JOURNAL OF THE

ROYAL MICROSCOPICAL SOCIETY

CONTAINING ITS TRANSACTIONS AND PROCEEDINGS

AND

A SUMMARY OF CURRENT RESEARCHES RELATING TO

ZOOLOGY AND BOTANY

(principally Invertebrata and Cryptogamia)

MICROSCOPY, &c.

EDITED BY

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Instruction to Binder.

The Message from the King, the Plate facing page 353 in the August Part, should be inserted as a *Frontispiece* to the Volume for 1901.—EDITOR.

1901

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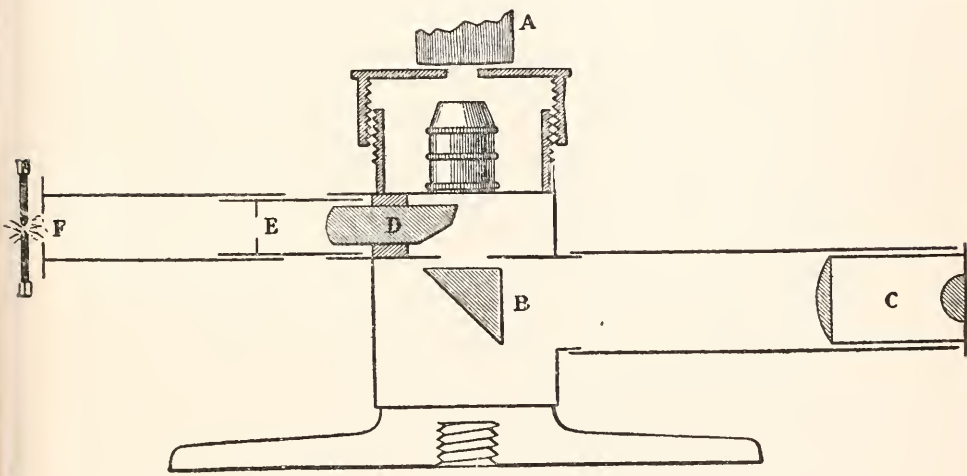
MICROSCOPY.

A. Instruments, Accessories, &c.*

(1) Stands.

Le Chatelier's Microscope for Examination of Opaque Bodies.†—The inverted position of the stage in this Microscope facilitates the arrangement of fragments of metal, which may then, with the exception of the polished surface, be of any shape. The horizontal pencil of light received by the illuminating prism D (fig. 1) is refracted upward and taken up by that half of the objective which is covered by D. The two faces of the prism make an angle of 45°, one of them forming

Fig. 1.



an angle of 22·5° with a horizontal line, the other a similar angle with a vertical line, which causes the axis of the reflected pencil to be vertical. The extreme edge of the prism intersects the axis of the objective and also its principal focus, or, at least, comes as near doing so as possible. The diaphragm E, placed at the conjugate focus of the object examined, and the screen F with its rectangular opening, provide a means for cutting off all the useless rays, whose diffusion by the lenses of the objective would otherwise illuminate the field of the Microscope and diminish the visibility of the images. To reach this result, the diaphragm E must have an opening exactly equal to the diameter of the

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

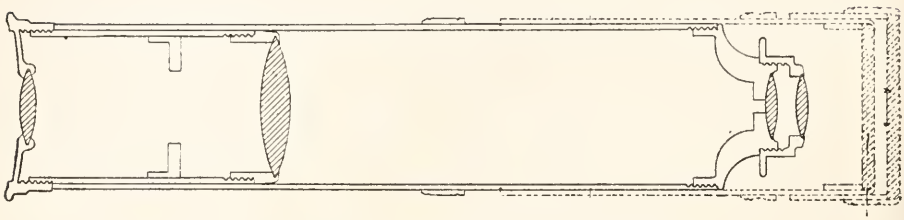
† Metallographist, Jan. 1898, pp. 83–4 (1 fig.).

image of the useful portion of the object under examination; and the opening of the screen F a height equal to half the dimensions of the image of the upper lens of the objective.

A is the object examined; C the eye-piece.

Gilbertson's Microscope. — This old non-achromatic Microscope, kindly lent for exhibition by Mr. H. E. Freeman, and since presented to the Society, was made by H. Gilbertson, of London; the date of its manufacture, however, has not been determined. The instrument was evidently designed for use in the field, for on reference to fig. 2, drawn by Mr. Parsons, it will be seen that it is essentially a hand Microscope, without either stand or stage, but in place of the latter there is a compressorium, or live-box, fitted to the end of a tube which slides over the body-tube of the Microscope; this sliding tube constituting its sole focussing adjustment.

Fig. 2.



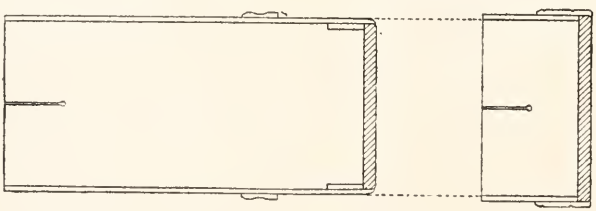


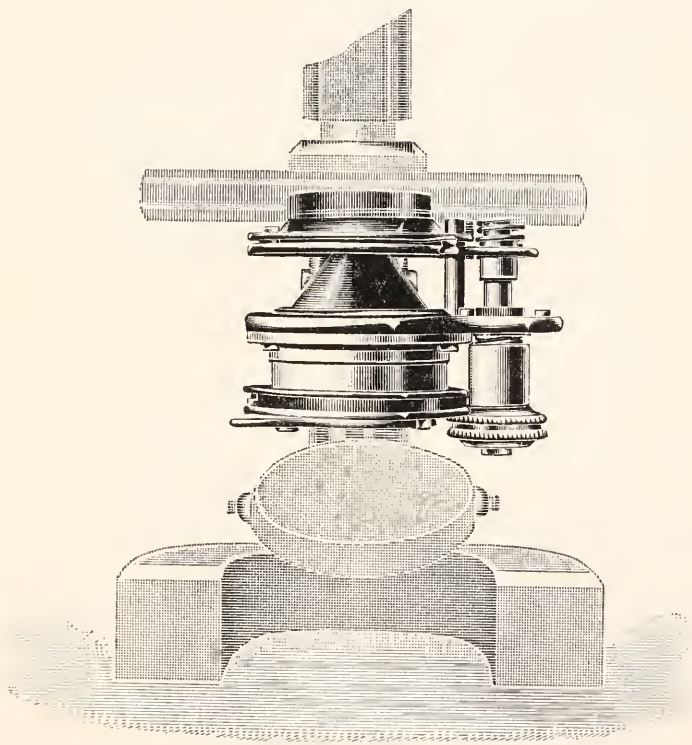
Fig. 3.

A lower power is obtained by removing the front lens of the objective; the body has marks upon it indicating the position of the sliding tube when either the high or low power is employed. There is one drawback in the design of this instrument, and that rather a serious one, viz. the only motion that can be given to the object is in the direction of the line of sight for focussing; all other movements, such as lateral motion in the field, are impossible. If the object, therefore, is not placed with tolerable accuracy in the centre of the compressorium, it will not be visible in the field of the Microscope. Diameter of field with high power, $\frac{1}{10}$ in. Diameter of field with low power, $\frac{1}{3}$ in. Working distances, $\frac{7}{16}$ and $1\frac{1}{16}$ in. respectively. Length with live-box closed, $4\frac{1}{2}$ in. Greatest diameter, 1 in.

Fig. 2 represents the arrangement with the tube drawn over the instrument, indicated by the dotted lines; fig. 3 the compressorium detached from the Microscope and the cap removed.

Bausch and Lomb's Duplex Substage.* — To meet the need for a substage attachment which shall be simpler than the complete Abbe substage, and yet embrace its principal advantages, Mr. E. Bausch has constructed a modification designated as above. As shown in fig. 4, two arms are movable up and down upon a metal post rigidly fixed to the stage. The upper arm carries an iris diaphragm which may be used in the plane of the stage or below it; the lower heavier arm carries the Abbe condenser with an iris diaphragm attached below. In addition to

Fig. 4.



the firmness afforded by the rigidly fixed supporting post, a metal guide passes through the arm of each ring, the result of which is to render the substage accessories, when in position, absolutely free from any appreciable lateral movements, and to keep them throughout all vertical movements in the optical axis of the Microscope.

The upper arm has a vertical movement sufficient to obtain the best optical results from the iris diaphragm when this is used alone. The lower arm, however, has a vertical movement the upper limit of which brings the condenser into immersion contact with the object-slide; from

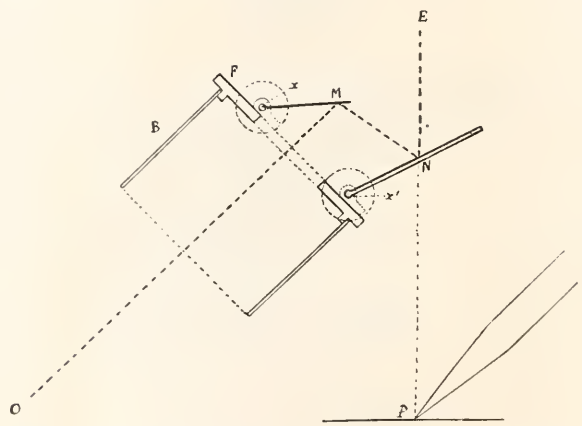
* Journ. App. Micr., July 1900, pp. 933-4 (1 fig.).

which point it may be rapidly lowered free of the guide-post where it may be swung to the left, completely out of the path of light from the mirror. When in this position it may be again raised, the guide-post passing through a second hole in the arm and preventing its accidental displacement.

(3) Illuminating and other Apparatus.

Ashe's Camera Lucida.*—D. J. Scourfield describes this accessory, which has been lately slightly modified and thereby improved by its inventor. As will be seen from fig. 5, Ashe's camera lucida is, in essence, an improved form of Beale's neutral tint reflector, the most important difference being that the light from the eye-piece, instead of

Fig. 5.



being received directly upon the neutral tint glass, is first of all received upon a small mirror, which reflects the light down upon the neutral tint and so up to the eye. By this means the light undergoes two reflections before reaching the eye, and the most important defect of Beale's neutral tint reflector, viz. the reversal of the top and bottom of the image without a corresponding reversal of the sides, is corrected.

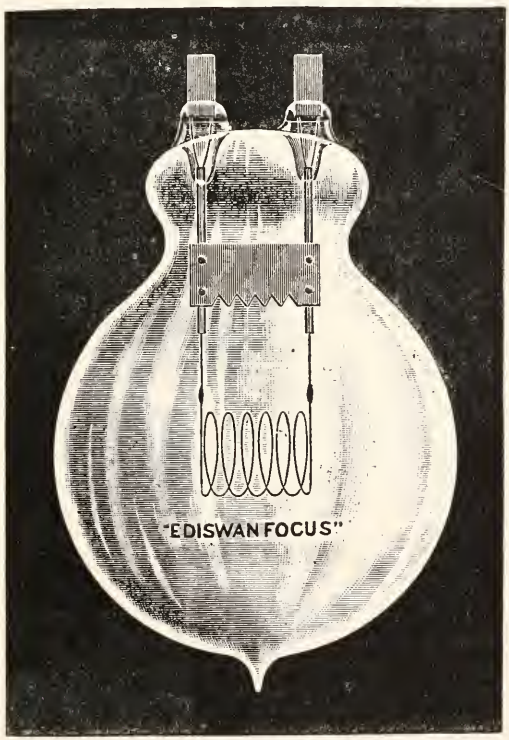
But by making the mirror and the neutral tint glass to rotate upon two parallel pins, the inventor has succeeded in producing a camera which can be used in any position of the Microscope. When the latter is inclined at any angle between about 45° and the horizontal, the image can be projected (only apparently, of course) vertically downwards on to the table by a suitable adjustment of the relative positions of the mirror and neutral tint glass. When the Microscope is vertical (and also when inclined) the image can be projected to the side by rotating the camera 90° from its former position. The drawing paper must now be placed on a board inclined at the proper angle, i.e. at right angles to the line of sight. The correct placing of the board is easily determined by observing the outline of the image of the field. If this be a circle, the

* Journ. Quek. Micr. Club, 1900, pp. 413-6 (1 fig.).

board is correct. A sheet of paper with a series of concentric circles drawn upon it will enable the question of the circular outline of the field to be readily settled. Such a sheet of paper is also useful for determining whether the line of sight is vertically downwards when the camera is used to project the image upon the table.

If the camera is used not only with low-power, but also with moderately high-power eye-pieces, the mirror must be so arranged that its free end, when the mirror is inclined at about 45°, is as close as possible to the eye-lens. This can only be done by making the mirror

Fig. 6.



rather small and pivoting it to the front plate just above the central opening in the latter. After several trials it was found that a small cover-glass, say, about half-an-inch in diameter, silvered on one side and cemented to a thin metal plate, gives excellent results, and seems altogether the simplest and most suitable form of mirror for this camera.

As regards the neutral tint glass, it is necessary to make it rather large, because, owing to the adjustments which have to be made for various inclinations of the Microscope, the light is not always reflected from the same spot. Moreover, it is evidently essential that the whole

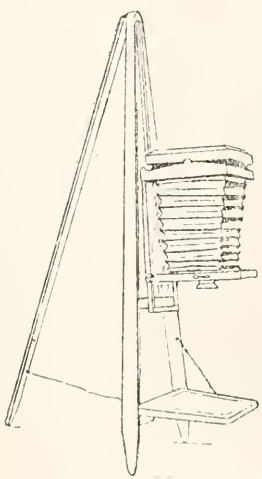
image of the field, as seen on the drawing-paper, should be visible through the neutral tint glass.

Lastly, the tube-fitting of the camera should be made as long as possible, thus allowing of the camera being moved closer to or farther from the eye-piece, and enabling the best position to be obtained for use with eye-pieces of different powers and focal lengths.

Electric Focus Lamp for the Microscope.—Fig. 6, on the foregoing page, illustrates Edison and Swan Company's focus lamp recommended by Mr. C. F. Rousselet for use with the Microscope, and described by him in the number of this Journal for December 1900, p. 741. The lamp should be of 8 candle-power, and mounted with the usual brass collar terminal for use with the ordinary bayonet-joint holder, like the ordinary electric lamp. Mr. Rousselet recommends that the standard to carry the lamp should have an arm to move up and down, similar to the ordinary Microscope lamp, and the arm a knuckle-joint in order to be able to adjust the lamp in an upright or horizontal position, or at any intermediate angle, as may be desired. A second similar arm may be provided to carry a bull's-eye condenser.

Resolution of Striæ.*—Dr. R. H. Ward, of Troy, N.Y., recommends for the resolution of striæ, &c., the old method of obtaining oblique light by the decentralisation of the substage condenser.

Fig. 7.



(4) Photomicrography.

Photography in Botany and in Horticulture.†—Messrs. Waugh and Macfarland consider the importance of the camera as second only to the Microscope for the botanist; while for the horticulturist they would give it the first place.

