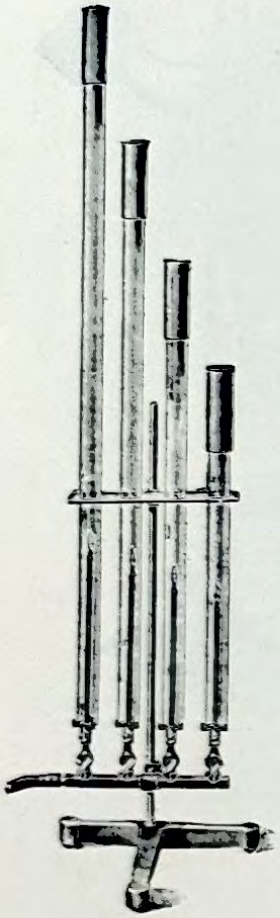
10877



10878

10876	**Vowel's Flame Burner** on Stand, with adjustable Chimney, complete	£0 8 6
10877	**Apparatus for Singing Flame,** Hydrogen, consisting of two necked Woulfe's Bottle, Funnel, Jet Tube, and Sounding Tube	0 4 6
10878	**Harmonican,** with four Glass Tubes, giving one Chord, four Gas Jets with Stopcocks, fitted on Polished Mahogany Stand	3 0 0

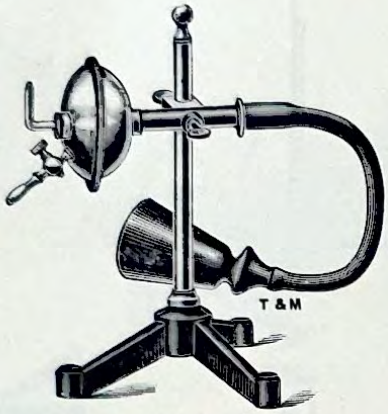
• OIL AND TAR TESTING APPARATUS •



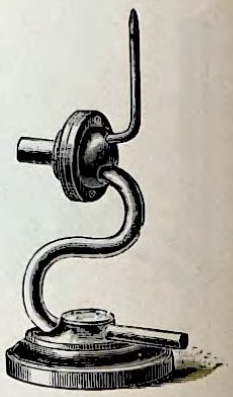
10879



10880



10881



10882

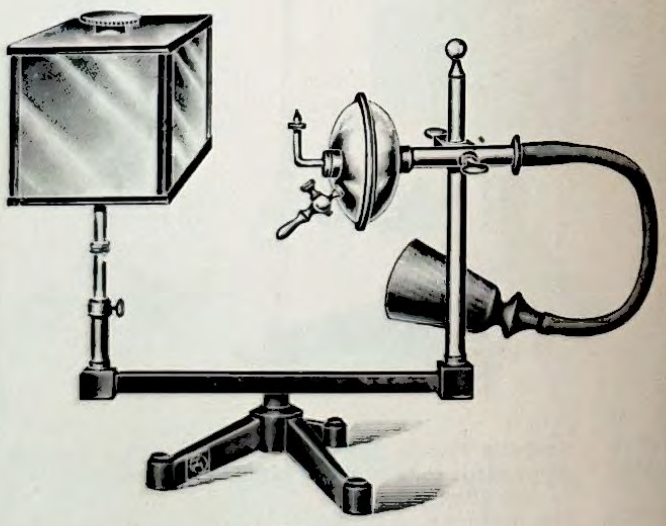
10879 **Chemical Harmonicon,** with four Brass Movable Hinged Caps on the Tubes, fitted on Metal Stand, complete **£4 10 0**

10880 **Manometric Flame Apparatus,** with Tube and Trumpet, complete on Stand **£1 17 6**

10881 Ditto, Larger and Superior Finish, with Stopcock to Jet, complete on Heavy Brass Upright with Tripod Foot **£2 15 0**

10882 **Weinhold's Gas Flame Manometer** **£1 5 0**

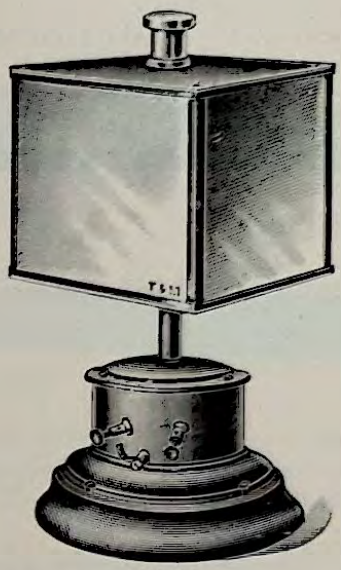
10883 **Manometric Flame Apparatus,** as No. 10881, mounted on Stand, with rotating Mirror (No. 10887) 5 × 5 in. Complete **£4 10 0**



10883



10884



10885

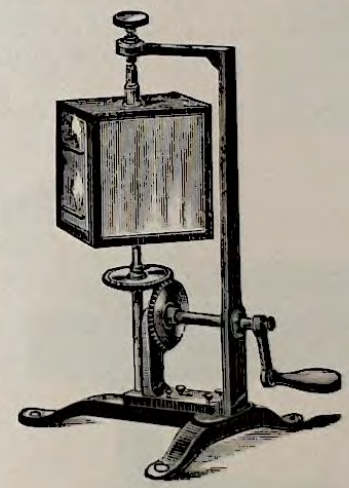


10886

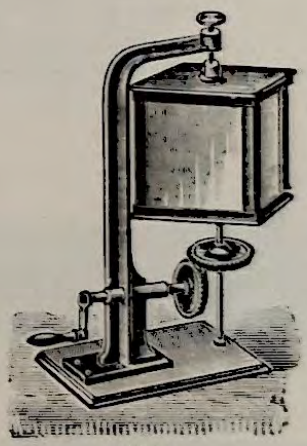
10884	**Reflectors,** Parabolic, Nickel Silver, Polished, 14½ in. diameter, depth 4½ in., Focus 7 cm., on Stands. Complete, per pair	£2	12	6
10885	**Rotating Mirror, Pfaundler's,** mounted on suitable Motor	2	15	0
10886	**Rotating Mirror, Pfaundler's**	2	2	0



10887



10888



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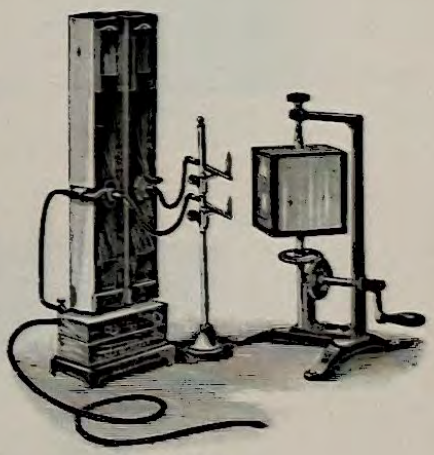


10890

10887	**Rotating Mirror, Pfaundler's,** for use with Whirling Table. Size of Mirror	4×4 in.		5×5 in.	
		£1	1 0	£1	5 0
10888	Ditto, ditto, Large size with Bevelled Cog-Wheel Driving Gear, on Iron Stand ...	£4	10	0	
10889	Ditto, ditto, Smaller size ,, ,, ,, ,, ,, ...	3	15	0	
(F) 10890	**Koenig's Apparatus,** for comparing two Organ Pipe Notes by means of the Manometric Flame, consisting of five Pipes mounted on a Wind Chest, with Valves for two Pipes, Stand with two Manometric Gas Jets, and a Rotating Cubical Mirror, complete	22	10	0	

(F) Foreign manufacture.

Monochords.

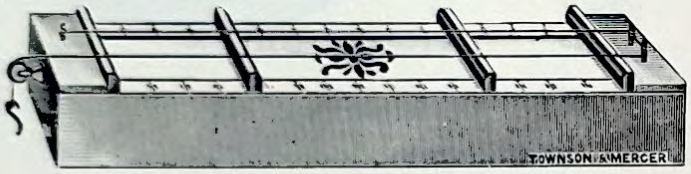


10892



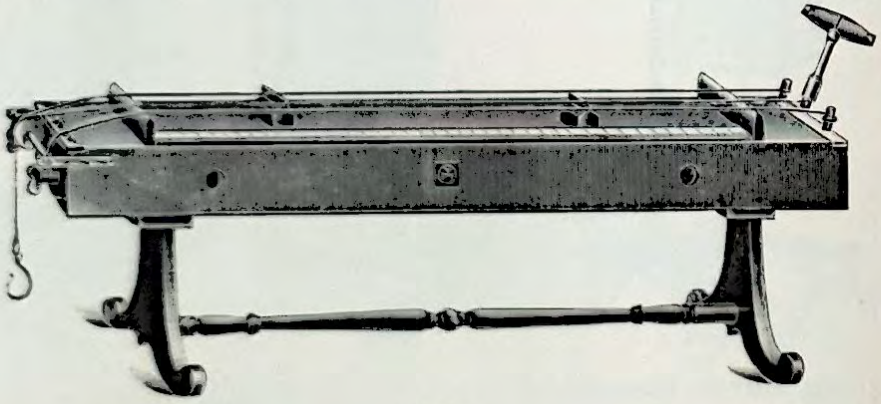
10893

10892	**Monochord,** simple form, with two sliding Bridges and Spring Balance, on Walnut Base and Fittings, complete. As described in Watson's "Physics"	£0 17 6
10893	Ditto, on Mahogany Base, fitted with three Wires, Boxwood Scale and Sliding Bridges	1 4 0



10894–5

10894	**Monochord,** with two Wires, one to be stretched by a weight, the other by a screw, Graduated Boxwood Scale, 1 metre long, in centimetres, two Movable Bridges on Polished Box...	£1 12 6
10895	Ditto, as above, on Polished Mahogany Box and fitted with End Pieces for clamping to table	2 5 0

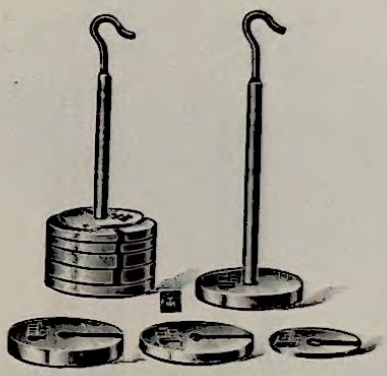


10896

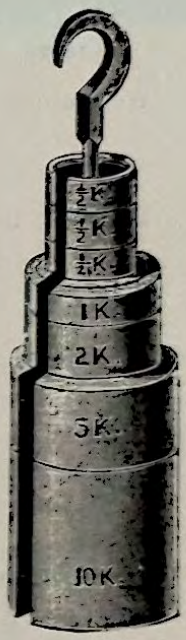
10896	**Monochord,** large size superior, with Metre Boxwood Scale, graduated in inches and centimetres, fitted with three Wires, Sliding Bridges, adjustable Pulley and Key, mounted on Mahogany Frame and Stand	£3 17 6
10897	**Keys,** for Monochords, as illustrated in No. 10896	0 4 0
10898	**Small Hammer,** for Monochords, Tuning Forks, etc.	0 1 6
10899	**Pianoforte Wire,** Steel ... ... per hank	0 0 9
10900	„ Brass ... ... „	0 0 6



10902

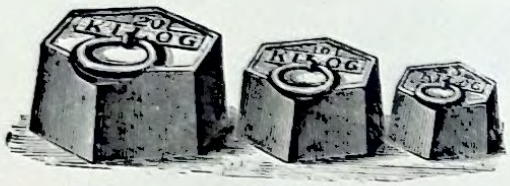


10907-9



10903

10902	**Monochord,** Vertical for fixing to wall, consisting of Polished Mahogany Base, fitted with Boxwood Scale, two Bridges, one of which slides along a vertical grooved plate and is fitted with Clamping Screw. Price, without weights ...	**£1 12 6**
10903	**Weights,** Slotted, for Monochords, Set of seven, comprising three half-kilo, and one each 1, 2, 5 and 10 kilo. weights	**2 5 0**
10904	Ditto, ditto, consisting of six Weights: two of 5 lbs., three of 10 lbs. and one of 20 lbs.	**2 7 6**
10905	Ditto, ditto, consisting of four Slotted Weights, 1 kilo. and Hanger weighing 1 kilo.	**0 12 0**
10906	Ditto, as above, comprising nine 500-gramme Weights and two Carriers of 500 grammes as supplied to the London County Council, etc. ... per set	**0 18 0**
10907	Ditto, as above, consisting of Hanger weighing 500 grammes and the following weights: two of 500 grammes, two of 200 grammes and one of 100 grammes per set	**0 9 6**
10908	**Hangers,** for carrying slotted weights weighing 500 1000 grammes. Diameter and length of rod 12 × ¾ 18 × ½ **3 6** **4 3** each	
10909	**Weights,** Slotted (Iron), for use with above Hangers:— 200 500 1000 grammes **1 2** **1 6** **2 0** each	



10910



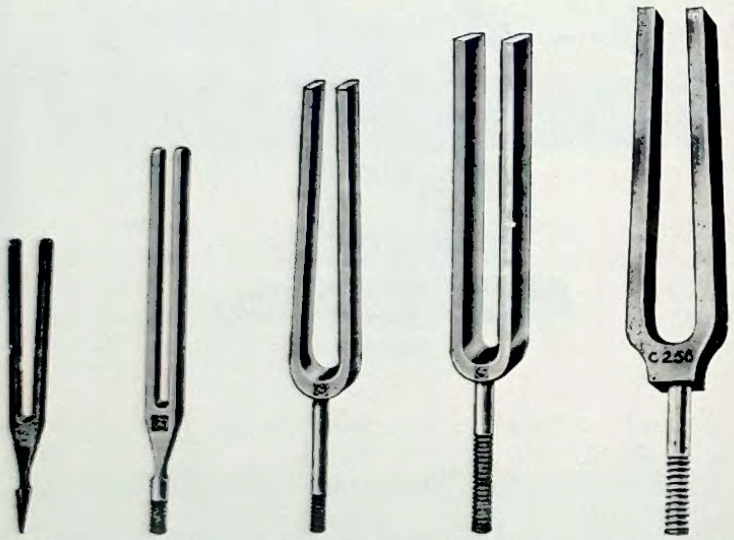
10911

10910 **Weights,** Iron, Hexagon pattern, with Ring Handle.

100	200	500 grammes	1	2	5	10 kilogrammes
6d.	**8d.**	**1/2**	**1/9**	**2/9**	**5/9**	**10/0** each
5/9	**7/6**	**13/3**	**20/0**	**31/6**	**66/0**	**115/0** per doz.

10911 **Weights,** Iron, Square shape, with Ring Handle.

¼	½	1	2	4	7	14	28	56 lb.
7d.	**8d.**	**1/0**	**1/8**	**2/6**	**3/6**	**5/6**	**10/0**	**22/0** each



10912-3 10914 10915 10916 10917-8

(F) **10912** **Tuning Forks,** Small size, Blued Steel A and C512 ... each **1/0,** per doz. **£0 10 6**

10913 Ditto, Better Quality G, A, and C512 ... ... „ **1/6,** „ **0 16 6**

10914 Ditto, Best English Make (Nickel-plated), Small size, screwed ends.

C256	D	E	F	G	A	B	C512
2/9	**2/9**	**2/9**	**2/9**	**2/9**	**2/6**	**2/6**	**2/6** each

10915 Ditto, Best English Make (Nickel-plated), Medium size, screwed ends.

C256	D	E	F	G	A	B	C512
6/0	**6/0**	**6/0**	**6/0**	**6/0**	**6/0**	**6/0**	**6/0** each

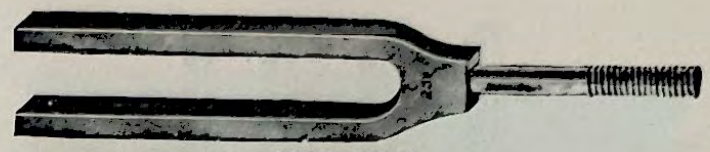
10916 Ditto, as above, Large size.

C256	D	E	F	G	A	B	C512
19/6	**19/6**	**19/6**	**19/6**	**16/6**	**16/6**	**16/6**	**16/6** each

10917 Ditto, ditto, Large size, stouter make C256 **£1 2 6**

10918 „ „ „ „ C128 **1 17 6**

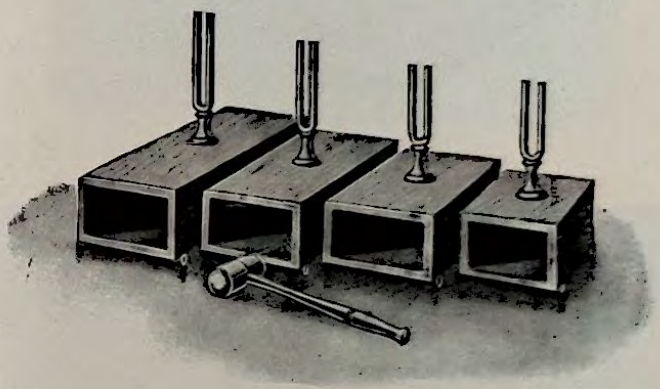
(F) Foreign manufacture.



10919-10920

10919 **Tuning Forks,** Best English Make, Standard Pattern C64 Vibrations, approximate length, 44 cm. **£2 17 6**

10920 Ditto, ditto, ditto, C128 Vibrations, approximate length, 34 cm. **2 2 6**



10921-25

10921 **Tuning Forks,** Best English Make, Small size, mounted on Resonance Boxes.

C256	D	E	F	G	A	B	C512	
7/6	**7/6**	**7/6**	**7/6**	**7/0**	**7/0**	**7/0**	**7/0**	each

10922 Ditto, mounted on Pine Resonance Boxes, Medium size.

C256	D	E	F	G	A	B	C512	
13/6	**13/6**	**13/6**	**13/6**	**12/6**	**12/6**	**12/6**	**12/6**	each

10923 Ditto, Large size, mounted on Polished Pine Resonance Boxes.

C256	D	E	F	G	A	B	C512	
35/0	**32/6**	**32/6**	**30/0**	**27/6**	**27/6**	**27/6**	**27/6**	each

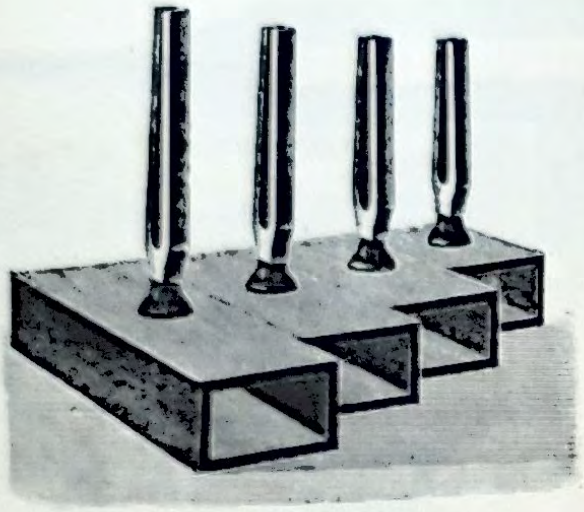
10924 Ditto, Sets of 3, two of C256 in unison and one of C512, Nickel Plated, mounted on Resonance Boxes.

Small ... ...per set **£0 19 6**
Medium ... ... „ **1 12 6**
Large ... ... „ **3 17 6**

10925 Ditto, Set of 4—C256, E, G and C512, Nickel Plated, mounted on Pine Resonance Boxes.

Small ... ...per set **1 7 0**
Medium ... ... „ **2 5 0**
Large ... ... „ **5 7 6**

10926 **Hammers,** for striking the above Forks, as in Fig. 10931 ... ... **0 1 6**



10927-8

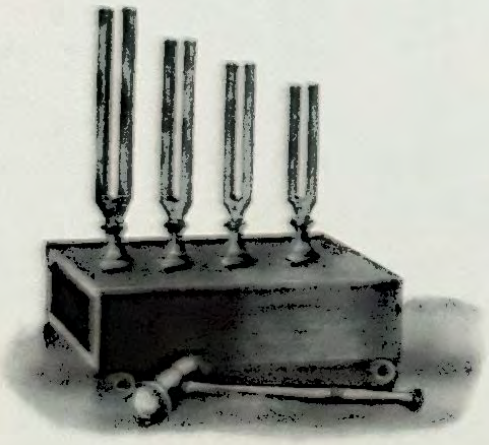
10927 **Tuning Forks,** Set of four, Large size, C256, E320, G384 and C512, mounted on superior finished Resonance Boxes, with Hammer, complete **£6 12 6**

10928 **Tuning Forks,** Large size, Standard.

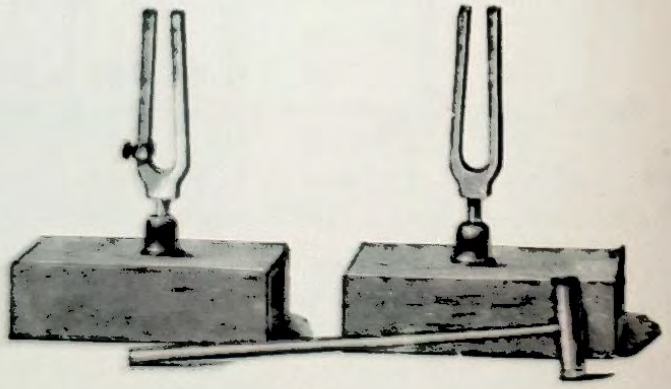
$C_0$128	$C_1$256	$A_1$435	$C_2$512	$C_3$1024	$C_4$2048
50 0	**40 0**	**37/6**	**37/6**	**45/0**	**45 0**

Mounted on superior finished Resonance Boxes, guaranteed to a degree of accuracy to + or — ·001. If separate certificates are required same can be sent to the National Physical Laboratory at a charge of **£1 12**s. **6**d. per fork extra.

10929 **Tuning Forks,** per Set of six, as above, with Hammer, complete... ... ... **£12 12 0**



10930



10931



10932

10930 **Tuning Forks,** Set of four, giving a chord, mounted on Resonance Box, with Hammer **£1 12 0**

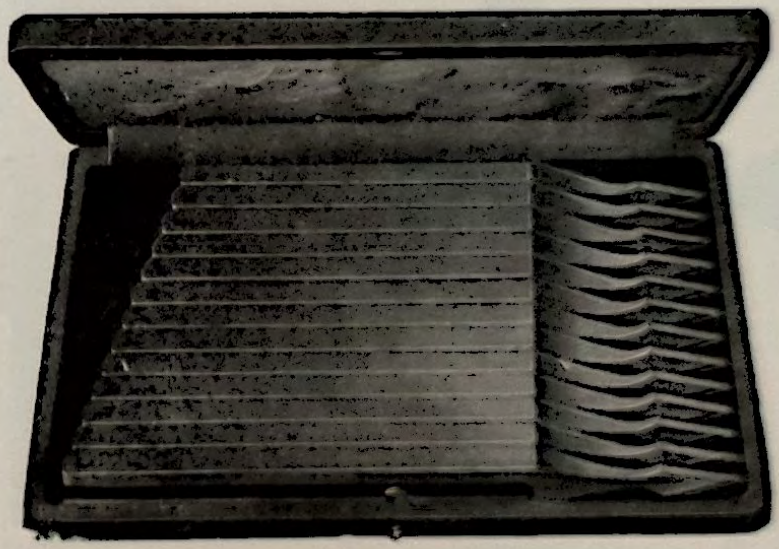
10931 Ditto, Set of two, each mounted on Polished Resonance Box, superior finish and Large size—A435, one of the forks being supplied with a movable Weight, with Hammer **3 5 0**

10932 Ditto, Large, with Handle and Steel Writing Point—C128 ... ... **1 17 6**



10933

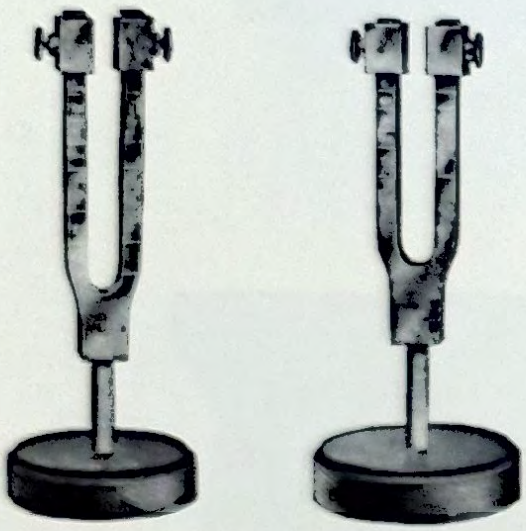
10933	**Tuning Forks,** Chromatic Pair of Forks, in Leather Case	per Case	**£1 10 0**



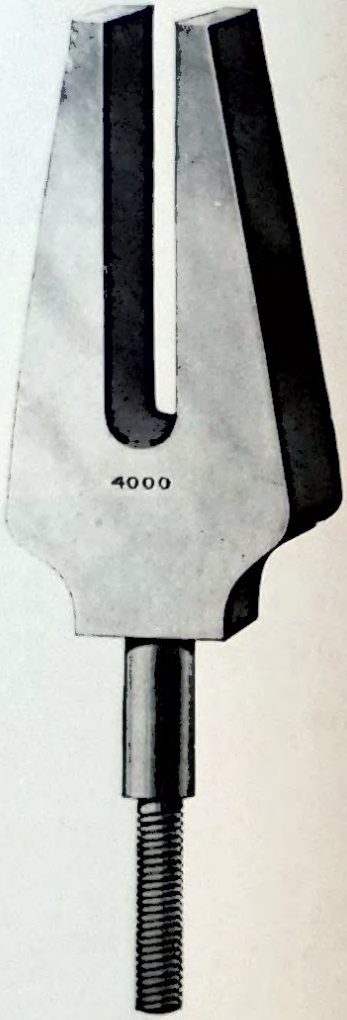
10934–37

10934	**Tuning Forks,** Chromatic Set of 13 Forks, in Leather Case ...	per Case	**£2 5 0**
10935	„ „ „ „ 13 Forks, in Oak Case	„	**3 0 0**
10936	„ „ „ „ 13 Forks, Marked Vibrations, in Leather Case	per Case	**2 15 0**
10937	„ „ „ „ 13 Forks, Marked Vibrations, in Oak Case	per Case	**3 10 0**

Sets outside of above compass specially quoted for.



10938



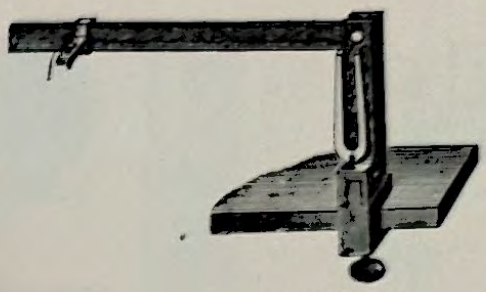
10939
½ size

10938 **Tuning Forks,** Pair of Large Chromatic Forks, C256—C512, mounted on Oak Blocks, with Hammer ... ... per pair **£6 17 0**

10939 Ditto, ditto, Heavy make, for 4,000 Vibrations, for showing Doppler's principle that when a sounding body approaches the ear the note perceived is higher than the true one, fitted in polished handle **2 10 0**



10940

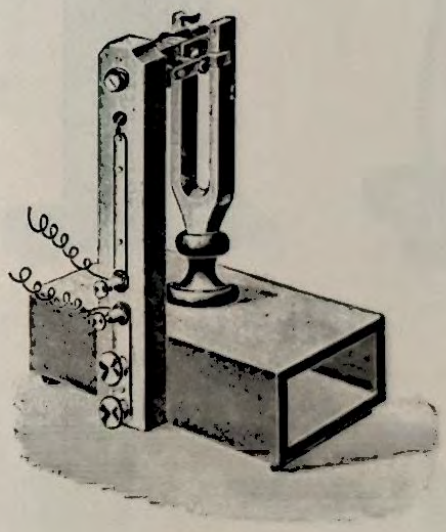


10941

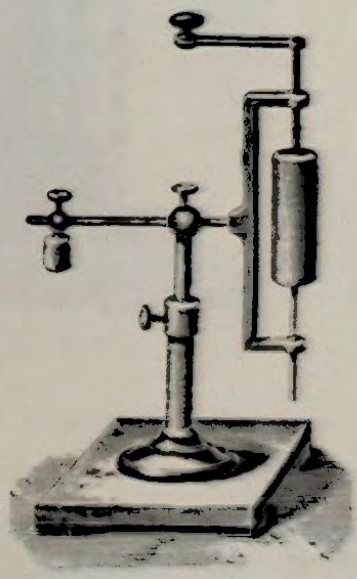
10940	**Apparatus** for registering the vibrations of two Forks, by means of a Writing Point. Large size	£12 10 0
10941	**Melde's Apparatus,** for demonstrating Stationary Waves by a gut string, which is set in synchronous vibrations by a large Tuning Fork	5 5 0



10942



10943-4

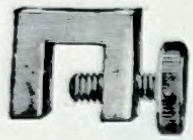


10946



10945

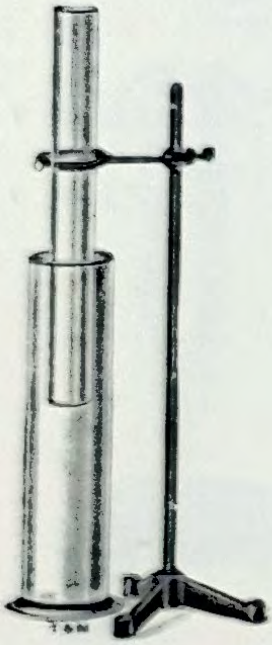
10942	**Kaleidophone,** Melde's, for showing transverse vibrations of Steel Rods, with Clamp complete	£1 10 0
10943	**Fork,** electrically driven, with detachable Electro Magnet, on Resonance Box. C—256 compound vibration	5 5 0
10944	A—435 compound vibration	5 10 0
10945	**Apparatus,** for comparing the frequency of vibrations of two Tuning Forks, as described in Watson's "Physics"	0 13 6
10946	**Vibrograph, Duhamel's,** for determining graphically the frequencies of tuning forks	4 4 0



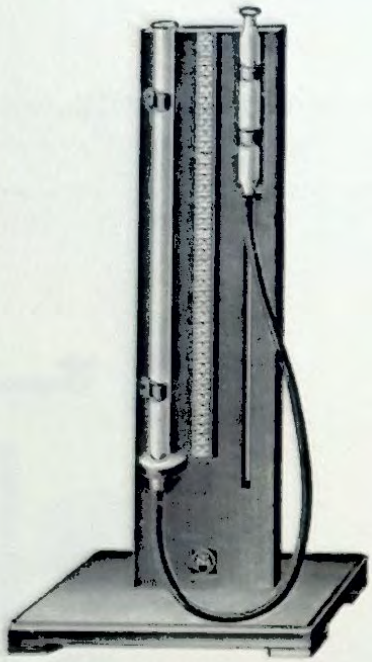
10951



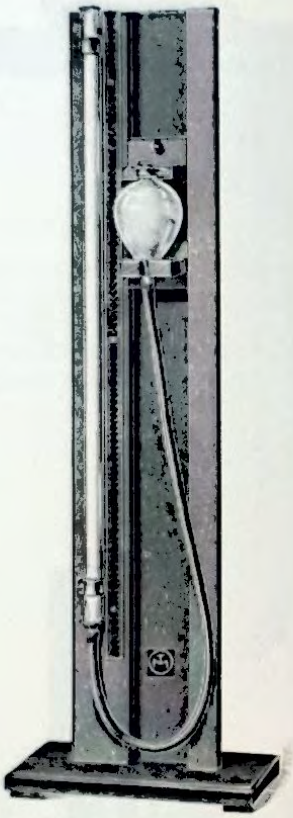
10952-3



10948



10949

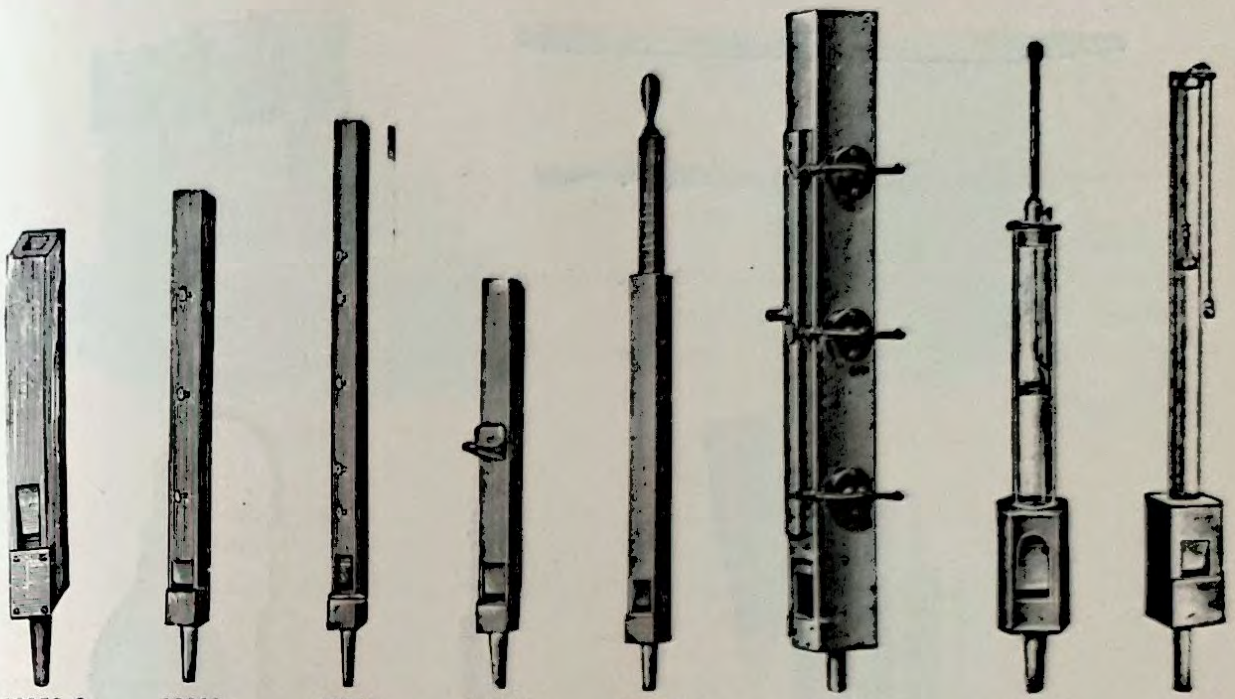


10950



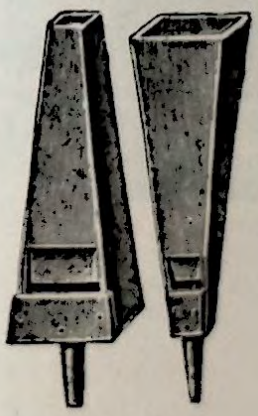
10956

10948	**Resonance Apparatus,** consisting of Resonance Jar, Tube Stand and Clamp ...	**£0 10 6**
10949	Ditto, with adjustable Reservoir, fitted on a solid Teak Stand, with Boxwood Scale	**1 7 6**
10950	Ditto, ditto, fitted with Glass Tube, 3 cm. diameter, 100 cm. long and adjustable Reservoir, on Polished Mahogany Stand, with Boxwood Scale and India-Rubber Pressure Tubing complete	**3 10 0**
10951	**Sliding Weights,** Dampers, for Tuning Forks, with Screw for adjustment each	**0 1 0**
10952	**Mirrors,** for use with Forks ... ... „	**0 0 9**
10953	Ditto, optically worked ... ... „	**0 2 6**
10954	**Bristles,** Hog... ... ... per bundle	**0 2 0**
10955	**Soft Red Wax,** for fixing Bristles, etc. ... ... per oz., **5d.**, per lb.	**0 4 0**
10956	**Resonance Glass Jars.** Height ... 12 12 14 16 18 18 in.	
	Diameter 1½ 2¾ 2 2 2 3½ „	
	1/2 1/3 1/4 1/8 2/3 3/6 each	



10958–9 | 10960 | 10961 | 10964 | 10965 | 10966 | 10967 | 10968

(F) 10958	**Organ Pipe**, Wood, Unpolished ... ... each	£0	12 6
(F) 10959	,, ,, Polished (Best Finish) ... ... ,,	1	0 0
(F) 10960	,, ,, ,, with three openings	1	12 6
(F) 10961	,, ,, ,, ,, five openings, for Flageolet Notes	1	15 0
(F) 10962	,, Set of four, giving a Chord	2	19 6
(F) 10963	,, ,, eight, giving the Gamut	3	5 0
(F) 10964	,, with Stop in centre	1	17 6
(F) 10965	,, with Graduated Piston, to give Chromatic Scale	2	2 0
(F) 10966	,, Koenig's, for illustrating Nodes and Loops	3	15 0
(F) 10967	,, Glass, Circular, with Sliding Membrane for showing Nodes, Large size	2	2 0
(F) 10968	,, ditto, ditto, another pattern	2	2 0



10969



10970



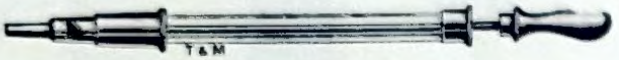
10971–2

(F) 10969	**Organ Pipe**, Pyramid form, as illustrated in No. 10970 ... ... per pair	£1	7 6
(F) 10970	,, with a Slide at the Node, which has three openings of different size, which raises or lowers the pitch	1	18 6
(F) 10971	**Reed Pipe**, with Free Reed and Cardboard Horn	2	10 0
(F) 10972	,, with Striking Reed and Cardboard Horn	3	0 0

(F) Foreign manufacture.



10973

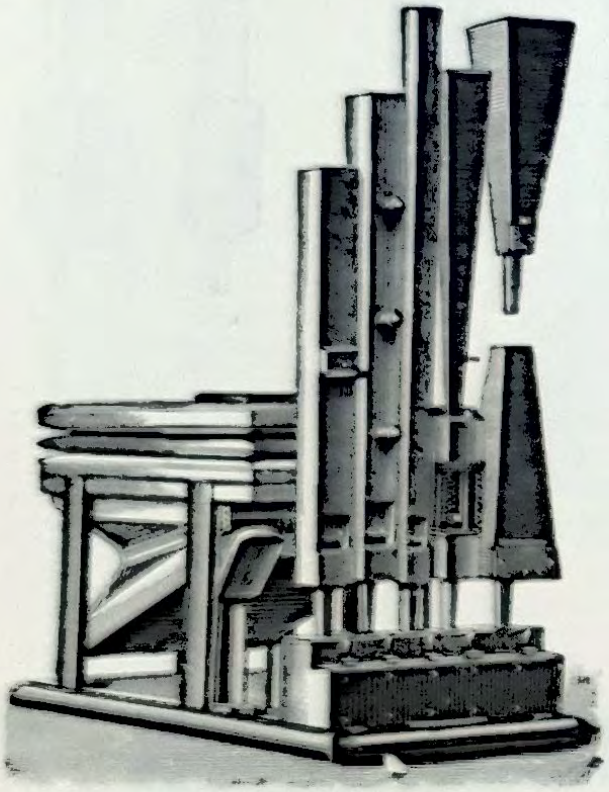


10974



10975

10973	**Organ Pipe,** Meyer's, Glass, with Brass Mouthpiece	£0 12 6
10974	Ditto, Meyer's, with Sliding Piston	1 0 0
(F) **10975**	Ditto, Set of four, cubical shape, closed, giving a Chord	4 5 0



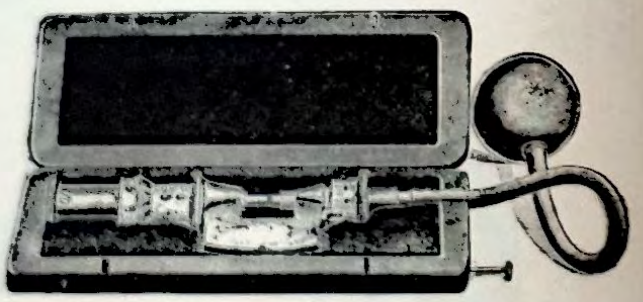
10976



10978



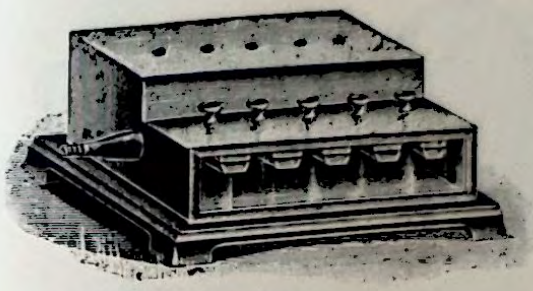
10979



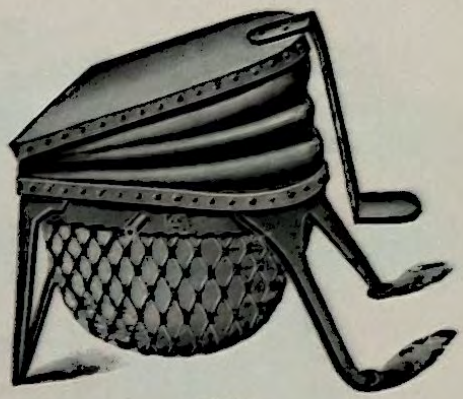
10980

(F) **10976**	**Double Bellows,** with Regulator, five Keys to open the Valves, with arrangement for five Pipes, and also side openings for a Horizontal Pipe; without Pipes or Weights	£9 0 0
(F) **10977**	Set of Six Pipes for above, as illustrated	8 17 6
10978	**Galton's Whistle,** Brass, best finish	0 14 6
10979	Ditto, with Graduated Scale, 10 mm., reading to $\frac{1}{10}$ mm., with Blowing Ball, complete	1 2 6
10980	Ditto, new improved pattern, for the tones A_4 to beyond the limit of audibility	3 0 0

(F) Foreign manufacture.

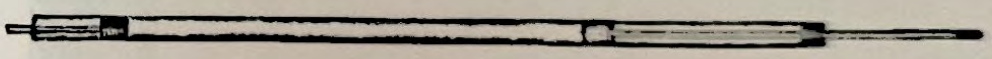


10982

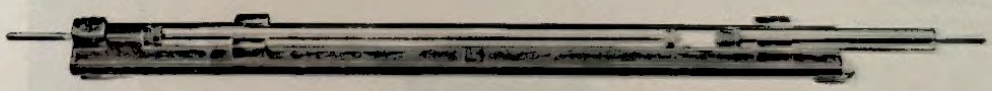


10983

10982	**Wind Chest,** for use on bench, fitted for five pipes, with Glass Front and Side Tube, for connecting to bellows			£4 10 0
10983	**Bellows,** Continuous Blast, on Iron Stand, with India-Rubber Discs and Net.	Nos. 3	5	
		40 0	45 0	each
10984	**Spare Rubber Discs.** Two Discs used on each Bellows	Nos. 3	5	
		2 3	2 9	each
10985	**Spare Nets**	Nos. 3	5	
		1 8	1 9	each



10986

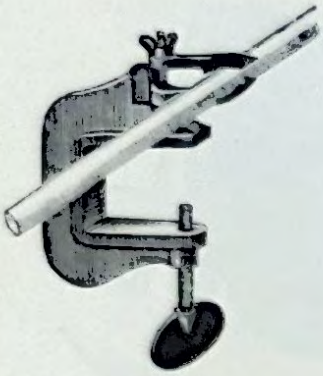


10987



10988

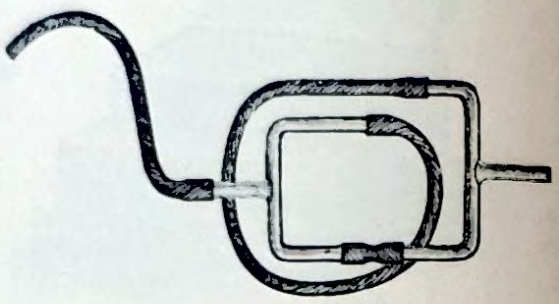
10986	**Kundt's Tube,** for showing Longitudinal Vibrations, consisting of Glass Tube, about 5 ft. long by 1¼ in. diameter, closed one end, with movable Stopper, the other by a sliding Piston with Metal or Glass Rod	£0 12 6
10987	**Kundt's Tube,** as described in Watson's "Physics," on Base, with Clamps, complete	1 8 6
10988	Ditto, ditto, with Brass Fittings, Stopcocks and two Piston Rods complete (only one shown in illustration)	2 7 6
10989	**Lycopodium Powder,** for above ... ... per oz. 11d., per lb.	0 10 6



10990

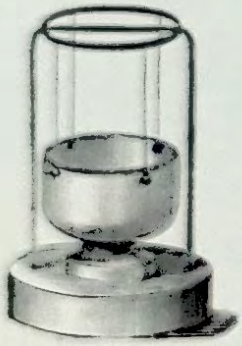


10991



10992

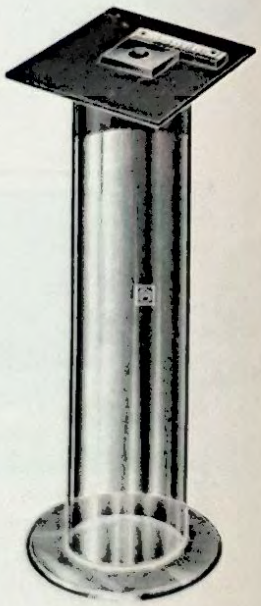
10990	**Clamp,** for holding Tubes for Longitudinal Vibrations	£0 9 6
10991	Ditto, ditto, another pattern	0 9 0
10992	**Quincke's Glass Interference Tube,** fitted with Rubber Tubing	0 5 0



10993

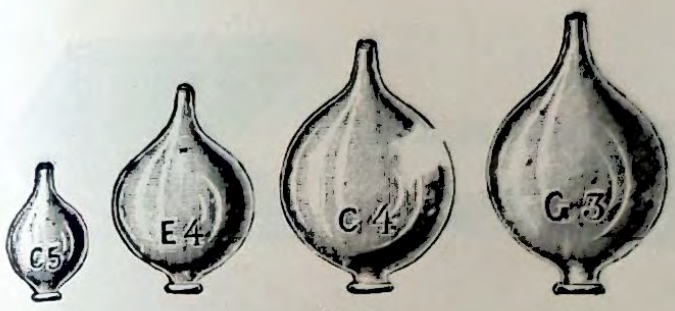


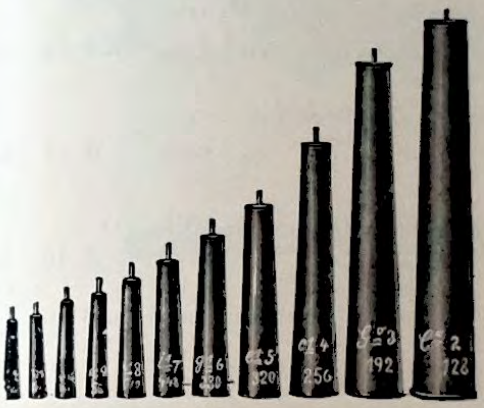
10994



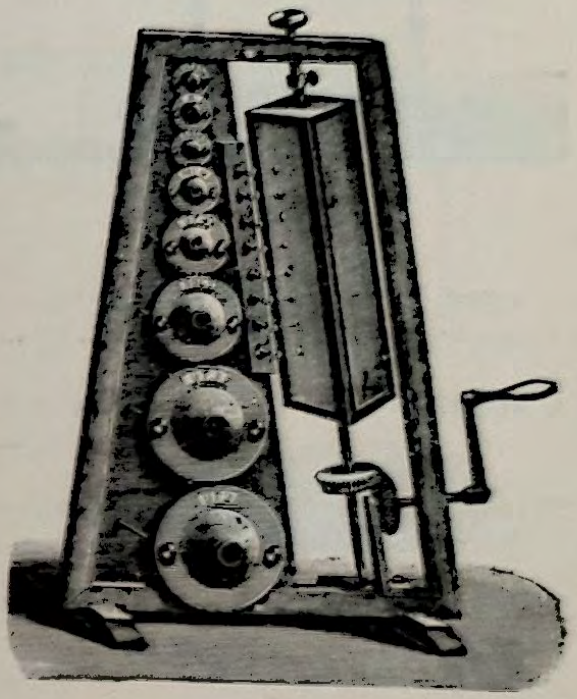
10995

10993	**Glass Vessel,** with four Wooden Balls, suspended on Brass Stand, mounted on Polished Wooden Stand, to demonstrate the Nodes of Glass Vessels ...	£2 5 0
10994	**Hopkin's Forked Tube,** Polished Wood, to show the interference of Sound ...	1 5 0
10995	**Resonator,** consisting of a tall Glass Cylinder with Cover, having a slotted aperture the size of which can be varied by means of a brass slider and measured on the graduated scale	0 15 0





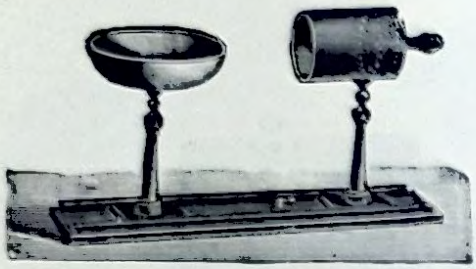
10998



11003

(F)	**10996**	**Resonators,** Helmholtz, Spherical shape, Brass, G, C_1, E_1, G_1, C_2	Set of 5	**£7 15 0**
(F)	**10997**	„ „ „ „ „	Set of 19	**17 10 0**
(F)	**10998**	„ Conical form, Metal	Set of 11	**4 17 6**
(F)	**10999**	„ „ Cardboard	Set of 11	**3 2 6**
	11000	**Hand Bell,** Brass		**0 4 6**
	11001	**Set of eight Plates of Wood,** giving the Octave		**0 15 0**
	11002	„ **four** „ „ „ Chord		**0 7 6**
(F)	***11003**	**Koenig's Apparatus,** Sound Analysis, eight Spherical Resonators, C to C^3, eight Manometric Jets, Rotating Mirror with Bevelled Cog Driving Gear and Handle, mounted on Polished Mahogany Frame		**35 10 0**

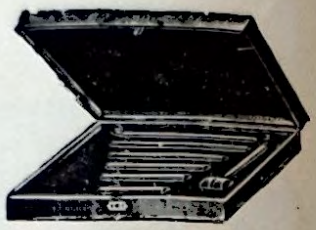
(F) Foreign manufacture.



11004



11005

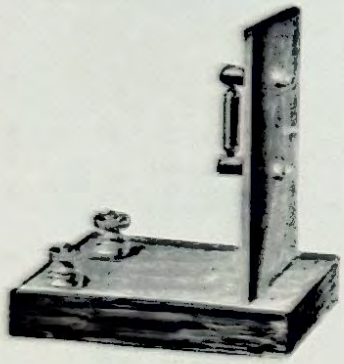


11006

11004 **Apparatus,** Savart's, for illustrating the influence of a Resonator on the strength of Sound **£3 12 6**

11005 **Rocker,** Trevelyan's, Brass, with Lead Block, to show the production of Sound by cooling Metal ... ... each **0 12 6**

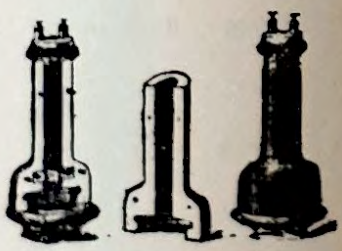
(F) **11006** **Rods of Steel,** for demonstrating the upper limit of audibility; in Case, with arrangement for suspension and Ivory Hammer ... ... Set of 5 **3 10 0**



11007



11008



11009

11007 **Microphone,** Professor Hughes', consisting of two small Rods of Gas Carbon, with Carbon Pencil between, on Stand, with Base and Binding Screws ... **£0 10 6**

11008 **Telephone Receiver,** Watch form, with Flexible Cords **0 12 6**

11009 **Telephone Receiver** (Models for Demonstration), one of which has removable section showing internal construction ... ...per pair **1 12 6**

(F) Foreign manufacture.

PART VI.

Frictional, Voltaic Electricity & Magnetism.

Frictional Electricity.



11021-22



11026



11032–5



11031



11036



11028–29

11020	**Specimen of Amber**								**1 0** and	**£0**	**2 0**
						$12\times\frac{1}{2}$		18×1		24×1	in.
11021	**Rods of Glass**					**1 0**		**1 6**		**2 0**	each
								18×1		24×1	in.
11022	,, ,, one half roughened							**2 6**		**3 0**	each
						5–10		11–15		16–20	mm.
11023	,, ,, Solid, for Pillars, etc.					**1 4**		**1 9**		**2 3**	per lb.
								$9\times\frac{1}{2}$		10×1	in.
11024	,, **Sealing Wax,** superior quality							**1 0**		**1 6**	each
11025	,, **Shellac**							**1 3**		**2 0**	,,
		$10\times\frac{1}{4}$	$10\times\frac{3}{4}$	$12\times\frac{1}{2}$	$12\times\frac{1}{2}$	$12\times\frac{3}{4}$	12×1	in.			
11026	,, **Vulcanite,** best quality, polished	**5d.**	**10d.**	**1 0**	**1 3**	**2 0**	**3 3**	each			
11027	**Rods of Brass,** rounded ends, 2 ft. long ... ... each									**£0**	**3 0**
11028	,, **Half Brass** and **Half Glass** ... ... ,,									**0**	**2 9**
11029	,, ,, ,, ,, ,, **Vulcanite** ... ... ,,									**0**	**3 6**
11030	,, **Gutta Percha,** 12×1 in. ... ... ,,									**0**	**4 0**



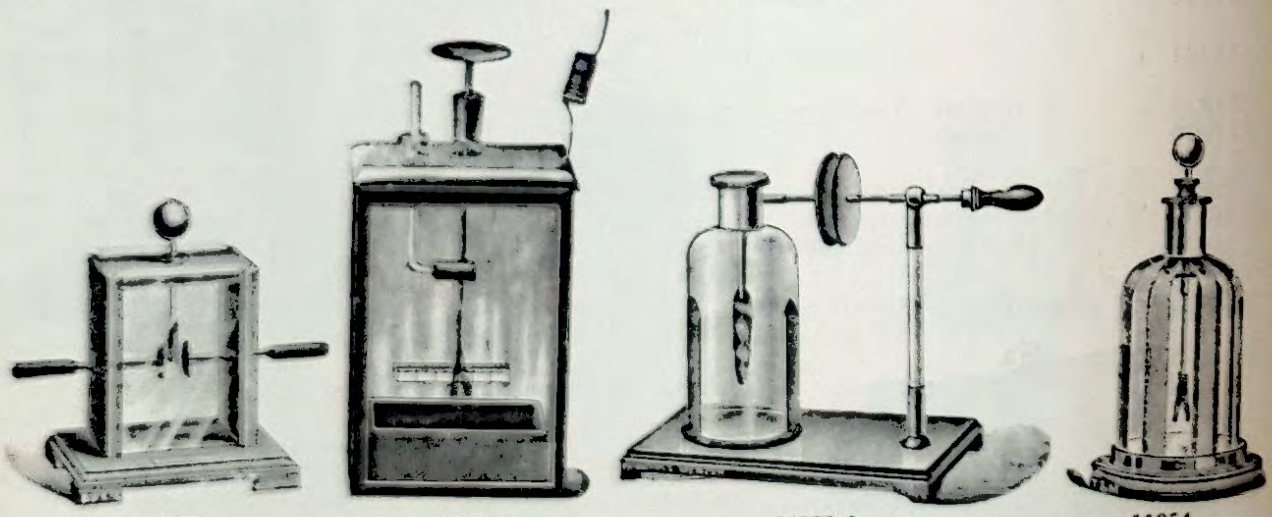
11037

11031	**Stirrups,** Wire, for suspending Rods, etc., each, **4d.** and	**0**	**0 6**
11032	**Rubbers,** Fur (Cat Skin) for exciting Tubes, each	**0**	**2 6**
11033	,, ,, ,, ,, Whole Skins, selected each, **7/6**, **10 0** and	**0**	**12 6**
11034	,, Silk ... ... each	**0**	**1 3**
11035	,, Flannel ... ... ,,	**0**	**0 8**
11036	**Rubber Gloves,** Thick ... per pair	**0**	**7 6**
11037	**Drying Ovens,** of Tinplate, with semi-circular Hood for drying Silk Rubbers, Glass Tubes, etc., without Gas Burner ...	**0**	**6 6**
11038	**Pith Balls,** ... per doz., **8d.,** per gross	**0**	**7 6**
11039	,, ,, large size ... ... per doz.	**0**	**1 0**
11040	,, **Figures** ... ... each	**0**	**1 0**



11041 11043 11044 11045 11047 11048 11049

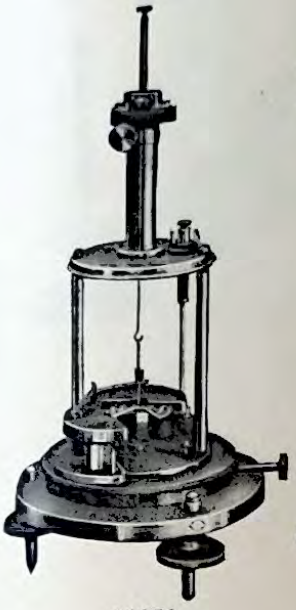
11041	**Electrometer,** Pith Ball, Tate's, Brass Support, on Mahogany Base ... ... each	£0	2	0
11042	,, ,, ,, large size, with Glass Rod with Brass Fittings ... ,,	0	3	6
11043	,, Apparatus to show that Electricity is distributed only on the surface of bodies... ... ... each	0	17	6
11044	,, Gold Leaf, Stewart and Gee's, cheap form ... ... ,,	0	2	6
11045	,, Gold Leaf ... ... each, 1 pint, **17/6**; 2 pints	1	2	6
11046	,, ,, ,, with Condenser ... ,, 1 ,, **21/0**; 2 ,,	1	6	0
11047	**Condensers,** only, for Electroscopes ... ... each **3/6** and	0	4	0
11048	**Electrometer,** Volta's Condensing ... ... ,, **22/0** ,,	1	6	6
11049	,, ,, ,, with removable Glass back and front in Polished Mahogany Case ... ... each	0	8	6
11050	,, Ditto, ditto, with Brass and Vulcanite Fittings ... ... ,,	0	16	6



11050 11051 11052-3 11054

11051	**Electroscopes,** Gold Leaf, Stewart & Gee's, best quality, with Vulcanite Top, Mirror and Glass Scale, in brass case ... ... each	£1	1	0
11052	,, ,, ,, with Sliding Condensing Plate and Insulated Handle, mounted on Wood Base ... ... each	1	15	0
11053	,, ,, ,, smaller size ... ... ,,	1	8	6
11054	,, ,, ,, Prof. Ayrton's ... ... ,,	1	12	6

DOLEZALEK QUADRANT ELECTROMETER



11056



11057

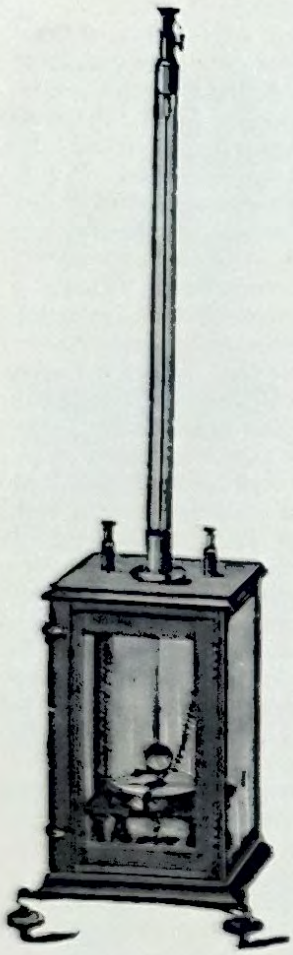
This Electrometer has a wide field of usefulness; in addition to its use in electrostatic measurements, the instrument can be employed for alternating current measurements. The quadrants and needle are so dimensioned that the electrostatic capacity of the instrument is small (about 80 centimetres). High insulation is secured by mounting the quadrants upon ambroid. In Fig. 11056 two adjacent quadrants are shown swung open to allow of access to the needle, which is of sheet aluminium, and so shaped as to secure ample rigidity. The suspension is usually a quartz fibre which is provided with geometrically designed hooks at either end for attachment to the needle and to the torsion head respectively. For lower sensitivity work the quartz fibre can be replaced by a phosphor-bronze strip. The extreme lightness of the needle enables a feeble controlling force to be used without rendering the period unduly great, thus securing a high sensitivity. Air damping renders the instrument nearly deadbeat. Over a wide range the deflections are proportional to the potential differences producing them. The optical system comprises a plane mirror (6 × 5 mm.) rigidly connected to the needle, and a lens of one metre focal length. When used with a quartz fibre, the needle is charged by means of a switch consisting of a terminal with a brass rod projecting downwards and carrying a light strip of phosphor-bronze at its lower end. By rotating the switch the strip can be brought into contact with the needle and then withdrawn. The needle may be charged to a potential of, say, 50 to 200 volts, from a charging battery or a D.C. lighting circuit. An adjustment is provided for varying the height of the needle, while the ebonite torsion head can be rotated and clamped in any position. The moving system is protected from dust, draughts and stray electrostatic fields by a cylindrical brass cover (not shown in Fig. 11056), which carries the lens; this cover can be independently turned to make the lens face in any desired direction. The instrument is mounted on a substantial brass base, upon which it can be rotated and clamped in any position; the base is fitted with levelling screws. Four suspensions (60 mm. long) are usually supplied, three of quartz (approximately 0·004, 0·006 and 0·009 mm. diameter respectively) and one of phosphor-bronze strip (approximately 0·115 × 0·008 mm.). If desired, plated fibres can be supplied. By fitting a Sayers' magnetically damped copper vane below the needle, and using a coarser suspension, the Electrometer may be used for such work as submarine cable testing. Some approximate sensitivity data are given in the following table.

=11056 Dolezalek Quadrant Electrometer **£12 12 0**

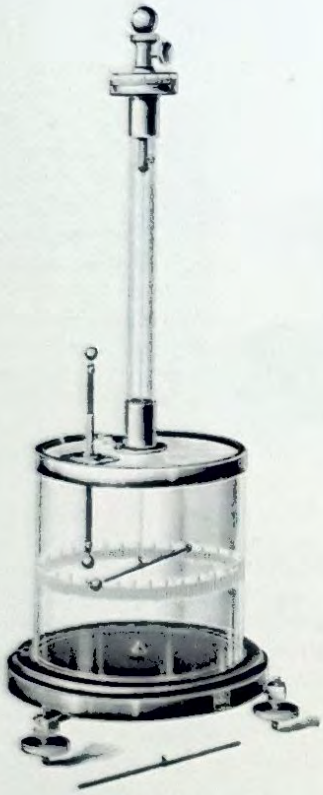
Suspension. Material.	Size (1 μ = 0·001 mm.)	Volts on Needle.	Volts on Quadrants.	Deflection in mm. at 1 metre.	mm. per volt per 100 volts on needle.	Period (secs.)	Time to get steady reading (secs.)
Quartz	9 μ dia.	100	1·0	300	300	30	60
Quartz	6 μ dia.	100	0·1	150	1,500	aperiodic	80
Quartz	4 μ dia.	50†	0·01	40	8,000**	..	200
Ph.B. strip	115 × 8 μ*	100	1·0	32	32	7·4	60
Ph.B. strip	115 × 8 μ*	30 volts A.C.		140	0·16‡	7	60

‡ For A.C. figures the heading of this column should read "millimetres per volt²." † Unstable on 100 volts.
* When a higher sensitivity is desired, a finer phosphor-bronze suspension can be fitted.
** It may not be possible to work with 100 volts owing to approaching instability, but the figures are given for comparison purposes.

11057 Electroscope, in Japanned Metal Case, fitted with grooved Ebonite Insulation, Glass Sides on Polished Mahogany Base **£0 17 6**



11058



11059



11061–2



11064



11065

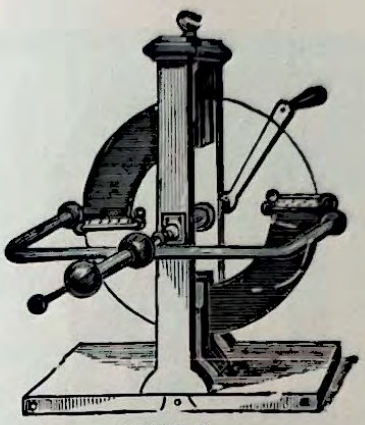


11063



11066

11058	**Electrometer,** Quadrant, Stewart and Gee's, with Levelling Screws, in Polished Mahogany Case					**£4 5 0**
11059	Ditto, Coulomb's Torsion Balance, Scale engraved on the glass, fine divided Head for measurement of Angle of Torsion, superior make, with Levelling Screws on Polished Mahogany Base					**6 0 0**
11060	Ditto, ditto, small size, not so finely divided, etc.					**4 10 0**
11061	**Electrophorus,** with Ebonite Disc in Metal Plate, with Glass or Ebonite Handle.	5	6	8	10	in. dia.
		7/9	**9/6**	**13/6**	**17/0**	each
11062	„ Discs of Vulcanite, ¼ in. thick, polished both sides	**3/6**	**4/6**	**8/6**	**10/6**	„
11063	„ Simple, Stewart & Gee's, 4 in. diameter ... ... each					**£0 3 6**
11064	**Tin Can,** Stewart & Gee's, with Vulcanite Handle ... ... „					**0 1 0**
11065	**Proof Plane,** Brass Disc, Ebonite Handle ... ... „					**0 1 0**
11066	„ „ „ „ about the size of a penny, with Vulcanite Handle ... „					**0 1 0**

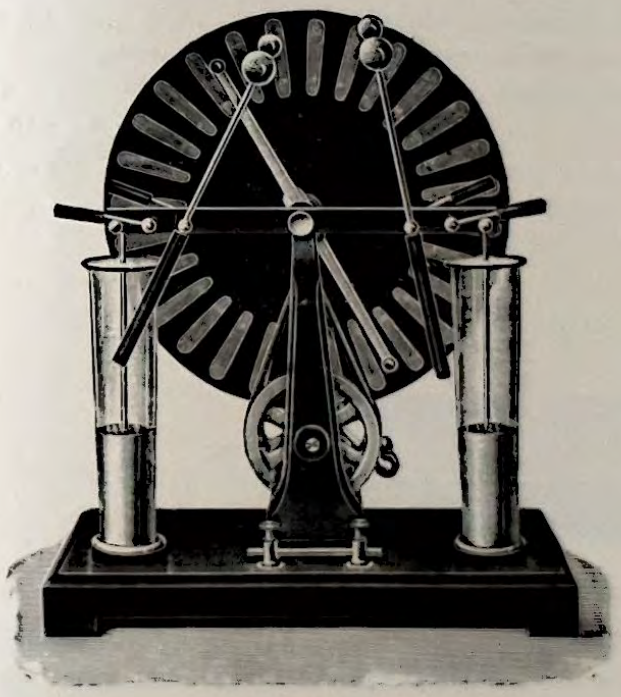


11067–8

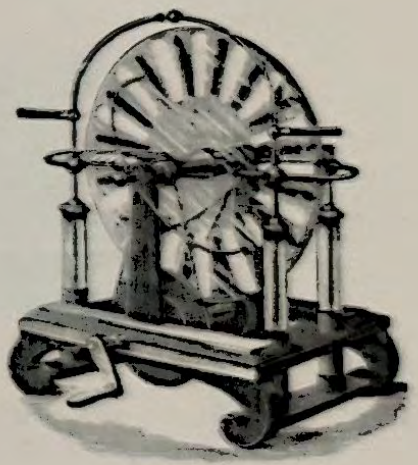


11069

11067	**Electrical Machine,** Stout Glass Plate, with Brass Conductor on Polished Mahogany Stand. Diameter of Plate, 30 cm.	£5	0	0
11068	Ditto, ditto, „ „ 40 „	6	0	0
*11069	**Electrical Machine,** Wimshurst's, Glass Plates 8 in. dia., fitted on Polished Mahogany Stand	1	17	6

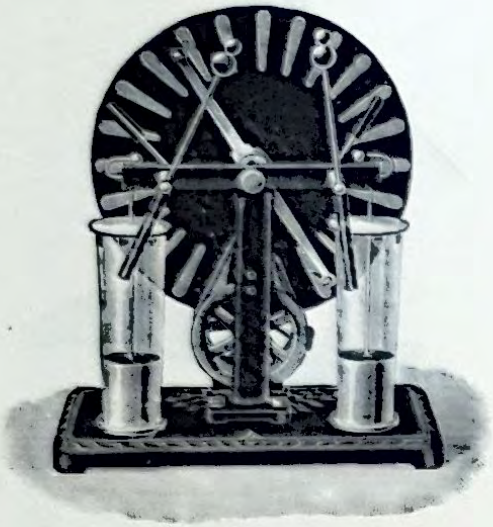


11070



11071-2

11070	**Electrical Machine,** Wimshurst's, Glass Plates, fitted on Mahogany Base. Diameter of Plates, 10 in. ... ... each	£3	15	0
	„ „ 12 „ ... ... „	5	0	0
11071	**Electrical Machine, The "Technical,"** Glass Plates 16 in. diameter, Brass Studs and Sectors, four Leyden Jars, on Heavy Polished Mahogany Base	10	10	0
11072	Ditto, as above, with Ebonite Plates, ¼ in. thick	12	0	0



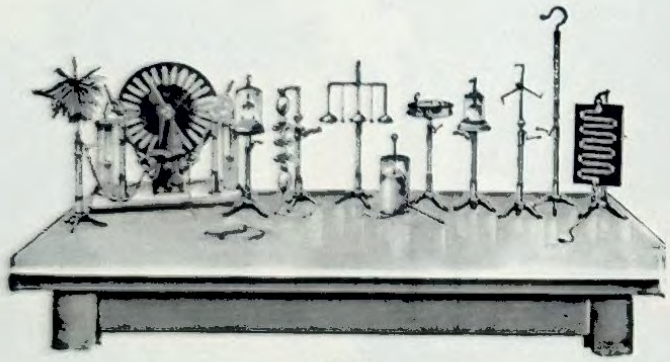
11073



11074

(F) **11073** **Electrical Machine,** Wimshurst's, with Ebonite Plates and Brass Fittings, on Enamelled Iron Base. Diameter of Plates 21 cm. **£2 15 0**

(F) **11074** **Electrical Machine,** Wimshurst's, best finish, with Ebonite Plates, on strong Polished Wood Stand. Diameter of Plates 26 31 36 41 cm.
£3 15 0 **£6 5 0** **£8 0 0** **£10 15 0**

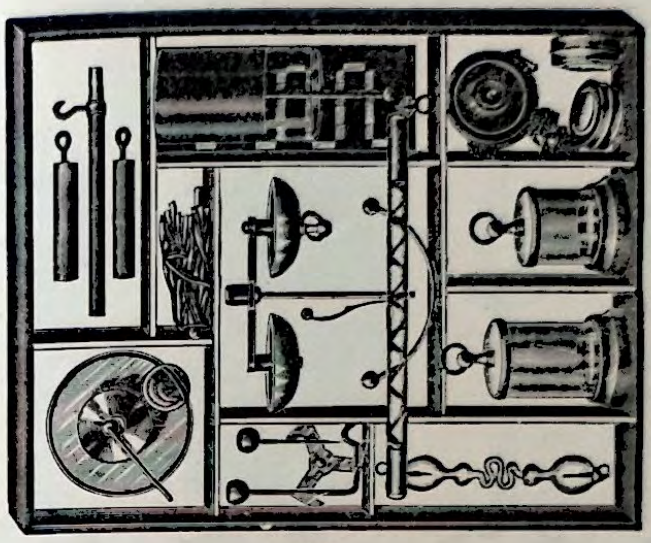


11075

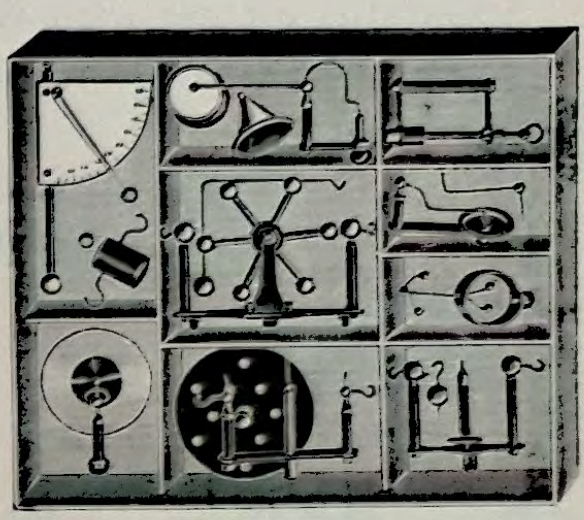
(F) **11075** **Set of Electrical Apparatus,** for use with Machine No. 11074, consisting of Paper Brush, Set of Five Bells, Whirl, Pith Ball Experiment, Vacuum Tube and Holder, Fulminating Plate and Holder, Electrical Circus, Smoke Condensation Apparatus, Fulminating Tube, Leyden Jar, Discharger, Conducting Chains and Brass Handles, with Book of Instructions, without Machine **£4 10 0**

For separate pieces of Apparatus as in No. 11075, see page 394-5.

(F) Foreign manufacture.



11077



11078

(F) **11077** **Set of Electrical Apparatus** as No. 11075 but smaller, consisting of Leyden Jar, Set of 2 Bells, Paper Brush, Whirl, Pith Ball Apparatus, Smoke Condensing Apparatus, Geissler Tube and Holder, Fulminating Pane, and Holder, Rotating Glass Ball, Hand Spiral, Pair of Brass Handles and Chain with Insulated Stand complete in Box £2 0 0

(F) **11078** **Set of Electrical Apparatus,** consisting of Motor for Static Electricity, Rotating Disc, Apparatus for producing Electric Breath Pictures, Radiation Apparatus, Lightning Conductor, Cap Firing, Candle Experiment, Quadrant Electrometer, Sand Apparatus, and Apparatus for piercing Glass, complete in Box ... 4 4 0



11079



11081

11079 **Balls, Brass,** Hollow, with small Hole.

		½	⅝	¾	⅞	1	1¼	in. dia.
		4d.	5d.	7d.	9d.	1 0	1/0	each
11080	Ditto, ditto, with Hook	5d.	7d.	9d.	1 0	1 3	1/4	„

11081 **Aurora Flask,** with Brass Cap and Valve for exhaustion ... ... £0 6 [6

(F) Foreign manufacture.

Apparatus for use with Wimshurst's Electrical Machines

(Suitable for use with either 8 or 12-in. Machines.)



11083–4



11085



11086



11087–8

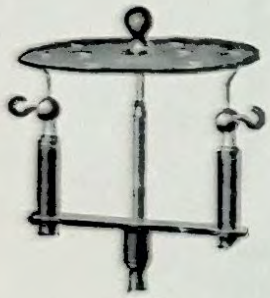


11089



11090

11083	**Stand,** fitting each of the following Apparatus	£0 5 0
(F) 11084	**Paper Brush** ... ... without stand	0 1 6
(F) 11085	**Set of 5 Bells** ... ... ,,	0 9 6
(F) 11086	**Electrical Circus,** rotating a Glass Ball ... ... ,,	0 7 0
(F) 11087	**Smoke Condensation Apparatus** ... ... ,,	0 7 6
(F) 11088	**Pith Ball Apparatus,** similar to No. 11087 ... ... ,,	0 7 0
(F) 11089	**Motor** ... ... ,,	0 12 6
(F) 11090	**Glass Boring Apparatus** ... ... ,,	0 6 0



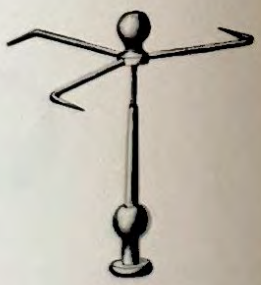
11091



11092



11093



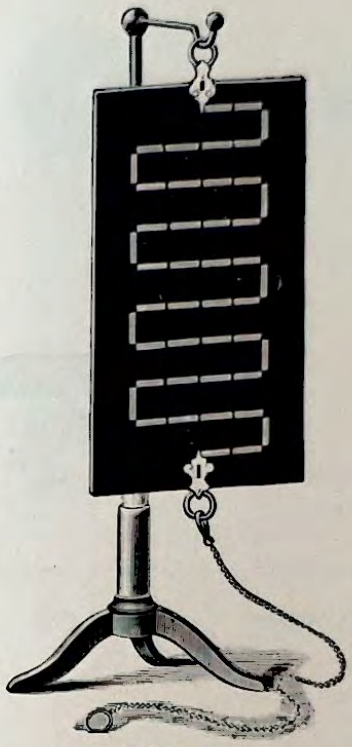
11094

(F) 11091	**Rotating Disc**	£0 10 6
(F) 11092	**Surface Apparatus**	0 8 6
(F) 11093	**Lightning Conductor**	0 10 6
(F) 11094	**Whirl**	0 4 0

(F) Foreign manufacture.



11095



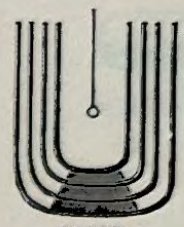
11096–8



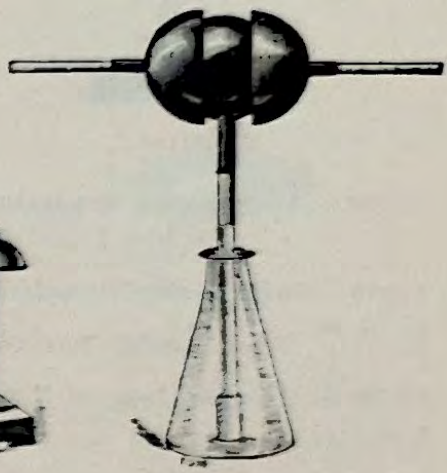
11099–11100



11101

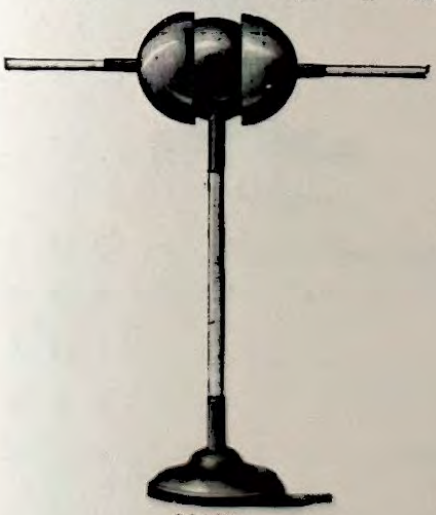


11102



11106

(F) 11095	**Spiral**	£0	5	0
(F) 11096	**Fulminating Plate,** Vulcanite, complete, on Stand...	0	12	9
(F) 11097	,, Plate only	0	6	0
(F) 11098	,, Holder	0	1	9
(F) 11099	**Electrometer,** Celluloid Scale, without Stand	0	7	6
(F) 11100	,, with Stand	0	12	6
11101	**Bells,** Set of three, on Insulating Rod, with Polished Mahogany Base	0	14	6
11102	**Faraday's Ice Pails,** Set of four, with Brass Sphere, complete	0	10	6
11103	,, ,, ,, Set of two, smaller size ,, ,, ...	0	5	6



11104



11107-8

11104	**Biot's Apparatus,** for illustrating the distribution of Electricity on the surface of Insulated Conducting Bodies, consisting of Polished Brass Ball, 4½ in. diameter, on Insulated Stand, with two Hemispheres 5 in. diameter, and Vulcanite Handles ...	£1	15	0
11105	**Biot's Apparatus,** consisting of Tinfoil-covered Ball, 5 in. diameter, and two Tin Hemispheres with Glass Handles, mounted on Insulated Stands	1	2	6
11106	Ditto, ditto, with Brass Sphere, 5 in., two ditto Hemispheres, mounted on Glass Insulated Stand, with removable ground-in centre support and Ebonite Handles ..	2	2	0
11107	**Hollow Sphere,** Brass, 5 in. diameter, on Insulated Stand, with hole in top for inserting Proof Plane	1	1	0
11108	Ditto, ditto, 6 in. diameter	1	5	0

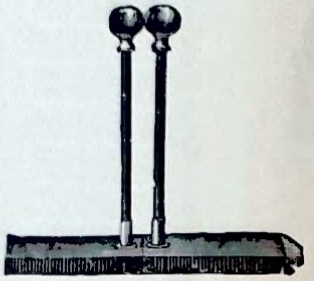
(F) Foreign manufacture.



11109



11110

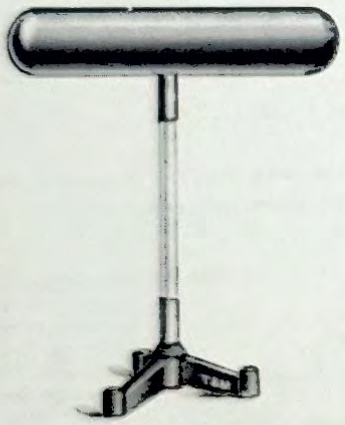


11111–12

11109	**Distribution Apparatus,** Brass Cylinder, with Pendulums on Glass Insulated Stand, with Iron Tripod Foot			£0	19 6
11110	**Wire Gauze Cylinder,** on Insulated Stand			0	12 6
11111	**Brass Knobs,** Stewart & Gee's, with Vulcanite Rods, on Stands ...	per pair		0	8 6
11112	Ditto, on Polished Mahogany Bases, large size	,,		0	15 0



11113–4



11115–6

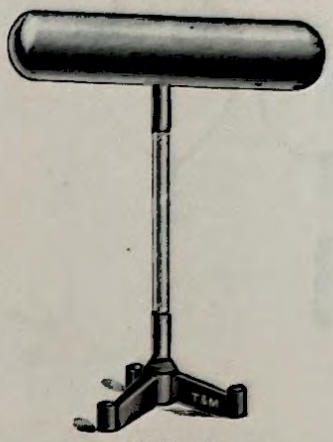


11117–8

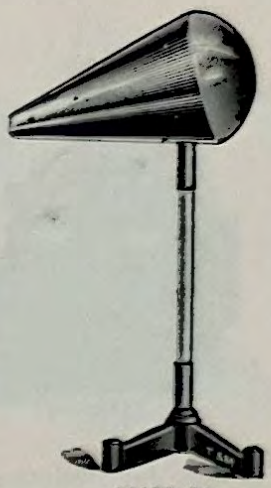
11113	**Conductors,** Spherical, covered with Tin Foil, 5 in. dia., on insulated Stand complete, each			£0	10 6
11114	,, ,, ,, ,, 3 ,, ,, ,, ,, ,,			0	7 0
11115	,, Cylindrical ,, ,, 11 × 2 in. dia., ,, ,, ,, ,,			0	11 0
11116	,, ,, ,, ,, $5\frac{1}{2} \times 2$,, ,, ,, ,, ,,			0	7 6
11117	,, Conical ,, ,, 10 × 5 ,, ,, ,, ,, ,,			0	12 0
11118	,, ,, ,, ,, $5 \times 2\frac{3}{4}$,, ,, ,, ,, ,,			0	7 6



11119–20



11121–22



11123–24

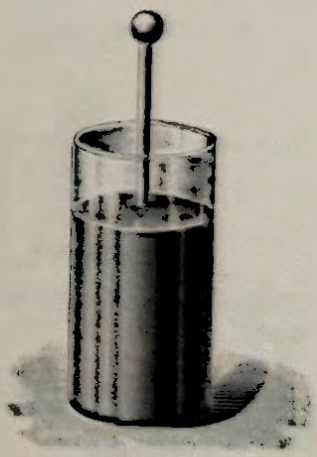
			Diameter.	
11119	**Conductors,** Spherical, Brass mounted, on Insulated Tripods, with Ebonite Rod,	5 in.	each	**£0 18 6**
11120	„ „ „ „ „ „ „ „	3 in.	„	**0 12 6**
11121	„ Cylindrical „ „ „ „ „ „	11×2¼ in.	„	**1 5 0**
11122	„ „ „ „ „ „ „ „	5½×2 in.	„	**0 17 6**
11123	„ Conical „ „ „ „ „ „	10×5 in.	„	**1 12 6**
11124	„ „ „ „ „ „ „ „	5×2⅞ in.	„	**0 18 6**



11125–26



11127

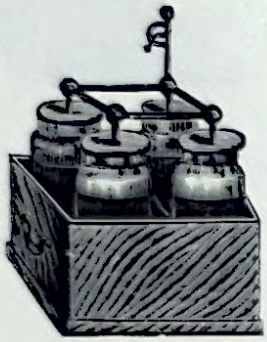


11128



11129

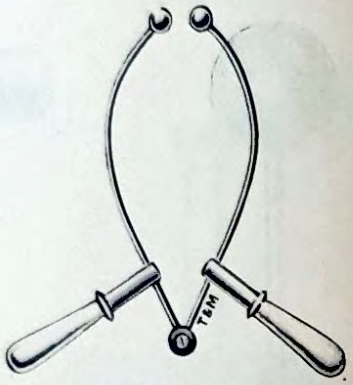
11125	**Faraday's Butterfly Net,** with Glass Rod, on Tripod Stand...	each	**£0 6 0**
11126	„ „ „ larger size	„	**0 8 0**
11127	**Leyden Jar,** of English Flint Glass, mounted with Polished Mahogany Top, and covered with Tinfoil, Brass Rod, etc. Capacity ½	1	1½	2	4 pints
	6 0	**7 0**	**8 6**	**10 6**	**16 0** each
11128	Ditto, with open Top and Ebonite Plate, same sizes and prices as above. Capacity ½	1	2 pints		
11129	Ditto, with Movable Coating	**7 6**	**8 6**	**10 6**	each



11131–34

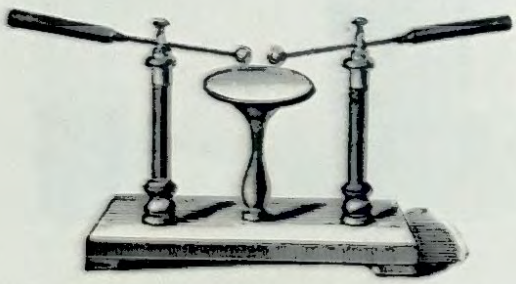


11135 11136–37

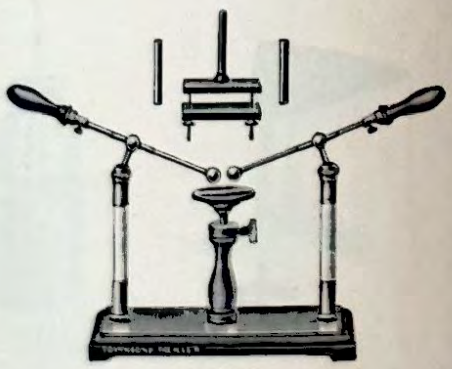


11138–39

11131	**Leyden Jar Batteries,** Battery of four, capacity 1 pint, in Polished Mahogany Tray	**£2 5 0**
11132	„ „ „ „ four, „ 2 „ „ „ „	**2 15 0**
11133	„ „ „ „ six, „ 1 „ „ „ „	**3 12 6**
11134	„ „ „ „ six, „ 2 „ „ „ „	**4 5 0**
11135	**Discharger,** Plain, with Glass and Wood Handle ... ... each	**0 3 6**
11136	„ Jointed „ „ „ ... ... „	**0 6 6**
11137	„ „ with Glass Handle ... ... „	**0 9 0**
11138	„ „ with two Handles ... ... „	**0 15 0**
11139	„ „ „ „ „ large size ... ... „	**1 0 0**



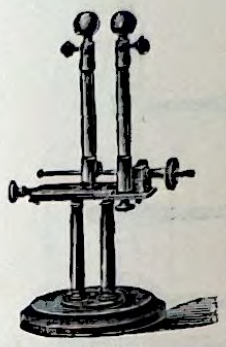
11140



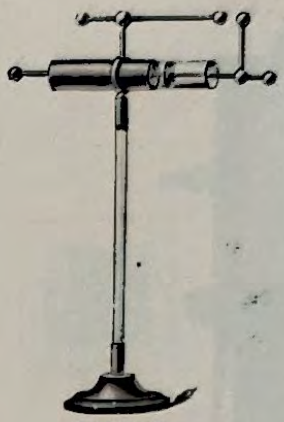
11141

11140 **Discharger,** Universal, Henley's, with Insulated Handles and Fixed Table, for deflagrating Metals or exposing substances to Frictional or Voltaic Electricity... ... **£1 18 6**

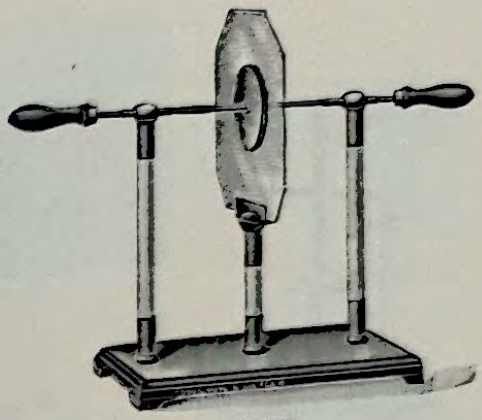
11141 **Discharger,** Universal, Henley's, with Insulated Handles, Press, Adjustable Table and Carbon Holder, for deflagrating Metals or exposing substances to Frictional or Voltaic Electricity **2 15 0**



11142

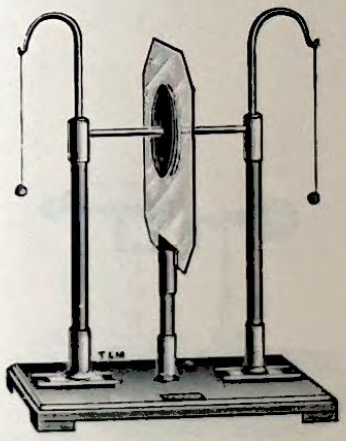


11143-4

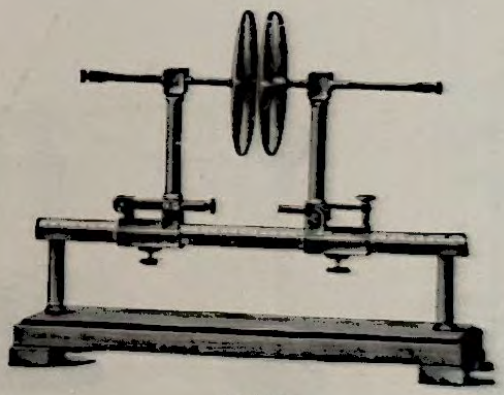


11145

11142	**Spark Micrometer,** Reis's, with Silvered Millimetre Scale, Vernier and Micrometer Screw, mounted on Brass Pillars and Mahogany Base	£3 17 6
11143	**Unit Jar,** Harris's, Brass, on Insulated Metal Stand	1 2 6
11144	,, ,, ,, larger size	1 7 6
11145	**Condenser,** consisting of Mounted Glass Plate, with two Brass Circles, Sliding in Insulated Supports, mounted on Mahogany Base	1 7 6



11146

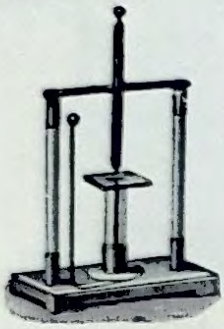


11148



11149

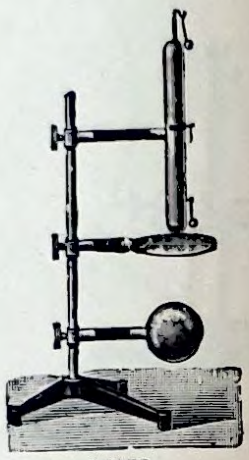
11146	**Condenser,** improved pattern, with two adjustable Sliding Supports	£1 10 0
11147	**Condenser,** best make, with three Insulated Supports, mounted on a Brass Slide	3 7 6
11148	**Condenser,** Kohlrausch's, best make, with Graduated Brass Scale and Brass Plates movable in any direction, mounted on Mahogany Base	5 5 0
11149	**Condenser,** Stewart and Gee's	0 10 6



11150

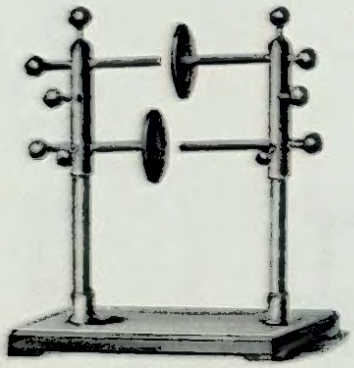


11151



11152

11150	**Apparatus,** for Glass Boring by the electric discharge, mounted on Mahogany Base	£1 5 0
11151	**Apparatus,** for Condensation of Smoke by electrical discharge. Large Model, with Glass Cylinder, 8 in. high	2 5 0
11152	**Distribution Apparatus,** Reis's, with Screen, mounted on Stand, complete ...	1 15 0



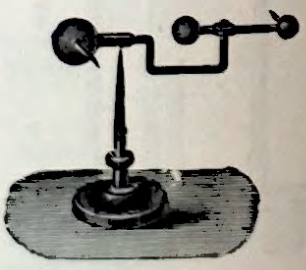
11153



11154

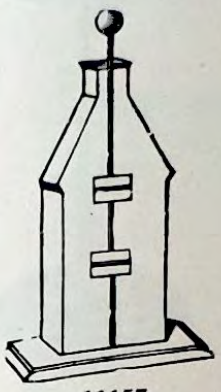


11155



11156

11153	**Weinhold's Apparatus,** to show the action of points on Positive and Negative Electricity, mounted on Insulated Stand	£1 5 0
11154	**Brass Ball,** with Point, on Insulated Rod, to show Lightning Discharge from Clouds each	0 5 0
11155	**Apparatus,** to show the electrical effect of Points ... ... ,,	0 16 6
11156	**Orrery,** Brass Wire and Wood Balls, mounted on Brass Stand ... ... ,,	0 10 6



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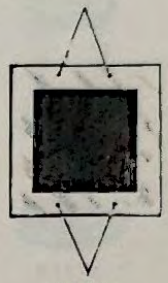
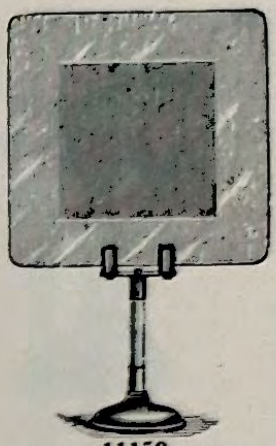


11158

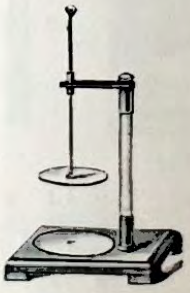


11159

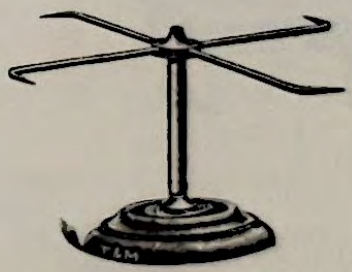


11160

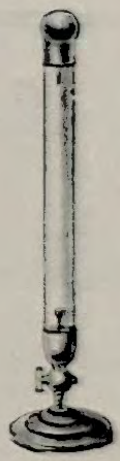
11157	**Thunder House,** for demonstrating the theory of Lightning	£0 18 0
11158	**Fulminating Plate,** with Silk Handles	0 6 0
11159	,, ,, Franklin's, on Insulated Stand...	0 18 6
11160	**Head of Hair,** mounted on Mahogany Base	0 6 0



11161



11162



11163



11164-5

11161	**Figure Plate,** with Sliding Rod on Mahogany Stand	£0 11 6
11162	**Whirl,** Brass, on Polished Mahogany Stand	0 5 0
11163	**Glass Tube,** 3 ft. long, fitted with Brass Cap at each end, with Stopcock for exhausting with Air Pump, to show Electric Discharge in Vacuo, on Polished Mahogany Stand	1 10 0
11164	**Luminous Globe,** large size, mounted in Brass Sockets, with Stopcock to attach to Air Pump, for showing Electrical Discharges in a Vacuum, or Rarefied Air ...	2 7 6
11165	Ditto, of smaller size	2 0 0

• OIL AND TAR TESTING APPARATUS •



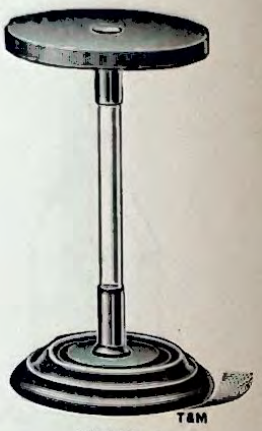
11167



11168



11169



11170–1

11167	**Electric Thermometer,** Kinnersley's, for showing atmospheric disturbances by Electric Spark (without Leyden Jar)	£1	5	0
11168	Ditto, cheaper form, on Polished Wood Base	0	10	6
11169	**Pith Ball Stand,** with twelve Pith Balls	0	7	6
11170	**Stand,** Insulating, Polished Mahogany, 7 in. diameter, mounted on Mahogany Foot	0	10	0
11171	,, ,, ,, ,, smaller size	0	7	6



11172–3



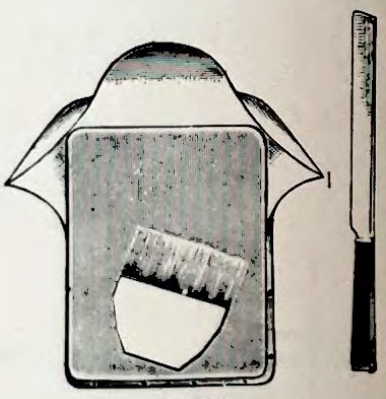
11174



11177



11175–6



11183

11172	**Stand,** Insulating, with adjustable Sliding Glass Rod, 7 in. diameter, on Tripod Foot	£0	12	6
11173	,, ,, smaller size	0	8	6
11174	,, ,, of Stout Glass, with Brass Plate at top, 6 in. diameter	0	18	6
11175	**Stool,** Insulated, Stained Wood, 12×11 in., on Ebonite Legs	0	14	0
11176	,, ,, Mahogany, 12×11 in. ,, ,, ...	0	16	6
11177	**Phosphorus,** or Spirit Cup	0	12	6
11178	**Tinfoil** ... ... No. 3, per lb., **5/0**; best quality	0	6	6
11179	**Roll of Tinfoil,** on Glass Rod	0	2	0
11180	**Copper Leaf** (Dutch Metal) ... ... per book	0	0	9
11181	**Gold Leaf** ... ... ,, ,,	0	3	0
11182	**Amalgam,** Electrical ... ... ,, oz.	0	0	10
11183	**Gilders' Knife,** Pad and Tip ... ... ,, set	0	10	6
11184	**Silk,** Unspun... ... ... ,, reel	0	0	8
11185	**Chain, Brass,** for connections ... ... ,, yd.	0	0	4
11186	**Ebonite Sheet,** Polished Surface, good quality, $\frac{1}{8}$ to 1 in. ... ...per lb.	0	4	6
11187	,, **Rod,** ,, ,, ,, ,, $\frac{1}{16}$ to 1 in. ... ... ,,	0	4	6

Thermo-Electricity



11193



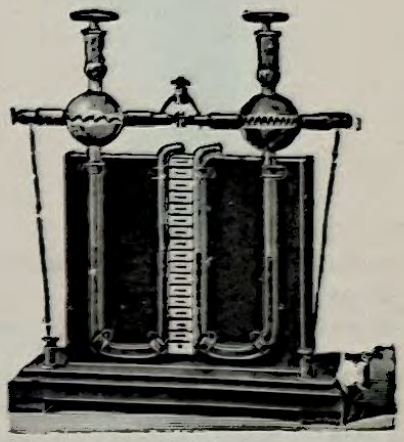
11190



11195



11194

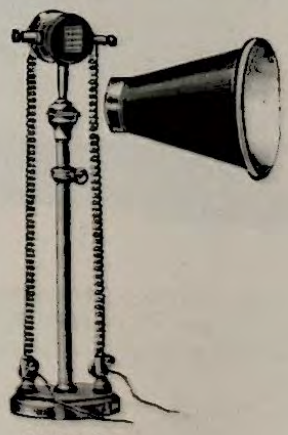


11196

11190	**Thermo Electric Pair,** of Bismuth and Antimony, V shape, with Wire for connecting to Battery, on Brass Stand	£0 10 6
11191	Ditto, without Stand	0 7 0
11192	Ditto, of Copper and Iron, without Stand	0 3 6
11193	Ditto, Simple, consisting of Rod of Bismuth on Copper Strips, with Terminals...	0 7 6
11194	**Peltier's Apparatus,** for demonstrating the rise or fall of temperature by means of the Electric Current	2 2 0
11195	Ditto, Peltier's Cross, for showing the generation of cold by the electric current, on Stand	0 10 6
11196	**Apparatus,** Foster's, for showing that the heating of a Wire is proportionate to the resistance and to the square of the strength of Current; improved form, on Walnut Stand	2 17 6



11197-8



11200-2

11197	**Thermopile,** mounted on Brass Stand, with adjustment for height, and Caps for the protection of the Couples, twelve pairs with Silver-plated Copper Cone ... . each	2 10 0
11198	Ditto, ditto, twenty pairs ...	3 3 0
11199	Ditto, mounted on Brass Stand with Silver-plated Cone Ball and Socket Joint, Sliding Tube and Terminals, on Brass Base, twenty-four pairs ... each	3 15 0
11200	Ditto, ditto, forty pairs	4 15 0
11201	Ditto, ditto, fifty-four pairs ..	6 0 0
11202	Ditto, ditto, sixty pairs	6 10 0



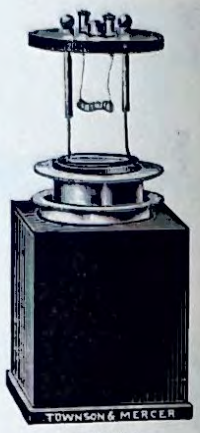
11204



11205



11206–8



11209

11204	**Seebeck's Rectangle,** consisting of Frame of Bismuth and Copper, with Magnetic Needle	£0 16 6
11205	,, ,, ,, ,, ,, ,, Antimony ,, ,, ...	0 17 6
11206	**Joule's Calorimeter,** Simple, consisting of Copper Vessel, Ebonite Cover, with Platinoid Wire, Terminals, Stirrer, and hole in centre for Thermometer	0 8 6
11207	Ditto, ditto, with Thermometer, in 1/5th degrees	0 14 6
11208	Ditto, ditto, with large size Outer Vessel of Silvered Copper, with Thermometer, complete	1 0 0
11209	Ditto, consisting of Polished Mahogany Box, with a Tin Vessel, in which is an Inner Copper Vessel, but insulated from it, containing a sliding Stirrer of Copper passing through a Cover. The ends of the German Silver Spiral pass through the cover to Terminals, and a hole is left for Thermometer	1 5 0

Voltaic Electricity



11212–3

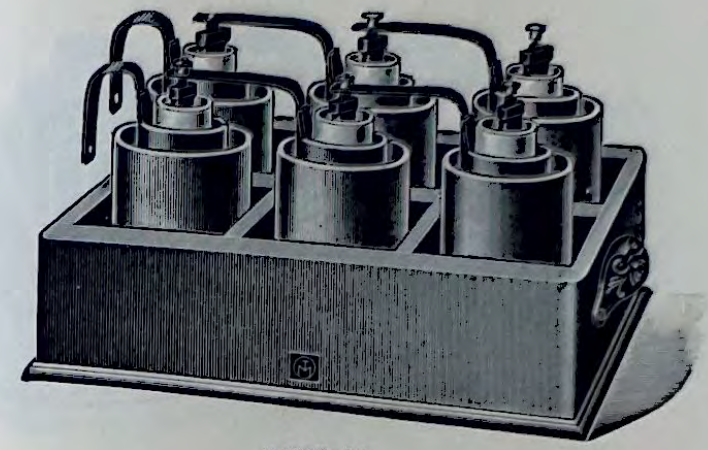


11214–5



11216

11210	**Elements,** Simple, plates of Copper and Zinc ... ...per pair				£0 0 9
11211	Ditto, ditto, with Wires attached ... ... ,,				0 1 0
11212	**Cell,** Volta's, Simple, consisting of Plates of Copper and Zinc, with Terminals attached, complete in Glass Cell				0 2 0
11213	Ditto, with Carbon and Zinc Plates, as illustrated, complete with Glass Cell				0 2 3
11214	Ditto, ditto, with Zinc and Copper Plates				0 2 6
11215	Ditto, ditto, with Zinc and Carbon Plates				0 3 0
11216	**Battery,** Bunsen's, cheap form, Carbon with Fixed Terminal in Brown Stoneware Outer Jar.	Capacity	1	2	3 pints each
			4/6	6/0	7/0
11217	**Zincs,** for ditto		2/6	3/3	4/0 ,,
11218	**Carbons,** for ditto, with terminal		6d.	6d.	9d. ,,
11219	**Porous Pots**		5d.	6d.	8d. ,,
11219/1	**Outer Jars**		1/1	1/8	2/0 ,,



11220–21

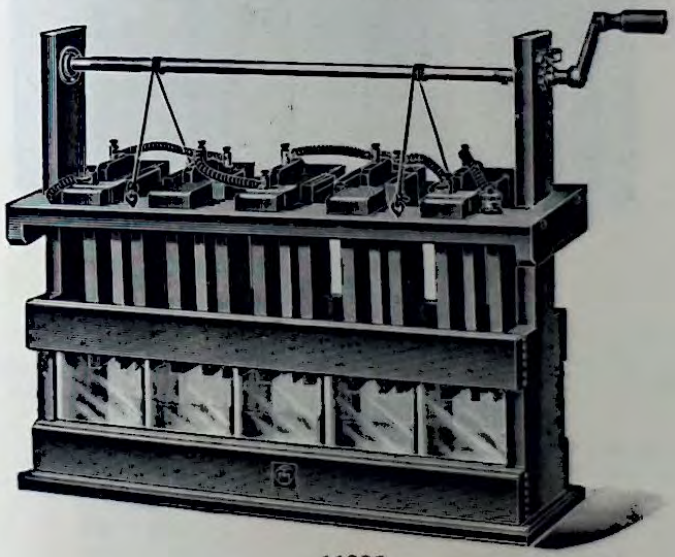


11222

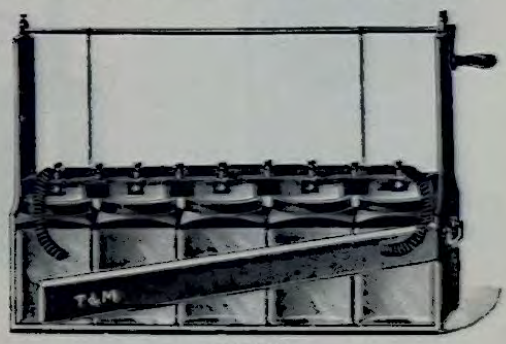
		Capacity, 1 pint in Sets of	3	4	6	Cells
11220	**Battery,** Bunsen's, Sets of, in Divisional Teak Tray, with Handles		**27/6**	**32/0**	**45/0**	
11221	Ditto, ditto ... ... 2 pint size		**32/6**	**42/0**	**52/0**	

11222 **Battery, Bichromate,** Bottle Shape, with Ebonite Top and Brass Fittings. New Form, with Carbons fixed in position by Screws, without the use of solder. This is a great advantage, as in the event of breakage, a new fitting can be forwarded, thus avoiding the necessity of returning the whole Battery

	Capacity	¼	½	1	2	litres
		3/6	**5/0**	**6/0**	**8/0**	each
11223	**Zincs,** for ditto, with Hole drilled and tapped	**5d.**	**6d.**	**9d.**	**1/0**	..
11224	**Carbons** for ditto, with Bevelled Edges and holed ready for fixing	**5d.**	**6d.**	**9d.**	**1/0**	..



11225



11229

11225 **Battery, Bichromate,** in Stout Teak Frame, with Rack Arrangement for raising and lowering the Elements; capacity of Glass Cells, 1 pint.

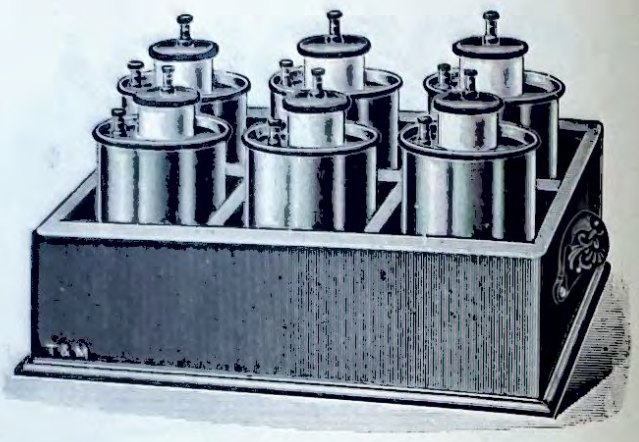
	Set of	4	5	6
		£3 3 0	**£3 17 6**	**£4 15 0**
11226	**Zincs,** for ditto ... each		**0 1 9**	
11227	**Carbons,** for ditto ..		**0 1 2**	
11228	**Outer Jars,** for ditto		**0 2 4**	

11229 **Battery, Bichromate,** 1 quart Cells, in Mahogany Frame, with arrangement for lifting Elements out of solution.

	Set of	4	5	6
		£3 0 0	**£3 12 0**	**4 5 0**
11230	**Zincs** for ditto ... ... each		**0 1 9**	
11231	**Carbons** for ditto		**0 1 9**	
11232	**Outer Cells** for ditto, Glass		**0 1 3**	



11233



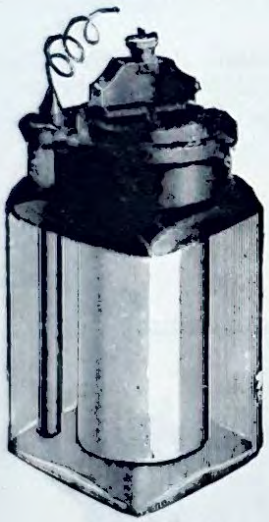
11235



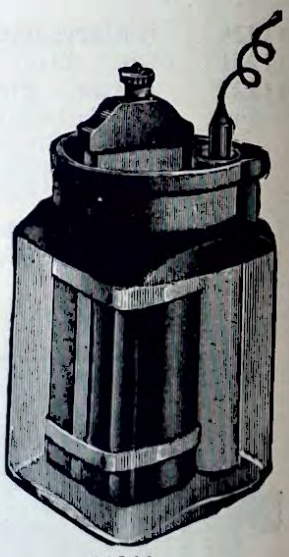
11236



11238

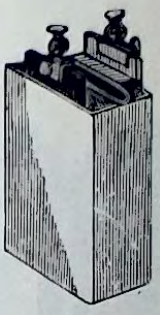


11240

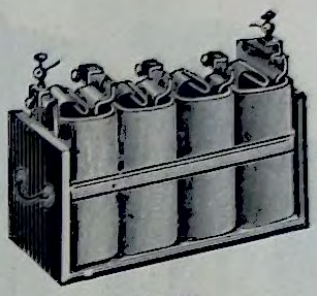


11244

11233	**Battery**, Daniell's, with Outer Cell of Copper, and Zinc Rod in Porous Pot. Size of Copper Cell	$4\frac{1}{2} \times 3$	$5\frac{1}{2} \times 3\frac{1}{2}$	$6\frac{3}{4} \times 4\frac{1}{2}$	$9\frac{1}{2} \times 4\frac{1}{2}$	in.
	Capacity	$\frac{1}{2}$	1	2	3	pints
		6/3	**7/0**	**8/0**	**10/0**	each
11234	**Zincs** for ditto, Tapped for Terminals	**9d.**	**10d.**	**1/6**	**2/0**	,,
11235	**Battery**, Daniell's, Sets of, in Divisioned Teak Tray, with Handles. Capacity 1 pint in Sets of	3	4	6		Cells
		30/0	**40/0**	**55/6**		per set
11235/1	Ditto, ditto ... ... 2 pint ,,	**35/0**	**45/0**	**66/0**		,,
11236	**Battery**, Daniell's Gravity. Capacity, 3 pints ... ... each				**£0**	**5** **6**
11237	**Spare Parts** for above—Coppers, **1/0**; Zinc, **3/6**; Glass Cells, **1/6** each.					
11238	**Battery**, Daniell's, 3 pints, with Glass Outer Cell ... ... ,,				**0**	**5** **0**
11239	**Spare Parts** for above—Coppers, **1/0**; Zinc, **1/9**; Porous Pots, **9d.**; Glass Cells, **1/6**.					
11240	**Battery**, Leclanché's, best quality, ordinary form, with Porous Pot, for Electric Bells, etc., E.M.F. 1·60 volts; retains the full working power for about eighteen months, and requires no further attention after being charged than the occasional addition of a little water; complete with charging. Capacity		2	3		pints
			2/0	**3/0**		each
11241	**Zincs** for ditto		**5d.**	**6d.**		,,
11242	**Porous Cells** for ditto (charged)		**1/1**	**1/6**		,,
11243	**Outer Cells** for ditto		**8d.**	**1/3**		,,
11244	**Battery**, Leclanché's Patent, agglomerate form, E.M.F., 1·55 volts		**3/3**	**4/3**		,,



11245

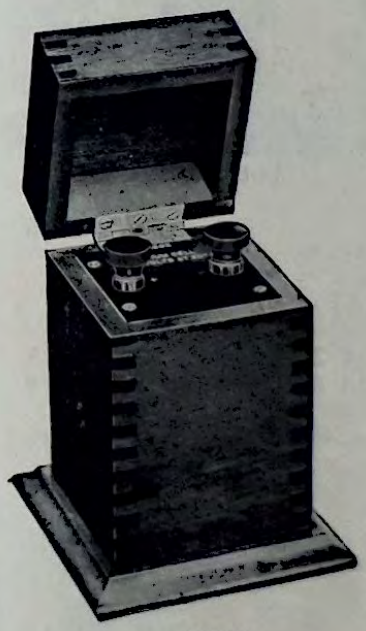


11247

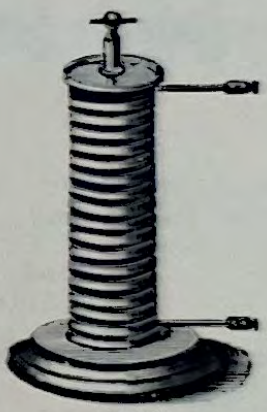


11248

11245	**Battery,** Grove's, in White Stoneware Cell	each		**£0**	**6** **6**
11246	Ditto, with Platinum Plate (subject to fluctuation of the price of Platinum)	„		**1**	**7** **6**
11247	Ditto, in Sets, in Mahogany Tray, without Platinum Plates.	Set of	4 **37/6**	6 **52/6**	Cells
11248	**Battery,** Smee's, in Glass Cell			**£0**	**12** **6**

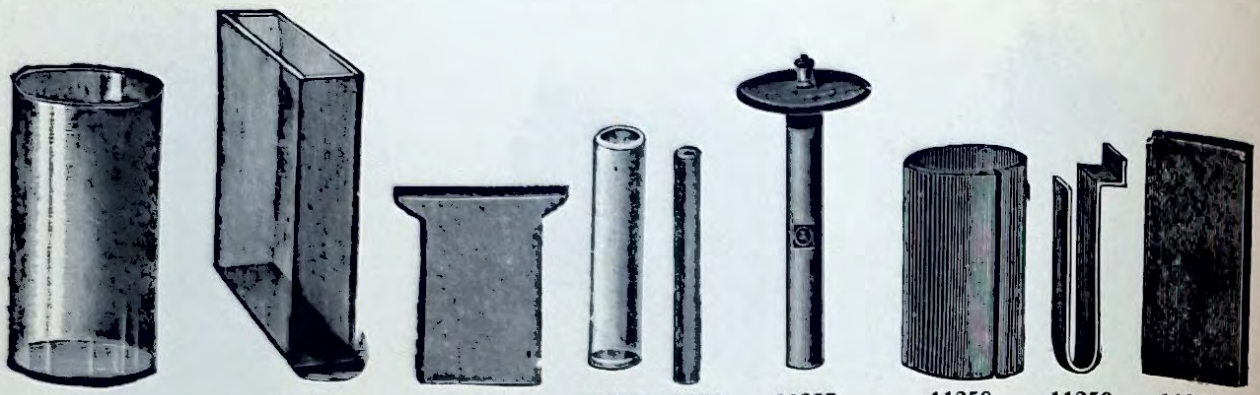


11249



11251

11249	**Standard Cadmium Cells.** These Cells are made up in the usual "H" form, and are supplied mounted in a Mahogany Case with Ebonite Top and protecting Cover. Their E.M.F. is 1·0183 volts at 20°C. Single Cell in Case			**£3**	**10** **0**
11250	Ditto, Two Cells in Case			**5**	**0** **0**
11251	**Volta's Pile,** consisting of 40 Pairs of Zinc and Copper Plates, 3in. diameter, with Flannel discs between, mounted on Mahogany Base			**1**	**17** **6**



11252 11253 11254 11255 11256 11257 11258 11259 11260

(F) **11252** **Battery Jars,** Glass, Stout, Round.