The essentials are a vertical camera and a horizontal shelf. Figs. 7 and 8 show two modes of attaining the result. The former is in use at the Vermont Experiment Station, and is more of an out-of-door form; the latter is used at the Mount Pleasant Printery, and is more intended for the studio.

The advantages are: (1) Nearly all trouble in arranging the object is avoided, as the specimen has merely to be placed on the shelf; in the case of a fruit which sometimes does not readily assume stable equilibrium, a rubber hose-washer forms a useful holder, and a supply of them should be always at hand. (2) A sheet of paper of any tint can be placed under the object so as to form any background desired. (3) Shadows are avoided. (4) The making of photographs exactly to the size is facilitated.

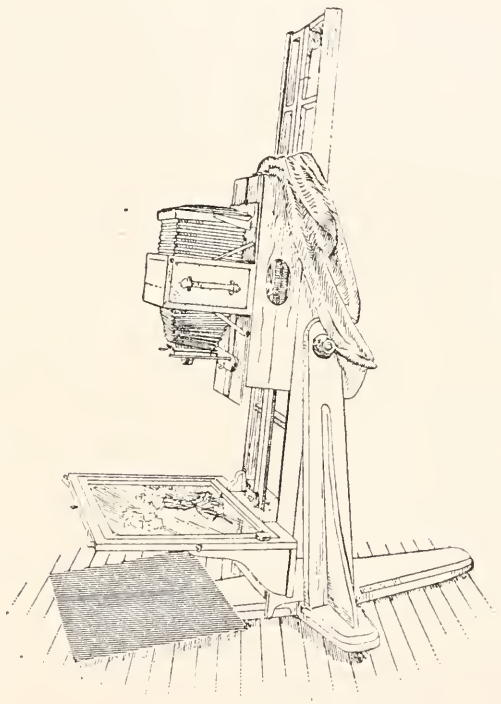
A photograph the same size as the object is most desirable; to obtain

* Trans. Amer. Micr. Soc., 1900, p. 111.

† Bot. Gazette, xxx. (1900) pp. 204–6 (2 figs.).

this a camera with considerable bellows extension is necessary, and the lens must be midway between the object and the camera glass. The best work will be possible with a wide-angle lens of rather short focal length.

Fig. 8.



Extreme care and cleanliness are urged; dust is a great enemy in full-size photography. It will generally be found necessary to arrange a wire frame with velvet hood to cover the camera top so as to exclude all reflections.

Penny, R. Greenwood—**Photomicrographic Apparatus.**
Amer. Mon. Micr. Journ., Nov. 1890, pp. 310–4;
and *English Mechanic and World of Science* (reference not given)

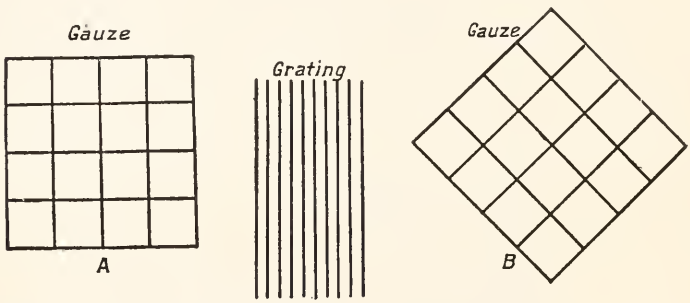
(5) Microscopical Optics and Manipulation.

Imitation of Polarised Light Effects by Diffraction.* — Mr. J. Rheinberg, by inserting a straight-lined diffraction grating of 100 lines per millimetre (about 2500 per inch) just above the objective, and focussing down on a small piece of wire gauze (wires 0·5 mm. apart), produces a series of brilliantly coloured results, which are strongly suggestive of polarised light effects; although, in reality, they are diffraction fringes.

* Journ. Quek. Micr. Club, 1900, pp. 407-10 (2 figs.).

As is well known, such a grating forms an uncoloured central image of a bright line, flanked on each side by a number of spectra, violet side inwards, red outwards. In the wire gauze each space between the wires takes the place of the bright line, and forms its own white central image in the proper place, with several broadened-out spectra on each side. The spectra produced by a number of the spaces overlap and produce composite colours. When these colours fall upon the bright white image of the interspaces, they produce no observable effect, being, in fact, flooded out. Where, however, the bright colours fall upon the dark image of the opaque wires, they readily manifest themselves. When the wires are parallel to the lines of the diffraction grating (fig. 9, A), then, if they are spaced regularly, the colours developed upon them must be the same in each case; but so soon as the wires are rotated, then, instead of having equally wide spaces lying transverse to the grating, the width of the spaces varies in a regular manner (Fig. 9, B), and the

Fig. 9.



spectra formed vary accordingly, so that we get the different colours showing themselves on the same wire.

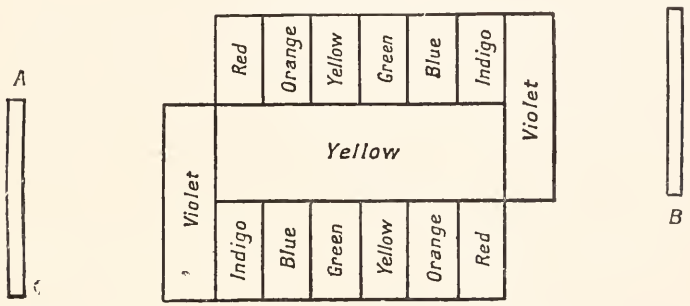
There are one or two useful purposes to which the above principle may be applied. Thus, in experimenting with wire and other gratings it is tedious to measure whether the wires and interstices are evenly spaced; but in this diffraction method any irregularity in the spacing or ruling of the object grating reveals itself immediately to the eye by reason of the different coloration of the particular wire or set of wires (or rulings) to the others.

Again, the arrangement may be used in investigations on colour sensation, as it is easy to obtain an admixture of two or more pure spectral colours in the *natural proportions* present in white light. If a screen be taken with two adjustable slots, any part of the spectrum of the one may be made to overlap the spectrum of the other, and, by having the slots A and B arranged the one a little above the other (fig. 10), the top or bottom of the field of view shows the two colours separately, and in the central part of the field we have the admixture.

This arrangement of slots, one above the other, seems to have been employed many years ago by Helmholtz (see his *Handbuch der Physiologischen Optik*, p. 353). It is also referred to by Ogden N. Rood in his *Modern Chromatics*. But apparently the employment of gratings

is a novelty, as both the above writers used prisms. The distinctive feature of the gratings is that the spectra with the order of their colours reversed can be superposed, whilst with a prism the superposed spectra would both have their colours in the same order, i.e. red ends both on

Fig. 10.



the same side. The former arrangement has an obvious interest of its own, because of the comparison it affords of colour sensation produced by a series of pairs of colours, each pair of which has the same wave-length.

(6) Miscellaneous.

Forgan, W.—**Simple Method of obtaining a Large Field of View with the Compound Microscope.**

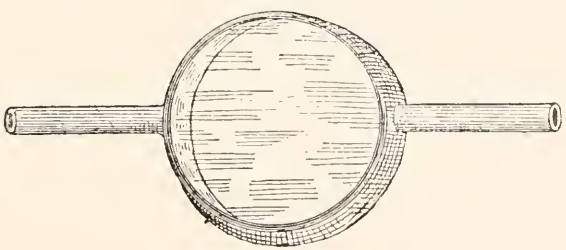
[The enlarged field of view caused by closing the draw-tube is simply a result of the reduction in power.] *Proc. Scottish Micr. Soc.*, iii. pp. 32–4 (1 fig.).

B. Technique.*

(1) Collecting Objects, including Culture Processes.

Simple Method for Cultivating Anaerobic Bacteria in Capsules.†—Dr. St. Epstein describes a very simple procedure for cultivating

Fig. 11.



anaerobic bacteria. A Petri's double capsule is fixed round with a broad rubber band having a couple of rubber tubes at opposite sides. The

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous. † Centralbl. Bakt., 1te Abt., xxviii. (1900) p. 443 (1 fig.).

chink between the capsule and the band is smeared up with paraffin and wax, and then hydrogen gas passed through for three minutes. The exit opening is then closed, and directly after the entrance opening. The bacillus of malignant œdema, *Bac. botulinus*, and *Bac. tetani* have been cultivated by this method. The contrivance is represented in fig. 11.

New Method of Cultivating the Tetanus Bacillus.*—Dr. L. Debrand describes a new method for cultivating the tetanus bacillus. A mixed culture of *B. tetani* and *B. subtilis* is grown under ordinary aerobic conditions in bouillon composed of Liebig's extract 5 grm.; peptone (Chapoteaut's) 10 grm.; salt 5 grm.; water 1000 grm. *B. subtilis* develops first and forms a thick surface scum, and after some 24 hours the drumstick microbe begins to grow. The toxin of the cultures is in no way modified by the symbiosis, and is in fact identical with that formed by *B. tetani* when cultivated under anaerobic conditions. It was found advisable to start the cultures at about 34°; but when the toxin production had attained its maximum (5 or 6 days), the tubes were withdrawn from the incubator, as the toxicity was from that time no longer increased.

(2) Preparing Objects.

Method of Preserving Crustacea.†—O. A. Sayce describes a method of preserving small animals which, while obviating the necessity of keeping them in a fluid, retains their suppleness and natural appearance. The method is specially adapted for crustacea and such animals as have a firm outer skeleton. The specimens (fresh or preserved in 70 per cent. alcohol) are placed in the following mixture:—glycerin 1½ parts, water 1 part, methylated spirit 1 part (each by volume); corrosive sublimate 1 in 2000. The time of immersion will depend on the size of the object, but there is no detriment from an indefinite period. Ten days will suffice for *Astacopsis bicarinatus*.

When the specimens have soaked sufficiently long to allow of all the tissues being penetrated by the solution, they may be taken out, and having been set aside for a few days to drain and allow the spirit to evaporate, they may be stored in suitable boxes or wrapped in waterproof paper. To prevent too much drying, or the deposit of moisture owing to the hygroscopic property of the glycerin, the specimens may be coated with gelatin and then immersed in 10 per cent. formalin for a few minutes. This renders the gelatin insoluble to water. In practice the author uses a quart glass jar in which are placed 8 oz. of methylated spirit, 7 grains of corrosive sublimate, 8 oz. of water, and 12 oz. of glycerin.

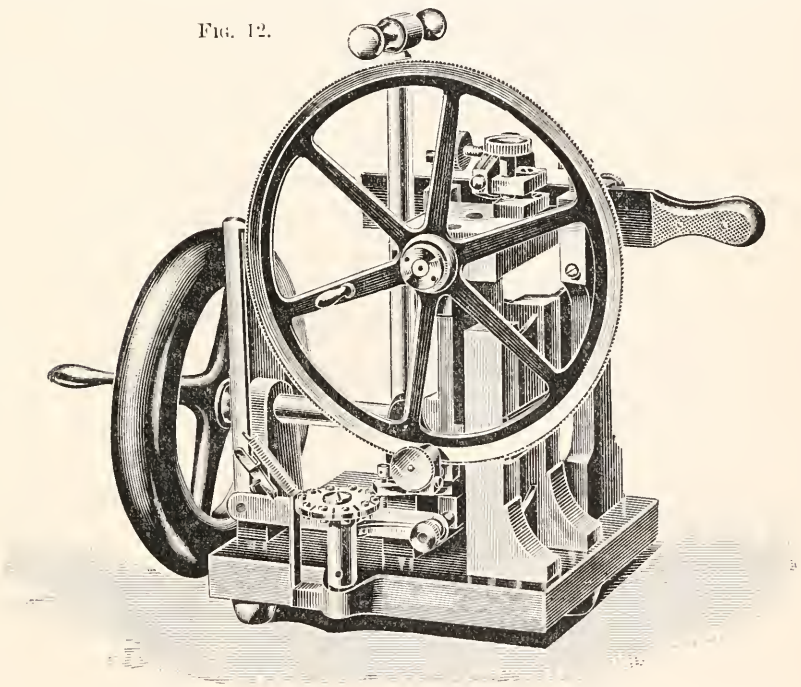
Silvering Nerve-tissue.‡—Sig. Mosso impregnates nervous tissue with 1–2 p.c. solution of argentamin, and reduces with 10 p.c. pyrogallol solution. The impregnation takes 10 minutes and the reduction five. The method was successful for the medullary sheath and for nerve-cells.

* Ann. Inst. Pasteur, xiv. (1900) pp. 757–68.
† Victorian Naturalist, xvii. (1900) pp. 75–8.
‡ Zeitschr. f. angew. Mikr., vi. (1900) pp. 161–2.

(3) Cutting, including Imbedding and Microtomes.

Minot-Blake Microtome.*—F. Blake has devised a microtome which remedies the mechanical defects of its prototype the Minot Wheel-Microtome. The substantial difference between the two instruments is in the methods used for supporting and guiding those structural parts by means of which the specimen to be cut is moved in a vertical and a horizontal direction. The moving parts have only three bearing points, and are held in contact with the guiding surfaces by the action of a flat steel spring. The points which form the base of the triangle are V-shaped, and are held in contact with a V-shaped groove, while the third

Fig. 12.



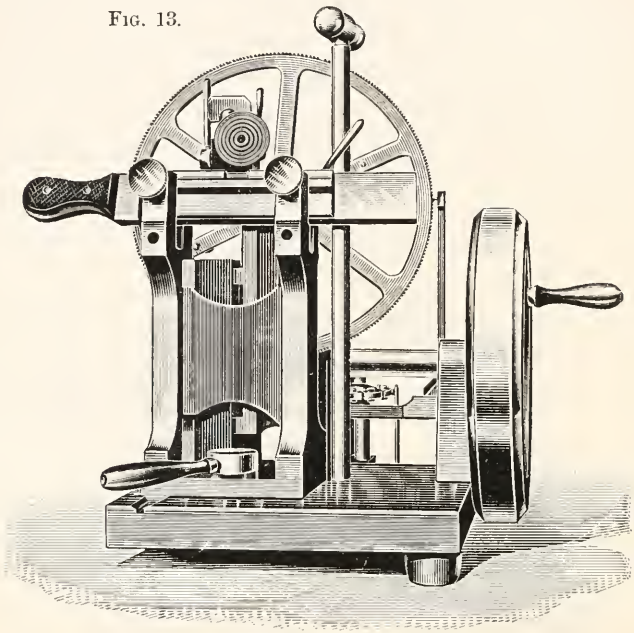
point is a flat block held in contact with a plane surface. The tripod bearing insures absolute stability under contact; and the stiff but yielding bar-spring gives absolute contact and compensation for wear.

From the description given by the Buff and Buff Manufacturing Company the following further details are gathered. The microtome is made up of a heavy base and fly-wheel of iron. The shaft and sliding block are of hardened steel operating on hard composition metal, and the vertical carriage moves on bell-metal uprights. The knife has a blade of $1\frac{1}{8}$ in. The feed-wheel is 7 in. in diameter, and is accurately cut to 500 teeth. The micrometer feed-screw for the cross-feed has 50·8 threads to the inch (half millimetre pitch) so that a single tooth of

* Journ. Boston Soc. Med. Sciences, iii. (1899) pp. 75–8 (3 pls.).

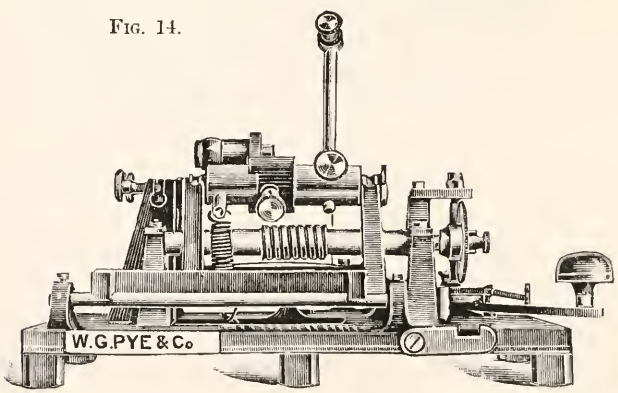
the feed-wheel advances the specimen one micron or $\frac{1}{25400}$ in. toward the knife. By a circular adjustment the feed may be varied from one to ten microns per stroke. The vertical movement is 1 in.

Fig. 13.



This instrument (see figs. 12, 13) will cut single micron sections in series without missing.

Fig. 14.



Leake's Microtome.—The accompanying cut (fig. 14) illustrates the microtome shown by Mr. Hugh M. Leake at the meeting of the Society on January 16th (see p. 106), designed for cutting perfectly flat sections.

(4) Staining and Injecting.

Mordants in Staining Technique. * —After alluding to the great advances made in dyeing by means of mordants, decolorising and other reagents, G. Marpmann suggests that similar combinations might be employed in microscopical technique. For this purpose the chloramin colours are recommended, such as chloramin yellow C.G., which is fast to alkalis, acids, heat, and chlorine, and chloramin violet R, which is fast to acids and alkalis.

The relations of pigments to organic cell-substances are deserving of special analysis. The following reactions are those best known :— Substances containing pectin, vegetable mucus, or gums stain red with ruthenium oxychloride in ammoniacal solution $Ru_2(OH)_2Cl_4+7NH_3$. The aqueous solution $\frac{1}{3000}$ is kept in dark bottles. With this stain plus acetic acid bacteria stain blue.

Vegetable fibres. The specimen is boiled with naphthol solution in alcohol $\frac{1}{5}$. One drop of the solution with 10 drops of water are mixed on the slide. After boiling, sulphuric acid is added. This gives a violet hue if vegetable fibres be present, and a brownish-red with animal fibres.

Cell-nuclei. A mixture of 0·5 carmin, 20 alcohol, and 2 hydrochloric acid, is heated, and then 25 chloral hydrate added. In this fluid nuclei stain a deep red in 10 minutes.

Mucin is stained a dark-brown in 1 p.c. Bismarck brown.

Muscle-fibres stain yellow in saturated aqueous solution of orange G.

Cell-substance stains reddish with orange G.

Nerve-fibres become deep red in saturated aqueous solution of acid fuchsin (fuchsin S).

Chromatin. Preparations stained with safranin are treated with one per thousand hydrochloric acid alcohol. Thionin stains the chromatin bodies of the nucleus in a similar way.

Diabetes blood is decolorised by methylen-blue solution. The solution consists of 1 part methylen-blue, 6000 parts of water, and 2 parts of 6 p.c. caustic potash. One part blood is mixed with 2 parts of water and 50 parts of the solution, and the preparation heated for 3 minutes in a water-bath. Normal blood remains blue, while diabetes blood turns yellow.

Wood (lignin). Sections are stained with phloroglucin and hydrochloric acid a rose colour; with orcein, reddish-violet; with carbazol, violet; with resorcin, bluish-violet; with naphthalin, yellow; with pyrogallic acid, bronze yellow; with indol, dark-red.

Differential Stain for Cell Structures. † —J. H. Schaffner uses the following stain for differentiating cell-structures. Stain first for two or three hours with anilin-safranin (equal parts of anilin oil, water, and saturated alcoholic solution of safranin). Then stain with picro-nigrosin solution (distilled water, 100 ccm.; picric acid, 1 gr.; nigrosin, 1 gr.; first dissolve the picric acid and then add the nigrosin). Dehydrate, and mount in balsam. The cell-wall stains black; the cytoplasm bluish; spindle-threads green; chromatin network brick-red; granules of the cell-plate black.

* Zeitschr. f. angew. Mikr., vi. (1900) pp. 169-73.

† Journ. Applied Microscopy, iii. (1900) p. 960.

Staining Elastic Fibres.*—Prof. C. Weigert has devised the following solution for staining elastic fibres a blue-black colour:—200 ccm. of a mixture of 1 p.c. aqueous solution of basic fuchsin and 2 p.c. aqueous solution of resorcin are heated to boiling in a porcelain vessel; 25 ccm. of liq. ferri perchlor. are added, and the mixture kept stirred for 2–5 minutes. After cooling it is filtered, and the precipitate on the filter is boiled in 200 ccm. of 94 p.c. alcohol. When cold the solution is filtered and brought up to 200 ccm. with alcohol, 4 ccm. of HCl are then added. The solution is now ready for use. The sections are immersed for 20–60 minutes, and then washed in alcohol and cleared up in pure xylol.

Differential Stain for Connective-Tissue.†—Dr. F. B. Mallory has found that the following method for staining connective-tissue fibrillæ and reticulum is very good, and though not absolutely perfect, gives better results than any yet proposed for the purpose. (1) Fix in corrosive sublimate or in Zenker's fluid; (2) imbed in celloidin or in paraffin; (3) stain the sections in $\frac{1}{2}$ to $\frac{1}{10}$ of a 1 p.c. aqueous solution of acid fuchsin for 1–3 minutes; (4) wash in water; (5) place in a 1 p.c. aqueous solution of phosphomolybdic acid for 1 minute or longer, using platinum or glass needles; (6) wash in two changes of water; (7) stain in the following solution for 2–30 minutes or longer:—anilin blue soluble in water 0·5, orange G 2, oxalic acid 2, water 100; (8) wash in water; (9) dehydrate in 95 p.c. alcohol; (10) blot on the slide, and clear up in xylol or in oleum origani cretici; (11) xylol balsam.

Staining Neuroglia Fibres with Phosphotungstic Acid Hæmatoxylin.‡—Dr. F. B. Mallory recommends the following method:—(1) Place the sections in 0·5 p.c. aqueous solution of permanganate of potash for 15–30 minutes; (2) wash in water; (3) 1 p.c. aqueous solution of oxalic acid 15–30 minutes; (4) wash in two or three changes of water; (5) stain in the following solution for 12–24 hours or longer:—hæmatoxylin 0·1, water 80, 10 p.c. aqueous solution of phosphotungstic acid 20, peroxide of hydrogen 0·2. Dissolve the hæmatoxylin in a little water by the aid of heat, and add it after cooling to the rest of the water and the acid, then add the peroxide of hydrogen; (6) wash quickly in water; (7) dehydrate in 95 p.c. alcohol; (8) oleum origani cretici; (9) xylol balsam. The nuclei, neuroglia fibres, and fibrin stain blue; axis cylinders and ganglion cells pale pink; connective-tissue deep pink.

(5) Mounting, including Slides, Preservative Fluids, &c.

Mounting in Glycerin.§—J. H. Schaffner recommends the following procedure. The objects are taken from water to glycerin by adding the latter gradually until pure glycerin is arrived at. They are then placed in a small drop of glycerin jelly on the slide, and a ring of Canada balsam is run round the drop, after which the cover-glass is put on.

Media for Mounting Diatoms.‖—Dr. J. F. W. Tatham refers to his experiences with different media of exceptionally high refractive indices

* Centralbl. f. allgem. Pathol. u. pathol. Anat., ix. (1898) pp. 289–92.
† Journ. Experim. Med., v. (1900) pp. 15–6. ‡ Tom. cit., pp. 19–20.
§ Journ. Applied Microscopy, iii. (1900) p. 960 (1 fig.).
‖ Journ. Quek. Micr. Club, vii. (1900) pp. 299–308.

for mounting diatoms. One of these is a solution of biniodide of mercury in excess of iodide of potassium. The solution is not only readily obtained, but is easily retained within a ring of Rousselet's gold-size-dammar (saturated solution of dammar in benzol 2 parts, gold-size 1 part). The solution, which is colourless, brings out the structure with clearness and beauty. Another colourless medium is phosphorus, which has a refractive index of 2·2. The pictures are clear and brilliant, but are only obtained by tedious and difficult manipulation. Quinidine is colourless and is easily manipulated; it is only necessary to place a portion along with the diatoms between the cover-slip and the slide, and fuse the quinidine with a spirit-lamp. Its chief fault is that the mounts soon become opaque from crystallisation of the medium. Realgar, which has a refractive index of 2·5, has several drawbacks. Great heat is required to fuse it, the high temperature often twists or distorts the valves, and the colour of the finished mount is yellow. Another medium is a mixture of piperine and bromide of antimony (3 to 2 by weight). A quantity sufficient only to fill two-thirds of the area of the cover-glass is placed on the slide; the mixture is then gently heated over a spirit-lamp; when the medium has set, the unoccupied margin is filled up with paraffin, and the cover-glass encircled with Hollis' liquid glue. This medium answers well for the finely lined species, but not for *Coscinodiscus* or for any of the other coarse circular forms.

(6) Miscellaneous.

New Thermo-Regulator.* — Dr. St. Epstein has devised a thermo-regulator which is not only easily filled, but can be rapidly set for different temperatures. The temperature oscillations do not amount to more than 0·1° C., and are quite independent of external conditions (gas and air pressure).

Demonstrating Form and Size of Bacteria. † — Dr. A. Macfadyen and M. J. E. Barnard give a short account, with photographic illustrations, of the main types of bacteria. The organisms described and depicted are *Streptococcus pyogenes*, *Staphylococcus pyogenes aureus*, *Diplococcus pneumoniæ*, *Bacillus pestis*, *Spirillum choleræ*, *Bacillus typhosus*, and *Bacillus tetani*. The magnification used (× 1750) was the same in all cases, so that by a glance at the plate the relative size and characteristic appearance of the various organisms can at once be grasped. The objectives used were a Zeiss 3 mm. apochromatic, and a Winkel 1·8 mm. fluorite system, low-power projection-oculars being used in each case, and magnification obtained by suitable camera extension. The organisms were all stained, and the screen used was a saturated solution of acridine yellow, about 15 mm. thick.

Apparatus for Testing Milk and for Cultivating Bacteria. ‡ —Dr. St. Epstein describes a new fermentation apparatus for testing the value of milk for cheese making and also for the aerobic cultivation of bacteria. The apparatus (fig. 15) consists of two parts: the vessel A for holding the milk or the nutrient medium, and B for collecting the gases. B

* Centralbl. Bakt., 1te Abt., xxviii. (1900) pp. 503–4 (1 fig.).
† Nature, lxiii. (1900) pp. 9–10 (1 pl., 8 figs.).
‡ Centralbl. Bakt., 2te Abt., vi. (1900) pp. 658–9 (2 figs.).

consists of a eudiometer *f*, which reaches almost to the bottom of the glass globe *d*. In the lower end *h* of the eudiometer is inserted a tube with a valve *v*. Before use A is sterilised or, as is customary in dairies, is washed with acid and then with milk, and is then filled with milk up to the mark 100. The eudiometer *f* is filled by pouring water in at the opening *o* up to the level of *n* at the lower part of the eudiometer. The stopper *s* at the top of the burette is then removed, *o* closed with the finger, and the eudiometer filled with water. The stopper is again inserted, and the finger removed. When the part B has been filled, its lower end *c* is flamed and carefully adjusted on A. Any gases that develope open the valve *v* and ascend into the eudiometer. If a chemical analysis of the gases be desired, the stopper *s* is replaced by a perforated caoutchouc stopper closed by a clamp (fig. 16). Should it be desired to transfer the collected gases to another vessel, the opening *o* of the glass bulb is connected with a tube. Then, by pouring water from a greater height than that of the eudiometer into the bulb *d*, the gas is expelled through the opening K. It is advisable to warm the flask A up to the temperature at which the experiment is to be carried on, and this is best done by placing it, when filled and inoculated, for some minutes in the incubator or in warm water.

Fig. 15.

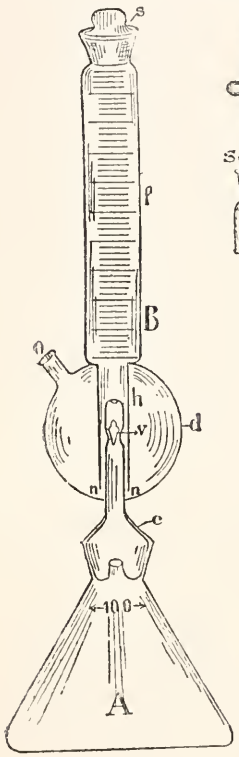
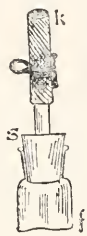


Fig. 16.



Demonstrating the Bacterial Capsule.*—Dr. I. Boni states that the capsules of bacteria, even from solid cultures, may be demonstrated by the following method. The white of one egg, 50 grm. of glycerin, and two drops of formalin, are mixed together, well shaken, and filtered. With a loopful of this fluid a trace of an agar culture of pneumococcus is carefully mixed and spread on a slide. The slide is then heated till white vapour ceases to be given off. The film is then covered with Ziehl's solution, which is allowed to act for half a minute. The preparation is washed, dried, and mounted in balsam.

Method of Examining Fæces and Morbid Secretions for Bacteria.† —Dr. J. Strasburger takes a piece of fæcal matter, the size of half a pea, stirs it up with a glass rod, and then centrifuges. The supernatant fluid is then treated with 96 per cent. alcohol in the proportion of 1 to 2 parts, in order to diminish the specific gravity, and so allow the bacteria

* Münchener Med. Wochenschr., xlvii. (1900) pp. 1262–3.
† Zeitschr. f. angew. Mikr., vi. (1900) pp. 169–1.

to sediment. Pus, urine, and other secretions may be treated in the same way.

Method for Examining quickly moving Micro-organisms.*—Herr H. Plenge gives the following procedure for obtaining an extremely thin layer of fluid in which the motility of micro-organisms is impeded. A very thin cover-glass which has been kept for some days in absolute alcohol is carefully dried. A trace of pure glycerin is then rubbed on with the finger tip, and afterwards rubbed off with a clean cloth. In this way an extremely thin and regular layer can be obtained from a culture fluid after the superfluous fluid is poured off.