Height ...	10	13	16	16	20	22	25	26	cm.
Diameter...	8	9	10	12	10	12	12	15	,,
	9d.	**10d.**	**1/2**	**1/4**	**1/6**	**1/7**	**2/0**	**3/0**	each
	7/0	**8/6**	**11/0**	**13/0**	**16/0**	**17/6**	**22/6**	**30/0**	per doz.

(F) **11253** Ditto, Stout Glass, Rectangular.

Height...	$3\frac{5}{8}$	$4\frac{3}{4}$	5	$5\frac{3}{4}$	8	in.
Diameter	$2\frac{5}{8}$	$3\frac{1}{4}$	$3\frac{1}{2}$	4	5	,,
Width...	$1\frac{7}{8}$	$1\frac{3}{4}$	$3\frac{1}{2}$	$2\frac{1}{2}$	$2\frac{3}{4}$	,,
	1/3	**2/0**	**2/4**	**2/9**	**4/0**	each

11254 **Battery Cells,** Grove's Flat, Porous, with Lips.

Height... ...	$4\frac{1}{2}$	5	$5\frac{3}{4}$	in.
Width at Top	$3\frac{1}{2}$	$4\frac{1}{2}$	5	,,
,, Bottom	$2\frac{1}{2}$	$3\frac{1}{2}$	$4\frac{1}{2}$	,,
	1/3	**1/6**	**1/9**	each
	13/6	**16/6**	**19/6**	per doz.

11255 Ditto, Round, Porous.

Height ...	3	4	$4\frac{1}{2}$	5	$5\frac{1}{2}$	6	6	7	10	in.
Diameter	1	$1\frac{1}{2}$	2	$1\frac{3}{4}$	$2\frac{1}{4}$	$1\frac{3}{4}$	2	$2\frac{1}{4}$	$2\frac{1}{2}$	,,
	6d.	**7d.**	**10d.**	**10d.**	**1/2**	**1/0**	**1/1**	**1/5**	**1/9**	each
	5/0	**6/0**	**9/6**	**9/6**	**13/0**	**11/0**	**11/6**	**15/0**	**20/0**	per doz.

11256 **Zinc Rods,** Amalgamated, for Daniell's Batteries (screwed for Terminals),

Size for	$\frac{1}{2}$	1	2	3	pint cells
	9d.	**10d.**	**1/6**	**2/0**	each

11257 ,, ,, with Mahogany Cap and Terminal fitted **1/6** **1/7** **2/3** **2/9** ,,

	1	2	3	pint size
11258 **Zinc Cylinders,** for Bunsen's Batteries	**2/6**	**3/3**	**4/0**	each

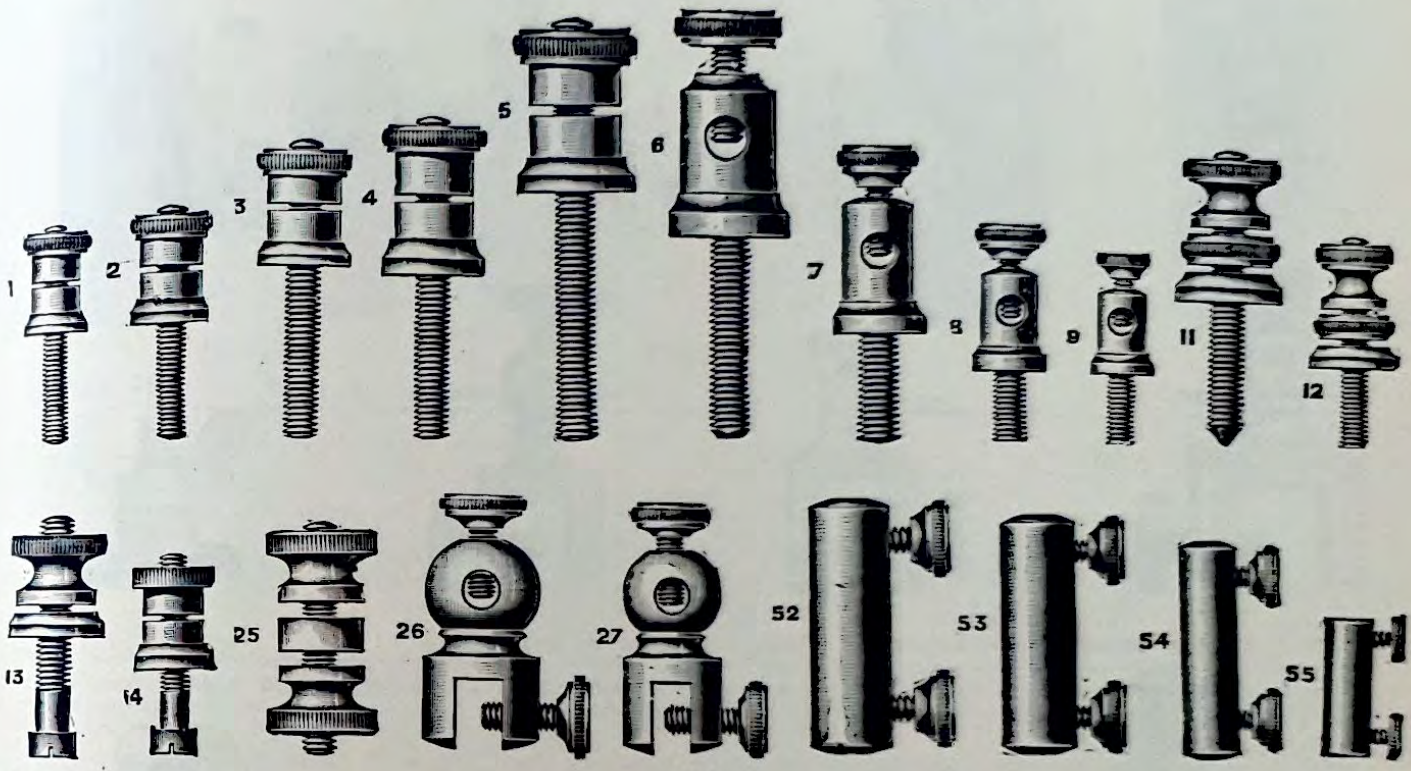
11259 **Zinc Plates,** bent, for Grove's Batteries, $5\frac{1}{2} \times 2\frac{1}{2} \times \frac{1}{8}$ in. ... ... each **£0 3 0**

11260 **Carbon Plates,** for Bichromate Batteries, etc., prepared from Selected Gas Coke.

$3\frac{1}{2} \times 1\frac{1}{2}$	4×2	5×2	$6\frac{1}{2} \times 2\frac{5}{8}$	7×3	in.
$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	$\frac{1}{4}$	.. thick
6d.	**8d.**	**10d.**	**1/0**	**1/6**	each

(F) Foreign manufacture.

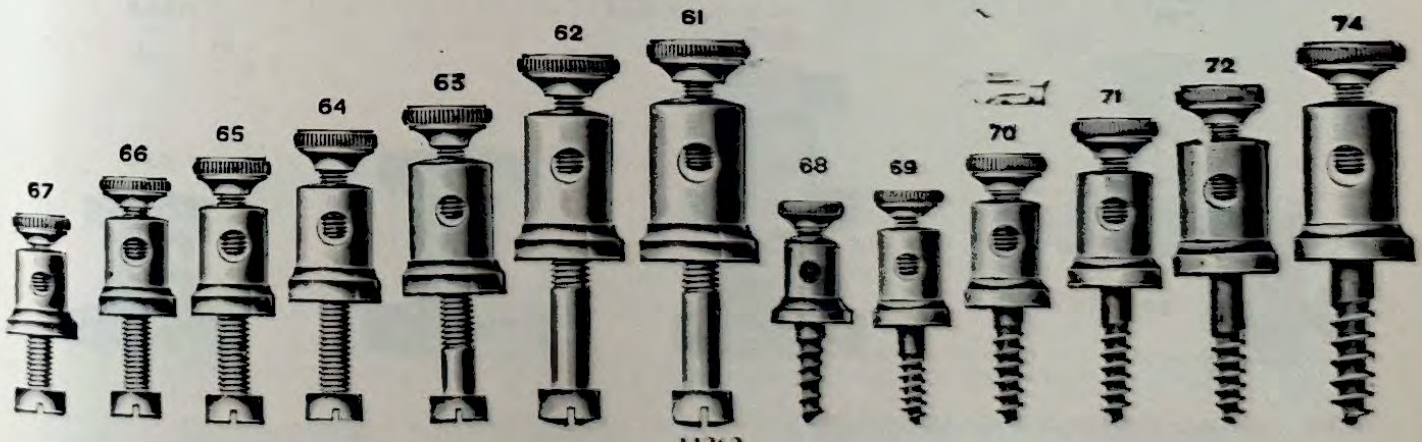
Battery Terminals and Clamps



11261

11261 Battery Terminals. The illustrations are shown actual size.

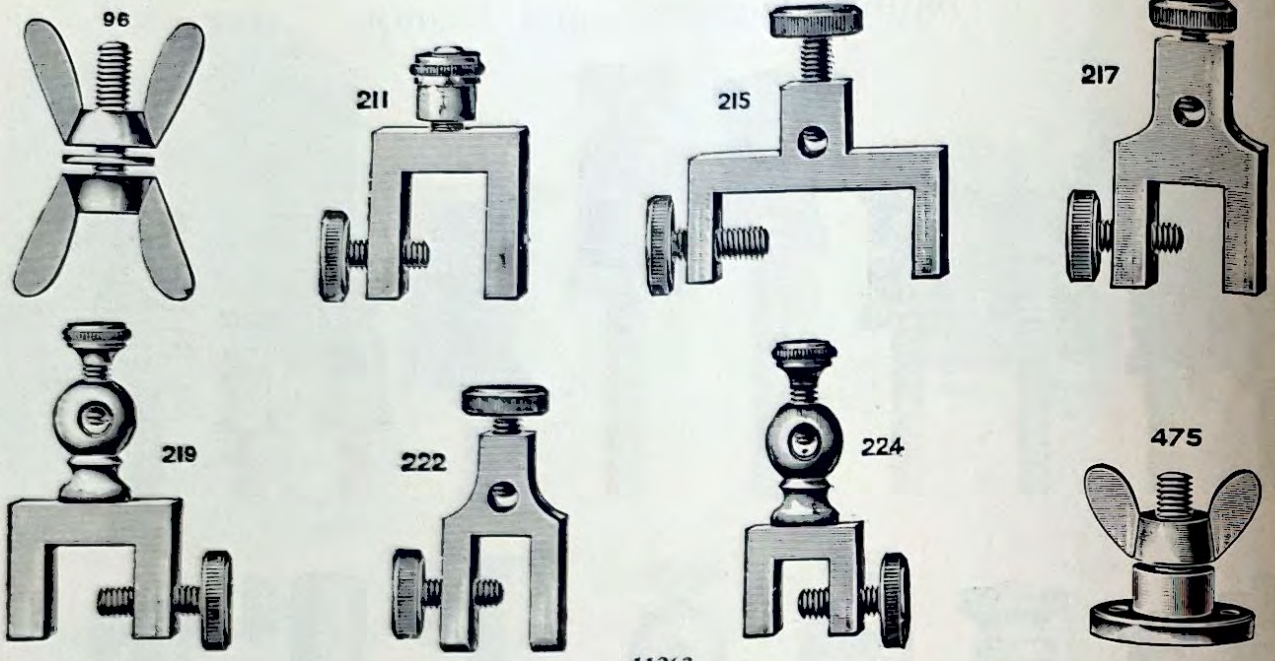
Nos.	1	2	3	4	5	6	7	8	9	11	12	13	14	25	26	27	52	53	54	55	
	2/0	2/4	2/9	3/3	4/0	5/3	3/3	2/3	2/0	3/3	2/3	2/3	2/4	3 6	5 0	4 6	4 0	3 6	3 0	2 0	per doz.



11262

11262 Battery Terminals. The illustrations are shown actual size.

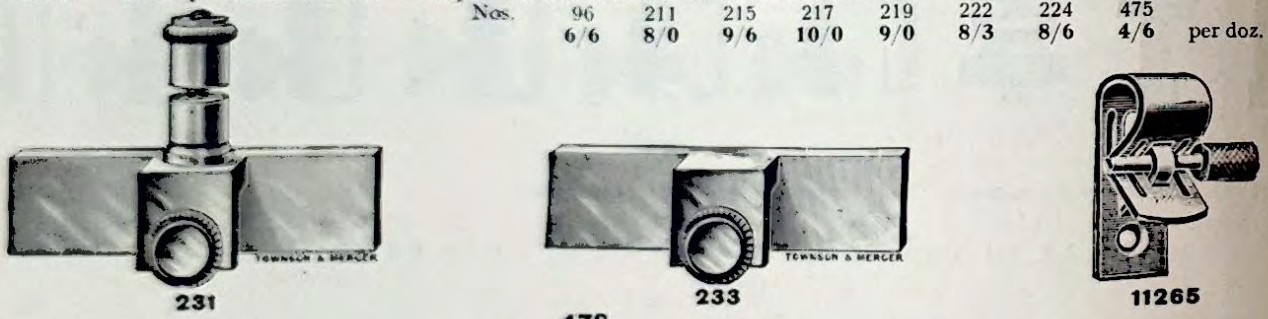
Nos.	67	66	65	64	63	62	61	68	69	70	71	72	74	
	2 6	2 9	3 6	3 10	4 0	5 1	5 3	2 6	3 0	3 3	4 0	4 1	5 3	per doz.

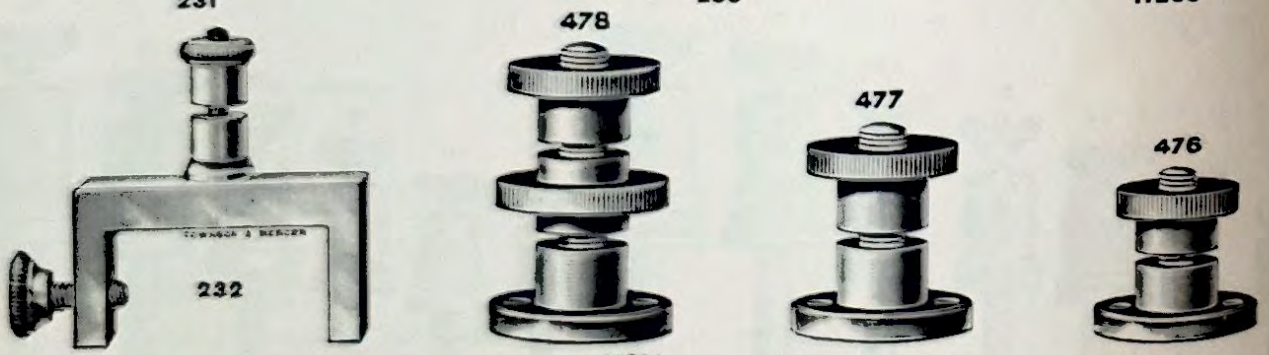


11263

11263 **Battery Terminals and Clamps.** The illustrations are shown actual size.

Nos.	96	211	215	217	219	222	224	475	
	6/6	8/0	9/6	10/0	9/0	8/3	8/6	4/6	per doz.





11264

11264 **Battery Terminals and Clamps.** The illustrations are shown actual size.

Nos.	231	232	233	478	477	476	
	11/0	12/6	7/6	17/6	5/6	4/3	per doz.

11265 **The Spring Clip Terminal** (Patent). Rapidly replacing other types of Binding Screws for Batteries, Coils, etc. They hold most tenaciously, and yet at the same time wires can be removed immediately upon pressure by the thumb.

Small Single	per doz.	£0 1 6
Large Single	"	0 5 6

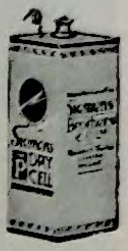


11266



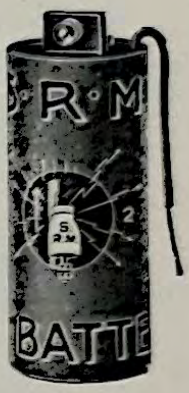


11267





11268



11269

11266 Siemens' Dry Cells, Standard Type. Round

Size.	Approximate dimensions (including terminals).		Approximate weight.		E.M.F.	Internal resistance.	Price per Cell.
	Inches.	Millimetres.	lbs. ozs.	Kilograms.	Volts.	Ohm.	
A	3 5/16 dia. × 8 high	84 dia. × 203 high	4 0	1·82	about 1·5	about 0·15	£0 4 6
B	2 11/16 ,, × 7 ,,	68 ,, × 178 ,,	2 4	1·02	,, 1·5	,, 0·20	0 3 2
C	2 1/4 ,, × 6 ,,	57 ,, × 153 ,,	1 6	0·62	,, 1·5	,, 0·25	0 2 3
D	2 ,, × 5 ,,	51 ,, × 127 ,,	0 14	0·40	,, 1·5	,, 0·30	0 1 11

Sizes A, M and N are recommended in all cases where a large output and strong currents are required, or where intermittent currents are required over an extended period, as when used with small glow lamps, for galvano-cautery, induction coils, ordinary telegraph and cable work, small motors, etc.

Sizes B and O are suitable for working bells, open circuit telegraphs and telephones, hotel indicators, railway signalling apparatus, etc.

Sizes C, P and Q are well suited for testing batteries, electro-medical work, etc.

Sizes D, R, S and T are also recommended for portable testing batteries and electro-medical purposes, where light weight is essential.

11267 Siemens' Dry Cells, Standard Type. Square.

Size.	Approximate dimensions (including terminals).		Approximate weight uncharged.		E.M.F.	Internal resistance	Price per Cell.
	Inches.	Millimetres.	lbs. ozs.	Kilograms.	Volts.	Ohm.	
	high	high			about	about	
M	4 7/16 × 4 7/16 × 8 1/2	113 × 113 × 206	10 0	4·54	1·5	0·15	£0 9 0
N	3 3/16 × 3 3/16 × 7 1/2	84 × 84 × 191	5 4	2·38	1·5	0·15	0 5 6
O	2 13/16 × 2 13/16 × 6 3/4	72 × 72 × 168	3 0	1·36	1·5	0·20	0 3 11
P	2 1/4 × 2 1/4 × 6 1/2	57 × 57 × 156	1 14	0·85	1·5	0·25	0 2 8
Q	2 × 2 × 5 1/2	51 × 51 × 140	1 4	0·37	1·5	0·25	0 2 3
R	1 13/16 × 1 13/16 × 5	46 × 46 × 127	0 14	0·40	1·5	0·30	0 1 11
S	1 1/2 × 1 1/2 × 4 1/2	38 × 38 × 114	0 9	0·26	1·5	0·50	0 1 6
T	1 1/4 × 1 1/4 × 3 5/8	32 × 32 × 92	0 6	0·17	1·5	0·50	0 1 5

The Square Cells in the above tables are those more generally employed. Each Cell is fitted with the usual Brass Terminal and connection wire.

11268 Dry Cell, the T.M. A thoroughly reliable Cell of English manufacture. Size, 6 1/2 × 2 1/2 in. ... each **£0 1 9**

11269 The "S.R.M." Dry Battery. This Cell has great recuperative powers, long life, and cannot bulge or burst, as it is enclosed in an outer Cylinder of Galvanised Iron, well insulated, and is not affected by damp or heat.

Nos.	2	3	
	7 1/2 × 2 1/2	5 1/2 × 2 1/2	in.
	2 6	2 3	each

Wires for Electrical Connections, Resistances, etc.



11271–11281

11270 **Copper Wire,** bare on Reels.

S.W.G.	16	18	20	22	24	26	28	30	32	34	36	38	40
8 oz....	1/1	1/1	1/2	1/2	1/2	1/3	1/4	1/6	1/6	1/7	1/8	1/10	2/1
1 lb....	2/2	2/2	2/3	2/4	2/4	2/5	2/6	2/9	2/10	3/0	3/2	3/6	3/9

***11271** **Copper Wire,** double cotton-covered.

S.W.G.	16	18	20	22	24	26	28	30	32	34	36	38	40
4 oz....	8d.	9d.	10d.	1/0	1/2	1/3	1/6	1/9	2/0	2/2	2/8	3/4	4/3
8 oz....	1/2	1/4	1/6	1/9	2/0	2/3	2/6	3/0	3/6	4/0	5/0	6/3	8/3
1 lb....	2/2	2/3	2/8	3/0	3/6	4/0	4/9	5/3	6/3	7/3	9/3	11/6	15/6

***11272** **Copper Wire,** double silk-covered.

S.W.G.	16	18	20	22	24	26	28	30	32	34	36	38	40
4 oz....	1/3	1/4	1/7	1/9	1/11	2/1	2/4	2/7	2/11	3/5	3/11	5/4	6/4
8 oz....	2/3	2/4	2/9	3/2	3/4	3/9	4/3	4/9	5/6	6/4	7/5	10/3	12/4
1 lb....	4/2	4/3	5/2	5/8	6/2	7/0	8/0	9/2	10/6	12/3	14/6	19/6	23/9

***11273** **Copper Wire,** Enamelled.

S.W.G.	16	18	20	22	24	26	28	30	32	34	36	38	40
4 oz....	9d.	10d.	11d.	1/0	1/0	1/1	1/2	1/4	1/6	1/8	1/9	2/0	3/0
8 oz....	1/4	1/5	1/6	1/8	1/9	1/10	1/11	2/1	2/4	2/9	3/2	3/7	5/6
1 lb....	2/2	2/3	2/8	2/9	2/10	3/3	3/4	3/8	4/4	5/3	6/0	6/10	10/6

***11274** **Copper Wire,** Enamelled, double cotton-covered.

S.W.G.	...	18	20	22	24	26	28	30	32	34	36	38	40
4 oz....	...	1/1	1/1	1/3	1/5	1/6	1/9	2/1	2/5	2/9	3/5	—	—
8 oz....	...	1/6	1/8	1/11	2/3	2/6	2/11	3/7	4/3	5/0	6/3	—	—
1 lb....	...	2/5	2/9	3/3	3/11	4/6	5/3	6/8	7/11	9/5	12/0	—	—

***11275** **Copper Wire,** Enamelled, double silk-covered.

S.W.G.	16	18	20	22	24	26	28	30	32	34	36	38	40
4 oz....	1/3	1/4	1/8	1/10	1/11	2/2	2/4	2/8	3/0	3/6	4/0	5/6	6/6
8 oz....	2/3	2/4	2/11	3/3	3/5	4/0	4/5	5/0	5/9	6/8	7/5	10/6	12/9
1 lb....	4/2	4/3	5/3	5/9	6/3	7/3	8/3	9/3	10/9	14/2	14/6	20/0	24/6

*11276 **Nickel Silver Wire,** bare.

S.W.G.	16	18	20	22	24	26	28	30	32	34	36	38	40
4 oz....	1/4	1/6	1/6	1/8	1/9	2/0	2/2	2/7	3/2	3/8	4/5	5/6	6/3
8 oz....	2/5	2/7	2/9	3/0	3/4	3/6	4/2	4/11	6/0	7/3	8/6	10/6	12/0
1 lb. ...	4/5	4/9	5/0	5/4	6/0	6/6	7/9	9/6	11/6	13/9	16/6	20/0	23/0

*11277 **Nickel Silver Wire,** double silk-covered.

S.W.G.	16	18	20	22	24	26	28	30	32	34	36	38	40
4 oz....	2/4	2/5	2/9	2/11	3/5	3/9	4/6	5/3	6/4	7/5	8/11	11/6	15/0
8 oz....	4/5	4/8	5/2	5/9	6/6	7/3	8/6	10/0	12/0	14/6	17/6	22/6	29/6
1 lb. ...	8/6	8/9	9/10	10/9	12/3	13/9	16/0	19/6	23/6	28/0	35/0	44/0	58/6

*11278 **Eureka Wire,** bare.

S.W.G.	16	18	20	22	24	26	28	30	32	34	36	38	40
4 oz....	1/3	1/4	1/5	1/6	1/8	1/9	2/0	2/2	2/4	2/8	2/10	3/3	4/3
8 oz....	2/3	2/4	2/6	2/9	3/0	3/3	3/6	3/10	4/5	4/9	5/6	6/6	8/0
1 lb. ...	4/0	4/3	4/6	5/0	5/6	6/0	6/6	7/3	8/0	9/0	10/3	12/0	15/0

*11279 **Eureka Wire,** double silk-covered.

S.W.G.	16	18	20	22	24	26	28	30	32	34	36	38	40
4 oz....	1/11	2/0	2/3	2/6	2/9	3/3	3/9	4/6	5/5	6/0	7/6	9/0	11/6
8 oz....	3/6	3/9	4/3	4/8	5/3	5/11	6/10	8/6	10/6	11/6	14/0	17/6	22/0
1 lb. ...	6/9	7/0	8/0	9/0	10/0	11/6	13/6	16/6	19/6	22/0	27/0	34/0	43/0

*11280 **Manganin Wire,** bare.

S.W.G.	16	18	20	22	24	26	28	30	32	34	36	38	40
2 oz....	2/4	2/6	2/7	2/8	2/10	3/0	3/3	3/4	3/8	4/0	4/3	5/0	6/6
4 oz....	4/3	4/6	4/6	5/0	5/0	5/4	6/0	6/0	6/6	7/0	7/9	9/0	12/0
8 oz....	6/9	7/0	7/9	8/0	8/9	9/0	9/6	10/0	10/6	11/6	12/9	16/0	20/6
1 lb. ...	13/0	13/6	14/6	15/6	16/0	17/0	18/0	19/6	20/6	22/6	24/6	30/0	39/0

*11281 **Manganin Wire,** double silk-covered.

S.W.G.	16	18	20	22	24	26	28	30	32	34	36	38	40
2 oz....	3/3	3/6	3/9	4/0	4/4	4/8	5/3	5/6	6/6	7/3	8/6	11/3	12/9
4 oz....	4/6	4/6	5/3	5/9	6/4	6/6	7/3	7/6	8/6	9/6	11/0	13/6	17/6
8 oz....	8/3	8/9	9/6	10/6	11/0	11/6	13/0	14/6	16/6	18/0	21/0	26/0	34/6
1 lb. ...	16/0	17/0	18/6	20/0	21/0	22/6	25/6	28/6	32/6	35/0	40/0	51/0	67/6

* **Nickel-Chrome Wire. High Resistance Alloy.** Approximate Characteristics.

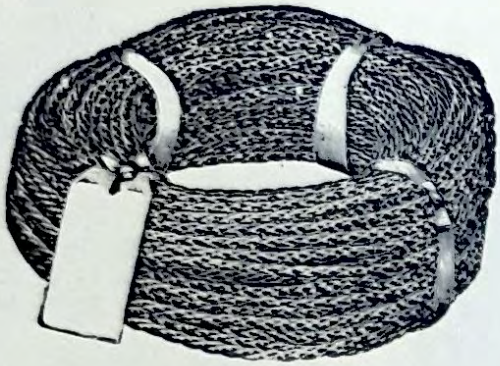
Temperature Co-efficient ·00042 per degree C. Melting Point ... ... 1550 C.
Specific Resistance ... 100 microhms per centimetre cube. Comparative Resistance 58 times copper.
Tensile Strength ... 47·12 tons per sq. in.
Specific Gravity... ... 8·15. Weight per cubic inch ... ·29 lb.

*11282 **Nickel-Chrome Wire,** bare, on reels.

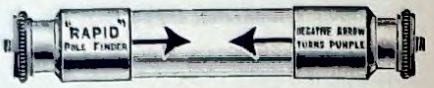
S.W.G.	14	16	18	20	22	24	26	28	30	32	34	36	38	40
2 oz.	4/6	4/9	5/0	5/6	6/0	7/0	8/0	9/0	9/9	10/9	12/0	12/9	14/0	15/0
8 oz.	8/0	8/6	9/0	10/0	11/3	13/0	15/0	17/0	18/9	20/9	22/0	24/9	27/0	29/0
1 lb.	15/6	16/0	17/6	19/6	21/6	25/6	29/6	33/6	36/6	40/0	45/6	49/0	53/0	57/6

*11283 **Pure Tin Fusible Wire,** for cut-outs.

S.W.G.	16	18	20	22	24	26	28	30	32	34
Per 4-oz. reel	1/6	1/7	1/8	1/9	2/0	2/0	2/3	3/0	3/3	3/6



11286



11287

11284 **Copper Wire,** Tinned, insulated with single rubber, double cotton and paraffined, for Electric Bells.

	S.W.G. ... No. 22	20
Per 12 yds.	**9d.**	**10d.**
,, 110 ,,	**5/6**	**6/6**

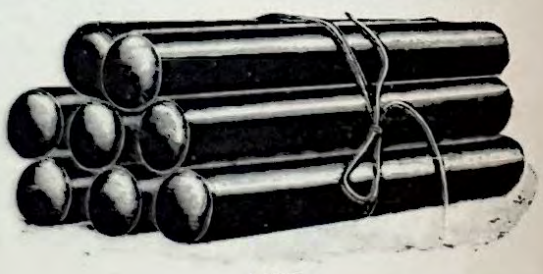
11285 **Red and Black Flexible Wire,** specially made for Battery Leads, Extensions, etc., best quality, per doz. yds. **£0 1 6**

	Thin	Thick
11286 **Flexible Twin Wires,** silk-covered, two strand, for Telephones, Bells, etc., per yd.	**4d.**	**5d.**
12 yds.	**3/0**	**4/0**

11287 **Pole Finder,** "The Rapid," complete in Tubular Case, with instructions **£0 2 0**



11288



11291

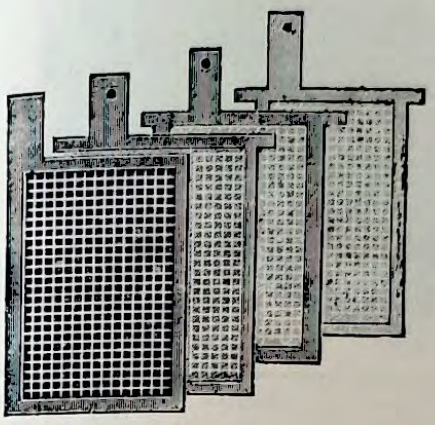
11288 **Prepared Tape** (both sides) for wrapping wire joints ... ... per oz. **£0 0 3**

11289 **Pure Para India Rubber Tape,** No. 22 B.W.G. thickness, $\frac{1}{2}$, $\frac{3}{4}$, or 1 in. wide ,, **0 1 0**

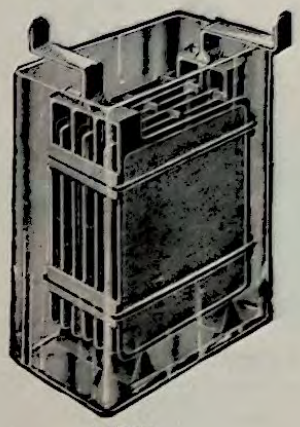
11290 **Thin Wire Solder,** for copper wire joints ... ... per lb. **0 2 6**

11291 **Chatterton's Compound,** highly flexible, rich in rubber, 2-oz. sticks... ... each **0 0 6**

Accumulators



11292



11293



Exide Cell, Type DTG.
(Showing Metal Carrier).

11294

11292 **Accumulator Plates,** Set of 6, for showing their construction during process of manufacture, per set **£0 7 0**

11293 **Storage Cells,** T-Type, for General Laboratory use. The rates of discharge can be largely increased after being charged and discharged a few times. Size of plates, 4 × 4 in., in Glass Boxes.

Number of Plates	3	5	7
Capacity	10	20	30 ampere-hours
Price	**10 0**	**15 6**	**18 6**

Exide "Mass" Type Batteries, Series "C" Low Tension—for Slow Discharge. Series "D."

These batteries are recommended particularly for cases where the battery is to be "trickle charged" or is normally to be given an ordinary re-charge less frequently than once a fortnight. When the discharge is such as to necessitate re-charging, say, every two weeks or less, Exide Cells, Series "C," are recommended.

Exide "Mass" Type Batteries are specially designed for long, slow or intermittent discharges, and are particularly serviceable in cases where re-charging is only necessary at infrequent intervals.

They will stand and hold their charge, and when not in use can be left without attention, even though partially discharged, for long periods, and will not suffer any detriment.

They are specially adapted for small dull emitter valve sets; their discharge is steady, reliable, and free from fluctuation, while the filament rheostats once set can be left unaltered. These cells are also suitable for operating electric clocks, bells, telephones, fire and burglar alarms, and signalling circuits.

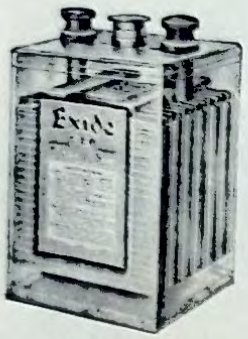
An outstanding feature of these cells is the moulded ebonite lid in which the plate pillars are moulded as an integral part and cannot possibly work loose, thus absolutely eliminating acid creepage up the terminal posts. The terminals are non-interchangeable, of different colours, and of different shape, thus facilitating connecting up in a dark cupboard. These cells give more burning hours in relation to first cost than any other battery.

Metal Carriers are supplied free with these Cells.

11294 **Particulars of Exide "Mass" Type Batteries, Series "D"**

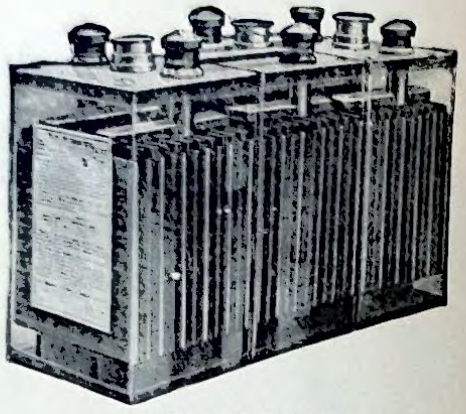
Type.	DTG	2-DTG-1	DFG	2-DFG-1	DMG	DHG
Voltage	2 volts	4 volts	2 volts	4 volts	2 volts	2 volts
Capacity (a) on slow discharge ...	20 A.H.	20 A.H.	45 A.H.	45 A.H.	70 A.H.	100 A.H.
(b) at 100-hour rate ...	12 A.H.	12 A.H.	27 A.H.	27 A.H.	42 A.H.	60 A.H.
Normal charge current	½ amp.	½ amp.	1 amp.	1 amp.	2 amps.	3 amps.
Dimensions	2 ⅛ × 2 ⅛ in. × 5⅝ in. high	2 ⅛ × 5 ⅛ in. × 5⅝ in. high	3½ × 3½ in. × 7⅛ in. high	3½ × 6 ⅛ in. × 7⅛ in. high	4½ × 4½ in. × 8⅛ in. high	5 × 5 in. × 9½ in. high
Weight, including acid	3¼ lb.	7¼ lb.	7 lb.	13¼ lb.	11¼ lb.	15½ lb.
Price per 2-volt Cell (uncharged) including metal carrier	**4 6**	—	**8 6**	—	**11 0**	**14 6**
Price per 4-volt Battery (uncharged) including metal carrier	—	**9 0**	—	**17 0**	—	—

These Cells, on being filled with acid, will give current, but, for best results, it is strongly recommended that a charge be given them before they are put into service. See instruction label on every Cell and follow carefully.



Exide Batteries

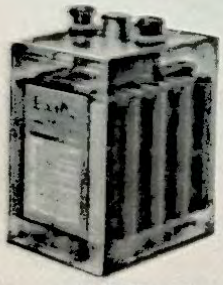
Series C in Celluloid and Glass Containers.



Type CZ-6 **11297** **Type 3-CX6-1**

	TYPE.	Actual Ampere-hour Capacity at 20-hr. rate.	Normal Charge Current in Amps.	Dimensions in Inches over Cells only. W.	L.	Height. Box.	Height. Over-all.	Weight in lbs. with Acid.	PRICES. Battery only Uncharged.	Battery in Crate Type "O." Uncharged.
2 VOLTS (single cells)	1-CO2	10	½	2⅜	1⅛	5⅛	6⅛	2¼	£0 7 6	—
	1-CO3	15	1	2⅜	2¼	5⅛	6⅛	3	0 8 6	—
	1-CZ2	20	1½	4¼	1⅜	6¼	7¼	3¾	0 9 6	£0 14 6
	1-CZ3	30	2	4¼	2¼	6¼	7¼	5	0 11 6	0 16 9
	1-CZ4	40	3	4¼	2⅞	6¼	7¼	6¼	0 13 6	0 19 0
	1-CZ5	50	4	4¼	3⅝	6¼	7¼	8	0 15 6	1 1 3
	1-CZ6	60	5	4¼	4⅛	6¼	7¼	9¼	0 17 6	1 3 6
	1-CX5	75	6	5	3⅛	7⅛	8¼	13	1 1 6	1 7 6
	1-CX6	90	7	5	4⅛	7⅛	8¼	15	1 4 6	1 11 0
	1-CX7	105	8	5	4⅞	7⅛	8¼	17	1 7 6	1 14 0
	1-CX8	120	9	5	5⅝	7⅛	8¼	19	1 10 6	1 17 6
4 VOLTS (2 cells)	2-CZ2-3	20	1½	3⅛	4⅛	6¼	7¼	7½	0 19 0	1 4 9
	2-CZ3-1	30	2	4¼	4⅛	6¼	7¼	10	1 3 0	1 9 0
	2-CZ4-1	40	3	4¼	5⅛	6¼	7¼	13	1 7 0	1 13 3
	2-CZ5-1	50	4	4¼	7	6¼	7¼	16	1 11 0	1 17 6
	2-CZ6-2	60	5	4¼	8¼	6¼	7¼	19	1 15 0	2 1 9
	2-CX5-1	75	6	5	7	7⅛	8¼	26	2 3 0	2 10 0
	2-CX6-1	90	7	5	8⅛	7⅛	8¼	30	2 9 0	2 16 6
	2-CX7-1	105	8	5	9⅛	7⅛	8¼	34	2 15 0	3 2 6
	2-CX8-2	120	9	5⅛	10	7⅛	8¼	38	3 1 0	3 9 0
6 VOLTS (3 cells)	3-CZ2-1	20	1½	4¼	4⅞	6¼	7¼	11	1 8 6	1 14 9
	3-CZ3-1	30	2	4¼	6⅛	6¼	7¼	16	1 14 6	2 1 6
	3-CZ4-1	40	3	4¼	8⅛	6¼	7¼	20	2 0 6	2 7 9
	3-CZ5-1	50	4	4¼	10⅛	6¼	7¼	24	2 6 6	2 14 0
	3-CZ6-2	60	5	4¼	12⅛	6¼	7¼	28	2 12 6	3 0 6
	3-CX5-1	75	6	5	10⅛	7⅛	8¼	39	3 4 6	3 13 0
	3-CX6-1	90	7	5	12⅛	7⅛	8¼	45	3 13 6	4 2 6
	3-CX7-1	105	8	5	14⅛	7⅛	8¼	51	4 2 6	4 12 0
	3-CX8-2	120	9	5⅛	15	7⅛	8¼	57	4 11 6	5 1 6

The prices shown above are for celluloid boxes. Cells in glass boxes known as CZG or CXG can be supplied at same prices. CZ, CX, CZG, and CXG cells are for use when the conditions of service are such that they will be given an ordinary re-charge once a fortnight, or more frequently.



11298
Exide Cell, Type HZ4, in Celluloid

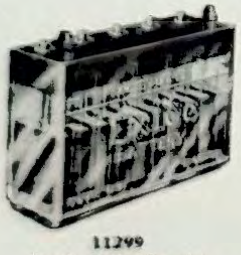
11298 EXIDE DE LUXE L.T. CELLS

combining the advantages of Series C and D types).

Type HZ.

Type	Cap.*	Price per cell
HZ2	40	£0 13 6
HZ3	60	0 17 6
HZ4	80	1 2 0

*Note.—Capacity at 100 hour rate.



11299
Exide WH, 10 volts

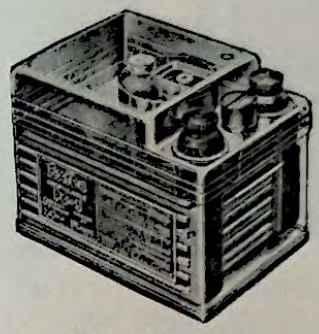
11299 EXIDE H.T. BATTERIES

(assembled in 10 volt. units)

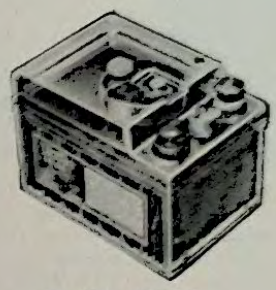
Type	Capacity*	Price per 10 volts
WJ10	2,500 mah.	£0 5 0
WH10	5,000 ,,	0 6 3
WT10	10,000 ,,	0 12 0

*Capacity on slow discharge.

Exide Batteries



Exide PC3 Cell
(Free Acid Unspillable).



Exide JWK7
(Jelly Acid Unspillable).

EXIDE BATTERIES, Unspillable Type.

		Voltage.	Actual Ampere-hour Capacity at 20-hr. rate	TYPE.	Normal Charging Current in Amperes.	Overall Dimensions in Inches. W.	L.	H.	Weight in lbs. including Acid.	PRICE (Uncharged)
11300	**For use in Transportable Receivers.**	2 volts	7	MR2	¾	3½	1⅝	4 7/16	1⅝	£0 10 0
		2 ,,	13	DY4	1	2⅝	2⅛	6⅜	3½	0 12 0
		2 ,,	15	NSA	1	4 3/16	1 13/16	7	3¾	0 12 6
		2 ,,	20	SP7-B	1½	3 3/16	4½	4⅞	4½	0 14 6
		2 ,,	20	DO4	1½	2⅜	2⅞	7⅜	4½	0 14 6
		2 ,,	24	RMP6	2	3½	4½	4 3/16	4½	0 13 6
		2 ,,	25	TZ3	2	4½	2½	7 3/16	4½	0 13 6
		2 ,,	25	LCR4	2	4⅜	2⅜	5⅜	4½	0 18 6
		2 ,,	26	NSB	2	4 3/16	2⅞	6 3/16	4½	0 14 0
		2 ,,	38	NSD4	3	5½	2 13/16	6⅞	6½	0 19 0
		2 ,,	48	NSD5	4	5½	2 13/16	6¾	8	1 2 6
		2 ,,	48	MPC6	3	3 7/16	4⅛	5 11/16	8	1 1 0
11301	**For use in Suit-Case Receivers.** (In these Cells the Plates are always fully immersed in the acid whether the Receiver is in the carrying or operating position.)	2 volts	11	PY3	¾	2 3/16	3 1/16	4	2½	£0 12 9
		2 ,,	14	PY4	1	2 3/16	3 5/16	4 13/16	3	0 13 6
		2 ,,	18	PY5	1¼	2 7/16	3 5/16	5⅛	3½	0 14 6
		2 ,,	11	PO2	¾	2 11/16	4 3/16	3½	2½	0 12 9
		2 ,,	16	PO3	1	2 11/16	4 3/16	3⅝	3¼	0 14 0
		2 ,,	16	PC2	1	3 3/16	4 13/16	3½	3¼	0 14 0
		2 ,,	24	PC3	1½	3 3/16	4 13/16	3¾	4½	0 16 0
		2 ,,	20	PZ2	1½	4 3/16	5	3½	3¾	0 15 0
		2 ,,	30	PZ3	2	4 3/16	5	3¾	5¼	0 17 0
		2 ,,	28	WPO7	2	2 7/16	4 7/16	5 7/16	6	0 18 0
		4 ,,	11	2PY3	¾	4⅛	3 1/16	4	4½	1 5 6
		4 ,,	14	2PY4	1	4⅛	3 3/16	4 13/16	6	1 7 0

The above Cells are of the Free Acid Type; for those who prefer Cells with Jelly Acid Electrolyte, **Exide G.E.L.-Cells** are available, and Prices will be sent on request.

Drydex Batteries

DRYDEX BATTERIES (Dry Batteries by Exide).

11302 Bell Cells.

	W.	L.	Volts.	Price.
B10	2½	6½	1·5	2 2
B11	2½	6½	1·5	2 7

B11 has larger capacity.

11303 Cells for Torches.

	L.	W.	H.	Voltage	Price.
T20	—	1⅜	2½	1·5	4d.
Cells for Pocket Lamps F40	2 3/16	11/16	2½		6d.

Drydex Batteries are made in a variety of sizes for H.T., Grid Bias, etc., and as above. Full details will be supplied on request.

DAGENITE "TELL-TALE" ACCUMULATORS for Radio.

With the few exceptions as indicated in the list, the whole range of Dagenite Low Tension Accumulators are fitted with our patented "Tell-Tale" device. This consists of three small coloured floats, white, green, and red, which are calibrated to sink or rise in the acid according to the state of the charge. Each float operates in a different channel, so there is no fear of their becoming confused or interfering with each other, and the indication shown by the position of the floats is quite clear.

When the cell is fully charged all three floats are at the top of the channels. The white or charge float will not rise until the cell is fully charged, and will sink soon after the cell is put on discharge.

The green float commences to sink when the cell is approximately half discharged. When the cell is nearly discharged the red float will commence to sink. When the red float reaches the bottom the cell should be immediately recharged.



11305



11307



11308

It will thus be seen that the floats give an indication that the cell has been properly charged and of how long the accumulator will last, which is an immense advantage over the ordinary types of accumulators.

A range of accumulators which do not include the "Tell-Tale" device is also listed, but we strongly recommend the "Tell-Tale" range to all users.

The usefulness of the "Tell-Tale" device cannot be over estimated. If this indication is acted upon, damage to the accumulator through over-discharge can be entirely avoided. A glance at the floats tells you exactly the state of the charge and gives a clear indication as to when recharging is necessary.

DAGENITE UNSPILLABLE ACCUMULATORS in Celluloid Containers, for Transportable Sets.

Specially designed for use in portable wireless sets of the cabinet type. Unspillable in any position. Capacities are such as are recommended by the actual set manufacturers. Certain types fitted with patented "Tell-Tale" device, which shows at a glance when accumulator needs recharging.

	Voltage	Type of Accumulator	Capacity Ampere Hours at 20-hour Rate	Dimensions in inches. Length.	Width.	Height.	H'ght Overall.	PRICE.
11305 With Tell-Tale Device.	2	ZRF 9	23	4	2¼	6 3/32	6 11/16	£0 16 0
	2	ZAF 11	32	3⅜	2⅝	7 3/16	7 13/16	0 18 6
	2	ZDF 11	25	3 11/16	2⅞	5 9/16	6	0 15 6
	2	ZPF 11	21	4 1/16	3⅛	4 1/16	4¾	0 16 0
11306 Without Tell-Tale Device.	2	ZR 9	23	3⅞	2¼	6 3/32	6 11/16	0 14 6
	2	ZA 11	32	3⅜	2⅝	7 3/16	7 13/16	0 16 6
	2	ZM 11	20	4 9/16	2½	5¼	5¼	0 17 6
	2	ZP 11	21	3⅞	3⅛	4 1/16	4¾	0 14 0

DAGENITE ACCUMULATORS in Celluloid Containers.

The PM range has the same characteristics as the PMF Accumulators, but without the advantage of the "Tell-Tale" device. The Dagenite range of Celluloid Accumulators is very much more robust than many types on the market.

	Voltage	Type of Accumulator	Capacity Ampere Hours at 20-hour Rate.	Normal Charging Rate Amperes.	Dimensions in inches. Length.	Width.	Height.	Weight including Acid. lbs.	PRICE.
11307	2	PM 5	20	1½	1½	4¼	7¼	3½	£0 9 6
	2	PM 7	30	2	2 1/16			5	0 11 6
	2	PM 9	40	3	2⅝			6½	0 13 6
	2	PM 11	50	4	3 1/16			8	0 15 6
	2	PM 13	60	4½	3½			10	0 17 6

DAGENITE "TELL-TALE" ACCUMULATORS in Celluloid Containers.

Where there is a preference for Celluloid Cells, it will be found that the PMF range meets every requirement.

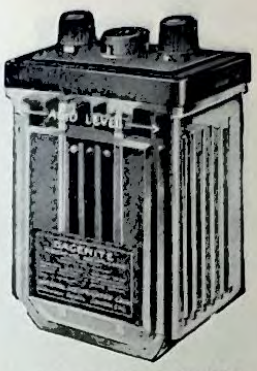
Capacity for capacity, these Cells are lighter in weight than the Glass ranges PGF and RMF.

Attractive in appearance, sound in design and fitted with plates that will give a very long life.

The "Tell-Tale" device indicates, by means of the floats, the exact state of the charge. Correct indication is given as to when the accumulator needs recharging, thus preventing damage of over discharge.

	Voltage	Type of Accumulator	Capacity Ampere Hours at 20-hour Rate	Normal Charging Rate Amperes.	Dimensions in inches. Length.	Width.	Height.	Weight including Acid. lbs.	PRICE.
11308	2	PMF 5	20	1½	1½	4½	7¼	3½	£0 11 0
	2	PMF 7	30	2	2 1/16			5	0 13 0
	2	PMF 9	40	3	2⅝			6½	0 15 0
	2	PMF 11	50	4	3 1/16			8	0 17 0
	2	PMF 13	60	4½	3½			10	0 19 0

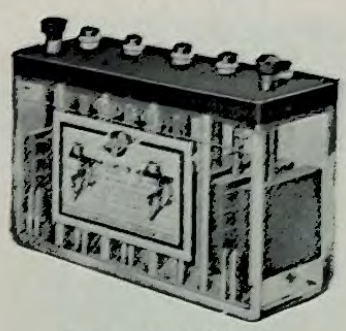
Prices for 4 and 6-volt Batteries (including Connectors) pro rata.



Type PGF 11309



Type RMF 11310



Type BX 11311

DAGENITE "TELL-TALE" ACCUMULATORS in Glass Containers.

Clear glass moulded box allowing for easy inspection. Ample space for acid as there are no separators, plates being held in recesses in the side of box. Plates of interlocking grid type, moulded Dagenite lid, large screwed vent, acid-proof glands fitted to each terminal pillar preventing acid creeping. Terminal stems are of different dimensions to prevent reversal, and terminals coloured red and black to indicate polarity.

Fitted with "Tell Tale" device which indicates at a glance when the accumulator needs recharging, and so enables the user to avoid damage to the cells due to over discharging.

Operation of "Tell Tale" device described on page 418.

	Voltage.	Type of Accumulator.	Capacity Ampere Hours at 20-hour Rate.	Normal Charging Rate Amperes.	Dimensions in inches. Length.	Width.	Height.	PRICE.
11309	2	PGF 5	20	2	3	5¼	7½	**£0 10 6**
	2	PGF 7	30	3	3¾			**0 12 6**
	2	PGF 9	40	4	4½			**0 14 6**

Wire Carrying Handles included in Price.

DAGENITE GLASS CELL ACCUMULATORS in Glass Containers.

Similar in design to the PGF type, but with thicker positive plates and slightly higher capacity.

A very reliable Cell, which will give steady discharge at constant voltage for very long periods. The absence of separators allows ample space for electrolyte, which is a great advantage.

Over discharging—a frequent source of ruined accumulators—can be avoided with the help of the "Tell-Tale" device. The floats give accurate indication as to the state of the charge.

Operation of "Tell-Tale" device described on page 418.

	Voltage.	Type of Accumulator.	Capacity Ampere Hours at 20-hour Rate.	Normal Charging Rate Amperes.	Dimensions in inches. Length.	Width.	Height.	Weight including Acid. lbs.	PRICE
11310	2	RMF 5	24	2½	3¾	4¼	8½	7½	**£0 11 0**
	2	RMF 7	36	3½	4½			9¼	**0 13 0**
	2	RMF 9	48	5	5			11¼	**0 15 0**

Wire Carrying Handles included in Price.

DAGENITE HIGH-TENSION ACCUMULATORS in Glass Containers.

These models are made up in 10-volt units, the containers being of one-piece moulded glass.

The terminal stems are drilled to provide for the insertion of wander plugs.

High Tension Accumulators have many advantages over eliminators and dry batteries, and much purer reception is obtained when H.T. supply is obtained from accumulators.

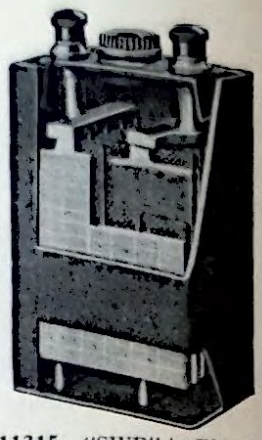
The BX Accumulators have a capacity four times that of the SX type. They are particularly suitable for radio transmitter work, and for large receiving sets such as those installed in hospitals, for public address systems, etc.

	Voltage.	Type of Accumulator.	Capacity Milliampere Hours at 1,000-hr. Rate.	Charge Rate Amperes. Not to be Exceeded.	Dimensions in inches. Length.	Width.	Height.	Weight including Acid. lbs.	PRICE.
11311	10	SX	2,500	½	2 3/16	5 11/16	4¾	3½	**£0 5 0**
	10	MX	5,000	1	2 7/16	7	5¼	6¼	**0 6 3**
	10	BX	10,000	2	3 3/16	8 7/16	6½	10½	**0 12 0**



11313—Type SWG.

"SPARTA" 2-VOLT ACCUMULATORS.
High capacity, double grease cup terminals, exclusive Micro-porous Pasted Plates, Moulded Covers, large Filling Vents, long life, heavy Plates, indestructible Separators, liberal acid space, strong best quality Boxes.



11315—"SWE" in Ebonite

11313 TYPES "SWG"—in Glass Boxes.

Type	5	7	9	11	13
Price	9/0	11/0	12/9	14/9	16/9
Actual cap. amp. hrs., at the 20-hr. rate	20	30	40	50	60
Intermittent cap. amp. hrs.	40	60	80	100	120
Length, inches	1⅞	2⅛	3 3/16	3 11/16	4¼
Width ,,	4⅝	4⅝	4⅝	4⅝	4⅝
Height, ,,	7⅜	7⅜	7¼	7¼	7¼
Weight with Acid, lb.	6	7	9¼	11	13

11314 TYPES "SWG"—in Celluloid Boxes.

Type	5	7	9	11	13	17
Price	9/0	11/0	12/9	14/9	16/9	21/0
Actual cap. amp. hrs., at the 20-hr. rate	20	30	40	50	60	80
Intermittent cap. amp. hrs.	40	60	80	100	120	160
Length, inches	1 1/16	2 3/16	2¾	3⅜	4	5 5/16
Width, ,,	4 1/16	4 1/16	4 1/16	4 1/16	4 1/16	4 1/16
Height, ,,	7¼	7¼	7¼	7¼	7¼	7¼
Weight with Acid, lb.	4¼	5¾	7	8½	9¾	13

11315 TYPES "SWE"—in Ebonite Boxes.

Type	5	7	9	11	13	17
Price	8/6	10/6	12/3	14/3	16/0	20/0
Actual capacity, ampere hours at the 20 hour rate	20	30	40	50	60	80
Intermittent capacity, ampere hours	40	60	80	100	120	160
Length, inches	1⅝	2¼	2 13/16	3 7/16	4 1/16	5¼
Width, ,,	4⅝	4⅝	4⅝	4⅝	4⅝	4⅝
Height, ,,	7¼	7¼	7¼	7¼	7¼	7¼
Weight with Acid, lb.	4¼	5¼	7	8½	9¾	13

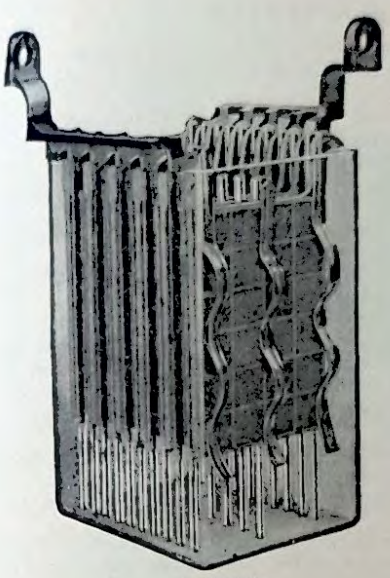
11316 "SPARTA" ACCUMULATORS.
TYPES "SWDG" in Glass Boxes. TYPES "SWDX" in Celluloid Boxes. TYPES "SWDE" in Ebonite Boxes.

Type	Price	Volts	Actual Cap. amp. hrs., 100-hr. rate	Overall size (ins.) Width	Length	Height	Weight with Acid, lbs.
SWDG.5	12/6	2	40	4⅝	3 1/16	7¼	7¼
SWDG.7	17/0	2	60	4⅝	4¼	7¼	10¼
SWDX.5	12/6	2	40	4⅝	2¼	7¼	6¼
SWDx.7	17/0	2	60	4⅝	4	7¼	9¼
SWDX.9	21/0	2	80	4⅝	5 5/16	7¼	12¼
SWDE.5	12/0	2	40	4⅝	2 13/16	7¼	6¼
SWDE.7	16/6	2	60	4⅝	4 1/16	7¼	9¼
SWDE.9	20/6	2	80	4⅝	5¼	7¼	12¼

11317 "SPARTA" ACCUMULATORS. For Low Intermittent Discharge.
Glass Containers. Carriers Free for 2-volt Cells. Dry Charged.

Type	Price	Volts	Capacity	Overall size (ins.) Width	Length	Height	Weight with Acid, lbs.
SDG	5/6	2	25	2 11/16	2 11/16	5⅜	3
LDG	9/0	2	60	4⅛	3 3/16	7¼	8¼
RDG	14/0	2	120	4⅛	5	7¼	14
*2LDG	19/0	4	60	4⅛	6	7¼	17½
MSG	4/6	2	22	2⅛	2⅛	6¼	3¼
*2MSG	9/0	4	22	2⅛	3⅛	6¼	7¼

Capacities are at a low intermittent rating. *In double-compartment Glass Boxes.



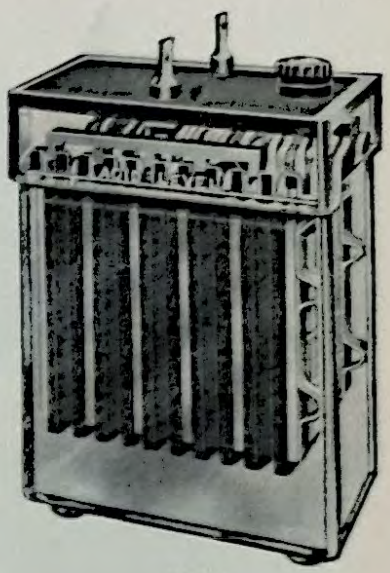
11318-9

"ST" & "STA" TYPE CELLS

IN GLASS BOXES.

Planté Positive Plates and "Box" Negative Plates.

For Electric Lighting Installations and Similar Purposes.



11320

Cat. No.	Type of Cell	Number of Plates per Cell	CAPACITY, Ampere Hours	CHARGE RATE AMPERES		DISCHARGE RATE AMPERES			EXTERNAL DIMENSIONS OF CELL		Distances between Centres	Acid per Cell	Approx. Weight including Acid	PRICE			CODE WORD
			10-Hour Rate	Normal	Maximum	For 10 Hours	For 7 Hours	For 5 Hours	Length	Width				£	s.	d.	
									Inches	Inches	Inches	Gallons	Lbs.				
11318	ST	5	20	2·8	5·6	2·0	2·63	3·34	5 7/16	6 1/2	6 1/16	·31	19	0	15	10	Yigyn
		7	30	4·2	8·4	3·0	3·94	5·00	7 3/16	6 1/2	7 13/16	·42	22	1	0	6	Yihaj
		9	40	5·6	11·2	4·0	5·25	6·67	8 15/16	6 1/2	9 5/16	·53	25	1	4	9	Yihek
11319	STA	5	50	7·0	14·0	5·0	6·55	8·33	5 7/16	9 1/4	6 1/16	·76	35	1	8	8	Yihja
		7	75	11·0	22·0	7·5	9·83	12·50	7 3/16	9 1/4	7 13/16	1·05	55	1	16	2	Yihke
		9	100	14·0	28·0	10·0	13·11	16·67	8 15/16	9 1/4	9 5/16	1·33	76	2	2	10	Yihmo
		11	125	18·0	36·0	12·5	16·38	20·84	10 11/16	9 1/4	11 1/16	1·62	97	2	14	7	Yihpy
		13	150	21·0	42·0	15·0	19·66	25·00	12 7/16	9 1/4	13 1/16	1·90	118	3	1	5	Yihyp
		15	175	24·0	48·0	17·5	22·94	29·17	14 3/16	9 1/4	14 13/16	2·18	139	3	9	0	Yijak

The overall heights of these cells are: "ST" 10 in., "STA" 16¾ in.

"KB" TYPE CELLS IN GLASS BOXES WITH SEALED LIDS. Suitable for Small Electric Lighting, Installations and General Purposes.

Cat No.	Number of Plates per Cell	CAPACITY, Ampere Hours	CHARGE RATE AMPERES		DISCHARGE RATE AMPERES			EXTERNAL DIMENSIONS OF CELL		Acid per Cell	Approx. Weight including Acid	PRICE			CODE WORD
		10-Hour	Normal	Maximum	For 10 Hours	For 7 Hours	For 5 Hours	Length	Width			£	s.	d.	
								Inches	Inches	Gallons	Lbs.				
11320	3	25	3	6	2·5	3·27	4·16	3 1/4	8 1/2	·47	26	0	18	5	Wyssa
	5	50	7	14	5·0	6·55	8·33	5 1/4	8 1/2	·71	40	1	8	8	Wyste
	7	75	11	22	7·5	9·83	12·50	6 1/4	8 1/2	·96	54	1	16	2	Wysux
	9	100	14	28	10·0	13·11	16·61	8 1/4	8 1/2	1·20	68	2	2	10	Wyswo
	11	125	18	36	12·5	16·38	20·84	10 1/4	8 1/2	1·44	82	2	14	7	Wytat
	13	150	21	42	15·0	19·66	25·00	11 3/4	8 1/2	1·69	96	3	1	5	Wytev

The overall height of these cells is 17 in.

• GAS ANALYSIS APPARATUS •

THE "UNIQUE" CELL TESTER.



Registered Design No. 711338.

General.—This unique instrument has been designed to meet the demand for a thoroughly reliable instrument which is reasonable in price, light in weight, and easy to handle.

Principle.—The action of the instrument depends on the rotation of a carefully wound Coil placed in the magnetic field of a permanent magnet.

Control.—The movement is spring controlled.

Construction.—The case is of black non-hygroscopic moulded insulation material, and is not brittle.

The Movement is of the Moving Coil type with special pole pieces to give wide divisions at the working parts of the scale.

The Scale is arranged with a centre zero, and is divided into 60 parts, each division representing 0·1 volt.

A Knife-edged Pointer is provided to facilitate close readings.

The movement is extremely light, but at the same time robust and of very high resistance, the advantage of this being that it takes practically no current from the cells, and contact errors are negligible. The Pivots operate in best quality sapphire jewel bearings.

Damping is greatest between the range of 1·5 and 2·5 volts, and the instrument is practically dead beat between these points.

The Dial is of satin-finished aluminium and is unaffected by damp and heat.

Zero Adjustment.—An external zero adjusting screw is fitted to the instrument and is located on the front of the case opposite the point from which the pointer is pivotted.

Spears and Leads.—Each instrument is provided with an insulated barb for making contact on the battery terminals, and 2 ft. of insulated flexible cab-tyre lead with spear and hand-guard. The spiked barb and insulated lead are adjustable and interchangeable in position, and the spiked barb will rotate so as to make contact in any direction. The instrument may thus be used in any position with the barb either at the top or the bottom of the instrument as preferred.

PRICES

11322	**"Unique" Cell Tester,** as illustrated ... ... nett	**£2**	**7** **6**
	Instrument with movement mounted into Case as illustrated on page 450 ... ... „	**1**	**18** **0**



11323-4



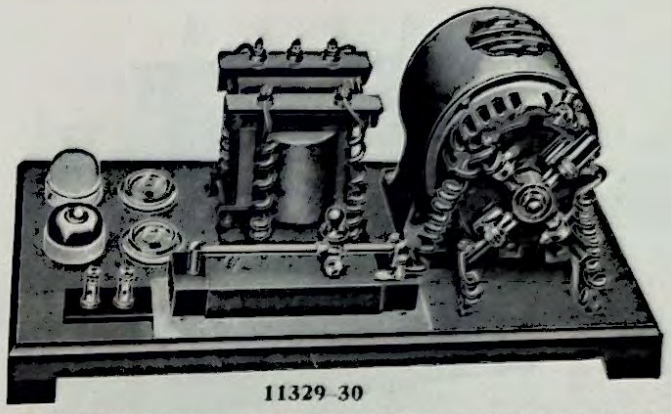
11325



11327

(F)	11323	**Acidometer,** for use in Accumulators. Flat Bulb, length about 10 in., reading from 1·100 to 1·280, best quality ... ... each	**£0**	**2** **6**
(F)	11324	Ditto, cheaper form ... ... „	**0**	**2** **0**
	11325	Ditto, for small Accumulators, Pocket Batteries, etc., where it is impossible to use the ordinary glass form, consisting of a set of three Glass Beads, which float at their respective specific gravity, enclosed in a glass tube with Rubber Cap and Tube ... ... each	**0**	**5** **3**
	11326	Ditto, with four Glass Beads, of different colours, and Outer Tube with Hook on top, so that it may hang inside the accumulator ... ... each	**0**	**6** **3**
	11327	**Syringe Hydrometer,** for testing acid in glass syphon Tube with Rubber Ball	**0**	**4** **0**
	11328	**Pole-Finding Paper,** for determining the —pole, the paper turning a purple tint when damped and brought in contact ... ... per book	**0**	**0** **3**

(F) Foreign manufacture.



11329-30

Combined Rectifier and Switchboard. A thoroughly reliable machine which is gaining in popularity and is in use extensively where alternating current is supplied. Some form of rectifier is essential before direct current can be obtained, and this machine is the latest development in apparatus of this kind.

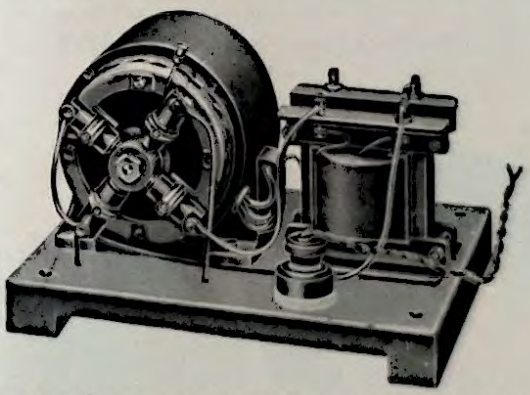
Rectifier mounted on switchboard, with transformer, central zero ammeter and voltmeter, battery terminals, switch and fuse, regulating resistance, flex lead, and plug.

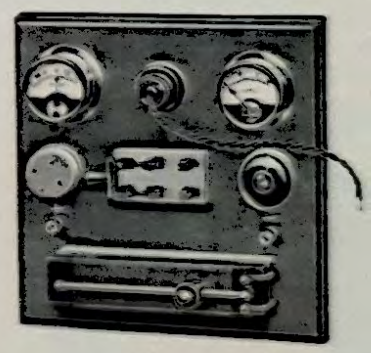
The Commutator is readily accessible for cleaning and replacement brushes, an essential item where rotary plant is concerned.

This machine has been specially designed for battery charging and efficiencies of approximately 90 per cent are obtained.

Prices:

***11329**	Complete Outfit. 1A. Output, 25 volts, 5 amp.	**£13 10 0**
***11330**	1B. Output, 50 volts, 5 amp.	**14 0 0**
	If separate Switchboard required (extra)	**1 10 0**





11331-2

COMMUTATING RECTIFIERS, WITH SEPARATE SWITCHBOARD. COMPLETE OUTFIT.

Rectifier. Mounted on wood base, complete with Transformer and two-pin Plug and flexible cord for connecting direct to Switchboard.

Switchboard. For the control of the Rectifier, a Switchboard is supplied, upon which is mounted a central zero reading Voltmeter and an Ammeter, variable Resistances, Change-over Switch, Fuse Box, Tumbler Switch and Plug Socket, including Two-pin Plug.

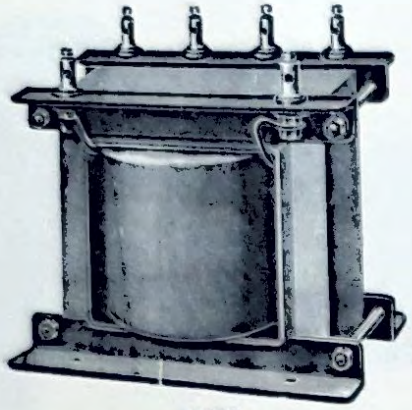
Prices:

***11331**	Output 50 volts, 10 amp.	**£19 10 0**
***11332**	Output 50 volts, 15 amp.	**21 10 0**

N.B.—Above prices are for Rectifiers to be used on any normal voltage (single phase), 100 to 250 volts, 50/100 cycles.

For 40 cycles 10 per cent extra, 25 cycles 25 per cent extra

When ordering please state voltage and periodicity of supply, and whether 25 volt or 50 volt output is required.



11334

***11334 TRANSFORMERS** (Air-cooled, Single Phase).

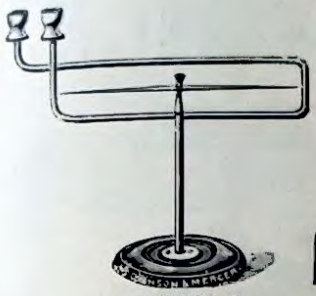
Primary Voltage	SECONDARY Volts	SECONDARY Amps.	Auto Wound Price (C)	Primary Voltage	SECONDARY Volts	SECONDARY Amps.	Auto Wound Price (C)
100/110	22/25/30	5	**50/0**	100/110	25	5	**40/0**
100/110	22/25/30	10	**60/0**	100/110	50	5	**45/0**
100/110	22/25/30	20	**80/0**	100/110	50	10	**70/0**
100/110	22/25/30	30	**120/0**	100/110	50	15	**75/0**
200/220 or 230/250	22/25/30	5	**53/0**	200/220 and 230/250	25	5	**50/0**
200/220 or 230/250	22/25/30	10	**66/0**	200/220 and 230/250	50	5	**55/0**
200/220 or 230/250	22/25/30	20	**88/0**	200/220 and 230/250	50	10	**77/0**
200/220 or 230/250	22/25/30	30	**130/0**	200/220 and 230/250	50	15	**90/0**

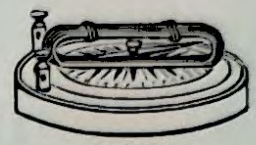
All Prices on this page are for 50-100 Periods	Primary Voltage	SECONDARY Volts	SECONDARY Amps.	Double Wound (E)	Extras
	Any named Voltage 100/250	30	70-75	**120/0**	40 Periods +10%
		40	70-75	**150/0**	25 " +25%

THREE-PHASE TRANSFORMERS quoted on receipt of particulars

Any Transformer required not in above list, including Double Wound, quoted for on receipt of following particulars, Primary voltage, phase and periodicity, Secondary voltage and amperage.

Galvanometers


11336-7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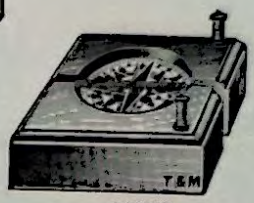
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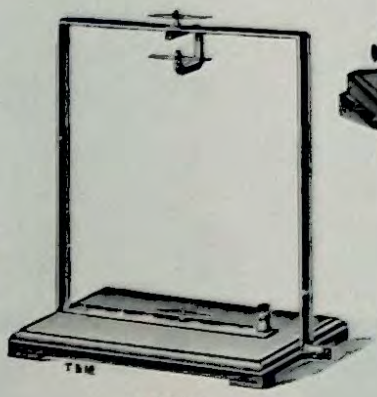
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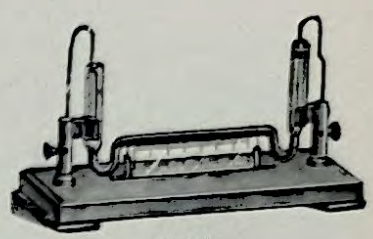
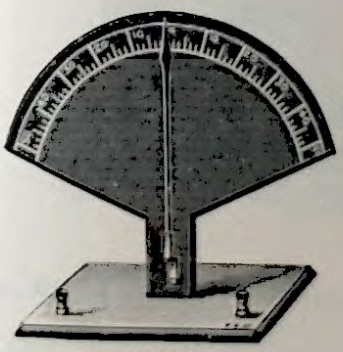

11341


11342

11336	**Oersted Apparatus,** for showing the Deflection of the Magnetic Needle by a current, with Mercury Cups and 3-in. needle	£0 5 6
11337	Ditto, ditto, with 6-in. needle	0 10 0
11338	Ditto, with Copper Strip, 3 Magnetic Needles with Agate Centres and Terminals, mounted on Polished Mahogany Board	1 7 6
11339	Galvanoscope, for detecting galvanic currents by the amount of deflection of the Needle, with Graduated Scale, on Mahogany Base	0 12 6
11340	Ditto, Simple, on Mahogany Base (*vide* Ashford's "Electricity and Magnetism," Fig. 39)	0 10 6
11341	**Galvanoscope,** Capillary, for Lantern use, Scale etched on glass, with Terminals, mounted on Mahogany Base	1 1 0
11342	**Galvanometer**, Cheap pocket form, with Compass Needle ... ... each	0 1 9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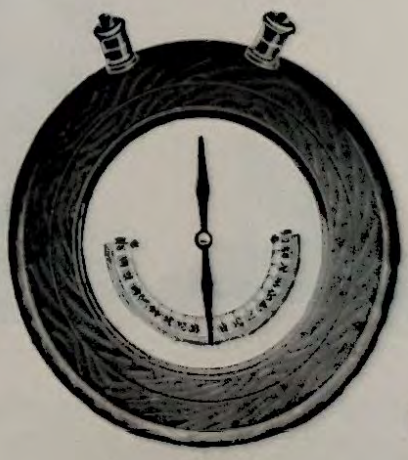
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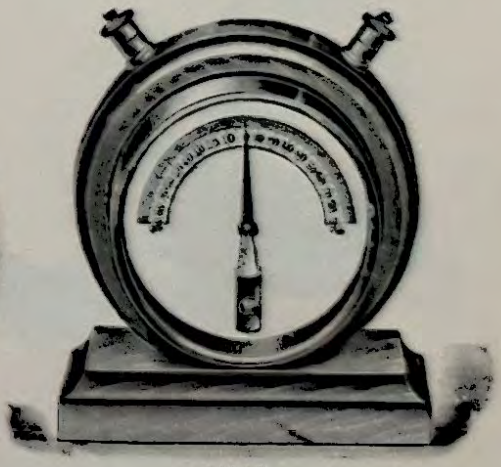

11345

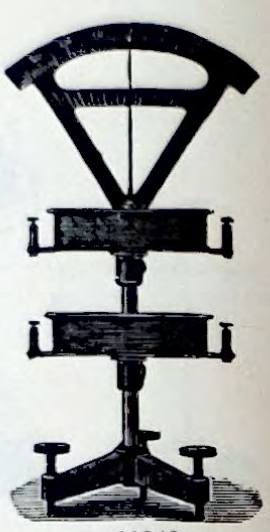
11343	**Galvanometer,** Vertical, for Class Demonstration, with 6-in. Aluminium Needle and Card Scale	£1 5 0
11344	**Galvanometer,** Horizontal, cheap form, with Dial 2½ in. divided to 90°, two Terminals, mounted on Walnut Base ... ... each	0 6 6
11345	**Galvanometer,** Vertical, in Polished Walnut Case ... ... ,,	0 12 6



11346



11347



11348

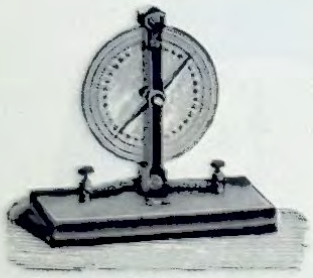
11346 **Galvanometer,** Vertical, for Lecture use, small size, with sliding Coil, on Polished Mahogany Base ... ... each **£1 15 0**

11347 Ditto, ditto, Larger, on Tripod Stand, with tall Brass Pillar and supplied with separate Coils of High and Low Resistance **3 10 0**

11348 Ditto, ditto, Large size, very sensitive, on Zinc Foot, with two changeable Coils of High and Low Resistance, Graduated Arc and Tangent Division, Pointer, 6½ in. long, fitted with Levelling Screws **4 15 0**



11350



11349

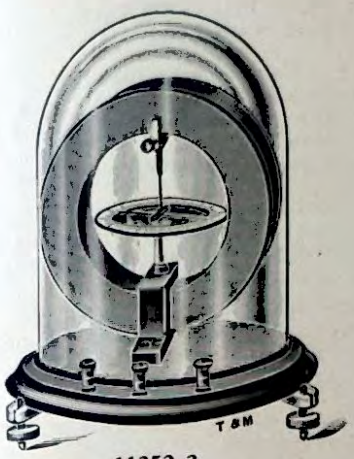


11351

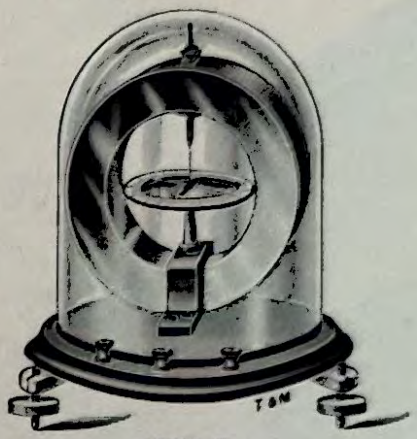
11349 **Galvanometer,** for use with Lantern, with Glass Graduated Scale and adjustable Needle **£2 10 0**

11350 **Galvanometer,** Tangent, simple, fitted with levelling screw, brass ring 11·5 cm. diameter, low resistance Coil. A coil of 10 turns double silk covered, wire wound on the Brass Ring forming high resistances, Agate Centre Needle fitted with long Aluminium Pointer of special construction. The Coils, Needle, and Dial are enclosed in glass shade. Resistance of Coils, low, ·02 ohms; high, ·2 ohms **1 5 0**

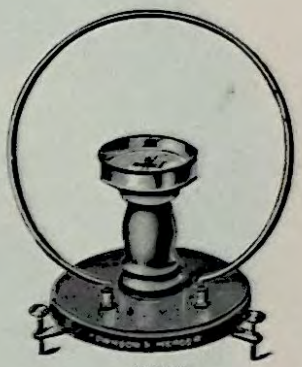
11351 Ditto, Tangent, special design, for School use, with Fibre Suspension, Fine and Coarse Windings, Scale being mounted on Mirror to avoid Parallax, Mahogany Ring and Base, with Levelling Screws **2 0 0**



11352–3

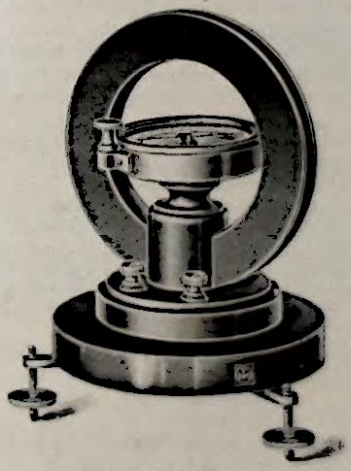


11354–5

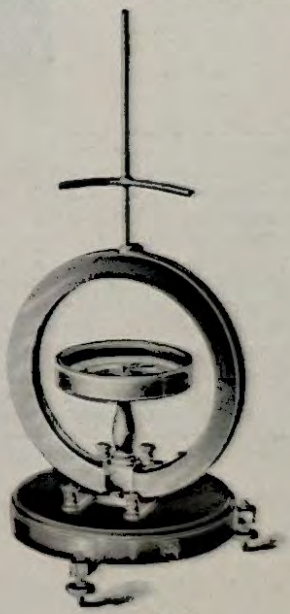


11356

11352	**Galvanometer,** Tangent, as above, with Silvered Metal Dial mounted on Mirror to avoid parallax, reel-pattern Fibre Suspension, Fine or Coarse Windings, on Mahogany Ring and Base, with Levelling Screws	£2	10	0
11353	Ditto, as above, but with three Coils	3	0	0
11354	Ditto, Tangent, Ball adjustment to Needle Suspension, Silvered Metal Scale mounted on Mirror to avoid parallax, with supporting Brass Pillar, Fine and Coarse Windings, Brass Ring on Mahogany Base with Levelling Screws, superior finish	3	10	0
11355	Ditto, as above, with three Coils	3	17	6
11356	Ditto, Tangent, Simple form, with 10-in. Copper Ring, on Mahogany Base, with Levelling Screws	1	10	0



11357–9



11360

11357	**Galvanometer,** Tangent, with one winding of 50 Turns, on Mahogany Ring, fitted with Agate Centre Needle, in Brass Box, with Anti-Parallax Mirror, mounted on Revolving Base	£2	0	0
11358	Ditto, ditto, with two Coils of 2 and 50 Turns, on Mahogany Ring, 6 in. diameter, etc., as above ...	2	5	0
11359	**Galvanometer,** Tangent, with three Coils (2, 50, and 500 Turns), Agate Centre Bar Needle, in Brass Case, Scale mounted on Anti-Parallax Mirror, with 6-in. Mahogany Ring, fitted on Revolving Base, with Levelling Screws	2	15	0
11360	Ditto, ditto, with three Resistances, wound on stout Brass Ring, Agate Centre Bar Needle, mounted on Anti-Parallax Mirror, in Brass Case, with Silvered Metal Dial, graduated one half to tangents, other half to degrees, on Brass Pillar and mounted on Polished Mahogany Base, with Levelling Screws	5	5	0



11361-7

CALIBRATED MOVING COIL POINTER GALVANOMETERS with 6-in. and 8-in. Scale Lengths.

These Calibrated Moving Coil Galvanometers have been produced to meet the demand for Pointer Galvanometers of robust construction and relatively high sensitivity. These galvanometer movements can be mounted in either 6 or 8 in. dial circular pattern cases as illustrated, or in portable pattern cases as shown on page 452, Fig. 2.

Each galvanometer is calibrated for direct indication of milliamps and millivolts, and full particulars of ranges and resistance are marked on the dial. They are supplied with windings having a resistance varying from 2 to 200 ohms.

Construction. The construction of these Galvanometers is generally similar to that of the standard moving coil instruments described on page 448. The movements are spring controlled, balanced for use in any position, and have external zero adjustment.

Unless otherwise specified, knife-edge pointers are fitted, but spade pointers will be provided if required.

Our standard arrangement is to supply non-detachable ebonized front terminals but, if preferred, back terminals can be fitted.

Ranges. The standard windings and ranges are given in the following table.

Figured	Scale Divisions	Resis. of Movement	Milliamps	Approx. Millivolts	Microamps per Division	Microvolts per Division
15–0–15	75–0–75	2 ohms	15–0–15	30–0–30	200	400
10–0–10	50–0–50	5 ,,	10–0–10	50–0–50	200	1000
5–0–5	50–0–50	20 ,,	5–0–5	100–0–100	100	2000
2–0–2	40–0–40	40 ,,	2–0–2	80–0–80	50	2000
	or					
	80–0–80	40 ,,	2–0–2	80–0–80	25	1000
1000–0–1000	50–0–50	200 ,,	1–0–1	200–0–200	20	4000
250–0–250	50–0–50	2000 ,,	0·25–0–0·25	500–0–500	5	10,000

The standard instrument is arranged with a central zero but a side or displaced zero can be provided on request, in which case the range must be equal to the sum of the positive and negative maximum readings of the central zero galvanometer having the same resistance, i.e., a 2–0–2 mA. 40 ohm galvanometer winding can be calibrated for use as an 0–4 mA. or a 1–0–3 mA. 40 ohm galvanometer. Where higher sensitivity is required, movements have been designed with specially shaped pole pieces to give a displaced zero and uneven scale with wide divisions adjacent to zero, increasing the sensitivity for null work by approximately 150 per cent.

With certain specified exceptions, galvanometers of the type described in this specification having a resistance of 40 ohms or more will not be damaged by temporary connection across the terminals of a fully charged 2-volt cell.

Momentary Measurements. Galvanometers may be provided with attachments which enable the pointers to be set up to any part of the scale assumed to approximate to the value of a momentary current to be applied. This attachment, by reducing the angular movement of the pointer to indicate such momentary currents, permits accurate determination of their value.

Ballistic Work. Similar galvanometers to those previously described can be supplied with undamped coils for ballistic work, but these cannot be connected across the terminals of a 2-volt cell without incurring risk of damage to the movement.

	Figured	Scale Divisions	Resis. of Movement	Range Milliamps	Range Approx. Millivolts	Price 6 in. Scale	Price 8 in. Scale
11361	15–0–15	75–0–75	2 ohms	15–0–15	30–0–30		
11362	10–0–10	50–0–50	5 ,,	10–0–10	50–0–50		
11363	5–0–5	50–0–50	20 ,,	5–0–5	100–0–100		
11364	2–0–2	40–0–40	40 ,,	2–0–2	80–0–80	£4 8 9	£5 0 0
11365	2–0–2	80–0–80	40 ,,	2–0–2	80–0–80		
11366	1000–0–1000	50–0–50	200 ,,	1–0–1	200–0–200		
11367	250–0–250	50–0–50	2000 ,,	0·25–0–0·25	500–0–500		

The above prices are for Galvanometers with front terminals; if back terminals are preferred deduct 4 0 — 3 0

Extras—Push up pointer attachment for momentary current measurements — 3 0

Rubber feet for back of case — No extra

Side or displaced zero — No extra

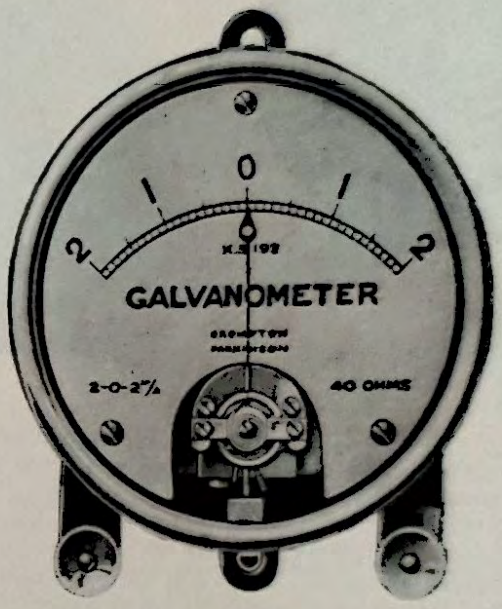
Unevenly divided scale with displaced zero to give greater sensitivity — No extra

Galvanometer with undamped coil for ballistic work — 10 -

For 6" scale movement, mounted in portable pattern case, as Fig. 2, page 452 — £1 7 6

For 8" scale movement, mounted in portable pattern case, as Fig. 2, page 452

3"-DIAL MOVING COIL POINTER GALVANOMETERS.

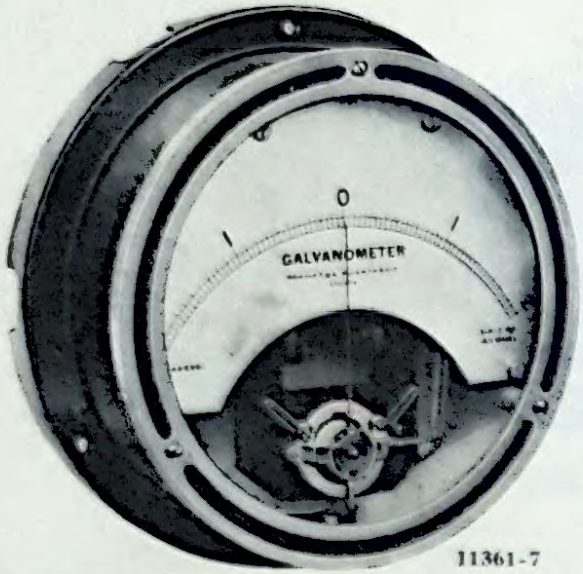


11368

Calibrated Galvanometer with front terminals.

11368 Calibrated Moving Coil Galvanometers. This calibrated Moving Coil Galvanometer gives full scale deflection at 2-0-2 mA. and has a resistance of 40 ohms, so it is also a 80-0-80 millivoltmeter. The Scale has 40 parts—100 micro-amps. and 500 micro-volts per division. It has first grade accuracy and is not damaged by temporary connection across a 2-volt cell. The standard Galvanometer, as illustrated, is sufficientiv sensitive for P.O. Box and Metre bridge work ... ... Price nett **£1 18 0**

11369 A Still More Sensitive Galvanometer, which, by means of specially shaped Pole Shoes which are in view for demonstration purposes, gives an uneven scale with wide divisions at zero, and doubles the sensitivity for null work. Its ranges are otherwise as the galvanometer illustrated above. With this instrument a current of 25 micro-amps. can easily be read. Like the Galvanometer with even scale divisions, it will temporarily withstand an overload thirty times its full rated current... Price nett **1 18 0**



11361-7

CALIBRATED MOVING COIL POINTER GALVANOMETERS with 6-in. and 8-in. Scale Lengths.

These Calibrated Moving Coil Galvanometers have been produced to meet the demand for Pointer Galvanometers of robust construction and relatively high sensitivity. These galvanometer movements can be mounted in either 6 or 8 in. dial circular pattern cases as illustrated, or in portable pattern cases as shown on page 452, Fig. 2.

Each galvanometer is calibrated for direct indication of milliamps and millivolts, and full particulars of ranges and resistance are marked on the dial. They are supplied with windings having a resistance varying from 2 to 200 ohms.

Construction. The construction of these Galvanometers is generally similar to that of the standard moving coil instruments described on page 448. The movements are spring controlled, balanced for use in any position, and have external zero adjustment.

Unless otherwise specified, knife-edge pointers are fitted, but spade pointers will be provided if required.

Our standard arrangement is to supply non-detachable ebonized front terminals but, if preferred, back terminals can be fitted.

Ranges. The standard windings and ranges are given in the following table.

Figured	Scale Divisions	Resis. of Movement	Milliamps	Approx. Millivolts	Microamps per Division	Microvolts per Division
15–0–15	75–0–75	2 ohms	15–0–15	30–0–30	200	400
10–0–10	50–0–50	5 ,,	10–0–10	50–0–50	200	1000
5–0–5	50–0–50	20 ,,	5–0–5	100–0–100	100	2000
2–0–2	40–0–40	40 ,,	2–0–2	80–0–80	50	2000
	or					
	80–0–80	40 ,,	2–0–2	80–0–80	25	1000
1000–0–1000	50–0–50	200 ,,	1–0–1	200–0–200	20	4000
250–0–250	50–0–50	2000 ,,	0·25–0–0·25	500–0–500	5	10,000

The standard instrument is arranged with a central zero but a side or displaced zero can be provided on request, in which case the range must be equal to the sum of the positive and negative maximum readings of the central zero galvanometer having the same resistance, i.e., a 2–0–2 mA. 40 ohm galvanometer winding can be calibrated for use as an 0–4 mA. or a 1–0–3 mA. 40 ohm galvanometer. Where higher sensitivity is required, movements have been designed with specially shaped pole pieces to give a displaced zero and uneven scale with wide divisions adjacent to zero, increasing the sensitivity for null work by approximately 150 per cent.

With certain specified exceptions, galvanometers of the type described in this specification having a resistance of 40 ohms or more will not be damaged by temporary connection across the terminals of a fully charged 2-volt cell.

Momentary Measurements. Galvanometers may be provided with attachments which enable the pointers to be set up to any part of the scale assumed to approximate to the value of a momentary current to be applied. This attachment, by reducing the angular movement of the pointer to indicate such momentary currents, permits accurate determination of their value.

Ballistic Work. Similar galvanometers to those previously described can be supplied with undamped coils for ballistic work, but these cannot be connected across the terminals of a 2-volt cell without incurring risk of damage to the movement.

	Figured	Scale Divisions	Resis. of Movement	Range Milliamps	Range Approx. Millivolts	Price 6 in. Scale	Price 8 in. Scale
11361	15–0–15	75–0–75	2 ohms	15–0–15	30–0–30		
11362	10–0–10	50–0–50	5 ,,	10–0–10	50–0–50		
11363	5–0–5	50–0–50	20 ,,	5–0–5	100–0–100		
11364	2–0–2	40–0–40	40 ,,	2–0–2	80–0–80	£4 8 9	£5 0 0
11365	2–0–2	80–0–80	40 ,,	2–0–2	80–0–80		
11366	1000–0–1000	50–0–50	200 ,,	1–0–1	200–0–200		
11367	250–0–250	50–0–50	2000 ,,	0·25–0–0·25	500–0–500		

The above prices are for Galvanometers with front terminals; if back terminals are preferred deduct 4 0

Extras—Push up pointer attachment for momentary current measurements ... 3 6

Knife-edge for back of case ... 3 6

Side or displaced zero ... No extra

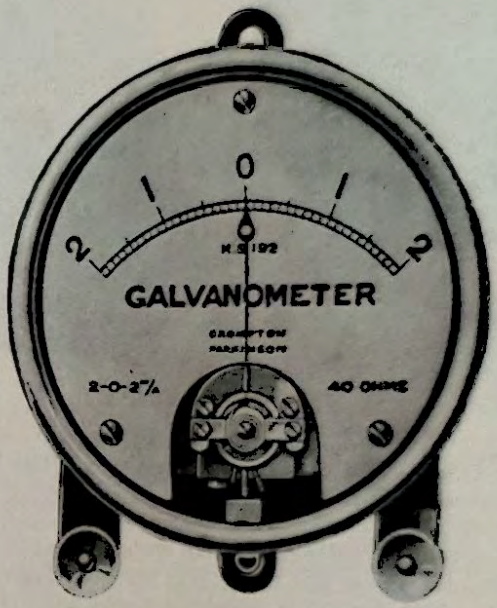
Unevenly divided scale with displaced zero to give greater sensitivity ... No extra

Galvanometer with undamped coil for ballistic work ... No extra

For 6" scale movement mounted in portable pattern case as Fig. 2 page 452 ... 10 -

For 8" scale movement mounted in portable pattern case as Fig. 2 page 452 ... £1 7 3

3"-DIAL MOVING COIL POINTER GALVANOMETERS.



11368

Calibrated Galvanometer with front terminals.

11368 **Calibrated Moving Coil Galvanometers.** This calibrated Moving Coil Galvanometer gives full scale deflection at 2-0-2 mA. and has a resistance of 40 ohms, so it is also a 80-0-80 millivoltmeter. The Scale has 40 parts—100 micro-amps. and 500 micro-volts per division. It has first grade accuracy and is not damaged by temporary connection across a 2-volt cell. The standard Galvanometer, as illustrated, is sufficiently sensitive for P.O. Box and Metre bridge work ... ... Price nett **£1 18 0**

11369 **A Still More Sensitive Galvanometer,** which, by means of specially shaped Pole Shoes which are in view for demonstration purposes, gives an uneven scale with wide divisions at zero, and doubles the sensitivity for null work. Its ranges are otherwise as the galvanometer illustrated above. With this instrument a current of 25 micro-amps. can easily be read. Like the Galvanometer with even scale divisions, it will temporarily withstand an overload thirty times its full rated current... Price nett **1 18 0**



11370

11 cm. dia. × 5 cm. 1·1 kg.



11371

6 cm. dia. × 4 cm. 0·2 kg.

UNIPIVOT GALVANOMETERS

Pattern A Unipivot Galvanometer, which is illustrated in Fig. 11370, has been adopted by the British General Post Office and the War Office as an official service pattern. The instrument is suitable for either indoor or outdoor work and can be used by unskilled persons. The moving parts are enclosed in a compact metal case with a glass front. The scale is approximately 80 millimetres long and has 70 equal divisions with a centre zero; the graduations are not individually calibrated. In standard instruments the moving coil has an approximate resistance of 5, 50, or 1,000 ohms; the 5 ohm coil is fitted where the instrument is to be used for detecting small pressures, while the 1,000 ohm coil is suitable where a high-current sensitivity is required. An instrument with a 50-ohm coil is adapted for general use, as, for example, in connection with a Wheatstone bridge, or when measuring low resistances by substitution methods. An outer leather case with carrying strap can be supplied to order. Approximate sensitivity data are given in the table below.

Pattern B Unipivot Galvanometer, illustrated in Fig. 11371, is the most compact model and can easily be carried in the pocket. It is particularly adapted for use where a small simple and reasonably sensitive detector is required to indicate balance in bridges or potentiometer circuits and for other similar work. It is also suitable for students' use. The moving parts are mounted on an ebonite base and are protected by a metal case with a glass front; an external zero adjustment is provided. An outer leather case can be supplied to order. The standard scale has 40 equal divisions with a centre zero. The moving coil may be either of low or high resistance, approximately 40 or 500 ohms respectively. The former is suitable for low resistance testing, while the latter is fitted when the galvanometer is to be used in conjunction with a high series resistance for insulation measurements. In the latter case a scale can be provided to read directly in megohms. Approximate sensitivity data are given in table below.

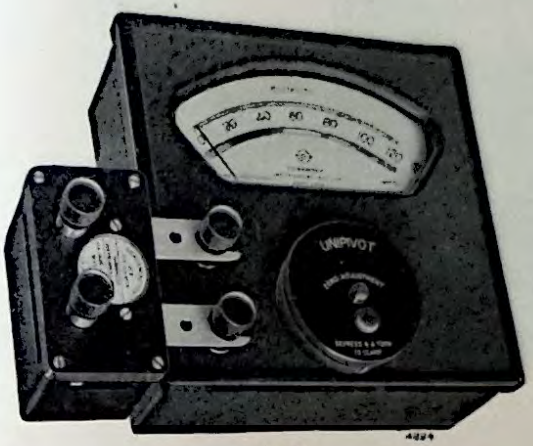
Pattern	Cat. No.	Fig. No.	Coil Resistance (ohms)	Ranges		Period‡ (seconds)	E.D.R.*	Price
				milliamperes	millivolts			
A	41311	11370	5 50 1000	0·36 0·12 0·024	1·8 6 24	3	3 190 —	£6 10 0
B	41315	11371	40 500	0·8 0·2	32 100	3	†	4 0 0

* External resistance for critical damping.

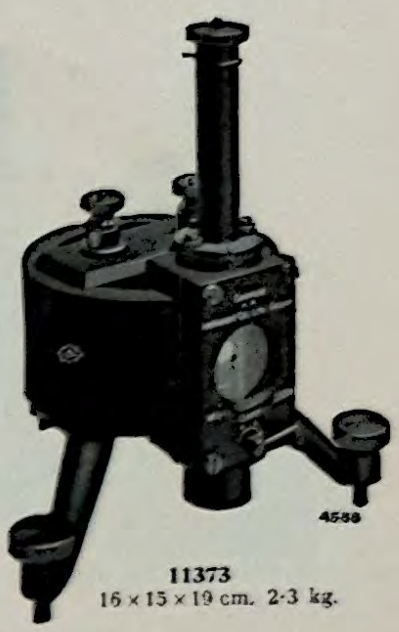
‡ Time taken for pointer to come to rest.

† Critically damped when used with shunts of very low resistance.

The ranges stated are for complete scale deflection, to obtain the available deflection on a centre zero scale, the figures must be divided by two.



11372
Galvanometer 18 × 17 × 9 cm. 2 kg.



11373
16 × 15 × 19 cm. 2·3 kg.

11372 Unipivot Galvanometer. Pattern "L."

This Galvanometer, with Range Multiplier attached, is shown in Fig. 11372. The essential feature of the design is that the moving coil is supported on one pivot only, which results in a diminution of pivot friction and renders it unnecessary to level the instrument. The galvanometer movement is enclosed in a dust-tight case. A clamping device enables the weight of the coil to be removed from the pivot during transit, and by mounting the jewel on a light spring the pivot is protected from injury by shock when the instrument is in use. The moving coil resistance is given in the table below; series resistances included in the instrument are added to make the instrument suitable for volt or ampere ranges as given in the table. The instrument, with a total internal resistance of 500 ohms, is adapted for use with range multipliers so as to extend the range up to 60 amps. or 600 volts ... ... each, nett **£8 10 0**

TABLE

Coil Resistance ohms.	Total Internal Resistance ohms.*	Range milliamperes	millivolts	Period† seconds
5	5	0·36	1·8	
10	10	0·24	2·4	
50	50	0·12	—	
10	10+40	0·24	12	4
10	10+90	0·24	24	
10	10+490	0·24	120	
1,000	1,000	0·024	—	

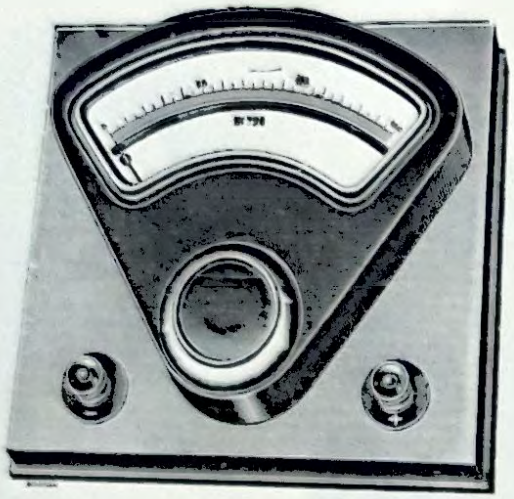
Centre-zero instruments have half the ranges mentioned in the table.
*Moving Coils of millivoltmeters usually have a resistance of 10 ohms, the balance being "swamping" resistance.
†Time taken for pointer to come to rest.

11372/1 D.C. Volt Range Multiplier, any standard range up to 60 volts ... ... nett **£1 5 0**
Ditto range, 120 or 240 volts **1 10 0**
Ditto range 480 or 600 volts **2 10 0**
D.C. Ampere Range Multiplier, any standard range **1 5 0**

Cambridge A.M. Galvanometer

This instrument, illustrated in Fig. 11373, is an inexpensive, simple, and robust Galvanometer which is sufficiently accurate for general laboratory and workshop use. It is a modified form of the original Ayrton-Mather moving coil galvanometer, in which the coil and magnet are of the form which has been found to have the greatest sensitivity for any given period. The coil, which rotates in a narrow gap between the poles of a powerful Magnet of circular shape, is wound with selected silk-covered wire on a wood former. To give critical damping, a short-circuited winding is superimposed on the coil winding, this damping being omitted when the instrument is required for ballastic work. The coil former carries a concave mirror of 8 millimetres diameter for a scale distance of 1 metre. By incorporating a Wadsworth reflecting device (not shown in the pattern illustrated), the scale deflections are increased. The coil is suspended by means of a phosphor bronze strip from a simple torsion head held in position in the suspension tube by a spring; with this suspension a stable zero is obtained. Provision is made for clamping the coil and for adjusting the zero. The instrument can be quickly and accurately levelled. The standard coil has an approximate resistance of 25 ohms, an undamped period of 6 seconds, and gives a deflection of approximately 110 millimetres per microampere on a scale at 1 metre distance.

11373 Cambridge A.M. Galvanometer ... ... nett **£4 15 0**



11374

Dead-Beat Moving-Coil Galvanometer.

DESCRIPTION:—

Movement.—Dead-Beat Moving Coil. Dial.—Silvered and Engraved, with Mirror. Central or Side Zero. Case.—Cast Metal, Enamelled and Nickelled. Size.—7×7×2½ in. overall.

This Galvanometer consists of a Pivoted Moving-Coil Movement, having specially wound Coil and Springs to give a very high degree of sensitiveness. It is dead-beat, portable, requires no levelling, and is unaffected by vibration. The Scale is divided into 150 divisions and reads approximately in micro-amperes, being the deflections proportional to the current. The Scale can be supplied with the zero in the centre of the scale if so ordered. A Mirror is provided to prevent parallax errors in reading. The Galvanometer is substantially made and well-finished. Having no delicate suspensions it is not easily damaged, and forms a most useful and necessary adjunct to any laboratory or test room.

11374	Price	**£5**	**5**	**0**
	*Polished Wood Case, with leather handle (extra)	**0**	**17**	**6**
	*Leather Case, with sling	**1**	**5**	**0**



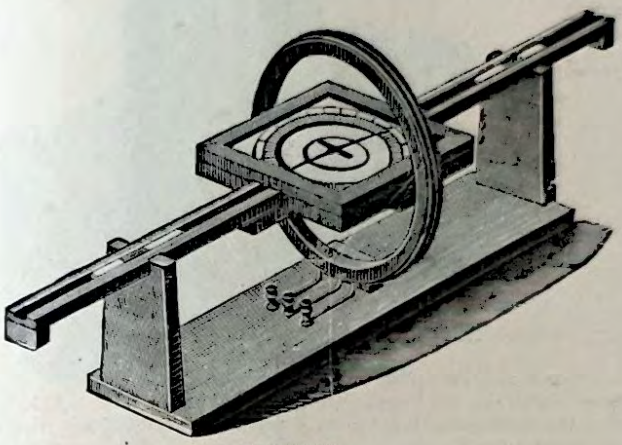
11375

11375 Galvanometer, reflecting, fitted with two Coils and Controlling Magnet; the Mirror and Magnets are suspended in a Removable Brass Frame, easy of access for cleaning and resuspending. Resistances up to 2,000 ohms, on polished Mahogany Stand **£5 5 0**

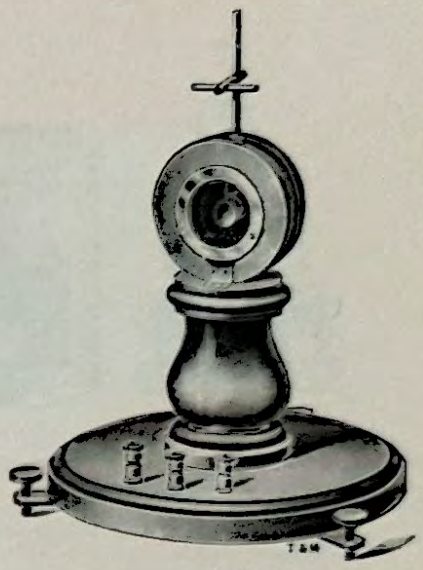
11376 Galvanometer, Thompson's, very accurately made; the resistance is measured and marked on each instrument; can be wound to any resistance required, with Directing Magnet, in Brass Box, on Brass Support, with Levelling Screws **5 5 0**



11376



11377-78



11379

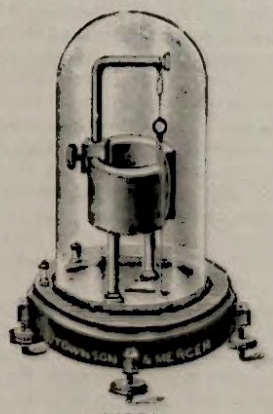
11377 **Galvanometer,** Tangent, with Agate Centre Bar Needle, and Scale mounted on Mirror, in Polished Oak Frame, Ring and Stand, complete **£3 15 0**

11378 Ditto, with Silvered Engraved Scale, in Polished Mahogany Frame **4 10 0**

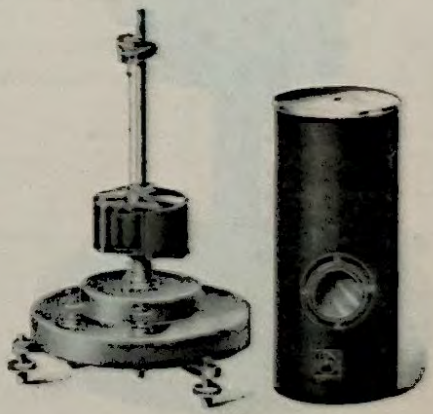
11379 Ditto, Mirror (Stewart & Gee's), with Controlling Magnet, Levelling Screws, on Polished Mahogany Base, etc. **2 0 0**



11380



11381



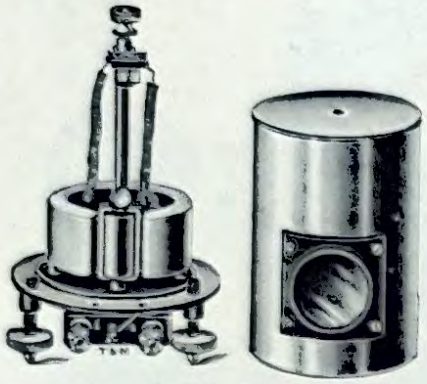
11382

11380 **Galvanometer,** Mirror with two Coils, in Polished Mahogany Case, fitted with Controlling Magnet, suspended Mirror and Magnets, mounted on Brass Tripod Stand, with Levelling Screws, complete **£3 10 0**

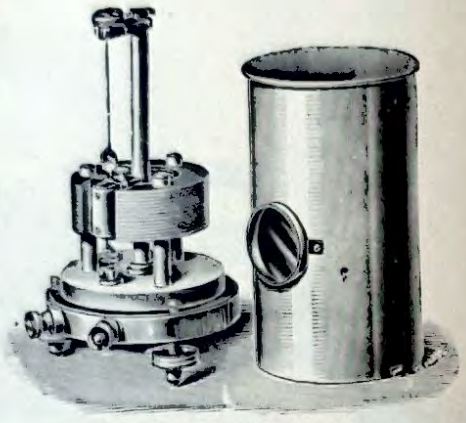
11381 **Galvanometer,** Mirror, D'Arsonval's, Cheap Form, with Levelling Screws **2 7 6**

11382 **Galvanometer,** D'Arsonval's, superior finish, in Brass Case, on Polished Teak Base ... **3 10 0**

OIL AND TAR TESTING APPARATUS



11383



11384

11383 **Galvanometer,** Mirror, d'Arsonval's, superior quality, in Brass Travelling Case, with Clamp to secure the Coil during transit **£4 0 0**

11384 **Galvanometer,** Mirror, d'Arsonval's Reflecting, in Brass Case, Phosphor Bronze Suspension, fitted with Travelling Clip to prevent damage in transit, with one Coil, complete **5 15 0**

(Supplied with an Aperiodic Coil of 250 turns, being the most suitable for general work; but coils of any number of turns either Aperiodic or Ballistic, supplied at the same price.)