Method of Measuring the Bactericidal Power of the Blood.†—Prof. A. E. Wright has devised a method of determining in a quantitative manner the bactericidal power of the blood. Measured volumes of serum and of graduated dilutions of serum are introduced into a series of capillary cultivation tubes along with a series of equal volumes of a gelatin culture containing an appropriate number of bacteria. Mixture of the contents of the serum and culture is then effected in the capillary tube. It will be noticed that by this arrangement the serum comes in contact with the bacteria only after they have been suspended in a fluid which is sufficiently viscid to make it impossible for them to come together into groups. After the gelatin has solidified, the tubes are incubated for a period of two or more days. The number of colonies is then counted under the Microscope, and the results compared with those from a series of control tubes filled with an equal volume of the gelatin diluted with an indifferent diluting fluid. For the details of the procedure, which are given with much minuteness, the original should be consulted.

Microscopy of Starches.‡—Dr. H. Galt has collected together in a booklet the results of his observations on some of the more commonly occurring starches, and has illustrated his work with 22 original photomicrographs. The author prefers to use the term microphotograph on the ground of euphony, but does not suggest that this atavistic spelling is easier to write or print. Another example of an old and not to be admired custom is the different magnifications under which the starches have been photographed. For the purpose of comparison and for the use of students it is wiser to adopt a single standard, as was done by W. Griffiths in *The principal Starches used as Food* (1892). Indeed, Griffiths' work is superior in every way, not only in the photomicrographs but also in the letter-press, which contains a large amount of useful information.

Simple Method for Estimating the Damage to Living Cells.§—Dr. M. Neisser states that the reducing power of living cells such as leucocytes may be used as an estimate of their vitality. Thus the normal leucocyte speedily decolorises methylen-blue; but if in any way damaged, the cell is unable to exert this power, and the solution retains its hue in proportion to the vital activity of the cell. If 0·5 ccm. of aleuron-

* Verhandl. Naturhist.-med. Vereins zu Heidelberg, vii. p. 218. See Zeitschr. f. angew. Mikr., vi. (1900) p. 188. † Lancet, 1900, ii. pp. 1556–61 (4 figs.).

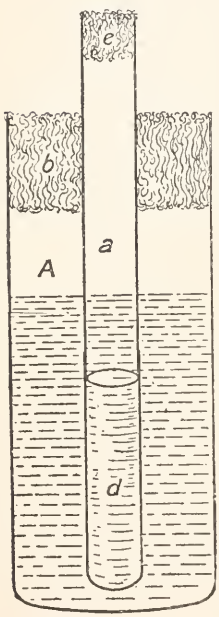
‡ Baillière, Tindal, and Cox, London, 1900, 108 pp., 22 pls.

§ Münchener med. Wochenschr., xlvii. (1900) pp. 1261–2.

exudate and 1·5 ccm. of physiological salt solution be mixed in a narrow test-tube (6–7 mm. diam.) and a drop of weak methylen-blue solution added, the colour is discharged in a short while. The tube is closed and placed in a thermostat. If, however, the leucocytes be damaged at all by leucocides, heat, chinin, &c., the fluid will remain more or less blue, and the amount of damage may be roughly estimated from the colour.

New Method for Making Collodion Bags.*—Dr. M. A. Ruffer and Dr. M. Crendiropoulo describe a new procedure for obtaining the diffusible poisons of micro-organisms in an ordinary culture tube. The apparatus (fig. 17) consists of an ordinary test-tube A filled to any required level with bouillon or some other fluid cultivating medium, and plugged with cotton wool at *b*. Through this plug *b* is introduced another smaller glass tube *a*, to the lower extremity of which is attached a collodion sac *d*. This inner tube is filled to any required level with some cultivating fluid, and is plugged at the upper extremity *e* with cotton wool. The collodion bag is made as follows: a small test-tube is rapidly dipped bottom downwards into a vessel filled with collodion until 2 or 3 in. are covered with collodion. The layer is allowed to dry, and then the process is repeated twice or thrice. In order to free the collodion from the tube, the whole is dipped alternately in strong spirit and then into water. After a few minutes the bag is loosened and can be slipped off the tube. A small glass tube is then inserted into the bag and the whole incubated at 37° C. The bag is by this means shrunk firmly on to the tube. In order to sterilise the collodion bag tube, it is fixed in an empty test-tube in the manner shown in the illustration, and the whole is sterilised at 150° C. by dry heat on one or several occasions. When this has been done, the inner tube *a*, together with the plug *b*, is transferred aseptically to a tube of sterilised bouillon or gelatin of equal size, the plug *b* now serving to close the tube of bouillon into which the inner tube is dipped. The bouillon in tube *a* is now inoculated with the micro-organisms to be studied, and the whole placed in the incubator. After a time the inner tube *a* is withdrawn; the outer tube contains the diffused products. This method may, of course, be used for other purposes—for example, for testing the action of microbes on fluids, or the antagonism of two different microbes.

Fig. 17.



The Plague.†—It may be useful to mention that the *British Medical Journal* for October 27, 1900, contains a series of original articles dealing with the plague from its clinical, pathological, bacteriological,

* Brit. Med. Journ., 1900, ii. pp. 1305–6 (1 fig.).
† Tom. cit., pp. 1229–58 (16 figs.).

and historical aspects. Among these may be mentioned 'Bacteriology of Plague,' by Mr. D. C. Rees, and 'Methods of making Antitoxic and Preventive Fluids,' by Dr. C. B. Stewart.

Progress in Metallography.*—T. K. Rose treats this subject with special reference to Le Chatelier's suggestions in the *Bulletin de la Société d'Encouragement* for September last. These relate mainly to the best methods of obtaining graduated polishing powders, of illumination, and of making alloys. In examining the alloys of two metals, much time is consumed in making and suitably preparing a series of typical specimens. Le Chatelier proposes to shorten the search by melting together two superimposed layers, each consisting of a pure metal, the lighter one being on the top. If no alloys are formed of greater density than the heavier metal, and the crucible is allowed to cool undisturbed, a culot can be obtained which, on being sawn through vertically, shows a complete graduation from one pure metal to the other, passing through the whole series of alloys, which can then be studied in one specimen. Figures are given of the aluminium-copper series obtained in this way.

Crystalline Structure of Iron and Steel.†—J. E. Stead describes an elaborate investigation of this subject. He arrives at ten conclusions, of which the following is a condensed summary:—

(1) That granules and crystals should not be confused; for although a granule is built up of crystals, its external form is not that of any kind of crystal, as it takes its shape from its surroundings. It is better to replace the term granule by grain.

(2) That grains formed in the solidification of liquid metals are large or small, according to whether the freezing is rapid or slow.

(3) That in practically carbonless pure irons, and in steels of fine grain produced by either forging or certain heat treatment, the grains increase in size slowly at 500° C., and more rapidly at between 600° and 750° C.; and it is possible, by heating at about 700° for a few hours, to develope granular masses of exceeding coarseness. When pure iron made coarsely granular by long heating at a dull red heat is heated between 750° and 870°, as a rule the structure is not materially altered; but at 900° the granules again become small, and heating to 1200° C. does not apparently produce any difference in their dimensions.

(4) That when steels containing 0·20 to 1·20 p.c. of carbon are subject to prolonged heating at 700° C., the grains do not increase in size; but they do increase if the temperature is raised above 750°. When, however, this coarse steel is reheated to between 700° and 750°, the coarse structure vanishes and the grains become very fine.

(5) That in steels with 0·10 to 0·15 p.c. containing the pearlite in widely separated areas, on heating and quenching from 750°, the large ferrite grains are not broken up, and the carbon apparently does not expand or diffuse beyond the original areas, as previously demonstrated both by Osmond and Arnold; yet, when the heating is raised to near 850° and the steel allowed to cool down naturally, the carbon areas are found far beyond their original positions, and exist in a number of smaller segregations.

* Nature, Jan. 3, 1901, pp. 232–3 (3 figs.).
† Metallographist, Oct. 1898, pp. 289–341 (26 figs. and 3 diagrams).

(6) That good open-hearth steel with 0·23 p.c. carbon may be heated to close upon its burning-point without becoming brittle, and that it only becomes truly burnt when intergranular separation is effected.

(7) That when solid steel is partially decarburised by oxidising agents at between 700° and 800°, an envelope of pure iron forms at the surface, and the grains in this layer assume a columnar structure radiating from the outside to a point below where there is carbon.

(8) That by strongly etching pure iron, or iron containing much phosphorus, aluminium, or silicon, the cubical crystals of pure iron are readily developed.

(9) That by mechanically testing micro-sections of pure iron by the method of fracture, it seems to follow that the smaller and finer the grain the safer the structure.

(10) That soft steel plates treated under certain conditions develope a most peculiar crystalline structure, whose cleavage lines are invariably at an angle of 45° to the direction in which the plates are rolled. This extraordinary development is sometimes destroyed by close annealing for 36 to 48 hours; but it is invariably destroyed by heating to 900° C., and the steel then becomes exceedingly tough.

Constitution of Steel considered as an Alloy of Iron and Carbon.* —Albert Sauveur argues that the formation of a cryohydrate and of an eutectic alloy are analogous phenomena; the only difference being that the former takes place at ordinary temperatures, and the other at high temperatures. The result in each case is a mechanical compound in which the constituents are juxtaposed in minute crystals and in definite proportions. He illustrates his reasonings by the solubility curve of sodium chloride in water, and by the cooling curve of the alloy of iron and carbon (i.e. steel). A plate of 16 figures reproduces the microstructure of the alloy. He quotes Ponsot's opinion† that the name "cryohydrate" should be abandoned, as being inapplicable to a mechanical mixture, and should be replaced by "cryosel."

Allotropic Iron and Carbon.‡—E. H. Sauiter's researches are intended as an unbiassed contribution towards the controversy encircling the cause of the glass-hardness of quenched carbon steel. His results were obtained by hot-etching on specimens of metal selected for their freedom from mechanical treatment—in other words, specimens in which the normal structure would be as perfect as possible. His investigations were arranged in three sections:—

i. The structure of pure carbonless iron at a bright red heat. (The cubical crystals of cold iron became replaced by rhombohedral crystals in the hot specimen, showing that iron is dimorphous.)

ii. The structure of pure carbon-iron compounds at a bright red heat. (There was a marked reduction in the size of the amorphous carbon grains, as compared with their cold state.)

iii. The effect of moderate quantities of sulphur, phosphorus, and manganese on the structure of carbonless iron at a bright red heat.

The dimorphism of section i. and the reduced amorphism of section ii.

* Metallographist, 1898, pp. 210-29 (1 pl. and 3 figs.).

† 'Recherches sur la congélation des solutions aqueuses étendues,' Paris, 1896.

‡ Metallographist, 1898, pp. 251-8 (7 figs.).

seem to point to allotropy, which is found to be modified by the impurities in section iii.

Notes on the Microscope in the Drug Store.*—Dr. H. M. Whelpley describes the value of even a low power cheap Microscope to a pharmacist. Among articles which are readily discriminated by such an instrument are: the different grades of hydrargyrum cum creta, leaves of senna and long buchu, short buchu and uva ursi; adulterations of lupulin; powdered rhubarb; distinction between fruits of hemlock and anise, &c.

RICE, F. S.—**Microstructural Characteristics of Steel.**
Trans. Amer. Micr. Soc., Aug. 1897.

MOLDERKE, R.—**The Microscope in the Study of Iron.**
Iron Trade Review, Oct. 28, 1897, p. 19.

RENARD, A. F., & F. STÖBER—**Notions de Minéralogie.**
[A noticeable feature of the short section on chemical crystallography is the inclusion of a number of micro-chemical tests, with figures of the crystalline products.] Ad. Hoste, Gand, 1900, x. and 374 pp., 732 figs.

The Metallographist. A quarterly publication devoted to the study of Metals, with special reference to their Physics and Microstructure, their Industrial Treatment and Applications. Boston, U.S.A.

In addition to the articles abstracted in our Journal, the following possess microscopical interest:—

Jan. 1898. Microstructure of Steel and the Current Theories of Hardening, pp. 27–51, numerous tables and figs. Albert Sauveur.

Jan. 1898. Microscope Accessories for Metallographers, pp. 82–3 (2 figs.). J. E. Stead.
[The author applies a method of fracturing to determine the locality of impurities in a metal.]

April 1898. Bibliography of the Metallography of Iron and Steel, pp. 168–78.
[Arranged alphabetically under authors' names; too long to quote; apparently a very complete list; nearly all the citations seem to bear on microscopy; some sixty authorities (English, French, German, American), covering the last twenty years, are given.]

* Amer. Mon. Micr. Journ., 1900, pp. 305–8; quoted from Bull. of Pharmacy.

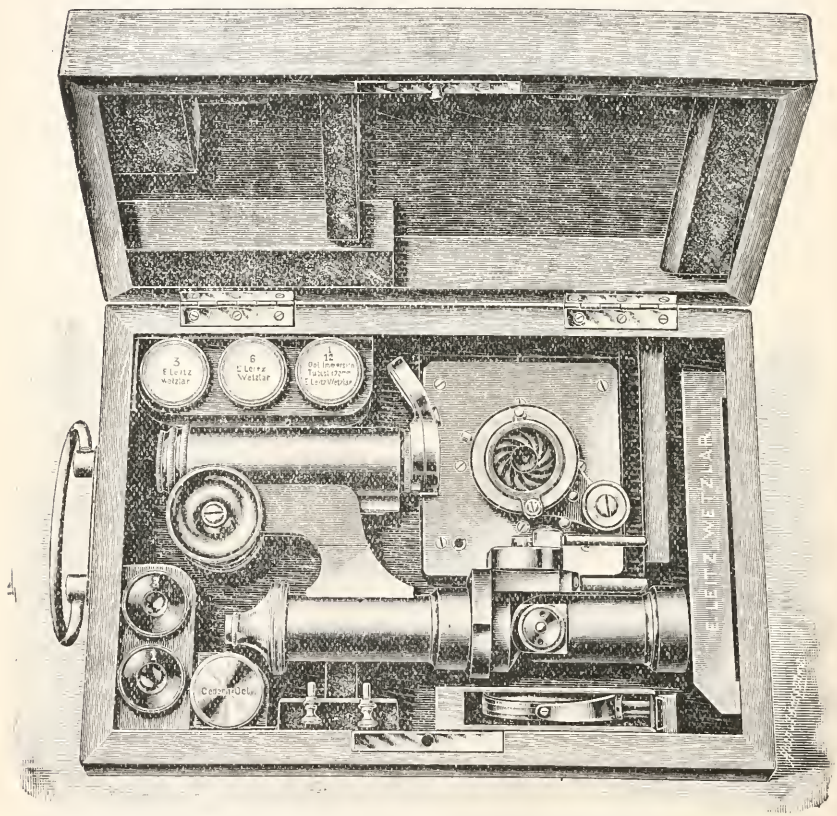
MICROSCOPY.

A. Instruments, Accessories, &c.*

(1) Stands.

Leitz' Large Travelling Microscope.—This instrument (figs. 20, 21), when set up, corresponds to Leitz' No. II. Stand. It is intended for

Fig. 20.

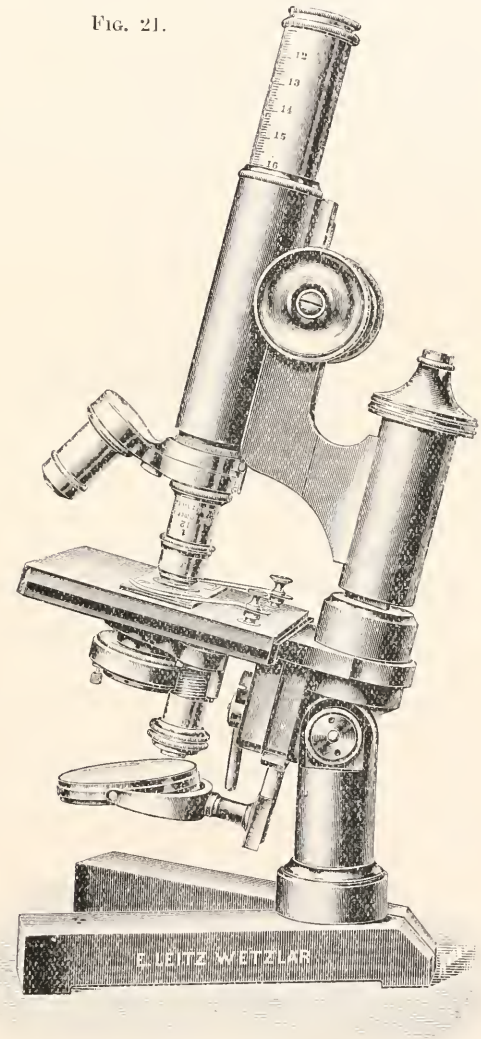


study of epidemics and diseases in their own habitats. In order that the apparatus may be packed in the case with the greatest economy of space, the two claws of the foot fold together, the stage and mirror rotate into a vertical position, and the draw-tubes completely telescope.

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

When in use the square stage is clamped firmly by a lever. The coarse adjustment is by rack-and-pinion, and the fine by a micrometer-screw. The Abbe illuminating apparatus and iris diaphragm are the same as in

Fig. 21.

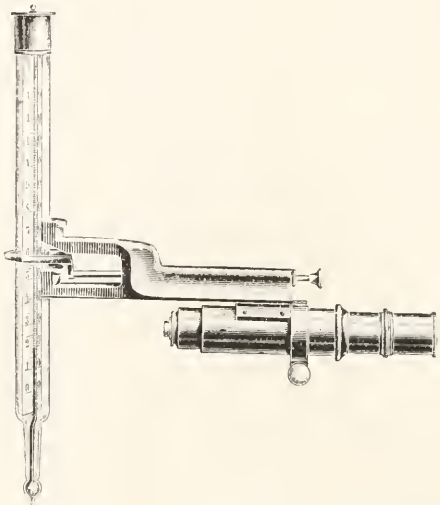


stand No. II. The stand is jointed for inclination of tube. The whole packs away in a mahogany case measuring 27·5 by 18·5 by 8 cm., as shown in fig. 20.

The instrument is also suitable for the highest laboratory work.

Leitz' Thermometer Microscope. — This apparatus (fig. 22) has been made by the Wetzlar firm to the design of Fridtjof Nansen, and is intended for the accurate reading of a thermometer. The nickelled draw-tube is attached to a black lacquered stand, whose foot ends in

Fig. 22.



two incisions into which thermometers of different sizes may be clamped by means of a holder acting on a spiral spring. The instrument is fitted with a micrometer eye-piece and a low-power achromatic objective.

Leitz' New Cheap Stand. — In this stand, No. III. in catalogue (fig. 23), economy has been especially studied. It is intended for ordinary laboratory use, and can take high-power dry objectives, but not immersion lenses. The coarse adjustment is by rack-and-pinion, and the fine by micrometer-screw. The mirror is plane and concave. The price of the stand, with the two adjustments and the revolving diaphragm disc, in mahogany case, is 2*l.* 10*s.*

(3) Illuminating and other Apparatus.

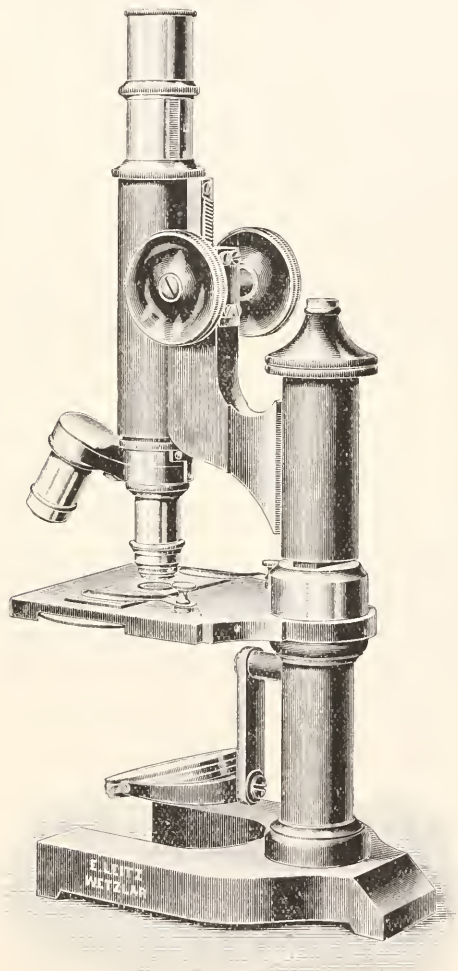
Drüner's New Magnifying Stereoscopic Camera. * — Dr. Drüner prefaces the description of his apparatus by a historical sketch of stereomicroscopy.

His instrument (fig. 24), which consists of a double aluminium camera encased in black leather, has, at its reduced lower end, the slide apparatus for the reception of the twin objectives. The optical axis of each of the two combined cameras coincides with the optical axis of one of the two systems of the twin objectives, and stands perpendicularly on the plane of one of the two reception screens *v*. These screens

* Zeitschr. wiss. Mikr., xvii. (1900) pp. 281-94 (1 pl. and 1 fig.).

are inclined to one another at 165°, the optical axes being at 15°. The screens work in grooves *p*, and are stopped off by two circular stops of 50 mm. in diameter. Thus the projected image also has a diameter of 50 mm. The width of the camera is 150 mm. The screens are the

Fig. 23.



ordinary commercial slides of 9 by 6 cm.; they are secured in their frame by a buckle *w*.

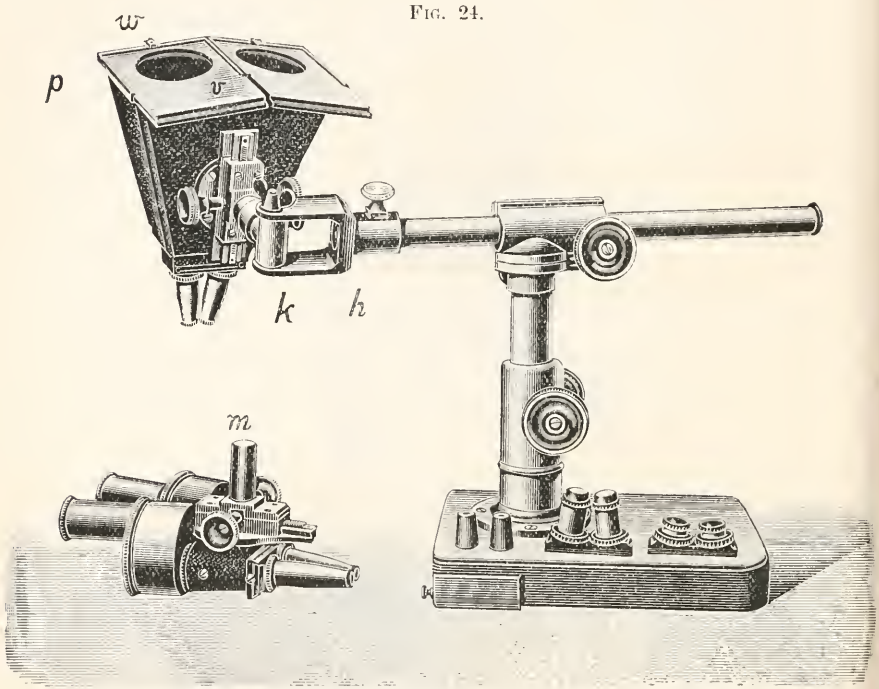
The camera can be exchanged for the tube of a preparation-Microscope on the same stand. For this purpose the plug *m* fits into a hollow cylinder, which, itself, is an arm of the cylinder *k* working between

the points of the fork *h* and rotatory about an axis perpendicular to those points. It will be readily seen that the arrangement permits of adjustment in any position. The set of five twin objectives of the preparation-Microscope can be used with the camera.

Each of the slides introduced into the camera presents a real inverted image of the object.

The magnification varies from 1·6 to 7 diameters. This appears

Fig. 24.



disproportionately small, but the stereoscopic magnification, in reality supplying the ocular magnification, has to be reckoned in addition.

Details of stops and light sources used are supplied; and a coloured plate illustrating some of the results obtained is appended.

Ross' "No. 1 Model" Projection Lantern.—This is an exceedingly small-bodied lantern fitted with lime-light jet (see fig. 25). It has many novel points of construction, and is very portable, rigid, and effective.

At the exhibition of Messrs. Ross' new apparatus for lighting purposes at the meeting of the Society on December 19th, 1900, this instrument was also shown mounted on an extra and detachable base-board on which may be placed any ordinary table Microscope having its optic axis central with that of the lantern. The object of this combined apparatus

Fig. 25.

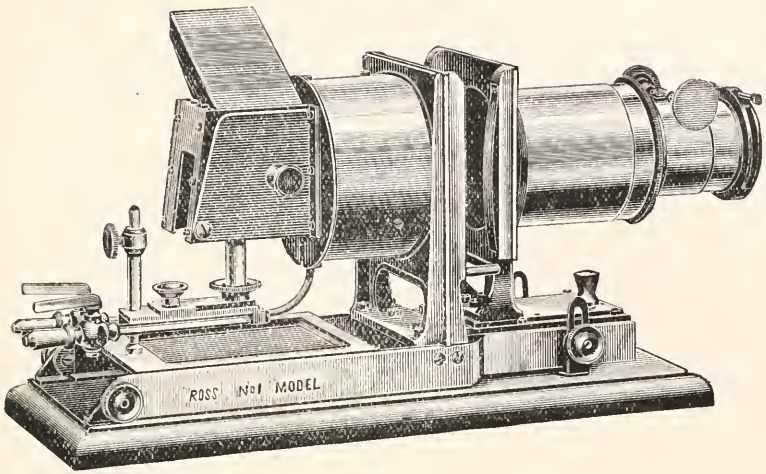
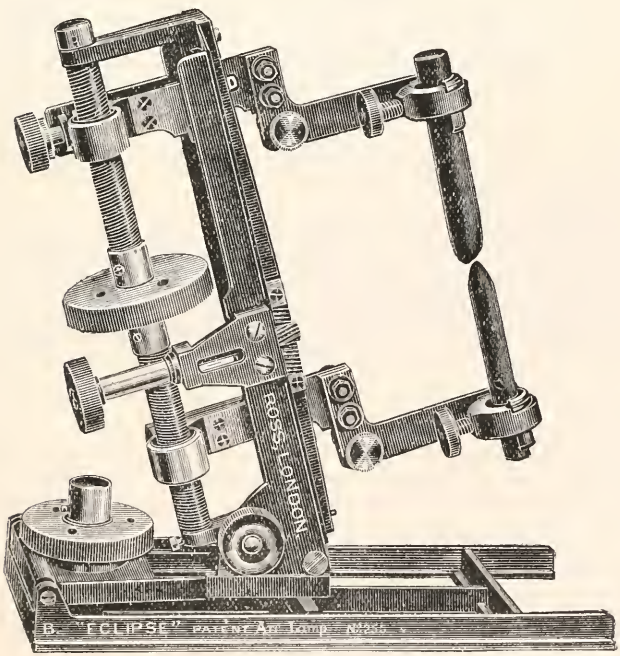


Fig. 26.



is to show how any ordinary Microscope can readily be used as a projection apparatus by the addition of the small lantern and baseboard.

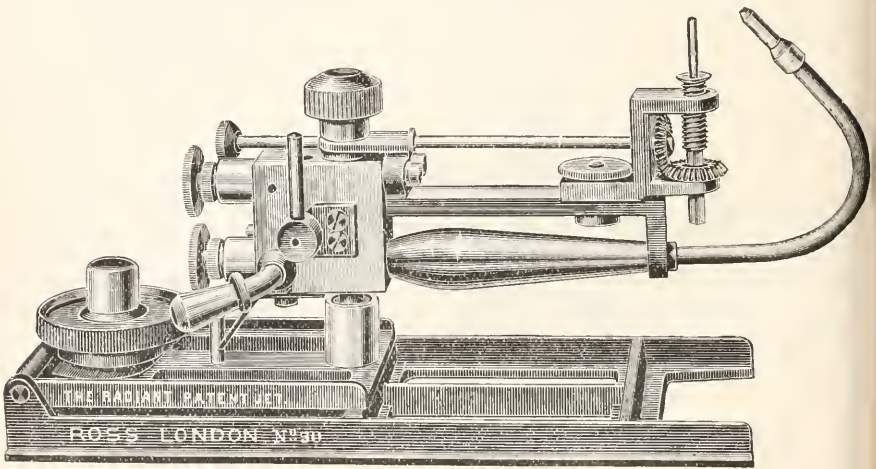
Ross' Arc Lamp "A".—This lamp (fig. 26) is designed expressly for lantern projection work, and is suitable for a current of 5 to 15 amperes. It has all motions for centering, &c., and these are very easily controlled, and the light kept very steady.

Ross' Arc Lamp "B".—This lamp is similar in general design to the lamp "A," and is designed to meet the requirements of those who wish for a lamp which can be used either for projection or for laboratory purposes. It is very solidly and substantially made, and has all the motions and adjustments necessary to this class of instrument.

Both this lamp and the lamp "A" were exhibited to the Society on December 19th, 1900.

Ross' "Radiant" Jet.—At the exhibition of Messrs. Ross' illuminating apparatus at the meeting of the Society on December 19th, 1900,

Fig. 27.