11385

20 × 20 × 32 cm. 5·5 kg.

CAMPBELL VIBRATION GALVANOMETER

The Galvanometer illustrated in Fig. 11385 is a sensitive detector which may be used in many alternating current bridge methods of measuring capacitance, inductance, and effective resistance. It possesses low inductance and moderate effective resistance, and can be easily tuned into resonance with the frequency of the current being measured. The instrument is relatively insensitive to currents having frequencies differing from the resonance frequency; this fact renders it highly selective. The narrow moving coil, which has a small moment of inertia, is held in the air gap of a permanent magnet by a double bifilar suspension. The effective length of the upper suspension can be varied by turning a pinion which moves a rack; this rack is attached to a slide block, carrying a bridge-piece. On this bridge-piece are mounted two grooved phosphor bronze wheels in which the suspension rests. It is thus possible to traverse the whole distance allowed by the rack and pinion without fear of breaking the suspension. Moreover, the elimination of sliding friction prevents unnecessary movement of the mirror. The tension of the suspension can be adjusted by a screw, which extends a spiral attached to the lower suspension. The galvanometer can thus be brought into mechanical resonance with the supply frequency. The fact that the instrument is insensitive to harmonics simplifies the measurements when currents which do not obey the sine law are used.

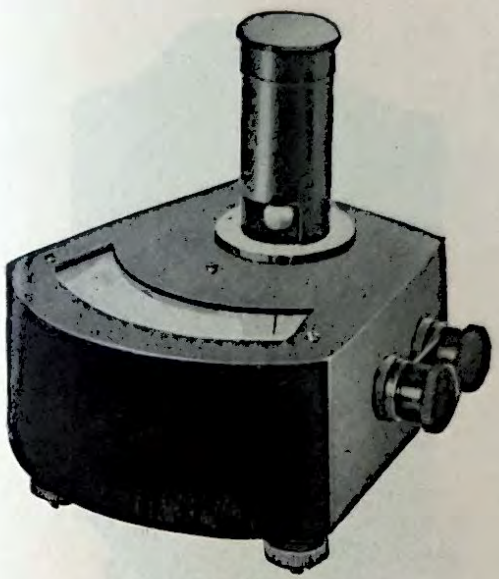
The galvanometer is rigidly constructed, and is mounted on a heavy slate base. In order to cover a wide frequency range, coils having different constants can be supplied, covering frequencies from 10 to 100, 20 to 200, 30 to 300, 60 to 600, and 200 to 1,200 cycles per second. Normally one of these standard coils is supplied with the galvanometer, but a reasonably skilful manipulator can readily interchange this for a coil of different range. The coil is fitted with a plane mirror, and a 100-centimetre convex lens on the case brings the spot to a focus on the scale.

The high sensitivity of these vibration galvanometers is obtained by reducing the damping to a small amount; the resonance is therefore sharp. To employ the sensitivity to full advantage, the frequency should be kept constant. If the frequency is inconstant, it is often better to flatten the resonance curve by adding a suitable shunt. When using null methods it is advisable to begin with the galvanometer heavily shunted, and gradually to increase the shunt resistance to infinity as the condition of balance is approached. For this purpose a shunt box can be supplied having positions for short and open circuit, and three shunts of 10, 100 and 500 ohms respectively.

If the galvanometer is required for use on a low resistance bridge a coil of a few turns and low effective resistance can be supplied.

11385 **Campbell Vibration Galvanometer,** with one standard Coil **£21 0 0**

11386 Spare Coil for above **0 15 0**



11387-88

(1)—BALLASTIC REFLECTOR

(2)—APERIODIC REFLECTOR

(3)—MICROAMMETER

(4)—BALLASTIC POINTER

(5)—APERIODIC POINTER

(6)—MILLIVOLTMETER

MOVING COIL GALVANOMETER (Pointer and Reflector).

This Galvanometer has been designed for all-round use, and is suitable for the laboratory or the class room, and also for out-door work. It is of robust construction and fool-proof, enabling it to be handled by the most inexperienced persons without fear of damage.

The following features are noteworthy:—

(a) The Moving Coil is spring suspended and the movement is protected from damage by a quick-acting clamp which automatically comes into operation immediately the instrument is upset or removed from the table. (This clamp was introduced by us in 1912 and has not yet been superseded.)

(b) Although two Levelling Feet are provided their use can be dispensed with on a normal horizontal surface.

(c) The Zero Adjuster is protected and fitted with Stops to prevent over-turning. It is accessible by removing the Cap of the Suspension Tube.

(d) Deflections are indicated by a knife-edged pointer on a scale divided 35—0—35 millimetres.

(e) A Concave Mirror of 1 metre focus is fitted enabling the Galvanometer to be used as a reflector for higher sensitivity.

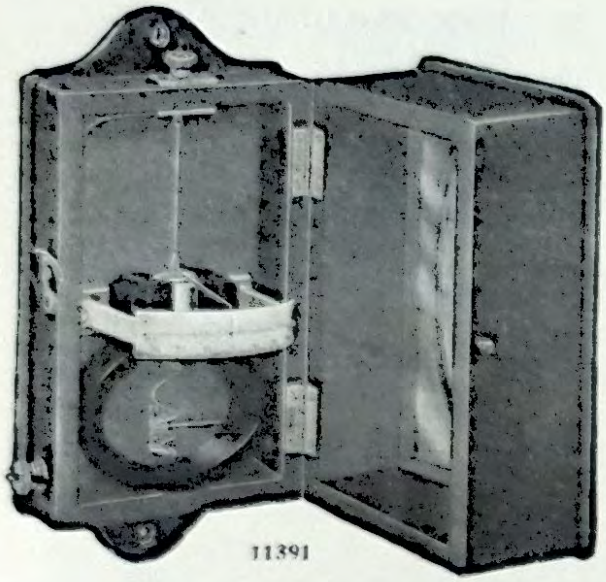
(f) Three Terminals and a Link are fitted so that the instrument can be used as a ballastic Galvanometer, an aperiodic Galvanometer, a microammeter, or millivoltmeter.

There are two stock windings, particulars of which are given below:—

Cat. No.	Resistance (ohms)	Aperiodic Sensitivities		Ballastic Sensitivities		
		Scale reading in microamps.	Divs. per microamp at 1 metre	Divs. per microcoulomb on Scale	Divs. per microcoulomb at 1 metre	
=11387	50	35—0—35	30	2·5	75	£3 15 0
=11388	350	14—0—14	75	4·5	130	3 15 0

=11389 Similar to No. 11387, but pointer only £3 10 0

=11390 Similar to No. 11388, but pointer only 3 10 0



11391



11394

WALL OR TABLE GALVANOMETER. MOVING COIL

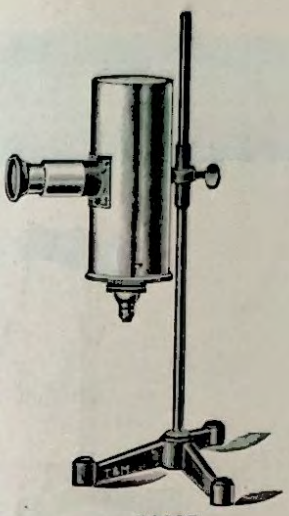
This instrument has been designed with the object of providing a Galvanometer which, while being simple and robust for students' use, has ample sensibility to enable accurate tests to be made.

The case is of polished Mahogany and provided with a large window through which all the parts are clearly seen without having to open the hinged front. The Magnet is provided with soft iron poles which are shaped to give a uniform and radial field so that the readings are quite proportional. The Moving Coil is wound on a pressed Metal Former which gives the Coil great rigidity, but is sufficiently light to ensure a quick speed and good damping. The Zero Corrector and Clamp for Coil are both operated from the outside.

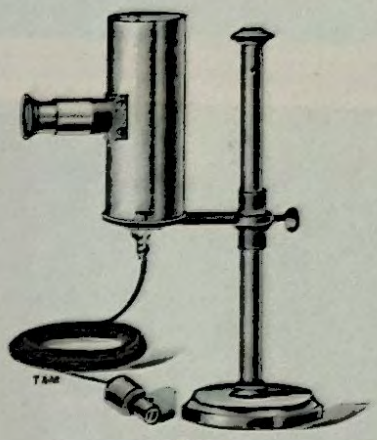
The instrument is intended for fixing to the wall, but for a small extra charge a Levelling Attachment is provided to enable the instrument to be used on the table. It can also be supplied with a small Mirror so that the instrument can be used as a pointer and reflecting Galvanometer. A reflecting instrument without pointer can be supplied also.

The Moving Coil is usually wound to a resistance of about 100 ohms. The pointer gives 1 millimetre deflection for 1 microampere, and if a mirror is also provided 40 millimetres per microampere at 1 metre scale is obtained.

= 11391	Pointer Galvanometer for wall	£2 10 0
= 11392	" " with table attachment	2 12 6
= 11393	" " Mirror for Lamp and Scale	2 15 0
= 11394	" " " " and table attachment	2 17 6
= 11395	Reflecting Galvanometer only, for wall use	2 10 0
= 11396	" " with table attachment	2 12 6

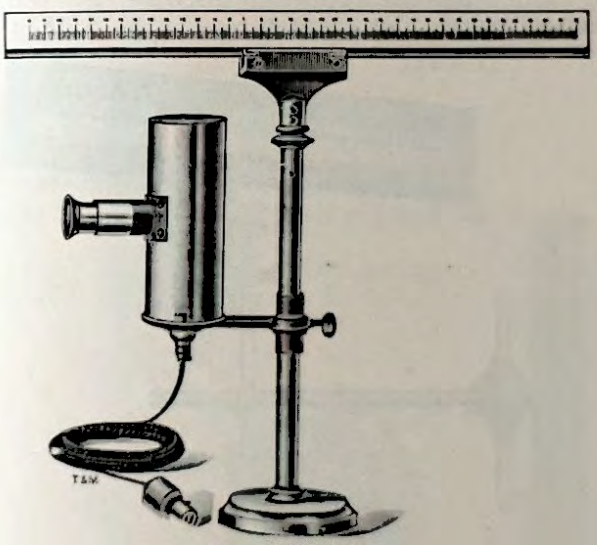


11397



11398

11397	**Galvanometer Lamp and Lens,** Electric, in Brass Case, with Cross Wire and adjustable Lens, mounted on Iron Stand, with heavy Tripod Foot	£1 5 0
11398	Ditto, Electric, in heavy Brass Case, with Cross Wire and adjustable Lens, flexible Cord and Bayonet Catch Lamp Holder, adjustable Clamp, sliding on heavy Brass Pillar with Solid Brass Base ...	2 7 6

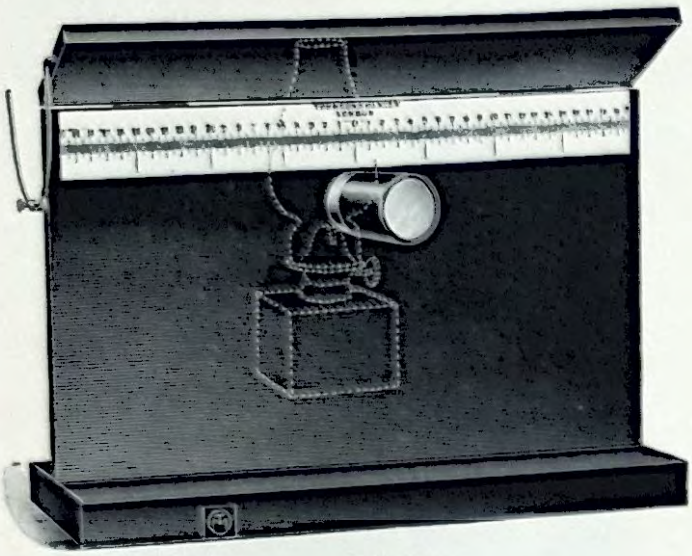


11399

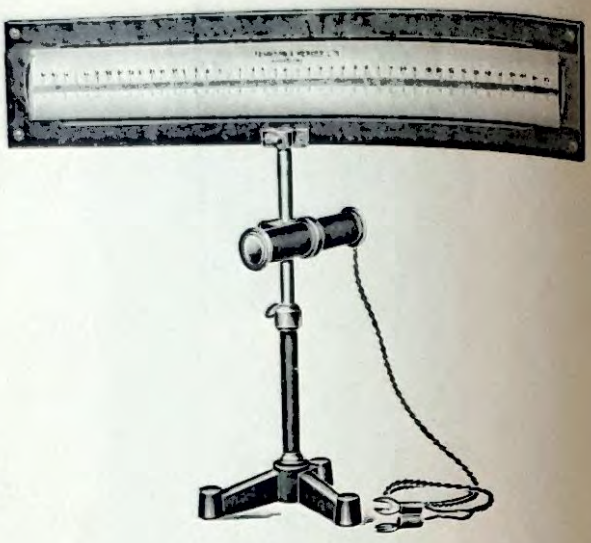


11400

11399	**Galvanometer Scale Stand,** and Lamp, for Electricity, as No. 11398, with semi-transparent Scale 50 cm., divided centimetres and millimetres, with Zero in centre, mounted on Telescope Pillar with heavy Brass Base	£4 4 0
11400	**Galvanometer Scale,** semi-transparent Paper divided into centimetres and millimetres, with Zero in centre, mounted between Clear Glass, in Polished Mahogany Frame	0 14 6
11401	Ditto, Scales Card, 50 cm. long, divided into millimetres... ... ... each	0 0 9
11402	Ditto, Paper, 50 cm. long, divided into millimetres	0 0 6
11403	Ditto, " " " Semi-transparent Paper ... ... "	0 0 8



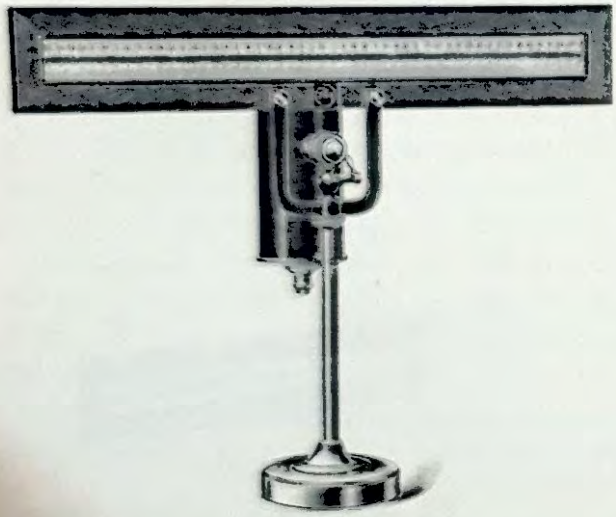
11404



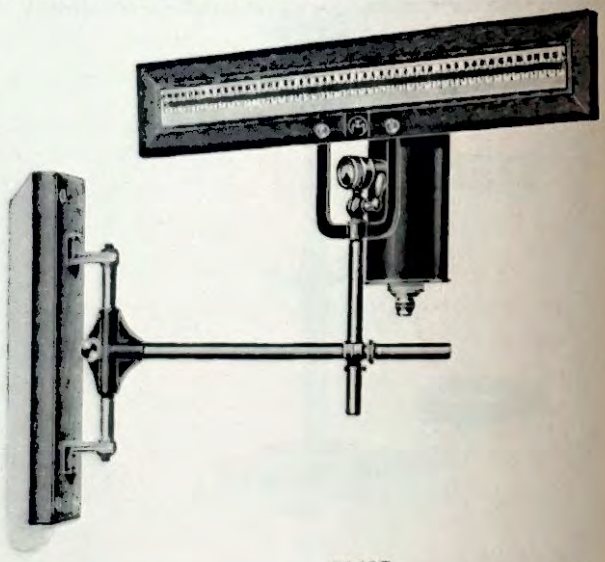
11405

11404 **Galvanometer Scale Stand, Lamp and Lens,** for use with Mirror Galvanometers ... **£1 12 0**

11405 **Galvanometer Lamp and Scale** for use with an accumulator or dry cell, comprising semi-transparent scale mounted in polished teak Frame on adjustable Stand. The Telescope is fitted with a miniature Screw Fitting Lamp, adjustable Focussing Lens, has horizontal and vertical movements, and with Flexible Cord and Tags complete **1 15 0**



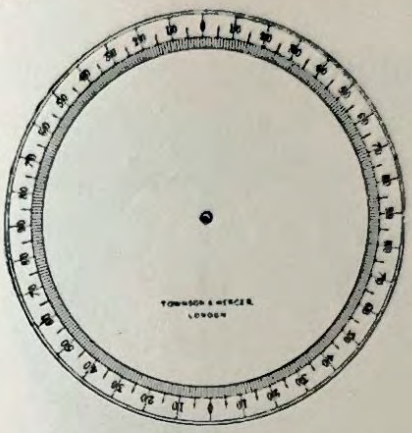
11406



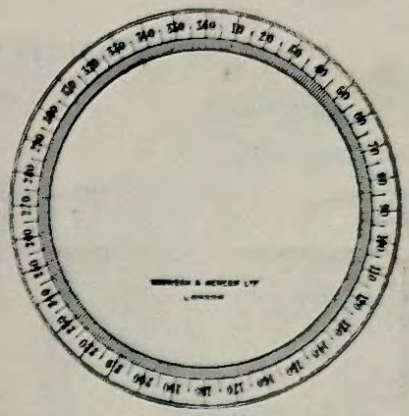
11407

11406 **Galvanometer Lamp and Scale.** The scale is of semi-transparent glass in Polished Mahogany Frame, the Lampholder of japanned metal fitted with Telescope Tube for focussing and adjusting Screw on heavy Brass Stand, complete with Lighting Flex and Plug **£4 10 0**

11407 **Galvanometer Lamp and Scale,** similar to No. 11406 with Hinged Bracket for mounting on wall, complete with Lighting Flex and Plug **4 10 0**



11408



11409

11408 **Galvanometer,** Dials, Card, with divided circle, 0°-90°, 4 times—

	3	3½	4	5	6	7½	10 inches diameter
	4/0	**5/0**	**5/0**	**7/0**	**8/0**	**15/0**	**18/0** per doz.

11409 Ditto, ditto, 0°-360°

	3	3½	4	5	6 inches diameter
	3/0	**5/0**	**5/0**	**7/0**	**8/0** per doz.



11410-11

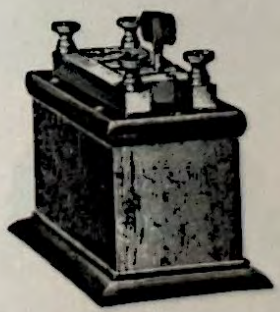


11412

11410 **Galvanometer,** Bar Needles, with Agate Centres and Aluminium Pointers—

		3	4	5 inches long
		3/6	**3/6**	**3/6** each
11411	Ditto, Superior quality	**4/6**	**4/6**	**4/6** „

11412	Ditto, Mirrors, Concave, optically worked, 100 cm. focus	10	13 mm. diameter	
		2/6	**2/9** each	
11413	Ditto, Mirrors, Plane, not optically worked	each	**£0**	**1** **0**
11414	Ditto, Suspension Ribbon, Phosphor Bronze	per reel	**0**	**2** **0**



11415



11416-17

11415 **Galvanometer Shunts,** Sets of, in Polished Mahogany Case, Ebonite Top, with Lozenge-shape Plug and Terminals, comprising $\frac{1}{10}$, $\frac{1}{99}$, and $\frac{1}{999}$ resistances. Superior Finish... **£2** **2** **0**

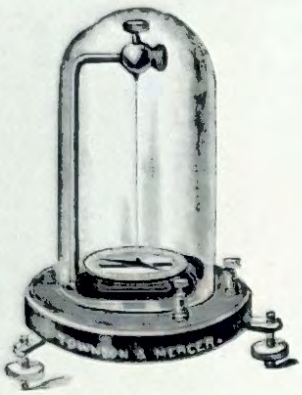
11416 Ditto, Ayrton & Mather's Universal Shunt, wound with Platinoid Wire to 10,000 ohms, in Circular Brass Case with Switch **4** **5** **0**

11417 Ditto, ditto, as above, but to 1,000 ohms **4** **0** **0**

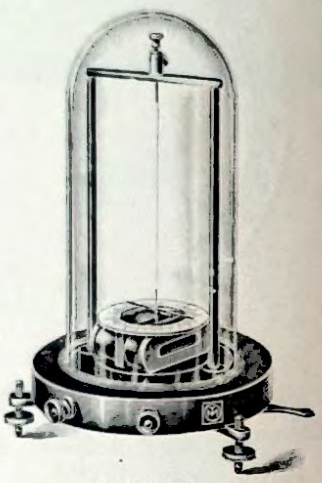
Astatic Galvanometers



11419

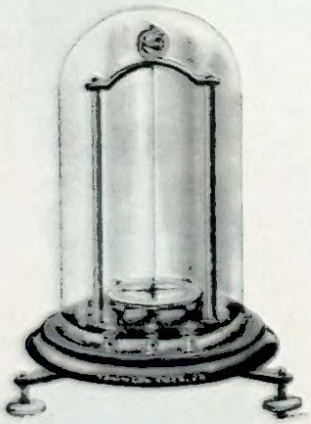


11421-23

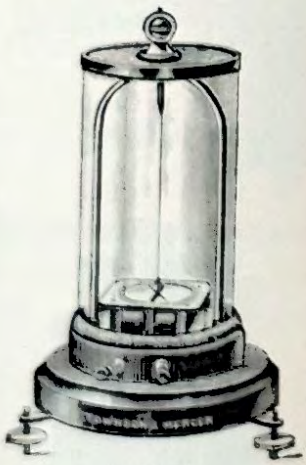


11424-25

11419	**Galvanometer,** Astatic, Simple, mounted on Polished Mahogany Stand, with Coil	each	£0	12 6
11420	Ditto, ditto, Needles, without Stand or Coil	,,	0	4 0
11421	Ditto, ditto, with Set Screw Adjustment for suspension, Glass Shade, with Levelling Screws, on Mahogany Base, Low Resistance		1	7 6
11422	Ditto, ditto, but wound for High Resistance		1	10 0
11423	Ditto, ditto, but wound for both High and Low Resistance		1	15 0
11424	Ditto, ditto, fitted with Duplex Supports, Screw Adjustments, and Movable Coil Frame, wound for Low Resistance		2	5 0
11425	Ditto, ditto, for High Resistance		2	10 0



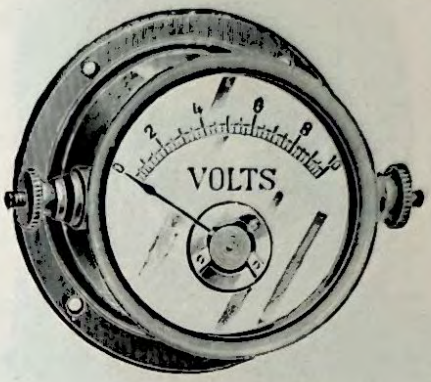
11426-27



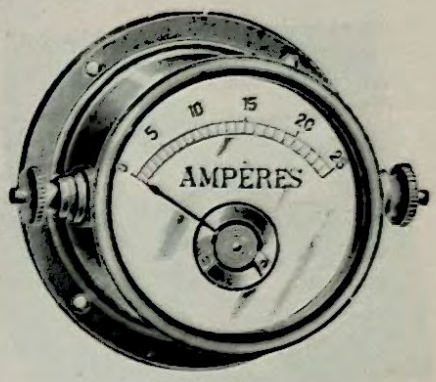
11428-29

11426	**Galvanometer,** designed for more advanced work, wound with High and Low Resistances, Silvered Engraved Dial, Duplex Support and Ball Adjustment for Suspension, with three Terminals, on Polished Mahogany Base		£4	0 0
11427	Ditto, as above, with Movable Coil		4	12 6
11428	Ditto, Nobili's, superior make, with Aluminium Pointer, Ball adjustment, for suspension, Silvered Metal Dial, Movable Coils, with Levelling Screws, on Mahogany Base		4	15 0
11429	Ditto, ditto, as above, wound for High and Low Resistance		5	5 0

Volt and Ampere Meters

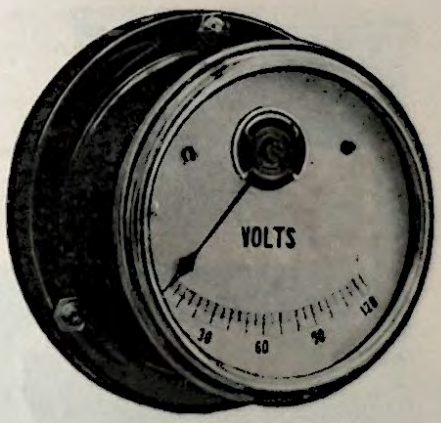


11431

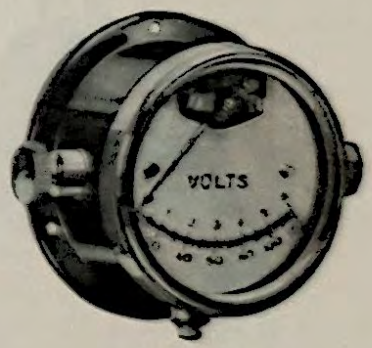


11432

11431	**Voltmeter,** British made, Silvered Metal Dial, 2½ in. dia., in Nickel-Plated Cases—	Reading	0–6	0–12	0–15	0–25 volts
			10 6	**10 6**	**10 6**	**11 6** each
11432	**Voltmeters,** as above, Dial 3½ in.		**18 6**	**18 6**	**18 6**	**19 6**
11433	**Ammeters,** as above—	Reading	0–5	0–10	0–15	0–20 amp.
			10 6	**10 6**	**10 6**	**11 6** each
11434	**Ammeters,** as above, Dial 3½ in.		**18 6**	**18 6**	**18 6**	**19 6**



11435-36



11437-38

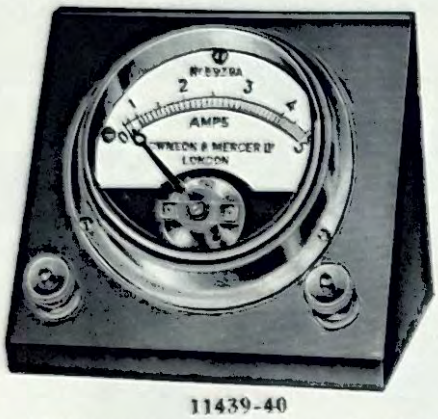
Ammeters and Voltmeters, Moving Iron Spring Control, 4-in. Dials in Black Stove-Enamelled Case with Nickel-Plated and Polished Front Rims.

(F) **11435**	**Ammeters,** 0-5, 0-10, 0-25	...	...	...	...	...	...	each	**£0 17 6**
(F) **11436**	**Voltmeters,** 0-25, 0-50, 0-100	...	...	...	...	...	...	,,	**0 19 0**

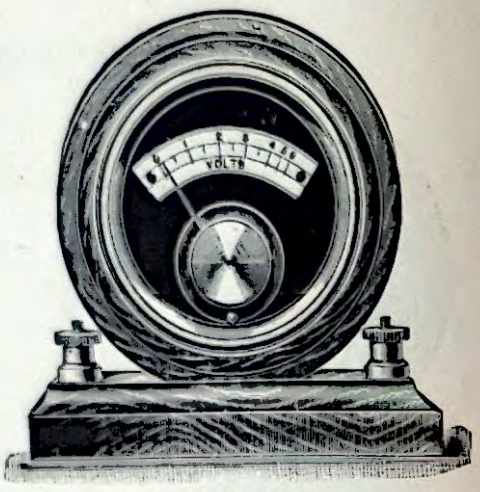
Ammeters and Voltmeters, Moving Coil, with 2½ in. metal Dials with Nickel-Plated Rim.

(F) **11437**	**Ammeters,** 0-1, 0-2, 0-3, 0-6	...	...	...	...	...	...	each	**1 5 0**
(F) **11438**	**Voltmeters,** 0-6, 0-10, 0-20, 0-60	...	...	...	...	...		,,	**1 5 0**

(F) Foreign manufacture.



11439-40



11441-42

11439 **Voltmeter,** new pattern, in Polished Teak Case, 2½-in. Dial, Silvered with Engraved Scale and Nickel-Plated Fittings

Reading	0–5	0–10	0–12	0–15 volts
	22/6	**22/6**	**22/6**	**22/6** each

11440 **Ammeter,** ditto, in Polished Teak Case, etc.

Reading	0–5	0–10	0–12	0–15 amp.
	22/6	**22/6**	**22/6**	**22/6** each

11441 **Voltmeter,** on Polished Teak Stand, with 3¼ in. Engraved Metal Dial and Nickel-Plated Fittings—

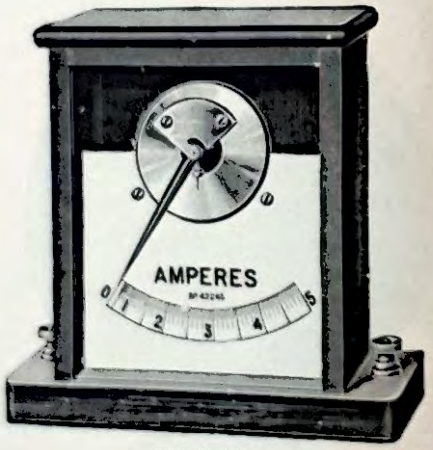
Reading	0–1	0–3	0–5	0–10 volts
	30/0	**30/0**	**30/0**	**30/0** each

11442 **Ammeter,** ditto, as above—

Reading	0–1	0–3	0–5	0–10 amp.
	30/0	**30/0**	**30/0**	**30/0** each



11443-44



11445-46

(F) **11443** **Voltmeters,** pocket, Moving Iron Single Scale, 0–6, 8, 12, or 15 volts... ... each **£0 7 6**

(F) **11444** Ditto, Double Scale, 0–6 and 0–120 ... ... „ **0 9 0**

Snap Cases for above ... ... „ **0 0 9**

11445 **Voltmeter,** Gravity type, in Polished Walnut Cases with glass fronts; the scale, having a long range, is easily read, each meter is carefully calibrated by hand and can be relied upon as being correct, no permanent magnets are used in their construction, therefore the readings are not liable to alter.

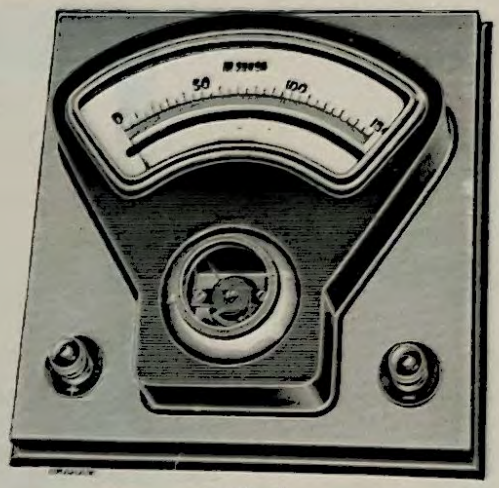
Reading to	1	3	5	10	20 volts
Divided in	·01	·05	·05	·1	·2 „
	52/6	**52/6**	**52/6**	**55/0**	**55/0** each

11446 **Ammeter,** as above **52/6** **52/6** **52/6** **55/0** **55/0** „

(F) Foreign manufacture



11447–48



11449–50

11447 **Voltmeter,** Moving Coil, Dead-Beat with accurately divided Silvered Scale. Visible moving parts mounted in Polished Walnut Case. Size 7 × 7 × 3 in. over all.

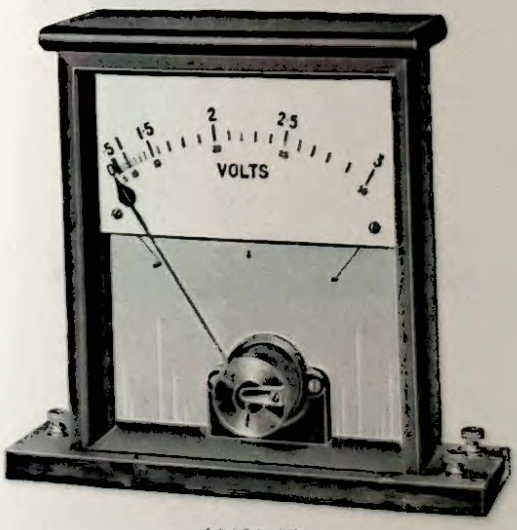
	Reading to	1	3	5	10	20	volts
	Divided in	·01	·05	·05	·1	·2	„
		77 6	**77 6**	**77 6**	**80 0**	**80 0**	each
11448	**Ammeter,** as above	**77 6**	**77 6**	**77 6**	**80 0**	**80 0**	„

These instruments are the best obtainable type for Direct Currents, where great accuracy is required.

11449 **Voltmeter,** Dead-Beat Moving Coil, with Knife-edge Pointer in Cast Metal Cover, Enamelled and Nickelled, on Polished Oak Base, Dial Silvered and Engraved Scale with inset Mirror. Size 7 in. × 7 in. × 2½ in.

	Reading	0–1	0–3	0–5	0–10	volts
		90 0	**90 0**	**90 0**	**95 0**	each
11450	**Ammeters,** as above	Reading	0–1	0–3	0–10	0–20 amps.
			90 0	**90 0**	**90 0**	**95 0** each

National Physical Laboratory Certificates can be supplied with above at additional cost.



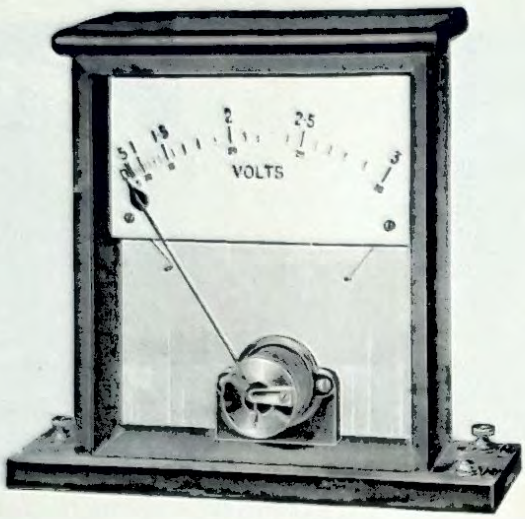
11451-52

Ammeter and Voltmeters, Lecture pattern, Gravity type. This instrument has a large dial, the Figures and Dividing being bold and easily read at a distance.

Both the front and the back of the Polished Walnut Case are of Glass, thus entirely exposing the movement, every portion of which is visible. An additional Scale is engraved on the back of the dial, so that readings can be taken from behind the instrument. This is frequently necessary when lecturing.

It is a most instructive and useful instrument, and can be supplied with either a Gravity movement or a Moving-Coil movement. The advantages of the latter are Dead-Beatness, and an evenly divided scale from zero to maximum range. (For Dead-Beat instruments see No. 11453-4.)

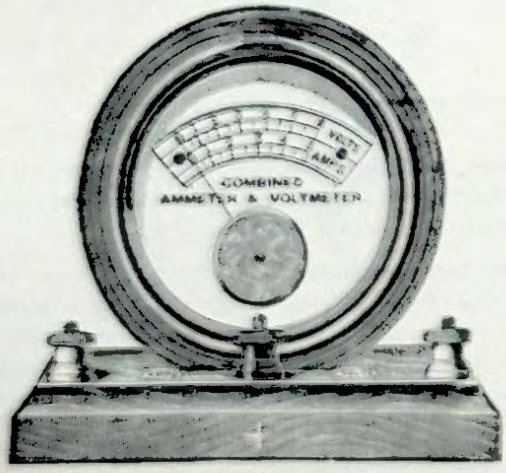
11451	Up to 3 and 30 amperes ...	each	**£5 10 0**
11452	Up to 3 and 30 volts	„	**5 10 0**



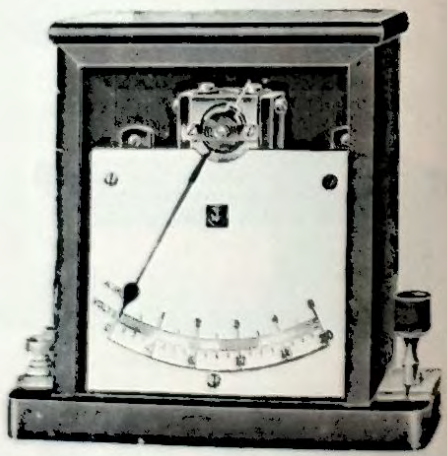
11453-54

Ammeters and Voltmeters, Lecture pattern, Moving Coil, Dead-beat. This instrument has a large Dial, the figures and dividing being bold and easily read at a distance. Both the front and the back of the Polished Walnut Case are of glass, thus entirely exposing the movement, every portion of which is visible. An additional Scale is engraved on the back of the dial so that readings can be taken from behind the instrument. This is frequently necessary when lecturing. It is a most instructive and useful instrument.

11453	Up to 3 and 30 amp.	each	£7	5	0
11454	Up to 3 and 30 volts	„	7	5	0

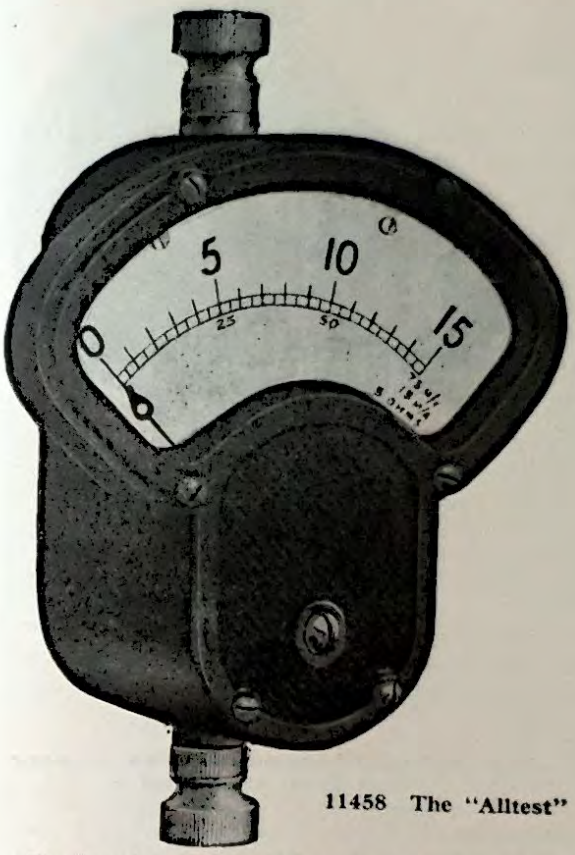


11455



11456

11455	**Combined Voltmeter and Ammeter,** Vertical Form, with 3½ in. Dial, reading to either 6 volts and 5 amps., or 10 volts and 10 amp.	£2	0	0
11456	**Combined Voltmeter and Ammeter,** Moving Coil Dead Beat, with accurately divided and Silvered Metal Scale, reading 0 to 20 volts and 0 to 5 amp. in $\frac{3}{16}$ in., in Polished Walnut Case	5	12	6



11458 The "Alltest"

THE "ALLTEST" INSTRUMENT for all D.C. Tests

Milliammeter.	Voltmeter.
Ammeter	Resistance Measurer.
Millivoltmeter.	Earth Leakage Indicator.

Swivelling Switchboard Instrument.

Standard Ranges up to 30 amperes and 150 volts.

The "ALLTEST" Instrument is a pocket, portable D.C. testing instrument, which is light in weight, easy to handle, and low in price. It can be used as a Milliammeter, Millivoltmeter, Ammeter (Fig. 1), Voltmeter (Fig. 2), Resistance Measurer, or Earth Leakage Indicator, and by the use of shunt and bobbin attachments its range is almost unlimited. The "ALLTEST" Instrument can also be converted into a swivelling switchboard instrument by means of brackets.

Instructions for the various uses of the "ALLTEST" Instrument are given in Booklet No. E.600, free on request.

General Construction

The action of the instrument depends on the rotation of a coil placed in the field of a permanent magnet. The coil is carefully wound and the whole movement is extremely light and, at the same time, robust. The movement is spring controlled and dead-beat; the pivots operate in best quality sapphire jewel bearings.

The Dial is of satin-finished aluminium and is unaffected by damp or heat: it is figured 0/15 and a spade pointer is provided.

The Case is made of black moulded insulation and is non-hygroscopic and non-brittle.

An external screw for zero adjustment is fitted on the front of the case.

Accuracy

At any point of the scale the accuracy of the instrument (at 20°C.) is within 1 per cent of the maximum reading.

STANDARD RANGES

The movement winding has a resistance of 5 ohms giving self-contained ranges of 0–15 milliamperes and 0–75 millivolts. The complete set of standard ranges is given below. Each shunt or resistance bobbin is clearly marked with its resistance value, range, and multiplying factor.

Current Ranges

Self-contained	0	15	milliamperes
By shunt attachments	0	150	milliamperes
	0	1500	milliamperes
	0	1·5	amperes
	0	3	amperes
	0	6	amperes
	0	15	amperes
	0	30	amperes

For ranges above 30 amperes, any standardised shunt with a potential drop of 75 millivolts at full rated capacity may be used, provided that a suitable multiplying factor (for the "ALLTEST" scale of 0/15) is employed.

Voltage Ranges

Self-contained:	0	75	millivolts
By bobbin attachments:	0	150	millivolts
	0	1500	millivolts
	0	1·5	volts
	0	3	volts
	0	15	volts
	0	75	volts
	0	150	volts

For ranges above 150 volts, standard bobbins may be used in series, the bobbins being supplied with screw and socket contacts for this purpose. Bobbins can also be screwed together for use as standards for bridge and other tests.

TECHNICAL PARTICULARS

Polarity

The top terminal is the positive and the bottom terminal the negative connection; they are distinguished by a red washer under the top terminal.

Resistance of Shunt Attachments

The resistance of shunt attachments at 20°C. is as follows:—

Range in Amperes	Resistance in Ohms
30	0·002502
15	0·005005
6	0·01253
3	0·0251
1·5	0·05051
0·15 (150 milliamperes)	0·5556

Accuracy is within 1 per cent, and the temperature coefficient is negligible.

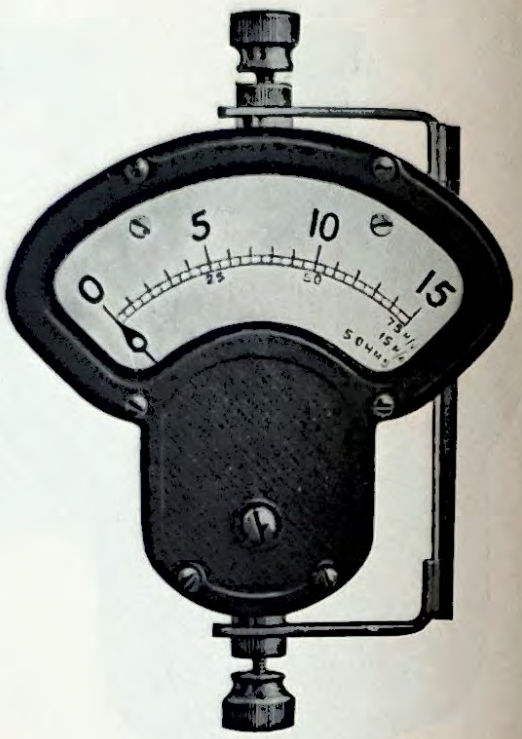


Fig. 1

The "ALLTEST" Instrument as an Ammeter with Shunt Attachment

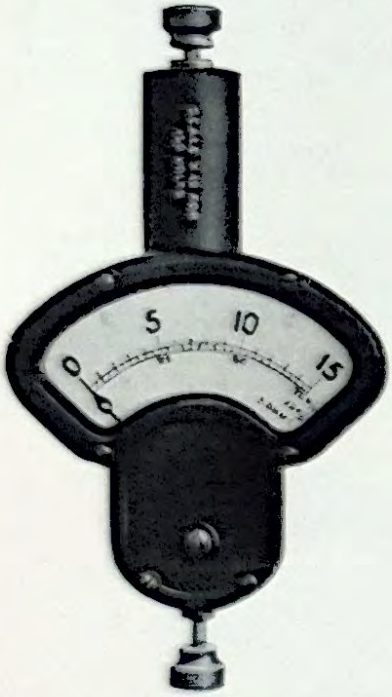


Fig. 2

The "ALLTEST" Instrument as a Voltmeter with Bobbin Attachment

Resistance of Bobbin Attachments

The resistance of bobbin attachments at 20°C. is as follows:—

Range in Volts	Resistance in Ohms
150	9995
75	4995
15	995
3	195
1·5	95
0·15 (150 millivolts)	5

Accuracy is within 0·25 per cent and the temperature coefficient of the bobbin is negligible. For the combination of the 150 millivolt bobbin and the "ALLTEST" instrument, however, the temperature coefficient is 1 per cent for 14°C.

It is useful to note that the bobbins may be used separately from the instrument as standard resistances, and by combining the 150 millivolt bobbin with any one other bobbin, even values of resistance, such as 100, 1,000, 10,000 ohms, etc., are obtained.

Each shunt and resistance bobbin attachment is marked with its range, resistance, and multiplying factor.

11458] Nett Prices of Instrument and Accessories

		£	s.	d.
"ALLTEST" Instrument figured 0-15 (0-75 millivolts and 0-15 milliamperes)		£2	7	6
Shunt Attachments for 150 milliamperes, 1·5, 3, or 6 amperes	each	0	4	0
Shunt Attachments for 15 or 30 amperes	"	0	5	0
Separate Portable Shunt to extend range to 75 amperes, with 4 ft. potential leads		0	12	6
Separate Portable Shunt to extend range to 150 amperes, with 4 ft. potential leads		0	14	0
Resistance Bobbin Attachments for 150 millivolts, 1·5, 3, 15, 75, or 150 volts	each	0	9	6
Spike Terminal to attach to Bobbin Resistance, and insulated lead and spear for battery testing		0	3	6
Fixing Brackets for switchboard mounting as Ammeter only		0	2	0
Fixing Brackets for switchboard mounting as Voltmeter, with bobbin fixing plate		0	3	6
Containing Case with compartments for accessories, with lock and key and adjustable carrying strap		0	10	0
Shunt Carrier to accommodate "ALLTEST" shunts when used with "Universal Indicators" listed on pages 451 and 452		0	2	6



11460-11474

Fig. 3. Projecting type with open dial and exposed movement, for educational purposes

MOVING IRON INSTRUMENTS.
For A.C. and D.C. Measurements.

All these instruments are fitted with repulsion pattern Mumetal movements, permitting First Grade Accuracy as required by British Engineering Standards Association Specifications, to be obtained on either D.C. or A.C., and at any frequency from 25 to 500, low-range voltmeters excepted.

Ammeters and Milliameters are not damaged by a momentary overload of 1,000% or 100% for 15 minutes. Voltmeters will stand an overload of 25 per cent indefinitely without damage.

Their torque-weight ratio is high, varying from 0·1 to 0·125. The damping period till pointer comes to rest is less than 2 seconds, except for the 8-in. dial size, which is 3 seconds.

The volt-amperes for full scale deflection is 1·0 for the 4 in. and 5 in., and 1·75 for the 6-in. and 8-in. instruments.

The whole of these instruments are normally arranged for spring control and are balanced for use in any position. External zero adjusters are fitted. The scales are almost evenly divided from 1/5 up to the maximum markings, no division being marked on the scale below 1/10 of the maximum reading.

Spade pointers are fitted, but if knife-edge pointers are preferred these will be supplied on request without extra charge.

The instruments are suitable for mounting on to carrying battens and are generally calibrated at an angle of 45°. They are normally fitted with all-glass fronts and exposed movement (see Fig. 3), but if preferred can be fitted with the protected front as illustrated by Fig. 2, page 448.

Prices:

Cat. No.	Range	Spring-controlled instruments with back terminals			
	Ammeters	4 in.	5 in.	6 in.	8 in.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.
11460	10 to 100 mA.				
11461	50 to 500 ,,				
11462	·1/1 amp.				
11463	·5/5 ,,	2 7 8	2 9 10	2 12 6	3 2 6
11464	1/10 ,,				
11465	2/20 ,,				
11466	3/30 ,,				
11467	5/50 ,,	2 10 4	2 12 6	2 15 2	3 5 2
11468	10/100 ,,	2 11 8	2 13 10	2 16 6	3 6 6
Cat. No.	Voltmeters	4 in.	5 in.	6 in.	8 in.
		£ s. d.	£ s. d.	£ s. d.	£ s. d.
11469	·5/5 volts				
11470	1/10 ,,				
11471	2·5/25 ,,	2 12 8	2 14 10	2 17 6	3 7 6
11472	5/50 ,,				
11473	10/120 ,,	2 14 2	2 16 4	2 19 0	3 9 0
11474	25/260 ,,	3 0 6	3 2 8	3 5 4	3 15 4

Instruments for intermediate ranges can be supplied at the price of the next higher range.
Front terminals are fitted free on request for all moving iron 4-in. and 5-in. instruments.
Extra price for front Terminals on 6-in. and 8-in. size instruments, **7 8** and **8 10** respectively.
If gravity control instruments are preferred, **3 6** may be taken off above prices.

MOVING COIL INSTRUMENTS

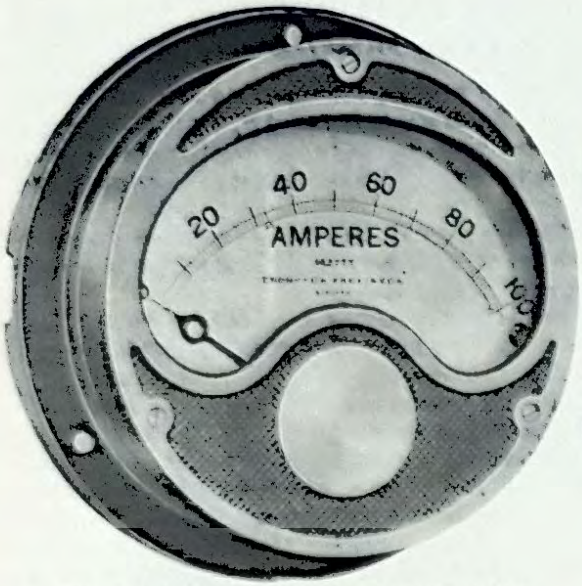


Fig. 2. **Projecting Type, Protected Dial Instrument, with Back Terminals. 11475—11495**

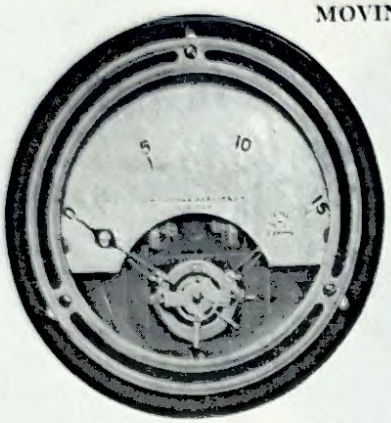


Fig. 3. **Projecting Type, with Open Dial and Exposed Movement, for Educational Purposes. 11475—11495**

These instruments are of the Moving Coil type, mechanically strong, suitable for Direct Current measurements only, having evenly divided scales, and are dead beat in action. The movements are magnetically shielded, inductively damped, and are mounted on best quality sapphire jewel bearings. The instruments are spring controlled for use in any position, and do not therefore require levelling up.

The cases are of black enamelled cast iron, and as the glass window is efficiently bedded in the lid, and jointless moulded rubber is used between the lid and case, the instruments are dust and damp proof.

The standard dials in each case are of satin-finish aluminium.

The pointers are of the spade type, but knife-edge pointers will be fitted if preferred.

Central or displaced zeros can be supplied without extra charge. External zero adjusters are provided.

The instruments comply with the requirements of the current B.E.S.A. Specification for First Grade Accuracy, and will withstand a test pressure of 2,000 volts A.C. applied for one minute between the windings and case.

Educational finish, enabling the movement to be seen for demonstration purposes (see Fig. 3) is supplied at the same price as for the protected front finish (Fig. 2).

Tabulated Prices and Other Particulars.

	Ranges Amps.	No. of Scale Divisions		Indication per Division.		Instruments with Back Terminals.			Extra for Front Terminals.
		4 in. & 5 in.	6 in. & 8 in.	4 in. & 5 in.	6 in. & 8 in.	4 in. & 5 in.	6 in.	8 in.	
11475	0/2 mA.	50	100	0·04 mA.	0·02 mA.				
11476	0/5 ,,	50	100	0·1 ,,	0·05 ,,				
11477	0/15 ,,	75	150	0·2 ,,	0·1 ,,				
11478	0/500 ,,	50	100	10 ,,	5 ,,				
11479	0/1 amp.	50	100	20 ,,	10 ,,	£4 3 8	£4 9 0	£5 0 2	£0 6 4
11480	0/5 ,,	50	100	100 ,,	50 ,,				
11481	0/10 ,,	50	100	200 ,,	100 ,,				
11482	0/20 ,,	50	100	400 ,,	200 ,,				
11483	0/30 ,,	60	120	500 ,,	250 ,,				
	Volts.								
11484	0/75 mV.	75	150	1 mV.	0·5 mV.				
11485	0/150 ,,	75	150	2 ,,	1 ,,	3 19 4	4 4 8	4 15 10	
11486	0/500 ,,	50	100	10 ,,	5 ,,				
11487	0/1 volt	50	100	20 ,,	10 ,,				
11488	0/5 ,,	50	100	100 ,,	50 ,,	4 1 6	4 6 10	4 18 0	
11489	0/10 ,,	50	100	200 ,,	100 ,,				
11490	0/50 ,,	50	100	1 volt	500 ,,	4 3 2	4 8 6	4 19 8	0 4 0
11491	0/75 ,,	75	150	1 ,,	500 ,,	4 4 4	4 9 8	5 0 10	
11492	0/100 ,,	50	100	2 ,,	1 ,,	4 5 0	4 10 4	5 1 6	
11493	0/150 ,,	75	150	2 ,,	1 ,,	4 8 2	4 13 6	5 4 8	
11494	0/200 ,,	50	100	4 ,,	2 ,,	4 10 2	4 15 6	5 6 8	
11495	0/300 ,,	65	130	4 ,,	2 ,,	4 10 8	4 16 0	5 7 2	

Instruments for intermediate ranges can be supplied at the price for the next higher range.

PORTABLE MOVING COIL AND MOVING IRON INSTRUMENTS, 8" SCALE, MILLIAMMETERS, MILLIVOLTMETERS, AMMETERS, VOLTMETERS

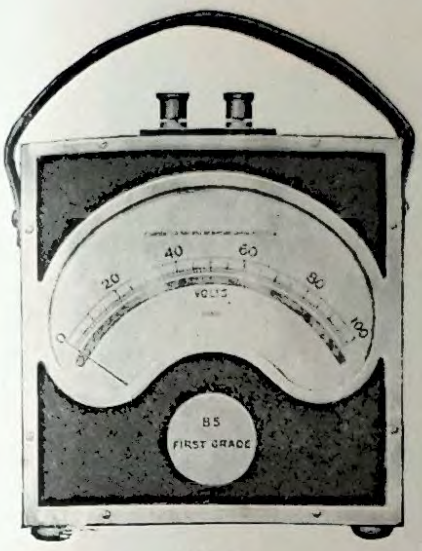


Fig. 1.
Standard "LD" pattern Portable Moving Coil Voltmeter.

Movements generally similar to those assembled into the 8-in. dial, 8-in. scale instruments on pages 447 and 448 are also mounted into portable carrying cases. These cases are of polished seasoned oak with metal fronts, black finish and with bright metal facings. All these instruments are provided with white enamelled dials and include an anti-parallax mirror under the scale.

Every instrument is balanced for use in any position and the cases are provided with resilient rubber feet both on their base and back for vertical and horizontal reading. Unless otherwise requested the instruments are calibrated horizontally.

The movements are all exposed for demonstration purposes. The scale figuring and dividing is generally similar to that given for the 8-in. dial instruments on page 448, but the moving iron instruments are not divided below $\frac{1}{10}$ of their maximum reading, and below $\frac{1}{5}$ the scale divisions tend to close together.

Every instrument is provided with an external zero adjuster.

Where instruments are intended for portable use on benches these instruments save the cost of providing carrying battens and in addition the anti-parallax mirror is provided.

The cases are provided with a leather carrying handle, but if preferred this may be omitted.

Prices:

MOVING COIL INSTRUMENTS

11496	**Ampere Indicator** only (0/75 millivolts) for use with external shunts	£6 16 0
11497	**Volt Indicator** only (0/15 milliamperes) for use with external resistances	6 16 0
11498	**Milliammeters** from 0·5 upwards, or **Ammeters** for any range up to 0/150 amperes	7 13 0
11499	**Millivoltmeters** from 0/50 millivolts upwards or **Voltmeters** up to 0/10 volts	6 16 0
11500	,, ,, 0/50 ,, ...	7 1 0
11501	,, ,, 0/100 ,, ...	7 5 9
11502	,, ,, 0/150 ,, ...	7 11 0
11503	,, ,, 0/300 ,, ...	8 5 9

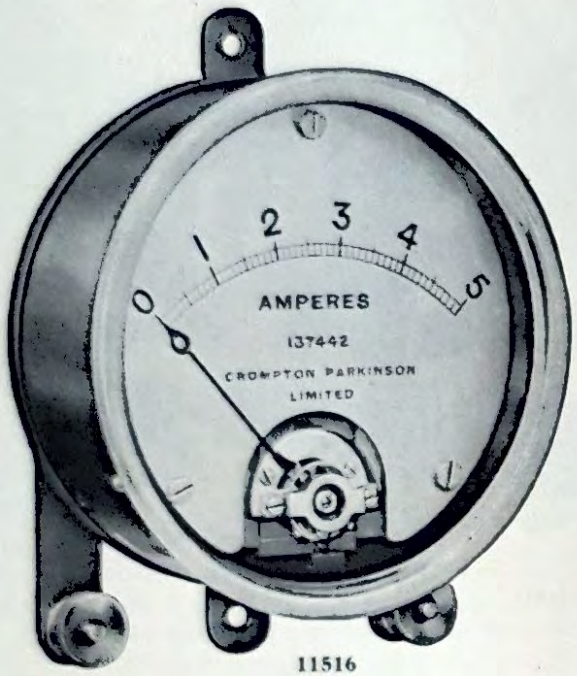
*Instruments for intermediate ranges can be supplied at the prices for the next higher range. "Alltest" bobbin resistances (page 446), can be used to extend the range of the 0/150 or 0/300 voltmeters if required.

MOVING IRON INSTRUMENTS

11504	**Ammeters** for any range from 0/100 milliamperes up to 0/20 amperes	£5 5 9
11505	**Ammeters** 0/30 amperes	5 7 3
11506	,, 0/50 ,, ...	5 10 9
11507	,, 0/100 ,, ...	5 19 0
11508	,, 0/150 ,, ...	6 4 6
11509	,, 0/200 ,, ...	6 8 6
11510	,, 0/300 ,, ...	6 11 6
11511	**Voltmeters** for any range from 0/5 up to 0/60 volts	5 8 9
11512	**Voltmeters** 0/100 volts	5 13 9
11513	,, 0/150 ,, ...	5 19 0
11514	,, 0/300 ,, ...	6 12 0
11515	,, 0/600 ,, ...	7 7 9

Instruments for intermediate ranges can be supplied at the prices for the next higher ranges.

3" DIAL MOVING COIL INSTRUMENTS



11516

11516 MOVING COIL MILLIAMMETERS, MILLIVOLTMETERS, AMMETERS, AND VOLTMETERS

The same movement is fitted into self-contained milliammeters, ammeters, millivoltmeters, and voltmeters.

All are balanced for use in any position and are suitable for mounting either vertically, horizontally, or on 45° angle battens for bench use.

Every instrument is fitted with an external zero adjuster and has its movement in view. Full particulars of resistance, etc., are given on the dials. Back terminals will be fitted free, if preferred. Ammeters for any range from 0/2 milliammeters up to 0/30 amperes, and voltmeters for any range from 0/75 millivolts up to 150 volts or "Universal Indicators" are supplied.

Price each ... ... nett **£1 18 0**

11517 MOVING IRON MILLIAMMETERS, AMMETERS, AND VOLTMETERS

Mumetal iron movements are also fitted into these cases. They are suitable for use on either direct or alternating current. They give first grade accuracy on either supply. All are spring controlled and suitable, like the Moving Coil Instruments, for use in any position, but are not fitted with external zero adjuster. The zero position can, if necessary, be corrected readily if the case is removed. While not deadbeat, the pointers come to rest in a few seconds on a steady supply. Ammeters for any range from 0/100 milliamperes up to 0/30 amperes and voltmeters for any range from 0/5 volts up to 0/120 volts are supplied.

Price each ... ... nett **£1 8 0**

INDICATING WATTMETERS (New Design, see page 625)

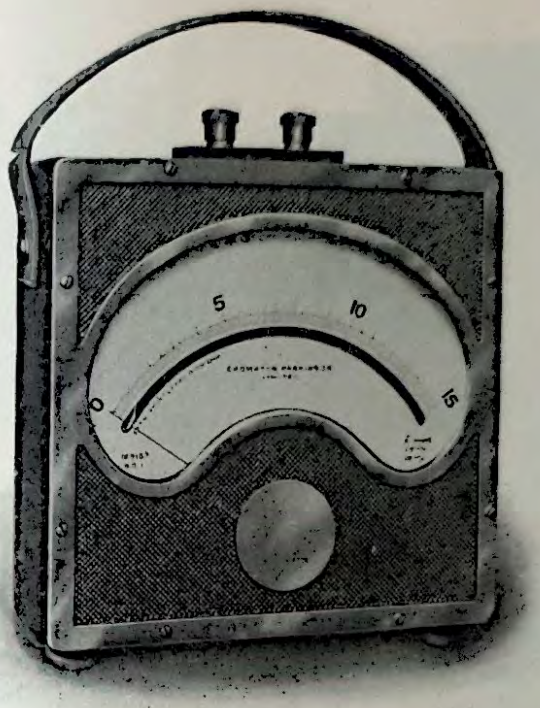


Fig. 1.

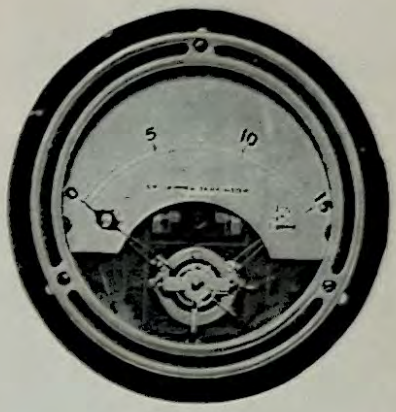


Fig. 3.

Projecting Type with Open Dial and Exposed movement, for Educational purposes.

"UNIVERSAL INDICATORS."
MOVING COIL, FOR DIRECT CURRENT MEASUREMENTS

The British Engineering Standard Association's current Specification for moving coil instruments requires that every moving coil ammeter shall be a 0/75 millivoltmeter indicating the potential drop across shunts of the carrying capacity for the current required to be measured, the shunts being arranged either inside the instrument or externally.

It follows, therefore, that an instrument giving full scale deflection at 75 millivolts can be used with any shunt of any make which complies with the B.E.S.A. Specification.

All moving coil voltmeters are actually milliammeters indicating the current in resistances of values varying with the potential to be measured, the current at full potential generally being 15 milliamperes.

If an indicating instrument gives full scale deflection at 75 millivolts and 15 milliamperes (5 ohms, including the necessary swamp resistance to reduce temperature co-efficient error), such an instrument would be a "Universal Indicator" for all standard shunts of any capacity and for use with standard voltmeter resistances.

If purchase of moving coil instruments are confined to these "Universal Indicators," any such instrument, with the addition of comparatively cheap multipliers, can be used for all tests. Any standard shunts or resistances already in the possession of customers can be used in conjunction with these instruments.

Fewer instruments will have to be purchased if "Universal Indicators" are employed than if each instrument is self-contained for a single range.

Shunts of American make generally have a potential drop of 50 millivolts at full rated current and these would, therefore, give two-thirds full scale deflection on the indicator, i.e., to 10 on the scale for full rated current.

The "Universal Indicator" movements are manufactured in three sizes, for assembly into instrument cases having diameters of 3, 6, and 8 in.; the two larger sizes have scale lengths of 6 and 8 in. respectively, while the 3-in. dial instrument has a scale length of 2⅜ in.

The 6 and 8-in. instruments (see Figs. 1, 2 and 3), have 150 part scales and are figured 0/15, the direct reading on the instrument corresponding to ·1 milliampere (100 micro-amperes) and ·5 millivolts (500 micro-volts) per scale division.

The 8-in. scale movement can also be fitted into a portable carrying case and arranged with terminals suitable for taking direct attachment of shunts for current measurements and bobbin resistances for volt measurements, thus eliminating potential leads (see Fig. 2).

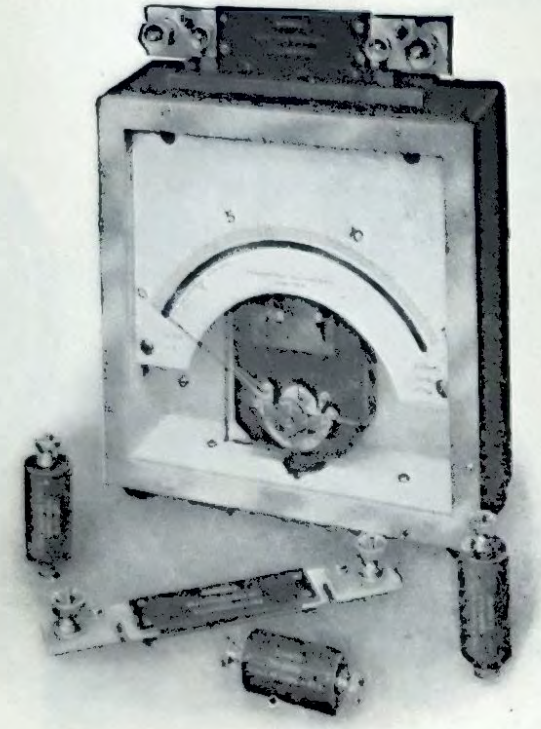


Fig. 2. Universal Indicator.
For Educational and Laboratory use
(with Slotted Shunts and Resistance Bobbins)

"UNIVERSAL INDICATORS"—*continued.*

The 3-in. dial "Universal Indicator" has 30 scale divisions and is identical so far as its movement and scale are concerned, with the well-known "Alltest" instrument.

The multipliers are multiples or sub-multiples of 15 to conform with the number of scale divisions for convenient reading, as given on pages 445 and 446, on which prices are also given.

All of these "Universal Indicators" have their movements exposed for demonstration purposes. They are suitable for use with thermo-couples as one half to two-thirds full scale deflection may generally be obtained with a single copper-eureka couple heated in a Bunsen flame.

The switchboard pattern instruments, if required for close reading, may be fitted with knife-edge pointers instead of spade pointers, and are provided with a matt finish aluminium dial. The portable pattern instruments have white enamelled brass dials and anti-parallax mirrors.

Unless otherwise ordered the switchboard pattern are calibrated at an angle of 45° for mounting on a batten and the portable pattern are calibrated horizontally, but both patterns are balanced for use in any position, and the indications then given are within the requirements of the current B.E.S.A. Specification for First-Grade Accuracy.

11519	**3-in. Dial "Universal Indicator"** scaled as "Alltest" on page 445 and in a case similar to the Galvanometers on page 429 ... ... nett	**£1**	**18** **0**
11520	6-in. dial, 6-in. scale, as Fig. 3	**4**	**6** **10**
11521	8-in. dial, 8-in. scale, as Fig. 3	**4**	**18** **0**
11522	8-in. scale portable pattern with protected or open glass front, arranged with terminals either as Fig. 1 or Fig. 2	**6**	**16** **0**
11523	**Shunts,** portable pattern or specially slotted type, for any range up to 30 amps. each 60 amps. ..	**0** **0**	**8** **0** **12** **0**
11524	"Alltest" resistances, any standard range up to 150 volts (2 for 300 volts), see page 446.		

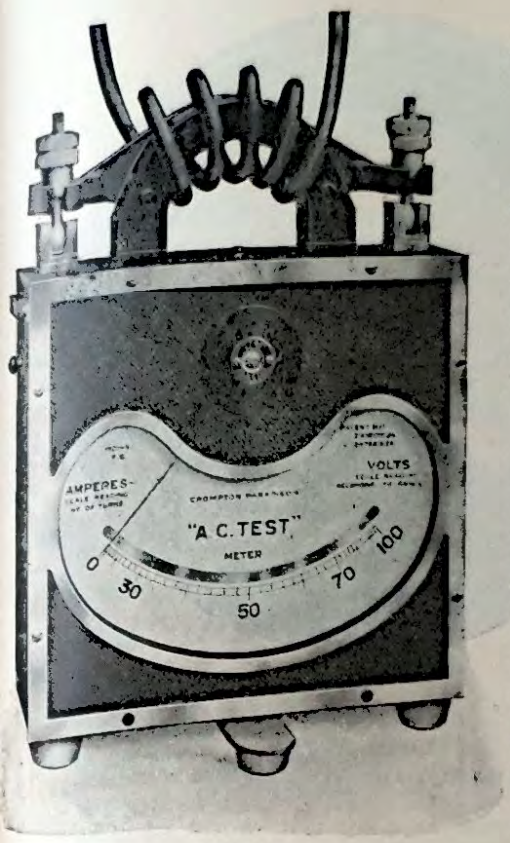


Fig. 1.

"A.C.Test" Instrument arranged as an Ammeter for 0/20 amps.

"A.C. TEST." FOR ALL ALTERNATING CURRENT MEASUREMENTS.

Milliamperes, Amperes, and Volts. An Indicating Fluxmeter for Magnet Comparisons.

The "A.C. TEST" Instrument is actually a Fluxmeter calibrated in ampere turns.

PRINCIPLE OF OPERATION. The principle on which the "A.C. TEST" operates is generally similar to that of the ordinary moving iron instrument, but instead of the movement operating within the field of a coil surrounding the moving iron, it is placed in a suitably shaped gap in a pack of circular iron stampings similar to those used in a Ring Type Current Transformer. The effect, therefore, is to combine a transformer and an indicating instrument in one piece of apparatus.

CONSTRUCTION. The movement is mounted in an oak carrying case with a removable leather carrying handle, has a cast aluminium front finished in black and with bright metal facings. It is provided with a zero adjuster and with rubber pads both on its back and its base to enable it to be used in either a horizontal or vertical position. A rotating foot is provided to give stability when the instrument is used vertically.

RANGES AS AN AMMETER. The instrument can be arranged to give full scale deflection with any current from 100 to 300 amperes when a single conductor, corresponding to one turn, is placed through the ring: the first scale marking being in every case 1/10 of the maximum. Each instrument has an infinite number of ranges downwards from its maximum, the scale reading being devisable by the number of turns when more than one turn is passed through the iron ring.

Suitable multi-turn attachments are listed for low-current measurements, but it will be obvious that a "Wireless" coil may be used. A coil of 1,000 turns, or 2 coils of 500 turns in series, would give a range of 10 to 100 mA.

POTENTIAL INDICATION. For potential measurements an attachment similar to the multi-turn low-current attachment is supplied, the number of turns employed giving full scale deflection at 75 mA. and includes the necessary series resistance up to 100 volts. Above 100 volts an external resistance arranged for screwing direct to the back of the "A.C.TEST" instrument is supplied. This external resistance box is arranged for a maximum of 600 volts, but tappings giving intermediate ranges below that figure and above 100 volts can be provided.

The "A.C.TEST" is the only instrument giving such unique services, and it will be noted that its range may be from a few milliamperes up to 100 amperes, and from 10 volts up to 600 volts.

USE AS A FLUXMETER

If the iron ring projecting from the top of the case is removed and a permanent magnet placed across the ends of the other half of the iron circuit which projects from the instrument case, a deflection will be given depending on the strength of the magnet under test.

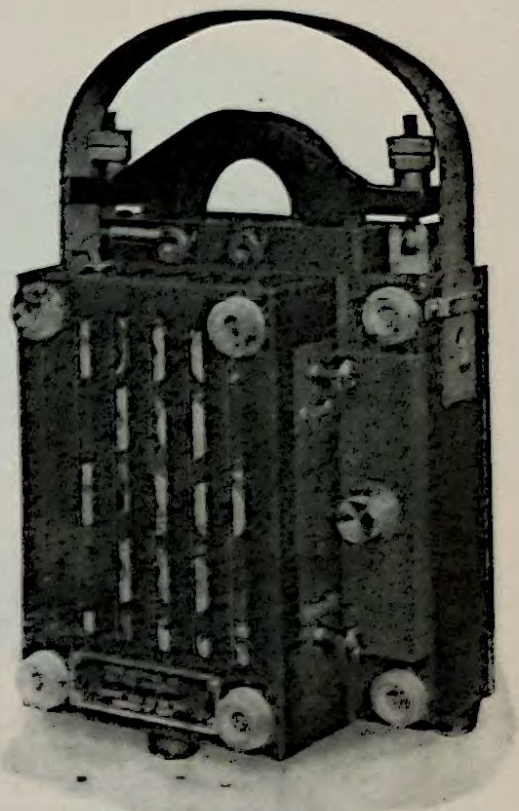


Fig. 2.

"A.C.Test" Instrument complete with Volt Attachment for 100 volts and with Resistance Box to give Ranges up to 600 volts.

"A.C. TEST" INSTRUMENT AND ATTACHMENTS

		£	s	d
11526	**Multi-range "A.C. Test,** scaled 0/100 amps.	7	10	0
11527	" " " " 0/200 "	7	10	0
11528	" " " " 0/300 "	7	10	0
11529	" " " " with three ranges of 0/100, 0/300, and 0/600 volts...	11	11	3
11530	Multi-turn Attachment for 100 ampere "A.C. Test" for low current measurements, standard windings as below ... ... each	1	5	0
	0/50 milliamps. 0/100 milliamps. 0/500 milliamps. 0/1000 milliamps. 0/5 amperes.			
11531	Ditto, for 0/200 ampere "A.C. Test" standard windings as below	1	5	0
	0/2 amperes. 0/5 amperes. 0/10 amperes.			
11532	**Volt Attachment** for 100 amps. "A.C. Test," converting it into a Voltmeter reading 0/100 volts ...	1	5	0
11533	**Resistance Box** to fit instrument, and for coupling in series with Volt Attachment, giving additional range, up to maximum of 600 volts (state range required when ordering)	2	3	9
11534	If Terminals are provided on the Resistance Box for additional range between 100 volts and the maximum for which the box is arranged ... ... extra	0	12	6
	(State range required when ordering.)			
11535	**Maximum Demand Indicator** with five seconds Time Lag, for the 0/200 or 0/300 amp. "A.C. Test"	2	3	9
11536	**Push up Pointer Attachment,** to enable currents with durations down to $\frac{1}{10}$th second to be accurately measured	0	5	0



Actual Size.

11540-45

PROJECTING TYPE

AMMETER OR VOLTMETER

	Metal Cover
Diameter of Front of Cover ..	.. 2 5/8 in.
Diameter of Base of Cover ..	.. 2¼ ,,
Depth Over All	.. 1¼ ,,



Actual Size.

11546-9

FLUSH TYPE

AMMETER OR VOLTMETER

	Metal Cover
Diameter over Flange	.. 3½ in.
Diameter over Cover	.. 2½ ,,
Depth Over All	.. 1¼ ,,
Length of Scale	.. 2·38 ,,

PARK ROYAL ELECTRICAL MEASURING INSTRUMENTS

All instruments are fitted with our Patent "Pivaspring" Movements. This ensures that the suspending moving parts are not damaged through shock or vibration. It is impossible for the pivot and jewels to receive a direct blow. The instruments are thus assured of a long useful life.

Type M.C. 2½P (scale full size). This type of instrument is suitable for checking milliampere consumption on radio sets. The movement is mounted on a moulded bakelite base which makes a dust-proof cover. The covers are made of stamped metal finished in ebony black enamel, and can be either of the projecting or flush type as illustrated.

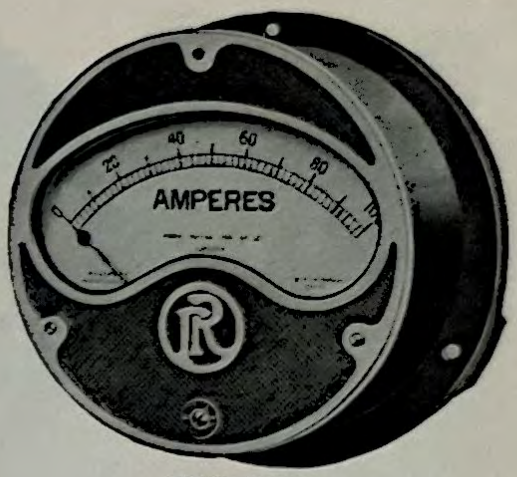
11540	Ammeters, direct current up to 30 amps.	**£1 19 0**
11541	Voltmeters, direct current up to 150 volts	**1 19 0**
11542	Ammeters, alternating current up to 25 amps.	**1 19 0**
11543	Voltmeters, alternating current up to 50 volts	**1 19 0**
11544	Ammeters, direct current 0-20 milliamperes, or higher	**1 19 0**
11545	Voltmeters, direct current 0-20 millivolts, or higher	**1 19 0**

Type M.I. 2½F (scale full size). Type M.C. is suitable for direct current only, whilst type M.I. is suitable for alternating and direct current. Both types are well damped and are calibrated to British Engineering Standards Specification No. 89/1929, for First Grade Accuracy. Voltmeters can be supplied with 1,000 ohms per volt resistance for D.C. only.

11546	Ammeters, direct current up to 30 amps.	**£1 19 0**
11547	Voltmeters, direct current up to 150 volts	**1 19 0**
11548	Ammeters, alternating current up to 25 amps.	**1 19 0**
11549	Voltmeters, alternating current up to 50 volts	**1 19 0**

PARK ROYAL ELECTRICAL MEASURING INSTRUMENTS

This class of instrument is used for switchboard mounting and is made either for projecting or flush mounting, the moving coil type being suitable for Direct Current only. The moving iron type is suitable for Alternating or Direct Current. The case is constructed of cast iron, made perfectly dust and weather proof, finished in high-class all-black stove enamel They comply fully to British Engineering Standards Association, Specification No. 89/1929, for First Grade Accuracy.



11550–11580

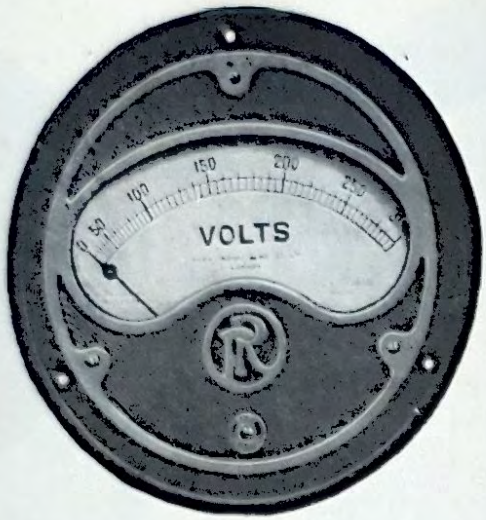
PROJECTING PATTERN MOVING COIL INSTRUMENTS

Ammeters.	Maximum Reading.	Nominal 4 in. diameter. 4½ in. scale. Price.	Nominal 6 in. diameter. 6½ in. scale. Price.	Nominal 8 in. diameter. 8½ in. scale. Price.
11550	10	£4 3 8	£4 9 0	£5 0 2
11551	30	4 3 8	4 9 0	5 0 2
11552	60	4 5 6	4 10 10	5 2 0
11553	80	4 7 0	4 12 4	5 3 6
11554	100	4 8 2	4 13 6	5 4 8
11555	120	4 9 4	4 14 8	5 5 10
11556	150	4 11 4	4 16 8	5 7 10
11557	200	4 11 8	4 17 0	5 8 2
Voltmeters.				
11558	10	4 1 6	4 6 10	4 18 0
11559	50	4 3 2	4 8 6	4 19 8
11560	80	4 4 4	4 9 8	5 0 10
11561	100	4 5 0	4 10 4	5 1 6
11562	120	4 5 6	4 10 10	5 2 0
11563	160	4 8 2	4 13 6	5 4 8
11564	200	4 10 2	4 15 6	5 6 8

PROJECTING PATTERN MOVING IRON DITTO.

Ammeters.	Maximum Reading.	Nominal 4 in. diameter. 4 in. scale. Price.	Nominal 6 in. diameter. 6 in. scale. Price.	Nominal 8 in. diameter. 8 in. scale. Price.
11565	10	£2 4 2	£2 9 0	£2 19 0
11566	30	2 4 2	2 9 0	2 19 0
11567	60	2 7 0	2 11 10	3 1 10
11568	80	2 7 2	2 12 0	3 2 0
11569	100	2 8 2	2 13 0	3 3 0
11570	120	2 9 2	2 14 0	3 4 0
11571	150	2 9 8	2 14 6	3 4 6
11572	200	2 12 2	2 17 0	3 7 0
Voltmeters.				
11573	Blank	2 10 8	2 15 6	3 5 6
11574	10	2 9 2	2 14 0	3 4 0
11575	50	2 9 2	2 14 0	3 4 0
11576	80	2 9 6	2 14 4	3 4 4
11577	100	2 10 0	2 14 10	3 4 10
11578	120	2 10 8	2 15 6	3 5 6
11579	160	2 12 8	2 17 6	3 7 6
11580	200	2 16 6	3 1 4	3 11 4

Above prices do not include Cable Sockets and Fixing Bolts. Extra for Spring Control, 4 6 per instrument.



11582-11612

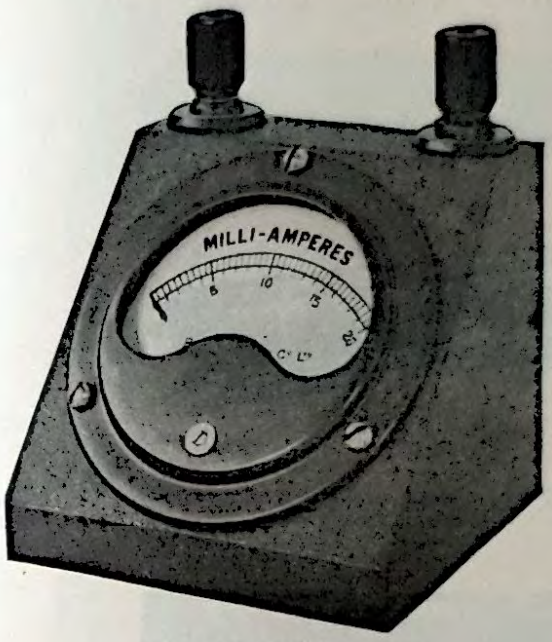
PARK ROYAL ELECTRICAL MEASURING INSTRUMENTS
FLUSH PATTERN MOVING COIL INSTRUMENTS

	Maximum Reading.	Nominal 6 in. diameter. 6½ in. scale. Price.	Nominal 8 in. diameter. 8⅛ in. scale. Price.
Ammeters.			
11582	10	£5 2 0	£5 13 2
11583	30	5 2 0	5 13 2
11584	60	5 3 10	5 15 0
11585	80	5 5 4	5 16 6
11586	100	5 6 6	5 17 8
11587	120	5 7 8	5 18 10
11588	150	5 9 8	6 0 10
11589	200	5 10 0	6 1 2
Voltmeters.			
11590	10	4 19 10	5 11 0
11591	50	5 1 6	5 12 8
11592	80	5 2 8	5 13 10
11593	100	5 3 4	5 14 6
11594	120	5 3 10	5 15 0
11595	160	5 6 6	5 17 8
11596	200	5 8 6	5 19 8

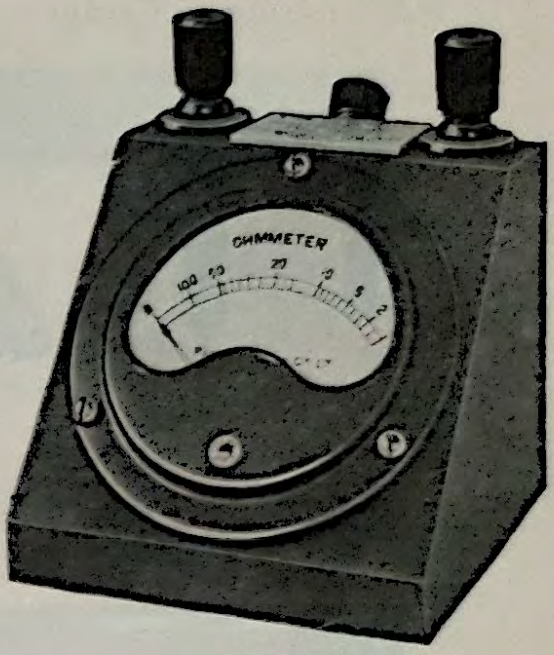
FLUSH PATTERN MOVING IRON INSTRUMENTS

Ammeters.	Maximum Reading.	Nominal 6 in. diameter. 6 in. scale. Price.	Nominal 8 in. diameter 8 in. scale. Price.
11597	10	£3 2 0	£3 12 0
11598	30	3 2 0	3 12 0
11599	60	3 4 10	3 14 10
11600	80	3 5 0	3 15 0
11601	100	3 6 0	3 16 0
11602	120	3 7 0	3 17 0
11603	150	3 7 6	3 17 6
11604	200	3 10 0	4 0 0
Voltmeters.			
11605	Blank	3 8 6	3 18 0
11606	10	3 7 0	3 17 0
11607	50	3 7 0	3 17 0
11608	80	3 7 4	3 17 4
11609	100	3 7 10	3 17 10
11610	120	3 8 6	3 18 6
11611	160	3 10 6	4 0 6
11612	200	3 14 4	4 4 4

Above Prices are exclusive of Cable Sockets and Fixing Bolts, but include External Resistances where necessary.



11614–11618



11619

BENCH TYPE MINIATURE TESTING INSTRUMENTS

Dimensions of Stand: Width 3½ in., Depth 3¼ in., Height 3 in. Scale Length 2–38 in.

The model illustrated can be supplied as a Galvanometer, Milliammeter, Millivoltmeter, Ammeter or Voltmeter, each of which is fitted with our Patent "Pivispring" Suspension. The instrument is flush pattern with Ebony finish, mounted on a crystallised finished Metal Stand, fitted with Bakelite covered Terminals.

11614 **Galvanometer.** This Galvanometer is scaled 30–0–30 and is graduated 30 divisions either side of zero. Resistance is approx. 70 ohms. Current required for one division deflection is approx. 9 micro amperes. If this instrument is required to be less sensitive, a suitable resistance can be connected across the terminals £3 15 0

11615 **Millivoltmeters**

Maximum Reading 20 50 75 100 250 ... ... each 3 6 9

11616 **Voltmeters**

Maximum Reading 25 10 15 25 50 ... ... 3 6 9

11617 **Milliammeters**

Maximum Reading 2 3 4 5 10 20 ... . 3 7 6

11618 **Ammeters**

Maximum Reading 2 5 10 15 20 25 ... . 3 6 9

Any of the above can be supplied Central Zero without extra charge.

OHMMETERS

This Bench Type Ohmmeter is suitable for reading direct Ohms on D.C. resistance testing. The scale is a very open one for the lower readings and requires only a 2-volt cell to actuate it. The Moving Coil is fitted with our Patent Spring Pivots, which render the instrument immune to shock and vibration. The Ohmmeter is also fitted with a regulating device for accurately setting it to the voltage of the cell in use, thereby maintaining an accuracy within 1 per cent.

11619 **Ohmmeters**

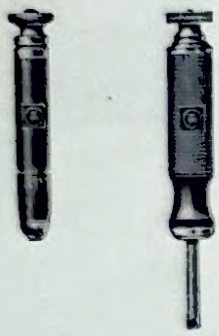
Maximum Reading 100 500 1000 ... ... each £4 4 0

Extras

2-volt Battery, Type O.V.D. 0 5 6

Wheatstone's Bridges, Resistance Coils, Boxes, etc.

A B

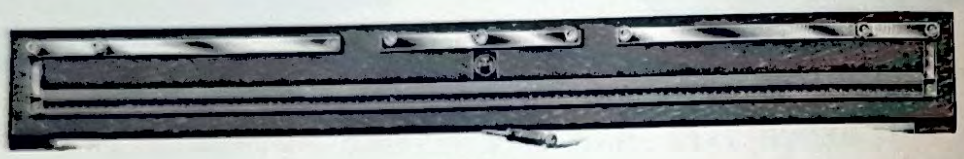


11624



11620–21

11620	**Wheatstone Bridge,** ½ metre, with Sliding Jockey and Boxwood Scale on Polished Mahogany Base, each	£0 18 6
11621	Ditto, ditto, as above, 1 metre long ... ... ,,	1 6 0



11622–23

11622	**Bridge, Wheatstone's,** ½ metre long, with Boxwood Scale, divided into centimetres and millimetres, with Loose Jockey, on Polished Mahogany Base ... ... each	£1 1 0
11623	Ditto, ditto, as above, 1 metre long, with Loose Jockey on Mahogany Base ... ... ,,	1 7 6
11624	**Spare Jockeys** for above Bridges, either Pattern A or B	0 1 9



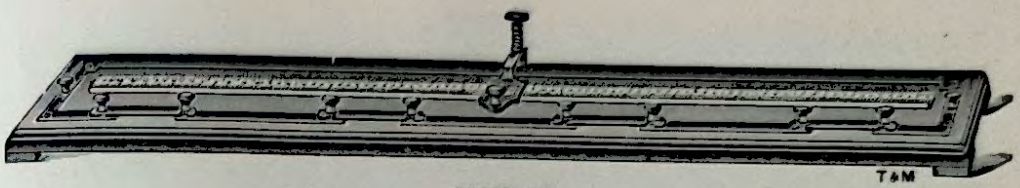
11625–26

11625	**Bridge, Wheatstone's,** ½ metre long, with Boxwood Scale divided into centimetres and millimetres, one edge, and in inches and tenths on the other. Sliding Spring Jockey with fine line on Celluloid for reading, complete on Polished Base	£1 5 0
11626	Ditto, ditto, as above, 1 metre long	1 10 0



11627–28

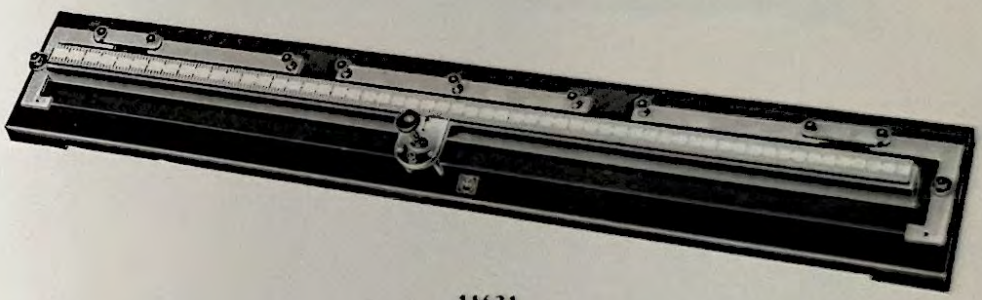
11627	**Bridge, Wheatstone's,** ½ metre long, best quality with Boxwood Rule divided into centimetres and millimetres one edge, and in inches and tenths on the other. Improved sliding Spring Jockey, complete on Polished Teak Base ... ... each	£1 15 0
11628	Ditto, ditto, as above, 1 metre long	2 5 0



11629-30

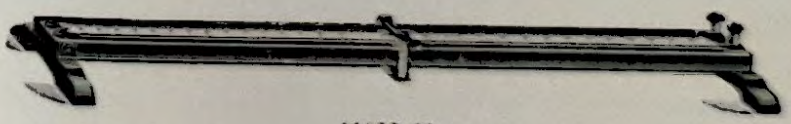
11629 **Bridge,** Wheatstone's, Foster's Method, 1 metre long, with Boxwood Scale divided into centimetres and millimetres, Stout Copper Band with breaks fitted with Terminals and Connecting Bars, Sliding Spring Jockey with Platinum Contact and fine line on Celluloid for reading, on Polished Mahogany Base **£3 10 0**

11630 Ditto, ditto, as above, ½ metre long **2 12 6**



11631

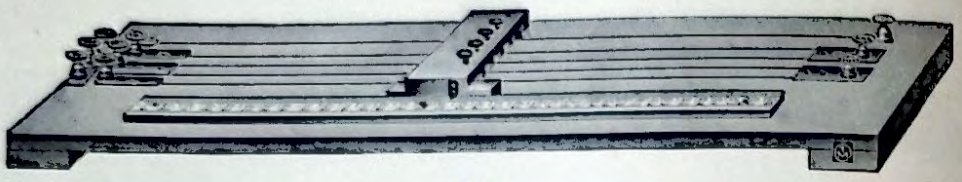
11631 **Wheatstone Bridge,** Foster's Method, 1 metre long, with Boxwood Scale graduated into millimetres and reading both ways, with special Pattern Stout Brass Spring Jockey with Platinum Contact, extra heavy Copper Strips and Brass Terminals, on Polished Mahogany Base **5 0 0**



11632-33

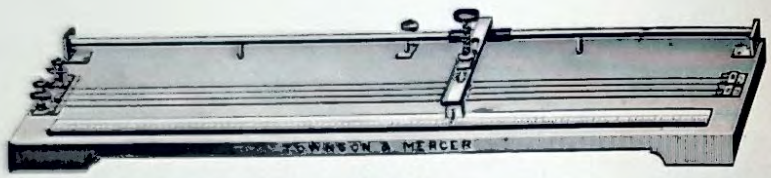
11632 **Potentiometer,** Stewart and Gee's Pattern, ½ metre long, with Boxwood Scale divided into centimetres and millimetres, on Polished Mahogany Base **0 15 0**

11633 Ditto, as above, 1 metre long **1 1 0**



11634

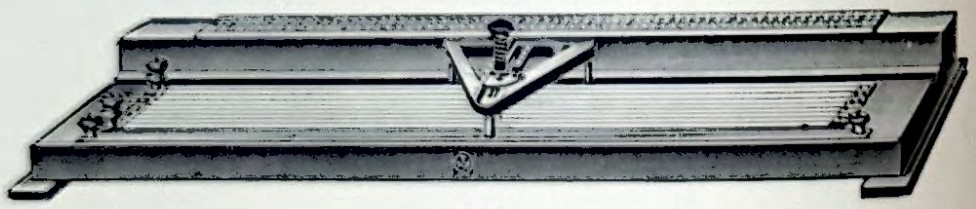
11634 **Potentiometer,** fitted with ½ metre Boxwood Scale divided into 1,000 parts. Slider with four Spring Jockeys, Copper Mounts on Polished Teak Base **£1 15 0**



11635

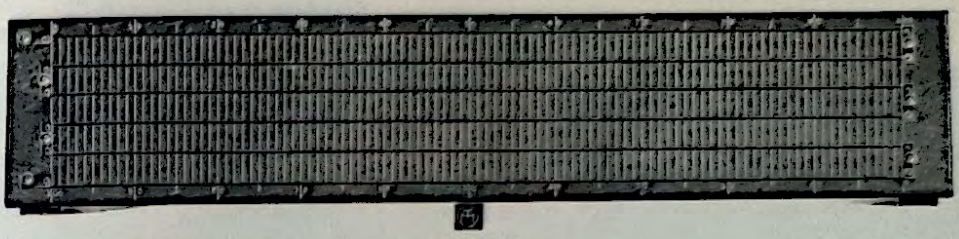
11635 **Potentiometer,** Latimer Clark's, 1 metre long, with Boxwood Scale divided into centimetres and millimetres on one edge and inches and tenths on the other, Platinoid Wire, Spring Sliding Jockey with Platinum Contact mounted on Polished Mahogany Base **3 10 0**

11636 Ditto, student's form, with Sliding Spring Jockey running in Groove, on Hardwood Base **1 12 6**



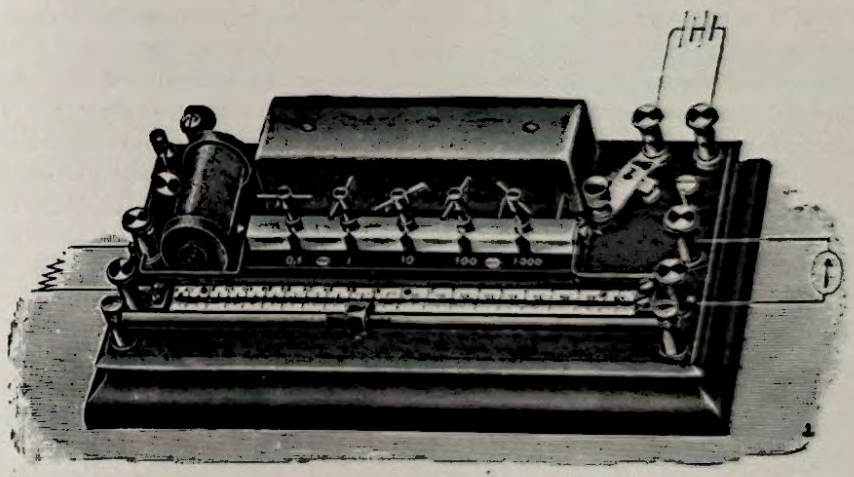
11637

11637 **Laboratory Potentiometer,** University Pattern, on Polished well-seasoned Teak Base, with 10 Wires 1 metre long, lying on top of an Opal Glass Plate. The Contact maker slides along a brass strip and "V" shaped groove. The Boxwood Scale is divided into millimetres and numbered in both directions. The Contact maker is slotted, the Plunger when moved across, clicks into position exactly over each wire, which are numbered on slide indicating the number of wires in circuit **4 17 6**



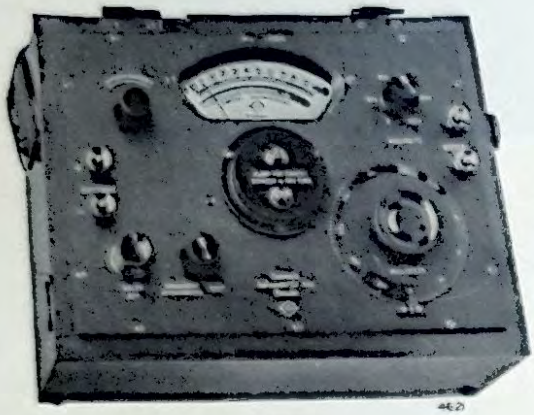
11638

11638 **Potentiometer,** on polished wood base fitted with six wires 1 metre long, complete with 7 terminals **£1 5 0**



11639

11639 **Kohlrausch's Universal Bridge.** This type of Bridge is very convenient, as the resistance can be read off on a scale in ohms direct, without reference to a table of values. The rheostat contains 5 comparative coils of 0·1, 1, 10, 100, 1,000 ohms, and the Bridge is suitable for resistance measurements on solid conductors between about 0·05 and 20,000 ohms with sufficient accuracy for most technical purposes. Using the alternating current of the small induction coil fitted with the instrument and substituting a suitable telephone for the galvanometer, the resistance of electrolytes, such as the internal resistance of cells or the resistance of earth to earth connections on lightning conductors, can be determined **£15 15 0**



11641

29 × 12 × 21 cm. 3·9 kg.

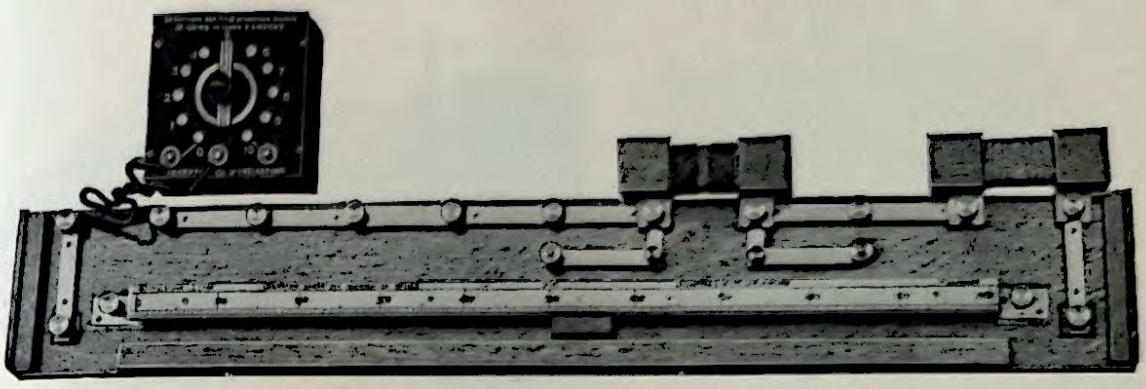


11642

—**11641 Portable Potentiometer, Standard Pattern.** The Potentiometer illustrated in Fig. 11641 is a compact and robust instrument suitable for routine measurements in many industrial processes and for laboratory tests where an instrument of high precision is not essential. It is used extensively in connection with the determination of hydrogen ion concentrations by the electrometric method. The instrument is self-contained, the only accessory being a dry cell. It comprises five 90 ohm coils in series with a 90 ohm slide-wire, together with a Unipivot galvanometer and rheostat for adjusting the battery circuit. When the current is standardised, each coil, and the slide-wire, gives a potential drop of 200 millivolts, the total range of the instrument being 1,200 millivolts. The circular slide-wire has 100 divisions, marked 0-200, each division corresponding to 2 millivolts. A two-position switch enables the galvanometer to be connected either in series with the unknown electromotive force, or across a portion of the potentiometer circuit for standardising. The current is adjusted by means of a rheostat until the galvanometer pointer is deflected to a red mark on the scale. This adjustment can be checked at any time. Terminals are provided for connection to the unknown electromotive force and the dry cell. The potentiometer is enclosed in a portable case, fitted with a carrying strap, and a hinged cover which is easily removable ... **£20 0 0**

***11642 Portable Testing Set.** This Combined Testing Set is for rapidly testing either Resistance or Insulation, and has a range from ·01 ohm to 20 megohms. The Galvanometer is of our Pivoted Moving Coil Type of a high degree of sensitiveness, and as no levelling is required the apparatus can be set up ready for use in a very few minutes. The readings are practically unaffected by the proximity of motors, dynamos, or cables carrying heavy currents. A set of instruction is affixed to each Instrument, which enables anyone to make a test, no previous knowledge of the apparatus being required **18 5 0**

***11643** Ditto, ditto, to measure Insulation from 10,000 ohms to 20 megohms, with Moving Coil Galvanometer, in case as illustrated **10 10 0**



11644-47

CROMPTON-ROBERTSON COMBINATION BRIDGE AND POTENTIOMETER

This Apparatus was designed by Professor David Robertson, B.Sc., M.I.E.E. of the Merchant Venturers' Technical College, Bristol, to meet the double purpose of an ordinary four-gap slide-wire bridge and a simple form of Potentiometer.

It may take the place not only of the ordinary bridge but also, except for the most accurate standardizing work, the Carey-Foster Bridge and Conductivity Bridge.

It has a very wide range reaching from 500 microhms to 50,000 ohms.

Special Features

The special features of this bridge are:—

(*a*) The slide-wire and one of the standard coils are adjusted to have a resistance of 1 ohm with an accuracy of within 1 part in 1,000, so that each scale division is 1 milli-ohm. Besides being useful for other purposes, this makes ordinary resistance coils convenient as extension coils, enabling the dial box (intended as an extension of the slide-wire when used as a potentiometer) to be graduated in ohms, so that it is also available for other purposes.
(*b*) The slide-wire is soldered to the terminal plates, instead of being merely pinched under a screw.
(*c*) While fully visible, and easily accessible for dusting, the slide-wire is completely protected from accidental injury.
(*d*) There is a second detachable slide-wire, which in most tests forms a connection between the slider and the terminals at each end of the bridge, to one of which the galvanometer is connected. This wire can be replaced by any wire up to 18 S.W.G., whose conductivity may be required, in which case the main slide-wire is used as a connector. Or it may be used instead of the main slide-wire, by a simple change in the connections, in those tests (*e.g.*, a comparison by the Carey-Foster method) in which a slide-wire of lower resistance than 1 ohm may be desired.
(*e*) The slider itself is of a new pattern of the utmost simplicity, which makes certain connection between the two slide-wires. It runs very smoothly, being designed on correct geometrical principles, and is easily adjusted within a fraction of a division. It can be removed by sliding it beyond the limits of the scale at either end, and can be as readily re-inserted in place. The actual contacts are gold wires soldered across the contact springs.
(*f*) The scale divisions are 1/40 in. This has long been used by us as the smallest division which can be comfortably read without the aid of a lens, and gives a handy length of bridge.
(*g*) By using screws instead of screwed pillars and nuts for the important contacts, the connecting bars can be easily and perfectly cleaned at these places.
(*h*) Keys for the battery and galvanometer are included on the bridge.
(*i*) All the baseboards are made to one standard length, and have cross straps above and below each end, so that any number can be piled one above the other. The under straps are concave at one end and convex at the other in order to give a steady base on any table.
(*j*) The three-terminal dial switch resistance box is fitted with an efficient substantial switch to ensure certain contact, and the bottom of the box is fitted with a glass window which enables the coils inside to be inspected.
(*k*) The standard coils, which in common with the rest of the apparatus are adjusted to have an accuracy of within 1 part in 1,000, have also been designed for storage one above the other. Throughout the whole set simplicity and visibility have been kept to the forefront, and as the resistance material used is manganin, entire freedom from all thermo electromotive forces is ensured.

List of Experiments with Combination Bridge and Potentiometer

1. Comparison of resistance by the slide-wire bridge (0·01–10,000 ohms).
2. Determination of the centre and end corrections of a slide-wire bridge.
3. Localisation of an earth fault by slide-wire loop test.
4. Measurement of resistance-temperature co-efficient by the slide-wire bridge.
5. Measurement of temperature by the resistance thermometer.
6. Comparison of four-terminal resisters by the slide-wire bridge (down to 100 microhms).
7. Measurement of conductivity by the slide-wire bridge (up to 16 S.W.G. copper).
8. Measurement of difference of standard coils by Carey-Foster's method.
9. Calibration of two slide-wires by Carey-Foster's method.
10. Calibration of two slide-wires by Gray's method.
11. Measurement of galvanometer resistance by the slide-wire bridge (Kelvin's method).
12. Measurement of battery resistance by the slide-wire bridge (Mance's method).
13. Calibration of a sensitive galvanometer by the slide-wire bridge (or fall of potential along a uniform line).
14. Comparison of E.M.F.'s by the potentiometer method.
15. Measurement of the resistance of cells by the potentiometer method.
16. Measurement of the polarization of a cell by the potentiometer method.
17. Comparison of resistances by the potentiometer method.
18. Calibration of a dial box by the potentiometer method.
19. Calibration of an ammeter by the potentiometer method.
20. Calibration of a low-range voltmeter by the potentiometer method.
21. Calibration of a voltmeter by the potentiometer method.

Prices

11644	Four-gap Slide-wire Bridge	**£12 0 0**
11645	Three-terminal dial switch Resistance Box, 1–10 ohm for one ampere	**5 0 0**
11646	Standard Resistance for 1 ohm for screwing directly into a gap of the bridge	**1 10 0**
11647	Standard Resistance for 100 ohm for screwing directly into a gap of the bridge	**1 10 0**
	Pamphlet giving detailed instructions for the experiments mentioned above.— One copy free, extra copies for students ... ... each	**0 3 0**

Besides these, a good galvanometer is necessary for accurate results in all the tests, and in some of the tests additional standard laboratory apparatus such as change-over switch and reversing switch are required as auxiliaries.



11648



11649



11650

*11648 **Resistance Coils,** for Students' use; wound on Ebonite Bobbins of latest design, with Terminals.

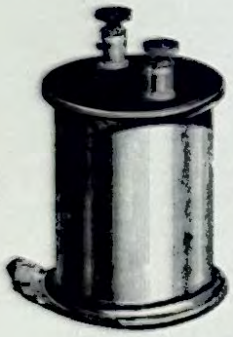
·1	·2	·5	1·0	2·0	5·0	10	20	50	100	500	1,000 ohms
3/6	**3/6**	**3/6**	**4/0**	**4/0**	**4/0**	**4/3**	**4/3**	**4/3**	**4/6**	**5/0**	**5/6** each

*11649 Ditto, wound on Hardwood Bobbins, with Brass Tube Covers and Terminals.

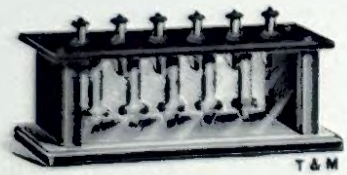
·1	·2	·5	1·0	2·0	5·0	10	20	50	100	500	1,000	5,000	10,000 ohms
4/6	**4/6**	**4/6**	**4/6**	**4/6**	**4/9**	**5/0**	**5/0**	**5/0**	**5/6**	**6/0**	**8/6**	**12/6**	**17/6** each

*11650 Ditto, in Brass Cases with Ebonite Cover, each coil being wound non-inductively, correct to 0·1 per cent.

·1	·2	·5	1·0	2·0	5·0	10	20	50	100	500	1,000 ohms
5/6	**5/6**	**5/6**	**6/6**	**6/6**	**6/6**	**6/6**	**6/6**	**7/6**	**7/6**	**9/6**	**10/0** each



11651



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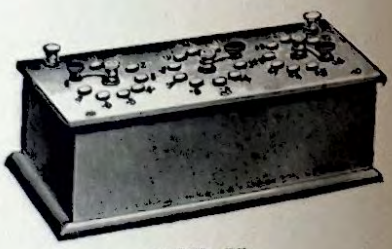


11653–55

*11651 **Resistance Coils,** best quality, in Polished Brass Case, Ebonite top, 2 in. diameter, Double Silk-Covered Platinoid Wire, well insulated, accuracy guaranteed to ·1 per cent.

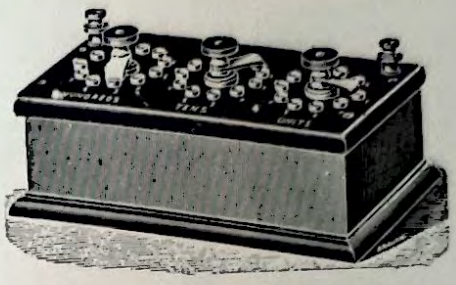
1·0	2·0	5·0	10	20	50	100	200	500	1,000 ohms
17/6	**17/6**	**17/6**	**17/6**	**21/0**	**21/0**	**21/0**	**24/0**	**24/0**	**24/0** each

*11652 **Resistance Boxes,** with Glass both sides, five Coils, reading in units—total=15 ohms, in Mahogany Case ... ... each **£1 10 0**

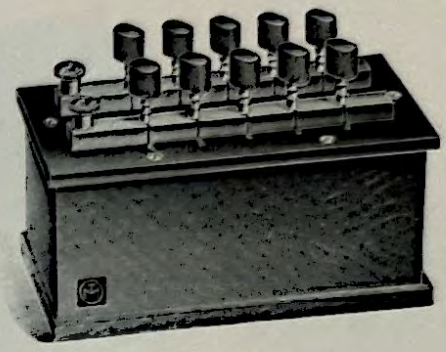
*11653 **Resistance Box,** in Mahogany Case and Ebonite tops, Three Dial, reading in Hundredths, Tenths and Units—total=9·99 ohms **2 5 0**

*11654 Ditto, ditto, Three Dial, in Tenths, Units and Tens—total=199·9 ohms **2 12 6**

*11655 Ditto, ditto, Three Dial, in Units, Tens and Hundreds—total=999 ohms ... **3 0 0**



11656–58



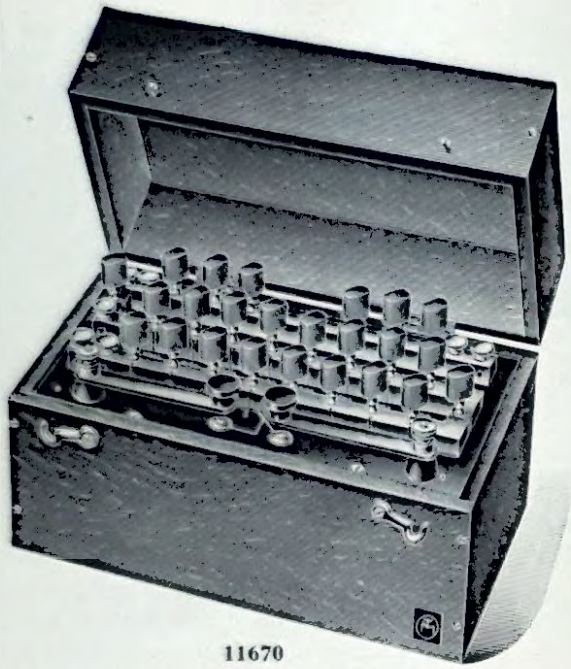
11659–11663

11656	**Resistance Box,** Best Make, in Polished Mahogany Case and Stout Ebonite Top, with Three Dials, reading in Hundredths, Tenths and Units—total=9·99 ohms ...	£5 5 0
11657	Ditto, ditto, Three Dials, in Tenths, Units and Tens—total=99·9 ohms	6 0 0
11658	Ditto, ditto, Three Dials, in Units Tens and Hundreds—total=999 ohms	6 15 0
*11659	**Resistance Boxes,** Special School Sets, adjusted to 0·1 accuracy, mounted in Polished Mahogany Cases with Stout Ebonite Tops and Plug Keys, reading ·01, ·02, ·02 ·05 —total=1 ohm	2 15 0
*11660	Ditto, ditto, reading 1, 2, 2, 5 ohms—total=10 ohms	2 15 0
*11661	Ditto, ditto, reading 1, 2, 2, 5, 10, 20, 20 and 50 ohms—total=110 ohms	2 17 6
*11662	Ditto, ditto, reading 1, 2, 2, 5, 10, 20, 20, 50 and 100 ohms—total=210 ohms ...	3 3 0
*11663	Ditto, ditto, 1-500 ohms—total=1,110 ohms	3 15 0



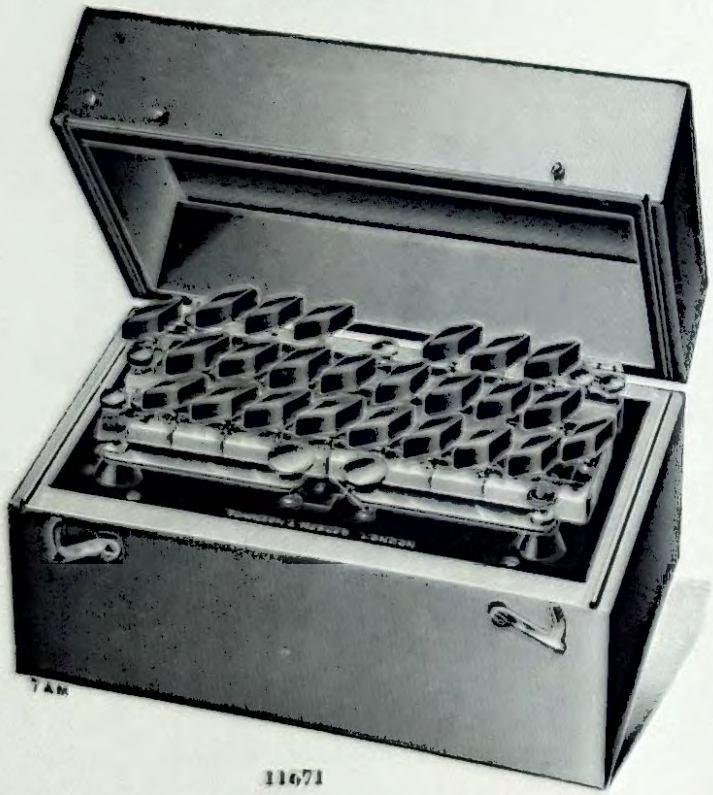
11664–69

*11664	**Resistance Box,** superior finish, mounted in Polished Mahogany Case, heavy brass blocks, Ebonite Tops and Lozenge-shaped Plug Keys, carefully adjusted, reading ·01, ·02, ·02, ·05—total=1 ohm	£3 5 0
*11665	Ditto, ditto, ditto, reading ·01, ·02, ·03, ·04—total=1 ohm	3 5 0
*11666	Ditto, ditto, ditto, reading 1, 2, 2, 5—total=10 ohms	3 5 0
*11667	Ditto, ditto, ditto, reading 1, 2, 2, 5, 10, 20, 20 and 50 ohms—total=110 ohms ...	4 5 0
*11668	Ditto, ditto, reading 1, 2, 2, 5, 10, 20, 20, 50 and 100 ohms—total=210 ohms ...	4 5 0
*11669	Ditto, ditto, reading 1, 2, 2, 5, 10, 20, 20, 50, 100, 200, 200, and 500 ohms—total= 1,100 ohms	6 10 0



11670

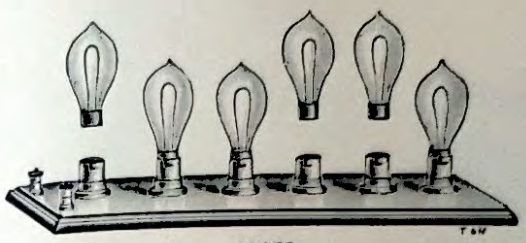
*11670 **Post Office Box,** School Pattern, Stout Ebonite Top and Fittings. The Resistances are from 1 to 5,000 ohms, with proportional arms 10-100 and 1,000 total resistance 13,330 ohms, in Polished Mahogany Case ... ... nett **£8 10 0**



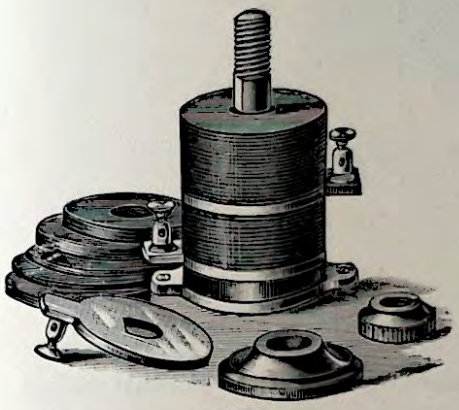
11671

*11671 **Post Office Box,** Superior Make and Finish, with three pairs of Proportional Arms, Resistances, 1 to 5,000 ohms—total=13,330 ohms. Heavy Brass Blocks with Lozenge-shaped Keys and Ebonite Top mounted in Polished Mahogany Case, with removable lid lined with Velvet ... **£12 0 0**

Certificate from the National Physical Laboratory extra **£2 10 0**



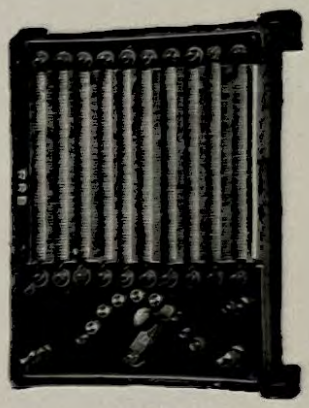
11672



11673



11674



11675-83

11672 **Lamp Resistance,** consisting of Holders for lamps, connected in parallel, with Terminals, mounted on Polished Mahogany Base (without lamps)—

for 4 lamps	6 lamps each
18 6	22 6

11673 **Rheostat,** Varley's, Carbonised Cloth, consisting of a number of Discs which vary in resistance with the pressure, size 4 × 3 in. diameter **£1 15 0**

11674 **Resistance Board,** simple form for currents up to 10 ohms, in Mahogany Frame **1 0 0**

ADJUSTABLE UNIVERSAL SLIDING RHEOSTAT:

When ordering, exact voltage must be stated.

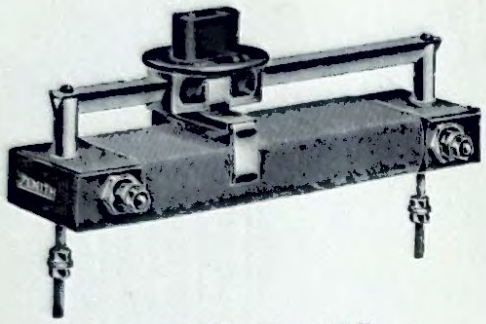
WALL TYPE (REGULATING)

No.	Amps.	Volts 60-75	Volts 100-120	Volts 200-220	Volts 230-250
11675	5-15	**£2 15 0**	**£3 3 0**	**£4 10 0**	**£5 0 0**
11676	5-20	**3 0 0**	**3 10 0**	**5 0 0**	**5 10 0**
11677	10-30	**3 7 6**	**3 18 0**	**5 12 6**	**6 5 0**
11678	10-40	**3 15 0**	**4 10 0**	**6 15 0**	**7 10 0**
11679	20-50	**4 0 0**	**4 15 0**	**8 5 0**	**9 0 0**
11680	20-60	**4 7 6**	**5 15 0**	**10 12 6**	**11 0 0**
11681	30-70	**4 10 0**	**6 5 0**	**12 0 0**	**13 2 6**
11682	30-80	**4 17 6**	**6 12 6**	**13 17 6**	**15 0 0**
11683	30-100	**6 0 0**	**8 5 0**	**16 10 0**	**19 5 0**

Duplex and Dissolving Resistances for fading and controlling two arc lamps, Parallel type with change-over switches, 75 per cent on above prices; Rotary type 100 per cent on above prices.

WALL TYPE (NON-REGULATING)

No.	Amps.	60-75	100-110	200-220	230-250 Volts
11683/1 ...	10 ...	**£1 17 6** ...	**£2 12 6** ...	**£3 17 6** ...	**£4 10 0**
	15 ...	**2 0 0** ...	**2 15 0** ...	**4 10 0** ...	**4 17 6**
	20 ...	**2 2 6** ...	**2 17 6** ...	**4 15 0** ...	**5 0 0**
	25 ...	**2 5 0** ...	**3 0 0** ...	**5 5 0** ...	**5 10 0**



11684-89 Type "A"

Fitted with three Terminals for series and potentiometer use and arranged for switchboard or panel mounting.

ADJUSTABLE LABORATORY RHEOSTATS

This type of Resistance comprises a bar or slab of specially selected slate free from metallic veins, machined and turned with a spiral groove, in which is wound under tension a suitable resistance wire, so that the increased length when expanded by heat does not result in the convolutions working loose and leaving the spiral grooves.

The sliding contact with the wire is made by means of laminated spring brass brushes arranged in such a way as to conduct the current direct from the wire to the triangular sectioned guide bar entirely independent of the perfection of fit between the triangular hole and the guide bar.

These resistances are usually in stock in the types shown in the following pages, but they can be supplied unmounted or arranged in other ways to suit special requirements.

To enable their use as Potentiometers all Resistances are fitted with three Terminals.

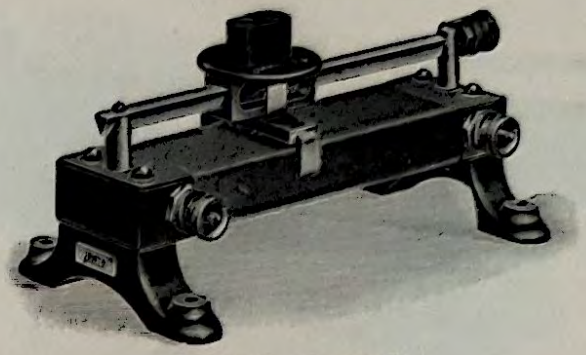
Current values listed are for intermittent work only.

11684 Single Resistances. Size of Slate Bars—4¼ × 1 $\frac{9}{16}$ × ⅜ in.

Maximum current	0·3	0·45	0·6	1·0	1·2	1·5	2·0	3·0	4·0	5·0	7·0	10·0	15·0	amps.
Approx. resistance	250	140	85	55	40	24	14	8	6	2·8	1·7	0·85	0·4	ohms
Price, Type A	**16/-**	**16/-**	**16/-**	**16/-**	**16/-**	**16/-**	**16/-**	**16/-**	**16/-**	**16/-**	**17/-**	**17/-**	**17/-**	each
Price, Type B	**18/-**	**18/-**	**18/-**	**18/-**	**18/-**	**18/-**	**18/-**	**18/-**	**18/-**	**18/-**	**19/6**	**19/6**	**19/6**	"

11685 Single Resistances. Size of Slate Bars—6¼ × 1 $\frac{9}{16}$ × ⅜ in.

Maximum current	0·3	0·45	0·6	1·0	1·2	1·5	2·0	3·0	4·0	5·0	7·0	10·0	15·0	amps.
Approx. resistance	400	250	140	110	60	40	24	16	10	4·5	3	1·5	0·8	ohms
Price, Type A	**19/6**	**19/6**	**19/6**	**19/6**	**19/6**	**19/6**	**19/6**	**19/6**	**19/6**	**19/6**	**21/6**	**21/6**	**21/6**	each
Price, Type B	**22/-**	**22/-**	**22/-**	**22/-**	**22/-**	**22/-**	**22/-**	**22/-**	**22/-**	**22/-**	**23/6**	**23/6**	**23/6**	"



11684–89 Type "B"

Fitted with three Terminals for series and potentiometer use, and arranged for bench and wall mounting.

11686 Single Resistances. Size of Slate Bars—7¼ in. × 2 in. × 13/16 in.

Maximum current ...	0·3	0·45	0·6	1·0	1·2	1·5	2·0	3·0	4·0	5·0	7·0	10·0	15·0	20·0 amps.
Approximate resistance ...	650	420	230	150	100	65	35	24	16	8	5	2·5	1·0	0·5 ohms
Price, Type A	**24/6**	**24/6**	**24/6**	**24/6**	**24/6**	**24/6**	**24/6**	**24/6**	**24/6**	**24/6**	**27/0**	**27/0**	**27/0**	**27/0** each
„ Type B	**32/6**	**32/6**	**32/6**	**32/6**	**32/6**	**32/6**	**32/6**	**32/6**	**32/6**	**32/6**	**34/6**	**34/6**	**34/6**	**34/6** „

11687 Single Resistances. Size of Slate Bars—11 13/16 in. × 2 in. × 1 in.

Maximum current ...	0·3	0·45	0·6	1·0	1·2	1·5	2·0	3·0	4·0	5·0	7·0	10·0	15·0	20·0 amps.
Approximate resistance ...	1,200	800	450	300	220	120	70	45	28	15	8	4	2	1 ohms
Price, Type A	**31/0**	**31/0**	**31/0**	**31/0**	**31/0**	**31/0**	**31/0**	**31/0**	**31/0**	**31/0**	**34/0**	**34/0**	**34/0**	**34/0** each
„ Type B	**40/0**	**40/0**	**40/0**	**40/0**	**40/0**	**40/0**	**40/0**	**40/0**	**40/0**	**40/0**	**44/0**	**44/0**	**44/0**	**44/0** „

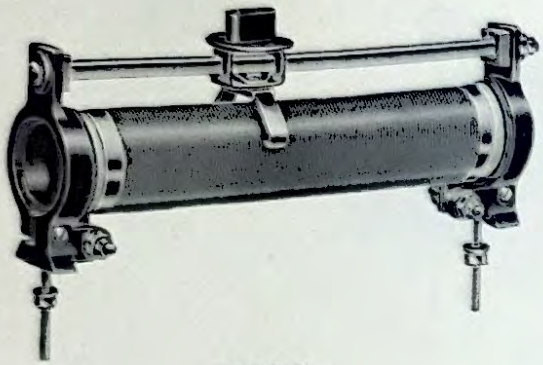
11688 Single Resistances. Size of Slate Bars—15¾ in. × 2 in. × 1 in.

Maximum current ...	0·3	0·45	0·6	1·0	1·2	1·5	2·0	3·0	4·0	5·0	7·0	10·0	15·0	20·0 amps.
Approximate resistance ...	1,700	1,150	700	440	285	170	105	65	44	22	13	6	3	1·6 ohms
Price, Type A	**50/0**	**50/0**	**50/0**	**50/0**	**50/0**	**50/0**	**50/0**	**50/0**	**50/0**	**50/0**	**52/6**	**52/6**	**52/6**	**52/6** each
„ Type B	**53/0**	**53/0**	**53/0**	**53/0**	**53/0**	**53/0**	**53/0**	**53/0**	**53/0**	**53/0**	**55/0**	**55/0**	**55/0**	**55/0** „

11689 Single Resistances. Size of Slate Bars—17¾ in. × 2½ in. × 1½ in.

Maximum current ...	0·3	0·45	0·6	1·0	1·2	1·5	2·0	3·0	4·0	5·0	7·0	10·0	15·0	20·0 amps
Approximate resistance ...	2,400	1,550	950	550	450	250	130	90	60	30	16	8·5	4	2·5 ohms
Price, Type A	**57/6**	**57/6**	**57/6**	**57/6**	**57/6**	**57/6**	**57/6**	**57/6**	**57/6**	**57/6**	**59/0**	**59/0**	**59/0**	**59/0** each
„ Type B	**60/6**	**60/6**	**60/6**	**60/6**	**60/6**	**60/6**	**60/6**	**60/6**	**60/6**	**60/6**	**62/0**	**62/0**	**62/0**	**62/0** „

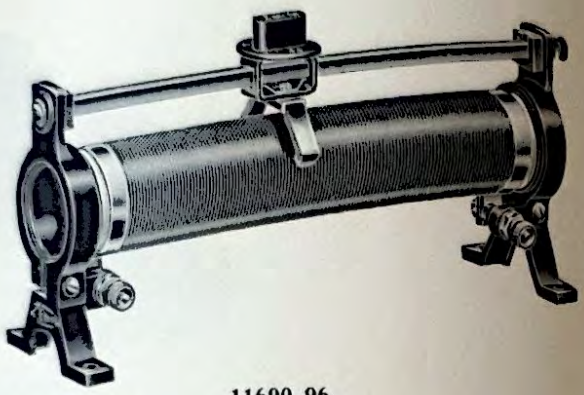
Permanent Loading should not exceed 60 per cent of the listed current.



11690–96

Type "A"

Fitted with three Terminals for series and potentiometer use and arranged for Switchboard or panel mounting.



11690–96

Type "B"

Fitted with three Terminals for series and potentiometer use, and arranged for bench or wall mounting.

***11690 Single Tubular Resistances** for Switchboard mounting (Type "A") or Wall mounting (Type "B"). Size of Tube 6 in. × 1¼ in. diameter.

Maximum current	0·3	0·45	0·6	1·0	1·2	1·5	2·0	amps.
Approximate resistance	650	353	213	142	88	49	28	ohms
Price, Type "A"	**18/0**	**18/0**	**18/0**	**18/0**	**18/0**	**18/0**	**18/0**	each
Type "B"	**20/0**	**20/0**	**20/0**	**20/0**	**20/0**	**20/0**	**20/0**	„

Maximum current	2·8	3·3	4·0	5·0	6·5	8·5	10·0	12·0	14·0	amps.
Approximate resistance	15	11·8	8·75	6	3·5	2·2	1·4	0·95	0·65	ohms
Price, Type "A"	**18/0**	**18/0**	**18/0**	**18/0**	**20/0**	**20/0**	**20/0**	**20/0**	**20/0**	each
„ Type "B"	**20/0**	**20/0**	**20/0**	**20/0**	**22/0**	**22/0**	**22/0**	**22/0**	**22/0**	„

***11691 Single Tubular Resistances,** as above Types "A" and "B." Size of Tube 8 in. × 1¼ in. diameter.

Maximum current	0·3	0·45	0·6	1·0	1·2	1·5	2·0	amps.
Approximate resistance	962	530	375	210	130	72	41	ohms
Price, Type "A"	**21/0**	**21/0**	**21/0**	**21/0**	**21/0**	**21/0**	**21/0**	each
„ Type "B"	**24/0**	**24/0**	**24/0**	**24/0**	**24/0**	**24/0**	**24/0**	„

Maximum current	2·8	3·3	4·0	5·0	6·5	8·5	10·0	12·0	14·0	amps.
Approximate resistance	22·5	17·6	13	8·75	5·3	3·8	2·4	1·4	1·0	ohms
Price, Type "A"	**21/0**	**21/0**	**21/0**	**21/0**	**24/0**	**24/0**	**24/0**	**24/0**	**24/0**	each
„ Type "B"	**24/0**	**24/0**	**24/0**	**24/0**	**26/6**	**26/6**	**26/6**	**26/6**	**26/6**	„

***11692 Single Tubular Resistances,** as above Types "A" and "B." Size of Tube 10 in. × 1¼ in. diameter.

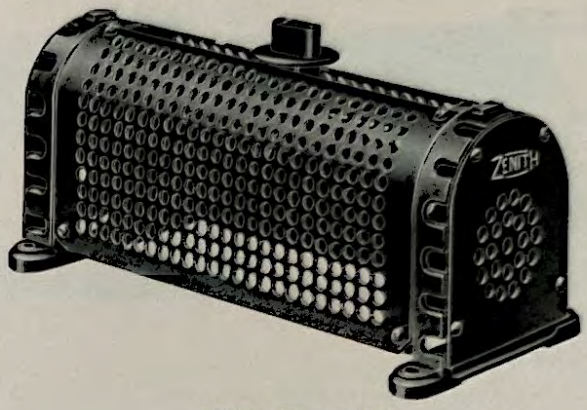
Maximum current	0·3	0·45	0·6	1·0	1·2	1·5	2·0	amps.
Approximate resistance	1,280	685	415	276	172	95	54	ohms
Price, Type "A"	**26/0**	**26/0**	**26/0**	**26/0**	**26/0**	**26/0**	**26/0**	each
„ Type "B"	**27/0**	**27/0**	**27/0**	**27/0**	**27/0**	**27/0**	**27/0**	„

Maximum current	2·8	3·3	4·0	5·0	6·5	8·5	10·0	12·0	14·0	amps.
Approximate resistance	29·5	23·4	17	11·5	6·8	4·2	2·8	1·8	1·3	ohms
Price, Type "A"	**26/0**	**26/0**	**26/0**	**26/0**	**27/6**	**27/6**	**27/6**	**27/6**	**27/6**	each
„ Type "B"	**27/0**	**27/0**	**27/0**	**27/0**	**28/6**	**28/6**	**28/6**	**28/6**	**28/6**	„

***11693 Single Tubular Resistances,** as above Types "A" and "B." Size of Tube 12 in. × 1¼ in. diameter.

Maximum current	0·3	0·45	0·6	1·0	1·2	1·5	2·0	amps.
Approximate resistance	1,600	875	521	347	215	120	68	ohms
Price, Type "A"	**27/0**	**27/0**	**27/0**	**27/0**	**27/0**	**27/0**	**27/0**	each
„ Type "B"	**30/0**	**30/0**	**30/0**	**30/0**	**30/0**	**30/0**	**30/0**	„

Maximum current	2·8	3·3	4·0	5·0	6·5	8·5	10·0	12·0	14·0	amps.
Approximate resistance	37	29	21·5	14·5	8·75	5·2	3·4	2·3	1·6	ohms
Price, Type "A"	**27/0**	**27/0**	**27/0**	**27/0**	**28/6**	**28/6**	**28/6**	**28/6**	**28/6**	each
„ Type "B"	**30/0**	**30/0**	**30/0**	**30/0**	**31/6**	**31/6**	**31/6**	**31/6**	**31/6**	„



11697 Type "E"

11694 Single Tubular Resistances, Types "A" and "B," see illustrations page 470. Size of Tube, 10 in. × 1¼ in. diameter.

Maximum current	0·3	0·45	0·6	1·0	1·2	1·5	2·0	amps.
Approximate resistance	1,660	907	545	362	224	125	70·5	ohms
Price, Type A	**28/0**	**28/0**	**28/0**	**28/0**	**28/0**	**28/0**	**28/0**	each
„ Type B	**30/0**	**30/0**	**30/0**	**30/0**	**30/0**	**30/0**	**30/0**	„

Maximum current	2·8	3·3	4·0	5·0	6·5	8·5	10·0	12·0	14·0	amps.
Approximate resistance ...	38·4	30·4	22·4	15·0	9·0	5·4	3·75	2·4	1·7	ohms
Price, Type A	**28/0**	**28/0**	**28/0**	**28/0**	**29/6**	**29/6**	**29/6**	**29/6**	**29/6**	each
Price, Type B	**30/0**	**30/0**	**30/0**	**30/0**	**31/6**	**31/6**	**31/6**	**31/6**	**31/6**	„

11695 Single Tubular Resistances, as above Types "A" and "B." Size of Tube, 12 in. × 1¼ in. diameter.

Maximum current	0·3	0·45	0·6	1·0	1·2	1·5	2·0	amps.
Approximate resistance	2,070	1,132	680	452	280	155·5	88	ohms
Price, Type A	**30/6**	**30/6**	**30/6**	**30/6**	**30/6**	**30/6**	**30/6**	each
„ Type B	**32/6**	**32/6**	**32/6**	**32/6**	**32/6**	**32/6**	**32/6**	„

Maximum current	2·8	3·3	4·0	5·0	6·5	8·5	10·0	12·0	14·0	amps
Approximate resistance ...	48	38	28	17·75	11·3	6·8	4·4	3·0	2·1	ohms
Price, Type A	**30/6**	**30/6**	**30/6**	**30/6**	**32/0**	**32/0**	**32/0**	**32/0**	**32/0**	each
„ Type B	**32/6**	**32/6**	**32/6**	**32/6**	**34/0**	**34/0**	**34/0**	**34/0**	**34/0**	„

11696 Single Tubular Resistances, as above Types "A" and "B." Size of Tube, 10 in. × 2 in. diameter.

Maximum current ...	0·3	0·45	0·6	1·0	1·2	1·5	2·0	2·8	3·3	4·0	amps.
Approximate resistance	1,865	1,020	608	405	251	140	79	51	34	25	ohms
Price, Type A ...	**29/0**	**29/0**	**29/0**	**29/0**	**29/0**	**29/0**	**29/0**	**29/0**	**29/0**	**29/0**	each
„ Type B ...	**33/6**	**33/6**	**33/6**	**33/6**	**33/6**	**33/6**	**33/6**	**33/6**	**33/6**	**33/6**	„

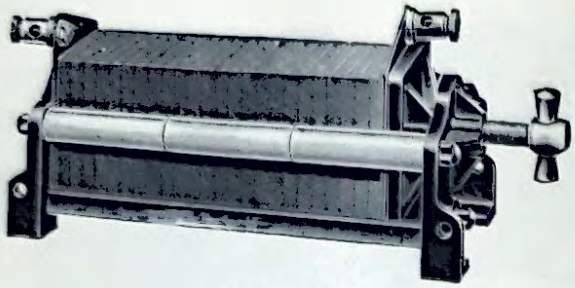
Maximum current	5·0	6·5	8·5	10·0	12·0	14·0	16·0	20·0	25	amps.
Approximate resistance ...	17	10	6	4·2	2·7	2·0	1·5	0·97	0·54	ohms
Price, Type A	**29/0**	**31/0**	**31/0**	**31/0**	**31/0**	**31/0**	**31/0**	**31/0**	**31/0**	each
„ Type B	**33/6**	**35/0**	**35/0**	**35/0**	**35/0**	**35/0**	**35/0**	**35/0**	**35/0**	„

11697 Single Tubular Resistances, Nos. 11690 to 11696 can be supplied with Ventilated Cover Type E at the following prices extra —

No. 11690-91	each extra	**£0**	**9**	**6**
No. 11692-93	„ „	**0**	**10**	**6**
Nos. 11694-95	„ „	**0**	**11**	**6**
No. 11696	„ „	**0**	**12**	**0**

11698 Tumbler Switch on Type "E" up to 5 amps. ... ... extra **0 3 4**

Ditto ditto ditto 10 „ ... ... „ **0 5 4**



11699-702

RESISTANCE, CARBON PLATE TYPE

The Carbon Plate type of Resistance is extremely convenient when it is desired to obtain a fine adjustment control in circuits carrying comparatively heavy currents as in meter testing, controlling the speed of motors driving precision apparatus, load testing, or any purpose where a non-inductive heavy current regulator is needed.

The type illustrated comprises two substantial iron castings connected together by steel rods, over which are threaded heat-resisting insulating tubes. Adjustment is effected by means of a strong, fine casting, which effectually distributes the pressure uniformly and entirely obviates the possibility of the carbon plates being broken, even when the strongest pressure is applied. The tie rods are of steel, and being in tension no strain is applied to the insulators.

Current is led into the Resistance by means of substantial Copper Plates, to which are attached terminals amply large enough for the purpose. These metal plates may be inserted in any intermediate position so as to include between them one or more carbon plates up to the maximum, and in this way the range of control is considerably extended.

The largest type is made in two lengths, incorporating either twenty-four or forty plates each 3½ in. × 3½ in. × ⅜ in. The smaller type is likewise made in two lengths, incorporating either twenty-four or forty plates, each 2 in. × 2 in. × ¼ in.

Any of the above Resistances, providing they are of equal length, may be bolted together to form convenient banks, for which purpose the end castings are provided on both sides, with suitably drilled lugs to carry the necessary bolts. When a number of Resistances are bolted together as above described, the carbon plates may be connected either in series to give a larger total ohmic value or alternatively in parallel to give increased current-carrying capacity.

The insulation is fireproof throughout and tested to 1,000 volts.

All the above Resistances are finished in black stoving enamel, the bright parts being heavily nickel-plated. It will be noted that they are of very substantial construction and will withstand the roughest use. Considerable numbers have been in constant use for upwards of ten years.

Prices

Size of Plates, 2 × 2 × ¼ in.

		Number of Plates.	Watts Dissipated.	Min. ohms.	Max. ohms.	Dimensions.	Weight. lbs.	Price.
11699	... ...	24	200	0·07	1·4	11 × 3½ × 3⅜ in.	5¾	£2 14 0
11700	... ...	40	350	0·12	2·35	15 × 3½ × 3⅜ „	7	2 19 0

Size of Plates, 3½ × 3½ × ⅜ in.

11701	... ...	24	450	0·017	0·18	15 × 5 × 5⅜ „	15	3 16 0
11702	... ...	40	750	0·003	0·29	21 × 5 × 5⅜ „	19	4 18 0
11703	Spare Carbon Plates, 2 × 2 × ¼ in.						each	0 0 6
11704	Spare Carbon Plates, 3½ × 3½ × ⅜ in.						„	0 1 0
11705	Extra Terminal Plates						„	0 2 3

Note.—Ohmic values stated above are of necessity approximate only for this type of Resistance.



Fig. 1

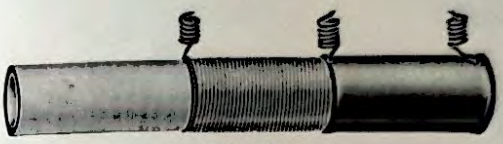


Fig. 3



Fig. 2

ZENITE WIRE WOUND VITREOUS EMBEDDED RESISTANCE UNITS

These Units comprise a heat-resisting Tube of special composition wound with high-grade alloy wire, to the ends of which are attached stout flexible copper conductors, the whole being solidly embedded in a vitreous mass fired at a temperature of 950° approx. They are substantially designed to provide in compact form a Register capable of dissipating considerable energy and operating at temperatures up to 350°C. when necessary.

This form of construction enables the heat generated in the resistance wire to be quickly transferred to the outside surface and radiated into the surrounding air. It also provides adequate protection to the winding from mechanical damage, and from damp or corrosive atmospheres.

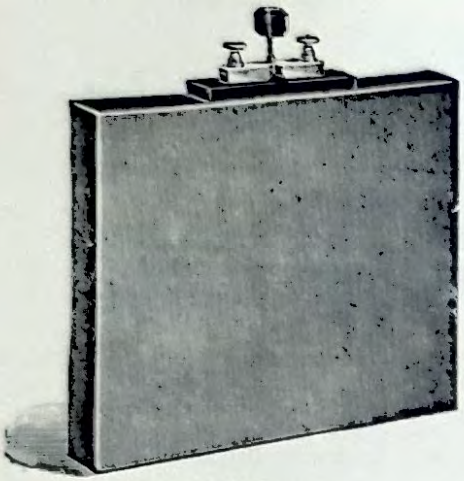
The Embedding Enamel is specially compounded so as to be chemically without action on the wire and to have the same expansion co-efficient as the former and wire so that no mechanical strain is applied to the winding when the Unit heats or cools in service. This point is of particular importance to the user as some similar units on the market are extremely unsatisfactory in this respect, whereas tens of thousands of "Zenite" Units have been in use and have given lasting satisfaction for upwards of five years.

High Ohmic Values are obtained with a first grade, iron-free nickel chrome alloy, having a temperature co-eficient of approximately 0·00025°C. Lower values not exceeding 2,000 ohms, being wound with copper nickel alloy, have a temperature co-efficient of only 0·000022°C.

Tappings. Any Unit can be fitted with additional Tappings, Fig. 3, in the form of flexible copper tails, the maximum number depending upon the size chosen. With the exception of the size 11706 four taps can usually be fitted, but a larger number can, when necessary, be provided on the larger sizes.

													£	s	d
11706	(Fig. 1) **Units only 10 Watts size,** $1\frac{5}{16} \times \frac{7}{16}$ in.														
	Ohms	0·6	1·2	2·54	5	10·5	22	45	89	174	255	356	700			
	Amps.	4	2·8	2	1·3	0·92	0·65	0·45	0·3	0·22	0·2	0·15	0·12	0	3	4
11707	(Fig. 2) Ditto, fitted with Caps and Clips													0	4	10
11708	**Units only 30 Watts size,** $2 \times \frac{5}{8}$ in.														
	Ohms	0·6	1·2	2·54	5	10·5	22	45	89	174	255	356	700			
	Amps.	7	5	35	2·5	1·75	1·22	0·8	0·6	0·4	0·35	0·28	0·2	0	4	2
11709	Ditto, fitted with Caps and Clips													0	5	6
11710	**Units only 60 Watts size,** $3\frac{1}{2} \times \frac{3}{4}$ in.														
	Ohms	0·2	0·4	0·9	1·8	3·6	5	10·5	22	45	89	174	356			
	Amps.	17·5	12	8	6	4	3·5	2·5	1·6	1	0·8	0·6	0·4	0	5	4
11711	Ditto, fitted with Caps and Clips													0	7	9
11712	**Units only 90 Watts size,** $6\frac{1}{2} \times \frac{3}{4}$ in.														
	Ohms	0·2	0·4	0·9	1·8	3·6	5	10·5	22	45	89	174	356			
	Amps.	22	15·5	10·5	7·5	5·2	4·5	3	2	1·4	1·1	0·8	0·54	0	7	8
11713	Ditto, fitted with Caps and Clips													0	10	0
11714	**Units only 180 Watts size,** $8\frac{1}{2} \times 1\frac{1}{2}$ in.														
	Ohms	0·1	0·2	0·4	0·9	1·8	3·6	7	13·4	31·6	60	126	253			
	Amps.	44	31	22·5	15	11	7·5	5·2	3·5	2·5	1·8	1·2	0·9	0	9	0
11715	Ditto, fitted with Caps and Clips													0	12	0

Intermediate Ohmic values can be supplied, price on application.



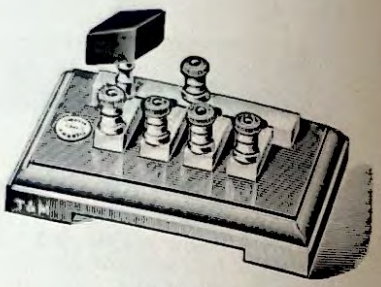
11717



11721–23



11719–20



11724–25

*11717 **Condenser,** mounted in Polished Teak Case, with Ebonite Terminal Blocks, with Short Circuit Plug, Paper Insulation. Capacity ·1 ·25 ·05 1·0 Micro-Farad
37/6 **45/0** **65/0** **85/0** each

*11718 **Condenser,** cheaper quality, in Teak Case, with Ebonite Terminal Blocks, without Plug. Capacity ·1 ·25 ·05 1·0 Micro-Farad
24/0 **28/6** **30/0** **36/0** each

Plug Keys, Switches, etc.



11726



11727



11728–31

		1	2	
11719	**Plug Key,** Best Quality, with Lozenge-shaped Plug on Walnut Base	**5/0**	**6/0**	way each
11720	„ „ „ „ „ „ on Ebonite Base	**7/6**	**9/0**	„
11721	„ „ heavy Brass Blocks, with Lozenge-shaped Plug, on Walnut Base each		**£0 5 6**	
11722	„ „ „ „ „ „ on Ebonite Base „		**0 9 6**	
11723	„ „ „ „ „ Superior make, on Stout Ebonite Base ... „		**0 12 6**	

		2	3	4	6	
11724	„ „ Battery Switches, with Lozenge-shaped Key, on Polished Mahogany Base.	**7/6**	**9/6**	**12/6**	**15/6**	way each
11725	„ „ on Ebonite Base	**10/0**	**12/6**	**16/6**	**21/0**	„

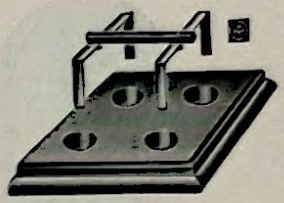
		2	3	4	6	
11726	**Plug Keys,** Extra Heavy Pattern, on Stout Ebonite Base	**12/6**	**17/6**	**22/6**	**32/6**	each
11727	„ „ Reversing, four Quadrants and two Lozenge-shaped Plugs ... each				**£0 16 0**	
11728	**Contact Key,** Single, on Teak Base ... ... „				**0 3 9**	
11729	„ „ „ better finished, on Polished Walnut Base ... ... „				**0 7 0**	
11730	„ „ „ on Ebonite Base ... ... „				**0 8 0**	
11731	„ „ „ with Platinum Contacts and extra Stout Base and Fittings „				**0 12 0**	



11732-33

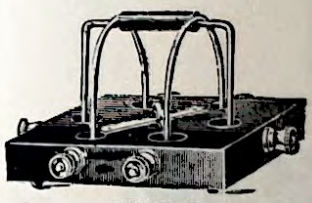


11734

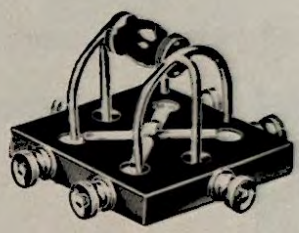


11735

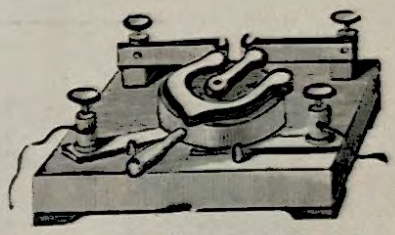
11732	**Contact Key,** Double, on Ebonite Base, with Platinum Contacts	each	£1	0	0
11733	,, ,, ,, on Extra Stout Base, with Platinum Contacts, best quality ..		1	5	0
11734	**Commutator,** simple, on Polished Teak Base, with two Copper Strips ...	,,	0	1	6
11735	,, ,, larger, and fitted with Ebonite Handle	,,	0	3	6



11736–7

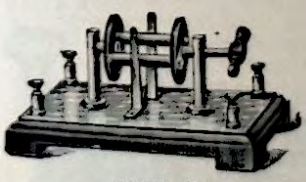


11738

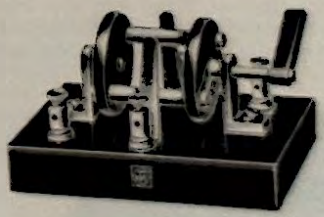


11739–40

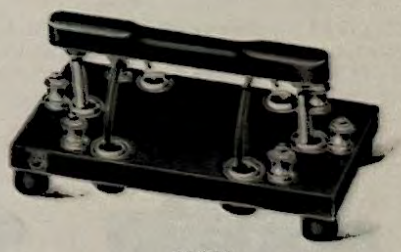
11736	**Commutator,** Pohl's, on Polished Mahogany Base	each	£0	7	0
11737	,, ,, on Ebonite Base...	,,	0	16	6
11738	,, ,, Superior make, Heavy Pattern, on Stout Ebonite Base	,,	1	10	0
11739	,, Bertin's, on Mahogany Base	,,	1	7	6
11740	,, ,, Superior make, on Stout Ebonite Base	,,	1	15	0



11741-2



11743



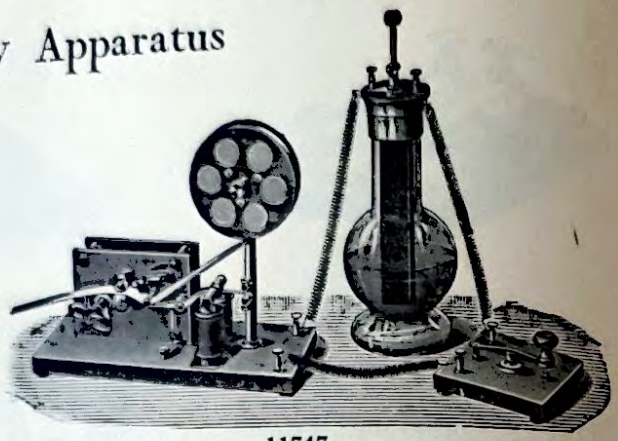
11744

11741	**Commutator,** Ruhmkorff's, mounted on Polished Mahogany Base ...	each	£0	17	6
11742	,, ,, ,, ,, Ebonite Base	,,	1	2	6
11743	,, ,, Superior make, on Stout Ebonite Base ...	,,	1	15	0
11744	,, as supplied to Leeds University, on Stout Ebonite Base ...	,,	1	15	0

Telegraphy Apparatus

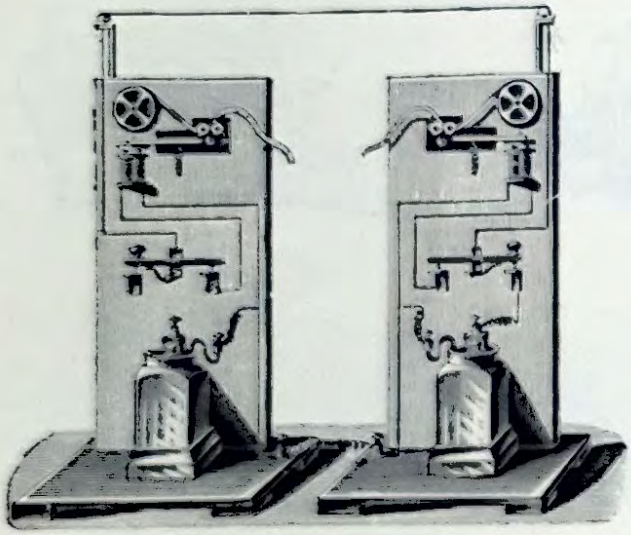


11746

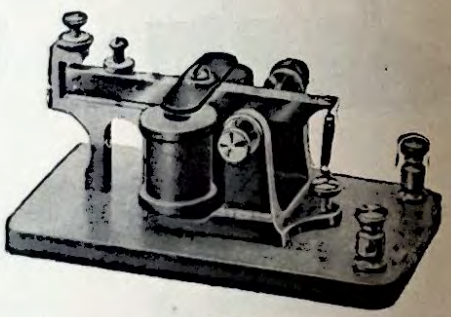


11747

11746	**Needle Telegraph,** for Table use or Lecture Demonstration, on Polished Mahogany Stand each	£1 5 0
(F) 11747	**Telegraph,** Morse (superior finish), Receiver, Sender and Relay with Clockwork Mechanism, Inkmarker, Drum for Rolls, and Key, with Battery and three extra Rolls of Paper ...	5 0 0



11748

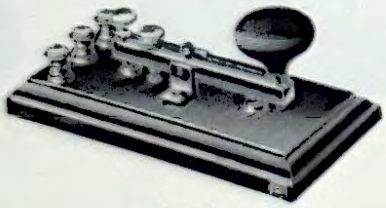


11749

(F) 11748	**Telegraph Model** (Morse's), Double Station, large size and better finish, with Clockwork Mechanism and two Leclanche Batteries, mounted on Wooden Stands, complete... ...	£12 0 0
11749	**Morse Sounder,** with Low Resistance Coils, mounted on Mahogany Base	0 17 0



11750-1



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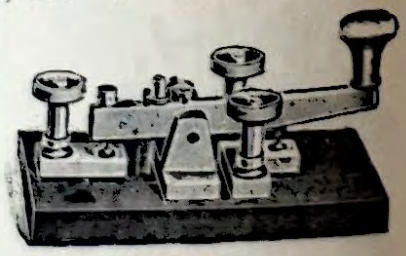


11753

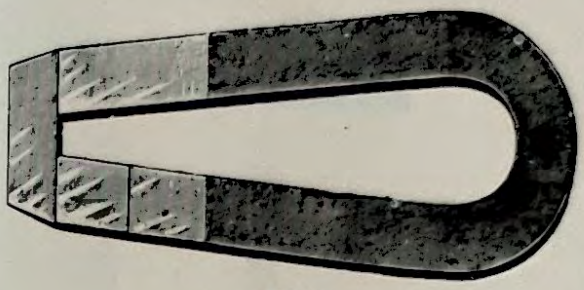
11750	**Morse Key,** Double Contact, mounted on Polished Base ... ... each	£0 6 0
11751	,, ,, Larger size ... ... ,,	0 8 6
11752	,, ,, Superior make, mounted on Polished Mahogany Base	0 14 6
11753	,, ,, ,, Heavy Pattern, with Platinum Contacts	1 10 0

(F) Foreign manufacture.

Magnetism



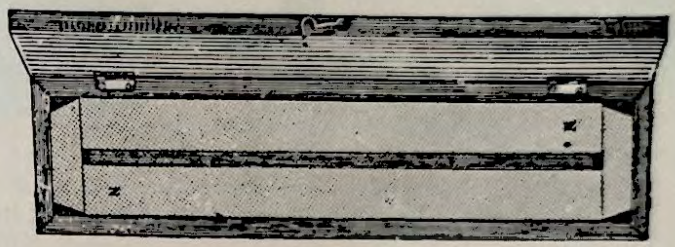
11757



11758



11759



11760–61

11755 **Magnetic Iron Ore,** Loadstone, typical specimen ... ... each **£0 2 0**

11756 ,, ,, Selected ,, ,, ... each, **5/0** and **0 7 6**

11757 ,, ,, mounted in Metal Frame, with Hook for suspension, and Keepers ... each **1 12 6**

11758 **Magnets,** Horseshoe, best English make, strongly magnetized, with Keepers.

2½	3	3½	4	5	6	8	9	10	12	in.
5d.	**6d.**	**8d.**	**1/0**	**1/6**	**2/0**	**4/6**	**5/9**	**7/6**	**11/6**	each

11759 ,, Compound, Horseshoe, with Hook for suspension, and Keeper.

5	6	7	6	9	in.
3	3	3	5	5	bars
14/0	**15/0**	**18/6**	**25/0**	**40/0**	each

11760 ,, Bar, best English make, Polished Steel, with Keepers.

3	4	6	8	10	12	in.
1/3	**1/6**	**2/3**	**3/9**	**5/9**	**6/9**	per pr.

11761 **Boxes,** Polished Teak, with Hinges, to hold one pair of above Magnets.

4	6	8	10	12	in.
1/9	**2/3**	**2/6**	**3/0**	**3/6**	each

COBALTCHROM STEEL MAGNETS

With a magnetic force three or four times as great as Tungsten Steel, they are particularly suitable in all experiments where the suspension of a magnet is necessary.

The cylindrical form when placed together in pairs, side by side, with like poles together and reversed, demonstrate to a marked degree the attraction and repulsion of magnetic poles.

This can also be shown with the rectangular form by placing one magnet over another and reversing the poles.

Practically rustless, they retain their magnetism far longer and to a greater extent than the usual form of steel magnet.

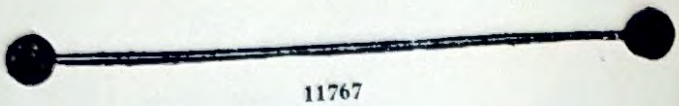
In Grey sandblast finish in the following sizes:—

11762 15 per cent Cobalt Steel Cylindrical Bar Magnets.

Diameter	Length 1	2	3	4	5	6	7	8	10	12	in.
1/8 in. ...	**2d.**	**3d.**	**4d.**	**5d.**	**6d.**	**7d.**	**8d.**	**9d.**	**1/0**	**1/3**	each
1/4 in. ...	**3d.**	**5d.**	**6d.**	**8d.**	**10d.**	**1/0**	**1/2**	**1/4**	**1/7**	**1/11**	,,
3/8 in. ...	**5d.**	**9d.**	**1/1**	**1/5**	**1/9**	**2/0**	**2/3**	**2/6**	**3/4**	**4/3**	,,

11763 15 per cent Cobalt Steel Rectangular Bar Magnets.

Cross Section ...	Length 2	3	4	5	6	7	8	9	10	12	in.
1/8 × 1/4 in.	**6d.**	**9d.**	**1/0**	**1/3**	**1/6**	**1/9**	**2/0**	**2/3**	**2/6**	**3/0**	each
1/4 × 1/8 in. ...	**9d.**	**1/1**	**1/5**	**1/9**	**2/1**	**2/6**	**2/9**	**3/2**	**3/6**	**4/2**	,,
1/4 × 1/4 in. ...	**11d.**	**1/5**	**1/9**	**2/2**	**2/6**	**3/0**	**3/4**	**4/0**	**4/2**	**5/2**	,,
1 × 1/8 in. ...	**1/2**	**1/8**	**2/2**	**2/8**	**3/3**	**3/8**	**4/3**	**4/6**	**4/9**	**6/9**	,,



11767





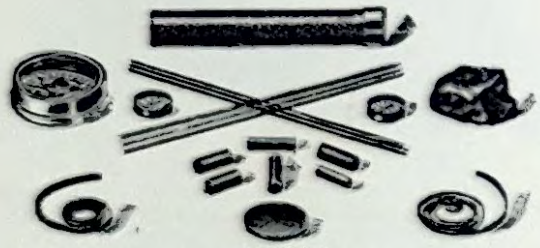
11766

11768–9

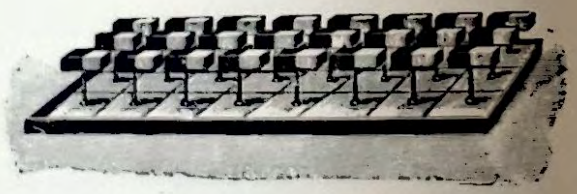


11770

11765	**Magnets,** Round, Polished Steel—	$4\times\frac{3}{8}$	$5\times\frac{3}{8}$	$6\times\frac{3}{8}$	$8\times\frac{3}{8}$	$12\times\frac{3}{8}$	inch	
		1/0	**1/3**	**1/6**	**2/4**	**3/0**	each	
11766	,, ,, with Painted Centres with Keepers in Polished Teak Boxes—				6 in.	8 in.	long	
					6/9	**9/6**	per	pair
***11767**	,, Robinson's, Ball ended— Length	20			30	40	cm.	
		3/0			**3/0**	**3/6**	per	pair
11768	,, Bar, 6 in., with hole drilled at neutral line					each	**£0**	**2** **0**
11769	,, ,, on Polished Mahogany Stand					,,	**0**	**5** **9**
11770	,, for use with Magnetometers, with Keepers—				2	4	in.	
					10d.	**1/6**	per	pair



11772–78

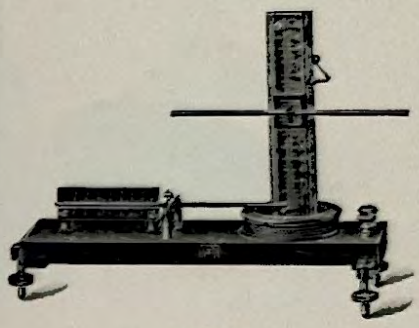


11779

11771	**Iron Bars,** Soft, $8\times1\frac{1}{2}\times\frac{1}{4}$ in., to show Magnetic Induction	each	**£0**	**1** **0**
11772	**Iron Rods,** Soft, 12 pieces in box, to show Laws of Magnetic Distribution in a Bar Magnet	per box	**0**	**1** **0**
11773	**Iron Rods,** Soft, 6 in. long	each, **4d., 6d.,** and	**0**	**0** **8**
11774	**Iron Discs,** Soft	per doz.	**0**	**3** **6**
11775	**Steel Wires,** Knitting Needles	,,	**0**	**0** **6**
11776	**Steel Clock Springs,** complete	,,	**0**	**10** **0**
11777	,, ,, ,, (Broken)	,,	**0**	**2** **6**
11778	**Iron Filings**	... per lb.	**0**	**0** **6**
11779	**Magnets,** Bar, to show distribution of magnetism in bar magnets	16	**£2**	**2** **0**
		24 magnets	**£2**	**15** **0**



11781–2



11786

11781	**Sieves,** Brass Wire, Gauze, Japanned Tin Frame, 3 in. dia., for use with Iron Filings	£0 2 3
11782	,, ,, ,, set of three, 30, 60 and 90 mesh, with Cover and Bottom, 3 in. dia.	0 7 9
11783	**Soft Iron Ring,** 10×2·5 cm., to show the effect of a Magnetic Screen...	0 2 3
11784	**Steel Bar,** unmagnetised, 8×½×$\frac{1}{16}$ in. ... ... each	0 0 8
11785	**Iron Plate,** to act as Magnetic Screen, about 14×10 in. ... ... ,,	0 1 0
=11786	**Hibbert's Magnetic Balance** with Plain Magnets, simple Magnet Holder, two Sliding Weights of 20 and 50 dynes, and Current Coil ... ... nett	2 10 0



11787



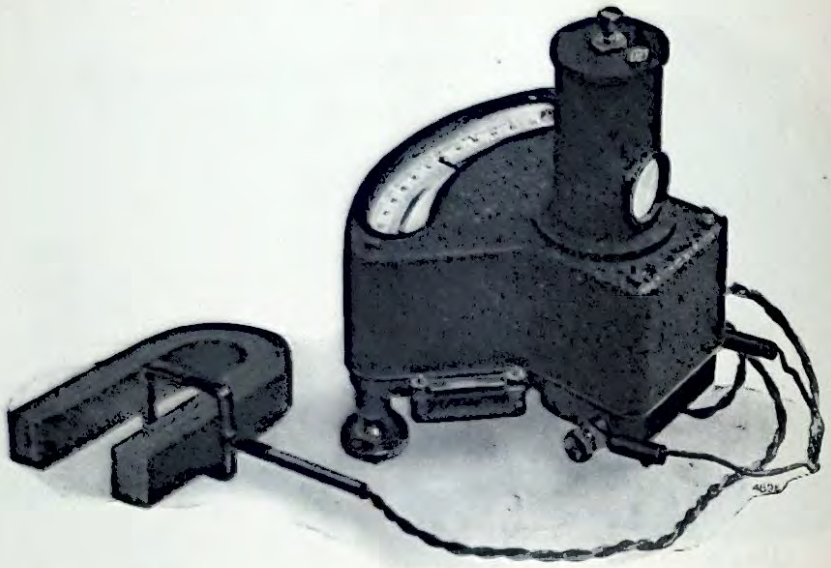
11789–90



11788

		¾	1	2	3	4	6	8	in. long
11787	**Magnetic Needles,** with Brass Centres.	7d.	11d.	1/1	1/3	1/6	2/0	3/3	each
11788	,, ,, with Agate Centres ...		1/4	1/6	1/9	2/0	2/9	3/9	,,

		3	4	5	in. dia.
11789	**Galvanometer Bar Needles,** with Agate Centres and Aluminium Pointers.	3/6	3/6	3/6	each
11790	,, ,, ,, Superior Quality	4/6	4/6	4/6	,,



11792–3
21 × 19 × 24 cm. 3·8 kg.

11792 GRASSOT FLUXMETER

The Grassot Fluxmeter is a suspended coil galvanometer specially designed for the investigation of magnetic fields. Its indications are determined solely by the total quantity of electricity discharged through the suspended coil, and, owing to the long period of the moving system and negligibly small control constant, the pointer remains at the limit of the deflection for a period of sufficient duration to enable readings to be taken. If a search coil connected to the terminals of the Fluxmeter is moved in a magnetic field, the instrument deflection will be proportional to the total change in the lines of force interlinked. Within wide limits, the reading is independent of the rate at which the magnetic lines are cut by the exploring coil.

While the Fluxmeter possesses the robustness of a workshop instrument, and can be used by unskilled workmen, it is, at the same time, an instrument of high sensitivity suitable for laboratory use.

The general appearance of the Fluxmeter will be seen in Fig. 11792-3, which shows the instrument connected to an open wound search coil. The moving coil of the instrument carries a pointer, and is suspended by a silk fibre, the upper end of which is attached to a spiral spring to avoid damage by shock. Current is led into and out of the coil by means of spirals, acting in opposition, so that the torsional controlling force is a minimum. On the other hand, the electromagnetic damping is made so great, in proportion, that the only appreciable force which controls the deflections of the coil is that due to this cause. The moving system is enclosed in a dust-tight robust metal case fitted with levelling screws and two side spirit levels. A clamping device secures the coil during transit.

The scale of the instrument is approximately 150 millimetres long, and is divided into 120 equal divisions, 60 on either side of a central zero. Each division represents a definite number of maxwell-turns, this number (generally about 15,000) being marked on the scale. Thus the total number of lines cut by each turn of the search coil may be obtained by dividing the scale reading by the number of turns, and if the mean area of the search coil is known, it is easy to calculate the field strength in lines per square centimetre. Full scale deflection corresponds to $1{\cdot}8 \times 10^6$ maxwell-turns, but the range may be extended by shunting the search coil with a non-inductive resistance. It is then possible, with a single-turn search coil, to measure total fluxes up to several megalines. On the other hand, very small flux densities may be measured by using a large area multi-turn search coil. In addition to the pointer, the instrument may be fitted with a plane mirror 5 × 4 millimetres, and with a lens suitable for a scale distance of one metre, so that for very accurate work a light spot may be used as an index, the beam of light entering through the lens fitted in the back of the case. When used in this way, a given pointer deflection is multiplied about 20 times. On open circuit, when the instrument is practically undamped, the free period is approximately 50 seconds. It is aperiodic when connected to a low resistance coil. The resistance of the instrument is approximately 20 ohms, and the search coil may have any value below about 15 ohms; single-turn low resistance search coils may thus be used, in which case the instrument will indicate directly the flux value. The instrument may be used in such applications as measuring the strength of a magnetic field, the pole strength and distribution of magnetism in a bar magnet, and mutual inductance, or it may be used to obtain the BH curve for a specimen, or winding data for transformers or D.C. series motors.

11792	**Grassot Fluxmeter,** without search coil ... ... Nett	**£15**	**10**	**0**
11793	Ditto, but with Reflecting Mirror	**16**	**11**	**0**
	Search Coil, open wound type	**1**	**0**	**0**
	„ „ in former type	**3**	**3**	**0**
	„ „ Type "B"	**3**	**3**	**0**
	„ „ Type "C"	**3**	**3**	**0**
	„ „ Type "D"	**3**	**0**	**0**



11794



11795



11796–7

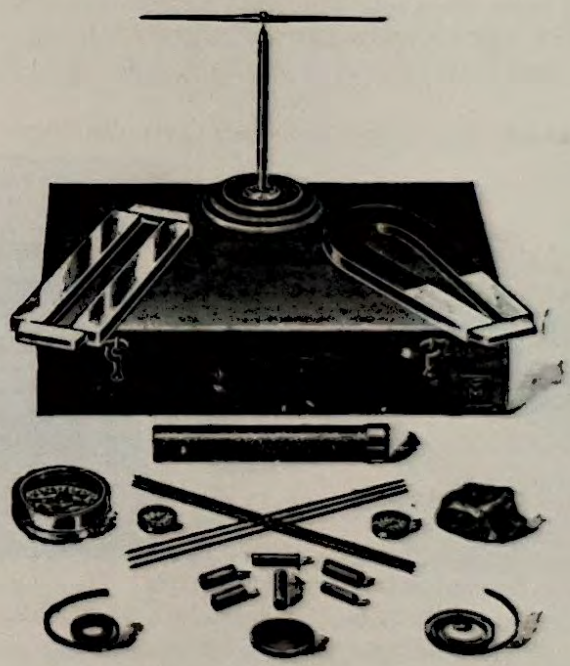


11798



11799

11794	**Stirrups,** Brass Wire, for supporting Magnets ... ... each, **4d.** and			**£0**	**0**	**6**
11795	**Magnetic Needle Stand** with Pillar and Steel Point, on Polished Hardwood Base each			**0**	**0**	**8**
11796	,, ,, ,, with Brass Pillar and Steel Point, on Polished Mahogany Foot each			**0**	**1**	**6**
11797	,, ,, ,, with Steel Point, Brass Pillar and Foot			**0**	**2**	**9**
11798	,, ,, ,, Light Brass, with Adjustable Needle ... ... ,,			**0**	**1**	**6**
11799	**Magnetic Needle Stand,** with Steel Point, Insulated Glass Rod, with Brass Fittings, 7 in. high, on Polished Mahogany Base			**0**	**3**	**6**



11800

11800 **Magnetism Set,** containing one 6-in. Horseshoe Magnet, two 6-in. Bar Magnets (polished all over) with Keepers, one 6-in. Magnetic Needle with Brass Pillar Stand, one 2½-in. Floating Dial (Mariner's) Compass in Brass Case with Cover, two small Compasses and Iron filings for Tracing Lines of Magnetic force, six Steel Needles, and two small Watch Springs for magnetisation, to illustrate that a magnet may be broken into any number of parts and show that each piece is a perfect magnet with two poles, six Soft Iron Bars and one Soft Iron Disc complete in Stained and Polish Whitewood Cabinet ... ... Price **£1 0 0**

• OIL AND TAR TESTING APPARATUS •



11802



11801-4



11803



11805



11806-7

(F) **11801** **Compasses,** for tracing Lines of Force, etc., in Brass Case, with Glass Top—

20	30 mm. dia.
7/0	**8/0** per doz.

(F) **11802** ,, cheaper quality; diameter, 20 millimetres ... each **3d.** per doz. **£0 2 6**

(F) **11803** ,, Glass, both sides ... ... ,, **0 7 6**

(F) **11804** ,, with Engraved Metal Dial and Glass Top, Nickel-plated Brass—

25	30 mm. dia.
10/6	**12/6** per doz.

(F) **11805** **Compasses,** Best make, Glass both sides, Agate Centres, $\frac{3}{4}$ in. diameter, and Needle with Cross Wire (*vide* Stewart & Gee's "Practical Physics") ... ... each **£0 7 0**

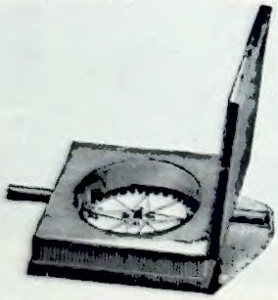
(F) **11806** **Compass,** with Stop, Paper Dial, $2\frac{3}{4}$ in. diameter, in Mahogany Box with Hinged Lid ... ... each **0 3 9**

(F) **11807** **Compass,** with Silvered divided Dial and Agate Centre Bar Needle ... ,, **0 6 6**



11808





11809



11810



11811

11808 **Compass,** Box, Brass, fitted with Agate Centre, Bar Needle, 4 in. Dial, Anti-parallax mirror, suitable for Magnetometers, etc., Best Quality ... ... each **£0 16 6**

11809 **Compass,** Box, with Sights and Wooden Support, with a Vertical Black Line, Agate Centre Needle, in Polished Mahogany Box, complete... ... ... each **0 12 6**

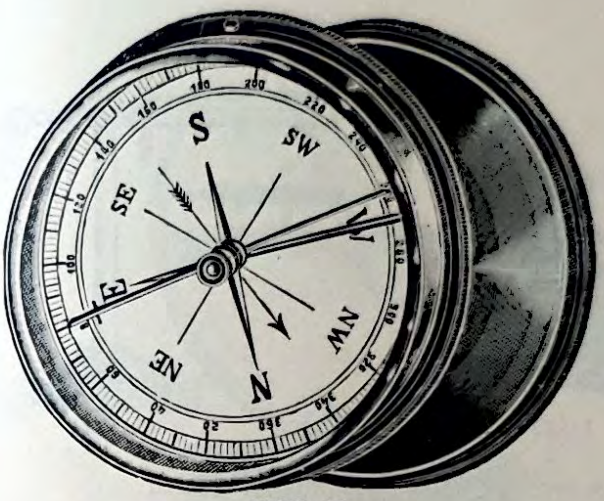
11810 **Compass, Mariner's,** Brass Bowl with Gimbals, in Oak Box—

Diameter of box	4	5	6	8 in.
	13 6	**15 6**	**19 6**	**27 6** each

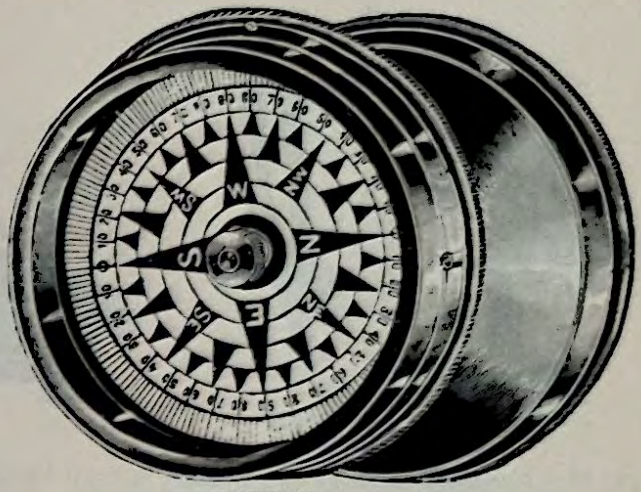
11811 ,, ,, with Agate Centre in Brass Bowl and Gimbals, mounted on Brass Pillar with Polished Mahogany Base, for demonstration purposes—

Diameter of Outer Ring	$4\frac{1}{2}$	7 in.
	21 0	**32 0** each

(F) Foreign manufacture.



11813–14

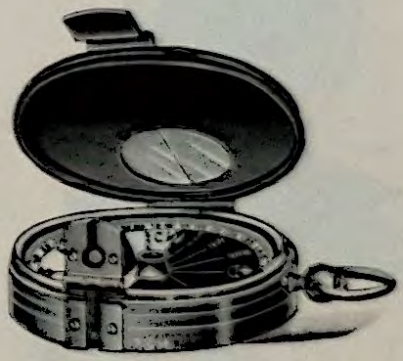


11815–16

(F) **11813**	**Compasses,** Pocket, superior quality, Enamelled Card Dial, Blued Needle, Bevelled Glass in Stout Brass Case, with Pull-off Lid.	1½	1¾	2	in. dia.
		2/0	**2/6**	**3/0**	each
(F) **11814**	Ditto, with Bar Needle, Jewelled Caps and Stop	**3/9**	**4/9**	**5/6**	,,
			2	3	in. dia.
(F) **11815**	Ditto, Floating Dial, in Nickelled Case, with Pull-off Cap ...		**3/0**	**4/0**	each
(F) **11816**	Ditto, ditto, with Agate Centres		**3/9**	**5/3**	,,



11817



11818

11817 **Mariner's Compass,** Dial 6½ in. diameter, with Stop, in Polished Mahogany Case, 7½ in. square **£0 18 6**

11818 **Combined Prismatic and Pocket Compass,** in Hunter Case of Brass, Bronzed, 2 in. diameter, with all the advantages of a 3 in. Prismatic Compass. Can be used as an ordinary Compass without opening the Cover, and as a Prismatic Compass by raising the Cover, which is glazed and etched with a line answering for the sight. Pearl Card Dial figured with 16 points. The Prism Box folds down when not in use **2 12 6**

(F) Foreign manufacture.



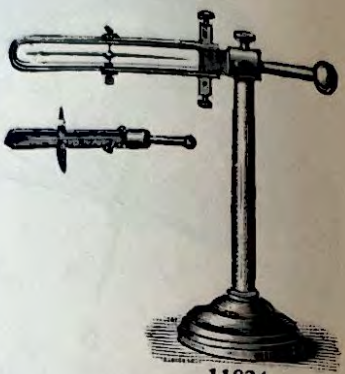
11820



11822



11823



11824

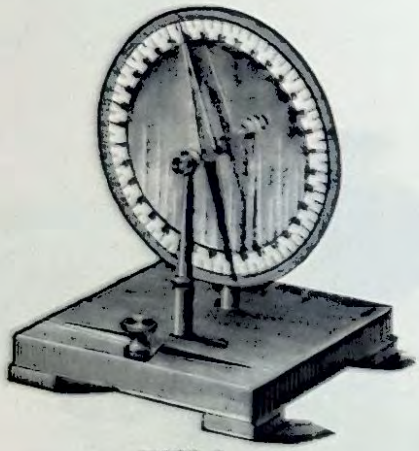
11820 **Needle, Dip,** best make, working in Agate Centre, with Adjusting Screws and Graduated Silvered Metal Arc, on Brass Stand ... ... each £0 11 6

11821 Ditto, Student's cheap form, without Arc ... ... „ 0 8 0

11822 Ditto, for Suspension, working in Agate Centres, in Brass Frame, with Adjusting Set Screws ... ... each 0 8 0

11823 Ditto, Superior make, working in Agate Centres, with Metal divided Arc, on Polished Mahogany Base ... ... each 0 17 6

11824 Ditto, with Simple Galvanometer combined, supported in Copper Frame, complete with Terminals, mounted on Mahogany Base 1 15 0



11825–6



11827



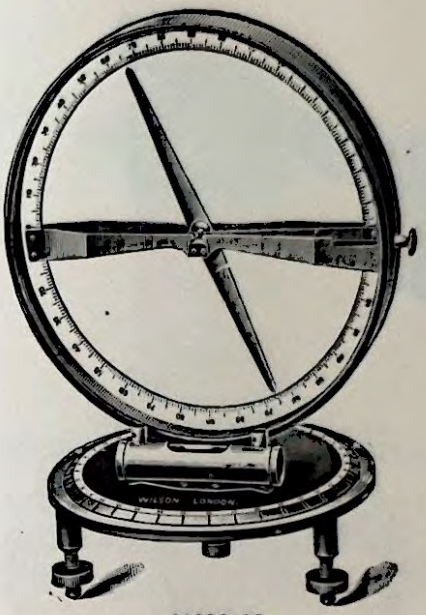
11828

11825 **Needle, Dip, Circle,** with Silvered Engraved Scale, mounted on Mirror with one each Magnetic and Non-magnetic Needle, 4 in. long, working in Agate Bearings, mounted on Brass Pillars with Polished Mahogany Base ... ... each £1 5 0

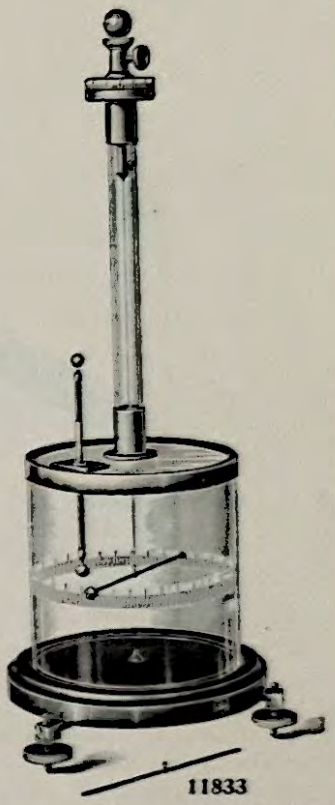
11826 Ditto, Larger, with 6-in. Needles ... ... „ 1 15 0

11827 Ditto, for Declination and Inclination, Agate Bearings for Needle, Silvered Engraved Circle, Frame with Terminals, Swivel Joint on Adjustable Rod with Brass Pillar and Base 3 5 0

11828 **Needle, Dip,** with two Silvered Engraved Arcs, Agate Bearings for Needle, Horizontal and Vertical Movement, Spirit Level mounted on Brass Pillar revolving on Tripod Foot, with Levelling Screws 5 0 0



11830–32



11833

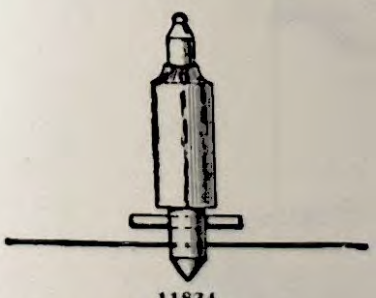
DIP CIRCLE

The Needle rests on two Agate Knife Edges, and swings in the centre of a Vertical Circle, graduated to degrees. It can be raised off the Knife Edges by the small Milled-head Screw at the side of the instrument, and is enclosed by two Glass Plates. The Horizontal Circle is also graduated to degrees, and carries a sensitive Adjustable Level to set the axis of the instrument vertical. The whole is supported by three Levelling Screws. The instrument is entirely of Gun-metal, and care is taken that no iron enters into its composition.

The Needle is adjusted so that it reads to within one degree both for reversals of position and for reversals of polarity—eight different positions in all.

This instrument has been adopted by the Education Department of the London County Council, after extensive tests with other instruments.

=11830	With 6 in. Needle ... ... Nett	£8	0	0
=11831	„ 4 „ „ ... ... „	6	16	0
=11832	„ 3 „ „ ... ... „	5	6	0
11833	**Torsion Balance,** Coulomb's, superior make, with Scale engraved on the glass, finely divided Head for measurement of Angle of Torsion, mounted on Polished Mahogany Base with Levelling Screws	6	0	0



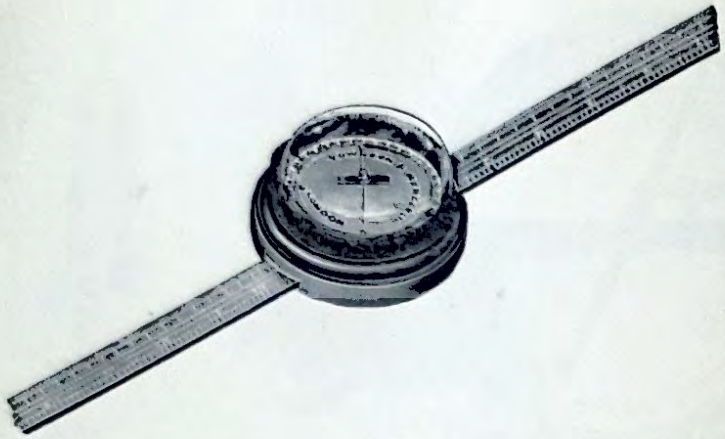
11834



11836–37

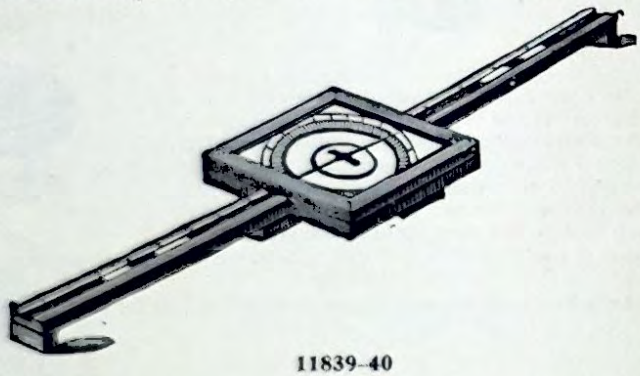
11834	**Magnetometer,** Searle's, in Brass Holder with Aluminium Pointer for comparing accurately Magnetic Fields up to 4·0 C.G.S. Units ... ... each	£0	2	6
11835	**Stand,** with Torsion Head, for use with above	0	13	6
11836	**Magnetometer,** Deflection, Agate Centre Bar Needle, with Aluminium Pointer, reading on Card Scale, with two Boxwood half metre Rules, divided into millimetres, complete in Polished Teak Box 3 in. Dial ... ... each	0	15	0
11837	Ditto, ditto. 4 „ „ ... ... „	0	17	6

GAS ANALYSIS APPARATUS



11838

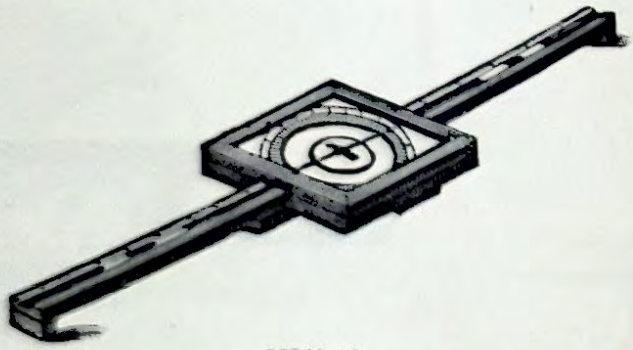
11838 **Magnetometer,** Deflection, on Polished Base with Metal Dial, Agate Centre Bar Needle Aluminium Pointers and Glass Cover, two half-metre Boxwood Rules, on Polished Base, complete **£0 12 6**



11839-40

11839 **Magnetometer,** Deflection, Agate Centre Bar Needle with Aluminium Pointer, 4-in. Graduated Card Dial with Magnets mounted in Polished Mahogany, complete **£1 1 0**

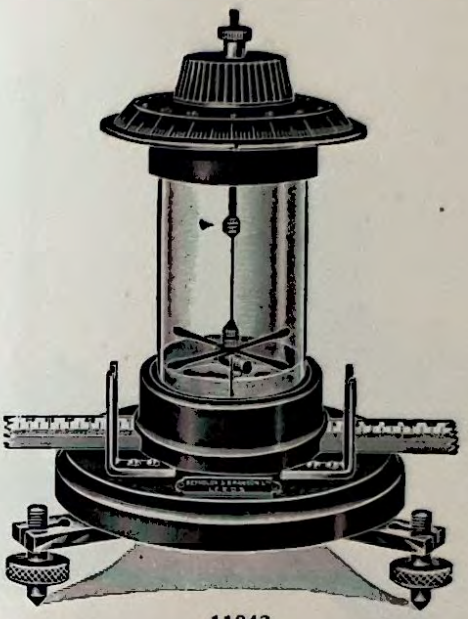
11840 Ditto, ditto, as above, 6-in. Dial, complete **1 5 0**



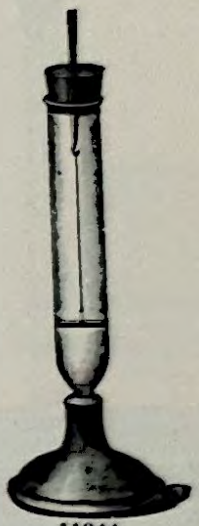
11841-42

11841 **Magnetometer,** Deflection, Agate Centre Bar Needle with Aluminium Pointer, 6-in. Graduated Card Dial mounted on Mirror to avoid parallax, and two Magnets, mounted in Polished Mahogany, complete **£1 15 0**

11842 Ditto, ditto, best quality, with Silvered Engraved Scale, with Magnets mounted in Polished Mahogany, complete **2 5 0**



11843



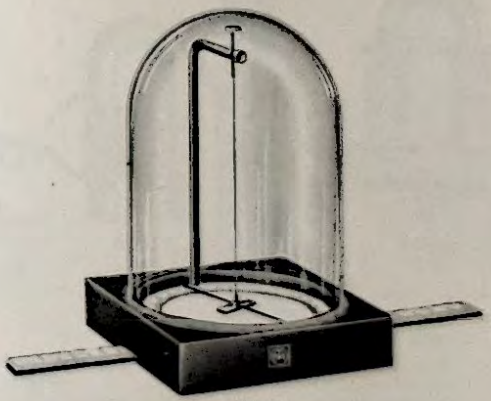
11844

*11843 **The Torsion Magnetometer.** By J. Ewles, M.A., University of Leeds; complete with cobalt chrome and soft iron needles, cylindrical magnet, 12× $\frac{3}{16}$ in., torsion head, phosphor bronze suspension, boxwood scales, levelling screws and damping fluid **£1 10 0**

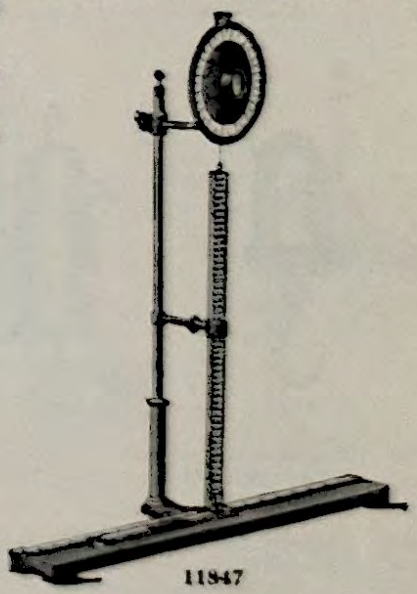
By means of this instrument all the experiments usually performed with the deflection and vibration magnetometers may be carried out easily and rapidly. It has the additional advantage of being independent of the earth's field. The whole is enclosed in a short glass cylinder which supports the torsion head and fits into a circular wooden base. A slot is cut in the base so as to take a cross arm carrying a metre rule ... **£1 10 0**

11844 **Magnetoscope,** Simple Form, Stewart and Gee's ... ... each **0 3 6**

11845 Ditto, Superior quality, Ebonite Fittings and Brass Mounts ... ... each **0 5 6**



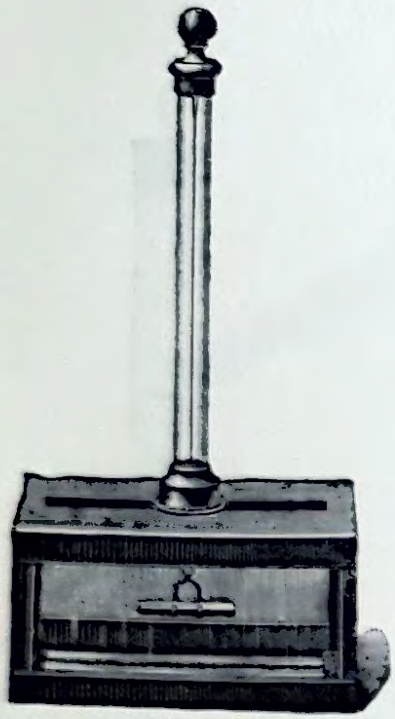
11846



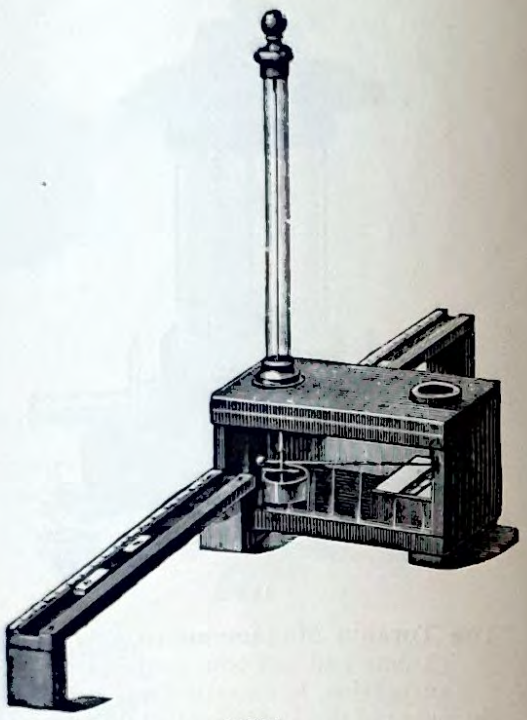
11847

11846 **Magnetoscope,** Schuster & Lee's Pattern, on Polished Teak Base, with Glass Shade and Graduated Rule, 1 metre long, reading from the centre **£1 5 0**

11847 **Magnetic Balance,** with Metal Dial and Boxwood Scale, mounted on Polished Mahogany Base **1 17 6**



11849–50



11851

11849	**Magnetometer,** Vibration, with two Magnets and two Brass Bars, complete in Polished Wood Case	£0 17 6
11850	Ditto, as above, best quality, in Polished Mahogany Case	1 1 0
11851	Ditto, Comparison Boxwood Scales, divided into millimetres, with one pair of Magnets, and one pair of soft Iron Bars, best quality, in Polished Mahogany Case	2 2 6

Electro-Magnetism



11852



11853



11854



11855

11852 **Magnets,** Electro, Soft Iron Cores, wound with Insulated Copper Wire, Keeper and Hook for suspending weight, complete with connecting Terminals.

Diameter of Core	½	¾	¾	1	in.
	4/6	6/6	8/6	13/6	each

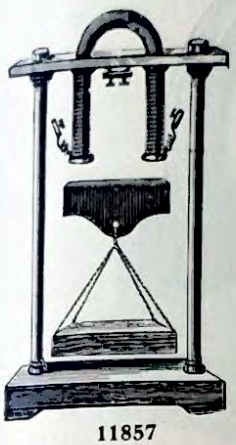
11853 **Magnets,** Electro, Students' Pattern, with Keeper and Hook for suspension, length 3½ in. ... each £0 5 0

11854 Ditto, superior quality, mound with insulated Copper Wire on Wood Bobbins, Keeper with Suspension Hook, complete with connecting Terminals.

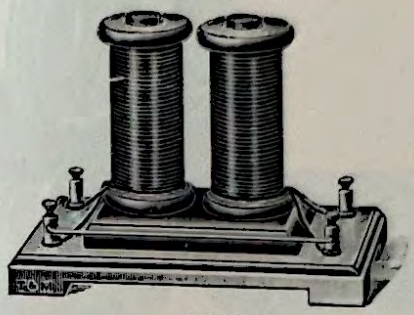
Length	4	5	6	7	in.
Diameter of Core	½	⅝	¾	1	"
	9/6	12/6	15/0	21/0	each

11855 Ditto, Iron Cores only ... ...

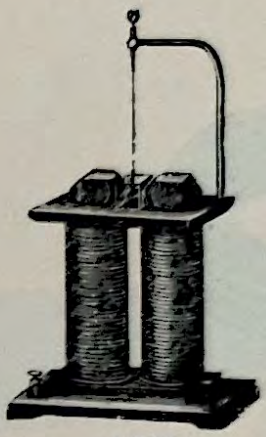
Length ...	4	5	6	in.
Diameter ...	½	⅝	¾	"
	1/3	1/10	2/4	each



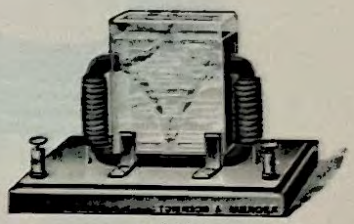
11857



11858



11859



11860

11857	**Magnet, Electro,** large, 6 × 1 in., very powerful, for Lecture use, mounted on Mahogany Base ...	£4	10	0
11858	**Magnet, Electro,** for Laboratory use, with soft Iron Cores, 8 × 1¼ in., movable Coils, 8 × 1¼ in., with Dia-Magnetic Poles and Iron Armatures, mounted on Mahogany Base	4	10	0
11859	**Dia-Magnetic,** small size, for use with Lantern; with movable Poles, two Armatures, Glass Trough, Rod of Bismuth, Tube of Iron Chloride Solution and Suspension Apparatus, complete ...	5	0	0
11860	**Apparatus,** for Objective Demonstration, for the production and fixing of Magnetic Curves	1	15	0

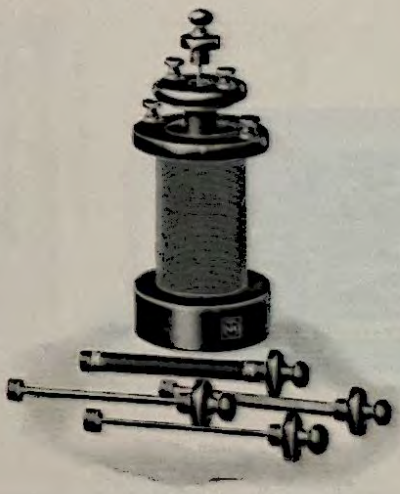
Induction Apparatus



11861



11862-3



11864

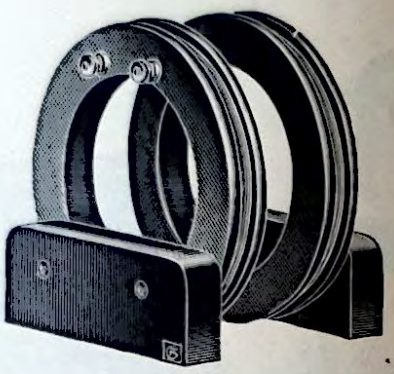


11865

11861	**Bobbin of Wire,** to show Faraday's Induction Experiments, single Coil and Core, mounted on Wood Base ... ... each	£0	10	0
11862	Ditto, Primary and Secondary Coils, with Soft Iron Core and Terminals, mounted on Polished Wood Base ... ... each	0	18	6
11863	Ditto, Large size, mounted on Polished Mahogany Base ... ... ,,	1	12	0
11864	Ditto, ditto, ditto, with Soft Iron Cores and Bundle of Soft Iron Wires, each fitted with Handles per set	2	7	6
11865	**Induction Coils,** Weinhold's, of fine and coarse wire, mounted on Mahogany Stand... per pair	1	1	0



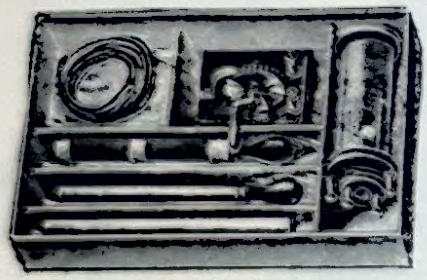
11867



11868

11867 **Apparatus** to show Induction of Current by currents under the influence of metallic conductors traversed by electric currents consisting of Mahogany Ring, diameter 5 in., wound with 300 turns Double Silk-covered Copper Wire, and fitted with Terminals ... ... each **£0 10 0**

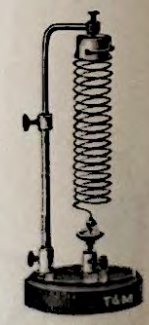
11868 **Induction Coils,** mounted vertically for experiments on Induction, consisting of Mahogany Rings 6 in. diameter, mounted on Mahogany Bases, wound with 500 turns Double Silk-covered Copper Wire, complete with Terminals, per pair **1 10 0**



11869



11870

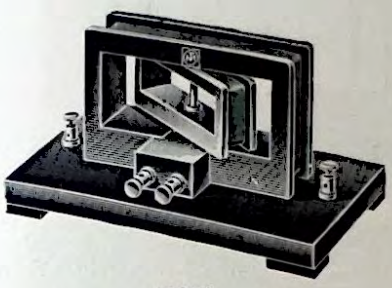


11871

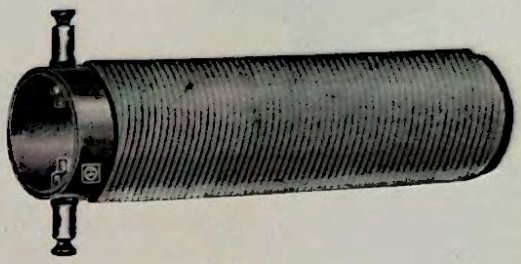
11869 **Apparatus,** Set of, for Induced Current Experiments, Bar Magnet, Soft Iron Bar with Handle, bundle of thin Iron Rods in Handle, two pairs of Conducting Cords and Interrupting Wheel, packed in Wooden Box, complete... ... ... **£4 4 0**

11870 **Spirals,** Flat, for illustrating Induced Currents, mounted on Wooden Boards per pair **0 11 6**

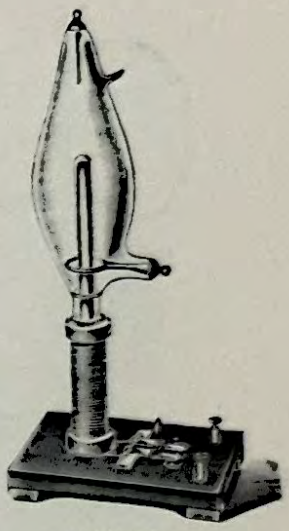
11871 **Jumping Spiral,** Roget's, mounted on Polished Mahogany Base **0 15 6**



11874



11873



11875–76

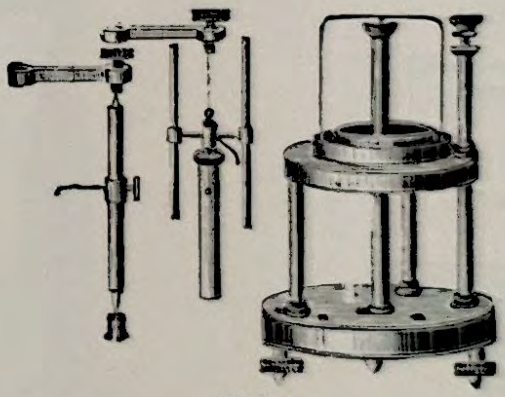
11873	**Solenoid,** for converting a Soft Iron Bar into a Magnet ... ... each	£0	4	6
11874	**Garth's Apparatus,** for showing the action of Angular Currents; best make	2	15	0
(F) 11875	**De la Rive's Apparatus** to show the action of a Magnet on the Current passing through a Vacuum Tube. Complete with Switch	1	10	0
(F) 11876	Ditto, ditto, with Vacuum Tube, made of Uranium Glass	1	12	6



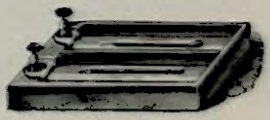
11877



11878



11879



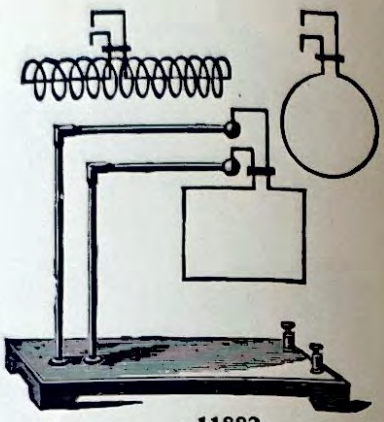
11880

11877	**Rotating Magnet,** Ritchie's, on Polished Brass Base	£1	7	6
11878	**Apparatus** for illustrating Rotation of a Current by a Magnet; Glass Tube, with Corks, one having Copper Wire with Platinum Wire joined, the other with Bar Magnet (*vide* Foster's "Electricity and Magnetism")	0	5	6
11879	Ditto, illustrating Rotation of a Magnet on its Axis, the Rotation of a Current round a Magnet, and the Rotation of a Magnet round a Current ...	5	12	6
11880	**Apparatus,** De la Rive's, to demonstrate that the different parts of the same current repel each other	0	6	6

(F) Foreign manufacture.

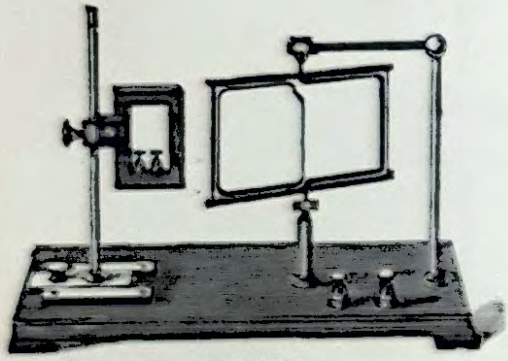


11880/1–81

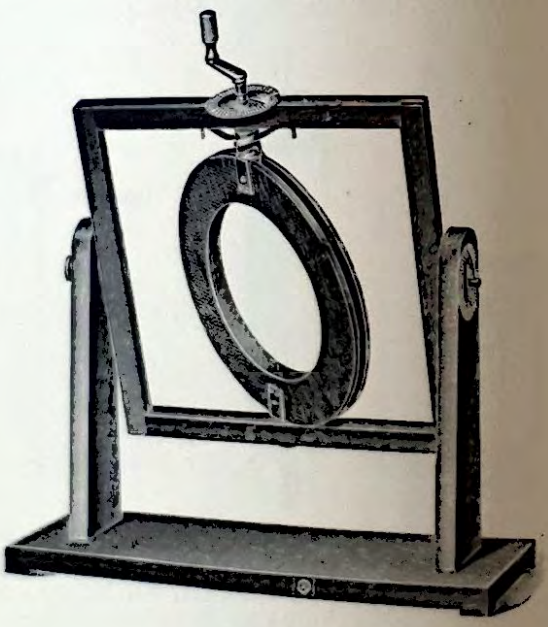


11882

11880/1	**Floating Batteries,** De la Rive's, with Ring or Solenoid, in Glass Vessel, either Form ... ... each	£0 7 6
11881	Ditto, per pair Elements, with one Glass Vessel only	0 12 6
11882	**Apparatus,** Ampere's, with Solenoid, Rectangle and Ring, to show attraction of parallel currents, on Polished Mahogany Base	1 15 0
11883	Ditto, with Reverser, on Polished Mahogany Base	2 5 0

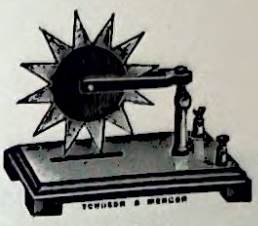


11884



11885

11884	**Apparatus,** with three Bent Wires and Coil, best quality, mounted on Polished Mahogany Base...	£4 15 0
11885	**Earth Inductor** or Delezenne Circle, consisting of Coil which is wound with a large number of turns of Insulated Wire and mounted so as to revolve within the Framework, which is of Polished Mahogany, fitted with two Metal Dials, etc. The number of turns of wire are stamped on the base...	4 10 0



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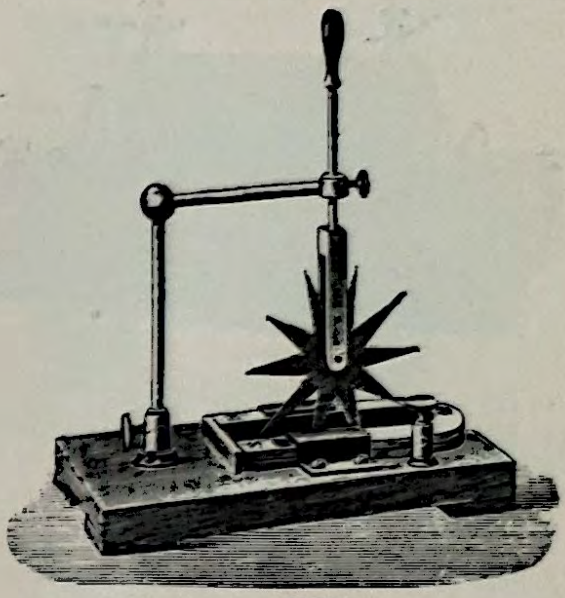
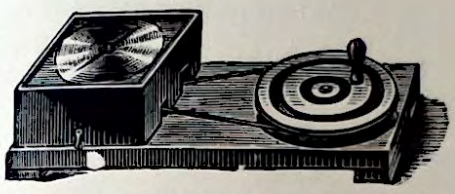
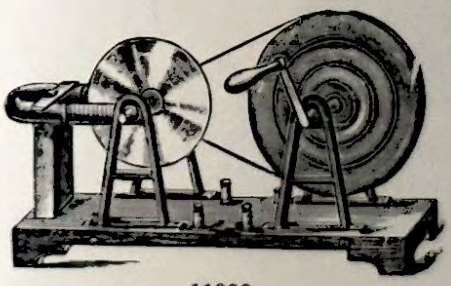


11887

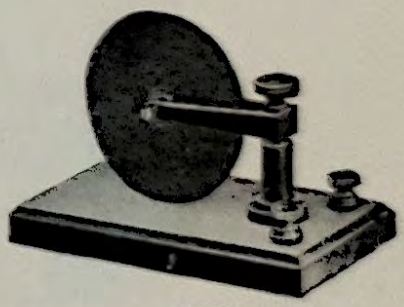


11888

11886	**Stella Wheel,** Barlow's, with adjustment for height, mounted on Polished Base ...	£0 15 0
11887	Ditto, ditto, large size, superior make, with Magnet mounted on Polished Base	1 17 6
11888	**Apparatus,** Arago's, to show the action of a rotating Copper Disc on the Magnetic Needle	3 5 0

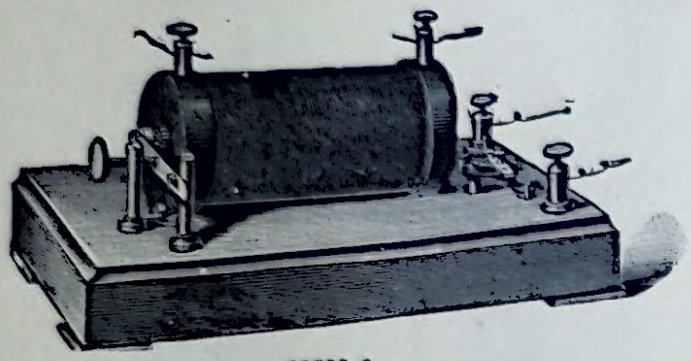


11889

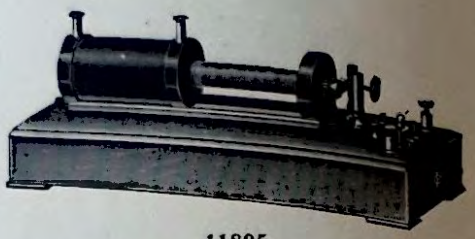


11890

11889	**Apparatus,** Faraday's, to show that current is produced in a Copper Disc rotating between Poles of a Magnet	£3 7 6
11890	**Sturgeon's Disc,** Copper Disc, 3¼ in. diameter, with Brass Fittings, Mercury Trough and Terminals, mounted on Polished Mahogany Base	0 15 0



11892-3



11895

(F) **11892** **Induction Coils,** without Commutator, mounted on Polished Mahogany Base.

Length of Spark	4	6	8	10	mm.
	9/0	**10/6**	**14/6**	**22/0**	each

(F) **11893** Ditto, with Ordinary Commutator.

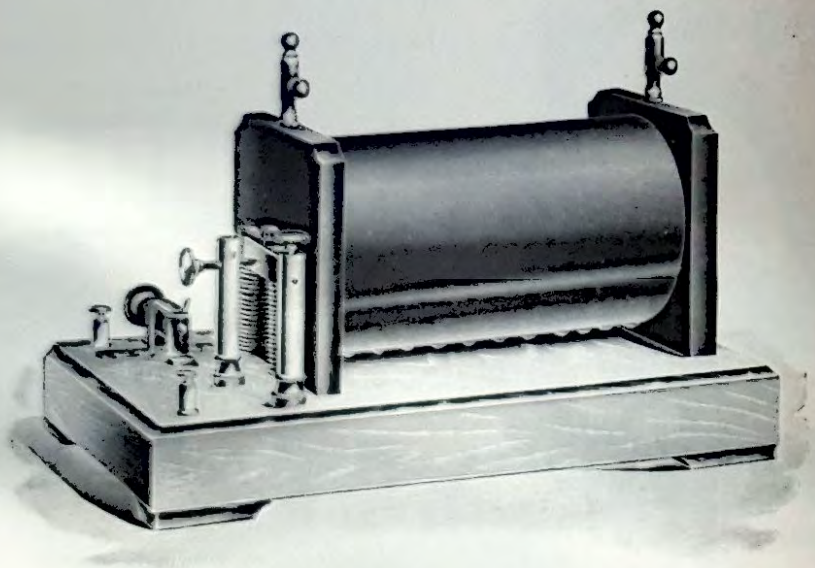
Length of Spark	4	6	8	10	12	15	20	25	mm.
	12/0	**13/6**	**17/0**	**24/0**	**30/0**	**36/6**	**47/0**	**58/0**	each

(F) **11894** Ditto, with Ruhmkorff's Commutator.

Length of Spark	10	15	20	25	30	40	mm.
	35/0	**45/0**	**55/0**	**67/6**	**75/0**	**100/0**	each

(F) **11895** **Induction Coils,** Sliding, to demonstrate construction of a Ruhmkorff's Coil, Secondary Coil sliding on Runners, showing Primary, with Platinum Break and Terminals, mounted on Polished Mahogany Base with Commutator

Length of Spark	6	8	10	15	mm.
	21/6	**29/0**	**39/0**	**60/0**	each



11897

(F) **11897** **Induction Coils,** Ruhmkorff's, with stout Ebonite ends and covered body on Polished Mahogany Base, with Ruhmkorff's Commutator.

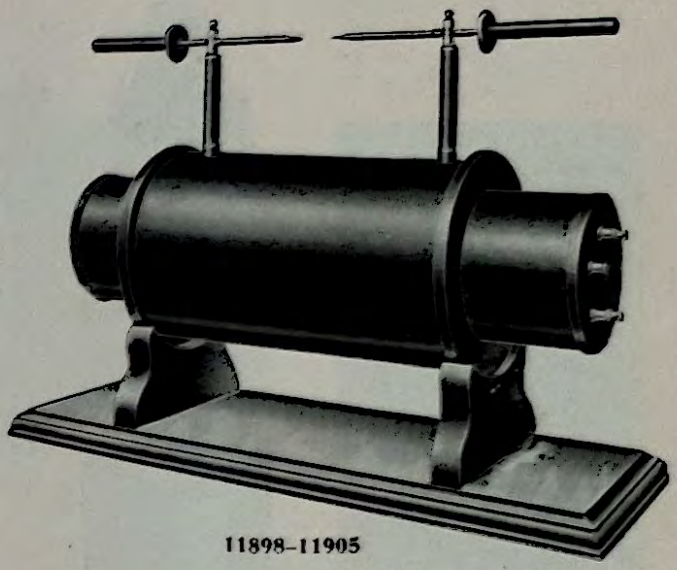
Length of Spark	50	75	100	mm.
	£6 15 0	**£9 15 0**	**£12 0 0**	each.

(F) Foreign manufacture

INDUCTION COILS

English Made Induction Coils of the Rhumkorff type. The insulation throughout is exceptionally good, the wax employed is a specially constructed composition which is practically indestructible.

These Coils are fitted with a high capacity well insulated condenser which is mounted in the base, which is constructed in polished oak or mahogany.



11898–11905

Prices.

Without Contact Breaker. Arranged to work from any voltage.

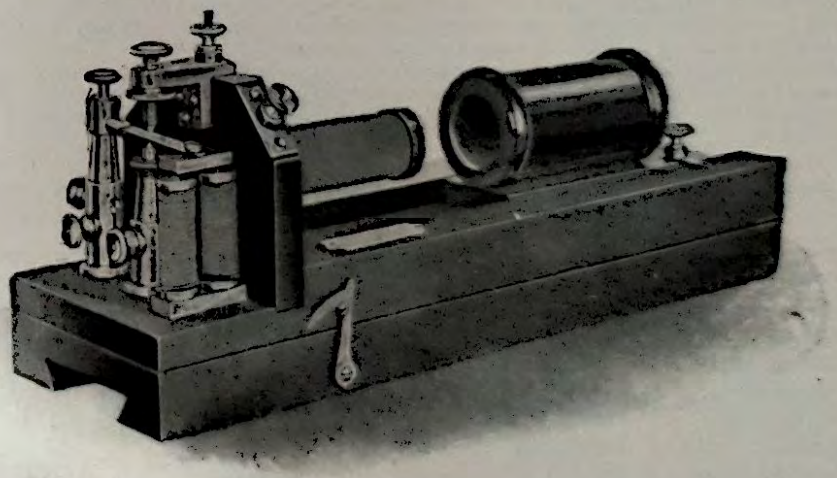
*11898	2 in. spark gap	£13 10 0
*11899	3 ,, ,, ,, ...	14 0 0
*11900	4 ,, ,, ,, ...	14 10 0
*11901	6 ,, ,, ,, ...	21 10 0
*11902	8 ,, ,, ,, ...	26 10 0
*11903	10 ,, ,, ,, ...	29 0 0
*11904	12 ,, ,, ,, ...	34 10 0
*11905	16 ,, ,, ,, ...	44 10 0

*Discharge Pillars £1 0 0 extra.

Prices.

Including platinum Contact Breaker. To work from 6-24 volts.

*11898CB	2 in. spark gap	£16 0 0
*11899CB	3 ,, ,, ,, ...	17 10 0
*11900CB	4 ,, ,, ,, ...	18 0 0
*11901CB	6 ,, ,, ,, ...	25 0 0
*11902CB	8 ,, ,, ,, ...	30 0 0
*11903CB	10 ,, ,, ,, ...	32 10 0
*11904CB	12 ,, ,, ,, ...	38 0 0
*11905CB	16 ,, ,, ,, ...	48 0 0



11906

***11906 INDUCTION COIL**

The above represents a well-designed, high-class coil, suitable for experimental or class work. It is of the well-known sledge type, after the model of Prof. du Bois-Raymond, with Helmholtz' modification of the Neef Hammer. The base is graduated in mm. to 500, and folds under to economise space. The primary consists of approximately 300 turns of silk-covered wire, wound on a core of specially annealed iron wire. For the secondary of 7,500 turns, a high grade enamelled wire is used, which, in combination with the "bank" system of winding, has been found to give good results for a general purpose coil. There are a full set of terminals, so that all the experiments mentioned in the text-books can be demonstrated.

Price £6 0 0



11908-10



11911-14

HIS MASTER'S VOICE CAESIUM PHOTO ELECTRIC CELLS

For Television, Picture Telegraphy, Photometry, Relays, etc.

Vacuum and Gasfilled. All cells can be supplied vacuum or gasfilled. The sensitivity figures are for white light on vacuum cells which work at all voltages from 50 to 500. Gas magnification varying from X2 to X20 can be obtained according to the working voltage required.

Types.

CS.1 Sensitive to all spectral light to orange.
CS.2A Sensitive to spectral light and infra-red.
CS.2B " " " " "
Type CS.2B vacuum is the standard type.

Prices.

11908 CS.2A Sensitivity exceeding 35 microamps. per lumen ... **£7 10 0**
11909 CS.2B Sensitivity exceeding 20 microamps. per lumen ... **£5 0 0**
11910 CS.1 (Gasfilled only) Sensitivity exceeding 15 microamps. per lumen ... **£5 0 0**

Cells can be made for any purpose.
Potassium and rubidium cells can be supplied.

OSRAM PHOTO CELLS

Extensive investigation and exhaustive experiments at the Research Laboratories of the General Electric Co. Ltd. have resulted in the production of a type of gasfilled photocell having a definitely higher sensitivity and a greatly improved frequency characteristic over those previously made.

The improvements in design render the older potassium type of cell, which has hitherto been widely used, obsolete for all but a few special purposes. The effective sensitivity of the new C.M.G.8 cell which is determined by the amplification obtained by gasfilling, is at least 75 microamperes per lumen at the normal working voltage of the cell. In the case of many of the photo cells this sensitivity is very much higher.

In the original C.M.G.8 cell the advantages over the potassium type, although very considerable, were appreciably less than in the new type, because if a voltage as high as that permissible with potassium cells was applied, the cell deteriorated and there was an imperfect response to light interrupted at high frequency.

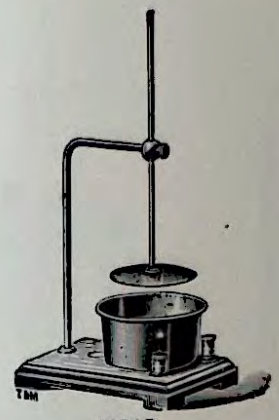
The marked sensitivity of the Osram C.M. cell to white light does not arise from increased response to light of all wave-lengths but has been obtained by moving the point of maximum sensitivity from the blue to the red end of the spectrum. The potassium cell is very insensitive to any but deep blue light, but to this light it is much more sensitive than any other cell—including the C.M. cell.

TYPES AND PRICES OF OSRAM PHOTO CELLS (Prices apply only to Gt. Britain and Northern Ireland).

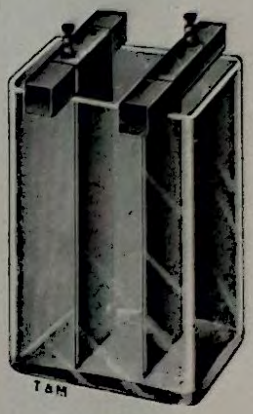
	Geometrical Form.	Application.	Cathode.	Type.	Price.
11911	Cylindrical (Standard type) gasfilled	General purposes requiring high sensitivity to white light and infra-red rays.	Cassium-Silver	C.M.G.8	**£7 10 0**
11912	Hemispherical	General purposes	Potassium	K.G.1	**4 10 0**
11913	Cylindrical with quartz window	Detection of Ultra-violet rays	Sodium	U.N.G.7	**8 0 0**
11914	Cylindrical	Scientific Applications	Potassium	K.G.7	**5 0 0**
			Potassium-Copper	K.M.G.7	**7 10 0**
			Caesium-Silver	C.M.G.7	**10 0 0**

Vacuum cells, types K.V.6, K.M.V.6, C.M.V.6, corresponding respectively to the gasfilled types K.G.7, K.M.G.7, C.M.G.7, are available for precision work at the same prices.

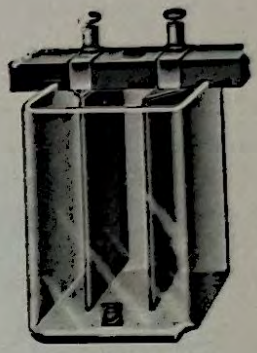
Voltameters



11915



11916

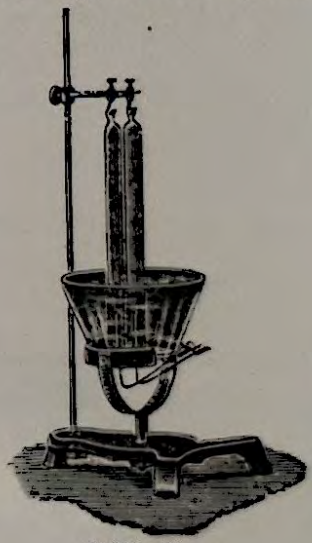


11918

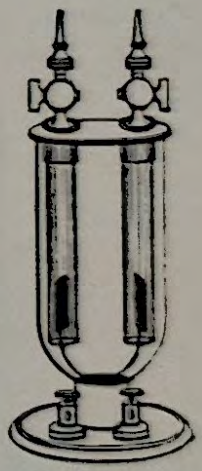
11915	**Voltameter,** Copper, Simple, on Polished Mahogany Base ... ... each	£0 13 6
11916	Ditto, another form, two Copper Plates on cross pieces with Terminals and rectangular Glass Vessel ... ... each	0 5 9
11917	Ditto, ditto, ditto, with cylindrical Glass Vessel	0 5 0
11918	Ditto, ditto, ditto, with Copper Plates adjustable on Teak Rod	0 7 6



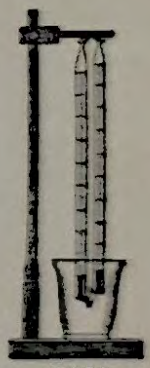
11919–20



11921–22



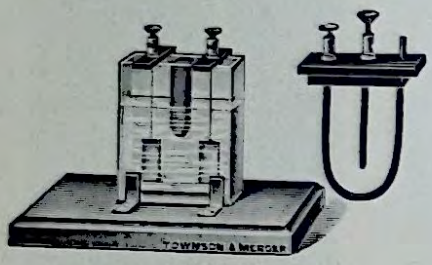
11923



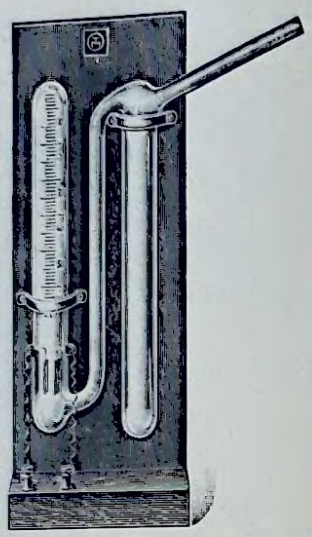
11924

11919	**Voltmeter,** with two Tubes, Platinum Electrodes and Bridge Support, on Polished Mahogany Stand	£0 16 0
11920	Ditto, as above, larger size ,, ,, ,, ,, ...	1 0 0
	(Nos. 11919 and 11920 can be supplied with Tubes fitted with Glass Taps at 4/0 per pair, extra.)	
11921	Ditto, with Adjustable Hook Supports for Tubes, on Iron Stand with Triangular Base	1 8 6
11922	Ditto, ditto, ditto, ditto, with Graduated Tubes	1 12 6
11923	**Voltameter,** Large size for Lecture Table, mounted on Polished Mahogany Base ...	2 5 0
(F) 11924	Ditto, Graduated Tubes, Platinum Electrodes and Tube Support on Polished Wood Stand	0 15 0,

(F) Foreign manufacture.