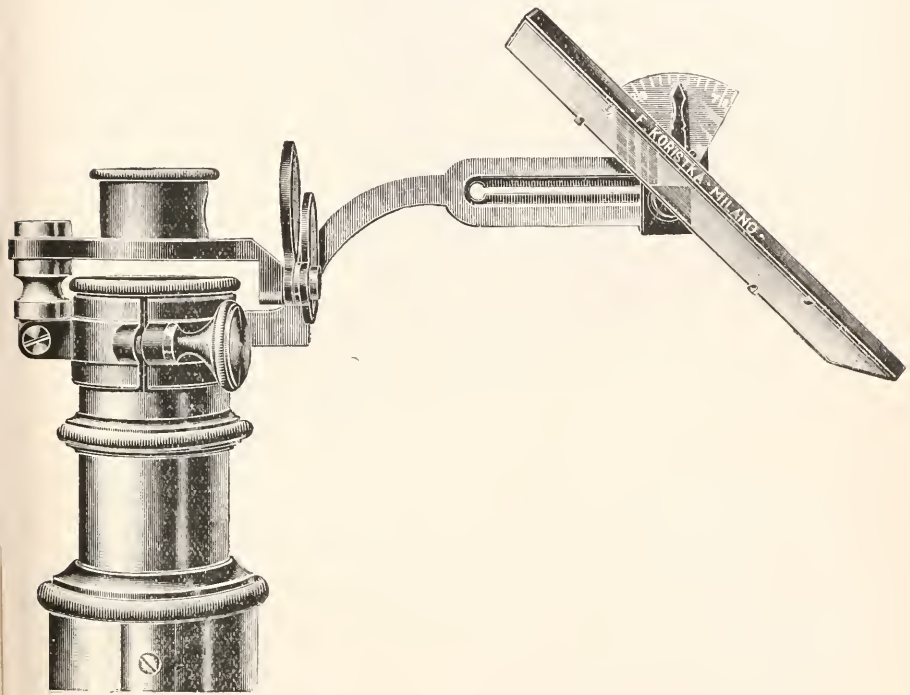


this jet (see fig. 27) attracted considerable attention by reason of the splendid light produced, together with its perfect silence. It can be regulated to give any desired amount of light according to the amount of gas consumed. It is entirely novel in form, and has very complete motions for centering, &c.

Koristka's Abbe Camera Lucida.—An improved form of this accessory has been brought out by Sig. Koristka, of Milan (fig. 28). The mirror is fitted with a graduated arc, and there is a slot in the stem

holding the mirror, so that the distance between the eye-piece prism and the mirror can be regulated. Diaphragms of coloured glass are also attached to the stem, and can be rotated into position, as required.

Fig. 28.



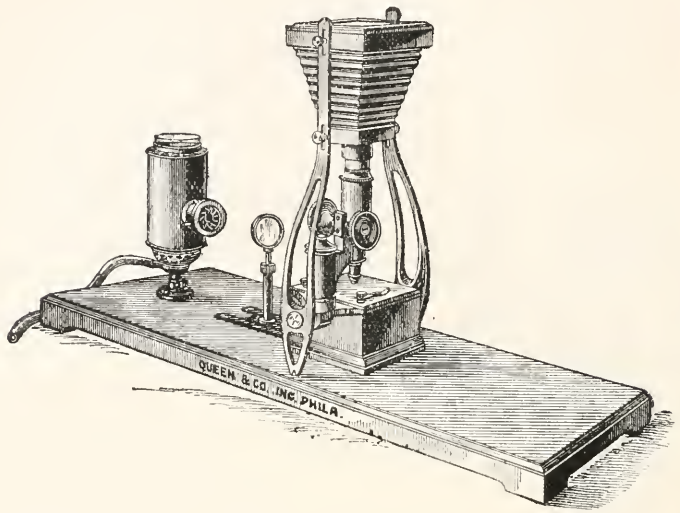
(4) Photomicrography.

Queen's Photomicrography of Metals.*—The camera arrangement shown in fig. 29 has been designed by Messrs. Queen, of Philadelphia, for the photomicrography of metals. The camera is so hinged that it may be tilted aside for ocular examination of the object, selection of spot to be photographed, adjustment of light, &c.; then replaced vertically and connected with the tube of the Microscope. The source of light is a Welsbach gas-burner completely surrounded by a metallic cylinder leaving only the necessary aperture for the illumination of the object. The emergent pencil of light may be controlled by an iris diaphragm fastened to the burner. The light is received by a condensing lens adjustable in height, and then by a vertical illuminator screwed between the body of the Microscope and the objective. The Zeiss model of vertical illuminator, consisting of a totally reflecting

* Metallographist, i. (1898) p. 167 (1 fig.).

prism, covering half of the aperture, is furnished with the instrument; but any other form of illuminator may be used, if preferred.

Fig. 29.



B. Technique.*

(1) Collecting Objects, including Culture Processes.

Culture of Mycetozoa. — A. Lister† gives some useful hints in respect to the cultivation of various species of Mycetozoa from spores for the purpose of following the whole cycle of development.

Clara Langenbeck‡ describes a convenient method of cultivating the plasmodes of Mycetozoa in an infusion of hay.

Medium for the Bacteriological Examination of Water.§—Dr. J. Thomann, after an examination of various nutrient media for the bacteriological examination of water, advocates the following, which constantly gave the best results. Liebig's meat extract 6 grm., pepton Witte 10 grm., salt 5 grm., diphosphate of potassium 2 grm., are dissolved in 1000 grm. of distilled water in a water-bath, and to the solution 100 to 120 grm. (according to the time of year) of gelatin are added. When the gelatin has dissolved, the mixture is neutralised with normal caustic soda solution, blue litmus paper being used as indicator, and then to the neutral fluid 1–5 grm. of soda (=15 ccm. of 10 p.c. soda solution) are added. After boiling for half an hour in a steamer,

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

† Journ. of Bot., xxxix. (1901) pp. 5–8.

‡ Journ. Applied Microscopy, iv. (1901) pp. 1119–21 (3 figs.).

§ Centralbl. Bakt., vi. (1900) pp. 796–800.

or better, for a quarter in an autoclave at 110°, the gelatin mixture is filtered, and distributed in the usual way.

Simple Method of Cultivating Anaerobic Bacteria.*—Dr. J. H. Wright describes the following method for cultivating anaerobic bacteria. After the culture medium in the test-tube has been inoculated, the cotton stopper is pushed in so far that its upper end is about 1 cm. from the mouth of the tube. Then a small quantity of an aqueous solution of pyrogallic acid and of sodium hydrate is run in.

The tube is at once closed air-tight by a rubber stopper. The pyrogallic acid and water are mixed in equal bulks, and one part of sodium hydrate with two of water. For test-tubes 6 in. by $\frac{3}{4}$ in., $\frac{1}{2}$ ccm. of the pyrogallic acid solution and 1 ccm. of the sodium solution are about sufficient. This simple method has given satisfactory results with tetanus and other essential anaerobic bacteria.

The author notes that the following points are highly important for anaerobic cultivations:—

(1) The medium should contain 1 p.c. of glucose, and should be boiled, and cooled immediately before inoculation.

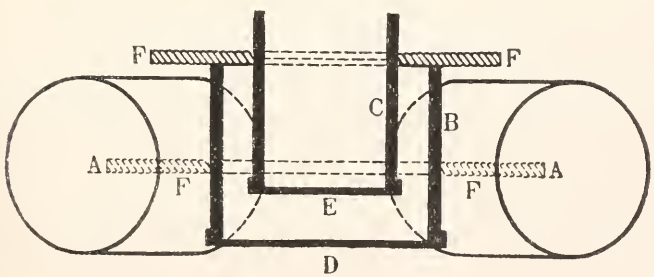
(2) The medium and reagents should be freshly prepared.

(3) The reaction should not be more acid to phenolphthalein than +1·5 of the scale of the Bacteriological Committee of the American Public Health Association.

(2) Preparing Objects.

Dialyser for Histological Purposes.†—Dr. R. Kolster has devised a dialyser for the purpose of dehydrating preparations at a regular and uniform rate from first to last. The apparatus is composed of the following parts (figs. 30, 31):—C and B are glass tubes, the outer one being

Fig. 30.



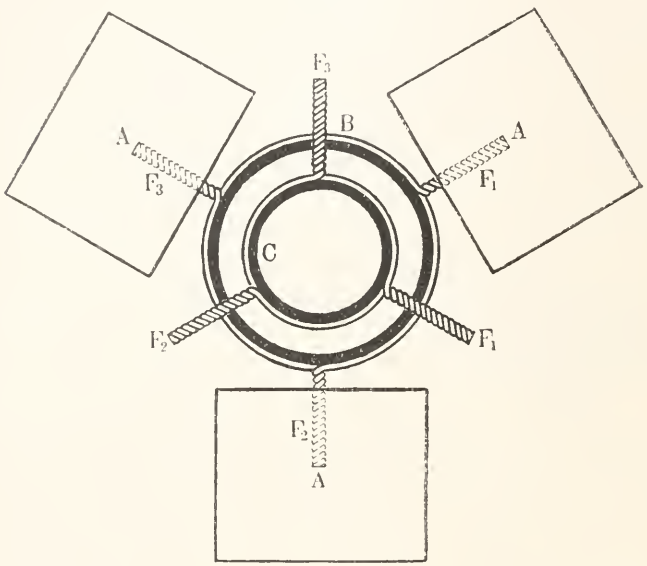
but a little longer than the inner one. To each are fixed twisted wire supports, F_1, F_2, F_3, arranged in the manner indicated in the illustrations. The projecting arms rest on cork blocks A A. The tubes C and B are closed by membranes made of very thin paper and stuck on with albumen. Into the tube C the specimen to be dehydrated, along with distilled water, is placed. The outer tube B is filled with 25 p.c. alcohol. The whole apparatus is placed on a large glass dish, half filled with 50 p.c. alcohol.

* Journ. Boston Soc. Med. Sci., v. (1900) pp. 114–5 (1 fig.).

† Zeitschr. wiss. Mikr., xvii. (1900) pp. 294–8 (2 figs.).

The dish is then covered, and the apparatus allowed to rest for 24 hours. On the next day the apparatus is placed in another dish, on the bottom of which is a layer $\frac{1}{2}$ centimetre high of dried copper sulphate. This dish is half filled with 96 p.c. alcohol. The B tube is now filled with 75 p.c. alcohol, and the glass dish having been again covered up, the

Fig. 31.



apparatus is allowed to work for another 24 hours. By this time the preparation is completely dehydrated.

Synthetic Alcohol as a Fixative.* — T. E. Oertel recommends synthetic alcohol as a fixing agent for tissues. It is cheaper, and fixes quite as well, if not better, than ordinary alcohol made by distillation from grain.

Fluid for Softening Chitin.† — Dr. C. Hennings uses the following fluid for softening chitin:—Nitric acid 16 parts; chromic acid 0·5 p.c. 16 parts; saturated solution of sublimate in 60 p.c. alcohol 24 parts; saturated aqueous solution of picric acid 12 parts; absolute alcohol 42 parts. The solution is allowed to act for 12 to 24 hours, according to the size of the object. The object is then washed in 60 p.c. iodine-alcohol, and afterwards passed through alcohols of increasing strength; then to xylol and paraffin.

Depigmenting the Eyes of Arthropoda.‡—For removing the pigment from the eyes of Myriopoda, Dr. C. Hennings uses a mixture composed of 2 parts 80 p.c. alcohol, and 1 part of glycerin, to which 2 vols. p.c. of strong sulphuric acid are added.

* Journ. Applied Microscopy, iii. (1900) p. 1061.
† Zeitschr. wiss. Mikr., xvii. (1900) pp. 311–2. ‡ Tom. cit., pp. 326–7.

The solution acts best at a temperature of about 35° C., and the time required varies from 10 minutes to about 12 hours, according to the kind of pigment. The prolonged action of the fluid is not at all detrimental to the eye-tissues.

Technique for Malaria Blood.*—Dr. J. W. W. Stephens and Dr. S. R. Christophers describe the following simple method for preparing and staining films of malarial blood. The finger is pricked with a triangular surgical needle, and a clean glass slide made to touch the exuding drop of blood. The drop thus received on the slide is then spread by the shaft of the needle in a broad even streak along the slide. On first touching the drop with the needle-shaft, a little time should be given for the drop to run along the needle for some distance by capillarity. The most perfect films are thus obtained. The slides are then placed in a pot of absolute alcohol for 5 minutes. The films are stained with a saturated alcoholic solution of hæmatein. To every 10 ccm. of this solution are added 50 ccm. of alum solution (alum 50 grm., water 1000 ccm.). The slides are immersed in the solution for 5 to 20 minutes, or even hours. The slide is examined by applying oil directly without the intervention of a cover-glass. If it be required to preserve the specimen, the oil is washed off with xylol, and the preparation mounted in balsam. The slides, however, will keep for a year if merely wrapped in clean paper and placed in a closed box.

Cleaning Desmids.†—G. H. Bryan describes the procedure he adopts for cleaning desmids. The apparatus consists of one or two saucers or porcelain dishes, an old pomatum-pot, and a pen-"filler," while a gauze strainer is useful for getting rid of large pieces of dirt. The material is strained into a saucer, and after an interval not exceeding half a minute the dish is inclined, a gentle rocking motion being given at the same time. Along the edge of the receding water the desmids collect in a bright green line or patch, from which they are picked up by the filler. They are next transferred to the pomatum-pot, and fixed with Zenker's fluid. A repetition of the rocking enables the desmids to be again collected and taken up in the filler, to be transferred to a dish containing clean water, in order to remove the fixative. The washing, together with the rocking, is repeated. The whole process takes from a half to one hour, and this procedure involves less loss of specimens than the decantation method.

Method for Isolating Bacterial Flora from Water.‡—R. Greig Smith, when isolating the bacterial flora of the Sydney water supply, used Abba's gelatin (Liebig's extract 6 grm., gelatin 150 grm., and distilled water 1000 ccm.; after neutralising, 0·5 grm. anhydrous sodium carbonate are added) and dextrin-meat-agar. The latter is prepared by dissolving 20 grm. of agar in 1000 ccm. of meat extract in the autoclave. After clarification with white of egg, 10 ccm. of the mixture are pipetted into warm water, and neutralised to phenolphthalein with tenth-normal sodium hydrate. The sodium hydrate, together with 0·5 grm. sodium carbonate, is added to the bulk, and then 20 grm. of dextrin or gum

* Roy. Soc. Reports to Malaria Committee, 3rd series, 1900, pp. 5–6.
† Journ. Applied Microscopy, iii. (1900) pp. 1026–7.
‡ Proc. Linn. Soc. N.S.W., xxv. (1900) pp. 438–40.

acacia dissolved in a small quantity of water; after which the mixture is boiled, filtered, placed in test-tubes, and sterilised. The water was allowed to flow from the tap for half an hour upon a sterilised watch-

Fig. 32.

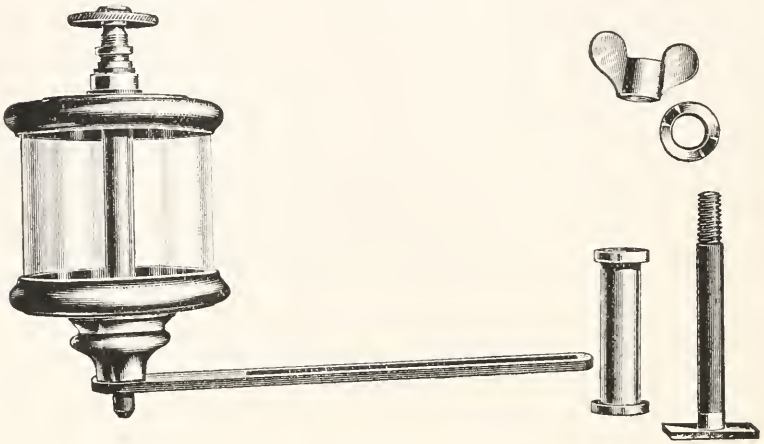
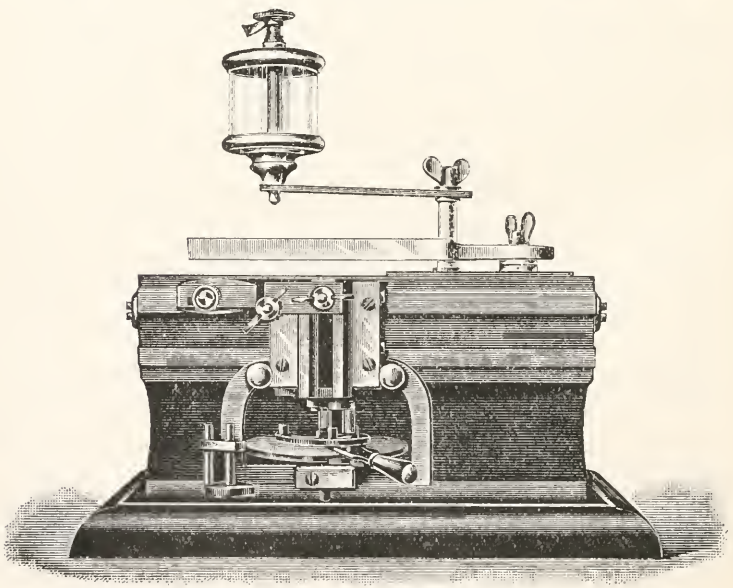


Fig. 33.



glass supported upon a tripod. From the watch-glass the water was taken up into a sterilised graduated pipette and added to the previously melted and cooled gelatin (30° C.) or agar (42° C.). The tube was then

shaken, and the contents poured into Petri dishes, which, after setting, were inverted, and inoculated at the requisite temperature (15°, 18°, or 22°). When the colonies were sufficiently grown, inoculations were made upon agar slopes and in gelatin stabs. When a pure culture was obtained inoculations were made on many other media.

(3) Cutting, including Imbedding and Microtomes.

Irrigating Apparatus for Celloidin Sectioning. * — Dr. P. M. Hickey devised an irrigating apparatus (figs. 32, 33), the essential points being a modified oil-cup such as is used in automatic machinery, and the attachment of this cup by means of a suitable support to the sliding block which carries the knife. In this way the alcohol can be dropped on any part of the knife. By means of the needle plunger in the cup the number of drops per minute can be regulated to a nicety.

Method of Procuring Ribands with a Microtome working Horizontally.†—C. Brookover made ribands of sections with a sliding microtome, by placing the edge of the knife parallel to the surface of the block to be cut. On that part of the knife where the cutting was to be done, a visiting-card was placed to receive the riband. The card was pierced by two pins sticking down over the back to keep the card from sliding out of position and over the edge of the knife. In transferring the ribands from the card, it is advisable to place the slide over the card, so as to be able to see the sections while they are arranged.

Imbedding in Celloidin.‡ — Herr Pokrowski dehydrates pieces of tissue which have previously been in alcohol above 55° by means of ether. The procedure depends on the fact that ether is miscible with alcohol of 55°. In this way the alcohol along with the water is extracted and replaced by ether. It is not necessary to use much ether at a time, but it is preferable to change it frequently. The extraction of all the water may be demonstrated by the fuchsin test. Fuchsin being insoluble in ether the slightest trace will stain the fluid if any water remain. In this way tissue may be more rapidly dehydrated than if alcohol had also been used. The dehydrated pieces may be at once transferred to thin and afterwards to thick ethereal solutions of celloidin. Blocks prepared in this way must not be kept in alcohol but in ether to which chloroform ($\frac{1}{4}$ vol.) has been added.

(4) Staining and Injecting.

Simple Method for Staining Bacterial Flagella.§ — Sig. De Rossi has obtained most excellent results from the following method. An agar culture less than four days old is used. A minute particle is diluted in a little distilled water, and from this a second dilution in $\frac{1}{2}$–1 ccm. of distilled water is made. A loopful is placed on a cover-glass and dried in a sulphuric acid exsiccator. The mordant consists of a solution composed of tannic acid 25 grm. and 1 per cent. KHO 100 grm. The stain

* Journ. Applied Microscopy, iii. (1900) pp. 994–5 (2 figs.).
† Tom. cit., pp. 987–8 (3 figs.).
‡ Mediz. Obosrenie, 1900, Mai. See Zeitschr. wiss. Mikr., xvii. (1900) pp. 331–3.
§ Arch. per le Sci. Med., xxiv. No. 15. See Brit. Med. Journ., 1901, i. Epit. 36.

is Ziehl's carbol fuchsin. On the unfixed film are poured one drop of the mordant and four or five drops of the stain. The mixture is allowed to act for 15, 20, or 25 minutes. The preparation is then washed, dried, and mounted.

Staining and Mounting Urinary Deposits.* — The editor of the *National Druggist* gives the following outlines of the procedure he has successfully adopted for some sixteen years for collecting, preserving, staining, and mounting tube-casts, epithelia, and other urinary deposits. If the urine has to come from a considerable distance a crystal of naphthalin should be placed in the bottle. This will preserve it for several days from decomposition. When received, the urine is placed in a cool place, e.g. a refrigerator, to settle. When the upper two-thirds have become clear this portion is siphoned or decanted off. A few drops of 2 p.c. osmic acid are then added, and afterwards sufficient eosin solution to make the whole strongly red. The urine glass is now exposed to a strong light which turns the liquid black. When the sediment has settled, the supernatant fluid is withdrawn and replaced by distilled water. This last process is repeated until the water no longer shows a trace of colour. The water is then drawn off, the last drops being removed by blotting-paper. To the moist sediment a few drops of glycerin are added, and intimately mixed by stirring and by rotating the vessel. The sediment is now ready for mounting. Instead of glycerin, glycerin-jelly may be used. The cell-walls should be old and thoroughly dry. The best cement for this purpose is made of zinc oxide in a solution of dammar in chemically pure benzol to which about ¼ p.c. of old gilder's size and a much smaller quantity of castor oil have been added. Such cells take from eight to twelve months to dry properly, but are then as "permanent" as any mount can be made.

Staining Embryonic Cartilage.† — A. Moll stains embryonic cartilage with Tänzer's orcein solution (orcein 0·5, absolute alcohol 40, distilled water 20, hydrochloric acid 10 drops). The preparation (embryos or pieces thereof) must be hardened in alcohol, and celloidin sections immersed in the above solution for 6–24 hours. The sections are then washed in 80–90 p.c. alcohol until the celloidin is almost colourless; after which they are dehydrated in 98 p.c. alcohol, cleared up in origanum oil, and mounted in balsam. This method imparts a double stain, the preformed hyaline cartilage having a blue-violet hue and the rest of the tissue being brownish-red. The stain affects the cartilage matrix, the nuclei being red. Embryonic elastic cartilage does not give the double stain. In adult cartilage the matrix is reddish and the cartilage cells dark-blue.

Staining Fluid for Counting Leucocytes.‡ — Dr. R. Zollikofer uses the following staining solutions to facilitate the counting and recognition of the varieties of leucocytes. Solution A:—Eosin W.G. 0·05; formalin 1·0; distilled water 100. Solution B:—Methylen-blue 0·05; formalin 1·0; distilled water 100. When required for use equal quantities of

* Amer. Mon. Micr. Journ., xxi. (1900) pp. 308–10.
† Centralbl. f. Physiol., xiii. (1899) pp. 225–6.
‡ Zeitschr. wiss. Mikr., xvii. (1900) pp. 313–21.

the two solutions are mixed together. The blood is sucked into a Thoma-Zeiss pipette up to the 0·5 mark, and then diluted with the staining solution up to 1–20. Five minutes are allowed for the mixing of the blood and stain in the pipette, after which the contents are blown into an Elzholz counting chamber, the capacity of which is 0·9 of a cubic millimetre. The total number, when the blood has been diluted twenty times, is multiplied by $\frac{200}{9}$ or 22·2, the product being the number per cubic millimetre. The solution may be used for film preparations, and is specially adapted for differentiating the varieties of leucocytes.

New Staining Method for Red Corpuscles in Sections. * — The method adopted by N. Petroff for staining red corpuscles depends on the fact that they pick up pigment from the malachite-green group when they are also treated with picric acid and alcohol. The preparations are fixed in Müller's fluid or in formalin, and imbedded in paraffin. The sections are stuck on the slide with water. The paraffin is removed with xylol, and they are then washed with alcohol and xylol. Thereafter follow:—(1) Staining with Bismarck-brown (saturated solution in 1 p.c. acetic acid) 10–15 minutes, or with lithium or borax-carmine for 20–30 minutes. (2) Washing in water and then staining for 10–15 minutes with 20 p.c. aqueous (i.e. five times diluted alcoholic) solution of malachite-green, brilliant green, or Victoria-green. (3) Washing with water, followed by staining for 1–1½ minutes by Van Gieson's method, or with aqueous solution of picric acid five times diluted. (4) Washing with water, followed by rapid dehydration in absolute alcohol; lastly xylol and balsam. By this method, which is really quite simple and easy of execution, the red corpuscles are stained emerald-green, the rest of the tissues being yellowish-brown or yellowish-red.

Fat-Staining.†—Dr. J. Lewinson stains fat by a modification of Wolters' method. The material is fixed in Müller's fluid for 2–6 weeks, and, after dehydration in 70 p.c. and 85 p.c. alcohol, is imbedded in celloidin. The sections are stained in hæmatoxylin solution (2 grm. hæmatoxylin dissolved in a little absolute alcohol and added to 100 ccm. of 2 p.c. acetic acid) for 12 hours at a temperature of 40° C. After washing in water, they are treated with a 1 p.c. aqueous solution of permanganate of potash for 10–15 minutes. The sections are again washed in water, and then immersed in 2 p.c. oxalic acid or a mixture of 2 parts 2 p.c. oxalic acid and 1 part 2 p.c. sulphite of potash for 5 minutes. They are next washed in water, and mounted in the usual way, or may be contrast-stained with borax-carmine and picric acid to show the nuclei and protoplasm of the cells.

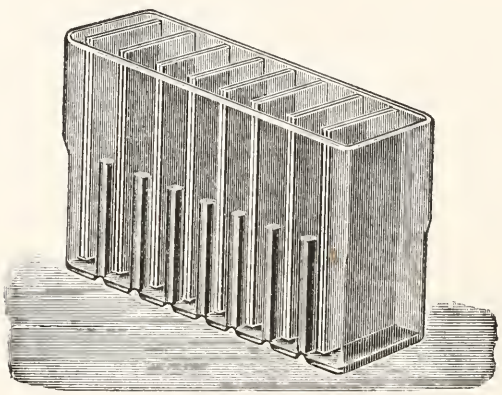
By the foregoing procedure even the smallest particles of fat are distinctly stained.

Modification of Pitfield's Method for Staining Flagella. ‡ — Dr. J. B. Smith has found the following modification of Pitfield's method for staining flagella very reliable and easily carried out. The mordant is made as follows:—A saturated solution of perchloride of mercury, made

* Bolnicznaja Gazeta Botkina, 1899. See Zeitschr. wiss. Mikr., xvii. (1900) p. 359.
† Zeitschr. wiss. Mikr., xvii. (1900) pp. 321-7. Cf. this Journal, 1891, p. 425.
‡ Brit. Med. Journ., 1901, i. pp. 205-6.

by boiling, is poured while still hot into a bottle in which crystals of ammonia-alum have been placed in quantity more than sufficient to saturate the fluid. The bottle is well shaken, and then allowed to cool. To 10 ccm. of this fluid, 10 ccm. of a freshly made 10 p.c. solution of tannic acid and 5 ccm. of carbol-fuchsin are added. The mixture is filtered. The cover-glasses are washed in strong hydrochloric acid, and when removed therefrom are wiped with a clean cloth and thoroughly heated over a Bunsen burner. The traces of acid left on the slips help to prevent precipitation of mordant or stain. The bacilli are placed on the cover-slip and fixed. The mordant is then filtered, poured on the film, and heated until steam is given off. The heating, without boiling, should be continued for about three minutes. The preparation is then washed in distilled water, and, after adding the stain, is heated in the same way for three or four minutes. The stain is made by adding 1 ccm. of a saturated alcoholic solution of gentian-violet to 10 ccm. of a saturated solution of ammonia-alum. This is filtered and poured on the preparation.

Fig. 34.



Double Staining of Spores and Bacilli.*—R. Greig Smith advises the following modification of Klein's method for staining spores. Four drops of normal saline solution are pipetted into a small test-tube, and the spore-bearing material is rubbed up with this until a homogeneous suspension is obtained. Four drops of carbol-fuchsin are pipetted into the tube, and the mixture shaken. A plug of cotton-wool is inserted, and the tube placed in a beaker of boiling water. The boiling is continued for a quarter of an hour, when the tube is taken out and shaken. A loopful of the bacterial suspension is withdrawn and spread uniformly over a cover-glass, which is dried either in the air or high over a Bunsen flame. The film is next fixed by passing the cover-glass thrice through the flame in the usual manner. The bacilli are decolorised in methylated spirit containing 1·5 p.c. by vol. of strong hydrochloric acid. When the film appears colourless, the cover-glass is withdrawn and the alcohol removed with water, after which the film is stained with carbol-

* Proc. Linn. Soc. N.S.W., xxv. (1900) pp. 394–7. Cf. this Journal, 1899, p. 346.

methylen-blue in the usual way. It is then washed, dried, and mounted. By the foregoing process the most refractory spores are stained.

New Staining-trough for Serial Sections.*—Dr. H. Hellendall has devised a trough for staining simultaneously a large number of sections (fig. 34). It is made of glass, is 8 cm. long, 3 cm. broad, and 8 cm. high. Along each side are seven ribs or fillets, each being 5 cm. high and 0·5 cm. thick. These fillets are blown into the vessel, and thus eight open compartments are formed, in each of which a couple of slides placed back to back can be located.

(5) Mounting, including Slides, Preservative Fluids, &c.