11926-27



11928



11929

11926	**Voltameter,** Projection Apparatus, for Lantern demonstration, mounted on Mahogany Base	£1 1 0
11927	Fitting to use with above, for generating a Leaden Tree ... ... extra	0 4 6
11928	Ditto, for Mixed Gases, mounted on Stand with Terminals	0 17 6
(F) 11929	**Doebereiner's Lamp,** with Brass Cover and Stopcock	1 1 0

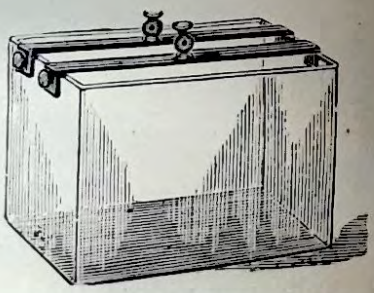
Extra Platinum Sponges, price varies **2/0** each.



11930



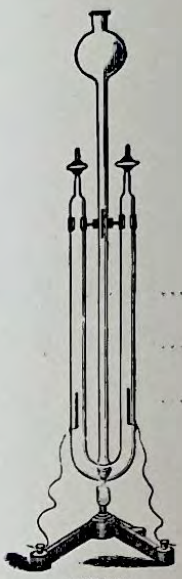
11931



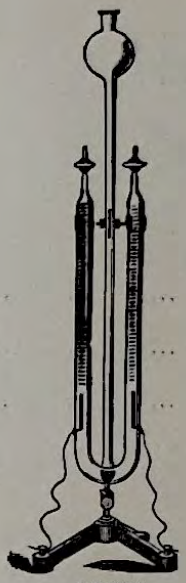
11932

11930	**Carbon Holder,** simple form, mounted on Mahogany Base, with sliding motion	£0 15 0
11931	**Electric Lamp,** large size, superior finish, with Electro-magnetic adjustment for Carbons, Reflector, mounted on Circular Polished Mahogany Base... ...	3 10 0
11932	**Decomposing Trough,** Earthenware, for Electro-plating, etc., with two Bars and Terminals about 13×17½×7 inches	1 1 0

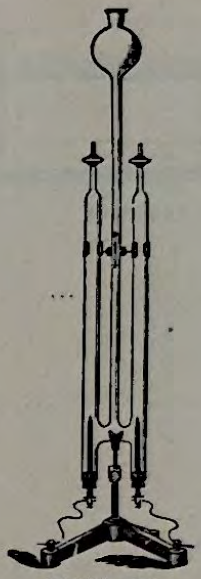
(F) Foreign manufacture.



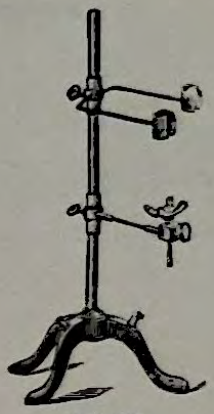
11934



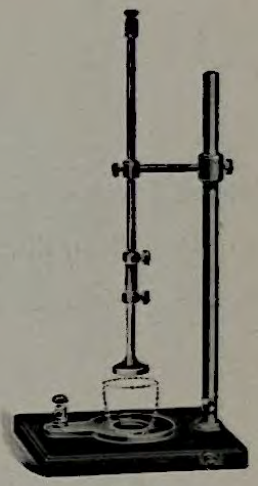
11935



11936–37



11939



11940

11934 **Voltameter,** Hofmann's, decomposition of water into one of oxygen and two of hydrogen, with two Stopcocks and Platinum Electrodes and Bulb-Reservoir, without stand ... ... each **£1 4 0**

11935 Ditto, with Tubes graduated into c.c.; without stand ... ... „ **1 10 0**

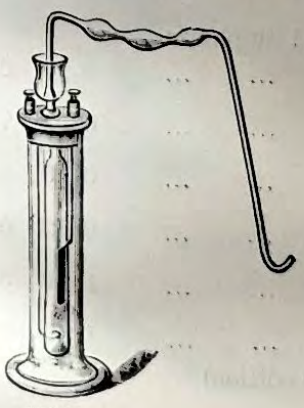
11936 Ditto, for Electrolysis of Hydrochloric Acid, with Carbon Electrodes; without stand each **0 18 6**

11937 Ditto, with Tubes graduated into c.c.; without stand ... ... „ **1 4 6**

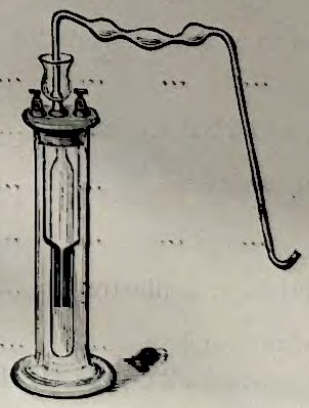
11938 Ditto, with both Carbon and Platinum Electodes, fitted in I.R. Corks and Tubes without stand ... ... each **1 6 0**

11938/1 Ditto, ditto, ditto, with Tubes, graduated into $\frac{1}{5}$ c.c. without stand ... ... „ **1 12 0**

11939 Ditto, Stand, Universal, to fit any of the above tubes; Brass Rod, Fittings and Terminals mounted on Tripod Foot ... ... each **0 11 6**



11941



11942

11940 **Silver Voltameter,** mounted on Slate Base with Copper socket for Platinum Basin, heavy Silver Anode and Brass Fittings, without platinum basin **£1 15 0**

(F) **11941** Ditto, Bunsen's, for preparing pure Hydrogen Gas **£1 4 0**

(F) **11942** Ditto, for generation of Explosive Gas **£1 5 6**

(F) Foreign manufacture.



11943-44

11943	**Tube,** Ozone Induction, covered with tin-foil	£0 9 6
11944	Ditto, ditto, tube only, without tin-foil covering	0 6 0
11945	Ditto, ditto, on Polished Mahogany Stand, complete	1 1 0



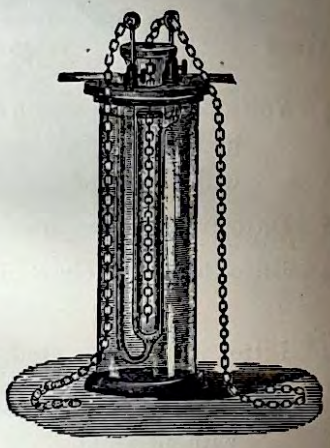
11946



11947



11948

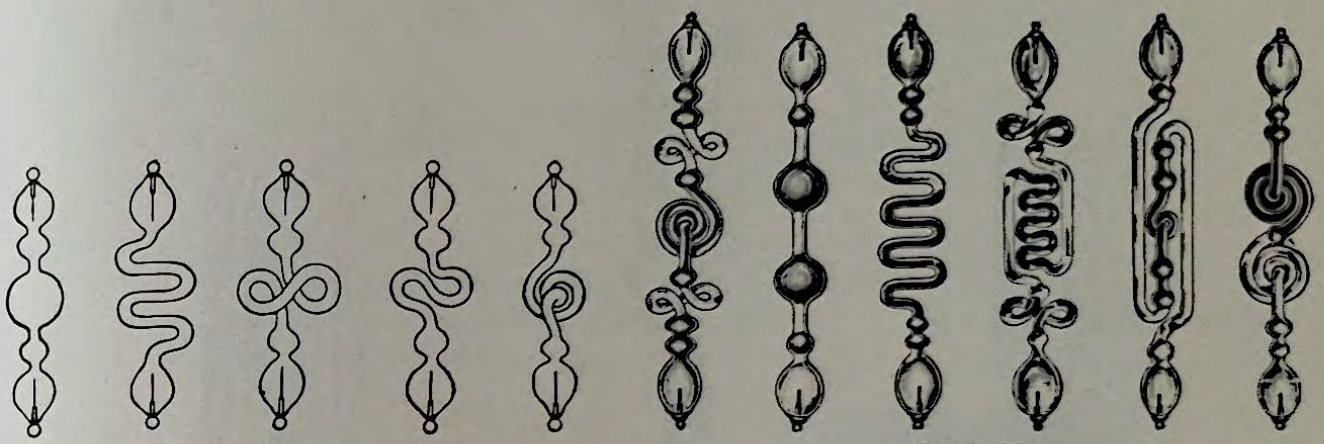


11949-51

11946	Ozone Apparatus, Newth's, to show the absorption of Ozone by Turpentine Price (without Platinum Wire)	£1 0 0
(F) **11947**	Ozone Apparatus, Kreb's, for making Ozone from Barium Peroxide and Sulphuric Acid	0 7 0
(F) **11948**	Ditto, ditto, ditto, Potassium Permanganate and Sulphuric Acid	0 2 9
11949	Ditto, Siemens', upright tube for use with Sulphuric Acid	0 8 6
11950	Ditto, with Glass Cylinder	0 12 6
11951	Ditto, complete with Vulcanite Cover and Fittings, as illustration	1 10 0
11952	Ditto, Newth's simple form with Platinum wire complete ... ... (See Newth's Chemical Section Experiments, Fig. 25, page 31, 1899 edition)	1 0 0

(F) Foreign manufacture.

Geissler Vacuum Tubes



11954–55 11956–57

(F) **11954** **Geissler Vacuum Tubes,** 10 cm. long, in Cardboard Boxes. Sets of 4 6
4/6 7/0

(F) **11955** Separate Tubes ... ... each £0 1 3

(F) **11956** Ditto, ditto, Sets of 6 Tubes, in Cardboard Boxes.

13	16	20	25	30	cm. long
9/6	10/0	12/6	15/6	20/0	per set

(F) **11957** Ditto, Separate Tubes ... ... 1/8 1/10 2/3 2/9 3/6 each



11958–61 11962

(F) **11958** **Vacuum Tubes,** various designs, height 25 cm., mounted on Polished Wood Bases each £0 11 6

(F) **11959** Per Set of 6 Tubes 3 5 0

(F) **11960** Ditto, 30 cm. high ... ... each 0 16 0

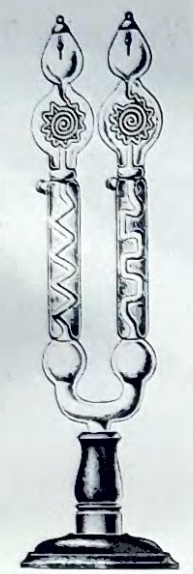
(F) **11961** Ditto, Per Set of 6 Tubes 4 7 6

(F) **11962** Ditto, ditto, height 35 cm., shape of a grill on Polished Wood Base ... ... each 1 2 6

(F) Foreign manufacture.



11963



11965



11964

(F) **11963** **Vacuum Tubes,** filled with two fluorescent liquids, mounted on Polished Wood Bases.

	15	20	25	cm. high
	6/6	**8/0**	**10/0**	each
(F) **11964** Ditto, ditto, filled with four fluorescent liquids—	20	25	30	cm. high
	13/6	**16/0**	**21/0**	each

(F) **11965** Ditto, ditto, filled with two liquids, 30 cm. high ... ... each **£1 2 6**



11966



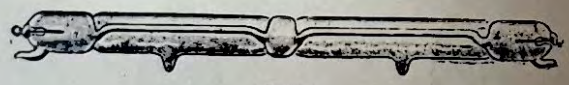
11967



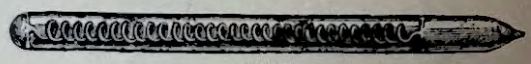
11970



11968



11969



11971

(F) **11966** **Vacuum Tubes,** filled with Fluorescent Liquids.

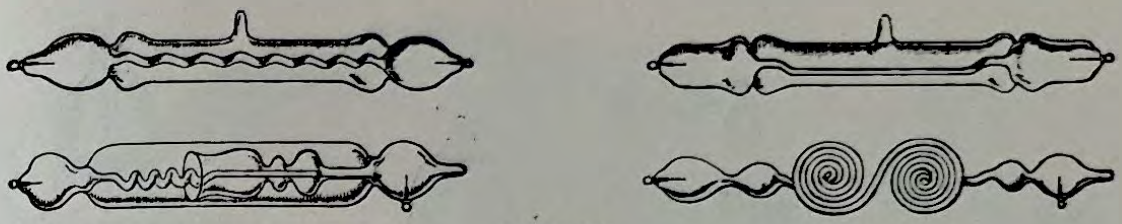
	10	15	20	25	cm. long
	2/0	**2/9**	**3/3**	**4/6**	each
(F) **11967** Ditto, ditto, filled with two Fluorescent Liquids.		25	30	35	cm. long
		6/0	**7/-**	**8/0**	each
(F) **11968** Ditto, ditto, containing one Phosphorescent Powder.		15		25	cm. long
		4/6		**7/0**	each
(F) **11969** Ditto, ditto, containing two Phosphorescent Powders.		25	30	35	cm. long
		7/0	**8/6**	**10/6**	each

(F) **11970** Ditto, ditto, containing Mercury which is illuminated by shaking.

	20	25	35	cm. long
	7/6	**8/6**	**9/6**	each

(F) **11971** Ditto, ditto, illuminated by rubbing with Silk, 50 cm. long ... ... each **£0 12 6**

(F) Foreign manufacture.



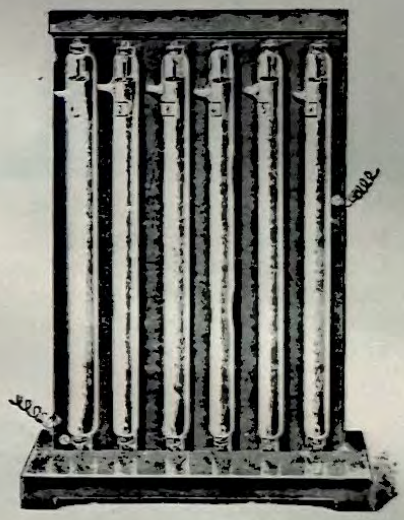
11973–74

(F) **11973** **Vacuum Tubes,** Set of 4 Tubes for Demonstration, 15 cm. long, containing: 1 Phosphorescent Powder; 2 Fluorescent Liquid; 3 Uranium and Ordinary Glass; 4 Uranium Vessel; In Cardboard Box, complete ... ... per set **£0 11 6**

(F) **11974** Ditto, ditto, as above, 20 cm. long ... ... „ **0 17 6**



11975–76



11977–80

(F) **11975** **Vacuum Tubes,** for Demonstration, 25 cm. long, set of 6 Tubes containing: 1 Phosphorescent Powder; 2 Fluorescent Liquid; 3 Uranium and Ordinary Glass; 4 Two Gases; 5 Mercury Salts; 6 Mercury illuminated by shaking. Complete in Cardboard Box **£1 15 0**

(F) **11976** Ditto, ditto, 35 cm. long, set of 7 Tubes containing: 1 Uranium and Ordinary Glass; 2 Two Fluorescent Liquids; 3 Two Phosphorescent Powders; 4 Two Gases; 5 Showing Stratification. 6 Mercury Salts; 7 Mercury illuminated by shaking ... **2 12 6**

(F) **11977** **Cross Vacuum Scale,** consisting of 6 Tubes, 20 cm. long, of different degrees of exhaustion, mounted on Wooden Stand **1 8 6**

(F) **11978** Set of Tubes only **0 19 6**

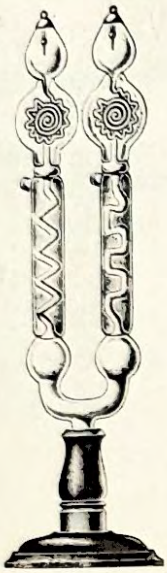
(F) **11979** Cross Vacuum Scale as No. **11977**, but tubes 40 cm. long, mounted on Polished Stand with Switch **5 0 0**

(F) **11980** Set of Tubes only **1 15 0**

(F) Foreign manufacture.



11963



11965



11964

(F) **11963** **Vacuum Tubes,** filled with two fluorescent liquids, mounted on Polished Wood Bases.

15	20	25 cm. high
6/6	**8/0**	**10/0** each

(F) **11964** Ditto, ditto, filled with four fluorescent liquids—

20	25	30 cm. high
13/6	**16/0**	**21/0** each

(F) **11965** Ditto, ditto, filled with two liquids, 30 cm. high ... ... each **£1 2 6**



11966



11968



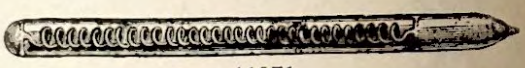
11967



11969



11970



11971

(F) **11966** **Vacuum Tubes,** filled with Fluorescent Liquids.

10	15	20	25 cm. long
2/0	**2/9**	**3/3**	**4/6** each

(F) **11967** Ditto, ditto, filled with two Fluorescent Liquids.

25	30	35 cm. long
6/0	**7/-**	**8/0** each

(F) **11968** Ditto, ditto, containing one Phosphorescent Powder.

15	25 cm. long
4/6	**7/0** each

(F) **11969** Ditto, ditto, containing two Phosphorescent Powders.

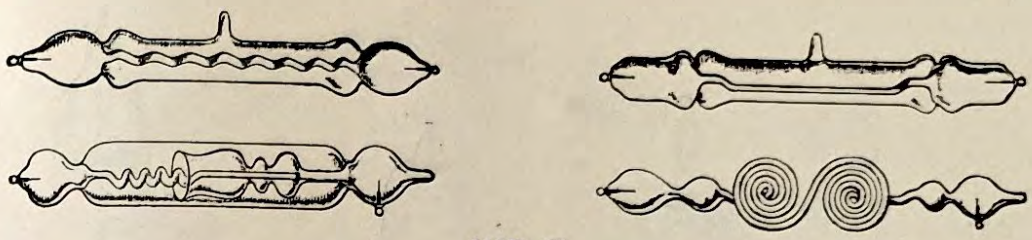
25	30	35 cm. long
7/0	**8/6**	**10/6** each

(F) **11970** Ditto, ditto, containing Mercury which is illuminated by shaking.

20	25	35 cm. long
7/6	**8/6**	**9/6** each

(F) **11971** Ditto, ditto, illuminated by rubbing with Silk, 50 cm. long ... ... each **£0 12 6**

(F) Foreign manufacture.



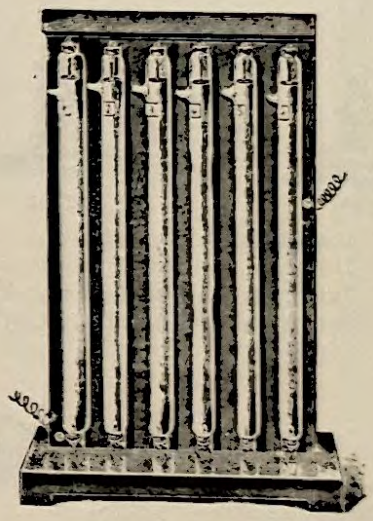
11973–74

(F) **11973** **Vacuum Tubes,** Set of 4 Tubes for Demonstration, 15 cm. long, containing: 1 Phosphorescent Powder; 2 Fluorescent Liquid; 3 Uranium and Ordinary Glass; 4 Uranium Vessel; In Cardboard Box, complete ... ... per set **£0 11 6**

(F) **11974** Ditto, ditto, as above, 20 cm. long ... ... „ **0 17 6**



11975–76



11977–80

(F) **11975** **Vacuum Tubes,** for Demonstration, 25 cm. long, set of 6 Tubes containing: 1 Phosphorescent Powder; 2 Fluorescent Liquid; 3 Uranium and Ordinary Glass; 4 Two Gases; 5 Mercury Salts; 6 Mercury illuminated by shaking. Complete in Cardboard Box **£1 15 0**

(F) **11976** Ditto, ditto, 35 cm. long, set of 7 Tubes containing: 1 Uranium and Ordinary Glass; 2 Two Fluorescent Liquids; 3 Two Phosphorescent Powders; 4 Two Gases; 5 Showing Stratification. 6 Mercury Salts; 7 Mercury illuminated by shaking ... **2 12 6**

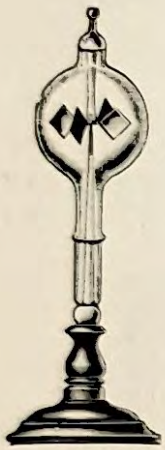
(F) **11977** **Cross Vacuum Scale,** consisting of 6 Tubes, 20 cm. long, of different degrees of exhaustion, mounted on Wooden Stand **1 8 6**

(F) **11978** Set of Tubes only **0 19 6**

(F) **11979** Cross Vacuum Scale as No. **11977**, but tubes 40 cm. long, mounted on Polished Stand with Switch **5 0 0**

(F) **11980** Set of Tubes only **1 15 0**

(F) Foreign manufacture.



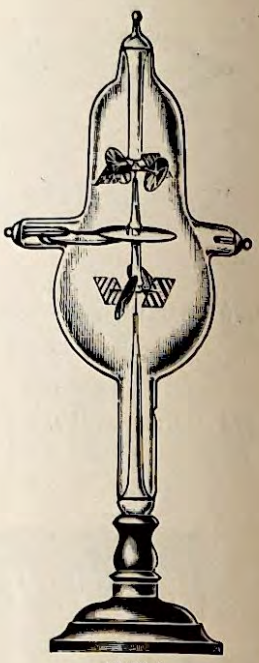
11981



11982

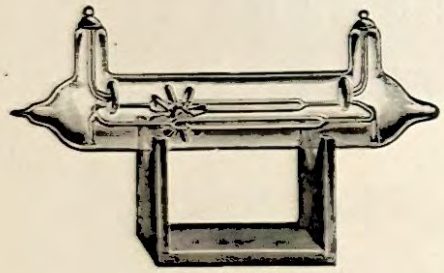


11983



11984

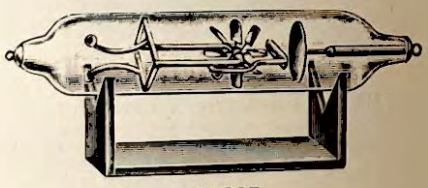
(F) **11981**	**Radiometer,** Crookes' ... ... each	**£0**	**7** **6**
(F) **11981/1**	Ditto, ditto, with Double Vane...	**0**	**15** **0**
(F) **11982**	Ditto, Crookes', with Double Vane, Cylindrical Pattern	**0**	**18** **0**
(F) **11983**	**Electrical Radiometer,** Puluj's, with Phosphorescent Vanes	**1**	**7** **6**
(F) **11984**	Ditto, ditto, ditto, with 2 sets of Vanes and fixed Disc	**2**	**10** **0**



11985

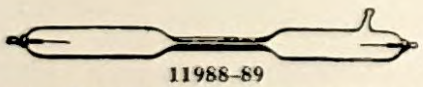


11986

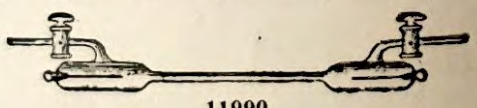


11987

(F) **11985**	**Crookes' Tube,** with Mica Wheel running on Glass Rails to illustrate the Mechanical Action of the Cathode Ray	**£1**	**10** **0**
(F) **11986**	Ditto, ditto, with Aluminium Cross for Shadow Experiment	**0**	**19** **6**
(F) **11987**	Ditto, ditto, with Mica Wheel, which is set in motion by means of a Magnet, the wheels can be rotated in opposite directions	**1**	**10** **0**



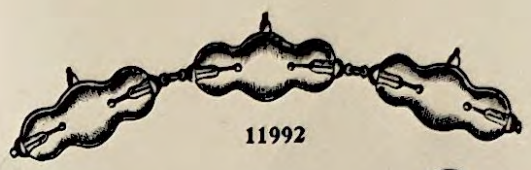
11988–89



11990

(F) **11988**	**Spectrum Tubes,** containing the following Gases— O, H, N, CO_2, H_2O, Cl, HCl, Br, I, Cy, HCy, NO, NO_2 each	**£0**	**5** **6**
(F) **11989**	Ditto, filled with Argon, Helium or Neon ... ... ,,	**1**	**5** **0**
(F) **11990**	Ditto, with 2 Stopcocks, for filling with Gases, Argon, Helium or Neon for Analysis	**0**	**9** **6**

(F) Foreign Manufacture.



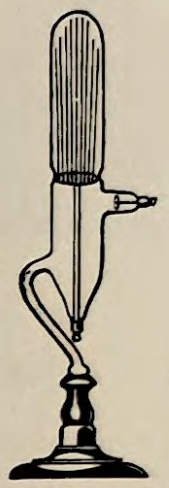
11992



11991



11993



11995



11994



11996

(F) **11991** **Phosphorescence Lamp** (Puluj's) **£1 2 6**

(F) **11992** **Set of 3 Glass Bulbs,** to show Phosphorescence, made of Uranium, German and English Glass ... ... per set **0 18 6**

(F) **11993** **Vacuum Tubes,** containing various Phosphorescent Substances, Shells, Stones, etc. each **0 15 0**

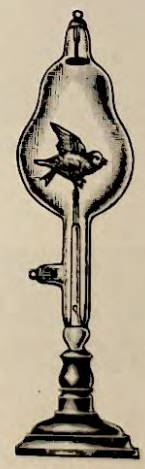
(F) **11994** Ditto, for the demonstration of the dark space **0 16 6**

(F) **11995** Ditto, Goldstein's Canal Ray, new pattern, 40 cm. **1 5 0**

(F) **11996** Ditto, containing Corals **1 1 0**



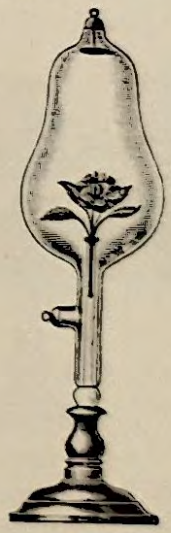
11997



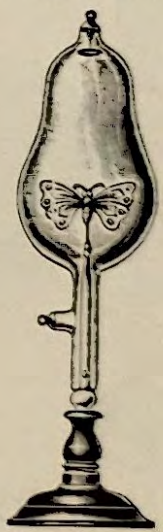
11998



11999



12000

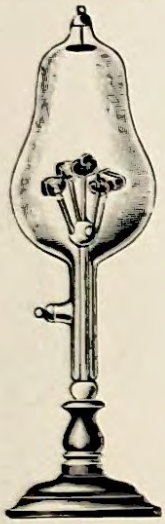


12001

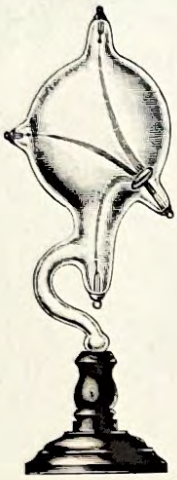
(F) **11997/12001** **Vacuum Tubes,** containing Phosphorescent Substances in various forms—

Nos. 11997	11998	11999	12000	12001 each
Flower	Bird.	Beetle.	Rose.	Butterfly.
7/6	**10/0**	**10/0**	**12/0**	**10/0**

(F) Foreign manufacture.


12002

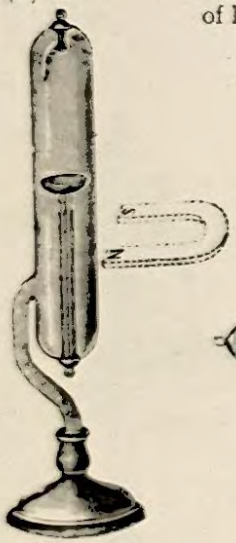

12003

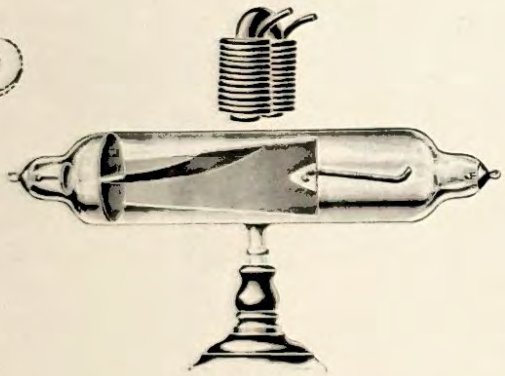

12004

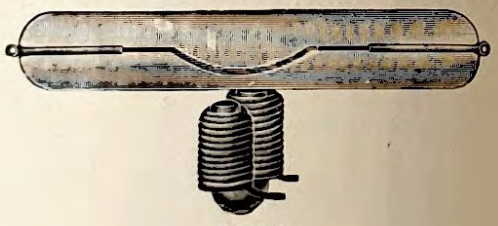

12005


12006

(F) **12002** **Vacuum Tube,** containing 5 Phosphorescent Minerals ... ... each £1 5 6
(F) **12003** **Low Vacuum Tube,** in which the discharge takes the form of a Sparking Current 0 14 0
(F) **12004** **High Vacuum Tube,** which allows the straight line propagation of the Cathode Rays and Phosphorescence ... ... each 0 16 0
(F) **12005** **Crookes' Vacuum Tube,** to show that Radiant Matter generates heat when impeded ... ... each 1 4 0
(F) **12006** **Crookes' Tube,** with Semi-circular Cathode to show that the appearance of the rays of light depends on the Negative Pole 0 15 6


12007


12008


12009


12010

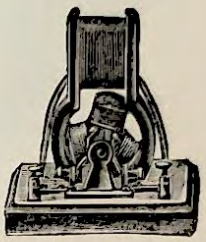
(F) **12007** **Crookes' Tube,** with Concave Mirror, for illustrating the heating effects of the Cathode Rays concentrated in the focus of the mirror ... ... each £0 12 6
(F) **12008** **Crookes' Tube,** to show that Radiant Matter is deflected by a Magnet ... „ 1 2 6
(F) **12009** **Tube,** with Low Vacuum, to show the deflection of Rays caused by an Electro Magnet. Price without Magnet ... ... each 0 8 0
(F) **12010** **Vacuum Tube,** with Concave Mirrors, to show that parallel currents of the same electricity are self-repellant ... ... each 1 10 0

(F) Foreign manufacture.

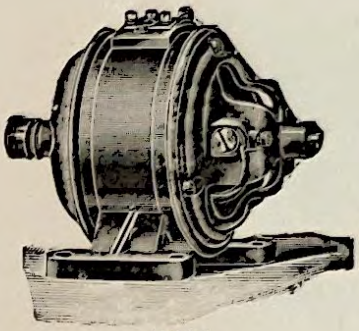
Motors



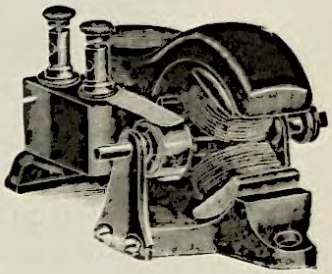
12011–12



12013

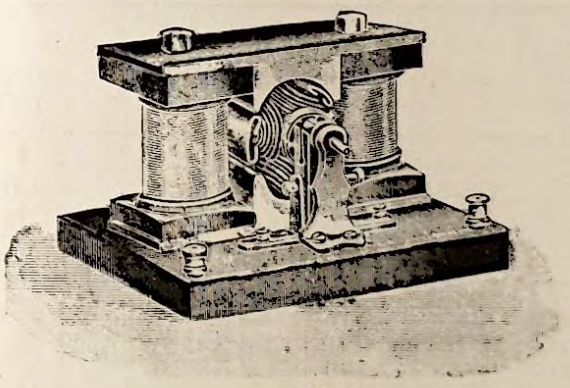


12014

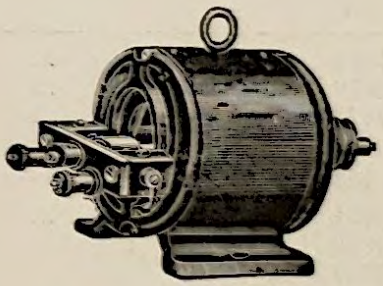


12015

12011	**Vacuum Tube Revolver,** suitable for Tubes up to 5 in. long ... ... each	**£0 17 6**
12012	Ditto ditto ditto 9 in. long ... ... „	**1 10 0**
(F) **12013**	**Motor,** Simple, with Tripolar Armature, self starting	**0 4 6**
(F) **12014**	**Motor,** semi-enclosed type, self starting	**0 6 6**
12015	**Motor,** The "Kent," self starting, with Tripolar Armature	**0 7 6**



12016



12017

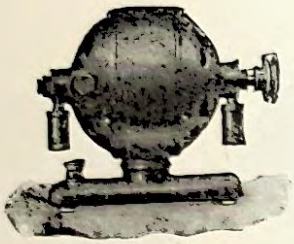
(F) **12016** **Motor,** with triple T Armature, on Black Enamelled Sheet Iron Bases, self starting.

No.	1	2	3	
	6/0	**9/0**	**12/6**	each

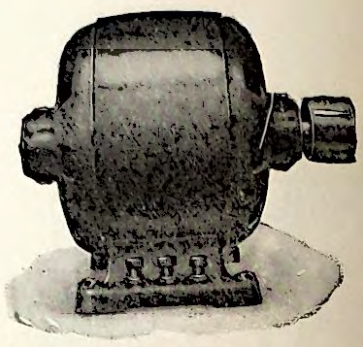
12017 **Motors,** semi-enclosed, self-starting Tripolar Armature, former wound field coils, Tubular Copper gauze brushes.

No. 1—4 volts	each	**£0 13 0**
No. 2.—6 „	„	**0 16 6**
No. 3.—8 „	„	**0 19 6**

(F) Foreign manufacture.



12018–20
D.C. Series Wound Motors.



12021–29
D.C. Shunt Wound Motors.

SMALL MOTORS

Fractional Horse Power Motors supplied in open protected type frames, with small openings in the end shields for ventilation and fixed position of brushes ("G" type frame) or with unrestricted ventilation and adjustable rocker for brushes ("N" type frame).

The series-wound motors will start against full load, and must not be run without load as they will attain dangerous speeds. They are particularly suitable for loads of a constant nature, as the speed is inversely proportional to the load.

D.C. SERIES WOUND

	Full load Speed R.P.M.	H.P.	Frame	Price each 100/110	Price each 200/220 230/250
(F) **12018**	2,000	1/35	G	**£1 18 0**	**£2 1 0**
(F) **12019**	2,000	1/10	G	**3 8 0**	**3 13 0**
(F) **12020**	2,000	1/8	N	**4 1 0**	**4 8 0**

D.C. SHUNT WOUND

(F) **12021**	2,000	1/25	G	**£2 14 0**	**£2 18 0**
(F) **12022**	2,000	1/10	G	**3 13 0**	**3 18 0**
(F) **12023**	2,000	1/8	N	**4 8 0**	**4 14 0**
(F) **12024**	2,000	1/6	N	**5 5 0**	**5 14 0**
(F) **12025**	2,000	1/4	N	**6 9 0**	**6 14 0**

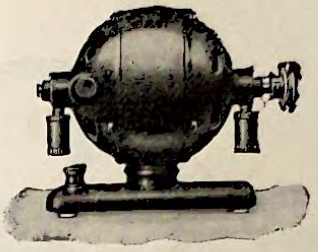
A.C. SERIES COMMUTATOR, 40/50 CYCLES

(F) **12026**	2,000	1/45	G	**£1 19 0**	**£2 3 0**
(F) **12027**	2,000	1/12	N	**3 17 0**	**4 3 0**
(F) **12028**	2,000	1/7	N	**4 17 0**	**5 5 0**
(F) **12029**	2,000	1/5	N	**6 2 0**	**6 11 0**

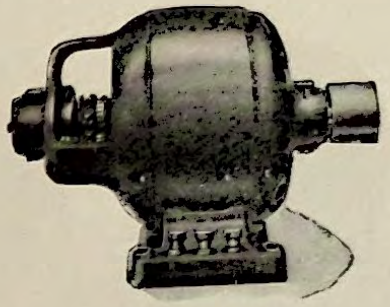
Tolerance in speeds + 10 per cent.

The above prices are for machine complete with standard pulley.

The use of a starting and regulating resistance is recommended with these motors.



12030–32
Single-phase Induction Motor
Type MIM



12033–35
Universal Motor
Type MSU

SMALL MOTORS

Similar in design and construction to the motors shown on the previous page. The Single-phase Induction Motor is of the Squirrel Cage type, while the Universal Motors can be supplied with either "G" or "N" type frames.

The Series wound Motors will start against full load and must not be run without load, as they will attain dangerous speeds.

They are particularly suitable for loads of a constant nature, as the speed is inversely proportional to the load.

SINGLE-PHASE INDUCTION FOUR-POLE

	Type	Output and R.P.M. at Full Load 50		Price each	
		H.P.	R.P.M.	100/110 Volts	200/220 230/250 Volts
(F) **12030**	MIM 0.7/4	1/20	1,375	**£3 13 0**	**£3 18 0**
(F) **12031**	MIM 1.5/4	1/10	1,400	**4 7 0**	**4 13 0**
(F) **12032**	MIM 2/4	1/8	1,400	**5 5 0**	**5 14 0**

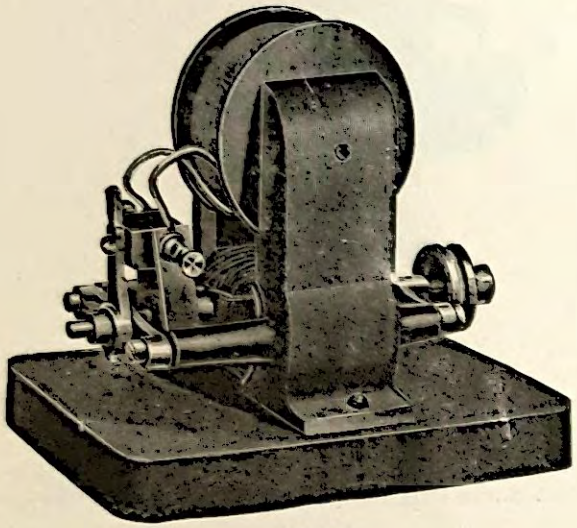
UNIVERSAL SERIES COMMUTATOR, FOR D.C. OR A.C., 25/50 CYCLES

	Type	Full load Speed R.P.M.	H.P.	Frame	Price each	
					100/110 Volts	200/220 230/250 Volts
(F) **12033**	MSU 0.2	2,400	1/50	G	**£2 3 0**	**£2 6 0**
(F) **12034**	MSU 1	2,400	1/15	N	**4 5 0**	**4 12 0**
(F) **12035**	MSU 1.5	2,400	1/8	N	**5 7 0**	**5 16 0**

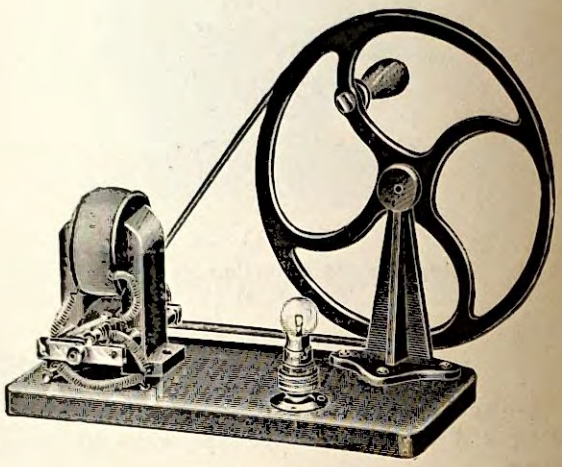
Tolerance in speeds: Single-phase Induction Type + 5 per cent; Universal Type + 12 per cent.
The above prices are for machine complete with standard pulley.
The use of a starting and regulating resistance is recommended with these motors.

(F) Foreign manufacture.

Dynamos

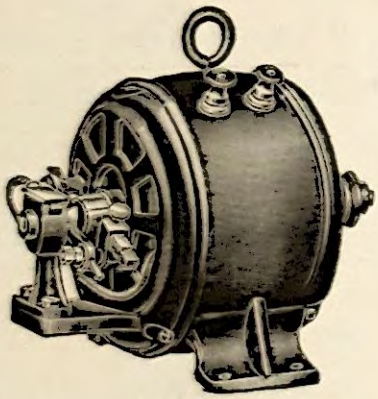


12037

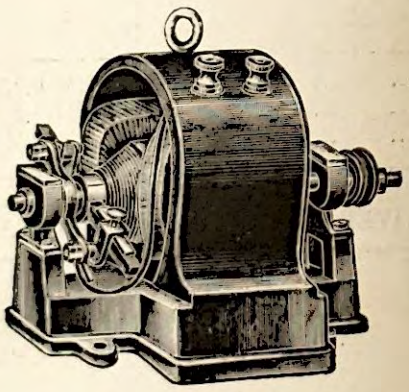


12038

*12037	**Dynamo,** The "Swift," fitted with two Pole Armature for lighting only, giving 8 volts at 3,000 r.p.m. ... ... each	£1 1 0
*12038	**Dynamo,** School Demonstration Model. This model consists of the Dynamo with the additional Hand Gear Drive, Leather Belt, also Lamp and Holder. Complete as illustration ... ... each	3 0 0



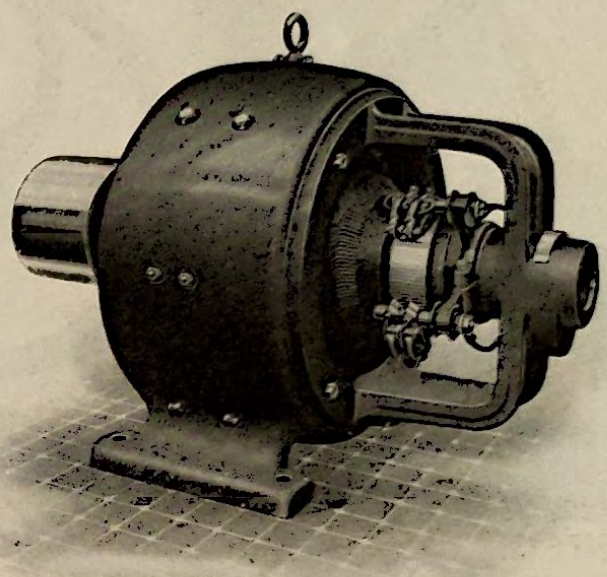
12039–40



12041–42

12039	**Dynamo,** semi-enclosed, Laminated Armature, Copper Gauze Brushes, adjustable Brush Rocker, Ring Oiler Bearings, Shunt Wound output 6 volts, 3 amperes each	£1 7 0
12040	Ditto, ditto, output 10 volts, 3-5 amperes ... ... „	2 10 0
12041	**Dynamo,** open protected type, 12-way Armature, Copper Gauze Brushes, adjustable Brush Rocker, Ring Oiler Bearings, former Wound Field Coils, Copper Commutator. Output 15 volts, 5 amperes ... ... each	3 15 0
12042	Ditto, Output 20 volts, 5 amperes .. .. „	6 5 0

Dynamos



12044-57

Direct Current Generators, for Country House and General Lighting (British made). All Machines built to B.E.S.A. 168/1926 specification.

Charging Dynamos—Outputs.

	Volts.	Type.	Amperes.	Speed.	Pulley.	Price.
12044	25/37	RF 1	7	1350	3 ×2½ in.	**£6 15 0**
12045	,,	RF 2	12	1250	3 ×2½ ,,	**9 0 0**
12046	,,	RF 3	18	1200	4 ×3 ,,	**10 2 6**
12047	,,	RF 4	20	1100	4 ×3 ,,	**15 10 0**
12048	50/73	RF 1	4	1300	3 ×2½ ,,	**6 15 0**
12049	,,	RF 2	6	1250	3 ×2½ ,,	**9 0 0**
12050	,,	RF 3	10	1200	4 ×3 ,,	**10 2 6**
12051	,,	RF 4	15	1100	4 ×3 ,,	**13 10 0**
12052	,,	RF 5	25	1100	4½×3½ ,,	**18 0 0**
12053	,,	RF 6	35	1100	5 ×4½ ,,	**21 7 6**
12054	100/150	RF 3	4	1300	4 ×3 ,,	**10 2 6**
12055	,,	RF 4	6	1300	4 ×3 ,,	**13 10 0**
12056	,,	RF 5	15	1250	4½×3½ ,,	**18 0 0**
12057	,,	RF 6	25	1200	5×4½ ,,	**21 7 6**

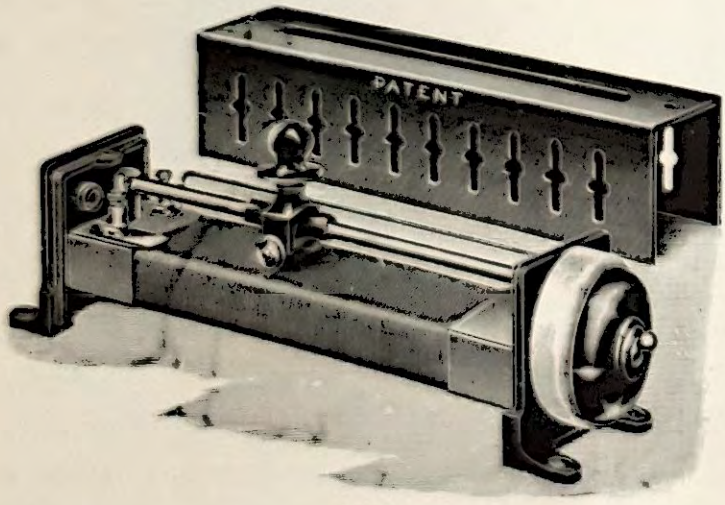


12058–59



12060–61

12058	**Hand Driving Gear,** fitted with adjustment for tightening the Belt. No. 1, diameter of wheel, 15 in. ... ... each	**£1 5 0**
12059	Ditto, ditto, No. 2, 17 in. ... ... „	**1 8 6**
12060	**Foot Driving Gear,** Heavy Flywheel for three speeds, hollow Shaft to secure ample oiling, Crank Pin fitted Bronze Bearing and Connecting Rod to Treadle by Ball Joint. Diameter of wheel, 18½ in.	**1 16 6**
12061	Ditto, ditto, diameter of wheel 15 in.	**1 12 6**



12062

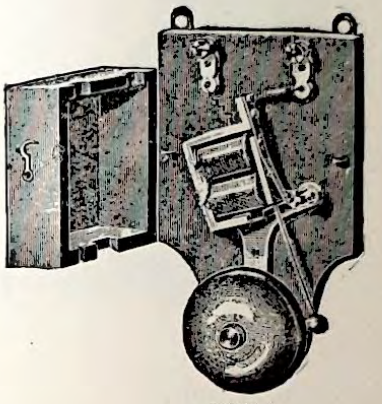
12062 The "Triumph" Regulator is for controlling the speed of small-power Motors, no matter for what purpose the Motor is employed.

They are fitted with Roller Contact, which never injures the winding, and Rocker Bearing, which slides without friction. Length, 9 in.

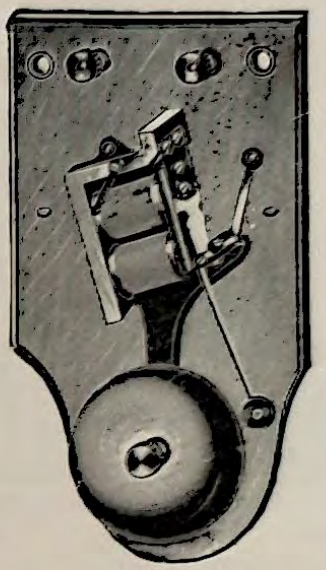
Best Crystalline finish.

Price **£1 5 0**

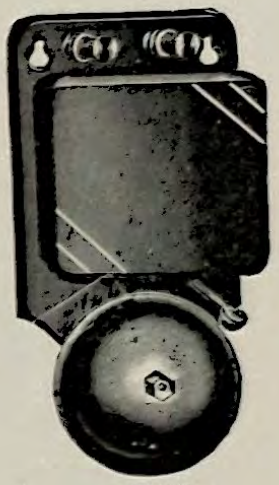
Electric Bells, Indicators, Relays, etc.



12064



12065



12066

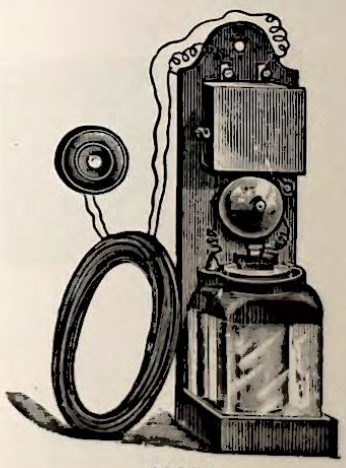
(F) **12064** **Electric Bells,** ordinary quality, Tempered Steel Springs, Brass Contact Pillar, Two Bobbins, wound with Silk-covered Wire and Iron Frame, mounted on Polished Wood Case.

2¾	3	
3/0	3/9	each

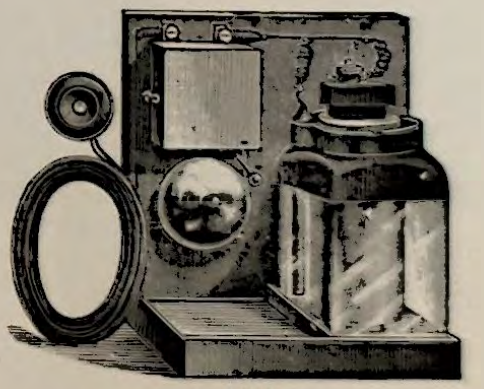
(F) **12065** Ditto, Best quality, Strong Cast Iron Frame, with Large Bobbins, Heavy Brass Contact Pillar, Nickelled Cast Bell-metal Gong, substantial Brass polished and Lacquered Terminals and Eyelets—with Dome-shape gong ... ...

2¾	3	3½	4	
5/0	5/9	7/6	9/6	each

(F) **12066** **Electric Bell,** in Stamped Iron Case, Japanned, Nickel-plated Steel Gong, a strong, cheap and reliable bell. With Gong 2½ in. ... ... each **£0 2 6**



12067



12368



12069-70



12071

12067 **Electric Bell,** Portable Set, with Leclanché or Dry Cell, 12 yards Insulated Twin Wire, Push and Bell mounted on Polished Wood Stand, complete **£0 11 6**

12068 **Electric Bell,** Portable Set, with No. 2 Leclanché Cell, 12 yards Wire, Push, and 3-inch Bell mounted on Polished Wood Stand, complete **0 12 6**

12069 **Pushes,** Ordinary Quality, Walnut, 2½ in. diameter ... ... each **0 1 3**

12070 Ditto, Medium Quality, fitted with German Springs with Bone Plungers, Brass Screws and washers, in Real Polished Oak or Walnut ... ...

2½	3	
1/6	2/0	each

12071 Ditto, Brass, Polished and Lacquered, Reeded pattern, with Front to unscrew, Ebonite Backs, and China Plungers, best quality ... ...

2	2½	3	
2/0	2/9	3/3	each

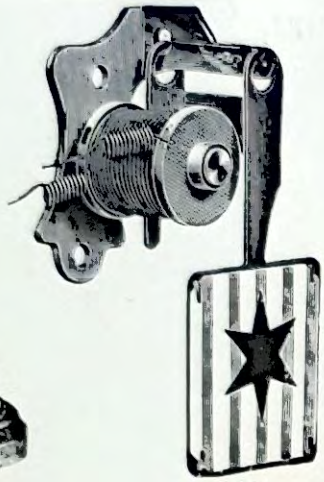
(F) Foreign manufacture.



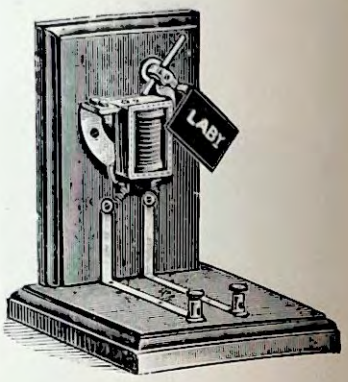
12073



12074



12075



12076

12073 **Pushes,** Pear shape, German Silver Springs, Bone Mounts, in Polished Solid Walnut, per doz., **8/6**; each **£0 0 9**

12074 **Wall or Ceiling Rose,** Bone centre, 2½ in. diameter, in oak or Walnut ... ,, **0 0 9**

12075 **Indicator Movement,** Electric, Pendulum movement, for Demonstration purposes each **0 1 6**

12076 Ditto, Model, for Teaching purposes, mounted on Mahogany Stand **0 7 6**



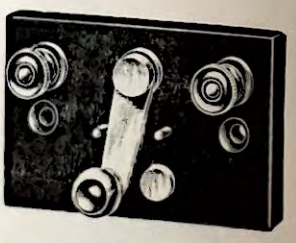
12077



12078



12079



12080

(F) **12077** **Switch, Lever,** with Nickel-plated Fittings, on Round Walnut Base.

1	2	3	4	way
1/2	**1/4**	**1/6**	**1/8**	each

(F) **12078** Ditto, ditto, on Oblong Walnut Base, with Moulded Edges.

1	2	3	4	way
1/2	**1/4**	**1/6**	**1/8**	each

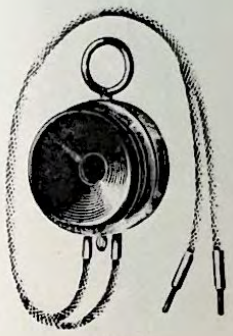
(F) **12079** Ditto, ditto, with Nickel-plated Fittings, on Ebonite Base, 1½ × 1¼ × ⅜ in., 1 way only, each **£0 1 4**

12080 Ditto, ditto, with Nickel-plated Fittings, on Ebonite Base, best quality.

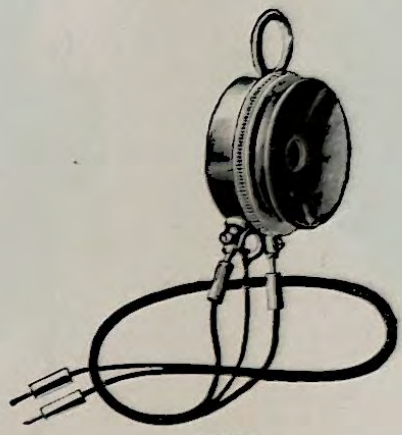
1	2	way
3/3	**3/9**	each

(F) Foreign manufacture.

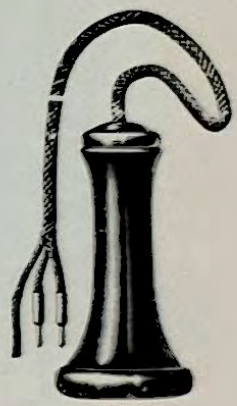
Telephones, Etc.



12082



12083



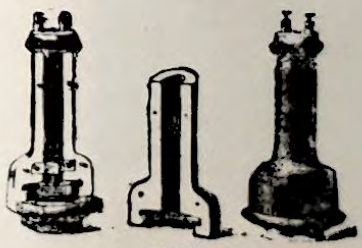
12084

12082 **Double Pole Watch Receivers,** Case of Brass Oxidised Finish, fitted complete with Earpiece and Flexible Cord ... ... each **£0 12 0**

12083 **Double Pole Watch Receivers,** Case of Brass, Oxidised Finish, fitted complete with Composition Earpiece and Flexible Cord ... ... each **0 15 6**

12084 **Double Pole Bell Receiver,** G.P.O. Pattern, Wound to 60 or 120 ohms as required, Case of Pressed Brass coated with tough Black Enamel, stoved on, fitted complete with Earpiece and Flexible Cord ... ... each **0 18 9**

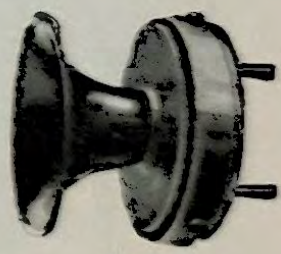
12085 Ditto, ditto, ditto, similar to above, but fitted with Suspension Ring on top of case, each **1 1 0**



12086



12087



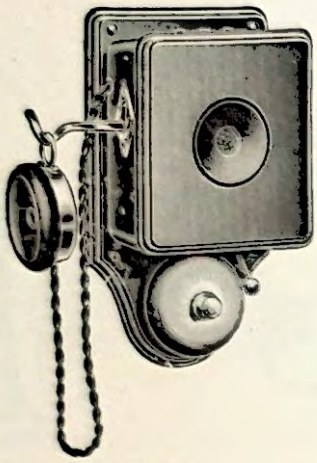
12088

12086 **Double Pole Bell Receiver,** one has removable sections to show Internal Construction, per pair **£1 12 6**

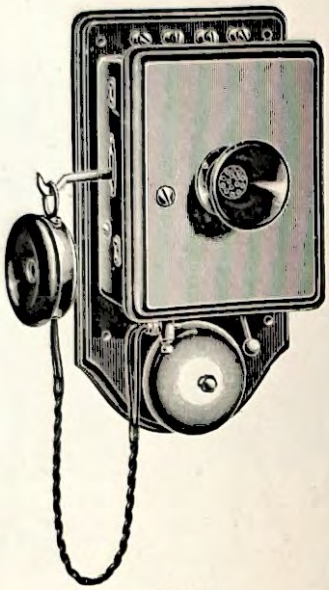
12087 **Hunningscone-Deckert Granule Carbon Transmitter**, in brass case, oxidised finish, fitted with composite mouthpiece and flexible cords ... ... each **0 12 6**

12088 **Manchester Shot Transmitter,** in oxidised Brass Case, with metal mouthpiece and terminals at back... ... ... each **0 10 6**

12089 **Induction Coil,** resistance of Primary 1 ohm, Secondary 25 ohms **0 4 6**



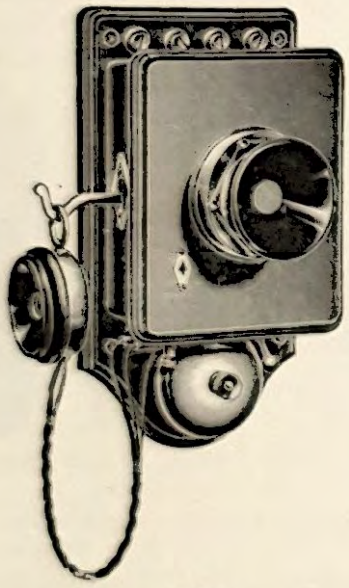
12090



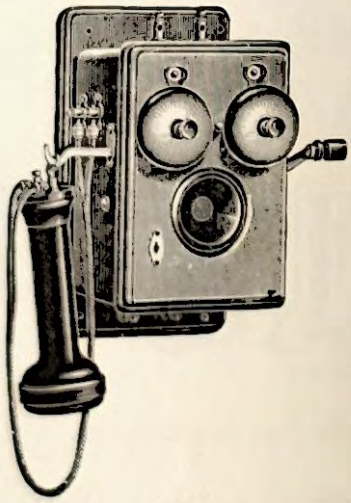
12091

12090 **Wall Station,** Battery Call, without Induction Coil, Polished Walnut Case, Trembling Bell "Inset" Transmitter and "Watch" Receiver **£2 0 0**

12091 **Wall Station,** Battery Call Telephone, comprising Induction Coil, Transmitter, Receiver, Trembling Bell wound to 25 ohms, Ringing Key and Automatic Switch Hook **2 10 0**



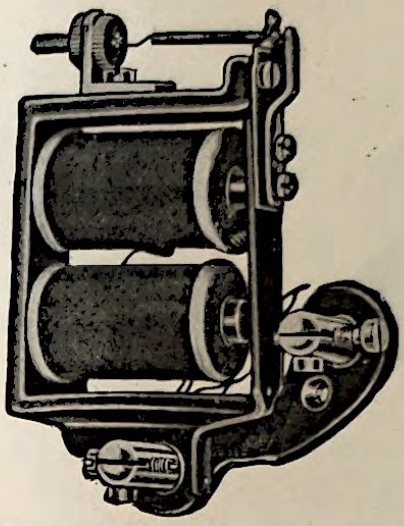
12092



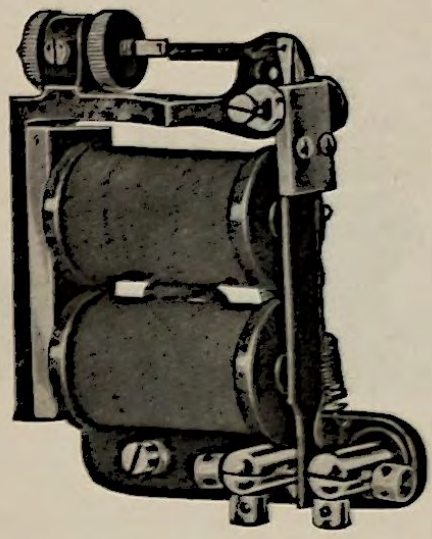
12093

12092 **Wall Station,** similar to above, but fitted to a Hunningscone-Deckert Transmitter ... **£3 3 0**

12093 **Telephone,** with Triple Magnet Generator, Polarised Call Bell, Solid Back Transmitter, Induction Coil, Double Pole "Bell" Receiver, Automatic Switch Hook, mounted on Walnut Case, with all Exterior Metal Parts Nickel-plated **8 0 0**

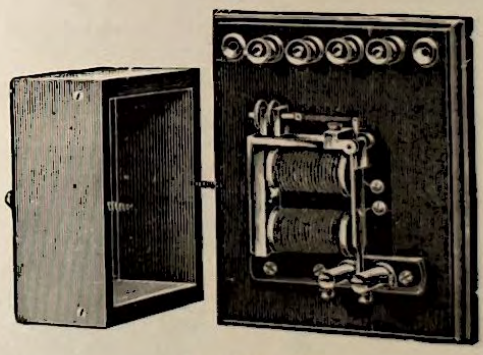


12094

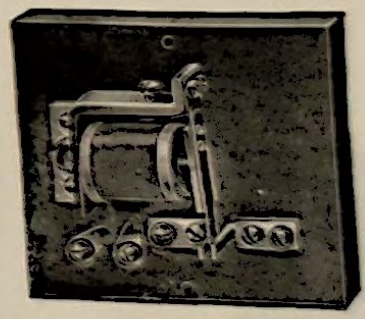


12095–7

12094	**Relays,** for automatically closing Local Circuits on short lines, Skeleton Form, best quality, Resistance 5 ohms ... ... each										**£0**	**8**	**6**
12095	Ditto, ditto	„	10	„	...	...	...	...	...	„	**0**	**17**	**6**
12096	Ditto, ditto	„	25	„	...	...	...	...	...	„	**1**	**2**	**6**
12097	Ditto, ditto	„	50	„	...	...	...	...	...	„	**1**	**3**	**0**



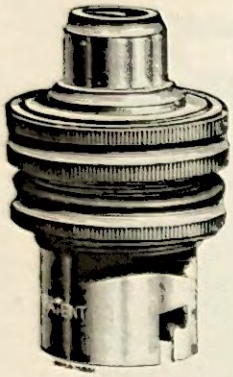
12098–101



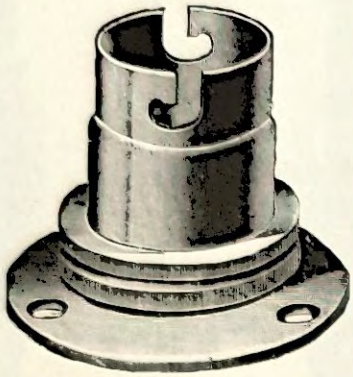
12102

12198	**Relays,** for automatically closing Local Circuits, for short lines, Resistance 5 ohms, in Polished Teak Case ... ... each										**£0**	**16**	**6**
12199	Ditto, ditto, Resistance 10 ohms ... ... „										**1**	**10**	**0**
12100	Ditto, ditto	„	25	„	...	...	...	...	...	...	„	**1**	**12**	**6**
12101	Ditto, ditto	„	50	„	...	...	...	...	...	...	„	**1**	**15**	**0**
(F) **12102**	**Buzzer,** in Hardwood Case, size approx. $4\frac{1}{4} \times 3\frac{3}{4} \times 1\frac{3}{4}$ in.... ... ... „										**0**	**2**	**9**

(F) Foreign manufacture.



12103–5

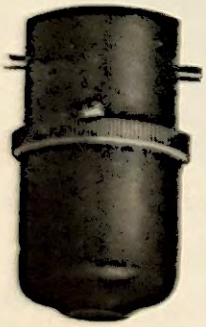


12106–8

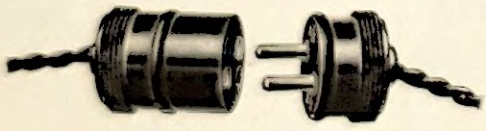


12109

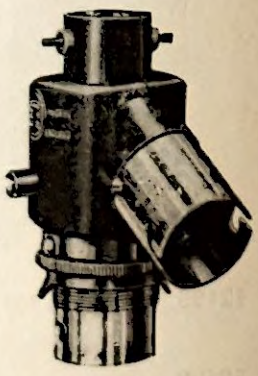
12103	**Holders, Lamp,** for Bayonet Mounted Lamps, with $\frac{3}{8}$ or $\frac{5}{8}$ in. Thread, with Shade Carrier ... ...each,	**1/0**;	per doz.	£0 11 6
12104	Ditto, ditto, Miniature, with $\frac{3}{8}$ or $\frac{1}{2}$ in. thread ... ... ,,	**10d.**;	,,	0 8 6
12105	Ditto, ditto, but without Shade Carrier ... ... ,,	**10d.**;	,,	0 8 6
12106	Ditto, ditto, Batten, heavy Brass Plate, with Solid Plungers and Round Back-plate, without Shade Carrier ... ... ,,	**1/1**;	,,	0 11 6
12107	Ditto, ditto, with Shade Carrier ... ... ,,	**1/3**;	,,	0 13 6
12108	Ditto, ditto, Miniature, with $\frac{3}{8}$ or $\frac{1}{2}$ in. thread ... ... ,,	**9d.**;	,,	0 8 0
12109	**Holder,** Plug, or Adapter, best quality, Polished Hardwood Body ,,	**8d.**;	,,	0 7 6



12110



12111



12112

12110	**Plug Holder** or Adapter, Bakelite, Standard Bayonet Fitting	each	£0 0 9
12111	**Connector** for Flexible Cord, Polished Hardwood	,,	0 3 0
12112	**Two-Circuit Adapter** with Bakelite body, and Switch to control light	,,	0 5 9



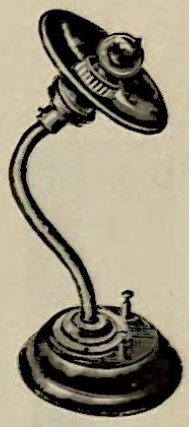
12113–14



12115–18



12119



12120

12113 **Wall Plugs,** Two-pin, High Voltage, to carry 5 amps., suitable for 250 Volt Circuits, Perfect Insulation, Screw-off Covers, 2 in. high, 2 in. dia., made in White China each £0 2 0

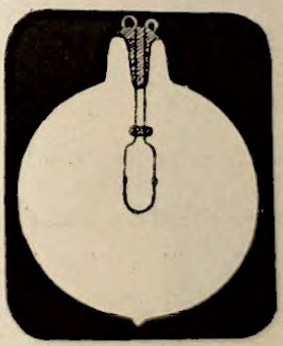
12114 Ditto, ditto, with China Base with Hardwood Cover and Plug 0 2 6

*Switches, Heater-type, Single Pole series parallel with nickelled cover Porcelain Handle. Indicator reading High, Medium, Low, Off.

	Capacity. At 125 volts	Capacity. At 250 volts	Diameter at Base.		
12115	„ 5 amps.	„ 2 amps.	$2\frac{1}{8}$ in.	each	£0 6 0
12116	„ 10 „	„ 5 „	$2\frac{15}{32}$ „	„	0 7 6
12117	„ 15 „	„ 10 „	$2\frac{11}{16}$ „	„	0 10 6
12118	„ 15 „	„ 20 „	$3\frac{1}{16}$ „	„	0 12 0

12119 **Holders,** for small Lamps, on Polished Wood Pillar, with Terminals fixed at Base each 0 2 3

12120 Ditto, ditto, on Brass Bracket with Reflector and Terminals, mounted on Polished Mahogany Base, with Screw Fitting ... ... each 0 2 6



12121



12122



12123

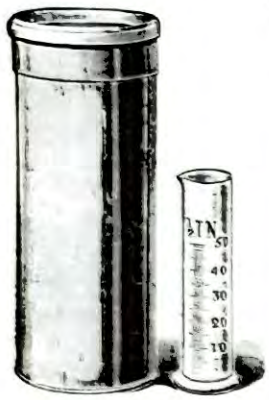
(F) **12121** **Incandescent Lamps,** with Carbon Filaments, from 2 to 10 volts ... ... each £0 1 0

(F) **12122** Ditto, ditto, with small Bayonet Caps, 2-10 volts ... ... „ 0 1 0

(F) **12123** Ditto, ditto, Small Battery Lamps, Pear shape, with straight wires, 2, 3 and 4 volts each 0 1 6

(F) Foreign manufacture.

Meteorology



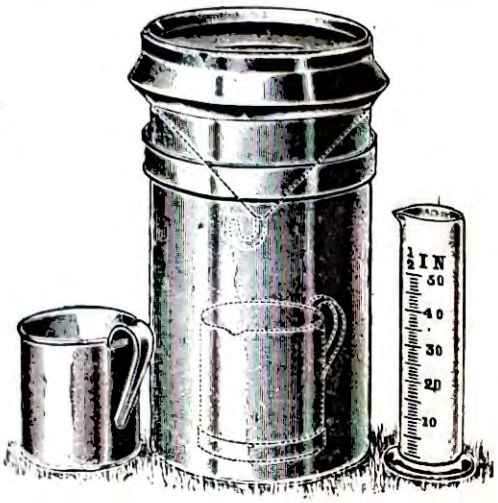
12130



12132

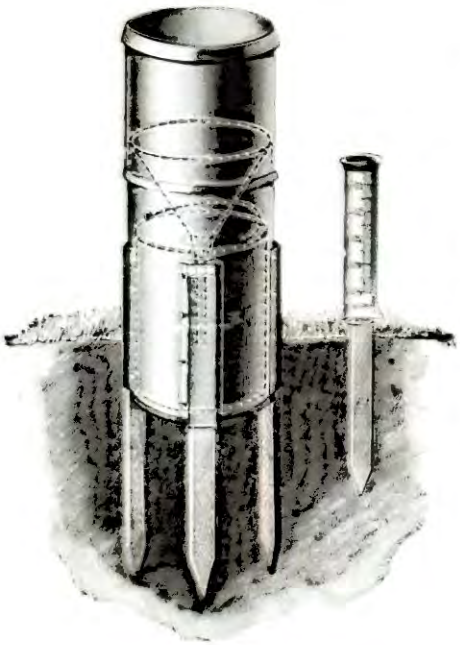


12134



12136

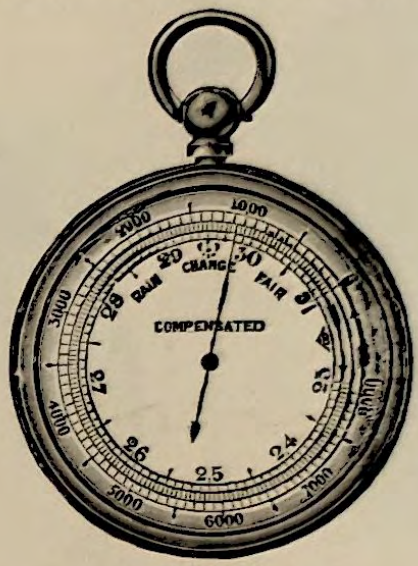
12130	**Rain Gauge,** British Association pattern, consisting of a Metal Cylinder 5 in. diameter, in which a funnel fits as a cap; the interior of the Cylinder contains a metal removable Receiver and a graduated Glass Jar	**£0 13 6**
12131	Same as above, in Copper	**1 0 0**
12132	**Rain Gauge,** Symond's, consisting of a bottle projected by a metal casing with openings down the side for observations, and graduated Glass Jar	**0 14 6**
12133	Same as above, in Copper	**1 1 6**
12134	**Rain Gauge,** Howard's, consisting of Copper Funnel, 5 in. diameter, with Polished Brass Rim, Glass Bottle, and graduated Glass Measure divided into $\frac{1}{100}$ths in.	**0 15 6**
12135	Same as above, in Japanned Tin	**0 9 6**



12138

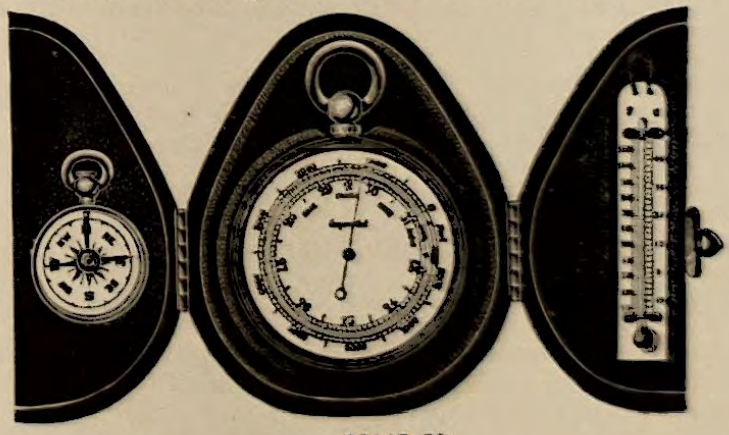
12136	**Rain Gauge,** Glaisher's, consisting of a Metal Receiver with Funnel 8 in. diameter, terminating in a Curved Tube which retains a small quantity of water and prevents evaporation, with graduated glass measure complete	**1 1 0**
12137	Ditto, ditto, ditto, in Stout Copper	**1 17 6**
12138	**Rain Gauge,** "The Snowdon," in Stout Copper, with deep funnel with Brass Rim 5 in. diameter, and stakes for holding in the ground, with graduated glass measure	**2 2 0**
12139	**Graduated Glass Jars,** for above, divided into $\frac{1}{100}$ths in. ... ... for 5 8 in. funnel	**2/3 3/0** each
12140	**"Camden" Graduated Rain Gauge Glasses,** showing ·005 in. ... ... each	**£0 5 6**

Aneroid Barometers



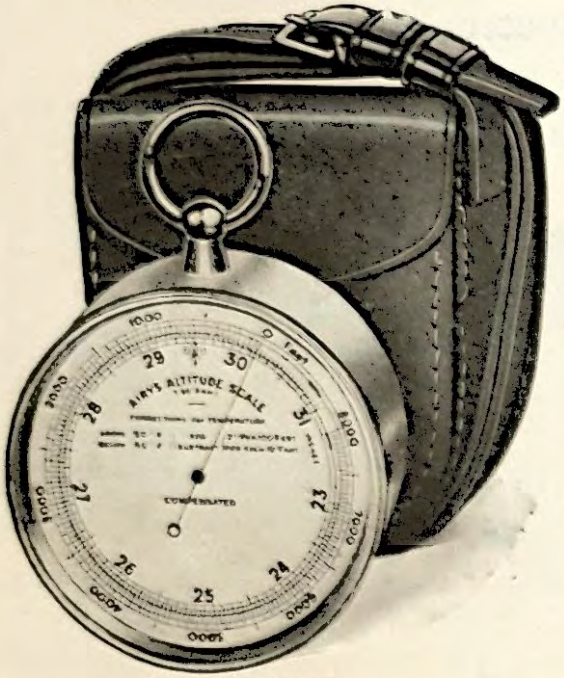
12141–46

*12141	**Watch Form Aneroid Barometers,** English make, 1¾ in. diameter, Gold-plated Case, Silvered Metal Dial, altitude scale to 8,000 feet in 100-feet divisions. Compensated for temperature. In leather case	£2	5	0
*12142	Ditto, as above, except reading to 3,000 feet in 10-feet divisions	2	10	0
*12143	Ditto, as above, but superior quality, English make, Gold-plated Case, 1¾ in. diameter Silvered Metal Dial, altitude scale to 8,000 feet in 50-feet divisions, compensated for temperature, in Flexible Leather Case...	3	5	0
*12144	Ditto, ditto, as above, but reading to 12,000 feet in 100-feet divisions	3	10	0
*12145	Ditto, ditto, as above, but reading to 12,000 feet in 50-feet divisions	3	12	6
*12146	Ditto, ditto, as above, but reading to 16,000 feet in 50-feet divisions...	3	17	6



12147–50

*12147	**"Stanley" Set,** comprising 1¾ in. best quality watch-size Aneroid, revolving altitude scale 8,000 feet, compensated for temperature, small size Compass and Thermometer, in folding best Morocco Case, to stand	£4	17	6
*12148	Ditto, ditto, as above, but reading to 3,000 feet in 10-feet divisions	5	2	6
*12149	Ditto, ditto, as above, but reading to 12,000 feet in 50-feet divisions...	5	2	6
*12150	Ditto, ditto, as above, but reading to 16,000 feet in 100-feet divisions	5	7	6



12152–55



12156–59
(About half actual size)

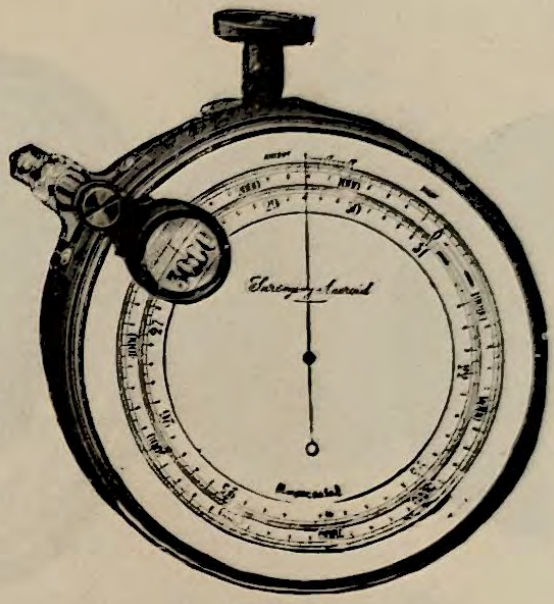
MILITARY ENGINEERING AND SURVEYING ANEROIDS

Compensated for Temperature. Aneroids with scales below 12,000 feet are fitted with a safety device to prevent overstrain. These Aneroids have equally spaced altitude scales, by means of which the aneroid is accurate by direct reading from the hand position without calculation.

Aneroids are usually compensated at a temperature of 50°F., and at this temperature the scale as laid out by Prof. Airy is correct. As the density of the atmosphere is affected by changes of temperature, a correction has to be applied to the altitude scale should the temperature at the time of observation be above or below 50°F. The correction formula is engraved on the dial.

*12152	**Engineering Altitude Aneroid, "Airy's Formula."** $2\frac{3}{4}$-in. Aluminium Case, evenly spaced revolving altitude scale to 8,000 feet in 50-feet divisions. Compensated for temperature. In Leather Sling Case ... ... each	£5	12 6
*12153	Ditto, ditto, as No. 12152, except reading to 3,000 feet in 20-feet divisions ... „	5	17 6
*12154	Ditto, ditto, as No. 12152, except reading to 12,000 feet in 50-feet divisions „	5	17 6
*12155	Ditto, ditto, as No. 12152, except reading to 16,000 feet in 100-feet divisions „	6	2 6
*12156	**Engineering Altitude Barometer.** 4-in. Black Enamelled Case, equally spaced revolving altitude scale, 8,000 feet in 20-feet divisions, compensated for temperature, in Leather Sling Case ... ... each	6	0 0
*12157	Ditto, ditto, as No. 12156, except reading to 3,000 feet in 10-feet divisions ... „	6	5 0
*12158	Ditto, ditto, as No. 12156, except reading to 12,000 feet in 20-feet divisions „	6	5 0
*12159	Ditto, ditto, as No. 12156, except reading to 16,000 feet in 50-feet divisions „	6	10 0

These Aneroids can be furnished with Metric Scale in place of the illustrated scaling without extra charge.



12160-63

SPECIAL SURVEYING ANEROID BAROMETERS.

These instruments have been designed and constructed especially for the purpose of readily ascertaining slight variations in gradients, levels, etc. For approximate surveys and levellings, for roads, railways, canals, water courses and mines, they are invaluable, as their readings can be easily and rapidly taken.

Besides extreme sensitiveness, the specialty claimed for them is an arrangement of the scale of altitudes which admits of sub-divisions by a Vernier, hitherto impracticable owing to the altitude scale in ordinary use being a gradually diminishing one, to which a Vernier cannot be applied.

In the present instruments, the action has been so arranged as to give accurate readings upon a regular scale of altitudes, the barometrical scale of inches having been made progressive to afford the correct relative readings with the scale of altitudes; this arrangement, therefore, in no way interferes with its use as an ordinary barometer.

For mining purposes, the entire circle of the dial is graduated to represent six inches of the mercurial column, i.e., from 27 to 33 inches. This scale will register about 2,000 feet below sea level, to 4,000 feet above. The divisions of the altitude scale represent 10 feet measurements, which can again be sub-divided by the Vernier to single feet—the Vernier scale is moved by a rackwork adjustment, and a magnifying lens which rotates upon the outer circumference of the instrument facilitates the reading of minute quantities.

For surveying purposes, where it is not required to be used below sea-level, the instrument is made with the scale divided from 25 to 31 inches, thus giving an altitude scale of 6,000 feet above sea level only, and with this open scale, and the assistance of the Vernier, the same minute readings can be easily taken.

The instruments are also constructed for measuring much greater altitudes, i.e., 10,000 to 15,000 or 20,000 feet, but with these scales the measurements cannot be made quite so minute as in the more open scales.

The instrument is made in two sizes, 3 inches and 5 inches in diameter respectively, and is provided with a solid leather sling case, thus making it sufficiently portable for all practical purposes.

In using the surveying Aneroid to obtain the difference of level of any two stations or positions, it is only necessary to place it horizontally at one of the two stations, adjust (by means of the rack motion) the zero of the Vernier until it coincides with the point of the indicating hand, and read off the number of feet indicated by the altitude scale and the Vernier; then remove the instrument to the other station and place it in the same position; adjust the zero of Vernier as before, and the difference of the two readings gives the difference of level.

Example.—Reading of scale at upper station	1,027 feet.
Reading of scale at lower station	785 ,,
Difference of level	242 ,,

Compensated for Temperature.

12160	**3-inch Stout Metal Case,** Silvered Metal Dial, with Vernier Scale moved by rackwork motion, Reading Lens arranged to traverse the entire circle, altitude scale 6,000 feet, in Solid Leather Sling Case...	£9 0 0
12161	**5-inch** ditto, ditto, in Solid Leather Sling Case...	10 10 0
12162	**3-inch** ditto, ditto, altitude scale arranged for mining purposes, 4,000 feet ascent, 2,000 feet descent, in Sling Leather Case	9 0 0
12163	**5-inch** ditto, ditto, altitude scale arranged for mining purposes, 4,000 feet ascent, 2,000 feet descent, in Case	10 10 0



12164



12165

		Diameter	5	6	in.
*12164	**Barometers,** Aneroid, English make, best quality, with Enamel Dial and Brass Case, in Cardboard Box		**30/0**	**40/0**	each
*12165	Ditto, open face, Enamel Dial showing working parts, in Velvet-lined Case		**35/0**	**45/0**	„
*12166	Ditto, as above, with Silvered Engraved closed Dial, compensated for temperature		**37/6**	**50/0**	„
*12167	Ditto, as above, with Silvered Engraved open-face Dial, compensated for temperature		**55/0**	**67/6**	„



12168



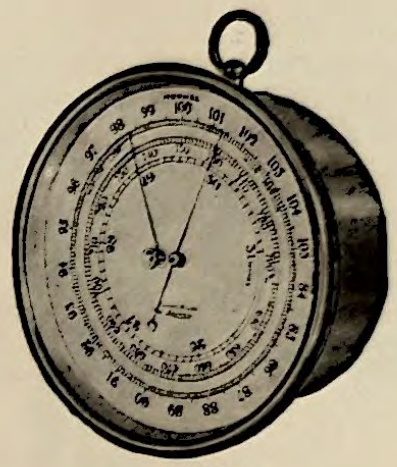
12169



		Diameter	5	6	8	in.
*12168	**Barometer,** Aneroid, English make, best quality, in Round Carved Oak Frame, Cable pattern, with Enamel Dial...		**30 0**	**40 0**	**50 0**	each
*12169	Ditto, ditto, Moulded Design, with Enamel Dial...		**27 0**	**35 0**	**45 0**	„
		Diameter $3\frac{1}{2}$	$4\frac{1}{2}$	$5\frac{1}{8}$	$6\frac{1}{8}$	in.
*12170	Ditto, ditto, second quality, with Opal Dial ...	**15 9**	**20 3**	**22 6**	**27 9**	each



12171



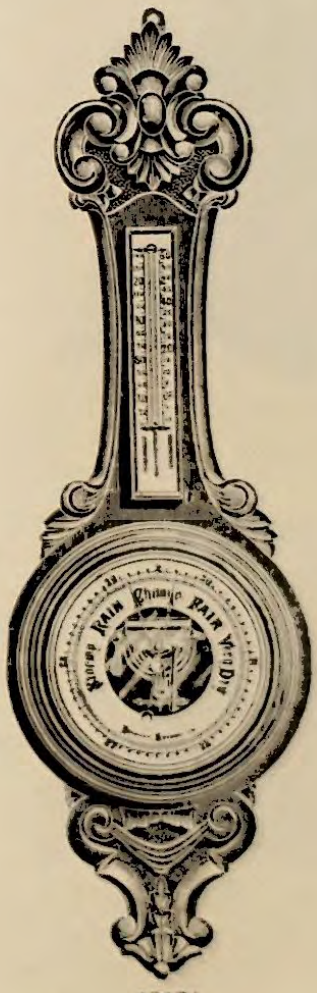
12172

*12171 **Barometer,** Aneroid, English make, in fancy shaped Oak Frame, second quality diameter of dial 5 in. **£1 5 0**

12172 **Barometer,** Aneroid, with millibar scale recommended by the Meteorological Office of Great Britain, in lacquered brass case, with 5-in. diameter Enamel Dial. Three Scales millibars, metres and inches, as illustrated, with patented folding legs, each **£1 10 0**



12173



12174



12175

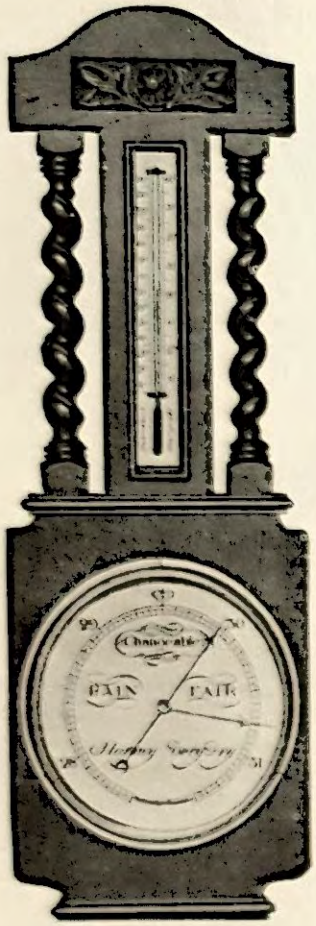
*12173 **Barometer,** Aneroid, Best Quality, Carved Oak Frame, Closed Enamel Dial and Thermometer—

Dia. 5 8 in.
40 0 52 6 each

*12174 **Barometer,** Aneroid, Best Quality, Carved Oak Pendant Frame, and Open Enamel Dial—

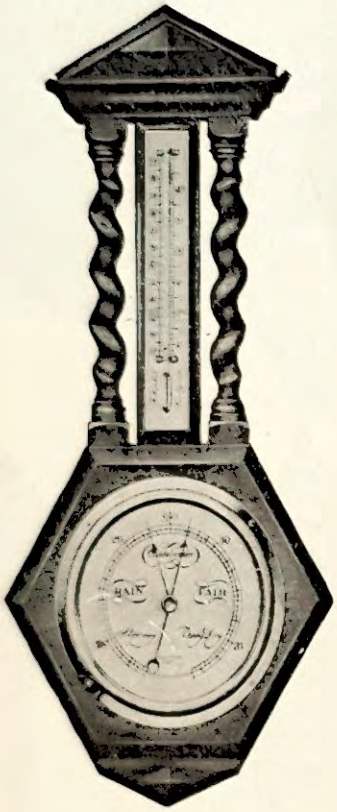
Dia. 5 8 in.
45 0 57 0 each

*12175 **Barometer,** Aneroid, with Fumed or Polished Carved Oak Frame, Open Centre Dial, 8 in. diameter, superior quality **£3 0 0**



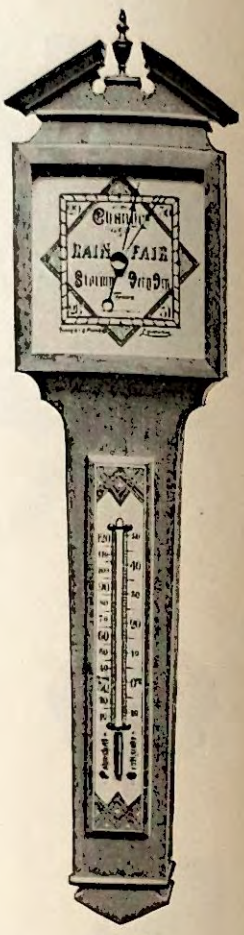
12177

Registered Design No. 695785.



12178

Registered Design No. 708362.



12179

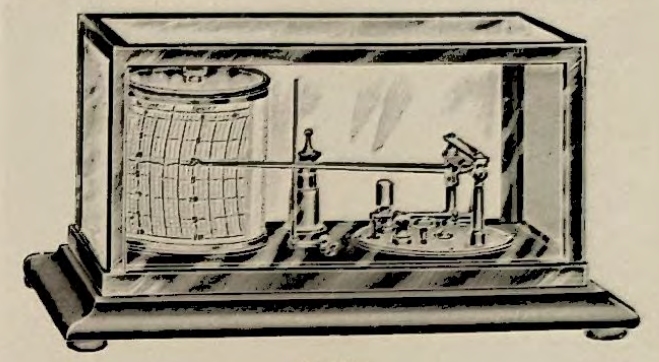
Registered Design No. 714941.

***12177** **"Jacobean" Pendant Aneroid Barometer.** Dark, age-rubbed effect Oak Frame, antique style, lacquered Brass Dial, 8 in. diameter, and Thermometer Scale. Red Fluid Tube. First quality compensated movement. Size 27 × 9¼ in. ... **£4 4 0**

***12178** **"Stuart" Pendant Barometer.** Dark age-rubbed effect Oak Frame, antique style, lacquered Brass Dial, 5 in. diameter, and Thermometer Scale. Red Fluid Tube. High-grade movement compensated for temperature. Size 19 × 9 in. ... **2 12 6**

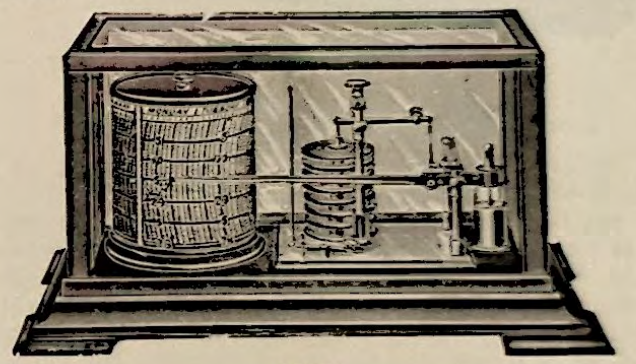
***12179** **"St. James" Pendant Barometer,** highly-finished Mahogany Frame, 22½ in. long by 6½ in. wide, with Pediment top and Brass Ornament. 4⅜ in. square Silvered Metal Dial. Thermometer Scale in keeping with the dial design on raised moulded panel. High-grade movement compensated for temperature. Size 22½ × 6 in. **3 12 6**

Barographs and Thermographs



12180

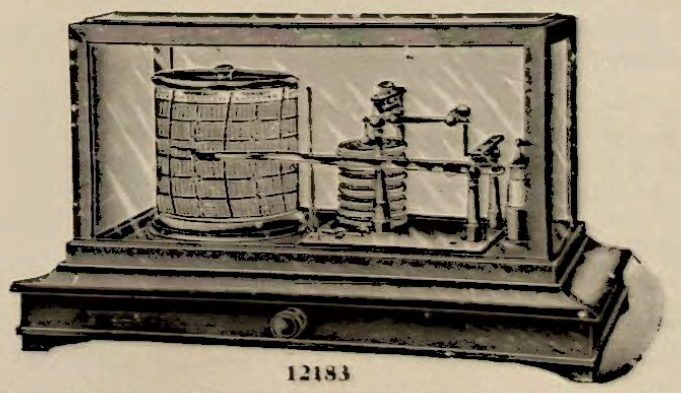
*12180 **Cyclo-Stormograph.** Simplified construction movement, supplied in Oak or Mahogany Case, Sheet Glass Cover, with Rubber padded feet. In addition it has forecast Plate and specially lettered forecast Charts. 14 in. long by 7½ in. deep by 8 in. wide **£6 10 0**



12181

*12181 **Barograph** in Polished Oak or Mahogany Frame, 14 in. long, 7 in. high, with bevelled plate glass. Weight, 10½ lb. Complete with Charts and Ink **£8 10 0**

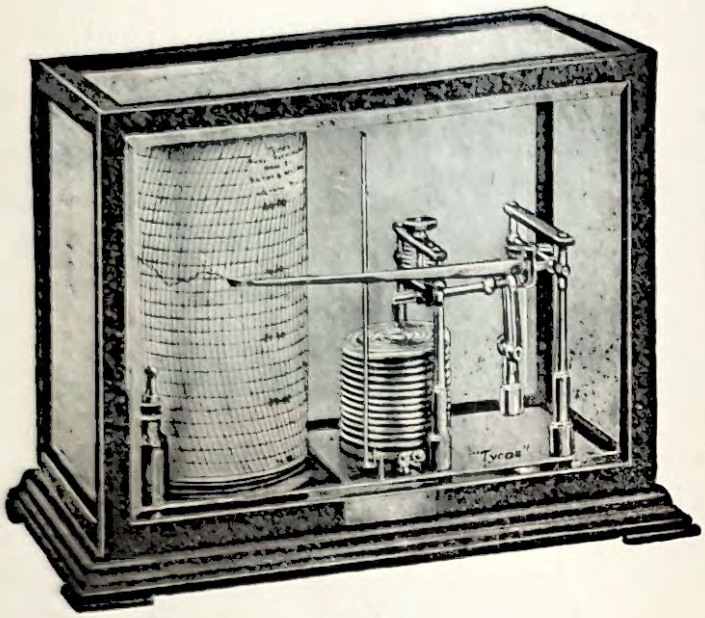
*12182 Extra Charts for one year **0 6 0**



12183

*12183 **Barograph.** Polished Oak or Mahogany Case, 14½ in. long, 8 in. high, 8¼ in. deep, bevelled plate glass with front opening drawer, which has two divisions, for holding used and unused charts. Weight 11 lb. Complete with Charts and Ink ... **£9 10 0**

*12184 Extra Charts for one year **0 6 0**



12185

MICRO-BAROGRAPH

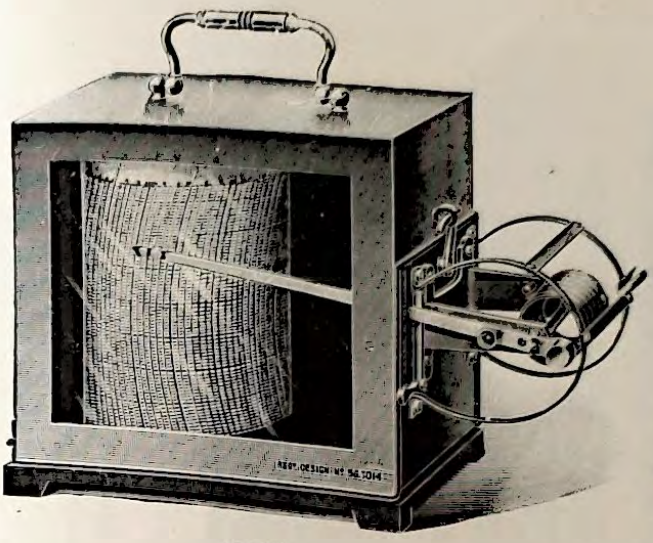
The Micro-Barograph is a modern development of the well-known Barograph (Stormograph) or Recording Barometer. The visible records of an ordinary barograph are not merely increased two or three times, but a high degree of sensitivity has been obtained by means of which atmospheric change and movement is readily recorded. During a storm or violent atmospheric disturbance, the actual travel of the pen is plainly visible, and has been seen to move as much as three-sixteenths of an inch in a few moments. The movement is efficiently compensated for temperature, and whilst all quoted Barographs are so compensated within the limits permitted by the National Physical Laboratory of England, in the Micro-Barograph the temperature errors are virtually eliminated, and for practical purposes are negligible. The chart is scaled from 28·50 in. up to 31·0 in. mercury pressure, figured and divided to read to 0·02 in. and measures 10¾ in. long by 6½ in. high. This Micro-Barograph can also be supplied with metric charts scaled from 720 to 790 mm.

The accurate measurement of atmospheric pressure is of great interest and value in many branches of human endeavour. Since the invention of the Mercurial Barometer by Toricelli in A.D. 1643 and the improvement of the Aneroid Barometer by Vidi in A.D. 1845, constant efforts have been made to reduce the reading of the changes to the smallest possible unit.

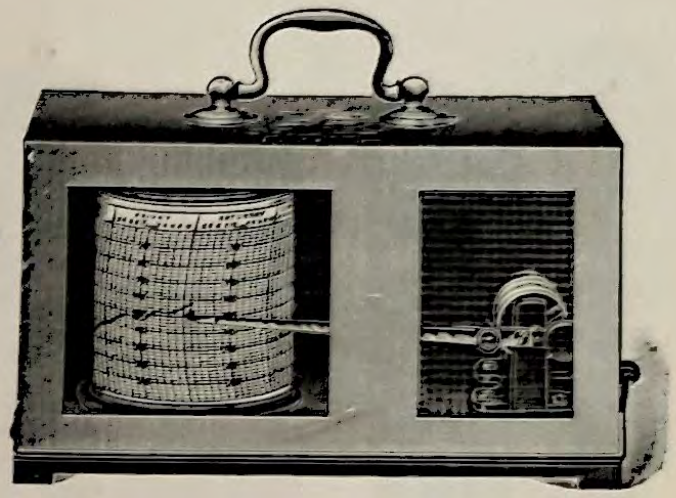
In laboratories where the determination of atmospheric pressure has a decided bearing on the results of investigations and experiments, the Micro-Barograph is a valuable addition to the equipment.

Universities, Technical and High Schools, can use this instrument to great advantage in connection with lectures, in the study of atmospheric pressures and the effect upon other natural phenomena because of its sensitiveness and its record of slight variations.

*12185	**Micro-Barograph.** Crystal enamelled Metal Frame 12 in. long × 9 in. high × 6½ in. deep, bevelled plate-glass sides and top. Includes Charts, Ink and Pen. Weight, 14 lb. 2 oz.	each	£18	0	0
*12186	Extra Charts for one year, ranged 28·50 in. to 31·0 in.	„	0	10	0
*12187	Metric Charts for one year, ranged 720/790 mm.	„	0	10	0



12188



12189

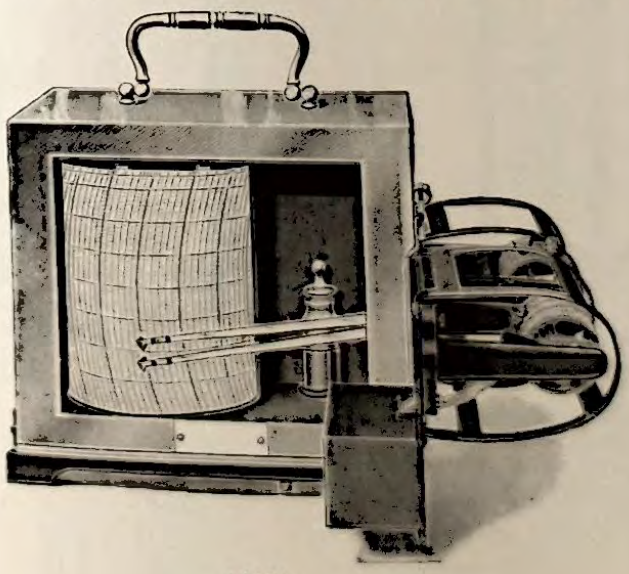
THERMOGRAPHS (Recording Thermometers)

*12188 **Thermograph,** Official pattern, as used by the Meteorological Office of Great Britain. In Copper-hinged Case with enamelled Iron Base, fitted with 7-day Clock, 6-in. setting Thermometer for purposes of comparison. Has exposed lamina which ensures perfect circulation of air. Complete with Ink and unfigured Charts for any 75°F. range **£9 10 0**

*12189 **Low Drum Clock Thermograph.** This instrument is fitted in Copper-hinged Case with Iron Base, and is supplied with 7-day Clock. Ranges 0° to 1,000°F., 20° to 120°F., 60° to 200°F. Complete with Charts and Ink **8 15 0**

*12190 Extra Charts for one year **0 8 0**

HYGROGRAPH (Recording Wet and Dry Thermometer)

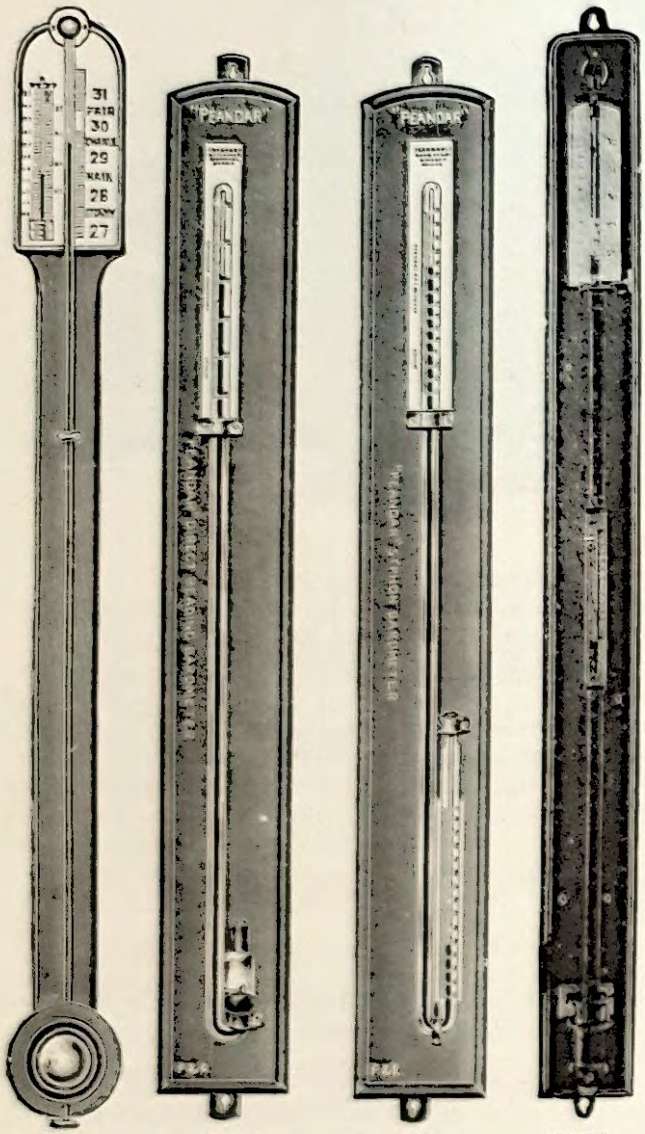


12191

*12191 **Hygrograph** ("M.O." pattern Recording Wet and Dry Thermometer), used and recommended by the English Meteorological Office, is similar in detail to No. 12188, but having two exposed laminas —one covered with silk wicking leading to the water reservoir—each actuating its own pen and recording respectively the wet and dry temperatures **£12 10 0**

*12192 Extra Charts for one year ... **0 8 0**

Barometers.



12194 12195 12196 12198

*12194 **Barometer,** Pediment, Ivory Scale, with Thermometer, Sliding Vernier, fitted on Polished Oak Frame with Adjusting Screw **£2 5 0**

*12195 **"Peandar" Standard "Direct Reading" Barometer.** The scale of this Instrument is compensated to allow for the rise or fall of the mercury in the cistern, and thus gives **direct readings** and obviates the addition necessary in the Syphon pattern. The scale, which can be either inches or millimetres, is divided and etched on the glass tube, and reads to ·05 in. or 1 millimetre. Mounted on polished Oak or Mahogany board with reflector **2 10 0**

*12196 **"Peandar" Standard "Syphon" Barometer.** The scales are divided and etched on the tube in millimetres, mounted on polished Oak or Mahogany board with reflectors **£2 10 0**

*12197 **Thermometer** (divided and figured on the stem) can be attached to either of these Barometers at an extra charge of **5/0**.

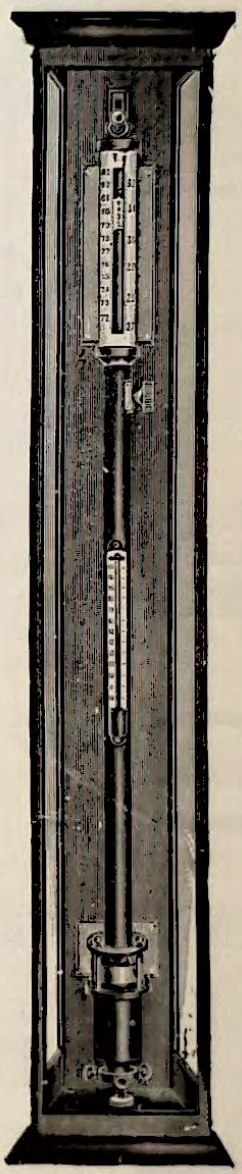
*12198 **"Fortinette" Standard Barometer,** constructed on the well-known Fortin principle. The level of the mercury in the cistern being adjusted to the ivory zero point. Bore of tube is ·25 in. The scales are engine divided on Opal glass and read by verniers to ·01 in. and $\frac{1}{10}$th millimetre. A thermometer with Fahrenheit and Centigrade scales attached to the frame, mounted on polished Oak or Mahogany board with reflectors ... ... nett **7 5 0**

*12199 **National Physical Laboratory Certificate** ... ... extra ,, **2 2 0**

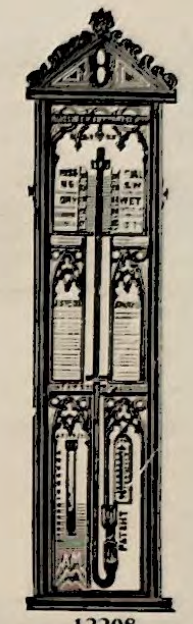
*12200 **Glazed Oak or Mahogany Case** to contain above ... ... ,, **2 10 0**



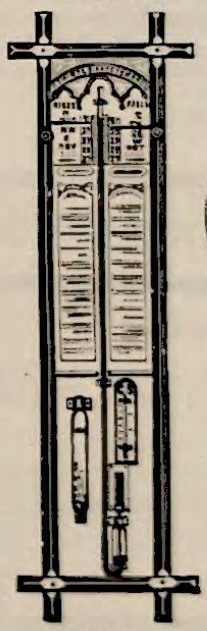
12202-3



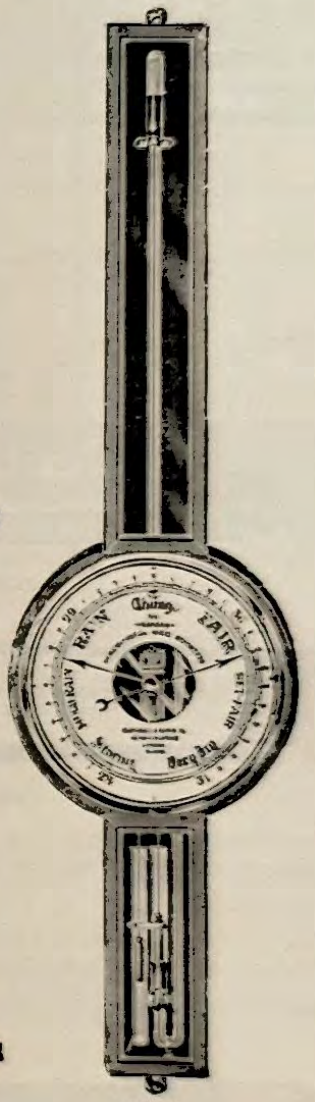
12204-5



12208



12206



12209

***12202 Barometer, Standard,** Fortin's Principle, Stout Tube and Cistern fitted in Bronzed Brass Frame, Double Scales and Verniers reading to ·1 mm. and 1/500th of an inch, with Opal Reflectors Mounted on Polished Mahogany Board with delicate Double Scale Thermometer—
Inside diameter of Tube, ·30 in. ... **£11 10 0**

***12203** Ditto, ditto, ditto, ·50 in. ... **£13 0 0**

***12204** As No. 12202, fitted in Polished Mahogany Case, Pediment top, Glass Panelled, with Lock and Key **£13 5 0**

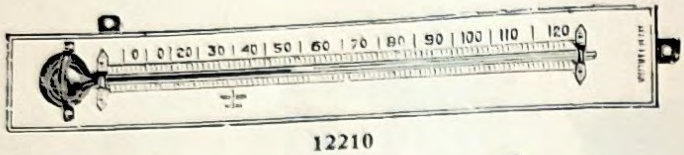
***12205** As No. 12203, fitted in Polished Mahogany Case, Pediment top, Glass Panelled, with Lock and Key ... **£16 15 0**

***12206 Barometer,** Fitzroy, in Plain Oxford Frames, with Sliding Index **£2 0 0**

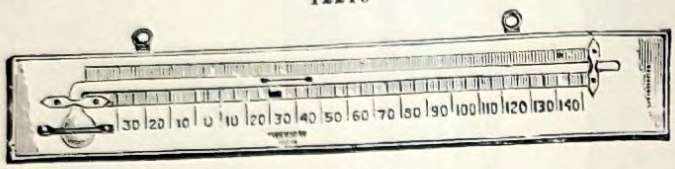
***12207** Ditto, ditto, Carved top **£2 5 0**

***12208** Ditto, ditto, Carved Gothic, best finish **£3 7 6**

***12209 Barometer,** Wheel Demonstration Model, 8 in. Engraved and Silvered Metal Dial divided to 1/100th in. from 28 to 31 in., thus giving a very open range showing slight variations in atmospheric pressure. The Spindle is hardened and polished Steel, and works without friction. The Tube is provided with a Glass Stopcock so that at any time it is required to shift the position of the Barometer the mercury can be run up to the top of the tube and the tap turned, thus making it safe for carrying about. Mounted in a well made fumed and Polished Oak Frame, with strong Brass Bezel with Domed Glass and Index framed Glass over top part of tube, and Hinged Door to lower end, thus making it dust proof **£3 10 0**

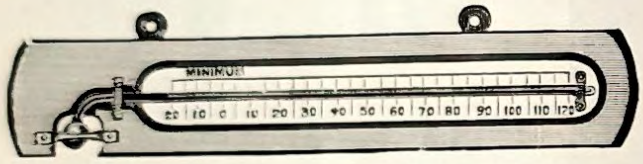


12210

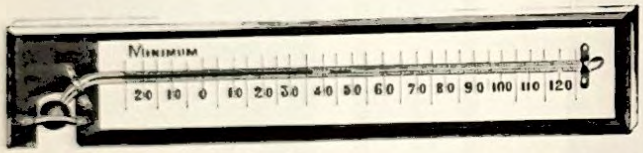


12211–12

12210	**Thermometer,** Minimum, Boxwood Scale	8	10	in.	
		2/6	**3/0**	each	
12211	„ Maximum, Self-Registering, Boxwood Scale, better quality, with Bent Bulb.	8	10	in.	
		5/6	**7/0**	each	
12212	„ Minimum, ditto, ditto	8	10	in.	
		4/0	**6/0**	each	



12213/5



12214/6

***12213**	**Thermometer,** Maximum, Opal Scale, hand painted, Divided Tube, mounted on Solid Oak or Mahogany Back, standard pattern, 14 in. ... ... each	**£1**	**5**	**0**
***12214**	**Thermometer,** ditto, smaller size ... ... „	**0**	**18**	**6**
***12215**	**Thermometer,** Minimum, Opal Scale, hand painted, Divided Tube, mounted on Solid Oak or Mahogany Back, standard pattern, 14 in. ... ... each	**1**	**2**	**6**
***12216**	**Thermometer,** ditto, smaller size ... ... „	**0**	**17**	**6**

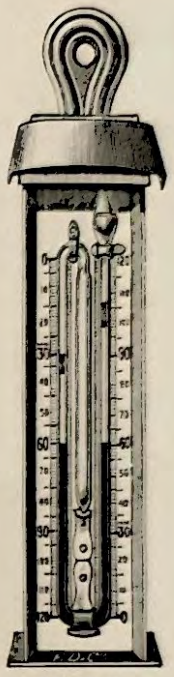


12217–8

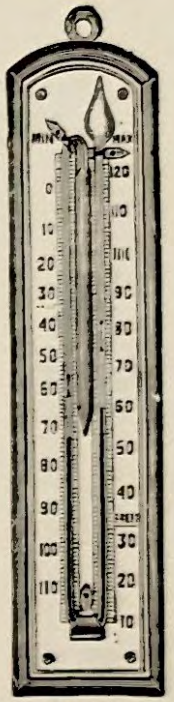
***12217**	**Standard Maximum and Minimum Thermometers,** graduated on tube and figured on opal glass, in screwed and polished Oak Frame. Maximum ...	**£1**	**7**	**6**
***12218**	... ... Minimum ...	**1**	**7**	**6**
	National Physical Laboratory Certificate	**0**	**3**	**6**



12220



12221–2



12223

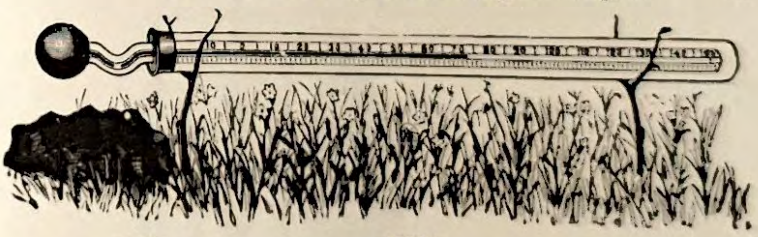
12220 **Thermometer,** Six's, Maximum and Minimum, Boxwood Scale, in Japanned Tin Case, with grooved Magnet ... ... 8 in. **6/6** 10 in. **8/6** each

12221 **Thermometer,** Maximum and Minimum, standard pattern, Opal Scale, Engine Divided Tubes, in White Japanned Metal Case, with Magnet, 10 in. **£1 1 0**

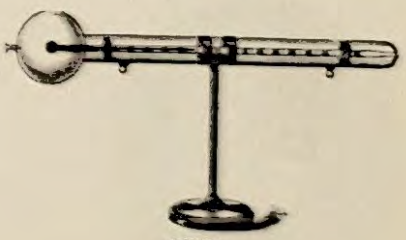
12222 **Thermometer,** ditto, as above, but in Copper Case ... ... each **1 5 0**

N.P.L. Certificates for above at an extra cost of ... ... ,, **0 10 6**

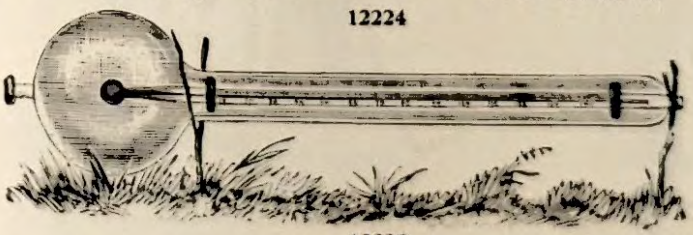
12223 **Thermometer,** Sixe's, Maximum and Minimum, Boxwood Scale, superior finish, with bevelled edges, with Magnet complete ... ... 8 in. **7/6** 10 in. **10/6** each



12224



12226



12225

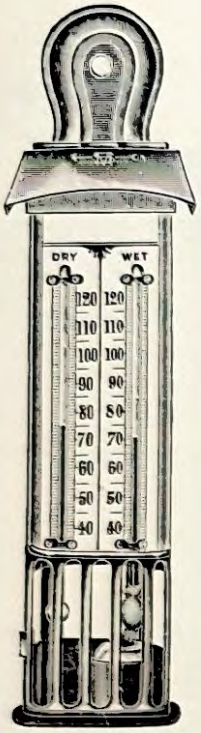
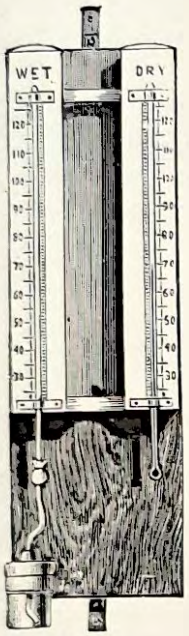
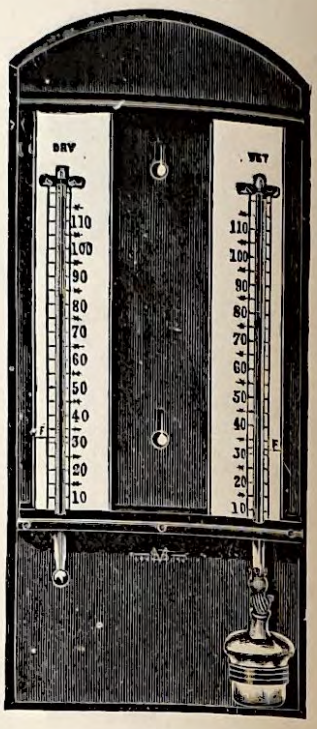
*12224 **Thermometer,** Solar Radiation, Maximum, with Black Bulb **£0 17 6**

*12225 Ditto, ditto, ditto, in Vacuum **1 7 6**

*12226 **Brass Stand** for above **0 7 6**

GAS ANALYSIS APPARATUS

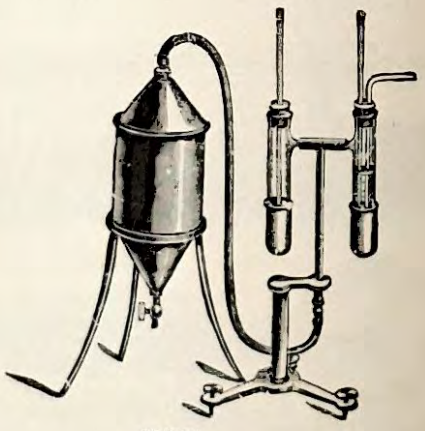


12228 12229 12231 12233 12234

12228	**Hygrometer,** Mason's,	Boxwood Scale, for School use, simple form	£0	7 3
12229	,, ,,	Wet and Dry Bulb, with Boxwood Scale, in Japanned Frame, 10 in., each	0	9 0
12230	,, ,,	Zinc Scale, in Japanned Frame ... ... ,,	0	10 6
12231	,, ,,	Opal Scale, with Bulb Guard in white Japanned Frame ... ,,	1	1 0
12232	,, ,,	Ditto, ditto, in Copper Case ... ... ,,	1	5 6
12233	,, ,,	with Porcelain Scales on Polished Oak Board ... ... ,,	1	5 0
12234	,, ,,	Standard pattern, Opal Scale, and Engine Divided Tubes, on Polished Oak or Mahogany Board, large size, superior finish... ... ... each	2	5 0

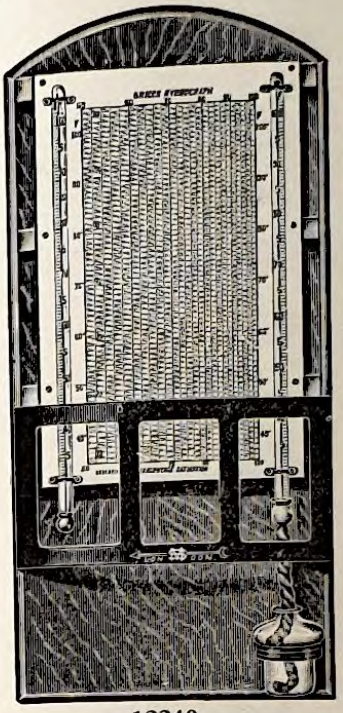




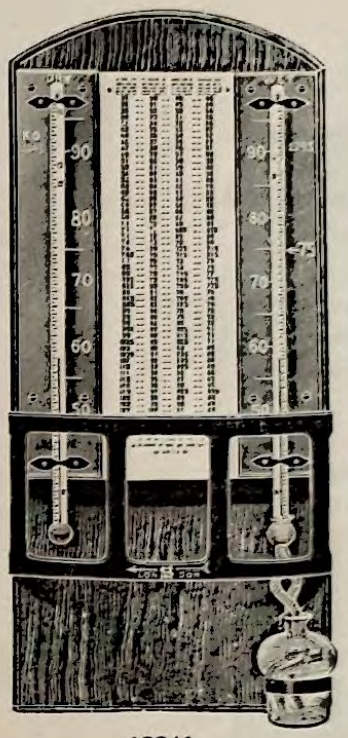
12235 12236 12237

(F) 12235	**Hygrometer,** Daniel's,	on Polished Wood Stand ... ... each	£0	17 6
12236	,,	Regnault's, with solid Silver Cup and Thermometer	0	8 6
12237	,, ,,	on Metal Stand with Levelling Screws, solid Silver Cups, Thermometers graduated in ½ths degrees, and Copper Aspirator	5	5 0
12238	,, ,,	cheaper make with Stand without Levelling Screws and Zinc Aspirator	3	5 0

(F) Foreign manufacture.



12240



12241

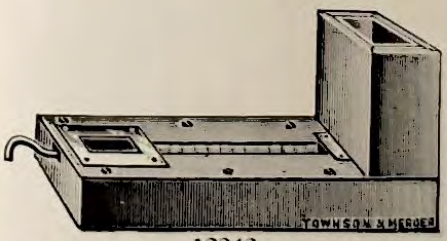


12242

12240 **Hygrometer,** with Briggs' Hydrograph, etched and divided Tubes on Metal Scale, mounted on Oak Board. The form of this chart, designed by Professor Henry Briggs, consists of three sets of straight lines, one set being horizontal, one inclined, and one vertical. The Thermometer readings having been taken, they are referred to the chart. By the aid of a scale at the right-hand side, the point indicating the wet bulb reading is noted. The sloping line from that point is then followed up until it crosses the horizontal line representing the dry bulb reading. By means of the vertical lines, this point of intersection is referred to the scale of "Percentage Saturation" at the bottom or top of the chart. The reading of that scale gives, straightway, the relative humidity of the air. Thus the Hydrograph gives percentage saturation by inspection. It supplies in a remarkably simple and highly condensed form all the facts given in hygrometric tables. It has been constructed from Glaisher's Tables (as used by the British Meteorological Office) and its accuracy is guaranteed. It is so readily understood that it can be used by those who have difficulty in using tables. A valuable instrument for Mines and Factories **£1 17 6**

12241 **Hygrometer, Cotton Factory,** etched divided Tubes, Metal Scales with Tables mounted on Oak Back, and N.P.L. Certificate **2 0 0**

(F) **12242** **Psychrometer,** consisting of two Thermometers with Milk Glass Scale, 0 to 40°C., in ½ths, mounted on Stand **1 16 0**



12243



12244



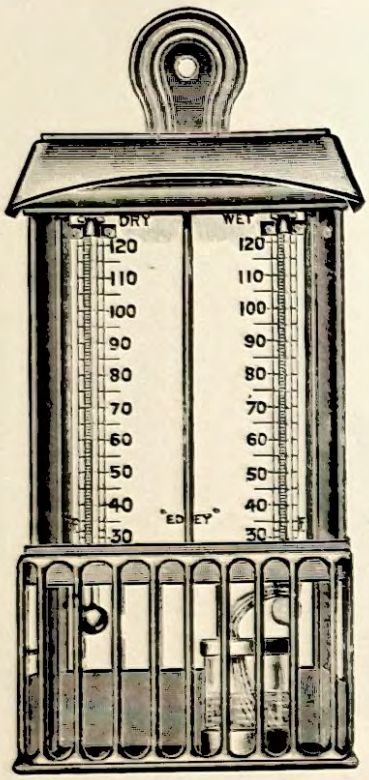
12245

12243 **Hygrometer,** Dines', for showing the Dew point by direct observation **£3 0 0**

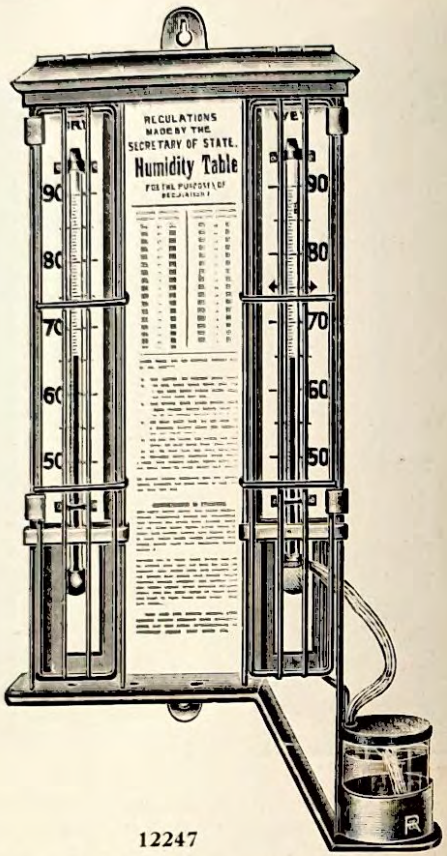
(F) **12244** ,, Saussure's, Hair **0 11 0**

(F) **12245** **Hygroscope,** Mithoff's, Spiral **0 12 0**

(F) Foreign manufacture.

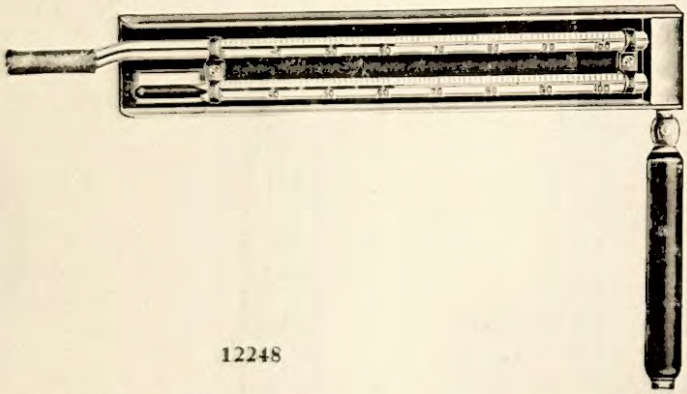


12246



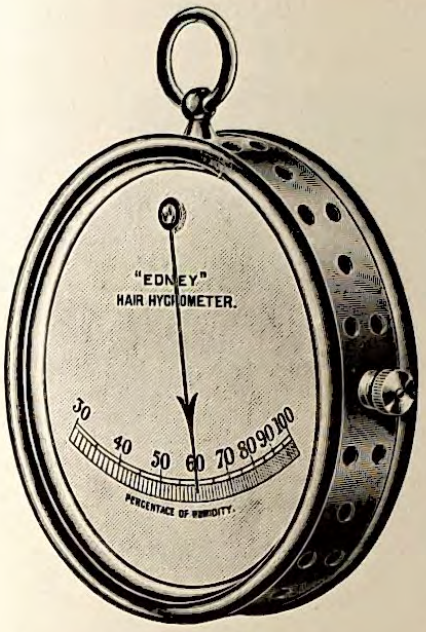
12247

*12246	**Standard Factory Hygrometer,** with stem-divided Tubes, Hand-painted Porcelain Scale and large Cistern ... ... nett	£2 0 0
12246/1	National Physical Laboratory Certificates ... ... extra	0 5 0
*12247	**Hygrometer,** with Opal Glass Scales, engine-divided Tubes, with National Physical Laboratory Certificates, in White Japanned Case, with hinged Wire Guards, Glass Cistern with Copper Cover, Humidity Table and Official Regulations ...	2 10 0



12248

*12248	**Inspector's "Swing" Hygrometer,** specially sensitive stem divided Tubes. The instrument is fitted in a Polished Mahogany Case containing Bottle for water, Spare Wicks, and Table showing per cent. of humidity...	£1 10 0
12248/1	National Physical Laboratory Certificate ... ... extra, nett	0 6 0



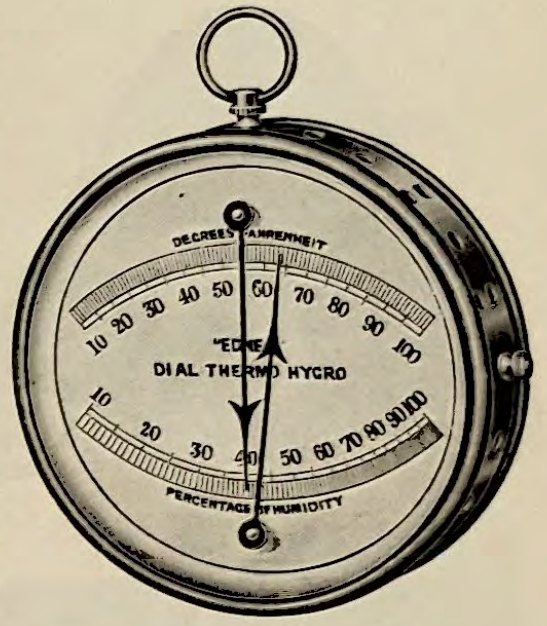
12249–50

"EDNEY" HAIR HYGROMETERS

Showing directly the Percentage of Humidity in the room or other place in which it is hung.

These instruments are strongly made, and mounted in stout polished and lacquered brass case, with 5-in. engraved and silvered Metal Dials, which give a very open range, allowing the variations in humidity to be easily observed.

The action is by the contraction or expansion of a strand of 50 specially treated human hairs, which alters in length according to the percentage of moisture in the atmosphere.

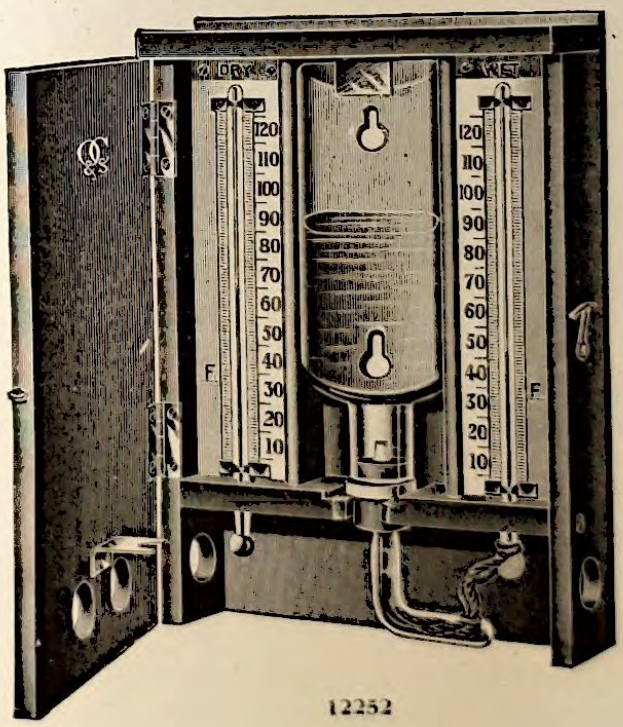


12251

This movement is conveyed by simple mechanism to a pulley on which the indicating hand is fixed.

Each instrument is tested against a standard Wet and Dry Bulb Thermometer, and is guaranteed to give accurate readings. A small adjusting screw is provided so that at any time the hand can be (if required) set to a standard.

*12249	Price	£2	2	0
*12250	Ditto, as above, but in 2¼ in. Brass Case	2	0	0
*12251	Ditto, in 5-inch Brass Case, and fitted with a Compound Metallic Coil Thermometer, so that the instrument shows both temperature and humidity	3	3	0
*12252	**Hygrometer for Mines,** with Boxwood Scales in Solid Oak Case with door to protect the bulbs and extra large Water Cistern	1	5	0



12252



12253

The HYGRODEIK gives relative humidity, dew point and amount of moisture in grains per cubic foot of air.

The "Mason" Hygrometer, consisting of a Wet and a Dry Bulb Thermometer, invariably recognised as the most accurate and satisfactory of the many forms of Hygrometers in use, has never enjoyed the popularity which its merits deserve, owing to the necessity of reference to complicated tables for determining the relative humidity and dew point corresponding to the difference in degrees between the Wet and Dry Bulb Thermometer at different temperatures.

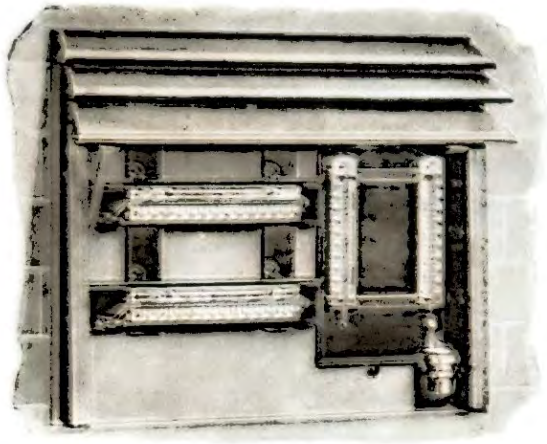
The Hygrodeik Chart is a condensed, graphic presentation of all the facts given in the Hygrometer tables. While complicated in appearance, it is simplicity itself. The lines on the chart are adapted to show graphically the relative humidity, dew point, absolute amount of moisture present, and the weight of water in each cubic foot of air, expressed in grains.

Directions for Reading the Hygrodeik

To find the Relative Humidity.—Swing the index hand to the left of the chart, and adjust the sliding pointer to that degree of the wet bulb thermometer scale at which the mercury stands. Then swing the index hand to the right until the sliding pointer intersects the curved line which extends downward to the left from the degree of the dry bulb Thermometer scale indicated by the top of the mercury column in the dry bulb tube. At this intersection the index hand will point to the Relative Humidity on the scale at Bottom of Chart. For example (see illustration), should the temperature indicated by the wet bulb Thermometer be 60° and that of the dry bulb 70°, the index hand will indicate humidity 55° when the pointer rests on the intersecting lines of 60° and 70°.

To find the Dew Point and absolute amount of Grains.—Observe the intersection as above, and follow the curved line (passing through it, which runs from the top downward to the right) to the point of contact with the dry bulb scale. The degree (53) at this point on that scale is the dew point required. The figure at the upper end of this line will give the absolute amount of water in grains (4·5 grains) per cubic foot of air.

(F) 12253	**Hygrodeik**, mounted on enamelled Metal Frame to stand. Special Chart ranged + 20° to + 120°F. Lens magnifying mercury tubes, etched and divided on stems	£3	13	0
(F) 12254	Ditto, + 80° to + 180°F	3	13	0
(F) 12255	Ditto, 10° to + 50°C.	3	13	0



12256

THE "DEMONSTRATION" SET OF THERMOMETERS AND SCREEN

The Screen illustrated is designed for the use of observers who have not the convenience for setting up the ordinary full size Stevenson's Screen.

As will be seen, the apparatus is easily fixed upon a wall or post, and the Thermometers are specially made in a reduced size, whilst still of standard accuracy.

The Screen is designed to allow of the correct observation of shade temperatures. It is well made, and painted white.

The Thermometers are graduated upon the stems, figured upon the opal scales, and well mounted upon seasoned Oak Slabs.

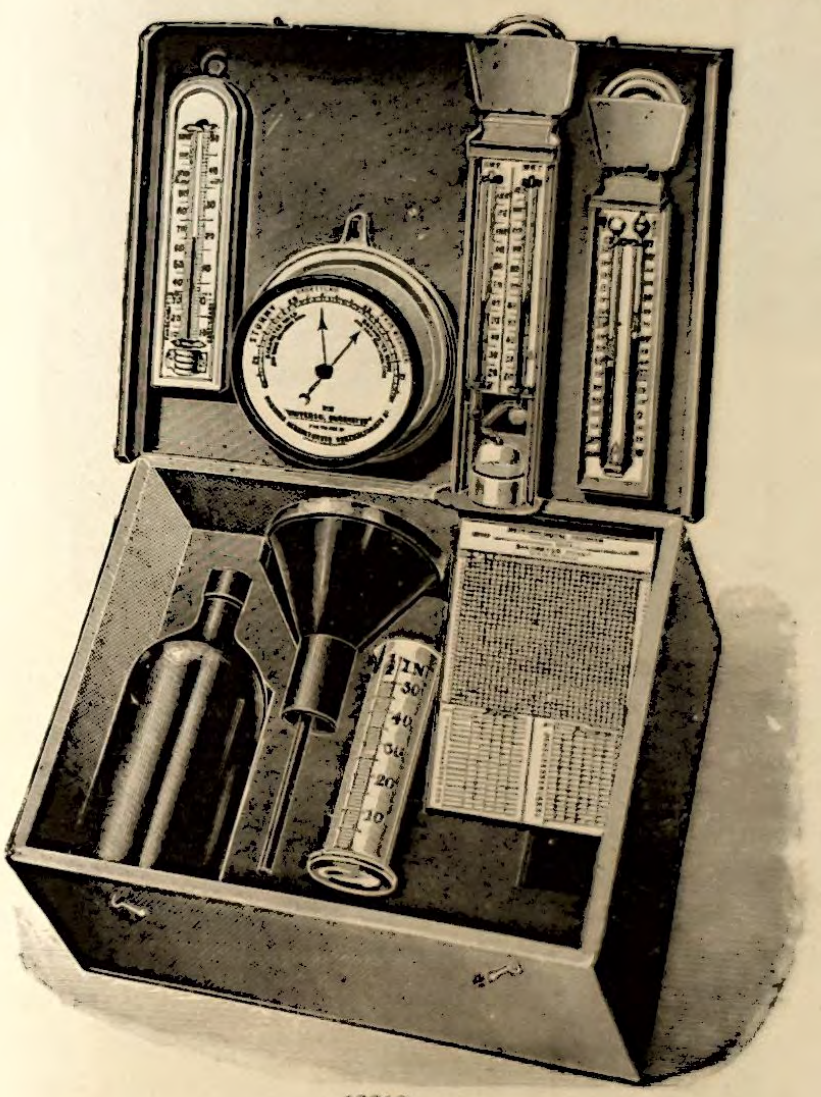
*12256	Price complete with Thermometers as illustrated	£6	0	0
*12257	Ditto, ditto, with National Physical Laboratory Certificate	6	12	6

Prices separately

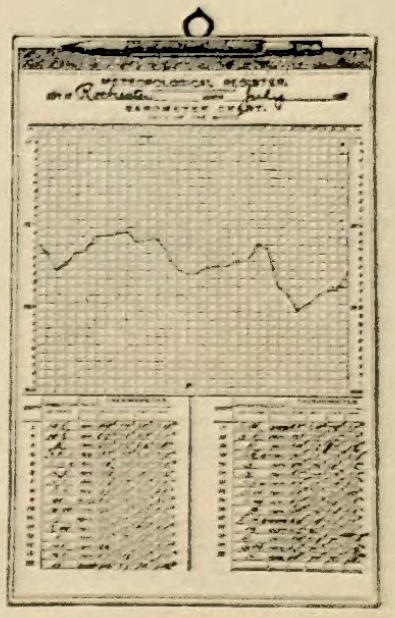
*12258	**Screen**	2	10	0
*12259	**Wet and Dry Bulb Hygrometer**	1	18	0
*12260	**Maximum Thermometer**	0	18	6
*12261	**Minimum Thermometer**	0	18	6

(F) Foreign manufacture.

Meteorological Sets



12263



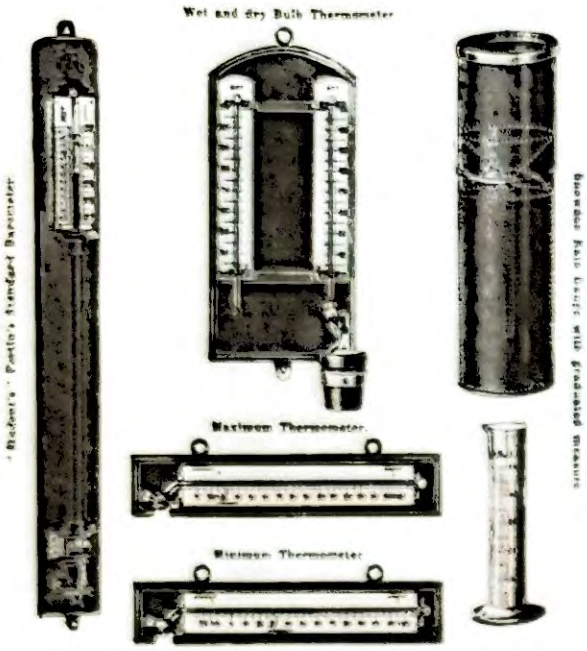
12266

***12263 Meteorological Set,** containing Rain Gauge, with 5-in. Funnel, Glass Receiver, and Graduated Tube reading to ½ in. downfall; Wet and Dry Hygrometer in Japanned Tin Case, with printed instructions; Aneroid Barometer, with Enamelled Porcelain Dial; Thermometer, with Centigrade and Fahrenheit Scales, mounted on Boxwood; Sixe's Maximum and Minimum Thermometer in Japanned Tin Case; Set of Charts, with Columns for recording each Instrument for one year; complete, in Stained and Polished Case with divisions £3 15 0

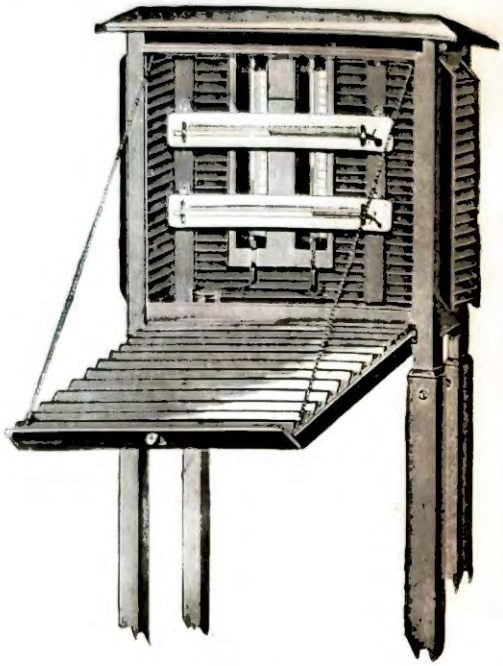
***12264** Ditto, ditto, as above, but fitted with Larger Aneroid Barometer, Hygrometer, and the Rain Gauge of Copper 4 5 6

***12265 Meteorological Charts,** Monthly Records of Barometer, Force and direction of Wind, Thermometer, etc., size 12×8 in. ... ... per doz. 0 1 3

***12266** Ditto, ditto, bound in Pads of 12 Monthly Charts as supplied with Meteorological Set No.12263, size 9×5½ in., complete with pencil ... ... each 0 1 6



12267



12269

SET OF METEOROLOGICAL INSTRUMENTS.

Of Standard Accuracy, eminently suited for use in small Observatories, Schools and for private observers.

*12267 **Set**, comprising "Student's" Standard Barometer (Reg. No. 420297). Diameter of mercurial column .25 in. Inches and Metric Scales, with Verniers reading to .01 in. and .1 millimetre. On Polished Mahogany or Oak Back Board, with Opal glass reflectors and screws for vertical adjustment. Standard Mason's Wet and Dry Bulb Hygrometer, oak frame, engine divided tubes, figured on opal glass scales. Copper Water Reservoir and Tables. Standard Maximum Thermometer, oak frame, engine divided tubes, figured on opal glass scale. Standard Minimum Thermometer, oak frame, engine divided tubes, figured on opal glass scale. Copper Snowdon Rain Gauge, complete with graduated glass measure. Meteorological Register for one year. Nett price ..... complete **£12 0 0**

N.B.—All the above Instruments will pass the National Physical Laboratory.

12268 National Physical Laboratory Certificates, if desired ..... **£2 16 0** extra, nett.

*12269 **Stevenson's Screen**, Improved, Double-louvered and painted white, to hold Hygrometer, Standard Maximum and Minimum Thermometers, etc., without leg supports **£5 5 0**



12271–73



12274

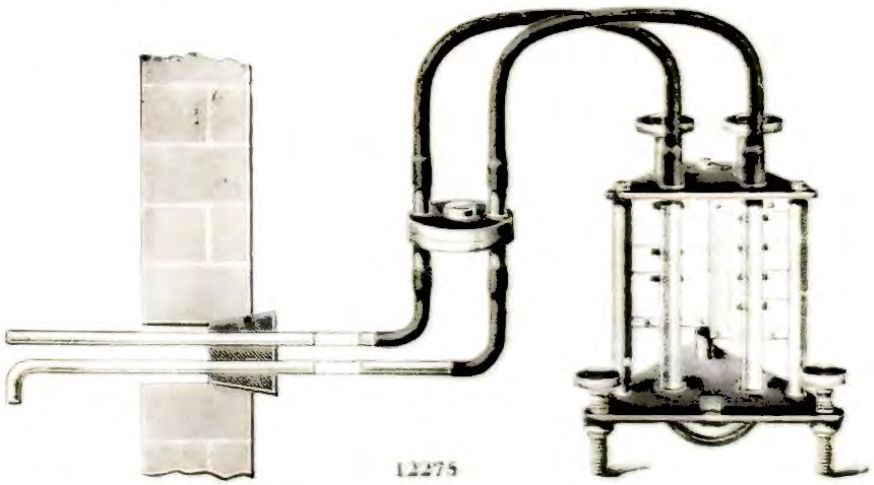
For registering the velocity of currents of air in mines, tunnels, flues of furnaces, etc., by means of a light fan, the revolutions of which are recorded on a dial.

12271 **Airmeter.** Indications are obtained by means of a delicately poised fan wheel, the record being commenced by the long hand, which traverses the outer circumference of the main dial, showing the passage of 100 ft. of air. The enumeration is continued by a series of small dials. A disconnector, projecting from the hand of the instrument opposite the fan wheel, serves to throw the mechanism out of gear, and arrests its action when required. This instrument has jewelled movement, is zero setting, has four dials reading 100,000 ft. In sole leather carrying case, weight 8½ ounces **£5 10 0**

12272 **Anemometer,** Biram's, 3 in., Jewelled movement, fitted with patent zero setting attachment (Patent No. 3729), 3 in. diameter, two dials reading to 1,000 ft. In sole leather carrying case, weight 8 ounces **£3 0 0**

12273 Ditto, as above, except 4 in. in diameter, and with four dials reading to 100,000 ft., weight 16 ounces **£3 5 0**

12274 **Anemometer,** Biram's, Pocket Size, 2 in. in diameter, ¾ in. thick, two dials reading to 1,000 ft., jewelled movement with stop. Will stand velocities up to 1,000 ft. per minute. Made much stronger than formerly, the hinged lids being of heavy gauge metal, and the dial being entirely enclosed, weight 5½ ounces **£7 10 0**

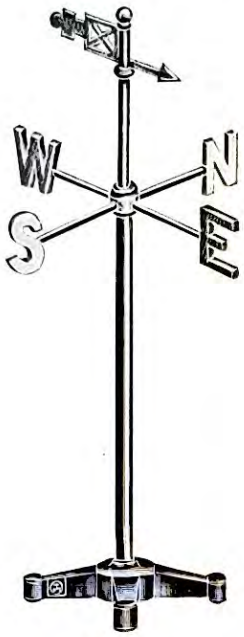


12275

12275 **Anemometer,** Fletcher's, for measuring the speed of draught in flues, on Brass Stand, with levelling screws, engraved scale, vernier and connecting tubes in Polished Mahogany Case **£4 10 0**



12276–77



12282

SUNSHINE RECORDERS, CAMPBELL-STOKES PATTERN

Adopted by the Meteorological Authorities as the Standard for Records of Sunshine Duration.

A Brass Bowl accurately turned to the focus of the Glass Sphere has three concentric grooves, in one of which is inserted the specially-cut card suitable for that period of the year. The cards are of three types, a long curve for the summer months, a short curve for the winter months, and a straight card for the Equinoctial periods.

The bowl is mounted on a brass arc carrying clamps for the Sphere, and graduated with a scale of latitudes. The standard to which this is clamped is mounted on a polished slate base.

The Glass Sphere is of the highest quality, and made to a Standard Specification.

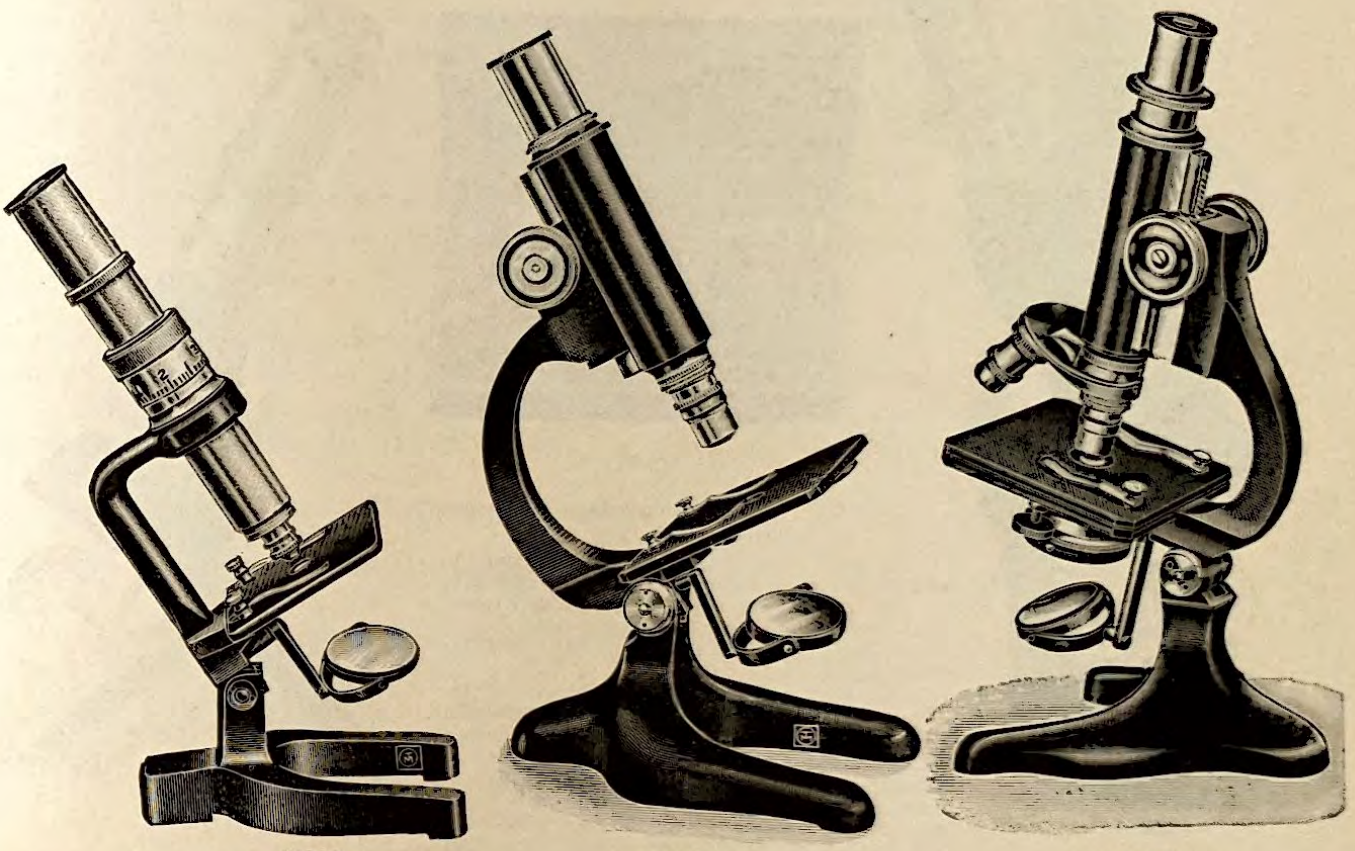
12276	**Sunshine Recorder,** Campbell-Stokes pattern, "Universal" type	nett	**£17**	**10** **0**
12277	Ditto, for any one latitude between 45° and 90°, with fixed pillar ...	,,	**16**	**10** **0**
12278	**Cards** for the above for one year: 150 Long Curve, 150 Short Curve, 100 Straight	,,	**2**	**5** **0**
12279	**Template** of transparent Celluloid for totalling the traces	,,	**0**	**3** **6**



12280

12280	**Improved Campbell-Stokes Sunshine Recorder,** Meterological Office pattern, with Sphere for latitudes between 40° and 70°	nett	**£15**	**10** **0**
12281	**Charts** for above, for one year, comprising 150 Summer Solstice, 150 Winter Solstice, 100 Equinoctial...	nett	**2**	**0** **0**
12282	**Model Weather Vane,** Brass on Iron Stand, height 18 in....		**0**	**15** **6**

Microscopes—Botanical Apparatus, etc.



12290 12291 12292

(F) **12290** **Microscope,** for School use, etc. This Microscope is mounted on Stand with heavy horseshoe Foot, strongly constructed, very rigid and of the best workmanship.

The instrument is intended for School use, and for Botanical as well as general Biological study. It is fitted with Interchangeable Eyepieces and a Set of three Objectives of varying magnifying power, as a rule ×50, ×100 and ×145. Coarse adjustment by the Sliding Tube, fine adjustment by revolving the broad milled Metal Ring. Illumination by Movable Plane Mirror. Complete in Wood Box... ... nett **£3 0 0**

(F) **12291** **Microscope** for Secondary and Technical Schools, full size, of solid construction and well finished, fitted with Rack and Pinion, Coarse Adjustment, Square Stage. Eyepiece No. 3 and Objective No. 3, Magnification ×84. In Polished Mahogany Case with Handle, with fitting for spare Eyepieces, etc. **£4 10 0**

(F) **12292** **Microscope.** A good general purpose instrument, fitted with Rack and Pinion, Coarse Adjustment. Fine Adjustment by means of a fine Screw under the Stage. Eyepieces No. 3 and 5, Objectives No. 3 and 7, magnification ×84 to 720.

Complete in Polished Wood Case with Fittings ... ... nett **£6 15 0**

Double Nosepiece extra **1 1 0**

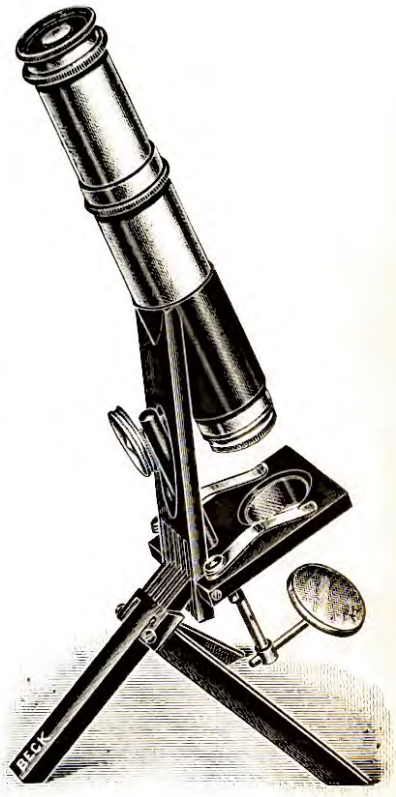
(F) Foreign manufacture.



12293



12294



12294

12293 C. BAKER'S "NATURE" MICROSCOPE

The above illustration introduces to you the new model of C. Baker's "Nature" Microscope. The limb has been redesigned, giving a more elegant appearance and, at the same time, greater efficiency, inasmuch that it also carries the illuminating mirror.

When first introduced, the "Nature" Microscope was intended to fill the requirements of a small, light, cheap and highly efficient Microscope for nature study as its name implies. As soon as it became available for us in Educational Institutions, it was quickly realised that this small instrument, in spite of its low price, was fitted with such a remarkable optical equipment that it had capabilities far beyond the scope for which it was originally designed. It is now to be found in Botanical, Biological, Chemical, Geological, Histological, Metallurgical, and Physical Laboratories, and although the name "Nature" is so widely known for the Microscope, it does not to-day convey a conception of the Microscope's capabilities.

Without wishing to labour the point, we must say that unless you have handled one of these small instruments you cannot realise the excellent performance of the lenses. Magnifications from 25 to 220 diameters can be obtained by means of extending the two tubes, and lower intermediate magnifications can be obtained by extending the tubes to the divisions marked on each. For instance, the first tube extended to 60, and the second tube to 80, will give a magnification of 140.

The following specimens can be seen without any difficulty, demonstrating its utility: **Mitosis, Bacteria (Anthrax), etc.,** as well as the usual botanical and physiological specimens.

The instrument is supplied in neat case, measuring $7 \times 3\frac{1}{4} \times 3\frac{1}{4}$ in., and weighs 2 lb. 4 oz. complete. Packing, postage and insurance inland, **1/3**. Price ... ... nett **£3 0 0**

THE "BABY LONDON" MICROSCOPE

The "Baby London" is a complete and efficient Microscope folding away into a small case which will slip into a coat pocket, but when extended for use the instrument is capable of work with high powers and possesses the necessary adjustments for such work. The case in which it is carried measures $5\frac{1}{4} \times 2\frac{1}{2} \times 2$ in. It has a sliding coarse adjustment and an extending drawtube giving tube length of 160 mm. The low power lenses can be used with the drawtube closed, giving lower magnifying powers, or with the drawtube extended. The high powers should only be used with the drawtube extended. Its fine adjustment is sufficiently perfect to enable a $\frac{1}{12}$ in. oil immersion object glass to be focussed. The thread into which the object glasses screw is the standard R.M.S. thread to which all object glasses are made. The eyepieces are the standard ·917 in. diameter, thus all kinds and makes of standard object glasses and eyepieces can be used. The $\frac{2}{3}$ in object glass is mounted so that the Microscope will pack into its case when it is in position. This gives, with the X10 eyepiece, magnifying powers from 30 to 110. An Abbe condenser and iris diaphragm with patch stops and a complete line of apparatus can be added, making the instrument thoroughly serviceable for naturalists, travellers and medical use. The mirror is concave and is provided with all adjustments. A flat mirror can be supplied for use with the substage condenser. The "Baby London" is the ideal microscope for the worker who has to carry his instrument from place to place, but apart from its portability its performance is so excellent that it can be used for delicate work with great satisfaction.

12294 Baby London Microscope, stand only, in case **£3 0 0**
12295 Baby London Microscope, with one Eyepice and $\frac{2}{3}$ in. Object Glass, in case **4 4 0**

No. 10 LONDON MICROSCOPE



The Microscope is a simple instrument of the vertical type, without joint for inclination and with one Focussing Adjustment by means of a specially cut Rack and Pinion giving very smooth motion free from backlash, capable of focussing Object Glasses up to $\frac{1}{8}$ in. The Base with the handle-shaped Limb is made in a solid casting, giving great rigidity. The Stage is square and is provided with Stage Clips for holding specimens. The Body-Tube has an adjustable Draw-tube. The Mirror is plane on one side and concave on the other, and is held in Gymbals. The instrument is finished in acid-resisting, stoved Black Enamel.

The Eyepieces and Object Glasses are of the standard series. This Microscope will be found to be suitable for use in Schools and Educational Establishments for Elementary, Botany, Zoology and similar work, and is also an excellent instrument for workshop use where the highest powers are not necessary.

=12296 **No. 10. London Microscope, Stand only** ... **£3 10 0**

=12297 **No. 10A. London Microscope, Stand only** **£3 10 0**
Two Eyepieces, 42 mm. (×6) and 25 mm. (×10) **1 4 0**
$\frac{2}{3}$ in. Object Glass (16 mm.) without box **0 12 0**
Magnifications: 62 to 110. **£5 6 0**

=12298 **No. 10B. London Microscope, Stand only** **3 10 0**
Eyepiece, 42 mm. (×6) **0 12 0**
$\frac{2}{3}$ in. Object Glass (16 mm.) without Box **0 12 0**
$\frac{1}{6}$ in. Object Glass (4 mm.) without Box **2 13 0**
Magnifications: 62 to 285. **£7 7 0**

=12299 **No. 10C. London Microscope,** Stand only, in Oak Case with Lock and Key **£4 7 6**
Two Eyepieces, 42 mm. (×6) and 25 mm. (×10) **1 4 0**
$\frac{2}{3}$ in. Object Glass (16 mm.) without Box **0 12 0**
$\frac{1}{6}$ in. Object Glass (16 mm.) without Box **2 13 0**
Double Nosepiece **1 1 0**
Magnifications: 62 to 490. **£9 17 6**

=12300 **Accessories.**
Oak Case with Lock and Key **£0 17 6**
Cylindrical Substage Fitting with Iris Diaphragm **0 9 6**
Abbe Condenser **1 5 0**
Dust-tight Double Nosepiece **1 1 0**
$1\frac{1}{2}$ in. Object Glass (32 mm.) with Box, giving power with 42 mm. (X6) Eyepiece of 25 ... ... **1 3 0**
Eyepiece Micrometer **0 10 6**
Stage Micrometer in ·1 and ·01 mm. **0 12 6**
Stage Micrometer in ·01 and ·001 in.... ... ... **0 12 6**



No. 29 LONDON MICROSCOPE

Every point in the design and manufacture of a Microscope which tends to make it efficient and serviceable, has been considered and incorporated into the No. 29 London Microscope, but in such a way that the price remains moderate. The whole instrument is of particularly solid construction, so that flexure in the parts is obviated and wear through use is reduced to a minimum.

Various Models of the No. 29 Microscope are made, the chief differences being in the Substages, of which there are several forms: a simple focussing Substage operated by a spiral screw, a non-centring form focussed by rack and pinion, a centring model focussed by rack and pinion, and a Substage in which the apparatus is changed by means of Akehurst slides. Model No. 29 F and G also have a new simplified mechanical Stage.

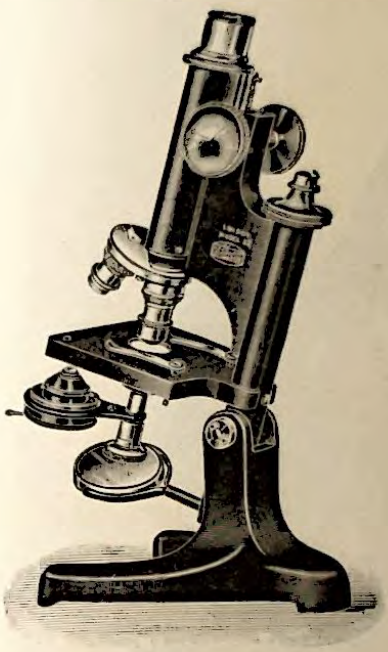
This Microscope is so made that all apparatus, such as Mechanical Stages, Condensers and Dark Ground Illuminators, Nosepieces, Object Glass Changers and extra Object Glasses and Eyepieces, can be added as occasions arises, without the necessity of returning the instrument for fitting. By this means the No. 29 Microscope can be purchased in its simplest form and built up as desired into a complete instrument for higher power work.

=12301	**No. 29A. Stand** with Tubular Substage, Iris Diaphragm			£6	13	0
	Eyepiece 42 mm. (×6)			0	12	0
	⅔ in. Object Glass, 16 mm., without Box			0	12	0
	⅙ in. Object Glass, 4 mm., without Box			2	13	0
					£10	10 0
=12302	**No. 29A. Model 29A** (1) as above			£10	10	0
	Double Nosepiece			1	1	0
					£11	11 0
=12303	**No. 29B. Stand** with Swing-out Focussing Substage			£7	1	6
	Two Eyepieces 42 mm. (×6) and 25 mm. (×10)			1	4	0
	⅔ in. Object Glass, 16 mm., without Box			0	12	0
	⅙ in. Object Glass, 4 mm., without Box			2	13	0
	Abbe Condenser and Iris Diaphragm			1	9	6
	Triple Nosepiece			1	10	0
					£14	10 0
=12304	**No. 29B. Stand**, with Swing-out Focussing Substage			£7	1	6
	Two Eyepieces, 42 mm. (×6) and 25 mm. (×10)...			1	4	0
	⅔ in. Object Glass, 16 mm., without Box			0	12	0
	⅙ in. Object Glass, 4 mm., without Box			2	13	0
	1/12 in. Oil Immersion Object Glass, 2 mm.			5	10	0
	Abbe Condenser and Iris Diaphragm			1	9	6
	Triple Nosepiece			1	10	0
					£20	0 0
=12305	**No. 29B. Model No. 29B** as above			£20	0	0
	Detachable Mechanical Stage			6	0	0
					£26	0 0

An Oak Case with Lock and Key is included in the price of the Microscopes supplied complete with Object Glasses and Eyepieces.

=12306	**Teak Cabinet** in place of Oak Case screwed, for tropical climates ...	extra	£1	5	0
=12307	Extra for Drawtube, graduated in millimetres	extra	0	7	6

Any apparatus can be added or omitted at a corresponding addition or reduction of price.



MICROSCOPE, "LONDON" MODEL, BECKS'

The "No. 22" is of simple design but of the highest quality and of the full standard size. No essential adjustments have been omitted to enable it to be produced at a low price, but the construction has been simplified and all elaboration of parts eliminated.

Base, Pillar and Limb. The Base and Pillar are in one heavy iron casting, and with good spread, making the Microscope stand firmly, either in the vertical or in an inclined position. The Limb is hinged into the top of the Pillar, so that the Microscope can be used at any angle, from the vertical to the horizontal. These parts are finished in stoved black enamel, which withstands the action of acids.

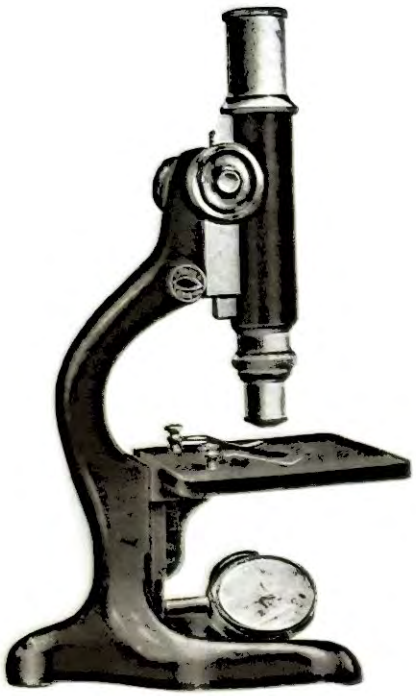
Stage. The Stage is large, measuring 4 × 3½ in. and is therefore of a sufficient size to permit of a petri dish or culture plate being placed upon it. It is of solid construction, and rigidly attached to the Limb of the Microscope.

The Focussing Adjustments. The Microscope has a Coarse Adjustment by helical rack and pinion. The greatest care is taken in the perfect smoothness of working of the slides in which the body moves, so that any shake or backlash is obviated. Comparatively high powers can be focussed with it. The fine Adjustment is of a simple but very strong and effective design. It is constructed in such a manner that a smooth working focussing adjustment giving no backlash is obtained. It is actuated by a large milled head, giving a sufficiently delicate movement for use with an oil immersion object glass. It is readily accessible to either hand, a quality which every slow motion should possess. It is superior to a fine adjustment worked by milled head at the side, unless two milled heads are provided one on each side of the Limb.

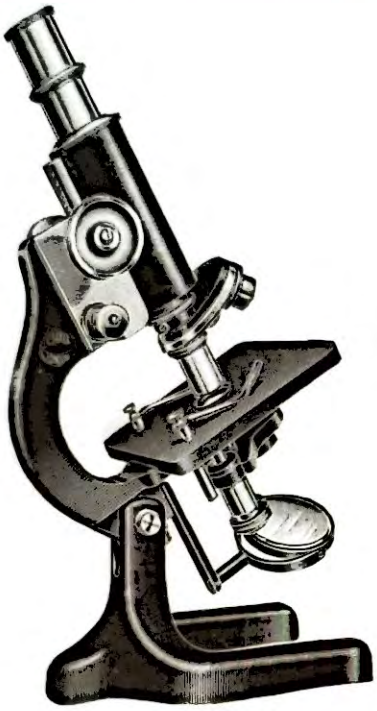
The Body Tube. This is of the standard length and has an extending drawtube, marked so that the tube length can be readily set at 160 mm., for which the Object Glasses are corrected.

The Mirror. A Double Mirror, plane and concave, is fitted into the bottom end of the Limb. It is in a semi-circular fitting which rotates, and in which the Mirror turns on its axis.

=12308	**Stand 22.** Without Substage, in canvas-covered Case ... ... nett					
	Eyepiece, 42 mm....	0	12	0		
	1½ in. (32 mm.) Object Glass, without Box	1	3	0		
	⅔ in. (16 mm.) Object Glass, without Box	0	12	0		
					£7	9 6
=12309	**Stand 22.** Without Substage, in Canvas-covered Case	£3	2	6		
	Eyepiece, 42 mm.	0	12	0		
	⅔ in. Object Glass, 16 mm., without Box	0	12	0		
	⅛ in. Object Glass, 4 mm., without Box	2	13	0		
					£8	19 6
=12310	**Stand 22.** Model 22 as above	£8	19	6		
	Double Nosepiece	1	1	0		
					£10	0 6
=12311	**Stand 22.** With Swing-out Focussing Substage in Canvas-covered Case	£6	0	6		
	Eyepiece, 42 mm....	0	12	0		
	⅔ in. Object Glass, 16 mm., without Box	0	12	0		
	⅛ in. Object Glass, 4 mm., without Box	2	13	0		
	Abbe Condenser and Iris Diaphragm	1	9	6		
					£11	7 0
=12312	**Stand 22.** With Swing-out Focussing Substage in Mahogany Cabinet ...	£7	5	6		
	Two Eyepieces, 42 mm. and 25 mm.	1	4	0		
	⅔ in. Object Glass, 16 mm., in Box	0	16	6		
	⅛ in. Object Glass, 4 mm., in Box	2	17	6		
	1/12 in. Oil Immersion Object Glass, 2 mm.	5	10	0		
	Abbe Condenser and Iris Diaphragm	1	9	6		
	Triple Nosepiece	1	10	0		
					£20	13 0
=12313	**Detachable Mechanical Stage** to any above Models				6	0 0
	Oak Cabinet in place of Canvas Case				0	7 6
	Mahogany Cabinet in place of Canvas-covered Case				1	5 0

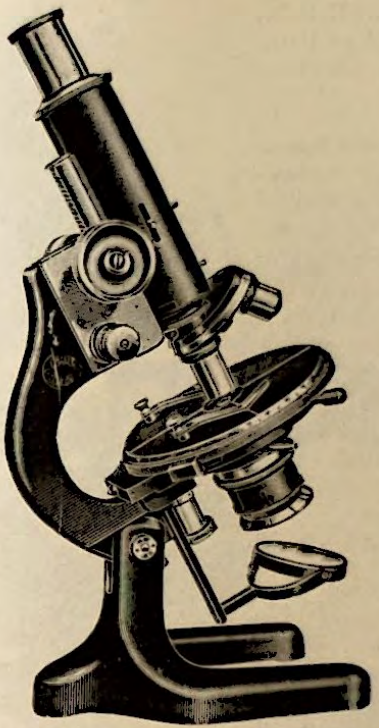


12314-16

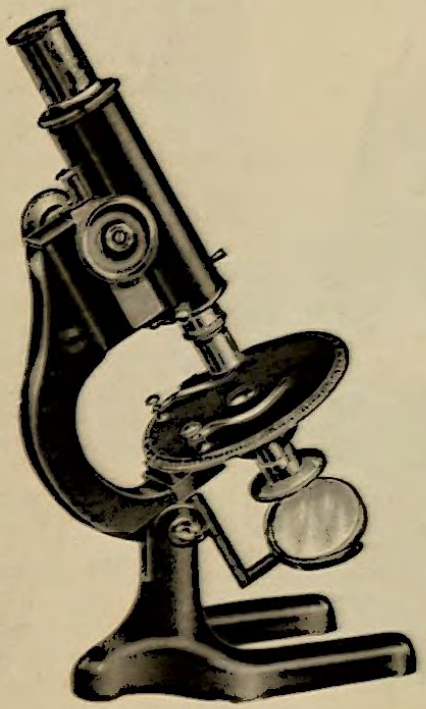


12318-24

12314	**C. Baker's Science Microscope** meets the requirements of many Schools who require a full size Microscope at a low price. The rack and pinion focussing is so delicately cut as to enable a $\frac{1}{6}$ in. objective to be easily focussed. Stand only... ... ... nett	**£3**	**10** **0**
12315	**Stand** fitted with Eyepieces 2 and 4, $\frac{2}{3}$ in. objective. Magnification 55 to 100... do.	**5**	**0** **0**
12316	(2) **Stand** fitted with Eyepiece 3, $\frac{1}{4}$ and $\frac{2}{3}$ in. objectives. Magnifications 76 to 320 do.	**7**	**10** **0**
12317	(3) Best quality **Pine Case** for any of the above outfits ... ... do.	**0**	**16** **6**
12318	**C. Baker's B.L.M. Microscopes** have proved very popular in Universities and Schools. Although offered at prices far below competitive instruments, the workmanship both optically and mechanically is of a very high standard.		
	(1) **Stand** in Case with objectives $\frac{2}{3}$ in., $\frac{1}{6}$ in. (3 and 6) without Boxes, Double Nosepiece, Eyepieces 2 and 4, Iris Diaphragm and Substage Tube. Magnifications 53 to 400... ... ... nett	**£10**	**7** **6**
12319	(2) **Stand** in Case as above, with Screw Focussing Substage, Abbe Condenser and Iris... ... ... do.	**13**	**12** **0**
12320	(3) **Stand** in Case with Objectives $\frac{2}{3}$ in., $\frac{1}{4}$ in. (3 and 6), $\frac{1}{12}$ in. O.I. without Boxes, Triple Nosepiece, Eyepieces 2 and 4, Abbe Condenser and Iris ... do.	**17**	**0** **0**
12321	(4) **Stand** in Case with Screw Focussing Substage, Objectives, $\frac{2}{3}$ in., $\frac{1}{6}$ in. (3 and 6), $\frac{1}{12}$ in. O.I. without Boxes, Triple Nosepiece, Eyepieces 2 and 4, Abbe Condenser and Iris, Mechanical Stage. Magnifications 53 to 900 ... ... do.	**24**	**0** **0**
12322	**C. Baker's B.L.M. Advanced Students' Stand**, as illustrated. This Microscope is fitted with Screw Focussing Swing-out Substage and fine adjustment on both sides of the limb. It is particularly recommended for Students in advanced work, and can be thoroughly recommended. Outfit as 2, but with Triple Nosepiece ... ... nett	**£14**	**12** **6**
12323	Outfit as 3	**19**	**12** **6**
12324	Outfit as 4	**25**	**2** **6**



12325–28



12329–30

12325 **C. Baker's B.L.M. 1.M. Microscope** is fitted with Bertrand Lens and square-ended Glan Thompson Prism Analyser, which are so mounted that they can be swung in and out of the optic axis; Centring Nosepiece, under which is a slot placed at an angle of 45°, to carry Wedges, etc.; large Rotating Stage divided to 360°, under which is mounted a Screw Focussing Substage with a converging system and Iris Diaphragm, the top lens of which can be turned out of the optic axis, and a large Polariser, also of the Glan Thompson type, in revolving Sleeve with Clock Stops to mark the positions of 90°, 180°, 270°, and 360°. In Case.
nett **£16 10 0**

12326 (a) **Stand** with Eyepiece No. 1 with Cross Lines and No. 4 Objectives, $\frac{2}{3}$ in., $\frac{1}{6}$ in., $\frac{1}{12}$ in. oil immersion, Triple Nosepiece, Selenite Plate, Quartz Wedge. Magnifications from 18 to 900 ... ... nett **31 10 0**

12327 (b) **Stand** with Eyepiece No. 1, with Cross Lines and No. 4 Objectives $\frac{2}{3}$ in., $\frac{1}{6}$ in., Double Nosepiece, Quartz Wedge, Magnification from 18 to 305 ... ... nett **25 6 0**

12328 (c) **Stand** with Eyepiece No. 2 with Cross Lines, Objectives $\frac{2}{3}$ in., $\frac{1}{6}$ in., Magnification from 45 to 164 ... ... nett **21 15 0**

C. Baker's B.L.M. 1.M.S. Microscope is introduced to meet the ever-increasing demand for a simple Mineralogical Microscope for use in Colleges and Schools. In the body is fitted a Swing-out Analyser and Centring Nose-piece, the Rotating Stage is divided to 360°, and under this is mounted a Rotary Nicol Prism Polariser on a Swing-out Arm with rotation.

12329 **Stand** only, in Case ... ... nett **£12 0 0**

(a) **Stand**, in Case, with Eyepiece No. 2 and Cross Lines, Objective 1 in., without Box, Magnification 22 ... ... nett **14 6 0**

12330 (b) **Stand**, in Case, with Eyepiece No. 2 with Cross Lines, Double Nosepiece, Objectives $\frac{2}{3}$ in., $\frac{1}{6}$ in., without Box. Magnifications 45 and 164 ... ... nett **15 8 0**



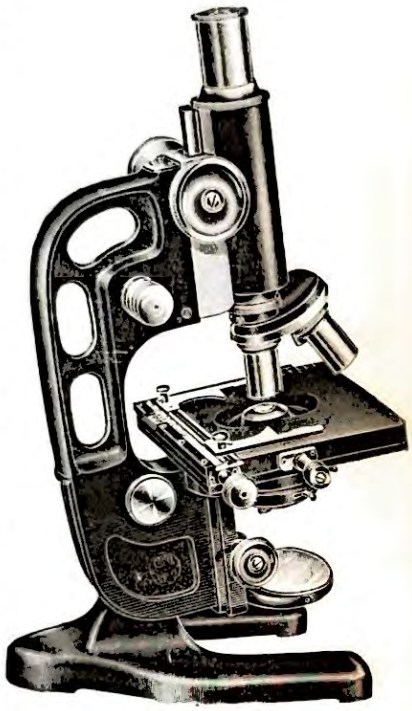
12331–12333

C. Baker's B.L.M. 1.A.D. and B.L.M. 1.A.B. represent the latest design and improvements to their well-known series of B.L.M. Microscopes.

C. Baker's B.L.M. 1.A.D. Microscope is fitted with a large Rectangular Stage measuring 4·5×4·5 in., to which can be added, if necessary, our Metron Mechanical Stage, and confirms to all the modern requirements of the Medical Students, inasmuch that it can be added to subsequently for advanced research work. The Substage is of the simple friction type but may be substituted by others at an extra cost as below. The body has a fixed length, and at an additional cost a divided Drawtube will be supplied.

12331 **Stand** only, without Case
each **£9 0 0**

12332 **Stand**, in Case, with Abbe Condenser, N.A., 1·1 and Iris, Double Nosepiece, Eyepieces 2 and 4, Objectives 3 ($\frac{2}{3}$ in.), 6 ($\frac{1}{6}$ in.), without Boxes, Magnification 53 to 406
each **£16 4 0**



12334–12337

12333 **Stand**, in Case, with Abbe Condenser, N.A., 1·1 and Iris, Triple Nosepiece, Eyepieces 2 and 4, Objectives 3 ($\frac{2}{3}$ in.), 6 ($\frac{1}{6}$ in.), $\frac{1}{12}$ in. oil immersion, without Boxes, Metron Mechanical Stage, Magnification 53 to 900 ... ... each **£26 10 0**

C. Baker's B.L.M. 1.A.B. Microscope. The stage measuring 4·5×4·5 in., is rigidly built to the Limb, and has movements of 60 mm. in the horizontal and 30 mm. in the vertical directions. The body has a fixed length but a divided Drawtube can be added as an extra when desired. This Stand is recommended for use in the Bacteriological and Research Laboratories. The Substage is of the simple friction focussing form, but others can be substituted (see extras, below).

12334 **Stand** only, without Case ... ... nett **£15 10 0**

12335 **Stand**, in Case, with Friction Focussing Substage, Abbe Condenser and Iris Diaphragm, Triple Nosepiece, Objectives $\frac{2}{3}$ in., $\frac{1}{6}$ in., Eyepieces 2 and 4, Magnification 53 to 400 ... ... nett **24 2 0**

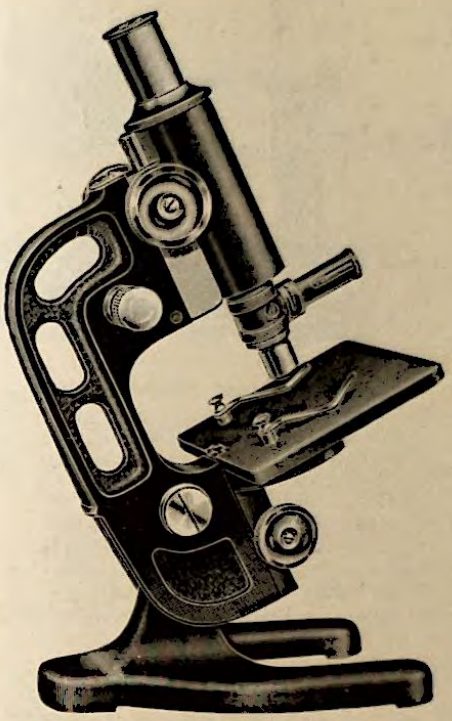
12336 **Stand**, in Case, with Rack and Pinion Focussing Substage, Abbe Condenser and Iris Diaphragm, Triple Nosepiece, Eyepieces 2 and 4, Objectives $\frac{2}{3}$ in., $\frac{1}{6}$ in., $\frac{1}{12}$ in. N.A., 1·30 oil immersion, Magnification 53 to 900 ... ... each **31 10 0**

12337 **Stand**, in Case, with Rack and Pinion Focussing Centring Substage, Achromatic Condenser and Iris Diaphragm, Triple Nosepiece, Eyepieces 2 and 4, Objectives $\frac{2}{3}$ in., $\frac{1}{6}$ in., $\frac{1}{12}$ in. N.A., 1·30 oil immersion, dark ground Illuminator, Magnification 53 to 900 ... ... nett **39 0 0**

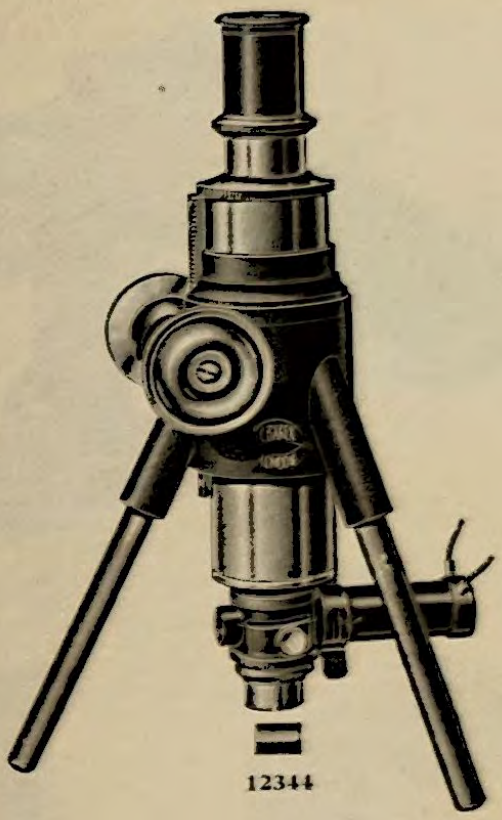
(The specially low figure at which these outfits are listed will not allow of the Microscope and Components being separated.)

12338 **Extras.**

Whitewood Case	nett	**£1**	**5**	**0**
Attachable Mechanical Stage		**5**	**0**	**0**
Mahogany instead of Whitewood Case		**2**	**10**	**0**
Divided Drawtube		**0**	**12**	**6**
Rack and Pinion Centring Substage		**1**	**17**	**6**
Rack and Pinion Centring Swing-out Substage		**2**	**10**	**0**
Boxes for Objectives		**0**	**3**	**0**



12340–42



12344

C. Baker's B.L.M. 1.Met. Metallurgical Microscope. This Microscope is fitted with a large Rectangular Stage, mounted on a slide with Rack and Pinion Focussing Adjustment. This Slide forms part of the Limb so that the body and the Stage are attached to one unit, ensuring alignment and rigidity. The Stand is inclinable to the horizontal position for photographic purposes. The Body has Rack and Pinion Coarse Focussing Adjustment, and the Fine Adjustment is operated from either side of the limb; a Divided Drawtube is also provided. A circular rotating Mechanical Stage can be fitted to this Stand at an extra cost (see below) when desired, but this is only made to order.

12340	**Stand** only, without Case ... ... nett	**£11**	**0**	**0**
12341	(a) **Stand,** in Case, with Vertical Illuminator, Iris Diaphragm and Condensing Lens, Vertical Illuminator and Iris Diaphragm, Prism Form. Eyepieces 2 and 4. Objectives 1 in., ½ in., ⅛ in., 1/12 in. 0·1. Magnifications 30 to 873 ... ... nett	**30**	**5**	**0**
12342	(b) **Stand,** in Case, with Vertical Illuminator, Iris Diaphragm and Condensing Lens, Eyepieces 2 and 4, Objectives ⅔ in., ⅛ in. Magnifications 53 to 406... ... nett	**18**	**15**	**0**
12343	**Extras.**			
	Metallurgical Centring Rotating Mechanical Stage ... ... nett	**10**	**10**	**0**
	Whitewood Case ... ... nett	**1**	**5**	**0**
	Stage fitted with Substage Tube, Plane and Concave Mirror in Gymbal for transmitted light... ... ... nett	**1**	**5**	**0**
	(All Objectives are corrected for uncovered objects.)			
12344	**C. Baker's Works Microscope** meets the request for a Stand to measure Brinell impressions, and for general works metallurgical examinations during the stages of manufacture and machining. The instrument is mounted on a Tripod, and for the examination of cylindrical work this Tripod can be placed on a flat platform in which is cut a V groove. Focussing adjustment is by means of a delicately-cut diagonal Rack and Pinion. The Illuminator attached to the Body just above the Objective is entirely self-contained and consists of a Vertical Illuminator of the cover glass form, and the light from a 3·5 volt lamp is directed on to same through a Condensing Lens, consequently it is only necessary to switch on the light and focus the object. nett	**£6**	**10**	**0**



12346



12351–2

= **12351 Dissecting Stage,** consisting of a metal Base upon which is mounted an Opal Glass Plate, 2¼ × 2½ in., or a Plain Glass Plate under which can be placed black or white paper, with Nickel-plated Upright carrying a Lens-holder which is adjustable for focussing. Price **£0 10 0**

= **12352 Stage** with Doublet Lens × 6 **0 15 0**

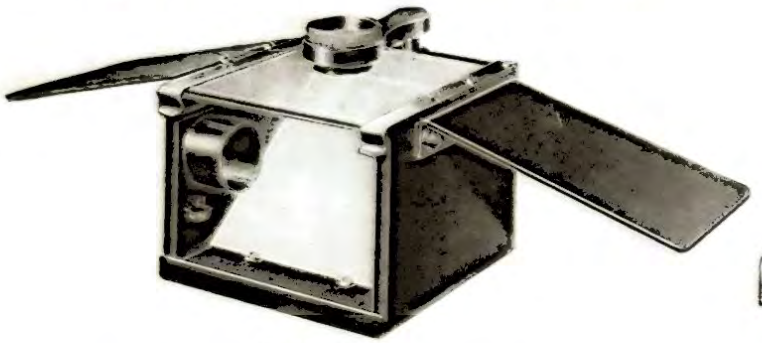
= **12346 Senior Dissecting Microscope**, comprising stand of suitable proportions, fitted with Rack and Pinion Focussing Adjustment to Jointed Lens Arm, large Stage Frame carrying Glass Plate under which slides a Metal Plate enamelled on one side black, and the other white. Provision is made for the attachment of a pair of strong metal Arm Rests and Spring Clips. A Plane and Concave Mirror, 50 mm. diameter, is attached to an Arm under the Stage. The whole packed in a neat Case with fittings to carry Aplanatic Lenses. Price **£2 15 0**

= **12347 Stand**, with Doublet Lens × 6 and Aplanatic Lens × 15. ... ... **3 16 6**

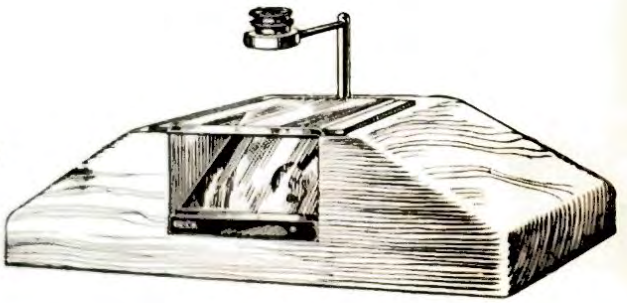
= **12348** ,, ,, ,, × 10 ,, ,, × 20. ... ... **3 19 0**

= **12349** ,, ,, Aplanatic Lenses × 8, × 15, × 20 ... ... **5 5 0**

= **12350** ,, ,, ,, × 10, × 20 ... ... **4 8 0**



12353–5



12356

Box-form Dissecting Microscope is recommended to Biologists on account of its extreme simplicity, durability, and low cost. It is very popular in Schools and Laboratories, where real efficiency is required at a reasonable cost.

The Body is made of Cast Iron and the Arm Rests can be readily attached to either side, both being finished in the effective Crystalline Enamel. The Stage consists of a thick Glass Plate, 4 × 4 in., under which is fitted an Opal Reflector, and above a strong Arm swinging from side to side, with a smooth Focussing Adjustment to carry Lenses of a standard diameter. The Arm Rests form a Lid for the front when the instrument is put away and there is provision for carrying a spare Lens.

Extras

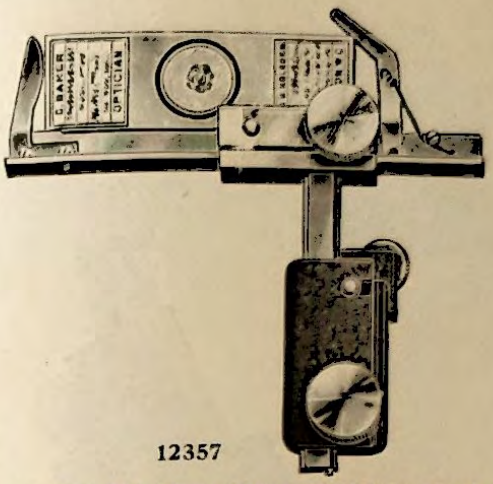
= **12353 Boxform Dissecting Microscope**, with × 6 Doublet Lens ... ... Price **£1 5 0**

= **12354** ,, ,, × 10 Doublet **1 7 6**

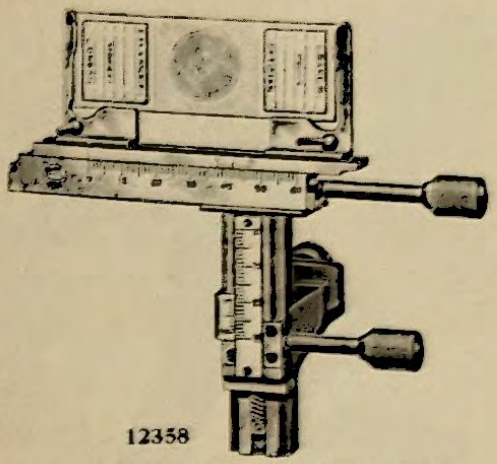
= **12355** ,, ,, two Aplanatic lenses, either × 8, × 10, × 15 or × 20 ,, ... **2 13 0**

Cornex Dissecting Microscope. This dissecting Microscope is constructed from a solid block of Wood, and in use will be found very rigid. The sides of the block are cut away at a convenient angle so as to form rests for the hands. A Glass Stage is provided upon which to place the objects, which are illuminated by a mirror set at an angle of 45°. The Lenses are carried in an arm which is attached to a rod, the rod being held in a tubular fitting which allows it to be slid up and down for focussing purposes, and also to be swung over the Stage Plate so that objects at different positions can be examined. With the Lenses supplied magnifications of 7 and 14 are obtained. These Lenses are so arranged that they combine together, the higher power being obtained with the two Lenses combined, the low power when separated. Holes are provided in the top of the Microscope into which the Lenses can be placed for storage purposes when the instrument is not in use. For Class use this Dissecting Microscope will be found most satisfactory, as although it is of the simplest construction it is very rigid and strong, and the magnification given is all that is required for ordinary Botanical and Entomological Dissection. For Naturalists' work and for such purposes as the recognition of diseases in bees and other insects, it will be found equally useful.

= **12356 Cornex Dissecting Microscope**, complete with two Magnifiers **£0 15 6**



12357



12358

12357 **C. Baker's New Kinematic Mechanical Stage.** This microscope-attachable Mechanical Stage is of entirely new design and is highly efficient. Economy of manufacture has also enabled the price to be considerably reduced... ... ... nett £2 15 0

12358 **C. Baker's Metron Mechanical Stage.** This model is very similar to the well-known Mayall pattern, but is simplified in its method of attachment to the Microscope. Will practically fit any square Stage if square has back and no projections ... ... nett 5 10 0

Ditto, without divisions ... ... „ 5 0 0



C. Baker's Dissecting Aplanats

12359	× 6	... Price	£0 16 6
12360	× 8	... „	0 17 6
12361	×10	... „	0 16 6
12362	×15	... „	0 16 6
12363	×20	... „	0 16 6



C. Baker's Dissecting Doublets

12364	× 6	... Price	£0 5 0
12365	×10	... „	0 7 6



C. Baker's Pocket Aplanats

12366	× 6	... Price	£1 2 0
12367	× 8	... „	1 2 0
12368	×10	... „	1 1 0
12369	×15	... „	1 1 0
12370	×20	... „	1 1 0

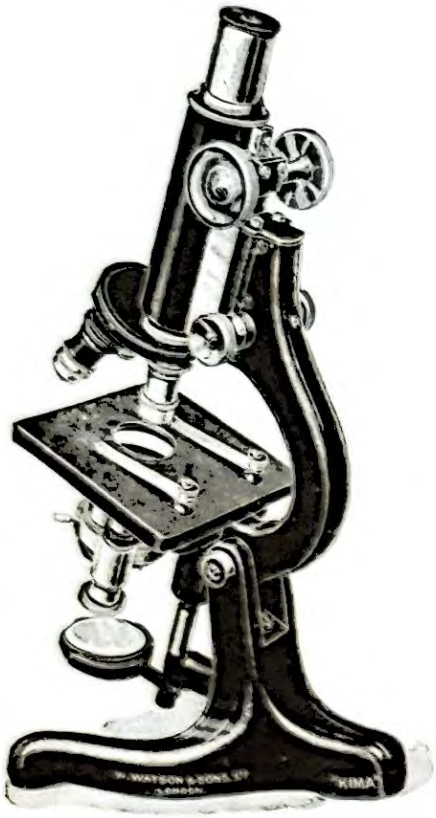
C. Baker's Objectives, Eyepieces, Aplanats, etc. British Manufacture.

12371 **Microscope Achromatic Objectives.**

Approximate Focal Length.	Initial Magnification at 250 mm. tube.	160 mm. length.	Numerical Aperture.	Price.
4 in. ...	2·6 ...	1·4 ...	·08 ...	£1 15 0
3 „ ...	4·2 ...	2 ...	·08 ...	1 15 0
2 „ ...	5·4 ...	2·8 ...	·1 ...	0 17 6
2 „ ...	5·4 ...	2·8 ...	·15 ...	2 0 0
1½ „ ...	7·3 ...	3·9 ...	·197 ...	2 5 0
1 „ ...	9·7 ...	6 ...	·197 ...	1 14 0
No. 3 (½) ...	14 ...	9·0 ...	·15 ...	0 17 6
½ in. ...	15 ...	9·3 ...	·25 ...	1 10 0
½ „ ...	16 ...	10·5 ...	·25 ...	1 12 0
½ „ ...	21 ...	14 ...	·35 ...	2 5 0
½ „ ...	— ...	— ...	— ...	1 10 0
¼ „ ...	46 ...	34 ...	·75 ...	3 0 0
¼ „ ...	61 ...	44 ...	·82 ...	3 9 0
¼ „ ...	95 ...	63 ...	·85 ...	3 10 0
¼ „ ...	105 ...	65 ...	·11 ...	1 12 0
1 in. water ...	105 ...	65 ...	·11 ...	4 15 0
⅛ „ „ ...	60 ...	40 ...	·75 ...	6 10 0
1/12 „ „ ...	150 ...	101·5 ...	1·20 ...	5 0 0
1/12 „ „ ...	150 ...	101·5 ...	1·20 ...	5 0 0

12372 **Huyghenian Eyepieces.** These Eyepieces are usually supplied with our Microscope Outfits and have an outside diameter of 23·2 mm., the actual magnifications given below are the same on the long or short tube.

Nos.	1	2	3	4	5	6
Magnifications	× 3	× 5	× 7	× 9	×12	×16
Price	8/0	8/0	8/0	8/0	12/6	12/6



12374–76



12380–82

Watson "Kima" Microscope. A full-sized instrument of robust design for Student and Laboratory use. All parts standardised; additional movements can be fitted by the user.

12374	**Outfits** recommended. Kima Microscope with Eyepiece × 6, × 8 or × 10, Objectives ⅔, ⅙, in Case	nett	£12	0 0
	Double Nosepiece	,,	1	5 0
	Iris Diaphragm	,,	0	15 0
12378	**Kima Microscope**, with Eyepieces × 6, × 10, Objectives ⅔, ⅙, Triple Nosepiece, Abbe Condenser N.A. 1·20, Iris Diaphragm, Oak Case, Spiral Focussing to Condenser	nett	16	15 0
12376	**Kima Microscope Outfit** as above, but with 1/12 in. Oil Immersion Objective in addition	,,	21	15 0
	Extras.			
12377	**Drawtube**	,,	0	8 6
12378	**Mechanical Stage**, Alpha pattern	,,	7	0 0
12379	**Spiral Focussing Screw**, underhitting	,,	0	17 6

If Case is not required, deduct 20/0 from above prices of Outfits.

N.B.—All Watson's Microscopes are sold with a five-year guarantee.

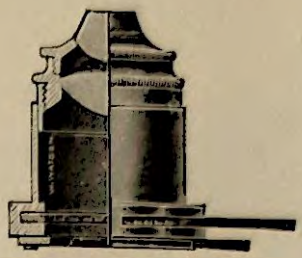
Watson "Service" Microscope. The most popular Students' Microscope made. Limb designed upon the Optical Bench principle. All parts standardised and interchangeable. All movements fitted with Compensated Bearings, robust design, rigid in all positions. Lever Fine Adjustment, milled heads each side of Limb, long range of Coarse Adjustment. Large diameter Body Tube. Vulcanite covered Stage. Independently focussing Mirror. A separate descriptive Booklet is published; sent gratis on request.

12380	**Outfits** recommended. Service Microscope with 1 Eyepiece × 6, × 8 or × 10, Objectives ⅔, ⅙, in Case	nett	£15	10 0
	Double Nosepiece	,,	1	5 0
	Iris Diaphragm	,,	0	15 0
12381	**Service Microscope**, with Spiral Focussing Condenser fitting Eyepieces × 6, × 10, Objectives ⅔, ⅙, Triple Nosepiece, Abbe Condenser N.A. 1·20 with Iris Diaphragm, in Case	nett	20	0 0
12382	**Service Microscope**, as above, but with Versatile 1/12 in. Oil Immersion Objective	,,	27	10 0
	With Utility 1/12 in. Oil Immersion Objective	,,	25	0 0
	Extras.			
12383	**Rack Focussing** and Screw-centring Substage, add to above prices		2	5 0
12384	**Service** Mechanical Stage		9	5 0
12385	**Alpha** Mechanical Stage		7	0 0
	If no Case is required, deduct from above prices of Outfits		1	4 9



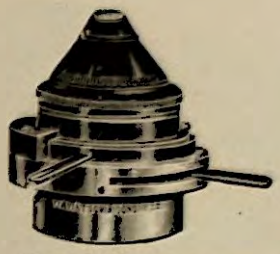
Optical part of Abbe Illuminator, 1·20 N.A.

12387



Mounted for Understage.

12389



Mounted for Substage.

12388



Low-power Objective, 2 in. to ½ in.

12392

CONDENSERS—SUBSTAGE

The continued popularity of this Condenser is due to the ease and rapidity with which it can be employed and for its brilliancy of image.

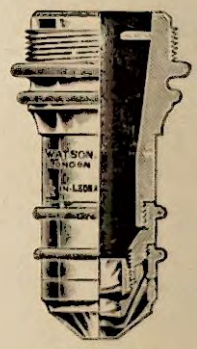
Although its numerical aperture is great, being 1·20, its Aplanatic Cone is comparatively small, but the ease with which it can be worked has caused it to be universally used for both high and low-power work; for the latter purpose the top lens is removed. A beautiful dark-ground effect may be obtained with it.

12387	**Optical Part** only, N.A. 1·20	nett	£1	5 0
12388	**Completely mounted** for Substage, with Iris Diaphragm and Carrier for Stops, N.A. 1·20 ...	,,	3	0 0
12389	**Completely mounted** for Understage with Iris Diaphragm and Carrier for Stops, N.A. 1·20 ...	,,	2	5 0
12390	**Set of Stops** for dark-ground, etc., illumination in Brass Box...	,,	0	10 0
12391	**Discs of Glass**, tinted, blue, signal green, yellow, ground glass, Dr. Spitta's "Pot Green" (two thicknesses), etc.	each, nett	0	1 6



Medium Power Objective, ⅛ in. to ⅓ in.

12392



Oil Immersion Objective, 1/12 in.

12393

12392 Watson & Sons' Parachromatic Objectives.

These may be corrected for any desired tube length, but are ordinarily supplied for a tube length of 170 mm.

Approximate Focal Length. in.	mm.		Initial power calculated for an image distance of 10 in. (about 250 mm.) Dias.		Numerical Aperture.		Price. Nett.
4	100	... ...	3	... ...	0·08	...	£2 0 0
3	75	... ...	4	... ...	0·09	...	2 0 0
2	50	... ...	6	... ...	0·13	...	2 0 0
1½	35	... ...	8	... ...	0·17	...	2 0 0
1	25	... ...	12	... ...	0·21	...	1 12 6
⅔	16	... ...	13	... ...	0·21	...	1 7 6
½	12	... ...	20	... ...	0·34	...	2 0 0
¼	6	... ...	42	... ...	0·68	...	3 5 0
1/10	4	Semi-Apochromatic	65	... ...	0·70	...	2 15 0
⅛	4		65	... ...	0·80	...	3 5 0
⅛	3	... ...	83	... ...	0·88	...	3 15 0

12393 Oil Immersion

	Approximate Focus. in.	mm.						Price. Nett.
Versalic	⅛	3·40	... ...	74	... ...	0·94	...	5 10 0
Utility	1/12	1·8	... ...	140	... ...	1·28	...	7 0 0
Versalic	1/12	1·8	... ...	140	... ...	1·25	...	5 0 0
	1/16	1·5	... ...	160	... ...	1·30	...	10 0 0

The price includes an Oil Bottle and supply of Oil.

12394 Objectives—with Variable Power. The following Objectives have been designed to give a range of magnifications between the limits specified; each of them may thus serve the purpose of two or more Objectives. A revolving collar effects the change of paper and focus.

Range of Focus.	Initial Power (Dias.)		Price
1½ to ⅔ in.	35 to 15	nett	£2 10 0
2 to 1 in.	10 to 5	,,	2 10 0
3 to 1½ in.	8 to 3	,,	2 10 0



Student's Eyepiece.
12395



Best Capped Eyepiece.
12396



12397



Eyepiece Micrometer.
12398

HUYGHENIAN EYEPIECES

This series of Eyepieces has been the subject of considerable experiment and re-computation. It has been found in consequence that the use of selected optical glasses, instead of the usual ordinary crown glass, worked to ascertained curves gives results that are superior to those ordinarily obtainable.

We strongly recommend microscopists to try our Huyghenian Eyepieces, and make comparisons between those of our current make and any others they may have hitherto used.

Huyghenian Eyepieces are made to work approximately in the same focal plane, so that on interchanging the different powers the object remains practically in focus.

The magnifying power of each Eyepiece is engraved on the eyecap. This figure represents the number of times the Eyepiece will magnify the image produced by the Objective in the draw-tube of the Microscope.

The Eyepieces also bear an ordinal number 1 to 5, which corresponds with the old notation of A, B, C, etc.

		Number	1	2	3	4	5	6
		Power	× 5	× 6	× 8	× 10	× 12	× 15
12395	Price for Universal Size		**10/0**	**10/0**	**10/0**	**10/0**	**15/6**	**15/6**
12396	Price for Large Capped Size		**25/0**	**25/0**	**25/0**	**30/0**	**30/0**	**30/0**

12397	**Students' Micrometer Eyepiece.** Power B 3602 Micrometer Eyepiece, for use with Micrometer No. B 3603 or B 3604. Eye-lens mounted on Telescopic Sliding Tubes for focussing Micrometer. Without Micrometer	**£0 15 0**
12398	**Eyepiece Micrometers,** ruled with scale, as figured, 1 cm. in 100 parts	**0 10 0**
12399	Ditto, ditto, in Squares, 1 cm. in 100 parts	**0 10 0**
12400	Ditto, ditto, the same as No. 12398 or 12399, but mounted to fit large-sized Capped Eyepiece (Eyepiece not included)	**0 12 6**
12401	**"Step" Eyepiece Micrometer,** the simplest and most accurate form of Eyepiece Micrometer, to fit any Eyepiece	**0 15 0**

Note.—The values of the lines of the Eyepiece Micrometer are ascertained by means of the Stage Micrometer and vary with every objective and tube-length. It is not therefore important what the divisions represent, so long as they are equidistant.

12402	**Stage Micrometers.** On 3 × 1 Slips ruled to 1/10 and 1/100 mm.	**£0 12 6**
12403	" " 3 × 1 " " 1/100 and 1/1000 in.	**0 12 6**



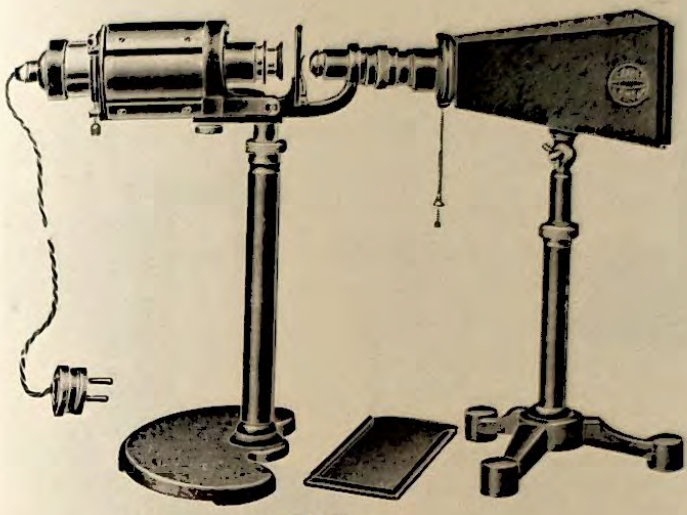
Consisting of Polariser and Analyser.



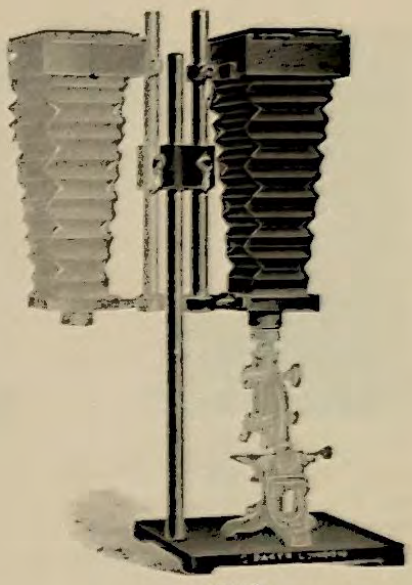
A Disc of Selenite is supplied with Sets 12404 12406.

WATSON POLARISING APPARATUS

12404	**Polariser and Analyser,** with Selenite, complete, small size	nett	**£1 10 0**
12405	Ditto, ditto, medium size	"	**2 5 0**
12406	Ditto, ditto, large size	"	**3 2 6**



12408



12410

C. BAKER'S PHOTOGRAPHIC AND RECORDING APPARATUS. British Manufacture.

12408 "Simplex" Photomicro Camera.

A very simple Camera, designed for use with the School Projector or any other Microscope in the vertical or horizontal position. Select the position of the specimen you desire to photograph, focus same, connect the camera and make the exposure in the ordinary way. A supplementary lens fitted in the camera renders any further focussing unnecessary. Shutter, Antinous Release, Stand adjustable for Height, and Tilt, Hood, Dark Slide, and Connections for using Camera on standard type of Microscope when in the vertical position. Price complete ... ... nett **£6 6 0**

12409 Extra Dark Slides ... ... each **0 3 0**

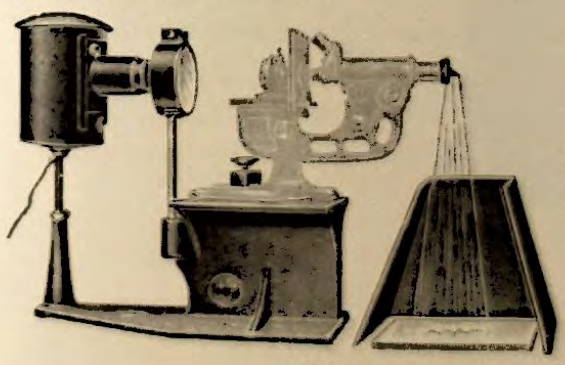
12410 Small Vertical Camera, 3¼ × 4¼ in.

This small Camera has been designed to meet the requirements of the Research Laboratory. Frequently occasions arise when the worker with the Microscope wishes to make a permanent record of some specimen without having to disturb the Microscope or transfer it to a large horizontal Camera. This apparatus meets the purpose and is always ready to use with any size Microscope by all makers.

The Camera, extending to 18 in. and closing to 4 in., with Ground Glass Focussing Screen and Clear Glass Centre for final focussing, one Double Dark Slide and Exposing Shutter, is mounted on a Solid Steel Upright so that it can be adjusted for height and swung aside. This Upright is mounted on a heavy Iron Base upon which the Microscope is placed.

Price, ¼-plate size ... ... nett **£8 0 0**

12411 Extra Dark Slides **1 1 0**

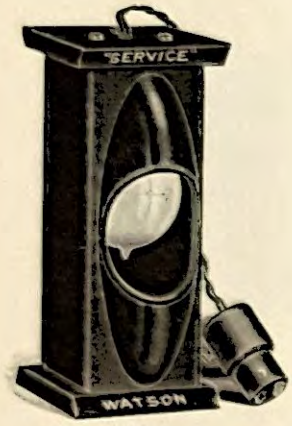


12412

12412 Metron Reflex Drawing Outfit.

Comprising Metal Stand carrying Illuminant in Lantern with Condensing Lens, Cooling Trough, Platform which will accommodate most Laboratory Microscopes, and Reflex Drawing Apparatus, for attaching to the Eyepiece of the Microscope. The specimen is projected on to a piece of white paper surrounded by a Screen, where it can be conveniently traced with a fine pointed pencil without the difficulties experienced with the usual form of micro-camera Lucidae. For Class demonstration a picture 30 in. diameter is obtained in a darkened room.

Price complete (please state voltage for electric current) nett **£5 5 0**



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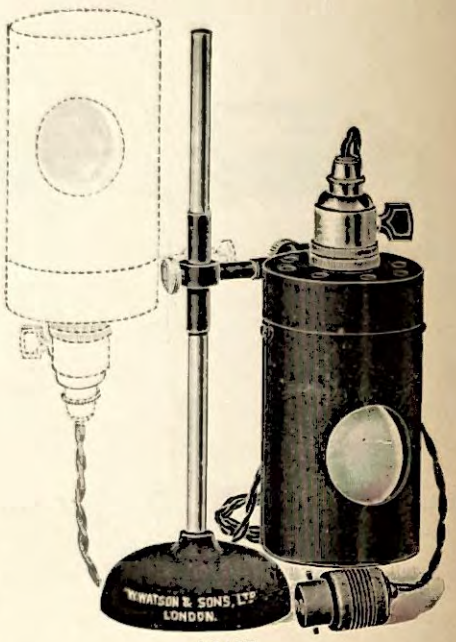
12415



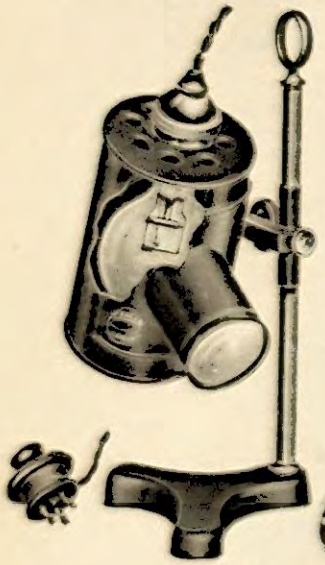
12417

LAMPS, ELECTRIC

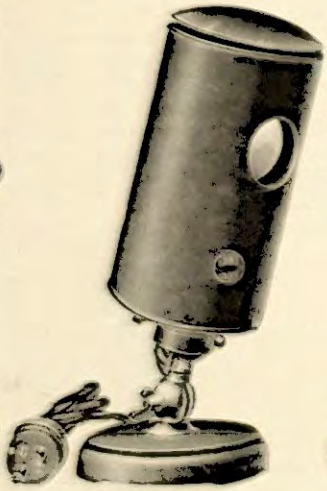
The "Service" Electric Lamp is made for use in Laboratories, Universities and Schools. It is constructed of stout metal finished in stoved black enamel. A bayonet-catch fitting in the roof carries a Gas-filled Electric Bulb. Light is available through two opposed openings, one of which may be provided with a Coloured Glass Disc or Iris Diaphragm; the other is hooded to avoid extraneous light. Total height, 175 mm ; height of centre of aperture, 85 mm.

=12414 **"Service" Lamp** with one yard of Covered Wire, Adapter, and 30 c.p. Lamp of any voltage... **£0 15 0**
=12415 **Iris Diaphragm,** mounted to fit "Service" Lamp **0 15 0**
=12416 **Glass Discs**—daylight blue, green, yellow, blue ... ... each **0 4 6**

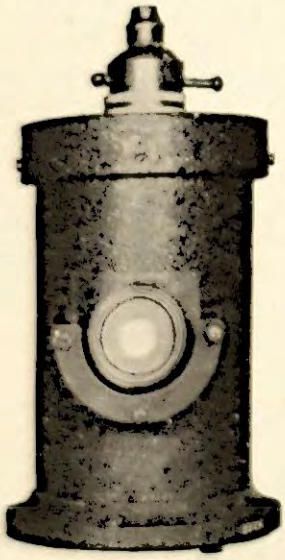
The "Universal" Electric Lamp utilises an intense Gas-filled Lamp with either "opal" or "interior-etched" bulb. The metal shade protects the observer's eyes. The Lamp may be adjusted for height and inclination, and is suited for use with the largest Microscopes for transparent or opaque objects, the position of the bulb and shade being reversible. With "interior-etched" bulbs, a Light Filter is necessary, on account of the great intensity.



12418-19



12421



12422

=12417 **"Universal" Electric Lamp** on Stand, with 60-watt Lamp, and one yard of Flex, any voltage **£3 0 0**

12418 **C. Baker's "Pointolite" Lamp,** 100 c.p., complete with Nelson Aplanatic Condenser and Variable Resistance, 100–240 volts nett **£10 10 0**

12419 Ditto, ditto, for Alternating Current nett **£11 10 0**

12420 **Spare Lamps** **1 10 0**

12421 **C. Baker's Laboratory Bench Lamp.** Universal movement, Lamp, Switch, Flex and Plug **£0 18 6**

Please state Voltage and Type of Plug Fitting.

The Beck "Cannister" Lamp.

This is a very simple lamp containing a "Pullolite" globe, the general design being seen from the illustration. It is solidly made and has an Iris Diaphragm fitted together with a cell in which a Colour Filter can be placed. It is a useful lamp for general work, as the light can be readily controlled by the Iris Diaphragm, but it is not sufficiently powerful for high power dark ground illumination, and cannot be used for top lighting of work with a vertical illuminator, as it has no raising motion.

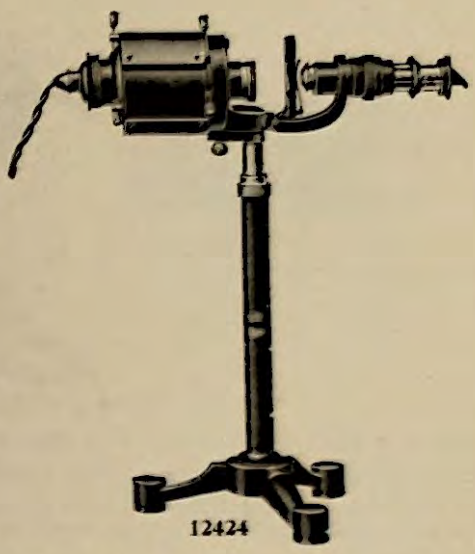
=12422 **Beck "Cannister" Lamp** with "Pullolite" Lamp, Iris Diaphragm and Green Glass... ... ... **£2 2 0**

BAKER'S SCHOOL MICRO-PROJECTION OUTFIT

The School Micro-projection Outfit is a further development of the Nature Microscope, which has proved to be one of the outstanding features among newly introduced scientific apparatus.

The Projector has been designed to meet the requirements of Educational Institutions wanting a simple piece of apparatus at a moderate price for the projection of miscroscope specimens.

The apparatus will be found invaluable for simultaneous demonstration to a number of students in the ordinary class-room, as by the Reflex Drawing Prism and the Special Light Shield supplied with the outfit, the image can be projected on to a sheet of paper placed on a table or bench, thus rendering a darkened room unnecessary.


12424

Among several unique features embraced in this apparatus we would specially direct attention to the following.

I. Initial magnifications varying from 40 to 220 can be obtained by tube extension only (no changing of objectives or eyepieces is necessary), and the two Extension Tubes are marked with varying magnifications within the above-mentioned figures.

II. In a moment the Nature Microscope can be removed from the Projector, the Substage Mirror replaced, and the Microscope used in the ordinary way.

Where customers are in possession of the improved model of the Nature Microscope (the model with ring base) the Projector, Resistance, and Reflex Drawing Prism need only be purchased.

The Lamp House, which is well ventilated, carries a 6 volt, 5 amp. filament lamp, which can be centred by three adjusting screws. A Compound Condenser is fitted to the Lamp House, each component of which can be separated, and the whole Condenser focussed at will. The Stand is adjustable for height, enabling increased magnification to be obtained as desired.

Although a Reflex Drawing Prism is provided in the complete outfit, a direct image can be projected on to a Screen, and at the lower magnifications, quite brilliant images will be obtained up to 3 ft. in diameter.

It is unnecessary to elaborate the many uses to which this piece of apparatus can be put, but its possibilities have already been realised by the many Colleges and Schools in which they have been installed.

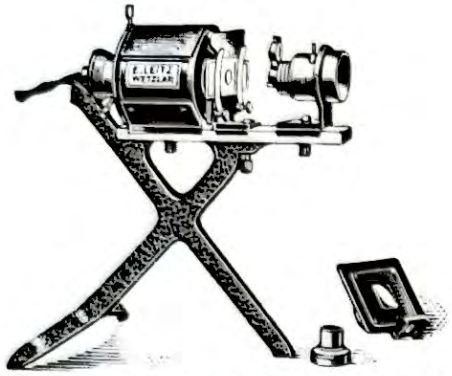
Outfits.

=12424	**School Projection Outfit,** complete with Nature Microscope, Reflex Drawing Prism, 6 volt, 5 amp. Lamp, Light Shield, Condenser, Lamp House, Stand, Flex and Plug	£6	10	0
=12425	**Low Power Micro-Projection Lamp.** Outfit as above, but without Nature Microscope, or Reflex drawing prism. This projector can be used with any ordinary microscope, and excellent results will be obtained with Objectives up to ½ in., and an Eyepiece...	3	0	0
=12426	**Resistance** for 100 to 250 volts	2	5	0
=12427	**Spare Bulbs** ... ... each	0	4	6
=12428	**Cloth-covered Light Shield** to protect projected image on the bench from outside light	0	4	6

Indispensable in Class Teaching.

Extremely simple to handle.

May be connected to any electric light system.



Magnifications 25 to 150 diameters at Screen distances of 3 to 10 feet.

Available for stationary film pictures.

Showing the Object Stage in its vertical position.

SMALL MICRO PROJECTOR FOR USE IN SCHOOLS

Horizontal and Vertical Model. Special Features: Clear and Sharp Pictures, Easy Manipulation, Compact Size.

The immense advantage of demonstrations by optical micro-projection, over individual observation through the microscope, is that the separate focussing of the microscope for each member of the class in rotation is eliminated, and a saving of time effected.

Our small Micro-projection Apparatus, as described herewith, offers an inexpensive and efficient apparatus for the projection of Microscopic Images as used in the teaching of elementary science. It is available for micro-projection as well as for the projection of stationary film strip pictures. The Apparatus is fitted with our well-known highly corrected Lenses, and furnishes exceedingly bright and beautifully sharp pictures. It is adapted for the projection of preparations of every kind, such as vegetable and animal cells, insects, as well as small elements, such as spiders' feet, the eye and the proboscis of a fly, etc.

Source of Light: 6-volt filament Lamp Bulb of an intensity of 50 c.p., which may be connected to the ordinary electric light circuit in conjunction with a resistance or, in the case of an alternating current, a transformer. In case of need a 6-volt accumulator may serve as a source of current, the connection then being made direct. The Lamp can be centred with the aid of three screws situated at the back of the Lamp Casing.

The Micro Screen Pictures are furnished by a Swing-out Objective made of two components (Achromat No. 1 and No. 2) or by Microscope Objectives No. 1 and 2, if these should be available. A Substage Condenser is fitted to the Object Stage, the latter having a suitable sized Aperture Stop. The Objectives are attached to the Carrier on the side facing the Object Stage (existing Microscope Objectives, if any, may be used with a ring adapter).

Projection of Preparation of Whole Objects, showing general features. This is done with the Three-lens Objective, of a focal length of 64 mm. In this case the Object Stage should be taken off after releasing the knurled screw under the Optical Bench and replaced by the other Stage with large Condenser. The 64 mm. Objective should be substituted for the Microscope Objective. The Objective should be sharply focussed by displacing its carrier with the aid of the helical motion.

Film Strip Projection. The arrangement is the same as in the preceding case. A Film Frame is then placed above the Object Stage and the Film drawn through it. Transverse film pictures can be projected with the Stand tilted. In this case the Projection Mirror requires to be turned through a right angle. Care should be taken not to touch this Mirror, as it is silvered on the surface.

As already mentioned, the small Micro-projection Apparatus is solely intended for elementary instruction in biological subjects and is accordingly furnished with the optical equipment required for the appropriate low magnifications only. For the use of University Institutes we have designed other types of apparatus affording a wide range in the choice of the optical equipment. On application we shall be pleased to furnish the requisite information respecting the larger kinds of apparatus.

			£	s	d
(F)	12430	**Small Micro-projector** on Tilting Stand, with 6-volt Filament Lamp in Lightproof Casing, Object Stage with Condenser, Swing-out Objectives Nos. 1 and 2, Reflecting Mirror silvered on the surface to fit on the mount of the Objective, with Flexible Conductor and Contact Plug. Equipment for micro-projection only, as specified	5	17	6
(F)	12431	**Small Micro-projector,** as above, together with a Second Object Stage, with Condenser, Film Frame and 64 mm. Objective, complete equipment for film and micro-projection	8	2	6
(F)	12432	**Separate Flexible Conductor** with Connecting Plug	0	5	0
(F)	12433	**6-volt, 50 c.p.** Renewal Filament Bulb	0	4	6
(F)	12434	**Intermediate Collar** for use with existing Objectives Nos. 1 and 2	0	2	0
(F)	12435	**Resistance** for 110 volts	1	0	0
(F)	12436	**Resistance** for 220 volts	1	5	6
(F)	12437	**Resistance** for 110–220 volts combined	1	7	6
(F)	12438	**Transformer** for 110–220 volts combined	2	0	0

Table of Magnifications.

Screen Distances in feet	Combin Objectives No. 1	Combin Objectives No. 2	Objective 64 mm	Standard Objective No. 1	Standard Objective No. 2
3	25	50	15	25	40
5	37	75	22	37	60
6	50	100	30	50	80
10	75	150	45	75	120

(F) Foreign Manufacture

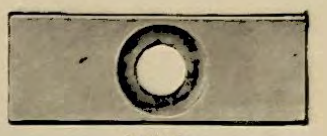
Microscopical Sundries



12440



12441



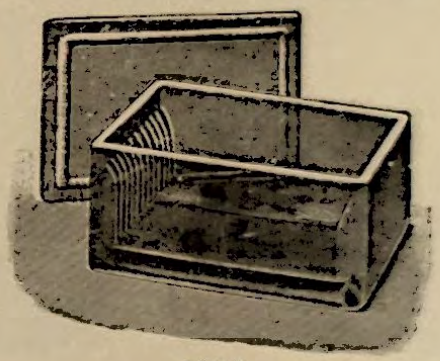
12442

	Diameter	15	18	20	22	mm.
	Height...	3	5	7	9	,,
(F) **12440**	**Glass Rings,** for Microscopic Work	**4/0**	**4/3**	**4/6**	**5/6**	doz.
(F) **12441**	**Slides,** 3×1 in., with Glass Cells cemented on, for Damp Chambers.					
	Diameter of Hole	10	12	15	18	mm.
	Height of Hole	1	1	1	2	,,
		1/6	**1/6**	**1/6**	**2/0**	each

(F) **12442** **Slides,** 3×1 in., with Central Hole, for viewing preparations from both sides, per doz. **£0 9 6**



12443



12445



12446

Porcelain Troughs, to hold Micro. Slides.

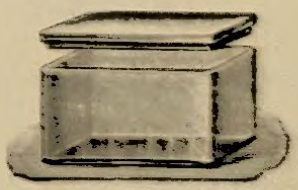
		Length.	Width.	Height.				
(F) **12443**	Flat form, to hold 6 slides	88	65	35 mm.	each	**£0**	**3**	**0**
(F) **12444**	Tall form shape ,, ,, ,, ...	65	35	88 ,,	,,	**0**	**4**	**0**
(F) **12445**	**Glass Staining Trough,** to hold Micro. Slides, to hold 20 slides, two in each groove, with Cover			per doz., **36/0**;	each	**0**	**3**	**3**
	Diameter approximate	60	65	70				mm.
12446	**Dishes,** White Porcelain, for staining	**3/0**	**3/6**	**4/0**				doz.



12447



12449



12450

12447	**White Porcelain Dishes,** 4½ in. square	each, **8d.**; per doz.	**£0**	**7**	**0**
12448	**White Stoneware Dishes,** 4 in. square, with two ridges in bottom for staining Microscopic Slides	each, **8d.**; per doz.	**0**	**7**	**0**
(F) **12449**	**Staining Tray,** of thick Glass, with 10 grooves to take 20 Slides, two in each groove. Will take Slides 3 in. long and any width up to 2 in. ...	each	**0**	**3**	**6**
(F) **12450**	**Rectangular Dish,** stout Glass with Cover Plate, suitable for the above Staining Tray	each	**0**	**4**	**6**
(F) **12451**	**Clips,** for lifting the above Staining Tray		**0**	**0**	**9**

(F) Foreign manufacture.



12452 12454 12455 12456 12457 12458 12459

(F) **12452** **Bottles,** White Glass, without Stopper, Wide Mouth, Ground Glass Cap.

Capacity	30	60	100	c.c.
	1/6	**1/8**	**2/0**	each
	16/0	**18/0**	**22/0**	doz.

(F) **12453** „ as above, but with loose Glass Cap ... ... **1/0** **1/2** **1/6** each; **10/6** **11/6** **16/0** doz.

(F) **12454** „ with Glass Cover and Glass Rod, 30 c.c. capacity each, **2/6**; per doz. **£1 7 0**

(F) **12455** „ with Shut Over Lid, for Canada Balsam, approx. 50 c.c. capacity, each, **1/7**; per doz. **0 17 9**

12456 „ Dropping, with Pipette Ground into Neck, and Rubber Teat.

Capacity	15	30	50	c.c.
	10d.	**1/0**	**1/4**	each
	9/0	**10/6**	**14/3**	doz.

(F) **12457** „ Dr. Mach's, for Cedarwood Oil ... ... each **£0 3 6**

(F) **12458** „ „ „ improved pattern ... ... „ **0 4 0**

(F) **12459** **Stoppered Glass Jars** to hold Microscopic Slides, 10×3 cm. internal, each, **1/5**; per doz. **0 15 0**



12460 12461 12462

(F) **12460** **Glass Boxes,** with Shoulder and Glass Drop-on Lids.

Diameter...	5	6	8	10	12	cm.
Height ...	3	3½	4	5	6	„
	11d.	**1/0**	**1/3**	**1/8**	**2/0**	each

(F) **12461** **Dishes,** Petrie's, for cultivations.

Diameter of Cover	6	8	10	12	15	18	20	cm.
	9d.	**11d.**	**1/0**	**1/5**	**2/2**	**2/9**	**4/0**	each
	8/0	**9/3**	**10/6**	**15/0**	**24/0**	**30/0**	**44/0**	doz.

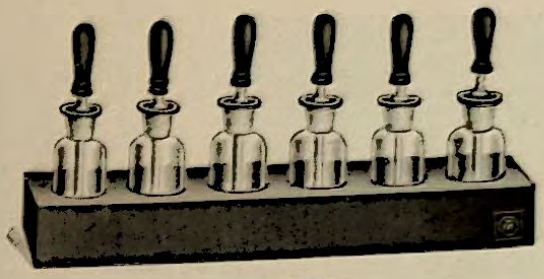
(F) **12462** **Glass Blocks,** White, with Cavity in Centre, and Flat Glass Cover, Polished Sides and Top.

Diameter ...	4×4	6×6	cm.
Diameter of Well	3	5	„
	1/0	**1/3**	each
	10/6	**13/6**	doz.

(F) Foreign manufacture.

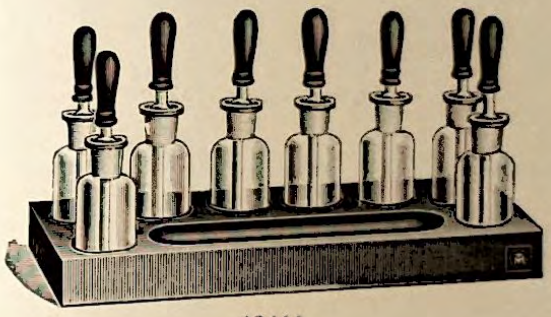


12463–4

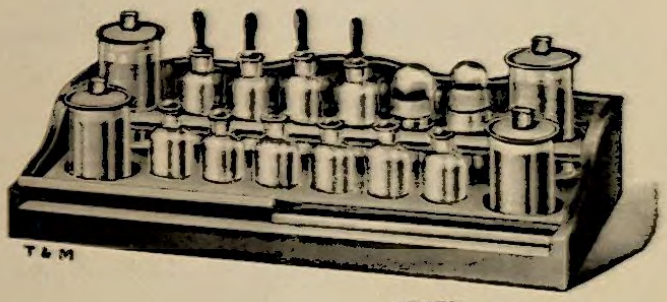


12465

		6	8	12	
12463	**Bottles,** Sets of, in Wooden Stand, fitted with either Pipettes or Rods. With Bulb Pipettes	5/6	7/0	10/6	bottles each
12464	With Rods	5/0	6/6	10/0	,,
12465	Ditto, ditto, fitted with Stoppered Pipette Bottles with Rubber Teats	8/6	11/0	16/0	,,

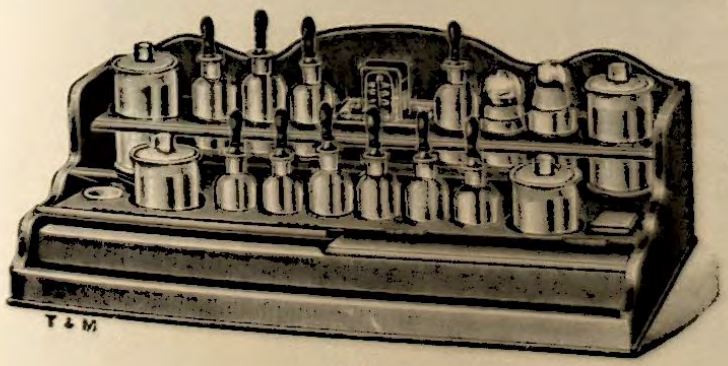


12466



12470

12466	**Bottles,** Sets of 8, in Teak Stand, fitted with Stoppered Pipette Bottles and Rubber Teats	£0 12 6
12467	,, Stand fitted with 10 Stoppered Pipette Bottles, Cedar Wood Oil, and Canada Balsam Bottles	0 17 6
*12468	**Stand,** of Teak, fitted with 10 Bottles, with Pipettes and Rubber Teats for holding Stains, 1 Cedar Wood Oil Bottle, 1 Canada Balsam Bottle, and Tray	1 7 6
*12469	Ditto, Stand, fitted with 8 Stoppered Pipette Bottles, Cedar Wood Oil and Canada Balsam Bottles, and fitted with two Trays for holding Needles, etc....	1 3 6



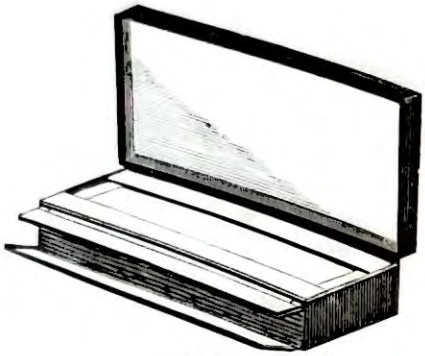
12471

*12470 **Stand,** of Teak, with 2 Trays with Lids, 10 Bottles with Pipettes and Rubber Teats for holding Stains, 1 Cedar Wood Oil Bottle, 1 Canada Balsam Bottle, and 4 Stoppered Jars for holding Slides ... £1 12 6

*12471 **Stand,** of Teak, with 2 Open Trays and 2 Trays with Lids, 2 Ink Wells with Covers, Stand for Matchbox, 4 Stoppered Jars to hold Slides, 1 Cedar Wood Oil Bottle, 1 Canada Balsam Bottle, and 10 Bottles with Pipettes and Rubber Teats to hold Stains. £2 0 0



12480



12481

*12472	**Microscopic Slides**, 3 × 1 in., Half White Glass, edges ground about $\frac{3}{4}$–1 mm. thick ...per gross								**£0**	**4**	**6**
*12473	Ditto, ditto, about 1–1$\frac{1}{2}$ mm. thick ... ... ,,								**0**	**3**	**6**
	Special quotations given for large quantities.										
*12474	**Microscopic Slides**, 3 × 1$\frac{1}{2}$ in., about 1–1$\frac{1}{2}$ mm. thick, edges ground ... ... per gross								**0**	**6**	**9**
*12475	,, ,, 3 × 2 ,, ,, 1–1$\frac{1}{2}$,, ,, ,, ,, ... ,,								**0**	**9**	**0**
*12476	,, ,, 3 × 1 ,, Half White Glass, edges ground with	1		2		3			cavities		
		1/5		**2/3**		**2/11**			doz.		
		15/6		**24/0**		**32/0**			gross		
12477	**Microscopic Squares**, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, and 1 in., in $\frac{1}{2}$-oz. boxes.										
	Nos....	1		2		3					
	Thickness approx. ...	$\frac{1}{200}$		$\frac{1}{130}$		$\frac{1}{70}$			in.		
		5/0		**4/0**		**3/0**			oz.		
12478	,, ,, larger sizes, No. 1, 1 × $\frac{5}{8}$, 1$\frac{1}{4}$ × $\frac{5}{8}$, 1$\frac{1}{2}$ × $\frac{5}{8}$, and 2 × $\frac{5}{8}$ in., at... ... per oz.								**£0**	**4**	**6**
	These sizes can be supplied in thicknesses No. 2 and 3, to order.										
12479	**Microscopic Circles**, $\frac{5}{8}$, $\frac{3}{4}$, $\frac{7}{8}$, and 1 in., in $\frac{1}{2}$-oz. boxes.										
	Nos.	1		2		3					
	Thickness approx ...	$\frac{1}{200}$		$\frac{1}{130}$		$\frac{1}{70}$			in.		
		6/0		**4/6**		**3/6**			oz.		
	Special quotations given for large quantities.										
		For	36	48	72	144			slides		
(F) *12480	**Cabinet**, for holding Microscopic Slides. Polished Pine		**5/6**	**6/3**	**7/6**	**11/6**			each		
(F) *12481	,, Cloth-covered, with Cardboard Trays. 6 Trays to hold 9 Slides 3 × 1 = 54 Slides in all, each								**£0**	**2**	**0**
	8 ,, ,, ,, ,, ,, ,, = 72 ,, ,, ,,								**0**	**2**	**6**
	12 ,, ,, ,, ,, ,, ,, = 108 ,, ,, ,,								**0**	**3**	**6**
	16 ,, ,, ,, ,, ,, ,, = 144 ,, ,, ,,								**0**	**4**	**6**



12482 Fig. 2.



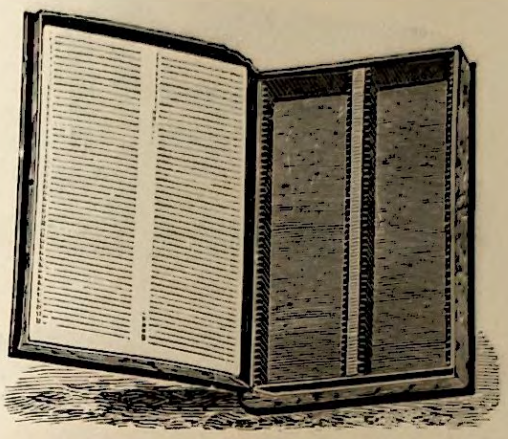
12482 Fig. 1.



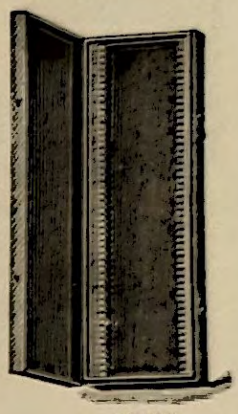
12483-4

(F) 12482	**Microscopic Slide Case**, suitable for pocket, to hold 12 Slides, 3 × 1 in., with Sliding Envelope, as Figs. 1 and 2 ... ... each **2/0**, per doz.			**£1**	**3**	**0**
(F) 12483	Ditto, ditto, Sliding Cases, cloth covered, to hold 12 Slides, 3 × 1 in. ... ,, **2/6**, ,,			**0**	**15**	**6**
(F) 12484	Ditto, ditto, to hold 25 Slides, 3 × 1 in. ... ... ,, **2/0** ,,			**1**	**2**	**0**

(F) Foreign manufacture



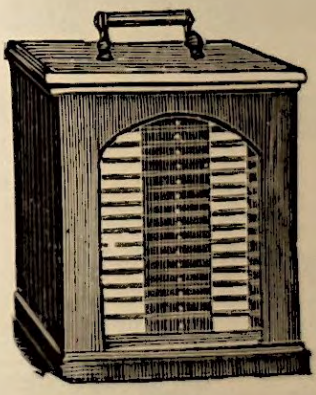
12487



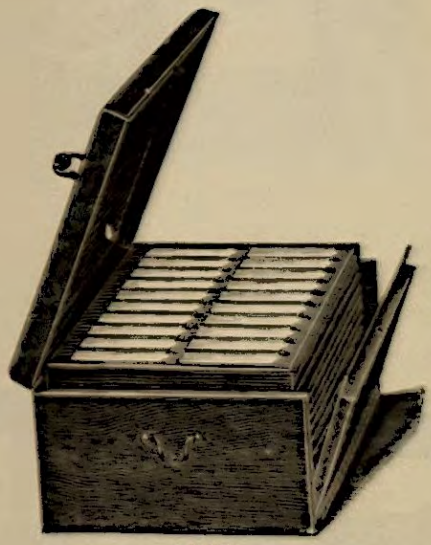
12488

(F) **12486** **Cabinet,** for Microscopic Slides, plain wood, strongly made, grooved sides and index for—

						24	36	72	slides
						1/0	**2/3**	**3/6**	each
(F) **12487**	,,	Book Form, cloth covered, to hold	...	...	...	50	100		slides
						5/0	**6/3**		each
(F) **12488**	,,	cloth covered, to hold	...	...	...	...	...	50	slides
								3/6	each



12489



12490

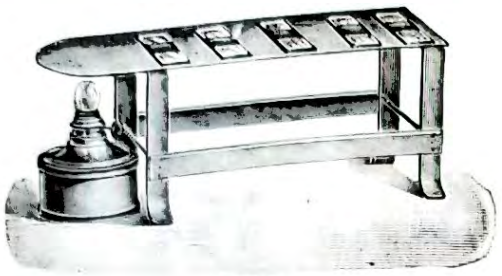
12489 **Cabinet,** for holding Microscopic Slides, Polished Mahogany, with Glass Door, Lock and Key, Trays numbered ... ... 500 1,000 slides
135/0 **190/0** each

12490 **Cabinets, Polished Oak,** for holding Microscopic Slides fitted with Hinged Lid and Front, with three Handles, Lock and Key, to hold 25 Trays of 20 Slides 3×1 in., i.e., 500 slides including 25 Trays £5 5 0

(F) Foreign manufacture.



12501



12502-3

12501	**Slide Dryer**, 7×3 in., of Copper, for drying Micro Slides	each	£0	2 9
12502	.. .. Dr. Ehrlich's, of Copper, price without Spirit Lamp ...	..	0	10 0
12503	**Spirit Lamp** for same		0	2 6



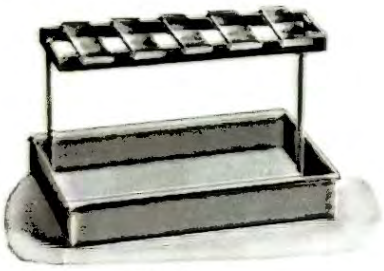
12504



12505

12504	**Heating Plate** for Object Slides, consisting of three Copper Plates on Iron Stand	£0	12 0
12505	Ditto, ditto, arranged for Electrical Heating with Flexible Cord and Plug ...	2	5 0

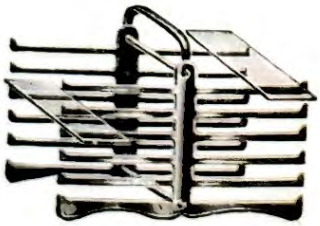
When ordering please state voltage.



12506



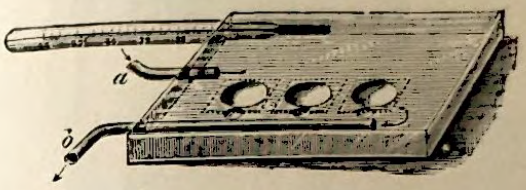
12507



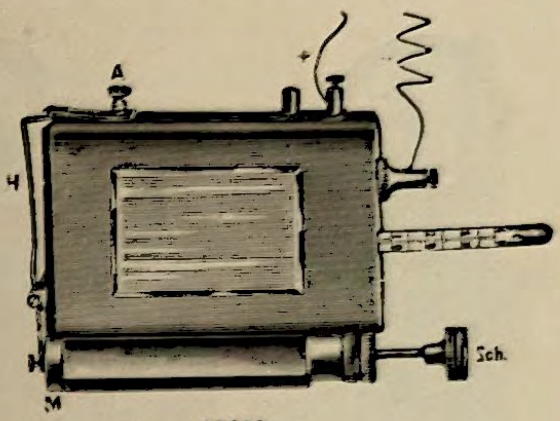
12508

12506	**Bath** for colouring Micro Slides, consisting of Zinc Tray and Stand		£0	10 0
12507	Ditto, ditto, as above, fitted with adjustable Gas Burner for heating		1	0 0
(F) 12508	**Stand** of stout Brass, Nickel-plated, for holding 12 Slides		0	5 0

(F) Foreign manufacture.



12509



12510

(F) **12509** **Glass Object Stage,** Dr. Pfeiffer's, for heating hot water, with 3 large and 3 small Cavities, and Thermometer 33 to 44°C. in $\frac{1}{5}$th degree, with Supply and Discharge Tubes ... ... each **£3 5 0**

(F) **12510** **Heating Stage, self-regulating,** for temperatures up to 50°C. and more, keeping temperature automatically constant by electricity to $\frac{1}{10}$th degree. Can be used on any light or power current of 110 or 220 volts ... ... each, nett **3 15 0**



12514



12511-12



12513

12511 **Turntable,** on Polished Mahogany Block **£0 9 6**

12512 ,, ,, ,, ,, larger size **0 12 6**

12513 ,, of Iron, with Clips for holding the Slides ... ... nett **0 17 6**

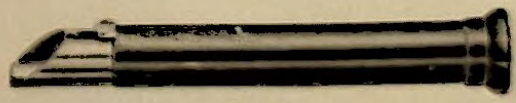
(F) **12514** **Camel Hair Brushes,** for Ringing Slides ... ... per doz., **1/0** and **0 1 3**

(F) **12515** **Elder Pith,** in Bundles ... ... per bundle, **6d.** and **0 0 9**

POCKET MICROSCOPES



12516



12517

(F) **12516** **Pocket Microscope,** Fountain Pen Pattern, with Clip for waistcoat pocket, fitted with focussing arrangement, Magnification 20×, Brass Case, nickel plated, each **£0 3 6**

(F) **12517** Ditto, ditto, large size, with Achromatic Lenses and Illuminating Mirror with focussing arrangement, Magnifications 40 to 60×, in Soft Leather Snap Case each **0 12 6**

(F) Foreign manufacture.



12520



12521



12522-23

12520	**Magnifying Lens**, 1 inch diameter, in Vulcanite Case ...	each, **1/3**; per doz.	**£0 14 0**
12521	,, ,, Double, for examining Crystals, etc., 1 in. dia.	,, **2/0** ,,	**1 1 6**
12522	,, ,, Triple, 1 in. diameter	,, **2/9** ,,	**1 10 0**
12523	,, ,, ,, best quality	,, **3/6** ,,	**2 0 0**



12524



12526



12527



12528

		Mounted for the Pocket.	Mounted for Dissecting Microscope.
12524	**Aplanatic Lenses**, Magnification × 5	**£1 2 0**	**£0 18 6**
	,, ,, ,, ×12	**1 2 0**	**0 18 6**
	,, ,, ,, ×20	**1 5 0**	**1 1 0**

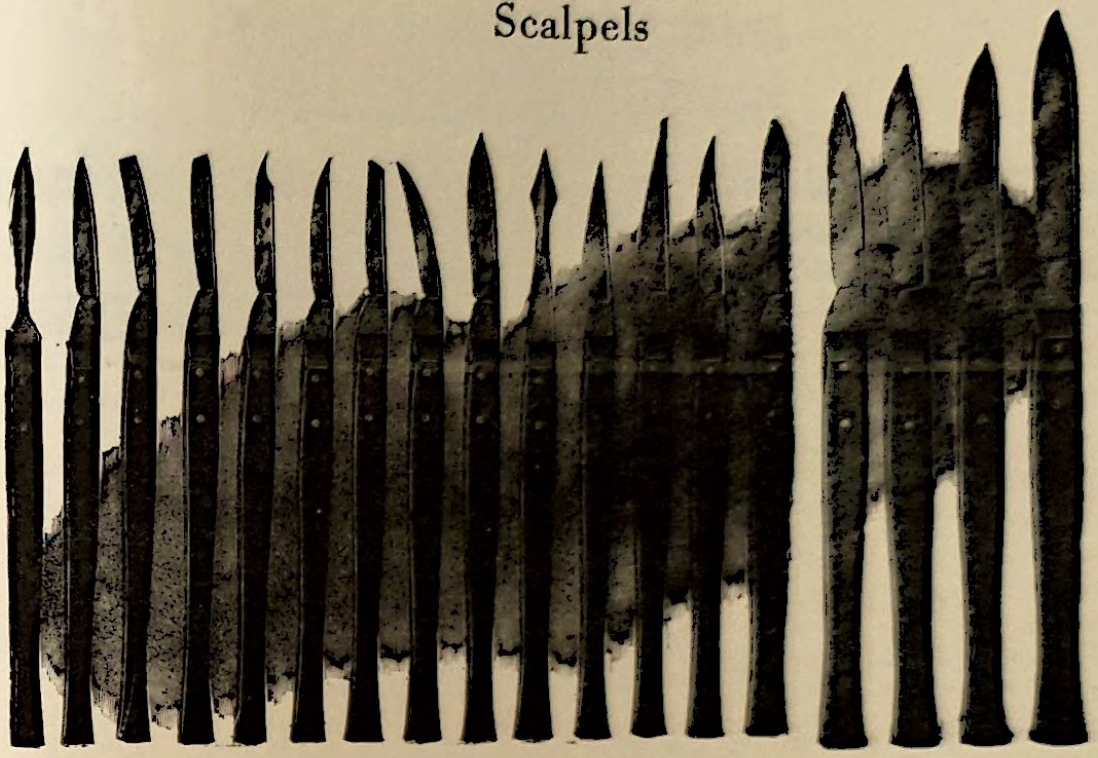
(F) **12525** **Single Lenses** ×5 or ×10, in Mounts for Dissecting Microscope ... ... each **£0 4 6**

External measurements of Bottom Plate 22×17·5 28×19·5 32·5×26 mm.

(F) **12526**	**Linen Provers**, Double Convex Lenses, in folding brass frames	**1 9**	**2 6**	**3 0** each
(F) **12527**	,, ,, Superior Quality, with Achromatic Lenses		**3 6**	**4 6** ,,
			$1\frac{7}{16}$	$1\frac{8}{16}$ in. dia.
(F) **12528**	,, ,, Tripod Magnifiers, with Brass Mounts		**3 0**	**4 0** each

(F) Foreign manufacture.

Scalpels



0 1 2 3 4 5 6 7 8 8a 9 10 11 12 14 15 16 17

12530

12530 **Scalpels,** fine quality, British manufacture, Forged Steel, Ebony Handles, polished Blades.

Nos.	0–7	8–12	14, 15	16, 17
Each	**1/8**	**1/8**	**1/9**	**1/10**
Per dozen ...	**18/6**	**18/6**	**19/6**	**20/6**

12531 Ditto, forged entirely from Solid Steel, N.P. Handles, polished Blades.

Nos.	0–7	8–12	14, 15	16, 17
Each	**2/6**	**2/6**	**2/7**	**2/8**
Per dozen ...	**27/0**	**27/0**	**28/0**	**28/6**

Length of Blades.

No. 0	1¼ in.	No. 5	1½ in.	No. 9	1⅞ in.	No. 14	1⅞ in.
No. 1	1¼ ,,	No. 6	1⅝ ,,	No. 10	1⅞ ,,	No. 15	2 ,,
No. 2	1⅜ ,,	No. 7	1⅝ ,,	No. 11	1⅞ ,,	No. 16	2⅛ ,,
No. 3	1⅜ ,,	No. 8	1¾ ,,	No. 12	1⅞ ,,	No. 17	2⅛ ,,
No. 4	1½ ,,	No. 8a	1¾ ,,	No. 13	1⅞ ,,		

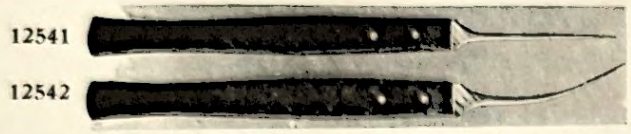
The above measurements are of the Blade only and do not include the Neck.



12532

(F) **12532** **Scalpels,** mounted in Ebony Handles. Length of Blade, 40, 44, 47, 50 mm.. Each, **1/6**, per doz. **£0 16 6**

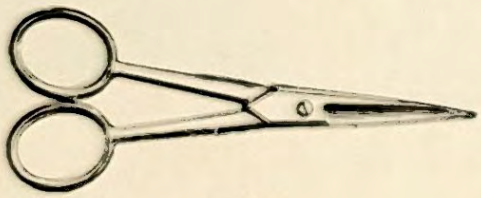
(F) Foreign manufacture.



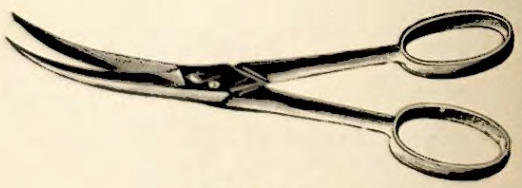




12534	**Needles or Teasers,** mounted in Wood Handles	per doz., **2/0**; per gross	**£1 2 6**
12535	„ „ „ Boxwood Handles, with Brass Ferrules.	per doz., **2/6**; per gross	**1 7 6**
12536	„ „ „ „ „ Polished, with Brass Ferrules.	per doz., **2/9**; per gross	**1 10 0**
12537	„ „ „ Rosewood Handles, Polished, with Brass Ferrules.	per doz.	**0 3 3**
12538	„ „ Curved, mounted in Rosewood Handles with Brass Ferrules	„	**0 3 9**
(F) 12539	**Needle Holders,** with Bone Handle and Adjustable Screw Top	each	**0 1 3**
(F) 12540	„ „ „ Ebony „ „ „ „	„	**0 1 3**
12541	**Seekers,** Straight, in Ebony Handle	„	**0 1 6**
12542	„ Bent „ „	„	**0 1 6**
12543	Dissecting Hooks, Single, in Ebony Handle	„	**0 1 6**
12544	„ „ Double „ „	„	**0 1 8**
12545	„ „ Triple „ „	„	**0 1 10**



12547



12549

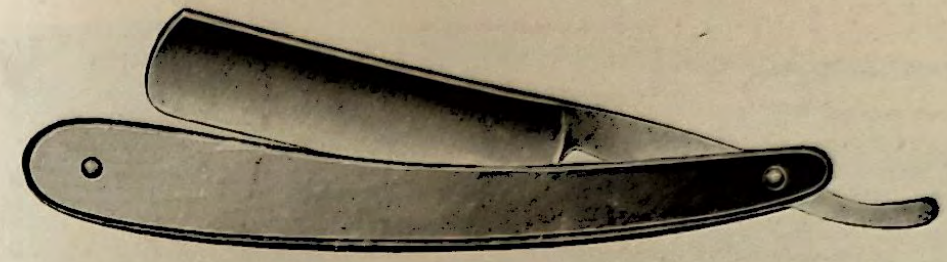




12546

12546	**Copper Stand** for Needles, etc.	each	**£0 2 0**
(F) 12547	**Scissors,** Straight Steel	each **1/8**; per doz.	**0 17 6**
(F) 12548	„ „ „ best quality	„ **2/0** „	**1 2 0**
(F) 12549	„ Curved Steel	„ **2/0** „	**1 2 6**
(F) 12550	„ „ „ best quality	„ **2/3** „	**1 5 0**

(F) Foreign manufacture.



12551

(F) **12551** **Razors,** for Section Cutting, flat one side, in Case ... each **2/11** and **£0 3 3**

(F) **12552** „ „ „ hollow ground, „ ... „ **3/6** „ **0 4 6**



12553–4



12555–6



12557

12553 **Section Lifter,** of Copper, length 15 cm. ... ... each, **7d.**; per doz. **£0 5 6**

12554 „ „ „ Aluminium, „ 15 „ ... ... „ **7d.** „ **0 5 6**

12555 „ „ in Ebony Handle, Blade 10 mm. ... ... each **0 1 4**

12556 „ „ „ „ „ „ 10 „ ... ... „ **0 1 6**

(F) **12557** „ „ double, in Ebony Handle ... ... „ **0 2 0**

12558 „ „ „ all Metal, Nickel-plated ... ... „ **0 2 0**



12559



12560



12561



12562

		7½	10	12½	15	cm.
(F) **12559**	**Forceps,** Polished Steel, with Ribs and Fine Points	**1/1**	**1/3**	**1/5**	**1/9**	each
		12/0	**14/0**	**15/6**	**19/0**	doz.
(F) **12560**	„ „ „ „ „ „ Wide Points, for Botanical and Microscopical Work	**1/1**	**1/3**	**1/5**	**1/9**	each
		12/0	**14/0**	**15/6**	**19/0**	doz.

(F) **12561** **Forceps,** Polished Steel, with Ribs and fine curved Points, length 12 cm., each, **2/0**; per doz. **£1 2 0**

(F) **12562** „ „ „ „ Smooth Points ... ... „ **1/6** „ **0 17 0**

(F) Foreign manufacture.



12564



12566



12565



12567

(F) **12564** **Forceps,** Cornet's, for lifting Slides, English Pattern... ... each, **1/6**; per doz. **£0 16 6**

(F) **12565** ,, Boston's, for holding Micro Slides ... ... ,, **9d.** ,, **0 8 0**

(F) **12566** ,, ,, ,, ,, ,, simple form ... ,, **7d.** ,, **0 6 0**

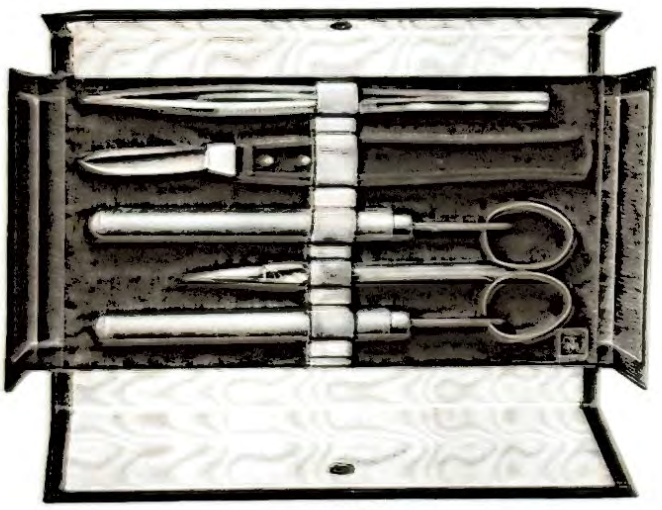
***12567** **Collecting Boxes** (Vascula), Japanned Tin, Black Enamelled outside, with Handle.

Sizes	$11\times5\frac{1}{2}\times2\frac{1}{4}$	$13\times6\frac{1}{2}\times2\frac{1}{2}$	$15\times7\frac{1}{2}\times3$	$17\times8\frac{1}{2}\times3\frac{1}{2}$
Nett	**5/6**	**6/6**	**7/6**	**8/6** each

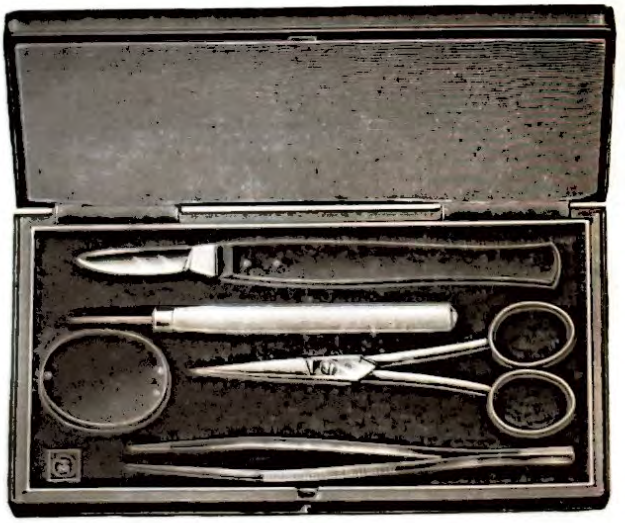
***12568** **Webbing Shoulder Straps** for above ... ...each **£0 1 9**

***12569** **Leather** ,, ,, ,, ,, ... ,, **0 2 0**

Students' Botanical Sets



12570



12571

(F) **12570** **Dissecting Set,** consisting of fine pointed Scissors, Scalpel, Forceps and 2 Needles, complete in Folding Case, Velvet lined ... ... nett **£0 5 6**

(F) ***12571** Ditto, consisting of fine pointed Scissors, Scalpel, Forceps, Needle and Folding Lens, in Vulcanite Mount, complete in Leatherette-covered, Velvet lined Case **0 10 6**

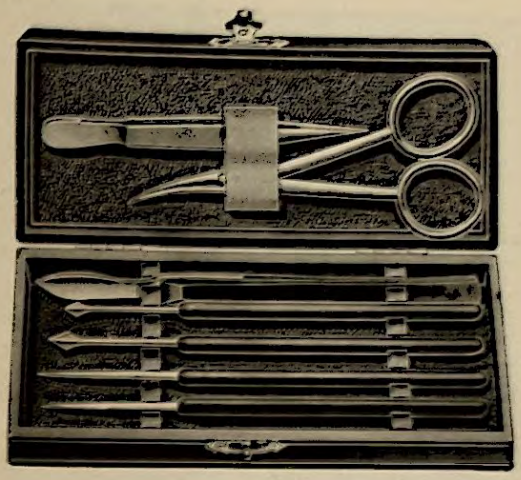
Special quotations given for quantities.

(F) Foreign manufacture.

Botanical and Biological Dissecting Sets



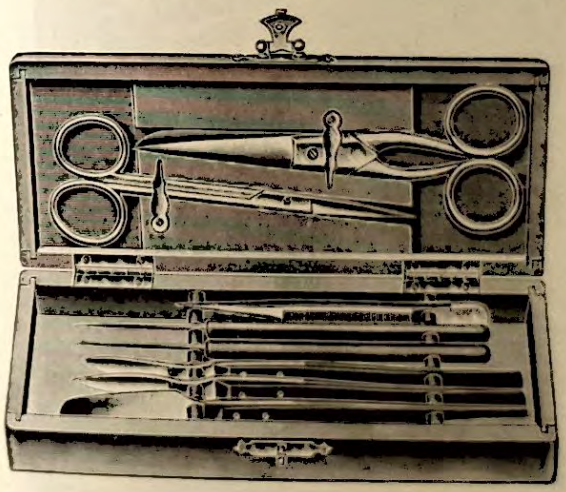
12572



12573

(F) ***12572** **Microscopical Set,** consisting of 1 Scalpel, 1 Scissors, 1 Forceps and 2 Needles, in Leatherette-covered Case **£0 7 6**

(F) ***12573** Ditto, consisting of 1 Scalpel, 1 Scissors, 1 Forceps, 2 Lancets, 2 Needles, in Leatherette-covered Case **£0 10 0**



12574

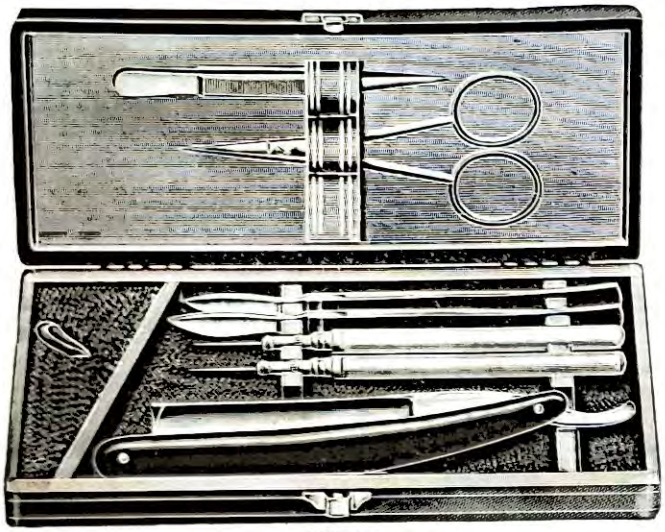


12575

(F) ***12574** **Microscopical Set,** in Hardwood Case, Polished, consisting of 1 Dissecting Scissors, 1 straight Scissors, 2 Needles, 2 Scalpels, 1 Section Lifter and Forceps **£0 12 0**

(F) ***12575** Ditto, consisting of Scissors, straight, 13 cm., Scissors, Microscopic, straight and curved, 2 Scalpels, Dissecting Forceps, straight and curved ditto, and 3 Needles, in Ebonite Handles, in Leatherette-covered Case **0 16 6**

(F) Foreign manufacture.



12576



12577

*12576 **Microscopical Set,** consisting of straight Scissors, 2 Scalpels, Razor, Forceps, 2 Needle Holders in Bone Handles and 50 Needles in Leatherette-covered Case **£0 12 6**

*12577 **Microscopical Set,** consisting of 1 curved Scissors, 1 Scalpel, Section Lifter, Razor, Forceps, fine, and 2 Needles in Ebonite Handles, in Leatherette-covered Case **£0 13 6**



12578



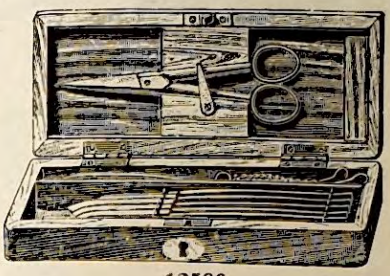
12579

(F) *12578 **Microscopical Set,** consisting of Scissors, fine, Scalpel, Razor, Double Section Lifter, Forceps, fine, 2 Lancets, and 1 straight Needle, in Leatherette-covered Case... **£0 16 6**

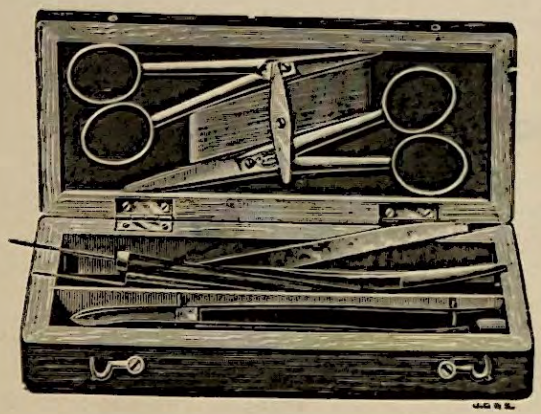
(F) *12579 Ditto, consisting of 1 Razor, 1 straight Scissors, 1 curved Scissors, 1 Forceps, 2 Scalpels, 1 Spatula, 2 Lancets, 2 Needles, in Leatherette-covered Case ... **0 17 6**

(F) Foreign manufacture.

Dissecting Sets



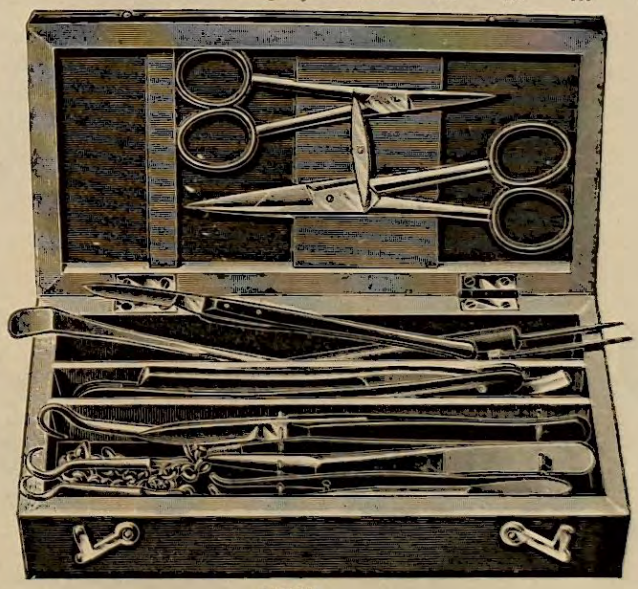
12580



12581

*12580 **Dissecting Set,** superior quality, British, consisting of 6 Scalpels (in Ebony Handles), Blowpipe, Chain Hooks, Spring Dissecting Forceps, Dissecting Scissors and Needle, in Mahogany Case, Polished throughout, with Lock and Key **£1 11 0**

*12581 Ditto, superior quality, British, containing Scalpels large and small, fine Scissors, large Scissors, Forceps, 2 Needles in Handles, in Mahogany Case **1 0 0**



12582

*12582 **Dissecting Set,** superior quality, British, consisting of Dissecting Scissors, large and small, Razor, Scalpels, large and small, 2 Needles in Handles, Forceps, large and small, set Chain Hooks, Blowpipe, Section Lifter in Mahogany Case **£2 0 0**

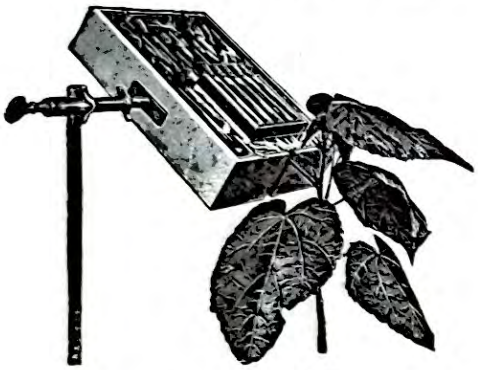
*12583 **No. 1 Set,** containing 3 Scalpels in Ebony Handles, N.P. Forceps 5 in. straight, Scissors 4½ in. straight, 2 Needles in Rosewood Handles, complete in Polished Mahogany Case **0 16 6**

*12584 **No. 2 Set,** containing 4 Scalpels in Ebony Handles, 1 each N.P. Forceps 5 in. straight and curved, 1 each Scissors 4½ and 5 in. straight, and 2 Needles in Rosewood Handles, complete in Mahogany Case **1 4 0**

*12585 **No. 3 Set,** containing 6 Scalpels in Ebony Handles, 1 pair each N.P. Forceps 5 in. straight and curved, 1 pair each Scissors 4½ in. curved and 6 in. straight, 1 Section Lifter in Ebony Handle and 2 Needles in Rosewood Handles, complete in Mahogany Case **1 7 6**

*12586 **No. 4 Set,** containing 3 Scalpels in Ebony Handles, 1 pair each N.P. Forceps straight 4½ in. and 5 in., 1 pair ditto curved 5 in., 1 pair each Scissors 4½ and 6 in. straight, 1 pair ditto 5 in. curved, 2 Needles in Rosewood Handles, 1 Hook in Ebony Handle, 1 Razor, 1 Strop, and 1 Section Lifter in Mahogany Case **1 15 6**

Ganong's Botanical Apparatus



12590



12591

(F) **12590** **Light Screen,** whole leaf form, Ganong ... ... nett **£3 17 6**

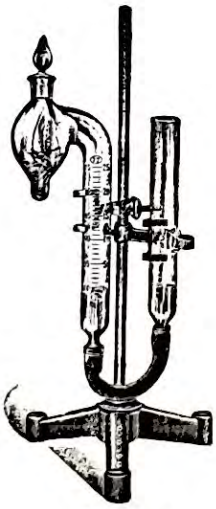
(F) **12591** „ „ part leaf form, Ganong ... ... „ **0 7 6**



12592



12593–4



12595–6

(F) **12592** **Leaf Area Cutter,** Ganong, complete as figured, with two Cups and Test Tube, and Holder for the latter ... ... nett **£3 10 0**

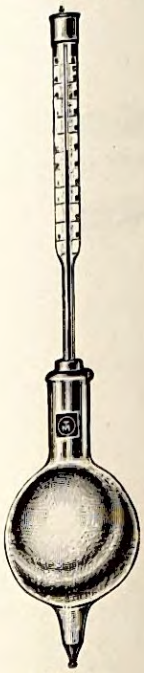
(F) **12593** **Photosynthometer,** Ganong, complete, including the Reagent Tubes with Rubber Connections and Clamps, and the Vertical Cylinder, but without the Vertical Support and Clamp ... ... nett **1 10 6**

(F) **12594** Suitable **Vertical Support and Clamp** ... ... „ **0 5 0**

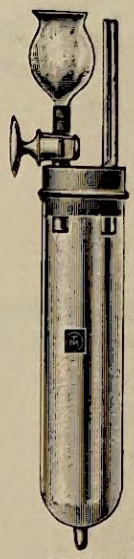
(F) **12595** **Respirometer,** complete with Rubber Connections, two Clamps and Upright Support ... ... nett **1 10 0**

(F) **12596** Ditto, Glass Parts only ... ... „ **1 0 0**

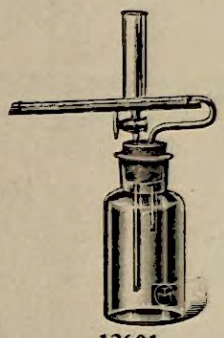
(F) Foreign manufacture.



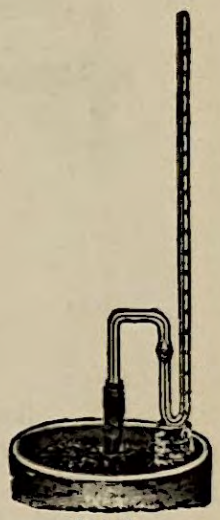
12597



12600

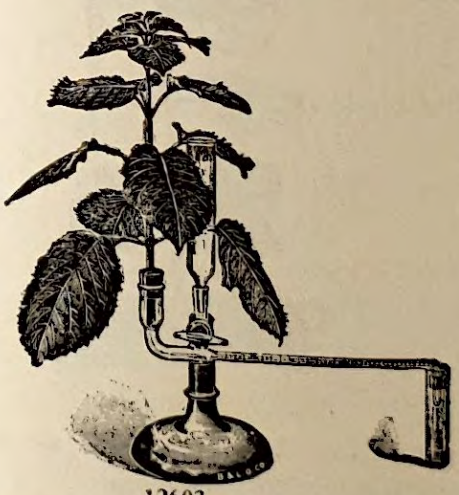


12601



12602

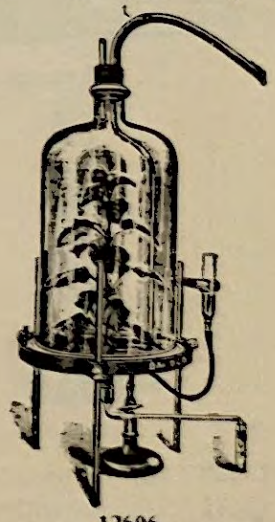
12597	**Simple Calorimeter,** for the study of the heat relations of respiration, as Ganong							£0	11	0
12598	**Vacuum Flasks,** unsilvered ... ... each							0	6	6
(F) 12599	**Thermometers,** 0° to 50°C. in $\frac{1}{5}$ths ... ... „							0	4	6
12600	**Demonstration Osmoscope,** as Ganong ... ... „							0	6	6
12601	**Potometer,** Farmer's, Fig. 24 Keeble Page 157 ... ... „							0	9	6
12602	**Manometer,** normal, complete with two Glass Sleeves ... ... nett							0	6	6



12603



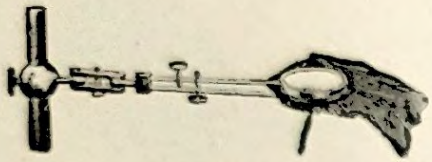
12604



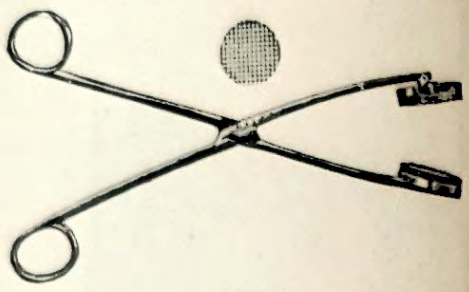
12606

12603	**Potometer,** complete, with Split Rubber Cork and Vial, as Ganong							£1	2	6
*12604	**Aluminium Shell** for transpiration experiments, as Ganong, with Metal Band and Clamping Screw for 4-in. Pot, 4½-in. inside... ... ... each							0	5	9
12605	**India Rubber Sheet,** best quality, for use with above, per square yard ...							0	7	6
12606	**Bell Jar Support,** as illustrated, with Split Glass Plate, and Bell Jar without Potometer							3	10	0

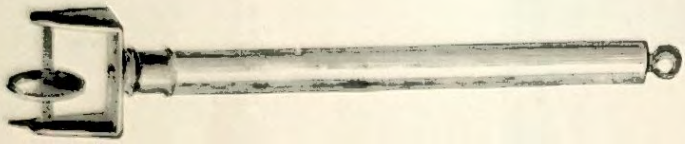
(F) Foreign manufacture.



12608

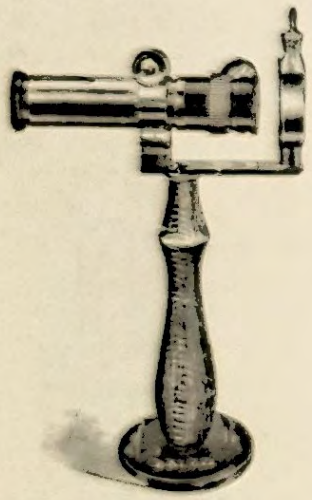


12609



12607

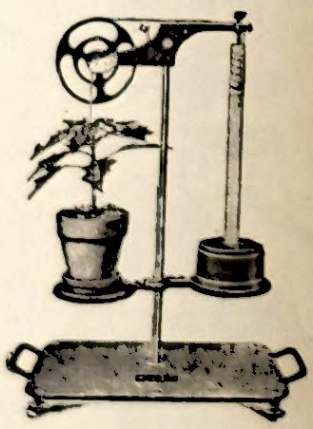
(F) **12607**	**Marker,** Brass, with Bone Handle	each	£0	1	6
(F) **12608**	**Leaf Clasp,** as Ganong	nett	2	16	0
(F) **12609**	**Space Marker,** for leaves, according to Ganong. Disc with Rubber Stamp with Raised Lines in the form of squares, 2 mm. on a side. The Disc is carried by means of a Scissors Frame against a Cushion Disc which is covered with Soft Felt	nett	0	16	6



12610



12611

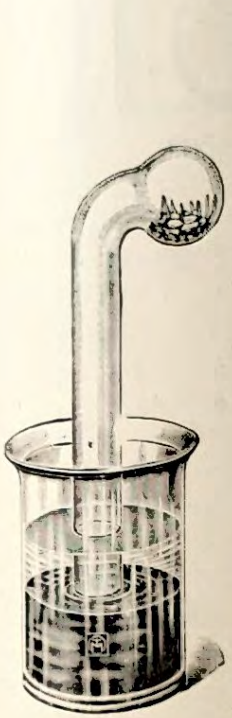


12612

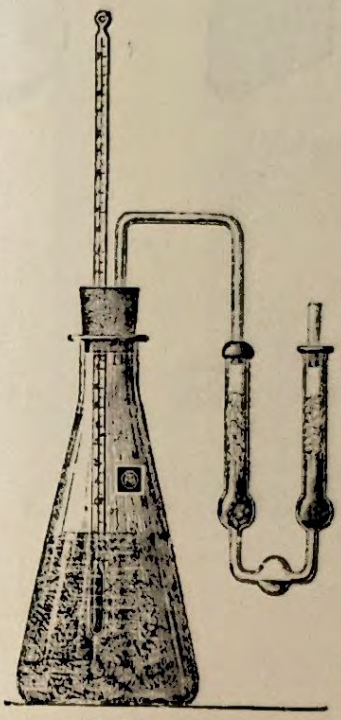
(F)—12610	**Spectroscope,** as Ganong	nett	£4	10	0
(F)—12611	**Demonstration Clinostat,** as Ganong, designed primarily for educational demonstration, but it is available for investigation involving plants of moderate weight where great precision of revolution is not required. It can be used in any position. Fitted with Eight-day Clock geared to a revolution in fifteen minutes. Complete with Disc, Screw Rods, Spindle Arm and Extensible Support, but without the Clamp Stand ... ... nett		20	0	0
(F)—12612	**Demonstration Auxograph,** as Ganong		15	0	0

(F) Foreign manufacture.

Dr. W. Detmer's Practical Plant Physiology



12613



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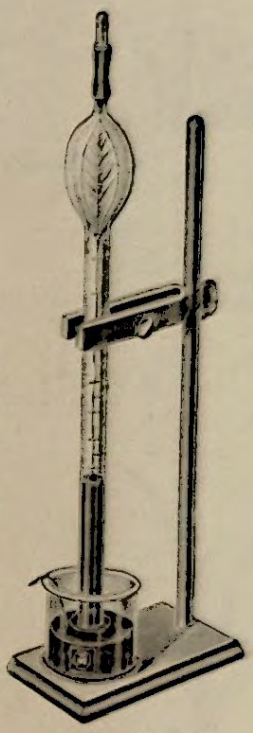
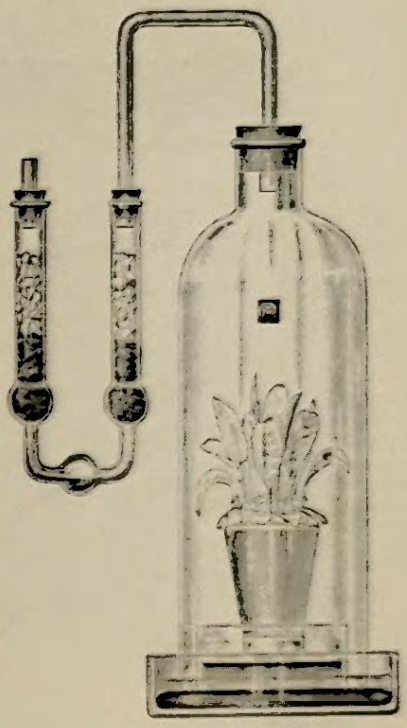


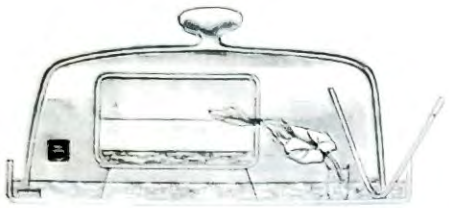
12615



12616

DR. W. DETMER'S PRACTICAL PLANT PHYSIOLOGY

12613	**Apparatus** for the culture of plants in a space devoid of oxygen. Detmer's book, Fig. 11, page 34	£0	3	0
12614	**Apparatus** for proving the fact that green plants can only produce oxygen when carbon di-oxide is at their disposal. Detmer, Fig. 15, page 40. With Thermometer	0	7	9
12615	**Apparatus** for determining the quantity of carbon di-oxide which assimilating plants decompose. Detmer, Fig. 16, page 42. Without Mercury or Platinum...	0	10	6
12616	**Apparatus** for the culture of plants in absence of carbon di-oxide. Detmer, Fig. 18, page 53. Without Flower Pot	0	10	6
12617	**Apparatus** for experimenting on assimilation, after Moll. Detmer, Fig. 19, page 54 (see illustration on page 580)	1	0	0
12618	**Apparatus** for investigating the influence of high temperature on seed. Detmer, Fig. 44, page 130 (see illustration on page 580)	0	10	6



12617



12619



12620

		5×4×2	8×6×2	10×8×2	
(F) **12619**	**Troughs**, Glass, with parallel walls	**12 6**	**17 6**	**27 6**	cm. each
(F) **12620**	**Culture Tubes**, with parallel sides	each, **1 6**; per dozen			**£0 16 6**

(F) **12622** **Glass Jars**, Cylindrical, for culture solutions.

Height ...	15	18	20	25	25	30	35	cm.
Dia. inside	5	8	5	5	8	5	10	,,
	1 0	**1 9**	**1 3**	**1 6**	**2 0**	**1 9**	**4 0**	each
	10 6	**19 0**	**13 6**	**16 0**	**22 0**	**18 6**	**45 0**	doz.



12618



12622



12623



12626



12624

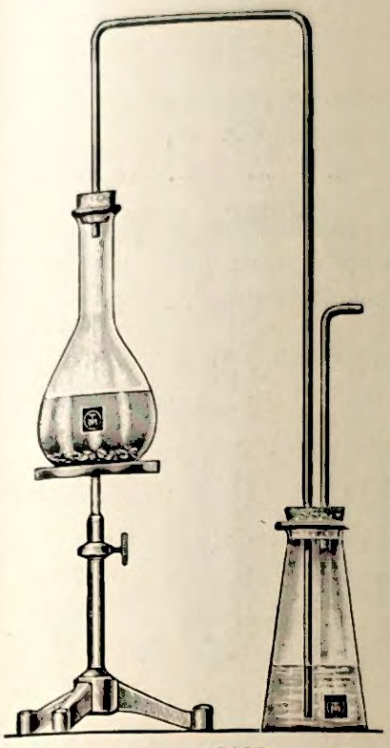
12623 **Covers of Teak** for Culture Jars.

Dia. ...	9	10	11½	12½	15	20	25	cm.
	11d.	**1 3**	**1 5**	**1 6**	**1 10**	**2 6**	**3 0**	each

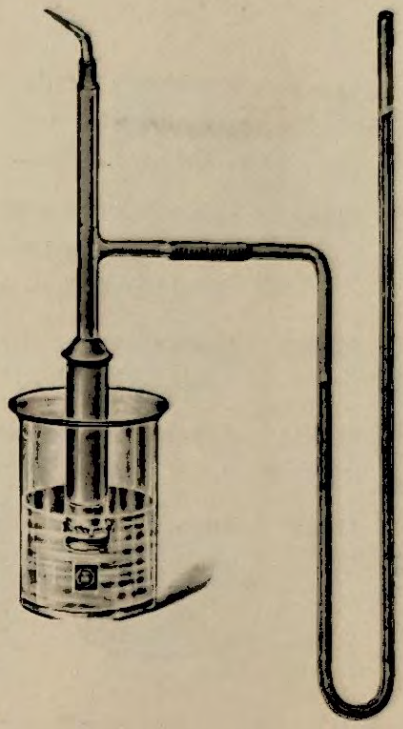
(F) ***12624** **Bell Jars**, with Double Walls and Stopper, to hold different coloured liquids, for showing the action of light upon growing plants.

Height inside ...	30	40	40	35	cm.
Dia.	12	15	18	25	,,
	32 0	**36 0**	**40 0**	**90 0**	each

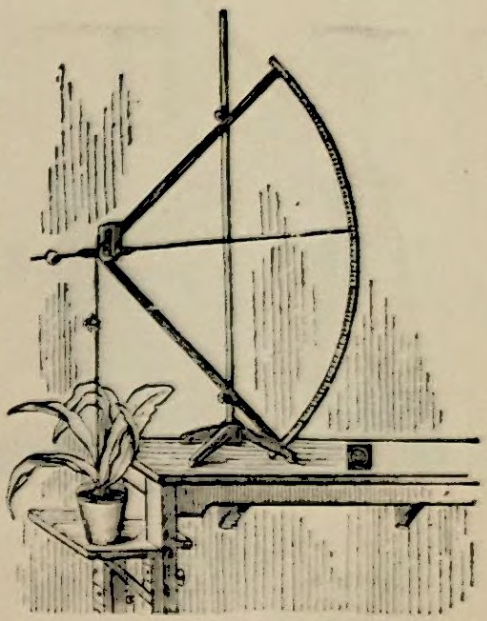
(F) Foreign manufacture



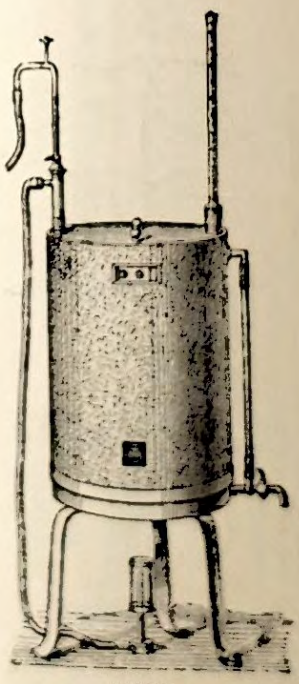
12627



12628



12629



12630

***12625** **Bell Jars,** or Propagating Glasses, Greenish Glass, height same as diameter.

Dia.	5	6	7	8	9	10	in.
	3 9	**4 0**	**4 6**	**5 0**	**6 0**	**7 0**	each

***12626** Ditto, Tall Form. (See illustration on page 580).

Height	10	12	16	16	18	20	in.
Dia.	5	6	7	10	8	8	"
	5 0	**6 0**	**7 6**	**9 0**	**9 6**	**10 6**	each

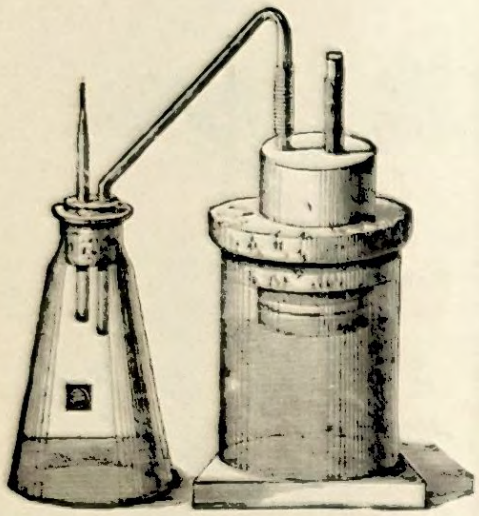
***12627** **Apparatus** for demonstrating the production of carbon di-oxide in fermentation **£0 9 0**

***12628** **Apparatus** for investigating pressure effects due to osmotic pressure **0 5 0**

(F) ***12629** **Indicator Arc,** by Pfeiffer **5 0 0**

***12630** **Thermostat,** Double-walled Steel, Copper Bottom, Linoleum covered, with Thermo Regulator, Fig. 76, Detmer. Complete with Burner **3 0 0**

(F) Foreign manufacture.

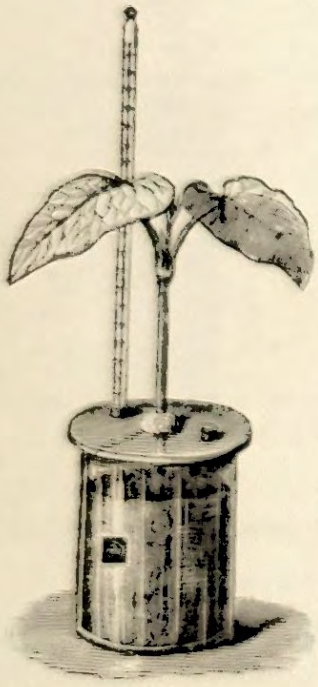


12631

*12631	**Apparatus** for illustrating the processes leading to root pressure, Fig. 77, Detmer	£0 10 0
*12632	**Apparatus** for investigating the influence of pressure on the escape of water from plant structures. Fig. 78, Detmer ...	0 2 6
*12633	**Apparatus** for transpiration experiments, Fig. 79, Detmer	0 8 0
*12634	**Apparatus** for investigating transpiration, Fig. 80, Detmer	0 15 0
*12635	**Apparatus** for investigating transpiration, Fig. 81, Detmer	0 7 6



12632



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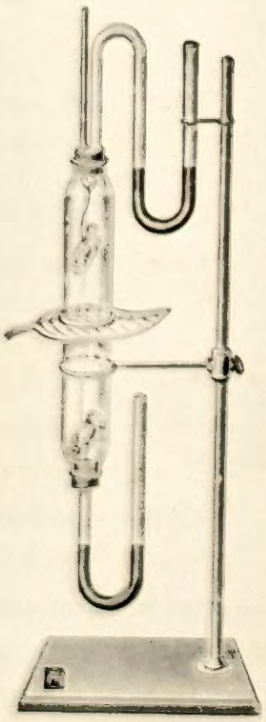

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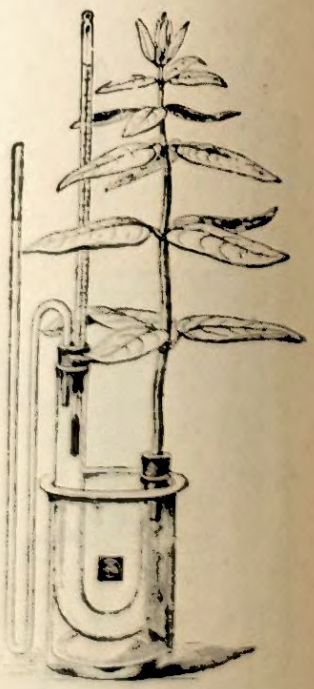

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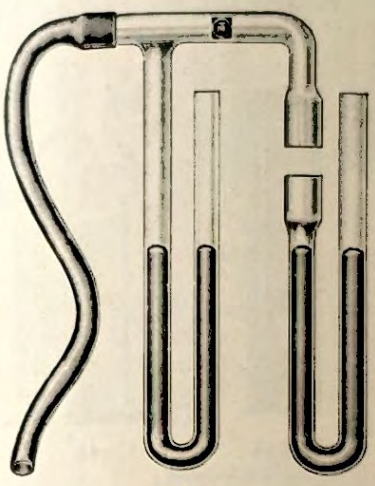
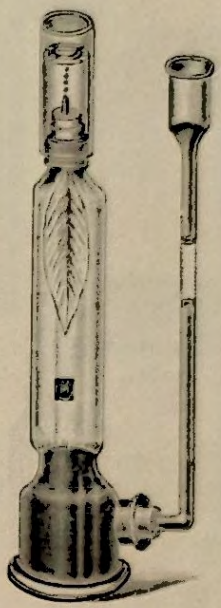


12636



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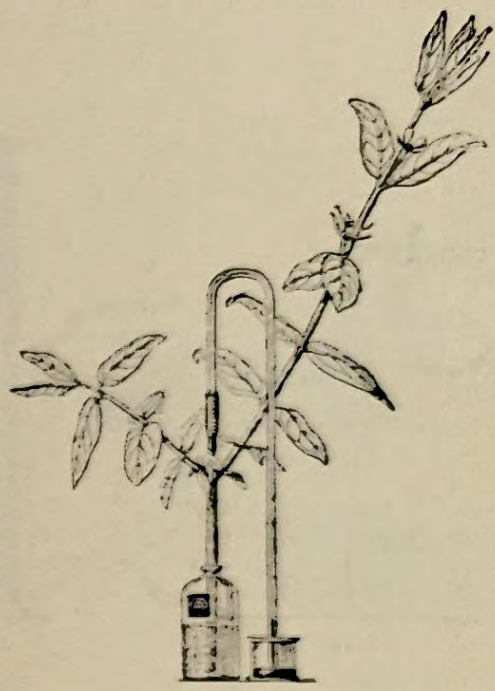
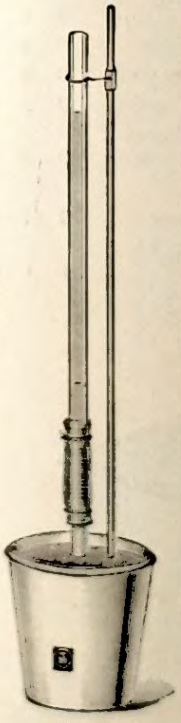


12638

*12636	**Poroscope,** as Fig. 64, Detmer, without mercury ...	£0	7	3
*12637	**Apparatus** for investigating the movement of gases in the plant. Fig. 65, Detmer	0	5	6
*12638	**Apparatus** for proving the negative pressure of air in the vessels. Fig. 66, Detmer	0	4	3



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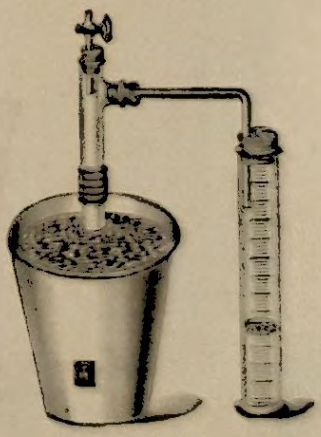


12640



12641

*12639	**Apparatus** for experiments on root pressure. Fig. 73, Detmer	£0	2	3
*12640	**Apparatus** for experiments on root pressure, after Pfeiffer. Fig. 74, Detmer ...	0	10	0
*12641	**Apparatus** for researches on root pressure, after Pfeiffer	0	7	0



12642



12643



12644



12645



12646

*12642	**Apparatus** for investigating fermentation in absence of free oxygen. Fig. 106, Detmer		£0	8 6
*12643	**Glass Cylinder** for culture of seedlings. Fig. 126, Detmer		0	6 0
*12644	**Apparatus** for investigating growth of roots. Fig. 128, Detmer		0	1 6
*12645	**Demonstration Respirosocope**, Corked Tube 6 × 1 in., fitted with Wire Gauze ...	per doz.	0	5 0
*12646	**Demonstration Respiroscope**, as Ganong	each	0	5 0
*12647	**Apparatus** for proving that plant structures do not undergo geotropic curvatures in absence of oxygen. Fig. 147, Detmer ... ... (Two of these are required for the experiment.)	each	0	3 9
*12648	**Apparatus** for demonstrating geotropic root curvature. Fig. 140, Detmer ...		0	14 6
*12649	**Zinc Case** with Glass Wall for observations on root development. Fig. 141, Detmer		1	1 0



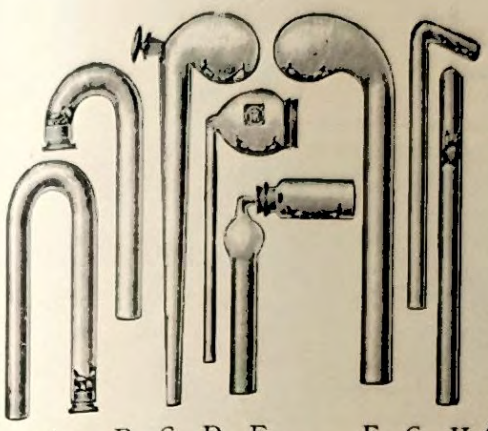
12647



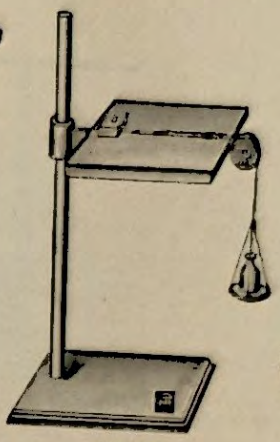
12648



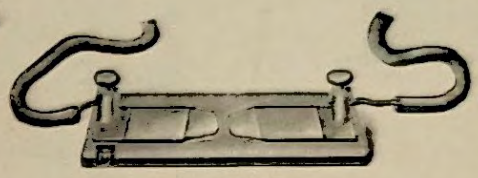
12649



12650

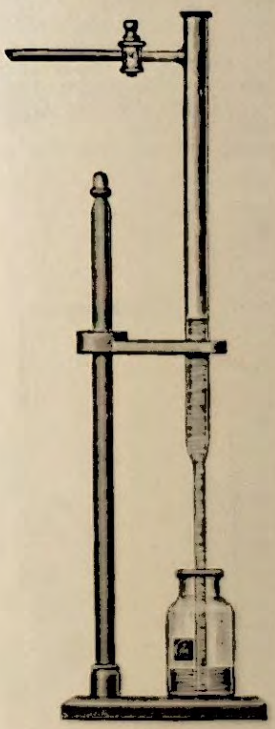


12651



12652

		A	B	C	D	E	F	G	H	
*12650	**Respiroscopes,** as Ganong, with Corks	4/6	4/6	10/9	4/6	5/0	7/6	3/6	2/6	doz.
*12651	**Apparatus** for demonstrating the amount of Osmotic Pressure, Fig. 51, Detmer...								£0 18 6	
*12652	**Object Glass** for investigating the action of electric currents on Plant Structures, Fig. 45, Detmer								0 7 6	



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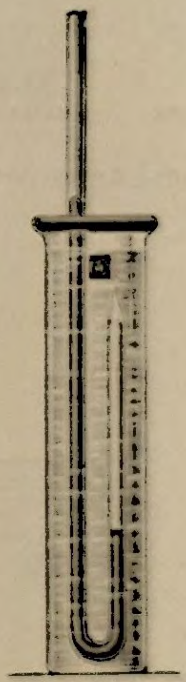
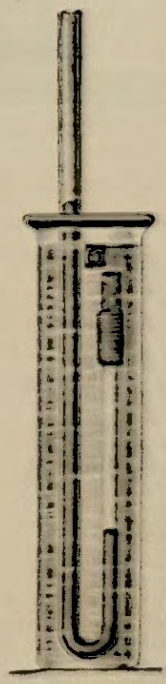
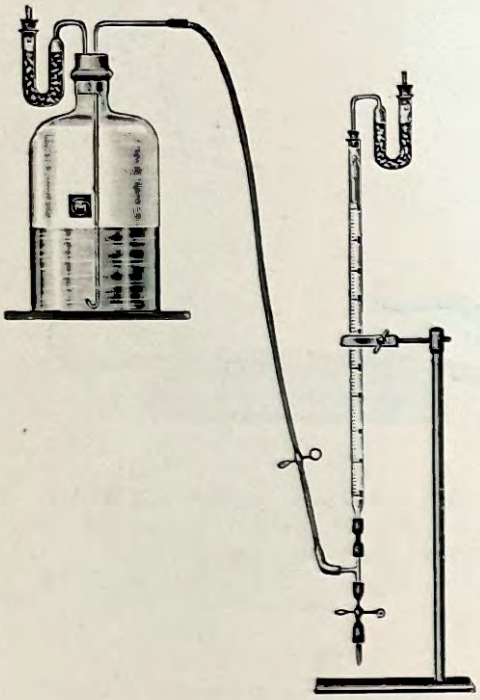


12656

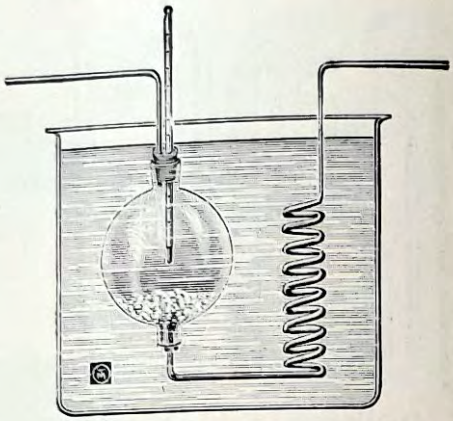


12657

*12653	**Apparatus** for investigating the diffusion of Gases, complete as Fig. 55, Detmer ...	£0 12 6
*12654	**Glass Parts** only	0 9 0
*12655	**Porous Clay Discs** ... ... each	0 0 3
*12656	**Apparatus** for investigating the permeability of capillaries to air, Fig. 62, Detmer...	0 4 0
	"U" Tube only... ... ... each	0 1 6
*12657	**Apparatus** for determining the permeability of the wood vessels to Air, Fig. 63, Detmer	0 4 0
	"U" Tube only... ... ... each	0 1 6

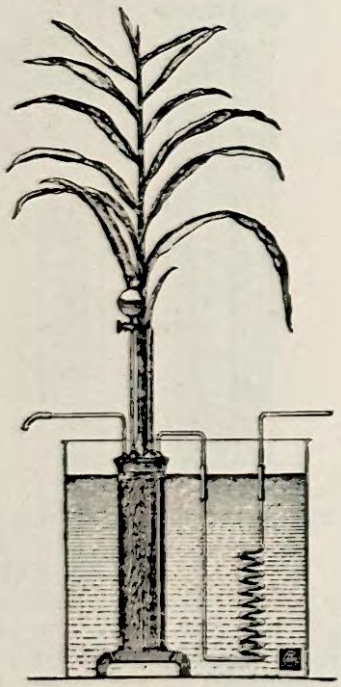


12658



12659

*12658	**Titrating Apparatus,** as Fig. 98, Detmer	£1 5 0
*12659	**Apparatus** for investigating the influence of light on respiration, Fig. 100, Detmer	2 2 0
*12660	**Apparatus** for experiments on the respiration of roots, Fig. 101, Detmer	1 15 0
*12661	**Apparatus** for determining the amount of Oxygen absorbed and of the carbon di-oxide produced in the respiration of plants, Fig. 103, Detmer	4 15 0
*12662	**Apparatus** for investigating fermentation, Fig. 104, Detmer, complete	0 9 6
*12663	**Conical Vessel** only	0 6 0



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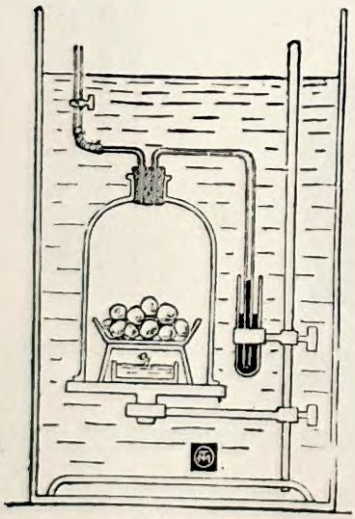


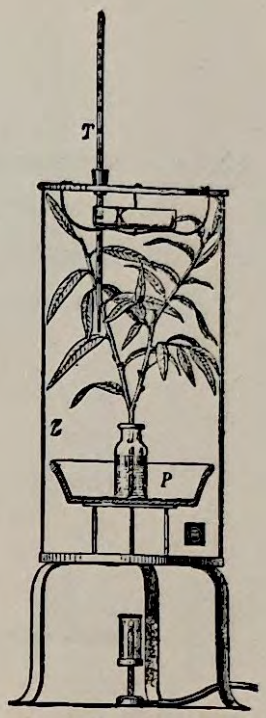
12661



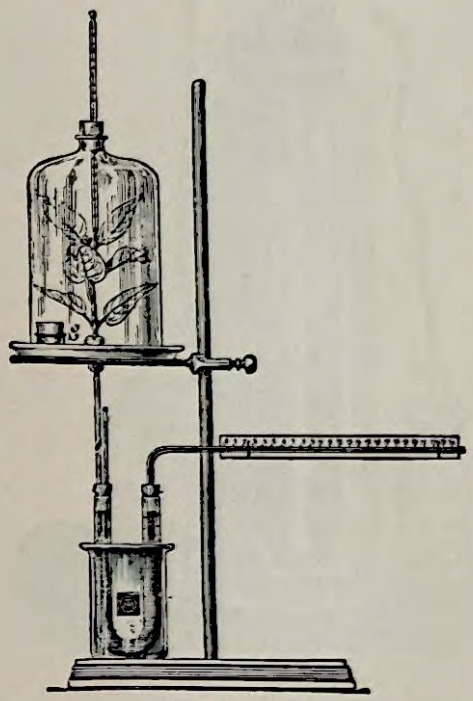
12662



12664



12665



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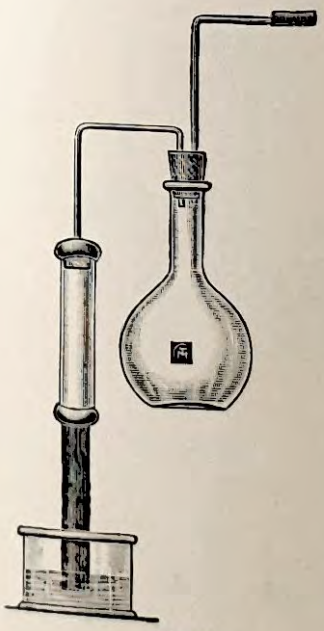


12667



12668

(F)*12664 **Apparatus** for determining the amount of water absorbed and given off by transpiring plants, after Pfeiffer. Fig. 82, Detmer **£0 9 0**

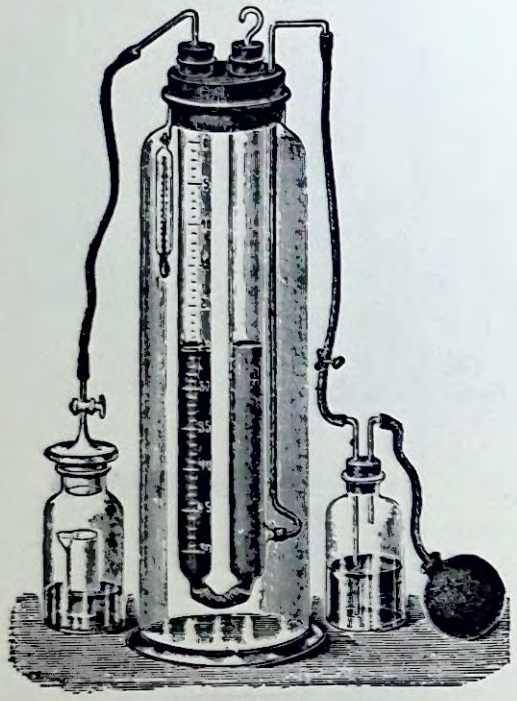
*12665 **Apparatus** for investigating transpiration. Fig. 84, Detmer **£2 2 6**

*12666 **Apparatus** for measuring the absorption of water by transpiring plants. Fig. 85, Detmer **£1 15 0**

*12667 **Apparatus** for demonstrating the readiness with which water moves in the wood. Fig. 87, Detmer **£0 5 0**

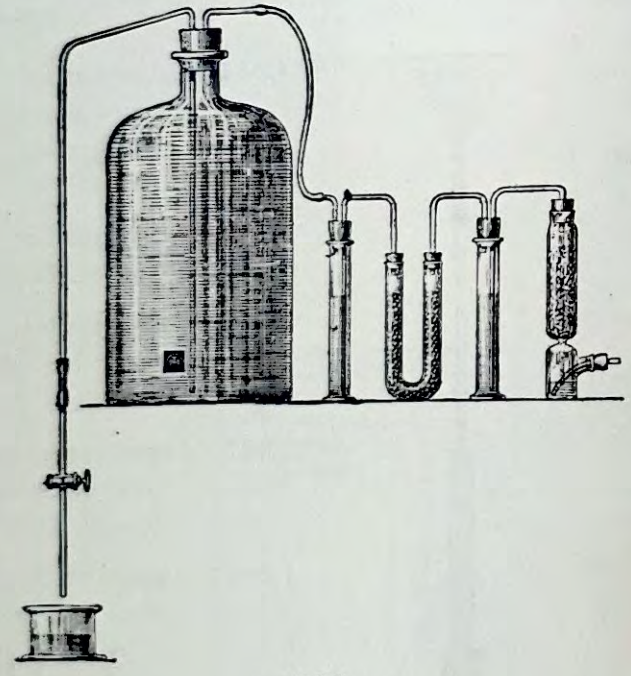
*12668 **Apparatus** for demonstrating the readiness with which water moves in the Wood and the fact that the closing membranes of the bordered pits of the tracheides are imperforate. Fig. 88, Detmer **£0 7 0**

(F) Foreign manufacture.



12669

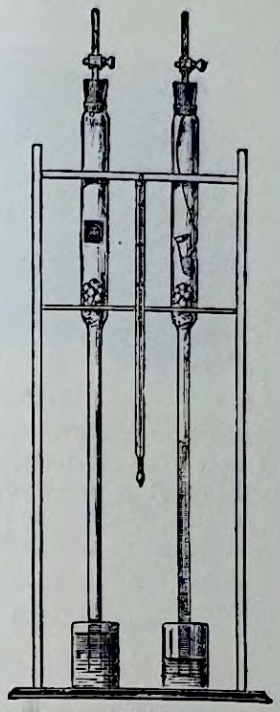
(F)*12669 **Ammoniometer,** Wagner's, complete, consisting of Burette graduated 0–50 c.c. in $\frac{1}{5}$ths, Gas Generating Bottle with Stopper and Stopcock, Solution Bottle fitted with Cork and Leading Tubes, Glass Jar, Rubber Blowing Ball and Thermometer **£3 10 0**



12670

(F) *12670 **Apparatus** for demonstrating the production of Carbon Di-oxide in the respiration of Plants, Fig. 93, Detmer **£1 2 6**

(F) Foreign manufacture.



12671

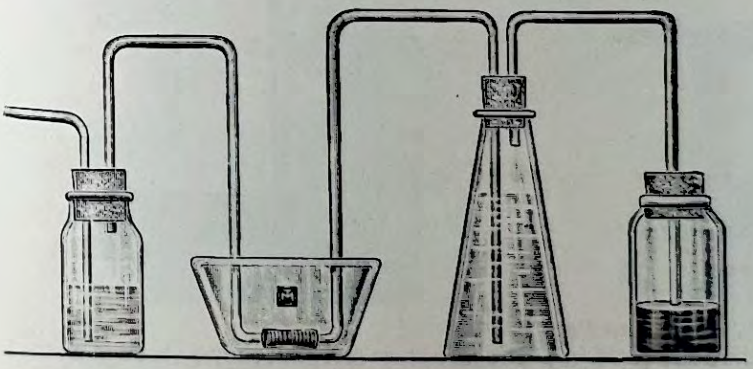


12673

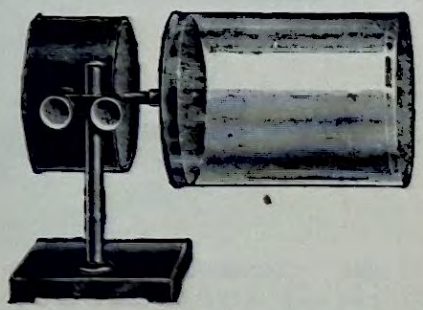
*12671 **Apparatus** for experiments on plant respiration, Fig. 94, Detmer, complete ... £2 2 6

*12672 **Graduated Tubes** only ... ... each 0 8 6

(F) *12673 **Fermentation Vessel,** Kuhne's, Fig. 96, Detmer ... ... 1/9 each; per doz. 0 19 0



12674

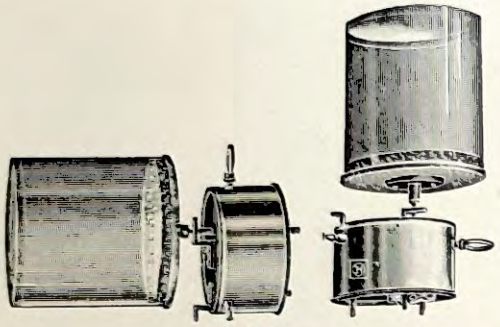


12675

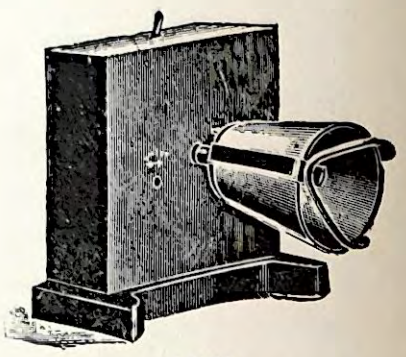
*12674 **Apparatus** for proving that there are organisms capable of growing in complete absence of oxygen, Fig. 105, Detmer £0 6 6

*12675 **Clinostat,** simple form, for seedlings, on heavy Base with Pillar and Clamp adjustable for height and any angle from vertical to horizontal, well made Clock, 5 in. Cork Disc and Celluloid Cover complete 2 5 0

(F) Foreign manufacture.

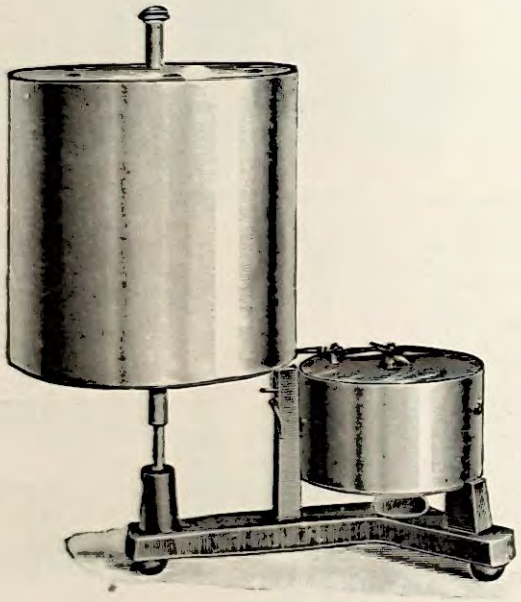


12677

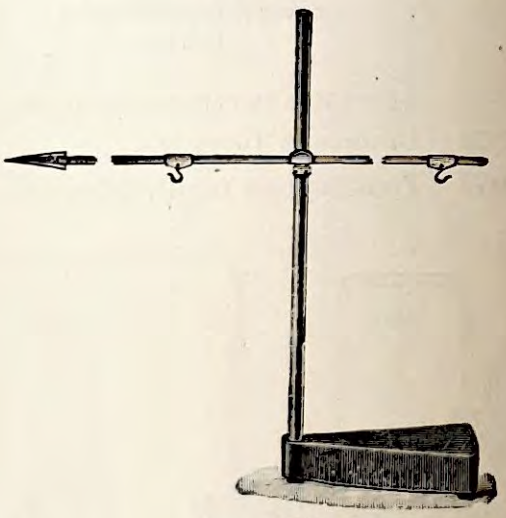


12678

*12677	**Clinostat,** Farmer's, for use either in a vertical or horizontal position, fitted with Cork Table and Celluloid Cover which revolves once every 15 minutes, each	£2 0 0
*12678	**Clinostat,** Heavier Model, for plants in pots, consisting of a well-made Clock that can be placed in either horizontal or vertical position, rotates once per hour	4 10 0
*12679	**Extra Pot Clamps** ... ... each	0 7 6



12680



12682

=12680 **Auxanometer, Professor J. B. Farmer's.**

The Drum is very light and is of the standard size (6×6 in.). It does not revolve, but moves through a small arc, and then back to its normal position. The Clock, which has a 30-hour lever movement, is so arranged that it can be set to give an impulse to the Drum every 15, 20, 30, or 60 minutes, and can be removed for rewinding without disturbing the record. The tracing being vertical, several levers can be arranged to write on the Drum at the same time. A Recording Drum, revolving once in 7 days, is also made, having superior clockwork movement with jewelled escapement contained in the base.

The Recording Lever is a long, light, but strong Wooden Beam, having a Writing Point at one end, also adjustable Bearings and two Hooks that can be slid anywhere along the beam. The one is for attaching to the plant and the other for the counterbalance weight provided. There is a support for the Lever, which can be fixed at any height on the Stand.

	Recording Drum ... ... nett	£4 10 0
=12681	**Glazed Papers,** cut to size and gummed, per 100 ... ... ,,	0 3 6
=12682	**Recording Lever** (complete on Stand) ... ... ,,	1 5 0



12684



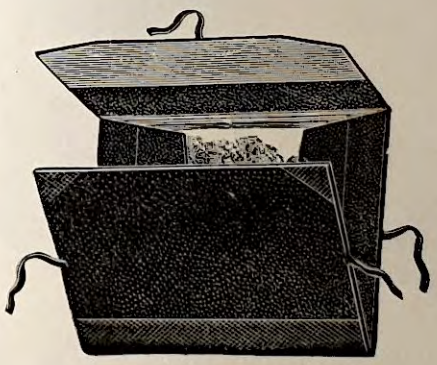
12686

=12684 **Press,** Woven Wire, 18½×12½ in., dark green enamel with Springs and Chains for adjusting pressure, will take about 5 in. in thickness, Leather Handles. Light, adapted for rapid drying **£0 16 6**

=12685 Ditto, ditto, 14½×12 in., cheaper, Galvanised, with two Webbing Straps, complete with Drying Paper **0 7 6**

=12686 **Light Press,** of Stout Cloth-covered Boards, 12×10 in., with two Webbing Straps and Drying Paper **0 4 0**

=12687 Ditto, ditto, as above, 14½×12 in. **0 5 0**



12688



12692



12693

=12688 **Portfolios** for mounting specimens, superior quality, with Cloth Hinge and Flaps inside, 12×10 in. ... ... each **£0 4 0**

=12689 Ditto, ditto, 18×12 in. ... ... ,, **0 5 6**

=12690 **Drying Paper** ... ... per quire, **2/0**; per ream **1 11 6**

=12691 **Mounting Paper** ... ... ,, **2/0** ,, **1 15 0**

=12692 **Fern Trowels,** best quality, Leather Sheath, with Loop for Belt **0 3 9**

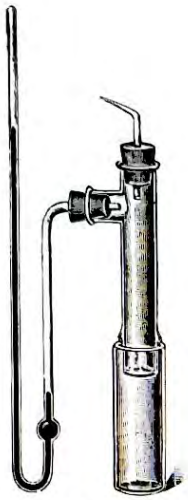
=12693 Ditto, cheaper pattern, Pressed Steel, Wood Handle, without Sheath... ... ... **0 0 9**



12694

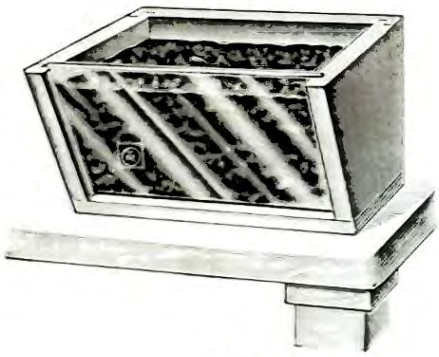


12695



12696

*12694	**Potometer**, Students', for transpiration experiments, complete with India-rubber Corks ... ... each, **1/6**; per doz.	£0 16 6
*12695	**Apparatus, Pfeiffer's**, for demonstrating Osmotic Pressure	0 12 0
*12696	Ditto, ditto, complete with Porous Pot	0 18 0



12697



12698

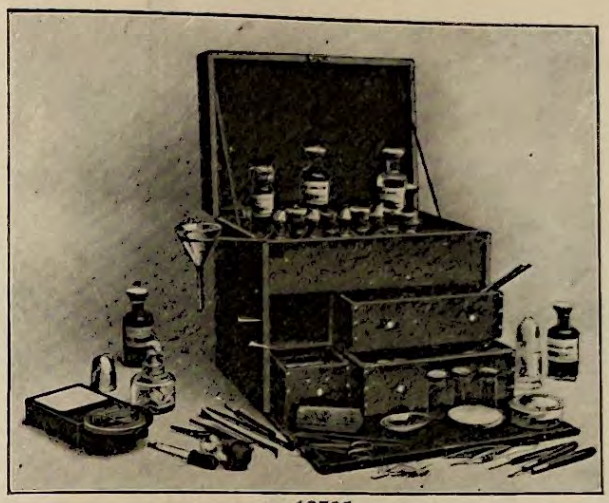


12700–1



12702

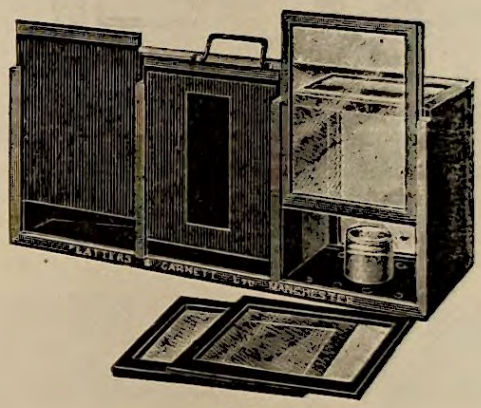
*12697	**Observation Box**, for seedlings, Fig. 32, Keeble, with sloping Glass Front ...	£0 10 0
	Diameter ... 6½ 8½ 10 in.	
*12698	**Plate**, Round, Porous ... ... **3/8** **6/0** 8/0 doz.	
12699	**Saucers**, Porous, about 5 in. diameter... ... ... per doz.	£0 3 6
12700	**Trays**, Porous Clay, 60×60×11 mm. deep ... ... each, **5d.**; ,,	0 3 6
12701	,, ,, ,, 165×85×10 mm. ... ... ,, **1/6** ,,	0 16 6
12702	**Rubber Prepared Tape**... ... ... per roll	0 0 8
	Circles 7 9 11 12½ 15 cm.	
12703	**Absorbent Paper**, thick, for seed germination, per 100... **6d.** **10d.** **1/4** **1/7** 2/2	
=12704	**Plasticine**, in 1 lb. Cartons, Blue, Red, Yellow, Green, White or Grey, per lb.	£0 1 6



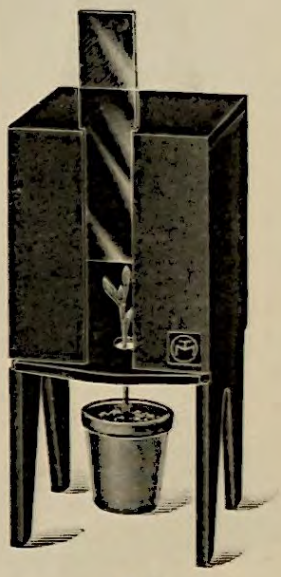
12705



12707



12709



12710

12705 **Mounting Cabinet,** Polished Mahogany, 12 × 10½ × 9 in., with Fall-front, Lock and Key, 3-partitioned Drawers, and movable Ring for funnel. Containing: Best Turntable, Slips, Covers, Tin Cells, Labels, Spring Clips, 1½ × 1½ in. Corked Tubes, 1 Pipette, 4 Watch Glasses, 2 Funnels, 100 Filter Papers, 2 Staining Dishes, 2 grooved-lid Glass Boxes, 1 Section Lifter, 1 Scalpel, 1 Scissors, 1 Forceps, 2 Needles, 2 Glass Rods, 2 Sable Brushes, Spirit Lamp, Stains and Reagents as follows: Malachite, Green, Borax, Carmine, Safranin, Eosin, Hæmatoxylin (Delafield), Caustic Potash, Chlorinated Soda, Absolute Alcohol, Xylol, Balsam in capped bottle, Euparal in capped bottle, Euparal Essence, Brown and Black Cements, Glycerine Jelly, Oil of Cloves, Oil of Cedarwood, Terpineol, Glycerine. (Other Stains, etc., of equal value may be substituted if desired.) **£6 6 0**

12706 Empty Cabinet, as above **3 7 6**

12707 **Mounting Cabinet,** small, with one Drawer, size 11 × 7 × 5 in., with six 2-oz. stoppered bottles of stains, Canada Balsam, Glycerine Jelly, Brown Cement, Asphaltum, Terpineol, Funnel; and in drawer: Small Turntable, Slides, Covers, Labels, Spring Clips, Filter Paper. Complete **£2 15 0**

12708 Empty Cabinet, as above **1 7 6**

12709 **Heliotropism,** New Combination Dark Chamber for Germination Experiments.

Consisting of a Portable Black Wood Box, 7 in. high, divided into three Compartments side by side, each with Glass Pot for seedlings. The first Chamber has a sliding opaque Shutter, the second a Shutter with slot to allow of partial light from one direction, and the third allows free access of daylight for use as a control. For experiments with coloured light additional Shutters, one of orange and one of blue glass, are provided.

Complete, as above **£1 7 6**

12710 **Blackwood Box** fitted with Sliding Bottom and Plain Glass Slide for admission of light **0 12 0**

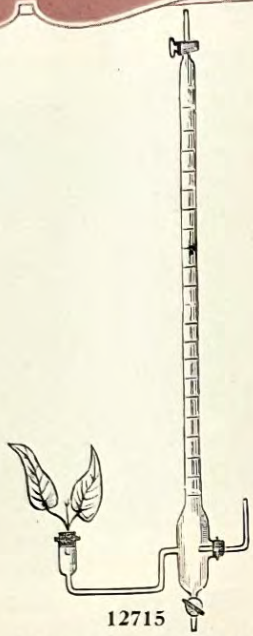
12711 **Set of Coloured Glass Slides** for above, Red, Blue, Green and Yellow... ... ... Per Set **0 2 0**



12712



12714



12715



12716–17

(F)	*12712	**Apparatus** for demonstrating the hydrotropism of roots							£0	8 6
(F)	*12713	**Porous Clay Funnels** for seedlings							0	5 6
(F)	*12714	**Apparatus** for fermentation, Einhorn's							0	3 6
(F)	*12715	**Moll's Apparatus,** to measure the aspiration of plants							0	17 0
	*12716	**Pots, Stoneware,** for plant cultivations, with Lugs and Outlet.								
		12×6½ in. diameter						each	0	8 0
	*12717	10×10 „ „						„	0	12 0



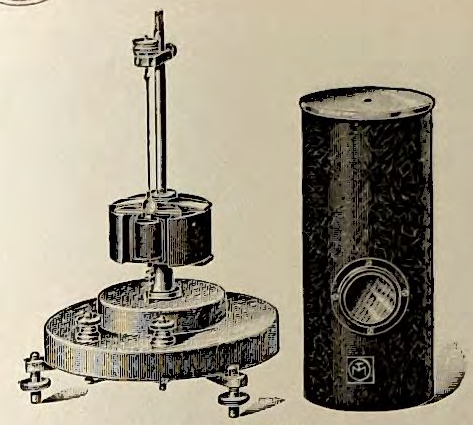
12718



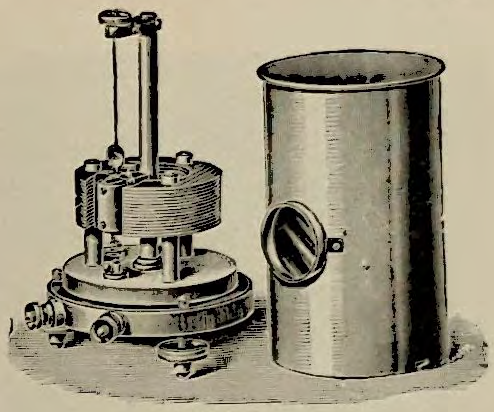
12719

12718	**Heliostat,** with Clockwork in Mahogany Case, best finish, with Spirit Level, Levelling Screws and Divided Circle	£16 0 0
12719	Ditto, ditto, in Polished Brass Cylinder, Graduated Circle and Levelling Screws	8 10 0

(F) Foreign manufacture.



12720

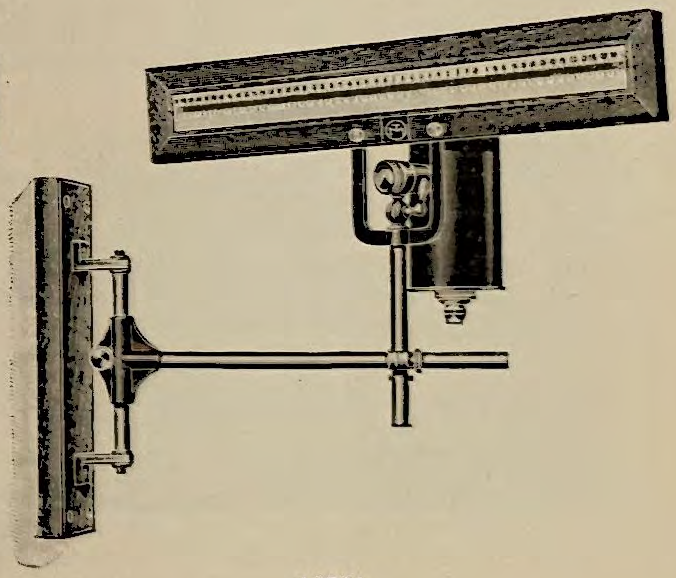


12721

12720	**Galvanometer,** Mirror, D'Arsonval's, in Brass Travelling Case, with Clamp to secure the Coil during transit...	£4 0 0
12721	Ditto, ditto, Reflecting, in Brass Case, Phosphor Bronze Suspension, fitted with Travelling Clip to prevent damage in transit, with one Coil complete. (Supplied with an Aperiodic Coil of 250 turns, being the most suitable for general work; but Coils of any number of turns, either Aperiodic or Ballistic, supplied at the same price)	5 10 0
12722	**Coils,** complete, with Suspension and Mirror, Aperiodic or Ballistic	1 1 0



12723

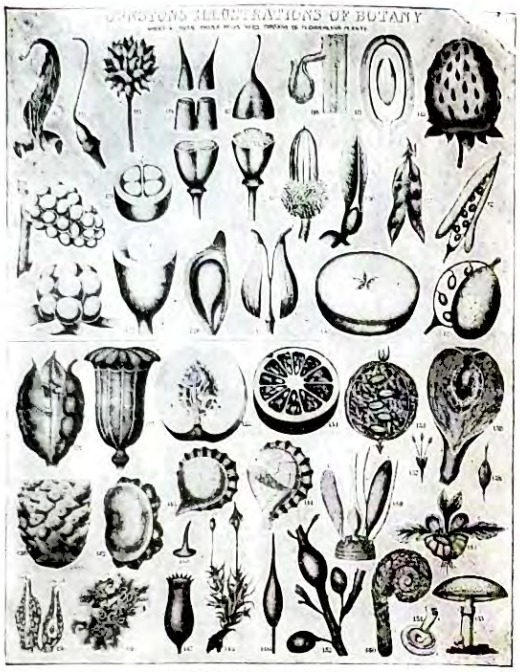


12724

12723	**Galvanometer Lamp and Scale.** The Scale is of Semi-transparent Glass in Polished Mahogany Frame, the Lampholder of Japanned Metal fitted with Telescope Tube for focussing, and Adjusting Screw on heavy Brass Stand, with Lighting Flex and Plug complete	£4 10 0
12724	**Galvanometer Lamp and Scale** similar to No. 12723, with Hinged Bracket for mounting on wall, with Lighting Flex and Plug complete	4 10 0



12725. Sheet 2.



12725. Sheet 4.

=**12725** **Diagrams.** Botanical, on Cloth and Rollers, Varnished, or on Cloth cut in sections to fold and Eyeletted. 50×42 in. Sheet 1.—Organs of Tissues, Plants, Root, Stem. 36 illustrations. Sheet 2.—Leaves and their modifications. 36 illustrations. Sheet 3.—Infloresence, Whorls of the Flower. 38 illustrations. Sheet 4.—Pistil, Ovule, Fruit, Seed, Organs of Flowerless Plants. 44 illustrations. Price ... ... each, nett **£0 14 0**

Handbooks ... ... ,, ,, **0 0 6**

=**12726** **Insectivorous Plants.** A new Chart, carefully and accurately prepared and coloured, to give a true representation of seven plants. Notes on the illustrations printed at foot of sheet. Size, 28×34 in. Mounted on Cloth and Rollers, varnished ... ... nett **£0 6 0**

=**12727** **Parasitic Plants.** A Companion Chart to one above, showing some of the best known Parasites in Plant Life, their Roots, and Mode of Adhesion. Descriptive Notes printed at foot of Chart. Size, 28×34 in. Mounted on Cloth and Rollers, Varnished. Uniform with "Botany Sheets for Beginners" Series ... ... nett **£0 6 0**

=**12728** **Poisonous Plants.** Beautifully printed in Colours, size 38×38 in., on Cloth, Rollers and Varnished ... ... nett **£0 7 6**

Handbook, with full descriptions of above Chart ... ... ,, **0 0 6**

=**12729** **Life History of the Wheat Plant.** A series of eight Coloured Diagrams representing: 1.—The Structure of the Grain. 2.—Germination of the Grain. 3.—The Young Plant. 4.—Early Growth of the Ear. 5.—Growth of the Ear and Flower. 6.—The Flower. 7.—Ripening of the Grain. 8.—The Wheat Straw.

These Diagrams are reproductions of original drawings by Francis Bauer, now in the Botanical Department of the British Museum, and are printed in colours. With each set is sent a Pamphlet by Mr. William Carruthers, F.R.S., Consulting Botanist to the Royal Agricultural Society of England, entitled, "The Wheat Plant: How it Feeds and Grows"; being Notes explanatory of the Diagrams. Size of Diagrams, 30×22 in.

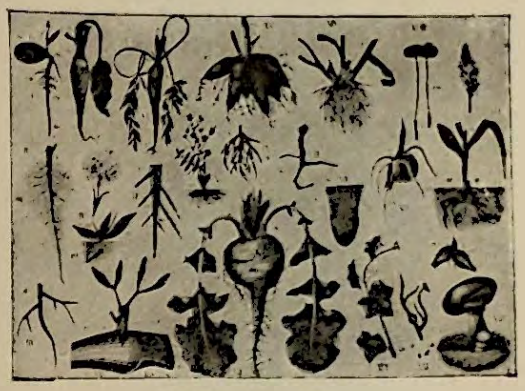
Price per Set of Eight Diagrams, in Sheets (including Explanatory Pamphlet), nett **£0 10 0**

Ditto, ditto, mounted on Cloth and Rollers, Varnished ... ... ,, **1 0 0**

Extra Copies of the Explanatory Pamphlet ... ... each **0 0 3**



12730. Sheet 5.



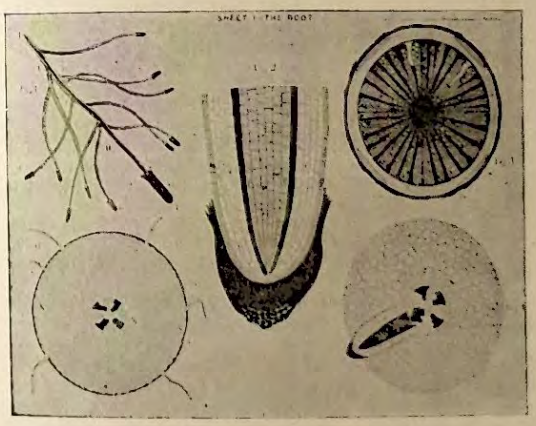
12730. Sheet 1.

=12730 **Botany Sheets for Beginners.**—By Alexander Johnstone, F.G.S., Lecturer on Botany, Edinburgh School of Medicine. Sheet 1.—Roots. Sheet 2.—Stems. Sheet 3.—Leaves. Sheet 4.—Leaves. Sheet 5.—Flowers. Sheet 6.—Fruits and Seeds.

In another series by the same author, "Illustrations of Elementary Anatomical Botany," the structural characters of plants as seen under the microscope are exhibited, while in the above set of highly-finished illustrations the external forms as observable by the unaided eye, as they appear in nature, are carefully brought out in all necessary detail.

Sheet 1 gives views of the different kinds of common roots. Sheet 2 shows the shape and different habits of growth of common stems. Sheets 3 and 4 contain numerous interesting examples of leaves. Sheet 5 is made up of typical flowers. Sheet 6 of various common fruits and seeds worthy of being studied by the beginner in Botany. While one sheet is specially devoted to flowers, these structures really appear to a greater or lesser extent in all the sheets, but in no case are same illustrations given twice. Copious explanatory letterpress is given at the foot of each sheet. Size 34 × 28 in. each.

On Cloth, Rollers, and Varnished, or on Cloth to fold up, with Cloth Sides... ... each, nett **£0 6 0**



12731 Sheet No. 1.



12732

=12731 **Elementary Anatomical Botany.**

The sheets of this series exhibit in a simple manner the general structural details of ordinary flowering plants. The evolution of structures is indicated as occurring in nature, and the whole series can be taken as illustrating the elementary anatomy of a typical flowering plant. Several comparative sections are given through the series. At the foot of each sheet full explanatory letterpress is given. Size 34 × 28 in. On Cloth and Rollers, Varnished or on Cloth cut in sections to fold, eyeletted.

Sheet 1.—Root. Sheet 2.—Stem. Sheet 3.—Leaf. Sheet 4.—Flower. Sheet 5.—Flower. Sheet 6.—Seed, Fruit.

Price ... ... each, nett **£0 6 0**

=12732 **Trees.** Beautifully printed in Colours, showing the Tree in full foliage, rough cut Plank, polished Plank, Leaf, Flower and Fruit. With explanatory letterpress at foot. Apple, Ash, Beech, Birch, Cedar, Cork, Elm, Holly, Mahogany, Maple (Great or Plane), Oak, Pear, Scotch Fir, Spanish Chestnut, Walnut. Size, 34 × 28 in. each, on Cloth and Rollers, Varnished.

Price ... ... each, nett **£0 6 0**



Marine Alga. Ptilota elegans.



Mildew on Corn. Puccinia graminis.

BOTANY MICROSCOPIC SLIDES, each **1/9,** unless otherwise marked.

12733 Elementary Tissues.
Bast Fibres, Leaf of Hemp
Bordered discs, single row, Pinus
,, ,, double row, Araucaria
,, ,, with spiral fibre, Yew
Cylindrical, Helianthus
Dotted vessels, Helianthus Root, L.S.
Double spiral, Grape Vine
Isolated liber cells, Leaf of Yucca
,, ,, woody cells, Elder
Medullary Rays, Pinus, L.S.
Primordial utricle, Zea Mais
Parenchyma of Pith, cells empty, Elder
Polygonal, Metzgeria
Pitted vessels, Laurus sassafras
,, ,, without border, Star Anise
Quadrangular, Cork
Reticulated, Taraxacum
Spiral vessels (isolated), Rhubarb
,, ,, *in situ*, Balsam
Scalariform, Fern
Sieve Tubes, Cucurbita, L.S.
,, Plates, Cucurbita, L.S.
Tubular, T.S. Leaf of Nerium Oleander
Woody cells with bordered pits, Pinus

12734 Intercellular Spaces.
Air Cavities, Nymphaea
Turpentine and Resin vessels, Spruce Fir (see also) gland and cell contents

12735 Meristem Tissue.
Cambium layer in Grape Vine
Cork Cambium (Phellogen)

12736 Fundamental Tissues.
Hypodermis, Leaf of Pinus Pinaster
Mesophyll, leaf of Laurel
Pith, stellate cells of Rush
Sclerenchyma, stem of Trichosmia antarctica

12737 Gland and Cell Contents.
Aleurone Grains, in Castor Oil Seed
Chlorophyll in Leaf of Mnium
Intercellular secretary reservoirs in petiole of Ivy
Latex vessels in Sonchoneta
Oil glands in Rind of Lemon or Orange
Raphides, Acicular, Squill
,, Conglomerate, Cactus
,, in Hyacinth, Pine Apple
,, Rhubarb, Lily
,, Prismatic, Cuticle of Onion
,, Octahedral, Garlic
Sclerogen, Star Anise and Damson Stone
Anthers of Lily or Tulip, Trans. Sect.
Mitosis in root of Fritillaria, **4/6**
,, ,, Garlic, **4/6**
,, ,, Hyacinth, **4/6**
,, ,, Lily, **4/6**
,, ,, Onion, **4/6**

12738 Ovaries.
Axile Placentation, Begonia
Development of Ovary,
Yucca Gloriosa, **2/0**
Gymnospermous Ovule, Yew
Male Inflorescence of Yew
One-celled, Orchis
Two-celled, Potato
Three-celled, Tulip
Parietal placentation, Poppy
Pistil of Dahlia

12739 Pollens, Flower Buds, etc.
Pollen of Convolvulus, Geranium, Hollyhock, Lily, Mallow, Pinus sylvestris, Anemone, Evening Primrose, Clematis, Rose, Passion Flower, Nasturtium, Antirrhinum, Maize
Pollen *in situ* on stigma of Oenothera, **2/0**
Stigma, Bilobate, Artemisia
,, Trilobate, Carex hirta
Section through entire flower buds of Lily, T.S.
Buttercup, T.S. and L.S. on one slide, **2/6**
Dandelion, T.S. and L.S. on one slide, **2/6**
Butterwort, T.S. and L.S. on one slide, **2/6**
Stock, T.S. and L.S. on one slide, **2/6**

12740 Starches.

Tuber *in situ* of Potato, Rest of Ginger	
Arrowroot	Arum
Bean (Haricot)	Calabar Bean
Ginger	Horse Chestnut
Indian Shot	Lentils
Maize	Oats
Peas	Potato
Rice	Rye
Sago	Tapioca
Wheat	Yam, etc.

12741 Parasitic Plants.
Cuscuta epithymum: Dodder on Clover, Long Sect. Parasite, and Trans. Sect. Host plant, **2/0.**
Viscum, Mistletoe, T.S. Stem
,, ,, T.S. Leaf
Hor. Sect. Leaf, showing stomata (See also Fungi)

12742 Insectivorous Plants.
Drosera, Leaf with captured insect, **2/0.**
Drosera, Part of Leaf, showing Glandular Hairs.
Nepenthes. Inner Epidermis of Pitcher—Digestive Glands
Utricularia. Bladder with captured insect, **2/0**
Utricularia V.S. Bladder Quadrifids
Utricularia. Stem T.S.

12743 Monocotyledons.
Burr Reed, Sparganium ramosum.
Butcher's Broom, Ruscus aculeatus
Cane, Sugar, Saccharum Officinarum
,, Wanghae and Malacca
,, Rattan and Bamboo
China Grass, Bochmeria nivea
Date Palm, Phoenix dactylifera
Dracena
Land Rush, Juncus communis
,, Rhizome of J. Lamprocarpus
Maize, Zea Mais
,, ,, ,, Long. Sect.
Orchid, Odontoglossum Rossi
,, ,, ,, Long. Sect.
Reed (common), Phragmites communis
Wheat, Triticum
White Water Lily, Nymphaea alba



Stinging Hairs on Leaf of Nettle.



Flower Bud of Lily. Trans. Sect.

BOTANY MICROSCOPIC SLIDES, each 1/9 unless otherwise marked.

12744 Dicotyledons.

Alder, Alnus glutinosa
Allspice Plant. Eugenia pimenta
Apple, Pyrus communis
Aristolochia trophydra. A gigas
Ash, Fraxinus excelsior
Beech, Fagus sylvatica
Berberry, Berberis vulgaris
Birch, Betula alba
Bramble, Rubus fruticosus
Bryoni, Bryonia dioica, Trans. Sect.
,, ,, ,, Long. Sect.
Burdock, Arctium lappa
Camphor Tree. Laurus comphora
Chestnut (Spanish), Castenea vulgaris
Chestnut (Horse), Æsculus Hippocastanum
Clematis vitalba. One year's growth.
Coffee Tree, Coffea Liberica
Cork Tree, Quercus suber
Currant (Black), Ribes nigrum
,, Ribes sanquinium, T.S. Petiole
Dodder on Clover, Long. Sect. of Parasite, Trans. Sect. of Host, **2/0**
Dog Rose, Rosa canina. Sec. through Spine
Eider, Sambucus nigra
Elm, Ulmus capestris
Fennel, Fœniculum officinalis
Flax, Linum usitatissimum
Fig Tree (Australian), Ficus australis
Geranium, Pelargonium
Grape Vine, Vitis vinifera
Gum Tree (red), Eucalyptus calophylla
Gum Tree (blue), Eucalyptus globulus
Holly, Ilex aquifolium
Idia-rubber, Ficus elastica
Jessamine, Jasminium officinale
Larch, Larix Europæus
Lime Tree, Tilia grandiflora
,, ,, Long. Radial Section
,, ,, Long. Tangential Section
Magnolia grandiflora
Maple, Acer campestris
Marestail, Hippuris vulgaris
Mimosa, Nilotica
Mistletoe, Viscum album
Mulberry, Morus nigra
Oak (Evergreen, Quercus ilex
,, British (Forest), Q. pendinnculata
Passion Flower, Passiflora quadrangularis
Pepper Plant, Piper nigrum
Pear Tree, Pyrus domestica
Plane Treem Plantatus occidentalis
Poplar, Populus nigra
Sarsparilla, Smilax officinalis
Sedge, Carex pendula
Sunflower, Helianthus tuberosa, L.S.
,, ,, ,, T.S.
Sycamore, Acer pseudo-platanus
Tea Plant, Thea chinensis
Traveller's Joy, Clematis vitalba

12745 Gymnosperms.

Cedar of Lebanon, Cedrus Libanus
,, Himalaya, Cedrus deodara
Chili Pine, Araucaria imbricata
Pine (Scotch Fir), Pinus Sylvestris
,, (Canadian), Pinus strobus
Pinus Sylvestris, showing 1, 2 and 3 years' growth on one slide, **2/6**
Pinus Sylvestris, Trans. Sect.
,, ,, Long Sect
Yew, Taxus baccata
Trans. Sect. Stems of Monocotyledon, Dicotyledon and Gymnosperm, 3 sections on 1 slide, **2/6**

12746 Set of 16 Typical Stems, Trans. Sects., specially selected. **£1 8 0**

1 Aquatic Dicotyledon, Hippuris
2 Arboreus Dicotyledon, Elm
3 Herbaceous Dicotyledon, Helianthus
4 Aquatic Monocotyledon, Sparganium
5 Arboreous Monocotyledon, Dracæna
6 Herbaceous Monocotyledon, Maize
7 Bamboo Cane
8 Cycas revoluta
9 Equisetum hyemale
10 Moss, Polytrichum
11 Lycopodium clavatum (Club Moss)
12 Male Fern, Aspidium
13 One Year's growth, Clematis
14 Selaginella
15 Pinus sylvestris
16 Tree Fern, Dicksonia

12747 Growing Point of Stems of:

Hippuris, Marestail, **2/0**
Equisetum, **2/0**
Elodea, **2/0**
Pinus Sylvestris, Scotch Fir, **2/0**
Helianthus, Sunflower, **2/0**

Leaves—Sections.

12748 Monocotyledons.

Aloe ferox, T.S., fleshy leaf of Xerophyte
Burr Reed, Sparganium ramosum
Bamboo, surface and section showing "nerves"
Marram Grass, Psamma arenaria
Esparto Grass
Pampas Grass, T.S.
Floating Leaf of Water Lily, showing Idioblasts
Maize, Zea Mais
Nerium Oleander, showing stomata
Orchid
Yucca gloriosa

12749 Dicotyledons.

Epidermis of box leaf showing stomata
Defoliation: Stem and Petiole of Virginia Creeper
Elm, Ulmus
Heather, Calluna vulgaris
Hemp, showing bast fibres
Hakea, centric type
Holly, Ilex Aquifolium
India Rubber, Ficus elastica
Laurel, T.S., showing mesophyll
Lime Tree, Tilia grandiflora
Mistletoe, Viscum Album
Oak, Quercus suber
Orange Tree, Cystoliths in situ
Plum, Prunus domestica
Red-Hot Poker Plant, Tritoma uvaria
Section of leaf and petiole of Magnolia grandiflora
Submerged leaf of Salvinia
,, ,, Ranunculus aquatilis
Sunflower, Helianthus
Tea Tree
Tobacco Plant

12750 Gymnosperms.

Cluster Pine, Pinus Pinaster
Cycad, Cycas revoluta
Pine (Scotch Fir) Pinus Sylvestris
Pinus Sylvestris
Male Cone, Long Sect.
Female Cone ,, ,,

BOTANY MICROSCOPIC SLIDES, each **1/9,** unless otherwise marked.

12751 Leaf Buds.

Ash, Fraxinus, Trans. Sect.
Elm, Ulmus, Trans. Sect.
Sycamore, Acer. Trans. Sect.
Syringa, Lilac. Long. Sect.
Winter Bud of Lime Tree, Tilia. L.S.
Veronica, Trans. Sect.

12752 Epidermal Tissue.

Stomata in Epidermis of :
- Fern leaf
- Tea ,,
- Mistletoe leaf
- Aloe, surface view
- Box ,, ,,
- Eucalyptus ,, ,,
- Iris ,, ,,
- Lily ,, ,,
- Ivy ,, ,,
- Tobacco. Trans. Sect.
- Cycas ,, ,,

Siliceous cuticle from seed of :

Bamboo	Barley	Cotton
Linseed	Rice	Canary Seed
Wheat	Oat	Cherry

Cell wall, thickened on exposed side, in stem of Mistletoe
Bark, Birch
Thickening of cell wall of Epidermis (Cystoliths), India-rubber, Ficus elastica and Orange, Citrus Aurantium
Cork, Quercus suber
Digestive Glands, Nepenthes
Hairs, Branched, Plane Tree
,, Glandular, Sting of Nettle
,, Prickle, Dog Rose
,, Simple, on Rose
,, Stellate, Deutzia
,, ,, Alyssum

12753 Seeds.

Oat, Avena sativa, Long Sect. seed
Maize, Zea Mais ,, ,, ,,
Wheat, Triticum ,, ,, ,,
Sugar Cane, Saccharum officinarum
Seed and fruit of Unripe Orange, T.S.
Hemlock, Conium maculatum, T.S.
Rice Grain, Oryza sativa, T.S.
Pepper Corn, Piper nigrum, T.S.
Acorn, Quercus, T.S.
Clove, Eugenia caryophyllata, T.S.
Bitter Almond, Prunus amygdalus, T.S.
Section of Stone of Apricot
,, ,, Damson
,, ,, Peach

Roots.—Transverse Sections.
1/9 each, unless otherwise marked.

12754 Monocotyledons.

Water Lily. Aquatic root showing air spaces
Duckweed. Aquatic root with sheath
Orchid. Aerial root, L.S. or T.S., showing Velamen
Maize. Zea Mais. L.S. or T.S.
Oat. L.S. or T.S.
Iris germanica. T.S.

12755 Dicotyledons.

Helianthus tuberosa. Sunflower. L.S.
,, ,, ,, T.S. showing root branch
Oak. T.S.
Pisum. Pea. T.S.
,, ,, L.S. showing root cap
Elm, Ullmus campestris. T.S.
,, ,, ,, L.S.
Bean, Vicia faba. L.S. or T.S.
Elder. T.S.
Maple. T.S.
Lime. Tilia europœa
Scorzonera. L.S. showing Latex vessels
Taraxacum. Dandelion, showing reticulated vessels
Wallflower. Cheiranthus Cheiri
Water Crowfoot, Ranunculus aquatilis

12756 Gymnosperms.

Pinus Sylvestris. T.S.
,, ,, L.S.
Yew. Trans. sect.

12757 Typical Stems, Roots and Leaves. Set of 24, in Polished Pine Case £2 2 0

Monocotyledons.

1 Water Lily. T.S. Stem
2 ,, ,, T.S. Root
3 ,, ,, Leaf showing idioblasts
4 Orchid. T.S. Stem
5 ,, T.S. Root
6 ,, V.S. Leaf through stomata
7 Maize T.S. Stem
8 ,, T.S. Root
9 ,, T.S. Leaf

12758 Dicotyledons.

10 Helianthus T.S. Stem
11 ,, T.S. Root
12 ,, T.S. Leaf
13 Elm T.S. Stem
14 ,, T.S. Root
15 ,, T.S. Leaf
16 Oak. T.S. Stem
17 ,, T.S. Root
18 ,, T.S. Leaf

12759 Gymnosperms.

19 Pinus Sylvestris. T.S. Stem
20 ,, ,, L.S. Stem showing medullary rays
21 Pinus Sylvestris. T.S. Root
,, ,, T.S. Leaf
23 Yew. T.S. Stem
24 ,, T.S. Root

12760 Marine Algæ—

Phæophyceæ.

Ectocarpus siliqulosos showing developing sporangia
Ectocarpus umlocula, sporangia
Fucus serratus:
- Male Conceptacle with antheridia
- Antheridia teased out
- Female Conceptacle with oogonia

Fucus vesiculosus:
- Male Conceptacle with antheridia
- Female Conceptacle with oogonia

Laminaria digita. T.S. of Leaf
T.S. of Stripe
L.S. ,,
Callithamnion: Tetraspores
Plumaria elegans
Dasya coccinea, Sporangia
Bonnemaisonia aspargoides

12761 Fresh Water Algæ.

Conjugatæ:
- Cosmarium, Desmid
- Closterium ,,
- Micrasterias ,,
- Spirogyra nitida in conjugation
- ,, ,, vegetative plant

Chlorophyceæ:
- Chalmydomonas

Volvox globator with resting spores
Protococcus viridis
,, olivaceous
Glœocystis vesiculosus
Pandorina morum
Œdogonium: Oogonium *in situ* on weed
Vaucheria showing Antheridia and Oogonia
Prasiola Crispa. Hydrodictyon
Chætophora. Batrachospermum moniliforme.

BOTANY MICROSCOPIC SLIDES, each 1/9, unless otherwise marked.

12762 Fungi—Eumycetes.

ZYGOMYCETES.—
Mucor Mucedo, Vegetable mould, showing mycelium and sporangia
Empusa Muscæ, Fungus on House Fly

OOMYCETES.—
Cystopus candidus, white rust on cabbage, showing conidiospores
Peronospora infestans, on Potato leaf

ASCOMYCETES.—
Eurotium (Aspergillus glaucus), Blue mould on cheese, showing mycelium and conidiospores
Penicillium glaucum, Vegetable mould, showing mycelium and conidiospores
Erysiphe
Truffle, Tuber
Peziza with Asci and Paraphyses
Claviceps purpurea, Ergot of Rye, stroma with Perithecia
Saccharomyces cerevisiæ, Yeast
Sphaerotheca mors-uvac, American Gooseberry mildew

BASIDIOMYCETES.—
Ustilago segetum, Smut in Grain of Wheat
Ustilago maydis, Smut in Indian Maize
Uredo fœtida, Bunt in Corn
Puccinia graminis, Mildew in Corn
,, showing teleutospores
,, showing uredospores
,, Graminis, showing æcidiospores
Lycoperdon saccatum, Puff Ball
Agaricus campestris, Mushroom, Section of Gills
Æcidium Berberidis, Leaf of Berberry
Lupinus polyphyllus, section of nodule with bacteria *in situ*

12763 Ascolichenes—Lichens.

Collema. V.S. Thallus with Apothecia
Paramelia. ,, ,, ,, ,,
Ramalina. ,, ,, ,, ,,

12764 Cryptogamia.

CHARACEÆ. Antheridia, Chara fragilis separated
Fertile Branch ,, ,, ,, ,,
Section of stem ,, ,, ,, ,,
HEPATICACEÆ.—
Frondose, Metzgeria furcata
MARCHANTIACEÆ.—
Antheridia, Marchantia polymorpha
Archegonia ,, ,,
Section of Thallus ,, ,,
Section through Gemmæ Cup, with Gemmæ *in situ*
SPOROGONUM.—
Elators and Spores, Marchantia polymorpha
Stomata in Marchantia polymorpha

12765 Jungermannieæ.

Pellia epiphylla. Vert. Sect. Thallus, showing developing sporogonium
Pellia. V.S. Thallus Antheridia
,, ,, ,, Archegonia
,, Spores and Elaters
EQUISETACEÆ.—
Strolbius of E. hyemale, Trans. Sect.
Section of Stem, E. hyemale
Spores and Elaters, E. hyemale
Long Section of Stem Apex, **2/0**
MARSILEACEÆ.—Microspores and Macrospores in Sporocarp of Pilularia
LYCOPODIACEÆ.—
Fertile Spike, Selaginella, showing Micro- and Megaspores
Leafy Stem, Selaginella
Section of Stem, ,,

12766 Musci.

Archegonium, Mnium, Long. Sect.
Antheridium, ,, ,, ,,
Chlorophyll in Leaf of Mnium
Polytrichum, L.S. of Capsule
,, T.S. of Stem
,, Peristome
Stem of Club Moss, Lycopodim clavatum
Spores of ,, ,, ,, ,,
Funaria hygrometrica, capsule. Long. Sect.
,, Antheridium. Long Sect.
,, Archegonium ,, ,,
,, Stem. Trans. Sect.
,, Protonema
Sphagnum acutifolium. L.S. Capsule
,, Leaf
Schistostega Osmundacea, whole plant

12767 Ferns.—Pteridophyta.

Adiantum Cuneatum:
Fructification on Fronds
Prothallus showing antheridia
Pteris Aquilina: Spores
Rachis T.S.
,, L.S.
Rhizome. T.S.
,, L.S.
Asplenium exulentus. T.S. Rachis
Isolated scalariform vessels from rachis of fern
Aspidium Filix Mas: T.S. Root
T.S. Rachis
L.S. ,,
Sorus of Male Fern
Osmunda Regalis, T.S. Stem
Woodwardia radicans, Tree Fern. T.S. Stem
Dicksonia: Tree Fern. T.S. Stem showing sclerenchyma
Scolopendrium vulgare:
Harts Tongue Fern. T.S. Stem and Leaf

SPECIAL EDUCATIONAL SETS

12768 24 Elementary Tissues. Separate Slides can be had for 1/9 each unless otherwise stated.

In Case complete **£2 2 0**

1 Annular vessels—Balsam
2 Bast fibres in cross section—Hemp
3 Cambium layer in Grape Vine
4 Chlorophyll in leaf of moss—Mnium
5 Cork Cambium in Quercus suber
6 Cylindrical cells—Helianthus
7 Cystoliths—Ficus elastica
8 Digestive glands—Nepenthes
9 Dotted vessels—Helianthus
10 Epidermis-stomata—Box
11 Lactiferous vessels—Scorzonera
12 Oil cavities—Lemon
13 Resin vessels—Spruce Fir
14 Reticulated cells—Taraxacum
15 Scalariform vessels—Fern
16 Sieve tubes, L.S.—Curcubita
17 ,, ,, T.S. ,,
18 Spiral vessels—Rhubarb
19 Starch grains *in situ*—Potato
20 Stellate pith—Rush
21 Stinging hairs—Nettle
22 Raphides—Onion
23 Vegetable cells—cell wall and nucleated protoplasm—Maize
24 Woody cells with bordered pits—Pinus

12769 24 Slides (Comparative Anatomy) in Case complete **£2 10 0**

1 Anther sac with pollen, *in situ*
2 Antheridia of Moss
3 Archegonia of Moss
4 Bud of Lily, section, showing ovary, anthers, petals, pollen grains, etc. *in situ*
5 Capsule of Moss-Polytrichum
6 Conjugation-Spirogyra
7 Desmid, Micrasterias
8 Fertile branch of Chara
9 Leaf, Vert. Sect., showing stomata
10 Microspores and Macrospores in Sporocarp of Pilularia
11 Pollen *in situ* on stigma
12 Protococcus viridis
13 Root, L.S., showing root cap
14 ,, T.S., showing branch
15 Section of angiospermous ovary
16 Sorus of Fern, Vert. Sect.
17 Stem of Aquatic Dicotyledon, Marestail
18 Stem of Monocotyledon, Maize, Trans. Sect.
19 Stems (T.S.) of Monocotyledon, Dicotyledon, and Gymnosperm, mounted separately on one slide, **2/6**
20 Stem of Lycopodium clavatum
21 Stem of Pinus sylvestris, 1, 2, and 3 years' growth, mounted separately on one slide, **2/6**
22 Stem of Selaginella
23 Wheat grain and embryo, Long. Sect.
24 Yeast

12770 24 Slides. This Set has been arranged to cover the Intermediate B.Sc. Course as approved by the University of London. In Polished Oak Case **£2 2 0**

1 Chlamydomonas
2 Pleurococcus Viridis
3 Spirogyra nitida
4 Œdogonium
5 Vaucheria
6 Fucus serratus. Male Conceptacle
7 ,, ,, Female ,,
8 Saccharomyces cerviseæ
9 Peronospora infestans
10 Mucor Mucedo
11 Eurotium
12 Agaricus campestris
13 Bacillus Subtilis, **2/6**
14 Micrococcus Prodigiosus, **2/6**
15 Funaria. L.S. Capsule
16 Pellia L.S. Developing Sporogonium
17 Aspidium, Sorus
18 Selaginella, Fertile Spike
19 Lycopodium, T.S. Stem
20 Cycas revoluta, Leaf
21 Pinus Stem, Trans. Sect.
22 Pinus, Long. Sect., Ovule
23 Orchid, T.S. Ovary
24 Mature Anther of Lily

COLLECTION OF BOTANICAL SLIDES.

Arranged to meet the requirements of the Board of Education and Intermediate Science Examinations, and for use with various Text-books.

=12772 Elementary Botany—Collection "A." Collection **24** Slides, in Box ... ... nett **£1 6 6**

Selected to show the structure of Roots, Stems, etc., as detailed below.

Vicia, L.S. Root apex—Plerome, Periblem, Dermatogen, Rootcap
Vicia, T.S. Root—Young Primary Xylems and Phloem
Hordeum, E. Rootlet—Root Hairs and Root Cap
Zea Mais, T. & L.S. Root—Typical Monocotyledon
Helianthus, T. & L.S. Stem—Typical Dicotyledon
Tilia, T.S., T.L.S., R.L.S. Stem—Arboreous Dicotyledon—Secondary Thickening
Sambucus, T.S. Stem—Lenticels
Zea Mais, T. & L.S. Stem—Typical Monocotyledon
Cucumis, T. & L.S. Stem Sieve Tubes and Plates
Pteris, T. & L.S. Rhizome, Polystelic—Scalariform Vessels.
Fraxinus, T.S.—Leafbud Prefoliation
Fagus, T.S. Leaf—Typical Leaf Structure
Narcissus, E. Epidermal Cells—Stomata and Guard Cells.
Acer, L.S. Stem node—Leaf-fall—Phylloptosis
Lilium, T.S. Flower-bud. Arrangement of parts for Floral diagram
Lilium, T.S. Ovary—Embryo Sac
Œnothera Stigma V.S.—Pollen Grains and Tubes
Capsella, E. Embryos *in situ* in capsule
Triticum, L.S. Fruit—Embryo and Starch
Phajus, T.S. Pseudobulb—Leucoplastids
Solanum—Tuber T.S. Starch *in situ*
Dahlia, T.S. Tuber. Inulin
Circæa, E. Leaf—Raphides
Ricinus, T.S. Seed—Aleurone

=12773 Intermediate Botany—Collection "B." Supplementary to Collection "A." Collection of **24** Slides, in Box ... ... nett **£1 6 6**

Chiefly Structure of Angiosperms and Gymnosperms.

Hippuris, T.S. Stem—Aquatic—Air Cavities
" L.S. Stem apex—Meristem
Buxus—Leaf. Upper and Under Epidermis and Mesophyll
Prunus, T.S. Leaf
Verbascum, T.S. Leaf—Branched Hairs
Empetrium, T.S. Leaf—Xerophyte
Erica, T.S. Leaf—Xerophyte
Ammophila (Psamma), T.S. Xerophyte—Rolled Grass Leaf
Potomageton, T.S.—Floating Leaf
Utricularia, E. Leaves—Bladders
Vicia, E.—Anther and Stigma
Triticum, E. Flower
Drosera, E. Leaf—Glandular Hairs
Pinus, T.S. Root—Tertarch arrangement
" T. & L.S. Young Stem
Pinus, T.S. Old Wood
" R.L.S. Old Wood
" T.L.S. Old Wood
" T.S. Leaf
" L.S. Ovule
Sphagnum, E. Leaf
Saccharomyces—Yeast Cells—Budding
Mucor—Sporogonia
Eurotium—Condiospores

=12774 Advanced Botany—Collection "C." Supplementary to Collections "A" and "B." Collection of **24** Slides, in Box ... ... nett **£1 6 6**

Cryptograms—Structure and Development.

Lycopodium, T.S. Stem
Selaginella, T.S. Stem
" E. Sporophyll—Micro- & Macrospores
Dryopteris Filix—Mas E. Prothallus
" T. & L.S. Rochis
" T.S. Frond—Sorus with Sporangia
Funaria, E. Leaf
" Antheridia
Funaria, E. Archegonia
" E. Peristome
Pellia, T.S. Thallus—Antheridia
" " " Archegonia
" L.S. Sporogonium
Fucus, T.S. Conceptacles—Antheridia & Oogonia
Spirogyra, E.—Conjugation and Zygospores
Ulothrix, E.
Nostoc, E.
Gleocapsa, E.
Pleurococcus, E.
Agaricus, T.S. Stripe
" T.S. Pilens
Pythium, E.
Collema, T.S.
Parmelia, T.S.

=12775 Angiosperms—Collection "D." Collection of **48** Slides, in Box... ... ... nett **£2 8 6**

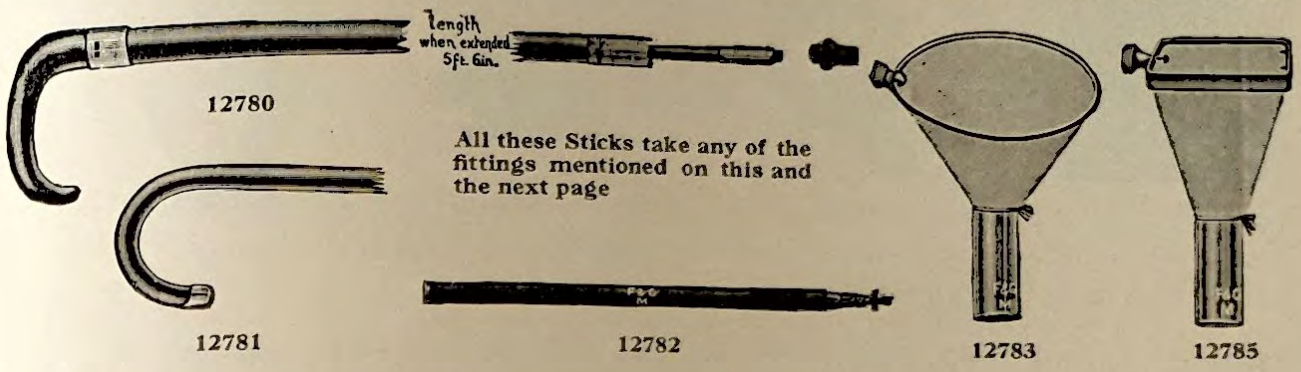
Allium, L.S. Root Apex—Mitosis
Tradescantia, L.S. Stem—Direct Nuclear Division
Lepidium, E. Root Hairs and Root Cap
Vicia, T.S. Young Root—Interfascular Cambium
" " Older Root—Secondary thickening
Iris, T.S. Root—Thickened Endodermis
Dendrobium, T.S. Root—Velamen
Hippuris, V.S. Stem apex—Apical Meristem
" T.S. " " Aquatic—Air Cavities
Helianthus, T. & L.S. Stem—Herbaceous Dicotyledon
Tilia, T.S., R.L.S., Stem—Arboreous Dicotyledon
Auricula, T.S. Stem—Polystelic Dicotyledon
Piper, T.S. Stem—Anomalous Dicotyledon—Scattered Bundles
Ribes, T.S. Stem—Phellogen—Cork
Syringa, T.S. Stem—Lenticel
Cucumis, T. & L.S. Stem—Sieve Tubes and Plates
Zea Mais, T. & L.S. Stem—Typical Monocotyledon
Ruscus, T.S. Stem—Typical Monocotyledon
Dracæna, T.S. Stem—Secondary thickening in Monocotyledon
Tamus, T.S. Stem—Anomalous Monocotyledon
Prunus, T.S. Leaf—Typical Leaf Structure (Dicot)
Hakea, T.S. Leaf Centric—Xerophyte
Ammophila, T.S. Leaf Xerophyte—Rolled Grass Leaf
Potamogeton, T.S. Leaf—Typical Floating Aquatic
Narcissus, E. Epidermal Cell Leaf—Stomata and Guard Cells
Saxifraga, T.S. Leaf—Water Stomata. Chalk Glands
Fagus, T.S. Leaf-Bud—Prefoliation
Acer, L.S. Stem—Node—Leaf Fall—Phylloptosis
Verbascum, T.S. Leaf—Protecting Hairs
Œnothera Stigma, V.S.—Germinating Pollen Grains
Hyacinth—Pollen Grains, E.
Lilium, T.S. Bud (Young), Early stage Anthers—Archesporium
Lilium, T.S. Bud (Young), Pollen Mother Cells—Division
Lilium, T.S. (Older), Mature Anthers in T.S.
" " " Dehiscent Anthers and Ripe Pollen
Lilium, T.S. Ovary—Embryo Sac
Capsella, H.L.S. Capsule—Embryo in L.S.
Triticum, L.S. Fruit—Embryo, Scutellem—Starch
Solanum, T.S. Tuber—Starch in cells
Phajus, T.S. Pseudobulb—Leucophastids
Ricinus, T.S. Seed—Aleurone Grains
Scorzonera, T.S. Root—Latex vessels
Dahlia, T.S. Tuber—Inulin
Rheum, T.S. Root—Crystals
Ficus, T.S. Leaf—Cystoliths
Agave, T.S. Leaf—Raphides
Nymphaea, T.S. Petiole—Idioblasts
Ornithogalum, T.S. Seed—Thickened Cell Wall

=12776 Gymnosperms and Cryptograms—Collection "E." Collection of **48** Slides, in Pine Cabinet, nett **£2 8 6**

Pinus, T.S., R.L.S., T.L.S. Stem—Annual Rings, Resin Ducts, Bordered Pits
Pinus, T.S. Leaf—Centric—Resin Ducts
" " Old and Young Root—Tetrach arrangement
Pinus, L.S. Staminate Strobilus—Developing Pollen
Pinus, L.S. Ovule
Selaginella Willdenovii, T.S. Stem—Polystelic
Kraussiana, T.S. Stem—Monostelic and T.S. Rhizophore
Selaginella Kraussiana, E. Sporophyll—Micro- and Megaspores
Lycopodium, T.S. Stem
Equisetum, T.S. Stem
" " Strobilus—Spores and Elaters
Ophioglossum, L.S. Sporangia—Sporogenesis
Pteris, T. & L.S. Rhizome
Pteris, T.S. Pinnule—Marginate Sporangia
Dryopteris Filix-Mas, T.S. Rachis. (Aspidium)
" " " Root
" " V.S. Sori—Sporangia
" " E. Prothallus—Antheridia and Archegoni
Polytricum, T.S. Stem
" " Leaf
Funaria, E. Protonema and Rhizoids
" V.S. Antheridial Head
" Teased Preparation, Archegonia
" L.S. Sporogonium
Sphagnum, Leaf, E.
Pellia, V.S. Thallus—Antheridia
" " " Archegonia
" " " Sporogonium (Young)
" E. Thallus—Sporogonium—Spores escaping
Marchantia, V.S. Thallus—Gemmæ
Marchantia, V.S. Antheridiophore
" " Archegoniophore
" " Sporogonia
Mucor mucedo—Mycelium and Sporangia
" stolonifer—Zygospores
Pythium—Teased—Asexual reproduction
Eurotium, E.—Conidiaspores
Penicillium, E.—Conidiaspores
Saccharomyces, E. —Budding
Coprinus, V.S. Pileus—Basidia
Physcia, V.S. Thallus with Apothecia
Spirogyra—Conjugation and Zygospores
Pleurococcus, E. Vegetative Cells
Vaucheria, E. Antheridia and Archegonia
Ulothrix—Filaments with Zoogoaidia
Oedogonium—Filaments with Oogonia
Nitella, E. Antheridia and Oogonia
Fucus, T.S. Conceptacles—Antheridia and Oogonia

Pond Life Apparatus, etc.

The following Apparatus is the outcome of many years' practical experience; each piece has been improved and modified from time to time and may now be fairly considered the most durable and reliable on the market.



12780 12781 12782 12783 12785

=12780 **Collecting Stick,** Malacca Cane, with inner lengthening rod, total extension 5 ft. 6 in. £1 7 6

=12781 Ditto, ditto, Polished Cane, neat and light, with inner lengthening rod 0 12 6

=12782 Ditto, ditto, Brass, Telescopic, closed 13 in., opens to 48 in., very portable, must not be used in sea water 0 8 6



12786 12787 12788 12789 12790 12791

=12783 **Round Net Frame,** suitable for above Sticks, 5 in. diameter, complete with bolting silk net and tube £0 5 0

=12784 **Round Net Frame,** 6 in. diameter as above 0 7 0

=12785 **Square Net Frame,** 4 in. side, complete with silk net and tube 0 9 0

=12786 **Canvas Net,** 9 in. diameter, on brass ring 0 4 0

=12787 **Strainer,** Zinc, new pattern, with removable top 0 5 0

=12788 **Clip,** for fixing strainer with Stick 0 2 6

=12789 **Cutting Hook,** rigid oval pattern, for use among weeds 0 3 0

=12790 **Shell Scoop,** strong with perforated bottom 0 6 0

=12791 **Spoon Strainer,** for skimming surface of ponds 0 2 9



12792



12795



12796

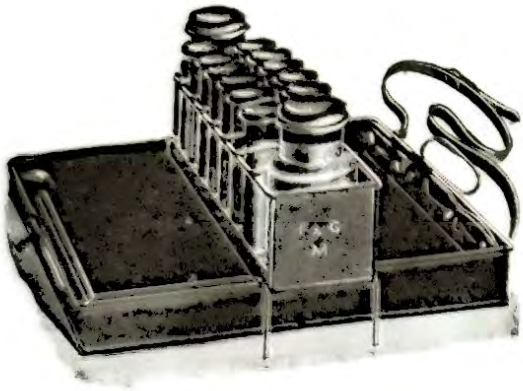


12797

12792	**Waterproof Bags** for Nets—best quality proofed both sides. Small, about 7×6 in.	£0 1 8
12793	Medium ,, 8×7 in.	0 2 0
12794	Large, suitable for all nets, 9×8 in.	0 2 6
12795	**Diatom Suction Bulb**, stout glass, for collecting diatoms from the bottom without disturbing the mud. With Ball and 6 ft. Tubing	0 8 0
12796	**Grapple**, flat pattern, for pocket, blunt points with 8 yards Cord and Wood Frame ...	0 3 9
12797	**Cheap Water Net**, 8 in. diameter (muslin), with detachable screw socket, for Bamboo without stick	0 3 0



12798



12800

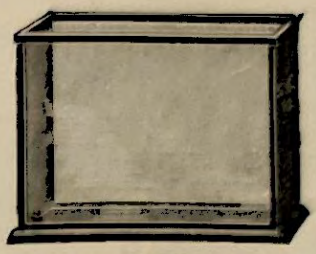


12799

12798	**Pocket Tube Case**, gold lacquered, with 5 corked tubes 2¼ × ⅝ in. each 1/2 per doz.	£0 12 0
12799	Ditto Larger Pattern Japanned 8½ × 4½ × 1⅝ in., with handle and 6 thick tubes 3½ × 1¼ in., as illustrated	0 9 6
12800	**Large Collecting Case**, 12½ × 5½ × 3½ in., as above, with 2 large bottles and 12 thick tubes 3½ × 1¼ in., Pipette with Rubber Bulb, spaces for pond net and knife, handle and shoulder strap. The frame carrying the tubes is made to slide out, the case then forming a handy vasculum for collecting plants, etc.	1 5 0



12801



12802



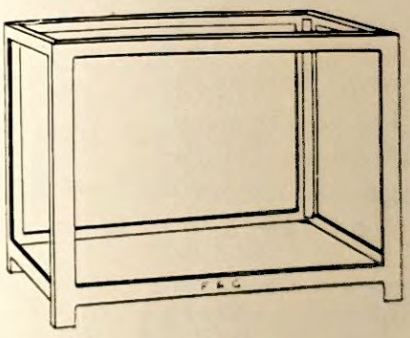
12803-4

=12801 (F) **Aquaria,** all glass on Feet, 4×4×1¼ in.... ... ... each **£0 7 6**

=12802 **Aquaria,** metal bound, lined with Opal Glass and clear Glass side.

	5×3⅜×1 in.	6⅛×5×1½ in.	8⅞×6½×2½ in.	12×8×3½ in.	
	5/9	**7/9**	**10/-**	**15/-**	each

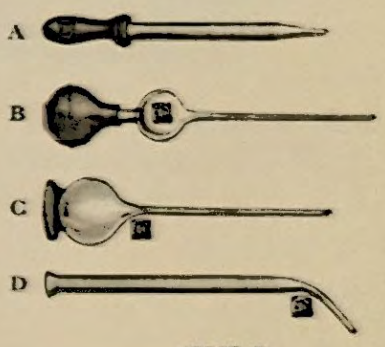
=12803	**Aquaria,** Rectangular, clear Glass Case.	12×8×4 in.	16×10×8 in.	22×12×11 in.	
		7/6	**15/6**	**25/0**	each
=12804	Complete with Wood Base and Cover	**21/0**	**35/0**	**50/0**	„



12805



12806



12807-9

=12805 **Aquaria,** strong welded Steel Frames, slate bottom. The two larger sizes have Plate Glass Sides

18×12×12 in.	... ...	**£2 0 0**
24×12×12 „	... ...	**2 10 0**
30×12×12 „	... ...	**3 10 0**
36×15×15 „	... ...	**5 0 0**
48×15×15 „	... ...	**7 10 0**

=12806 **Aquaria,** Round, clear Glass, height slightly more than diameter.

Diameter	6	7	8	9	10	12	14	16	in.
On Black Wood Base	**6/0**	**7/0**	**7/6**	**8/6**	**10/0**	**11/6**	**16/0**	**20/0**	each

		A	B	C	D	
=12807	**Pipettes.**					
	Complete with Rubber Ball	**—**	**7d.**	**—**	**6d.**	each
=12808	With Rubber Teat or Cap	**3d.**	**—**	**6d.**	**4d.**	„
=12809	Pipette only	**1d.**	**3d.**	**4d.**	**2d.**	„
		10d.	**2/9**	**3/6**	**1/9**	doz.

(F) Foreign manufacture.

Physical Geography and Surveying



12820-21

*12820 **Plane Table**, Superior Quality, fitted with Slotted Hardwood battens. Turntable with clamping screw and folding Tripod Stand, complete with compass and rule as above, but without cases ... ...

Size	18×16	24×18	30×24
Each	**£4 10 0**	**£5 5 0**	**£6 0 0**

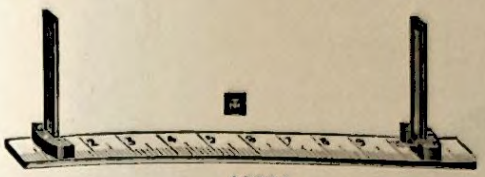
*12821 Ditto, ditto, as No.12820 but without Trough Compass and sight rule

Size	18×16	24×18	20×24
Each	**£3 2 6**	**£3 17 6**	**£4 12 6**

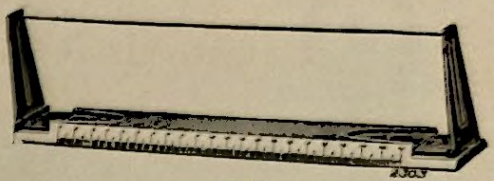


12822

*12822 **Plane Table**, strongly made for class use, consisting of a clamped drawing board, 24×18 in., fitted with turntable and clamping screw on 3-fold Ash Tripod Stand, complete **£2 2 0**



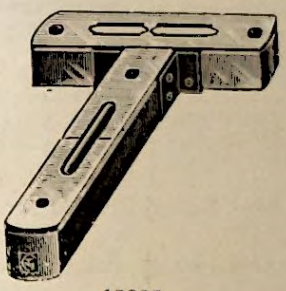
12823



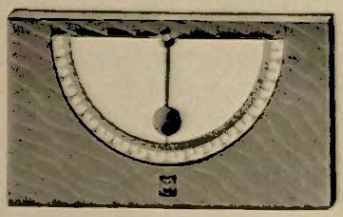
12824

*12823 **Sight Rule,** Brass, for use with Plane Tables, No. 12822, 12 in. long divided into $\frac{1}{16}$ in., fitted with Brass sights £0 13 6

*12824 Ditto, ditto, superior quality, Polished Boxwood, Engine Divided, fitted with Brass Vane and sighting cords, 12 in. long ... ... each 1 5 0



12825



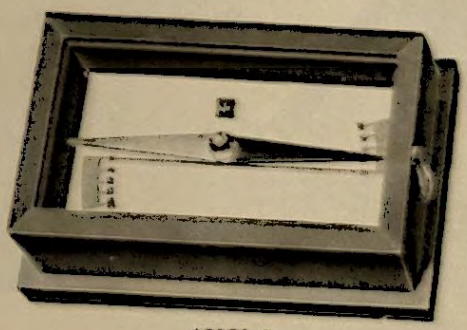
12826

*12825 **Spirit Level,** for use with Plane Tables, T shape in Polished Walnut Frame each £0 3 0

*12826 **Clinometer,** simple, fitted with Stout Card Scale on Polished Teak Stand 0 4 0



12827



12828-9

*12827 **Clinometer Compass,** metal dial, mounted on metal base in Mahogany Box each £0 18 9

*12828 **Trough Compass,** for use with Plane Table, No. 12822, fitted with Agate Centre Needle, 3 in. long, card dial in Polished Teak Cases ... ... each 0 4 6

*12829 Ditto, ditto, as above, fitted with stop 0 5 6



12830-33



12835



12834

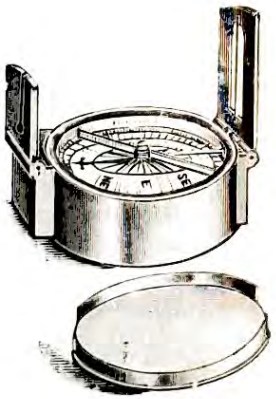
	12830	**Compasses,** with Card Dial in Brass Case with Bevelled Glass tops	35	45	50	mm. dia.	
			1/6	**1/8**	**2/0**	each	
(F)	**12831**	Ditto, ditto, but fitted with Stop	**2/0**	**2/3**	**2/9**	,,	
(F)	**12832**	Ditto, ditto, with Metal Dial without Stop	**2/3**	**3/0**	**3/9**	,,	
(F)	**12833**	Ditto, ditto, with Metal Dial and Stop	**2/9**	**3/6**	**4/6**	,,	
	*12834	Surveying Compass, in Bronzed Spring Hunter Case, Metal Dial, Raised Divided Ring, Bar Needle, Agate Centre with Stop, $1\frac{3}{4}$ in. dia.					**£0 12 6**
	*12835	Circular Oak Box Compass for Educational purposes, card dial, lozenge shape needle					
		$6\frac{1}{2}$ in.				each	**0 9 9**
		$8\frac{1}{2}$ in.				,,	**0 11 3**



12836



12837



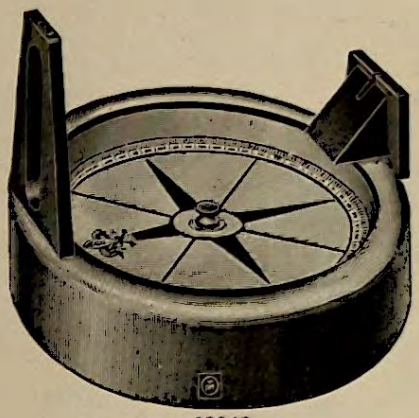
12838-40

*12836	**Sextant,** Model, fitted with Mirrors, etc., Aluminium Frame with Vernier reading to $\frac{1}{10}$th mm.	**£1 8 6**
*12837	**Aluminium Sextant** for Educational purposes, with vernier reading to $\frac{1}{10}$ths. Mirror and half mirror, the latter being adjustable. Sights fitted with smoked glass for use with artificial horizon, in case, complete	**2 5 0**
12838	**Sight Compass,** Brass, Bronzed, with best edge Bar Needle, Agate Cap, and Stop, $2\frac{1}{4}$ in.	**1 2 6**
12839	Ditto, ditto, ditto, $2\frac{1}{2}$ in.	**1 5 0**
12840	Ditto, ditto, ditto, 3 in.	**1 8 6**

(F) Foreign Manufacture.



18241-2

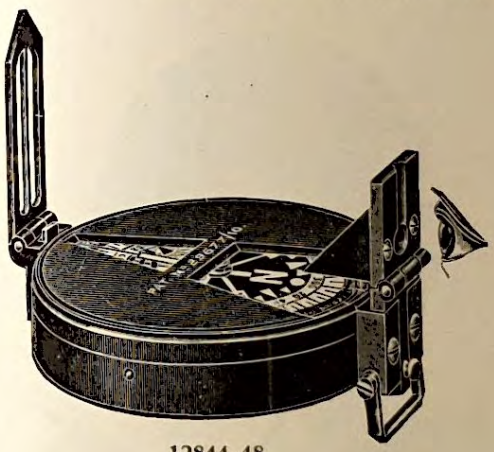


12843

*12841 **Sight Compass,** Colonial or Service Pattern, in Bronzed Snap Hunter Case, Enamelled Card, Dial, Bold Red N. Bar Needle, Agate Cap and Stop divided every 2°, and figured every 20° to 360°, 2¼ in. £1 1 0

*12842 Ditto, ditto, with Engraved Metal Dial 1 2 6

*12843 **Prismatic Compass.** A floating Card Dial, 3 in. in diameter, numbered from 0 to 360°. The Card is of a green shade, restful to the eye. Fitted in Circular Wooden Case, about ¾-in. deep, neatly turned and polished, with adjustable Prism and Sight of blackened steel 1 1 0



12844-48



12849-50



12851

Hutchinson Form Prismatic Compass. Patent Illuminated. Treated with Radium Compound for Night Work and use in Mines. Patent No. 29677.

*12844 **Plain Prismatic Compass,** with fixed Cover, Aluminium Outer Edge Transparent, Illuminated with Radium Compound, complete in Solid Leather Sling Case ... ... Dia. of Box, 3 in. nett £4 4 0

*12845 Ditto, ditto, ditto ... ... „ 4 „ „ 5 2 0

*12846 Ditto, ditto, Ordinary Hutchinson Prismatic Compass, Card Dial without Radium Compound, in Morocco Case ... ... Dia. of Box, 2 in. nett 2 5 0

*12847 Ditto, ditto, in Solid Leather Sling Case ... ... „ 3 „ „ 2 12 6

*12848 Ditto, ditto „ „ „ ... ... „ 4 „ „ 3 15 0

*12849 **Land Chains,** of best Iron Wire, with 3 Oval Rings, Brass Swivel Handles, and Tallies. The 2 and 4 Pole Chains are divided into Links and tallied at every 10 Links. The 50 and 100 feet Chains are divided into feet and tallied at every 10 feet ... ...

	Length	2 poles	4 poles	50 ft.	100 ft.
	No. 9 W.G.	11/6	17/6	13/0	20/0

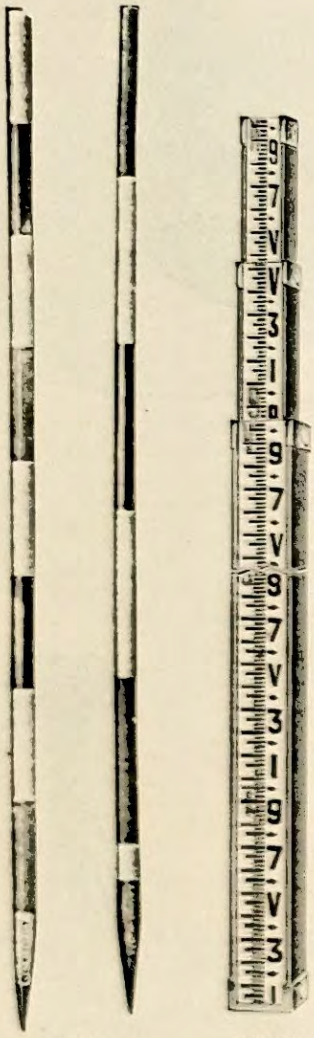
*12850 **Land Chains,** of Best Iron Ware, with two Oval Rings, Brass Swivel Handles and Tallies—

	Length	2 poles	4 poles	50 ft.	100 ft.
	No. 9 W.G.	10/0	16/0	12/0	18/6

*12851 **Land Chain Arrows,** 15 in. long in sets of 10, made of Best Iron Wire ... ... per set £0 2 9



12853



12854 12855

*12853 **Pocket Levelling Rods,** made of the best Woven Linen Tape, 2 in. wide, these can be coiled up and carried in the pocket and when used tacked on to a board or stick. Marked on one side in feet, 10ths, and 100ths—

Length	6	9	10	12	feet
	8/0	9/6	13/6	16/0	each

*12854 **Ranging Poles,** each 6 ft. long, 1 in. dia., fitted with Iron Shoes. Painted in two colours, Black and White or Red and White ... £0 6 0
per doz. 3 8 0

*12855 **Levelling Staff Sopwith,** Polished Mahogany, Brass mounted, with painted readings. Feet, 10ths, and 100ths.

Length	12	14	16	feet
	£4 7 6	£5 5 0	£6 0 0	each



12856-7



12858-61

*12856 **Steel Tapes** (Chesterman's), width of Tape ⅜ in. Marked one side only in feet, inches and ⅛ths, with latest pattern flush handles.

Length	25	33	50	66	100	feet
	12/0	14/0	19/0	22/0	31/0	each

*12857 Ditto, ditto, but width of tape ½ in. 14/0 16/0 23/0 28/0 39/0 „

*12858 **Metallic Tapes** (Chesterman's), Superior Quality. Marked inches and feet, in Stout Leather Cases with folding Handles—

Length	25	33	50	66	100	feet
	8/0	9/6	11/6	13/6	18/6	each

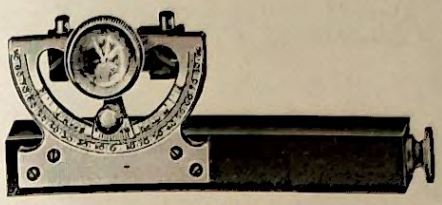
*12859 Ditto, ditto, as above with Flush Handle, as illustrated 9/0 10/3 12/6 14/9 20/6 „

*12860 Ditto, ditto, (Chesterman's), cheaper quality, width of tape $\frac{3}{16}$ths, in Leather Case with folding Handle—

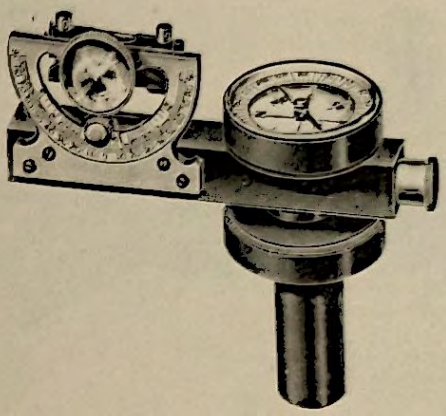
Length	25	33	50	66	100	feet
	4/0	4/6	6/0	7/0	9/0	each

*12861 Ditto, ditto, with Flush Handle, as illustrated 5/6 6/0 7/6 8/6 11/0 „

Abney Levels

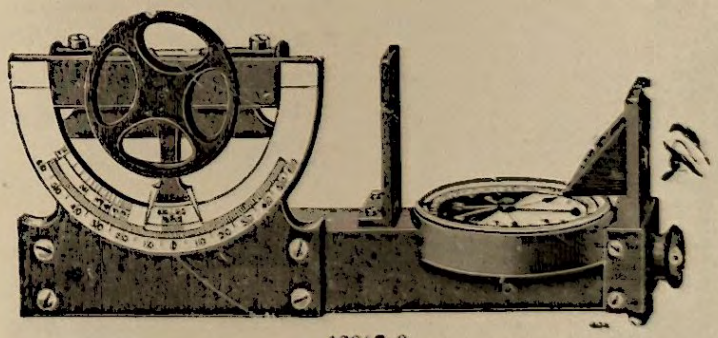


12863



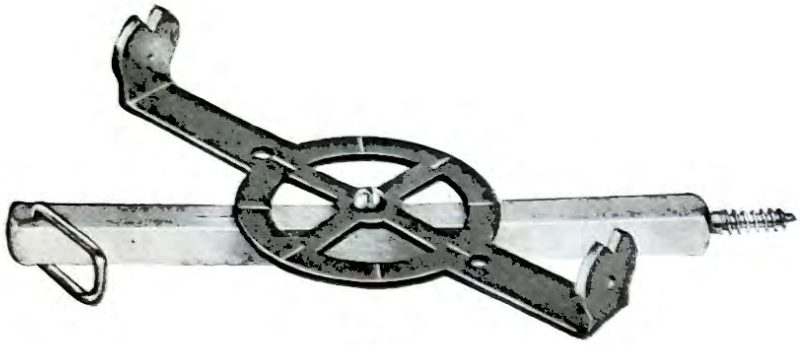
12866

*12863	5 in. Abney Level, Silvered Divided Arc, Clamp to Vernier, in Sling Leather Case, with separate Magnifier	£2 11 6
*12864	Ditto, Extra Large Arc	3 3 0
*12865	Ditto, with Graduated Ring Compass, with Bar Needle, also Socket Piece	3 10 6
*12866	Ditto, with Raised Graduated Ring Compass, Draw Telescope, Revolving Base and Socket Piece	3 15 0



12867-8

*12867	5 in. Abney Level and Prismatic Compass combined, Large Arc Divided to Degrees, with Vernier, reading to 10 ft., Card Dial, Compass with Magnifier, in Solid Leather Case	£5 5 0
*12868	7 in. Ditto, with Draw Telescope, Vernier, reading to 5 ft.	6 10 6



12870



12871

=12870 **Philip's Pocket Surveyor, designed by George C. Sherrin.** Made throughout of Oxidised Steel; rustless and highly durable. When closed, occupies hardly any more space than a pocket knife. Always ready for "spotting" levels, calculating heights of buildings and trees, gradients, and areas; for setting right-angles for sports grounds; and for simple map-making and contouring. A neat little pocket instrument—a great deal more than a toy. Provides a means by which levels, gradients, and a variety of measurements may be quickly calculated, nett **£0 2 9**



12872

=12871 **Handy Theodolite.** A new pocket instrument, compact, convenient, and durable; of practical value for a variety of purposes, such as taking levels, measuring heights and gradients, etc., etc. Size 4½ in. diameter. Beautifully moulded in ebonite composition with nickel-plated parts. Supplied in leatherette case, with explanatory pamphlet ... ... nett **0 17 6**

*12872 **Theodolite,** simple form, for use in the teaching of Practical Geography and Surveying. Aluminium Beam, 15 in. long, on Horizontal Table, divided 0-360°, the Beam elevation is measured by a vertically mounted Silvered Engraved Scale reading 0-90° up and down, both scales reading approximately to $\frac{1}{10}$th degree, with two Levels for adjustment mounted on Folding Tripod Stand ... **5 0 0**

Improved Pocket Theodolite. Patent No. 22499/13. A most Useful and Compact Instrument for Architects, Engineers and Surveyors.

This serviceable little Instrument only measures 4¼ in. high. Telescope 5½ in. long, fitted with cross webs for reading off staff, or levelling.

The horizontal and vertical circles are divided to single degrees with verniers reading to 10 minutes; the vertical Arc has also a proportion scale, which can be had in metric system if required.

The Compass is of the circular type, fitted with edge bar needle and agate cap, also stop to prevent unnecessary wear to both agate and point. The brass telescopic stand measures 16 in. closed, and 4 ft. 3 in. extended. It has the four screw levelling plates, also plumb bob and hook.

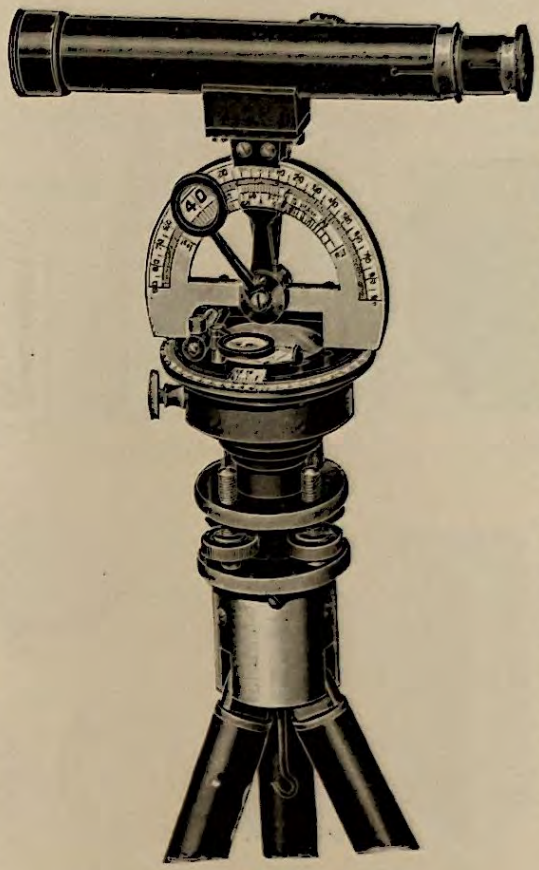
Size of the instrument case, in solid leather, with sling, 6 × 4¾ × 2¾ in. Ditto for stand, 16½ in.; dia. 2 in.

Illustration two-thirds Full Size.

Weight of Instrument in Case, 1 lb. 6 oz.

Weight of Stand in Case 2 lb. 4 oz. Height, 4 ft. 3 in.

As this instrument resembles the larger instruments, and its readings being taken in a similar manner, which is well known, it is not necessary to give a full detail of uses, etc. But the following tables will be found of much assistance.



12874

For finding Heights of Buildings, etc.—The instrument is aligned on the objective and the division on the proportion scale noted, which coincides with upper edge of vernier. The distance from the observer's position to the base of the objective is now measured, and the distance divided by the figure noted; the result, plus height of observer, is the required height. For example, supposing the vernier edge cuts division 3, and the distance is 150 ft., 150 ÷ 3 = 50 + height of observer = height of object.

The following tables will be found of much assistance. Table A gives certain angles of elevation or depression, which give unity of rise per amount of run. Thus 18° of elevation gives 1 vertical to 3·0 horizontal. Table B gives certain angles up to 85° the amount of rise or fall per 100 of run, measured horizontally. Heights can therefore be found as follows: Thus, for 4° of elevation the rise would be 7·0 per 100 horizontal, and an object 300 ft. from the observer extending an angle of 4° would be 7·0 × 3 = 21 ft. in vertical height.

Table A.

Degrees	One in	Degrees	One in	Degrees	One in	Degrees	One in	Degrees	One in	Degrees	One in
1	57·0	6	9·5	10	5·6	18	3·0	26	2·0	34	1·43
2	28·6	7	8·1	12	4·7	20	2·7	28	1·88	36	1·37
3	19·0	8	7·1	14	4·0	22	2·4	30	1·73	38	1·23
4	14·3	9	6·3	16	3·4	24	2·2	32	1·60	45	1·0
5	11·4										

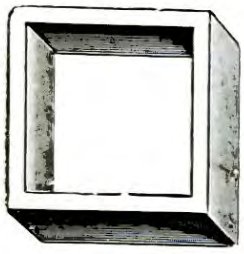
Table B.

Horizontal Distance = 100. Angle.	Rise or Fall.	Horizontal Distance = 100. Angle.	Rise or Fall.	Horizontal Distance = 100. Angle.	Rise or Fall.	Horizontal Distance = 100. Angle.	Rise or Fall.
1	1·7	10	17·7	18	31·8	50	110
2	3·5	11	19·5	19	34·5	55	143
3	5·3	12	21·4	20	36·6	60	174
4	7·0	13	23·2	25	46·9	65	214
5	8·8	14	25·2	30	58·0	70	275
6	10·6	15	26·9	35	70·5	75	303
7	11·3	16	28·7	40	84·2	80	575
8	14·1	17	30·7	45	100·0	85	1143
9	16·0						

=12874 Price of Instrument and Stand complete, in Strong Brown Leather Sling Cases ... ... nett £15 0 0

Drawing Models

These Models are made of well seasoned wood, well-finished, accurate, and durable; painted dead white, but can be had any tint to special order, also made up in Sets to meet the Government requirements.



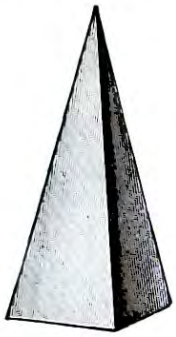
12876



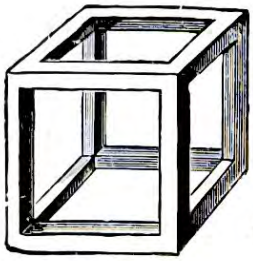
12877



12878



12879



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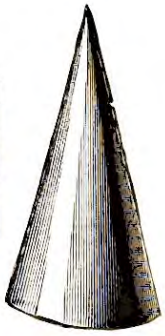

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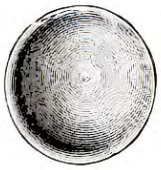
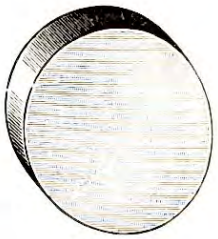


12888



12889

= 12876	**Hollow Prism**, 14 × 14 × 4½	...	...	...	...	...	...	...	...	...	...	**8/0**	each nett
= 12877	**Cubes**	...	...	...	6	9	10	12	14	in.			
					3/6	**11/0**	**12/0**	**17/6**	**20/0**	each nett			
= 12878	**Pyramids**, Hexagonal ...	...	...	...	...	12 × 8	14 × 9	15 × 7	22½ × 14	in.			
						11/0	**16/0**	**12/0**	**29/6**	each nett			
= 12879	Ditto, Square	...	...	...	...	...	...	14 × 10					
						9/6	**13/6**	**13/6**	**29/6**	„ „			
= 12880	**Cubes**, Skeleton ...	...	...	...	...	...	8	10	12	19	in.		
							8/0	**9/6**	**15/0**	**33/6**	each nett		
= 12881	**Cones**	...	...	12 × 8	14 × 9	15 × 10	18 × 10	18 × 12	22½ × 13	in.			
				11/0	**13/6**	**13/6**	**16/0**	**21/6**	**27/0**	each nett			
= 12882	**Prisms**, Hexagonal	...	12 × 8	15 × 7	12 × 9	15 × 9	18 × 12	18 × 14	in.				
			8/0	**13/6**	**13/6**	**15/0**	**24/0**	**27/0**	each nett				
= 12883	Ditto, Square	...	12 × 6	15 × 5	12 × 8	15 × 7	15 × 7½	18 × 12	in.				
			7/0	**7/6**	**13/6**	**13/6**	**13/6**	**24/0**	each nett				
= 12884	Ditto, Triangular	...	...	...	...	...	...	2 × 8	15 × 8	in.			
								9/6	**12/0**	each nett			
= 12885	**Cylinder**	...	...	...	...	...	12 × 4	12 × 8	16 × 13	in.			
							10/0	**12/0**	**28/0**	each nett			
= 12886	**Semi-Cylinder**	...	...	...	...	...	...	...	12 × 4	in.			
									8/0	nett			
= 12887	**Ring**	...	...	...	...	...	...	8 × 1	12 × 1½	in.			
								7/0	**9/0**	each nett			
= 12888	**Sphere**	...	...	...	...	...	...	8	9½	in.			
								12/0	**16/0**	each nett			
= 12889	**Flat Cylinder**	...	...	...	...	...	...	10 × 2½	12 × 4	in.			
								5/6	**10/0**	each nett			

=12891 **Set of Drawing Models, No. 1** ... ... nett **£4 0 0**

9 Cubes, 6 in.
Hexagonal Prism, 12× 8 in.
Square Prism, 12× 6× 6 in.
Hexagonal Pyramid, 12× 8 in.
Hollow Prism, 12× 14× 4½ in.
Cyliner, 12× 8 in.
Cone, 12× 8 in.
Cylinder, 12× 4 in.
Semi-Cylinder, 12× 4 in.
Cylinder, 10× 2½ in.
Strong Wooden Box, with Hinged Lid, suitable for keeping the Models in 12/- extra.

=12892 **Set of Drawing Models, No. 2** ... ... nett **£6 0 0**

Cube, 10 in.
3 Cubes, 6 in.
Hexagonal Prism, 12× 8 in.
3 Square Prisms, 12× 6× 6 in.
Triangular Prism, 12× 8 in.
Hexagonal Prism, 12× 8 in.
Hollow Prism, 14× 14× 4½ in.
Cylinder, 12× 8 in.
Cone, 12× 8 in.
Cylinder, 12× 4 in.
Semi-Cylinder, 12× 4 in.
Sphere, 8 in.
Ring, 12× 1½ in.
Strong Wooden Box, with Hinged Lid, suitable for keeping the Models in, 14/6 extra.

SPECIAL EXAMINATION SETS

=12893 **Set of Drawing Models, No. 1,** Elementary Stage ... ... nett **£5 7 6**

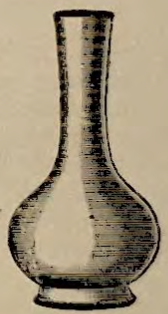
No. 1. Cone, 15× 10 in.
,, 2. Ring, 12× 1½ in.
,, 3. Square Prism, 15× 7½ in.
,, 4. Vase, 12¾× 6½ in. Bottle shape (white)
,, 5. Cylinder, 12⅛× 8 in.
No. 6. Cube, 10 in.
,, 7. Vase, 9½× 8¼ in. (terra-cotta)
,, 8. Hexagonal Prism, 15× 9 in.
,, 9. Triangular Prism, 15× 8 in.
,, 10. Square Pyramid, 14× 10 in.
Strong Wooden Box, with Hinged Lid, suitable for keeping the Models in, 14/- extra.

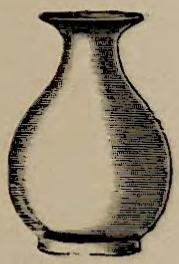
=12894 **Set of Drawing Models, No. 2,** Advanced Stage ... ... nett **£2 4 0**

No. 11. Sphere, 9½ in.
No. 12. Skeleton Cube, 12× 1¾ in.
No. 13. Vase, 10¼× 7 in. (red glazed)
No. 14. Cube, 6 in.
Strong Wooden Box, with Hinged Lid, suitable for keeping the Models in, 10/- extra.


12895


12896


12897


12899


12900


12901

=12895	**Vase,** Solid Wood, painted Dead White for Elementary Stage	nett	£0 7 0
=12896	Ditto, ,, ,, ,, ,, ,, ...	,,	0 7 0
=12897	Ditto, ,, ,, ,, ,, ,, ...	,,	0 9 6
=12898	Ditto, as above, Set of three ... ...per set	,,	0 19 0
=12899	**Vase,** for Advanced Stage	,,	0 11 0
=12900	Ditto ,, ,, ...	,,	0 11 0
=12901	Ditto, ,, ,, ...	,,	0 14 0
=12902	Ditto, as above, Set of three ... ...per set	,,	1 12 0

Can also be supplied painted Terra Cotta (dead) if required, or red and glazed.



12917



12916

9-in. Terrestrial Globes.

Physical Edition.—Land Elevations from below sea-level to 12,000 ft. and over, and sea-depths to 3,000 fathoms shown in distinctive tints. New Boundaries shown by red lines. Principal Railways shown by thin black lines; Steamship Routes in blue, with distances marked; chief Ocean Currents.

Political Edition.—Beautifully printed in distinctive flat tints, showing the new Boundaries. Sea Routes and Principal Ocean Current also shown.

*12912	On stained Wood Pedestal, tilted axis	£0 15 0
*12913	Ditto, with polished Brass plain half-meridian	0 17 6
*12914	Ditto, Ditto, with graduated half-meridian	0 18 6
*12915	Superior polished mahogany pedestal, graduated brass half-meridian	1 5 0

Please state when ordering whether Physical or Political Edition is required.

12-in. Globes, showing New Boundaries.

Physical (Contour) Edition).—Contours from below sea-level to 12,000 ft. and over, and sea-depths to 3,000 fathoms, shown in twelve distinctive tints. Pleasing and most graphic colour-scheme. Principal Railways shown by thin black lines; Steamship Routes in blue, with distances marked. This Globe is unequalled for teaching value and is just the size for present school requirements.

Political Edition showing New Boundaries.—An excellent Globe for school and for home library. Thoroughly up-to-date in all political information, Steamship Routes, and Railways. Ocean Currents are named and their direction indicated by small black arrows. Clear print and tasteful colours.

*12916	Mounted on handsome polished wood pedestal stand with engraved brass half-meridian	£1 5 0
*12917	On ornamental gilt iron Stand with inclined axis	1 7 6
*12918	with metal half-meridian engraved with degrees ...	1 10 0

Please state when ordering whether Physical or Political Edition is required.

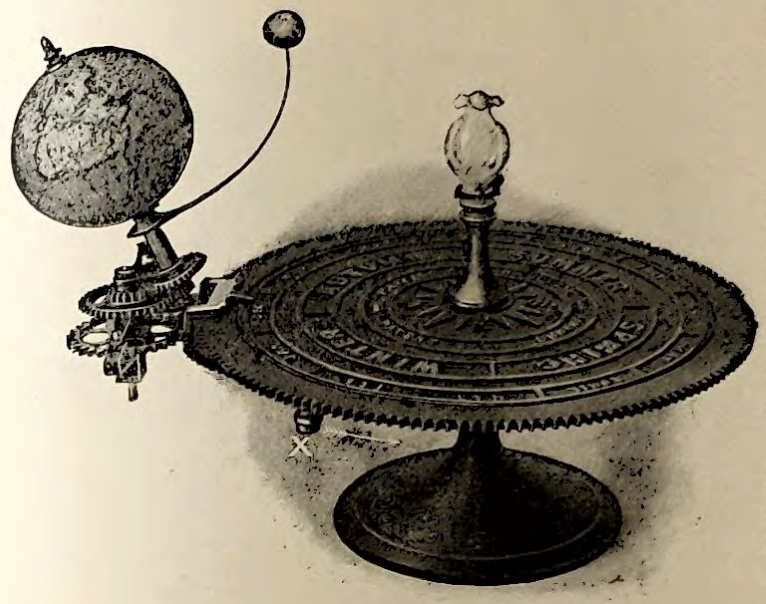
"Clear Print" Globe, 19 in. in diameter.

Physical Edition.—Beautifully coloured according to contours and sea-depths, similar in style to the 12-in. Globe but with the advantage of the larger size. Up-to-date Political Divisions are shown and names are in large clear type.

Political Edition, showing New Boundaries.—Political Divisions in colour; British Empire and possessions of other Powers easily distinguished; seas and lakes in light blue. All British cable route indicated by red line, and steamer routes, with distances in nautical miles, by dotted lines. All names in bold clear type. Unrivalled for class demonstration.

Please state clearly which edition is required.

*12919	Mounted on Ebonised Wooden Pedestal Stand with tilted axis	£4 4 0
*12920	With Brass graduated half-meridian	5 15 0



12922

***12922 School Orrery,** for illustrating the motions of the Earth and Moon, complete in Box **£4 10 0**

By moving round the handle X in the direction of the arrow, motion will be imparted to the earth and moon in varying speeds, viz., the earth will rotate upon its axis, and the moon will revolve in her path round the earth, and at the same time the earth and the moon are slowly making their annual journey round the sun, the moon periodically crossing and re-crossing the plane of the earth's orbit, illustrating the eclipse, months, etc.

The large sphere represents the earth, the small sphere the moon, and the lamp the sun. The large central disc wheel has upon its upper surface representative letters and divisions showing the months, seasons and cardinal points.

***12923 Orrery,** Improved Pattern. Designed expressly for Elementary and Secondary Schools, Colleges, Scientific Institutions, and to those preparing pupils for examination. The improved Orrery consists of Pedestal, Central Disc and Mechanism, by means of which motion is produced, together with the following parts, which may be readily attached for illustrating particular Lessons:—

Earth with screw to fit Axis.

Four pins with hinged pointers for showing the varying altitude of the Sun at noon according to the latitude and the season of the year.

Lamp, with Glass, Reflector and Lamp rod.

Metal framework containing disc of ground glass to illustrate solar eclipses —total, annular and partial.

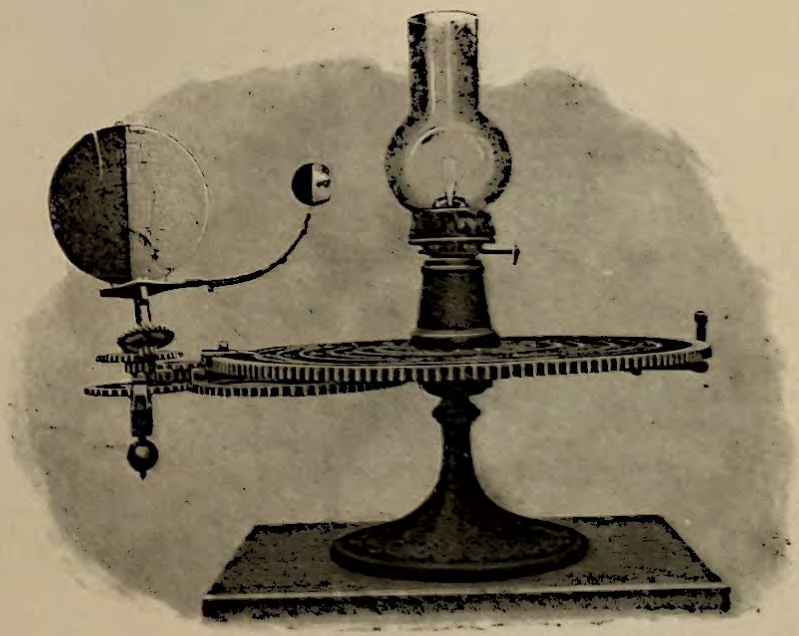
Metal protractor.

Moon's orbit for showing the inclination of orbit to the plane of the ecliptic.

Moon with arm of adjustable length.

Support for plane of the ecliptic, plane of ecliptic and floating plane of ecliptic.

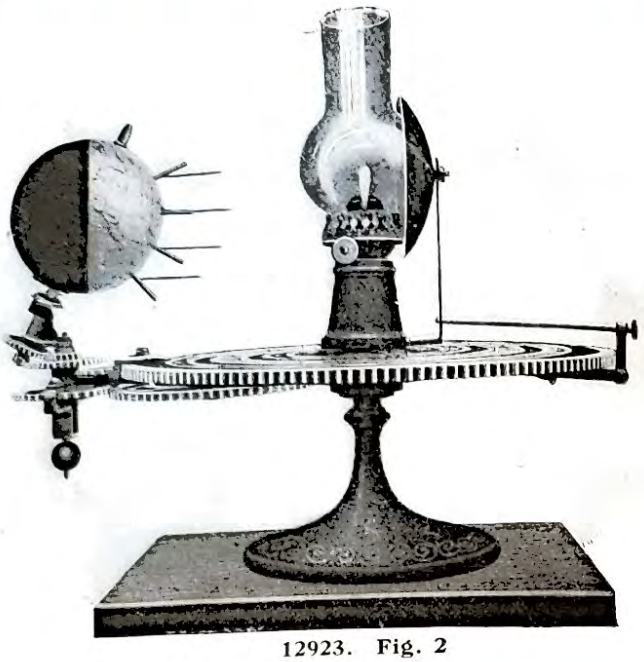
Suspension wire for floating plane of ecliptic. Tidal wave.



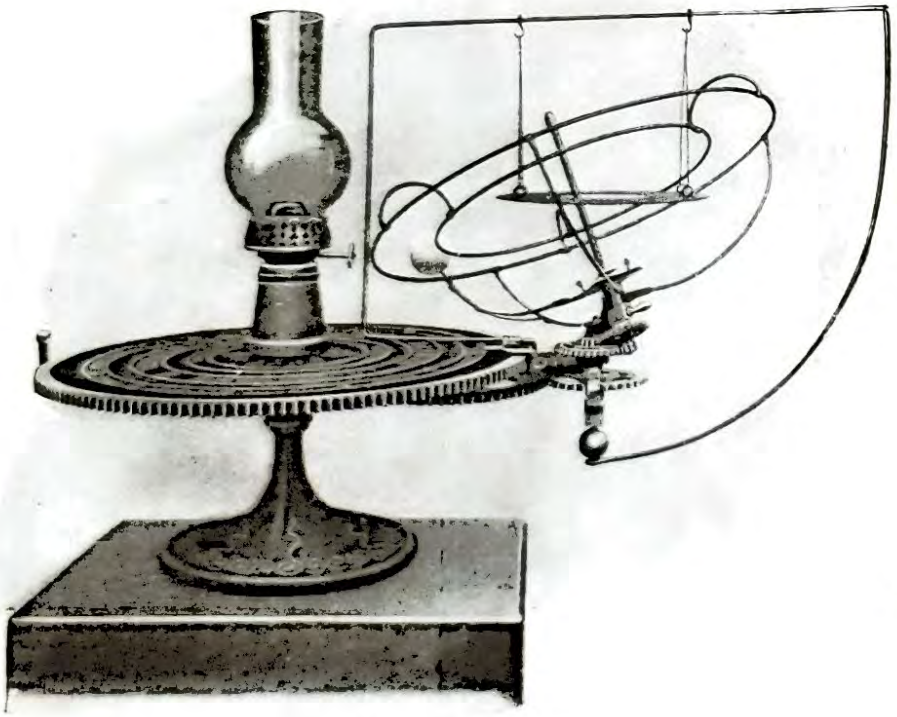
12923. Fig. 1

The instrument is used to illustrate the Revolution of the Earth round the Sun, and of the Moon round the Earth, the Rotation of the Earth on its Axis, the succession of Day and Night, Sunrise and Sunset, Local Time. (Fig. 1.)

The Pins with hinged pointers which are screwed into the Meridian through Greenwich, give the altitude of the Sun at noon at the Equator, the Tropics of Cancer and Capricorn, and in England (June in the figure). The altitude of the Sun can be obtained similarly at any other time of the year. The pins are also useful to explain why the Sun rises in the East, is at its highest point at Noon, and sets in the West. (Fig. 2.)



12923. Fig. 2

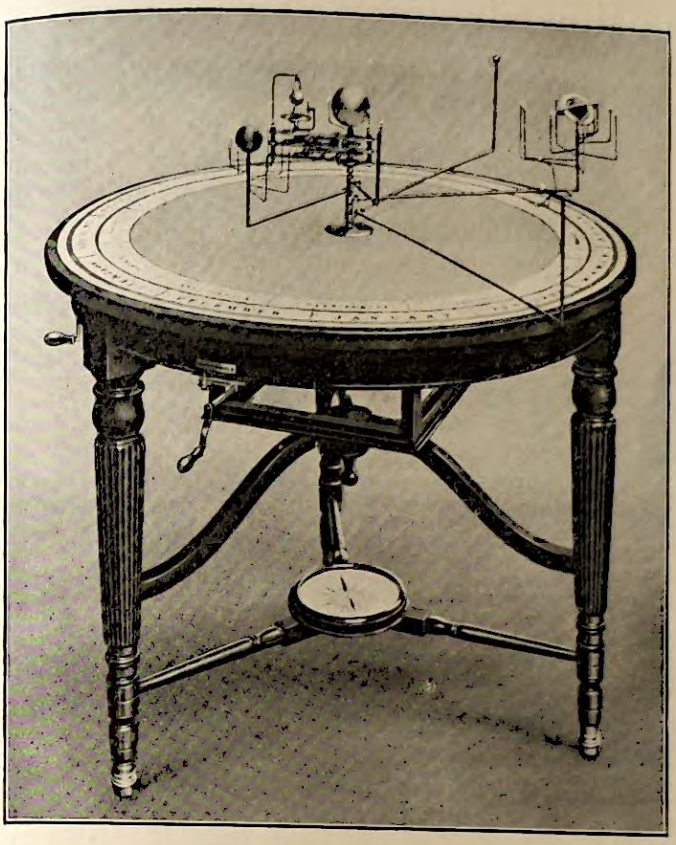


12923. Fig. 3

The Moon's Orbit and the Floating Plane of the Ecliptic are attached. The Inclination of the Orbit to the Plane of the Ecliptic is seen, the position of the Nodes can be found, and the conditions necessary for Lunar and Solar Eclipses.

*12923 **Price of Orrery,** packed in strong Wooden Box, with illustrated Hand book, giving full information how to use the apparatus and Suggestive Helps to Teachers. **£6 15 0**

*12924 Ditto, ditto, fitted in suitable case for carrying and storing. **£10 0 0**



=12925 Complete Clockwork Orrery.

The beautiful piece of mechanism illustrated is actuated by a powerful clockwork motor which is geared to cause the revolution of the entire model Planetary System at the correct relative speeds of the various Planets round the Sun.

By means of the horizon, upon which is inscribed the Months, Days, Degrees, Compass Points, Signs of the Zodiac and names of the Constellations, and the magnetic compass which is mounted in the stand, the relative position of each Planet on any day of the year is shown at a glance.

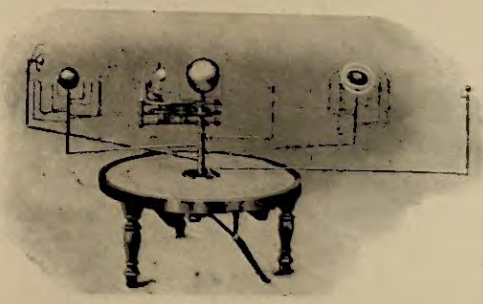
Special prominence is given to the Earth in its relation to the Sun, its diurnal motion and change of position as regards the Sun at the different seasons being clearly and accurately shown.

The Orrery affords an unrivalled means of demonstrating such other phenomena as the Phases of the Moon, Tides, Eclipses, and the Transits of Venus and of Mercury.

In its large mounting, or on the smaller stand illustrated below, this instructive and imposing Orrery deserves a prominent place in all educational institutions, great and small, where it is desired to instil an appreciation of the wonders of the Universe and to encourage the study of Astronomy.

An Illustrated Handbook with description of mechanism, directions for setting, etc., is supplied with the Orrery.

£75 0 0 nett.



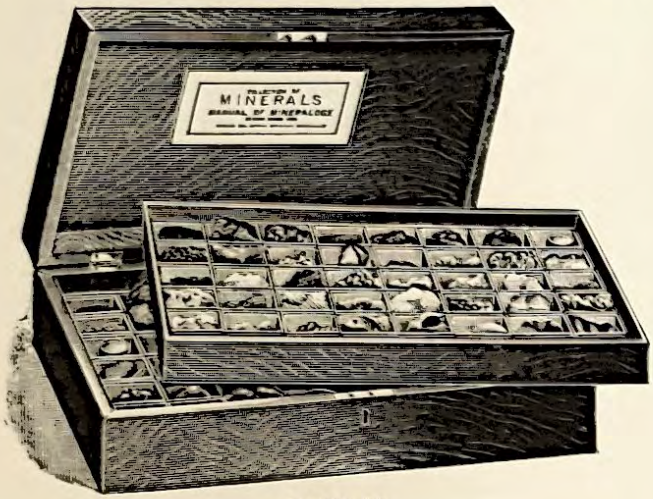
=12926 Complete Wheelwork Orrery.

Consisting of the same models and upper mechanism as in the larger apparatus, but mounted on a smaller stand for table use and actuated by a crank-handle.

With Descriptive Handbook.

£18 10 0 nett.

Sets of Minerals



12930-32

Minerals—Elementary Collections (in Cabinets
Arranged to illustrate Dana's "Mineralogy."

*12930	60	Specimens small, but all characteristic, with name and locality, in Cabinet	£1 5 0
*12931	100	Ditto, ditto	2 2 0
*12932	200	Ditto, ditto	3 15 0

The same number of larger Specimens at proportionate prices.
Arranged to illustrate Rutley's "Text-book of Mineralogy."

*12933	50	Specimens in Cabinet	£1 5 0
*12934	100	,, ,,	2 2 0
*12935	200	,, larger ,,	6 10 0
*12936	300	,, ,, ,,	9 15 0

Collections of Metallic Ores.

*12937	Collections of 100 ores of metal $1\frac{1}{2}\times1$ in. ...	£3 15 6
*12938	Ditto, ditto, 2×2 in. ...	5 17 6

Fossils—Elementary Collections (in Cabinets).
Arranged to illustrate the Works of Professor Geikie, Lyell, Page, etc.

BRITISH FOSSILS.

*12939	50 Specimens, small, but all characteristic, with name, locality and geological position in Cabinet	£1 5 0
*12940	100 Ditto, ditto	2 2 0
*12941	200 Ditto, ditto	3 15 0
*12942	300 Ditto, ditto, larger	6 10 0
*12943	400 Ditto, ditto, larger, in Cabinet of 9 Drawers	11 10 0
*12944	**Collections of Rock Specimens to illustrate F. Rutley's "Study of Rocks."** 50 Small British and Foreign Specimens, in Cabinet	1 5 0
*12945	100 Ditto, ditto	2 2 0
*12946	200 Ditto, ditto	3 15 0
*12947	200 Larger ditto, ditto	6 10 0
*12948	200 Ditto, ditto, $2\frac{1}{4}\times2\frac{1}{4}$ in. (a fine set)	8 10 0

Geology and Physiology—Elementary Collections of Minerals, Fossils, and Rocks.

*12949	50 Small Specimens, all with name, locality, etc., in cabinet	£1 5 0
*12950	100 Ditto, ditto	2 2 0
*12951	200 Ditto, ditto	3 15 0
*12952	300 Ditto, ditto, larger, in Cabinet with 6 drawers	6 10 0

Collections of Specimens.
To illustrate Professor Sir A. Geikie's "Class Book of Geology."

*12953	140 Hand-sized Specimens in Polished Cabinets	5 10 0
*12954	100 Rather Smaller Specimens	4 10 0

All characteristics and typical examples, numbered with labels, giving name, formation, locality, etc., of each Specimen.

*12955 **Special Elementary Collections.**
To illustrate Professor Geikie's Geology Primer, containing 22 convenient sized Specimens as named at end of Primer, in Polished Cabinet £1 5 0

Mineral Crystals, etc.

*12956 25 Natural Crystals of Minerals 1 6 3
*12957 50 ,, ,, ,, ... 3 2 6
*12958 25 Fragments of minerals for blow-pipe experiment 0 3 2
*12959 50 ,, ,, ,, ,, ... 0 6 3
*12960 104 larger fragments 1 2 6
*12961 Mohr's Scale of Mineral Hardness 0 6 3
*12962 Von Kobell's Scale of Fusibility of Minerals 0 3 9

Small Collections for Boys.

*12963 20 Specimens of Earthy Minerals all named, in Box 0 3 2
*12964 20 ,, Metallic Minerals and Ores, all named 0 3 2
*12965 20 ,, Sedimentary Rocks, all named 0 3 2
*12966 20 ,, Igneous, Metamorphic and Volcanic Rocks, all named 0 3 2
*12967 20 ,, Precious Stones, Gems and Ornamental Stones, all named, in Box 0 6 3
*12968 20 ,, Fossils from different formations 0 3 2

*12969 **Explorer's Mineral Cabinet of Minerals, Precious Stones, etc.**
Packed in a small compact portable mahogany well-made Cabinet of 6 drawers, containing examples of 30 varieties of precious stones as found in a native state, 20 specimens of the typical rocks, in which metals and minerals would be found or associated with, and 200 specimens of ores of metals and useful minerals, valuable for commercial purposes, all with names and localities. All are numbered corresponding to names on labels, etc., so that no difficulty can arise from confusion The 200 minerals and ores are intended for comparison with specimens that may be found by travellers. Of some species more than one specimen is given, showing different characters, etc. £15 15 0

Agricultural Geology.
A new collection of specimens prepared especially for the Science and Art Department containing examples of the various rocks, minerals, and organic substances from which soils are produced, also altered substances employed as fertilisers; also the various minerals that produce the colouring of soils, etc.

*12970 60 Specimens, in strong Cabinet with handles, and with wooden partition, so as to avoid packing. Specimens about 3 × 2½ in. £5 10 0
*12971 A smaller set of similar Specimens 2 10 0

New Collections.
To illustrate Physiography and Geology, according to new Science and Art Directory.

*12972 2 × 2 in.—Collection of 13 Common Rock-forming Minerals for elementary classes 0 10 0
12973 3 × 3 in.—16 Specimens to show Rock Structure, etc. 0 13 6
*12974 3 × 3 in.—20 Various Types of Common Rocks: Igneous, Metamorphic and Aqueous, for elementary classes 1 7 6
*12975 3 × 3 in.—20 Supplementary Rocks 1 7 6
*12976 2 × 2 in.—20 Supplementary Minerals 1 0 0
*12977 60 Typical Fossils 2 15 0
*12978 Coal Mining.—20 Specimens—Varieties of Coal, of Rocks and of Fossils found in the Coal Measures ... 1 5 0
*12979 Metalliferous Mining.—20 Specimens of the commoner ores of metals, and of the minerals associated with them 1 10 0

Students' Sets of Microscopic Slides and Sections

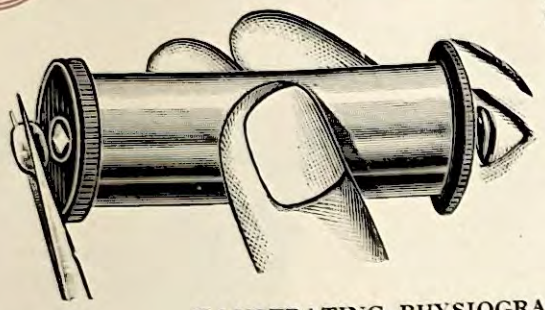
ILLUSTRATING PHYSIOGRAPHY AND GEOLOGY.

*12980 **Series A,** containing 6 slides illustrating Physiography, viz.:—
1 Foraminifera Sand
2 Globigerina Ooze
3 Radiolarians
4 Diatom Earth
5 Volcanic Dust
6 Desert Sand
nett £0 12 0

*12981 **Series B,** containing 12 slides illustrating Physiography, viz.:—
1 Capillary Ash (Sandwich Islands)
2 Volcanic Dust
3 Crystalline Sand (Triassic)
4 Ditto in Balsam
5 Desert Sand (rounded grains)
6 Angular Sand
7 Diatom Earth
8 Marine Diatoms
9 Radiolarians
10 Foraminifera Sand
11 Globigerina Ooze
12 Glauconite grains
nett 1 4 0

*12982 **Series C,** containing 12 slides of Typical Igneous Rocks, viz.:—
1 Granite
2 Quartz Felsite
3 Rhyolite
4 Obsidian
5 Syenite
6 Trachyte
7 Diorite
8 Andesite
9 Phonolite
10 Gabbro
11 Basalt
12 Serpentine
nett 1 4 0

Students' Sets of Microscopic Slides and Sections





12986

ILLUSTRATING PHYSIOGRAPHY AND GEOLOGY.

***12983 Series D,** containing 12 Slides of Typical Sedimentary and Metamorphic Rocks, viz.:—

1 Sandstone
2 Chalk
3 Oolitic Limestone
4 Crystalline Limestone
5 Clay Slate
6 Whet Slate
7 Chiastolite Slate
8 Gneiss
9 Mica Schist with garnets
10 Hornblende Schist
11 Chlorite Schist
12 Quartzite

nett **£1 4 0**

***12984 Series E,** containing 36 Typical Rock Sections, viz.:—

1 Muscovite Granite
2 Hornblende ,,
3 Graphic ,,
4 Luxulianite
5 Quartz Felsite
6 Rhyolite (banded)
7 Obsidian
8 Pumice
9 Pitchstone
10 Perlite
11 Spherulitic Felsite
12 Syenite
13 Trachyte
14 Diorite
15 Quartz Mica Do.
16 Granulite
17 Hornblende Andesite
18 Augite Andesite
19 Porphyrite
20 Nepheline Phonolite
21 Nosean Phonolite
22 Leucite ,,
23 Gabbro
24 Diabase
25 Basalt
26 Olivine Basalt
27 Leucite Basalt
28 Picrite
29 Limestone with Foraminifera
30 Oolitic Limestone
31 Clay Slate
32 Chiastolite Slate
33 Mica Schist with garnets
34 Chlorite Schist
35 Gneiss
36 Quartzite

nett **£3 17 6**

***12985 Series F,** containing 12 Typical Rock Sections for Elementary Classes

1 Granite
2 Rhyolote (banded)
3 Quartz Diorite
4 Augite Andesite
5 Gabbro
6 Basalt
7 Sandstone
8 Chalk Rock
9 Oolitic Limestone
10 Crystalline Limestone
11 Gneiss
12 Mica Schist with garnets

nett **£1 4 0**

1 10 0

***12986 Dichroiscope,** for testing Precious Stones, in Morocco Case ... ...

To distinguish a certain precious stone from one which may be similar in appearance, yet perhaps of much less value, or perhaps more, is not always an easy matter. To assist anyone in doubt, and in many instances to settle the point, the Dichroiscope (in shape a cylinder 2 in. long and an inch or less in diameter, and so easily carried about), is most useful, taking for granted that some practice with the various kinds of translucent or transparent stones of various shades and colours has been acquired. A preliminary examination of a few sapphires and rubies, spinel rubies, garnets, topazes, tourmalines, (green, brown, red) zircons of various colours, andalusite, water sapphire, coloured quartz (including amethyst), etc., will impart a confidence very much more than any tabulated results of dichroism, which depends much on the intensity or depth of colour in the stone.

Placing (by means of tweezers), a translucent or transparent stone close to the one end of the instrument where the two square images are seen when the instrument, held skywards, is looked into, and turning it about in various directions, and at the same time turning the instrument round, the observer will notice whether the colour of the two squares is one and the same. If the stone is amorphous, such as glass, flint, obsidian, etc., or crystallising according to the cubic system, such as diamond (N.B.—Colourless gems of any kind do not show two distinct colours, and so the coloured diamond is here suggested), spinal ruby, garnet, etc., the two squares will be of the same colour. In other cases the colour of one square will be of a different colour from that of the other when the coloured stone is examined in certain directions, though it may be the same in certain others.

When a transparent or semi-transparent stone is examined through the Dichroiscope, the colour of the square A *is different, or of a different shade, from that of the square* B *when dichroism exists.* (*See illustration.*)

Thus a true ruby, which affords two shades of pink, can be distinguished from a spinel ruby or garnet without dichroism, or from a pink tourmaline (rubellite), which gives two colours, but somewhat differently from those of ruby; so, too, sapphire, which gives a blue shade in one square and a light shade of colour without any shade of blue in the other (though sometimes in a deeply coloured stone what might be considered as a greenish blue is noticed), can be distinguished from an amethyst, which affords two shades of purple, or from a blue spinel (which does not show any twin colouration), or from an iolite (or water sapphire), in which the colouration is of its own kind.

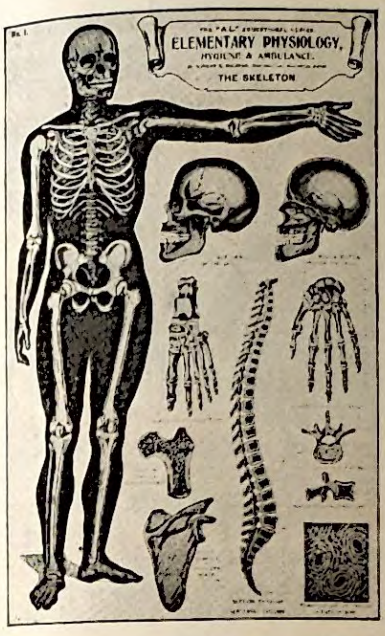
A tourmaline (very frequently associated with other gems, especially in Ceylon), either the green or the brown, can be recognised directly (indeed, often without using the Dichroiscope) by the colour of the one square being quite dark compared to that of the other.

An emerald affords two distinct shades of green (one bluish) easily remembered (quite distinguishable from the dichroism of a green tourmaline); so a green garnet, which does not show twin colouration, cannot be mistaken for it.

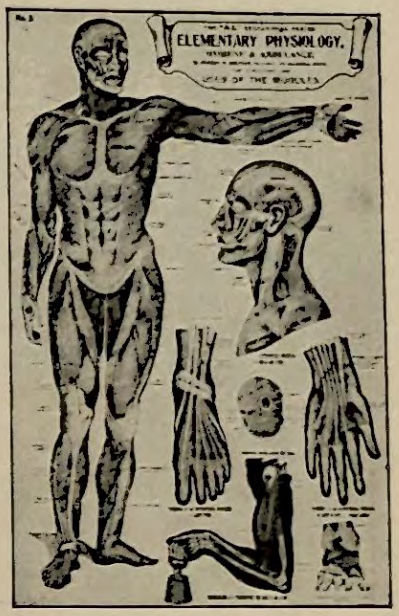
With the Dichroiscope and two or three minerals, such as the sapphire, topaz and rock crystal, to test for hardness, and a little practice—the more the better—and a slight knowledge of crystallisation of minerals, which, though frequently found water-worn, not uncommonly retain traces of the original crystal edges and faces, the prospector can examine his specimens with a very much easier mind than he would do without them.

Of all the transparent or transulent minerals, there are only a few kinds of value, and so a knowledge of the dichroism of all these in different colours and different depths of colour should be acquired. ("Prospector's Handbook"—*Anderson. Publishers: Crosby Lockwood & Son.*)

Physiological Diagrams



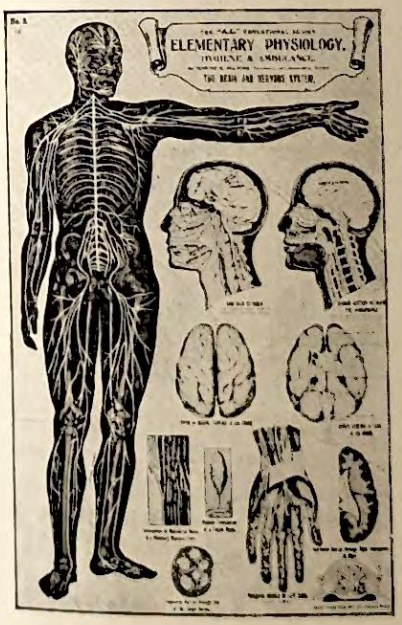
A—Skeleton



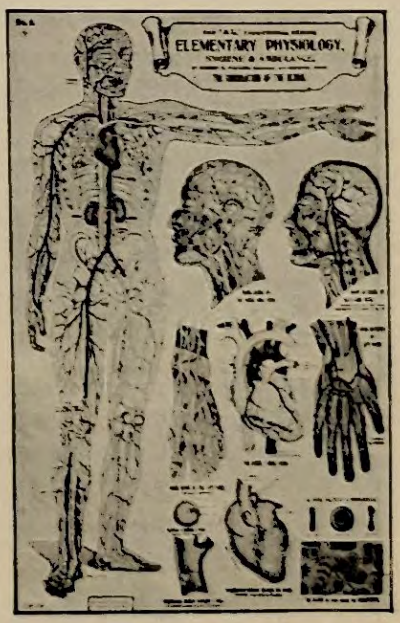
B—Muscles

This is a series accurately drawn by a specialist for the most part from the actual specimens concerned, and beautifully printed in colours. All those minute and unnecessary details which are not required for school and popular teaching are omitted, but everything requisite for thoroughly understanding Human Physiology in its broad outlines, and in connection with Hygiene and Ambulance, is included. For simplicity, clearness, accuracy, and suitability for the purposes intended, these diagrams are superior to anything of the kind hitherto published, the names of the various organs or parts are boldly printed on, or adjacent to, the portion referred to.

The complete series consists of eight sheets, each 40×30 in., printed in colours, of which the following illustrations are reduced facsimiles:—



C—Brain and Nervous System

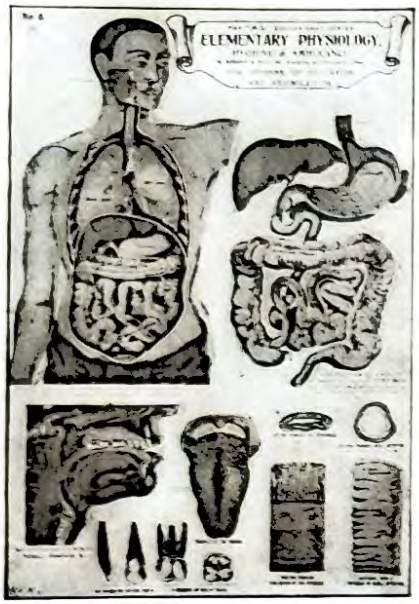


D—Circulation of the Blood

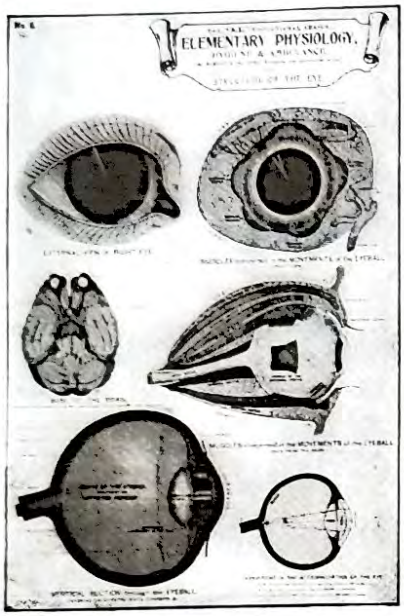
12988-89

12988-89

Physiological Diagrams



E. Organs of Digestion and Assimilation.



F. Structure of the Eye.

No. 1. The Skeleton. Entire Figure with 10 enlarged details or parts.

No. 2. The Muscles. Entire Figure with 6 enlarged details or parts.

No. 3. The Brain and Nervous System. Entire Figure with 10 enlarged details or parts.

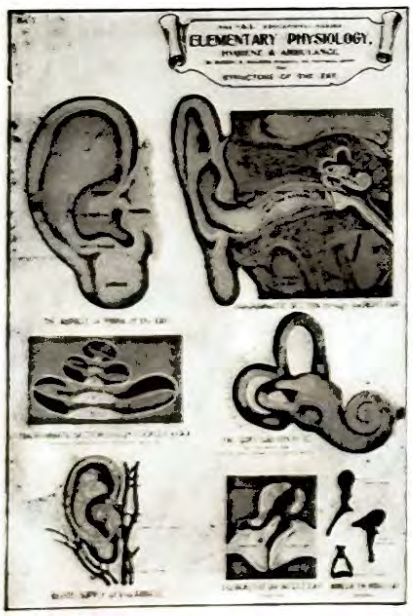
No. 4. The Circulation of the Blood. Entire Figure with 12 enlarged details or parts.

No. 5. The Organs of Digestion and Assimilation. With 11 enlarged details or parts.

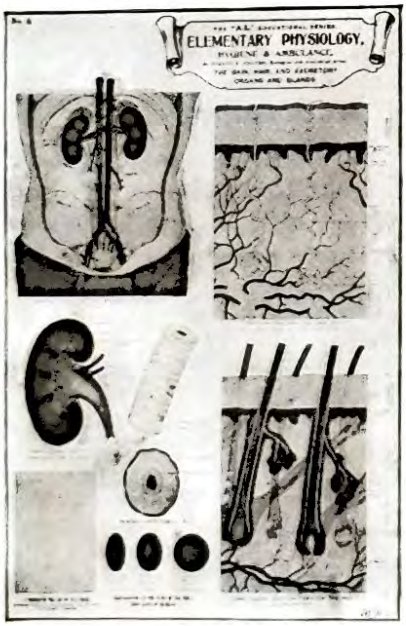
No. 6. The Structure of the Eye. With 5 enlarged details or parts.

No. 7. The Structure of the Ear. With 8 enlarged details or parts.

No. 8. The Skin and Excretory Organs. With 9 enlarged details or parts.



G. Structure of the Ear.



H. Skin and Excretory Organs.

12988-89

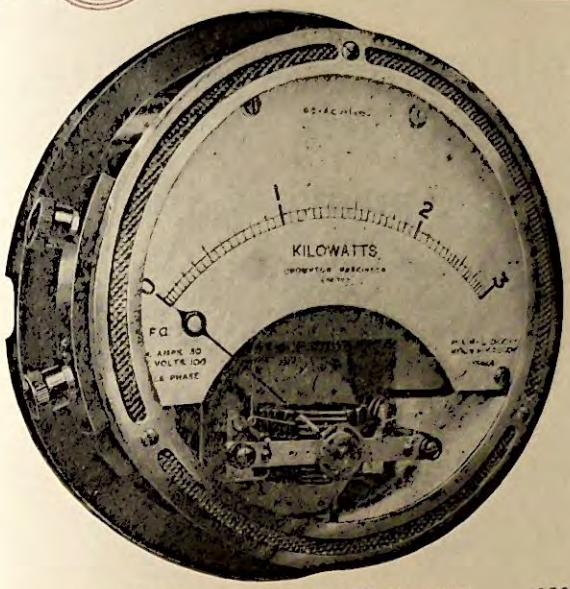
Prices.

=**12988** Set of 8 diagrams, each mounted on roller and varnished.
Nett **£2 16 0**

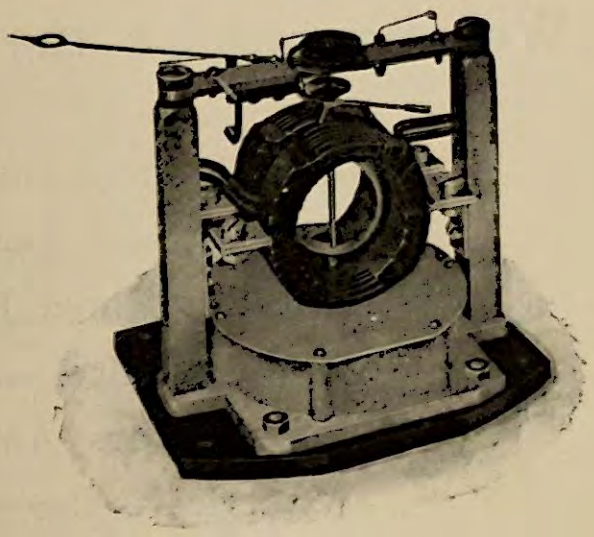
=**12989** Any Single Sheet, mounted on roller and varnished.
Nett **£0 7 0**

=**12990** Set of 8 Diagrams, printed on stout manilla and attached to lath at top.
Nett **£0 18 0**

=**12991** Single Sheets, printed on stout manilla, unmounted.
Nett **£0 2 0**



Single Phase Indicating Wattmeter. 12993-13000.



Movement of Indicating Wattmeter.

INDICATING WATTMETERS, DYNAMOMETER PATTERN.
For D.C. and Single Phase A.C. Circuit.

RANGES.—The main, or fixed coils, can be wound for currents up to and including 30 amperes. In instruments above this range the coils are wound for 5 amperes for use with current transformers on A.C. or shunts on D.C.

The pressure circuit is self-contained up to a range of 300 volts, an external resistance box being provided for higher voltages up to 750 volts. For voltages exceeding 750 a potential transformer should be employed.

Wattmeters of this type, when wound for 5 amperes at 110 volts, take approximately 2 v.a. for the current winding and 5·5 v.a. for the pressure circuit, at maximum current and voltage respectively.

ACCURACY.—The accuracy is in accordance with B.S. Specification No. 89 for First Grade Instruments.

EDUCATIONAL USE.—For instructional and demonstration purposes the Wattmeters can be provided with a totally glazed front cover and cut away scale plate exposing the movement to view, as illustrated above. No extra is charged for this finish.

MOVEMENT.—The movement, illustrated above, is provided with fixed and moving coils completely insulated from each other, the fixed coils carrying the main current and the moving coil a current of which the magnitude depends on the voltage of the circuit. The moving coil is mounted on sapphire jewel bearings, spring controlled, balanced for use in any position, and rendered dead beat by means of pneumatic damping. An external zero adjuster is provided.

"W.A." SWITCHBOARD PATTERN.—The external appearance is as illustrated above or may have a protecting front as illustrated on page 448, Fig. 2, and is supplied with 8-in. scales only.

"W.D." PORTABLE PATTERN.—The external appearance is similar to the instruments illustrated on pages 451 and 452. Portable instruments are always supplied with knife-edged pointers and mirrors under scale. Multi-range Wattmeters of this type can be supplied.

PRICES. For any pressure not exceeding 150 volts:

	Pattern	Current Range	6-in. Scale	8-in. Scale
*12993	"W.A."	Up to 10 amps.	—	£8 4 0
*12994	"W.A."	Up to 30 amps.	—	8 10 0
*12995	"W.D."	Up to 10 amps.	£9 3 0	9 13 0
*12996	"W.D."	Up to 30 amps.	9 9 0	9 19 0
*12997	"W.D."	2·5 and 5 amps.	10 0 0	10 10 0
*12998	"W.D."	5 and 10 amps.	10 0 0	10 10 0
*12999	"W.D."	10 and 20 amps.	10 6 0	10 16 0
*13000	"W.D."	15 and 30 amps.	10 6 0	10 16 0
A	For pressures up to 300 volts, add			£0 6 0
B	For pressures up to 750 volts, add			1 3 0
	If for use on a three-phase, three-wire balanced load system on which the neutral point is not available, add to the price of the Instrument the cost of an Artificial Neutral Point Resistance mounted in a suitable case. Phase pressure up to 300 volts.			1 3 0
C	For "W.A." pattern add			1 19 0
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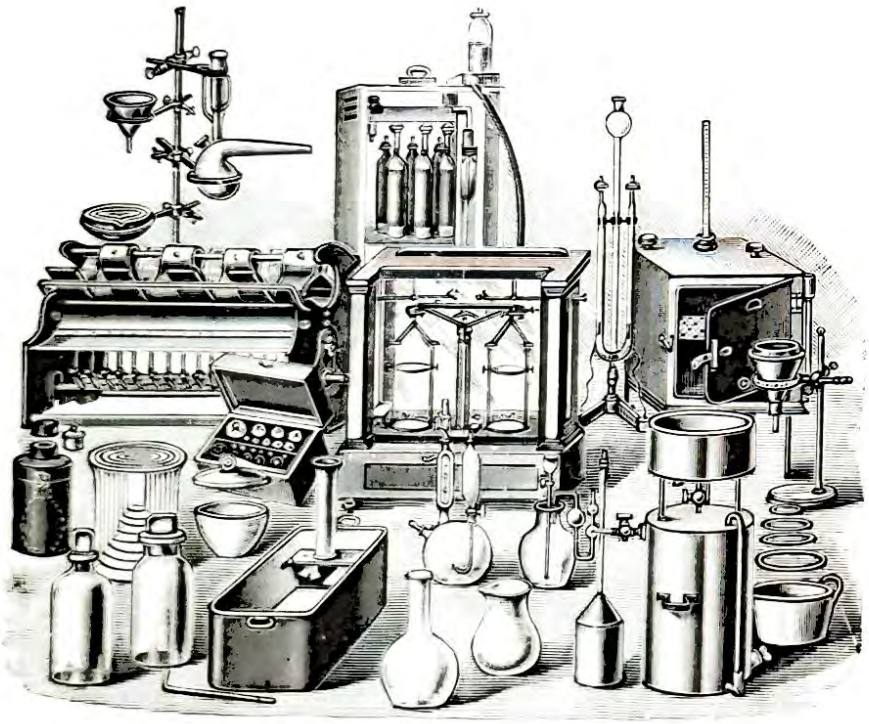

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Printed by
Percy Lund, Humphries & Co. Ltd.
3 Amen Corner, London, E.C.4
and Bradford
13666