New Fixative Solution, and Method for Restoring Old Specimens.†—Prof. M. Lavdovsky has found the following fixative give especially good results:—1 p.c. acetic acid 500 ccm.; chemically pure bichromate of potash 20–25 grm.; saturated aqueous filtered solution of sublimate 5–10 ccm. This combination acts well not only with fresh tissues, but also with old material, acting thereon like a restorative. The solution may be used as given, or diluted with an equal quantity of water. Fixation is completed in two or three days, the pieces being afterwards hardened in alcohol for 2–7 days.

The more important points in the restoration method are as follows. The slide is immersed for 24–48 hours, or longer, in turpentine oil, xylol, or toluol, until the cover-glass is easily separable from the slide. The slides, provided that the sections are not too firmly adherent, are placed in 95 p.c. to 100 p.c. alcohol for 15 minutes, and then in water for 5 minutes. The slides are then immersed for 6–24 hours in the chromaceto-sublimate solution diluted with half its bulk of water. After having been carefully washed with water, the slide is transferred to Weigert's acetic acid-copper solution for 6–24 hours. The preparation is again washed with water, and then placed in Weigert's hæmatoxylin solution, diluted with an equal bulk of water, for 6–12 hours, after which it is decolorised in the borax-ferridcyanide solution. This must be diluted with one or two volumes of distilled water to prevent too rapid decoloration. When the preparation has been thoroughly washed, it is dehydrated in 95 p.c. alcohol, cleared up in oil of cloves and xylol, and mounted in balsam. The foregoing procedure is suitable for animal and vegetable tissues.

Formalin as a Wet Method for Blood-Films.‡—The method described by the Hon. G. Scott is as follows:—Hold the film, wet side down, in the mouth of a wide bottle half filled with 40 p.c. solution of formic aldehyde for about 5 seconds. Drop, while still wet, film downwards, into absolute alcohol; leave for 15 minutes to 48 hours. Mop up on blotting-paper, and then before any drying occurs, drop on a few drops of eosin-methylen-blue stain, cover with a watch-glass, stain for not longer than 2 minutes. Run off excess of stain, and rinse in distilled water twice. Mop off excess of water. Dehydrate rapidly in absolute alcohol; then treat with xylol three times rapidly, and mount in balsam. The film must not be allowed to dry at any stage.

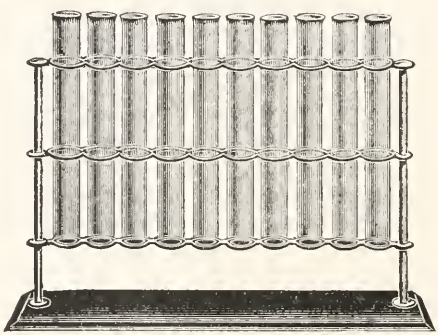
* Zeitschr. wiss. Mikr., xvii. (1900) pp. 299–300 (1 fig.). † Tom. cit., pp. 301–11.
‡ Journ. Pathol. and Bacteriol., vii. (1900) pp. 131–6.

Mounting Desmids.*—G. H. Bryan uses a small box made of parchment-paper. The water containing the desmids is placed in the box, which is floated on glycerin. In two days the water will have diffused into the glycerin and sufficient glycerin into the desmids. They are then ready for mounting in glycerin.

(6) Miscellaneous.

New Test-tube Stand.†—Dr. R. J. Petri has devised a convenient stand for ten tubes (fig 35). It is made entirely of metal, the base

Fig. 35.



and uprights consisting of iron or zinc. The new stand is more compact and takes up much less room than a wooden one, and is specially adapted for laboratories.

Quickly-made Glass Cell.‡—H. A. Doty places a cover-glass of the desired thickness on a turn-table together with a minute drop of water, by means of which the cover-glass is held firmly enough to permit circles being cut upon it with a diamond. As it is rarely possible to free the circle from the ring without breaking the latter, it is advisable to cut the ring across with the diamond, after which it is more easily detached. The cross-cut does not impair its efficiency as a cell when it has been cemented on to the slide.

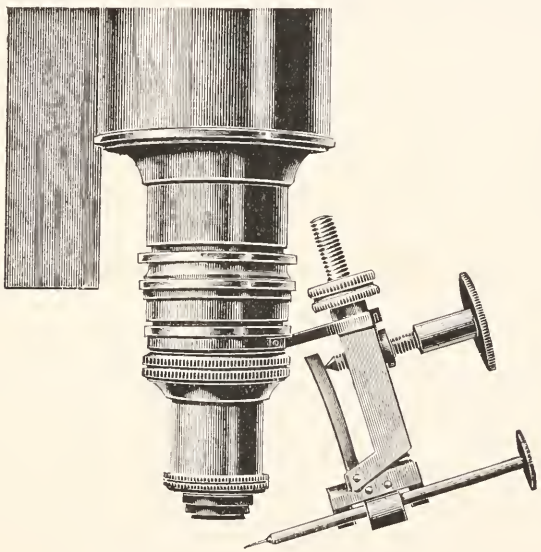
Mechanical Finger.§—H. A. Doty has devised a mechanical finger which allows the rod carrying the bristle to be instantly removed (fig. 36), the pin in the end of the rod being also removable, so that several sizes and forms of bristles may be employed, without loss of time, upon the same piece of work. The other adjustments are so clearly shown in the illustration as to need no further description.

Measurement of Bacteria.‖—R. Greig Smith states that the method he employs in determining the breadth of an organism is to fix on a bacterium in the microscopic field and measure its length. He then compares the organism with a series of diagrams representing bacteria, the breadths of which have been accurately measured in terms of the

* Journ. Applied Microscopy, iii. (1900) pp. 1027–8 (2 figs.).
† Centralbl. Bakt., 1te Abt., xxviii. (1900) pp. 747–8 (1 fig.).
‡ Journ. Applied Microscopy, iii. (1900) pp. 990–1.
§ Tom. cit., pp. 991–3 (2 figs.).
‖ Proc. Linn. Soc. N.S.W., xxv. (1900) pp. 533–6 (3 figs.).

length. From this series one group that appears identical with the organism fixed upon is noted, and the number of this group is multiplied by the length of the organism. The result is the breadth. The breadth of another organism in the same film may be calculated in a similar manner, and the second result will generally be identical with the first. For example, the rodlet measures $1 \cdot 5\,\mu$, and on comparison with the diagrammatic table it appears identical with the group whose type number $\left(\frac{\text{breadth}}{\text{length}}\right)$ is $0 \cdot 4$. On multiplying $1 \cdot 5\,\mu$ by $0 \cdot 4$, the breadth $0 \cdot 6\,\mu$ is obtained. The result may be checked by measuring with the

Fig. 36.



micrometer eye-piece. The diameters of cocci, streptothrix, &c., might be confirmed after micrometer measurement by comparison with lines ruled at intervals of $1 \cdot 2$ mm. (the length of the smaller diagrammatic organisms) upon a cover-glass which is superposed over the shorter diameter of the diagrammatic types. Such rulings can be made upon a cover-glass by dipping the latter into a dilute solution of gelatin ($0 \cdot 5$ p.c.), and ruling the lines with Indian ink upon the thin dry gelatin film.

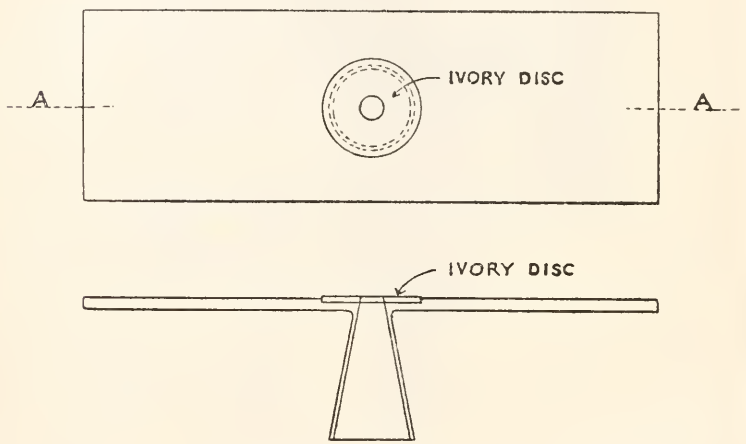
Examination of Arsenical Sublimates. * — M. H. Stiles has found that the examination of the arsenical sublimate under the Microscope is much facilitated by the adoption of the following method. A strip of copper foil, after having been boiled with 200 ccm. of the suspected fluid (beer) and 30 ccm. of pure hydrochloric acid for 45 minutes, is washed successively with water, alcohol, and ether, and dried. The strip is then placed in a dry test-tube $3\frac{1}{2}$ in. by $\frac{1}{2}$ in., containing

* Pharmaceutical Journ., lxvi. (1901) p. 4.

a strip of glass 3 in. by $\frac{3}{8}$ in. This is held in position by a flat steel spring about $\frac{1}{4}$ in. wide, folded like a pair of tweezers, and having just strength enough to keep the slide firmly pressed against the side of the test-tube. The lower part of the tube should be carefully and uniformly warmed, the copper strip being kept at the other end of the tube by tilting the latter. After the warming the tube is again inclined, and the sublimation effected at as low a temperature as possible. When the sublimation is completed, the copper foil and the spring are removed and the tube corked. By this procedure the sublimate is deposited on a plane surface, so that it can be examined under high powers and the slip preserved for future reference.

Micrographic Fly-Cage.—Fig. 37 represents the apparatus exhibited at the meeting of the Society on Feb. 20th (see p. 224), devised by

Fig. 37.



Section on Line A A.

Mr. G. H. J. Rogers, and made by Mr. C. Baker, for exhibiting the proboscis of the common house-fly as an opaque object. It is large enough for the blow-fly, but can be made any size. It consists of a brass cone soldered to a brass plate with a hole in it, just large enough to admit the head of the fly, which is surrounded by a disc of ivory, let into the plate. The fly is gently pushed into the cone with a little piece of wool behind it, and is ready for examination. A little treacle or honey is put on the ivory disc; the fly puts out its proboscis, which is kept flat and in one position. It is very easy to focus, and does not require any adjustment of the object more than an ordinary slide. The idea was taken from the well-known paper disc and stage forceps, the ingenious invention of Mr. Macer.

Metallography considered as a Testing Method.*—In an article with above heading Mr. Osmond illustrates (*inter alia*) the question of

* Metallographist, i. (1898) pp. 5–27 (17 figs.).

MICROSCOPY.

A. Instruments. Accessories, &c.*

(1) Stands.

Wilson's New Heating Stage.†—Leonard P. Wilson has constructed a satisfactory heating stage with water as the medium. The stage (fig. 39) is in the form of a double box, forming a water-jacket to the slide and its carrier. Water of the required temperature is passed in at A, and flows out at B, the temperature being taken by a thermometer passed into the tube C, round which the water passes in the middle of its course. The heating stage is fastened to the mechanical stage by means of the screw D. When using a high power, the objective passes into the upper aperture of the stage, and is below the level of its upper surface; and, in order that the stage may move freely in all directions in conjunction with the movements of the mechanical stage, it is necessary

Fig. 39.

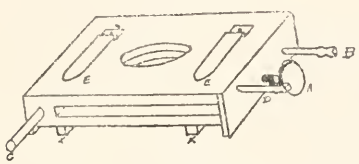
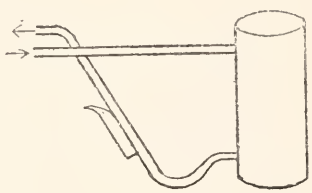


Fig. 41.



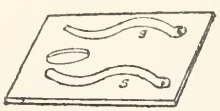


Fig. 40.

that this tubular aperture be greater in diameter than the objective. To prevent the intrusion of cold air, which might take place owing to this difference in diameter, a vulcanite plate, having an aperture which the objective just fits, slides on the surface of the stage under the clips E E. In a manner similar to the objective, the condenser passes up into the lower portion of the stage; spaces for the vulcanite plate in this case being made by the introduction of the two bars X X across the lower surface of the stage, which is thereby raised above the mechanical stage. The slide-carrier, as shown in fig. 40, consists of a brass plate, having a circular aperture through it, and having fixed to it two springs S S. By means of these springs, the slide is held in position on the carrier, and the carrier is also held in position between the upper and lower plates of the stage. The slide can be roughly adjusted by means of the carrier, fine adjustment being made with the mechanical stage.

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous. † Knowledge, 1901, pp. 45–6 (3 figs.).

The heating apparatus is represented in fig. 41; and by slightly raising or lowering the flame, the temperature can be regulated and kept constant within half a degree Centigrade.

(2) Eye-pieces and Objectives.

Malassez' New Micrometer Eye-piece.* — M. Malassez, after describing the defects of many micrometer eye-pieces, relates his attempts to remedy them :—

(i.) His first type has three concentric tubes sliding smoothly in one another (fig. 42). The middle one bears at its two extremities the two eye-piece lenses; it is the ocular proper. This tube has also several

Fig. 42.

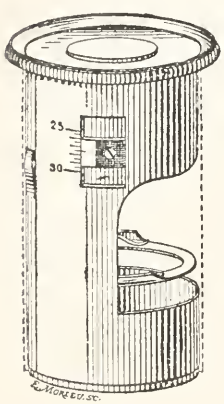


Fig. 43.

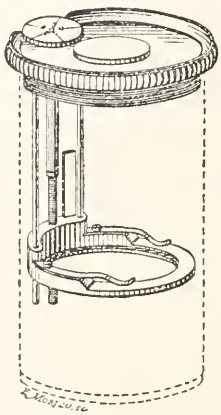
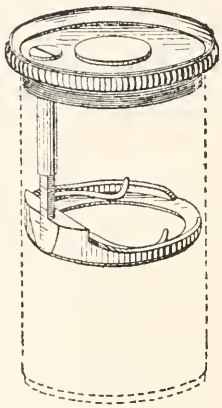


Fig. 44.



lateral openings; one very wide, admitting the micrometer slide; a second, on the same side and higher, near the upper lens; and two others vertically elongated, *vis-à-vis*, by whose means the interior tube can be operated. This inner tube carries the micrometer, and is sensibly less than the middle tube. Near its lower end it has a wide window for admitting the micrometer, which is actually placed on a diaphragm, and is retained in position on a circular rim and clipped by little springs. This inner tube also has two small milled projections, which penetrate the two vertical openings of the median tube, and allow of up-and-down adjustment. The projections are no thicker than the metal, but the milling allows a good grip, and the movement is easily done. The other window of the median tube exposes a mark on the innermost tube, which slides past a millimetre scale. The exterior tube is intended to close all the windows of the median tube.

When the focus has once been obtained, it is only necessary to note what reading on the millimetre scale corresponds to the reading on the tube, and the precise arrangement can be at any time recovered.

(ii.) This type differs much from the last, and is an ordinary ocular, whose upper lens-mount bears on its lower face the arrangement for raising or lowering the micrometer slip. This arrangement (fig. 43) con-

* Arch. Anat. Micr., 1900, pp. 429–35 (3 figs.).

sists of two small vertical stems, which are set near one another in the lower face of this mount, and work in the interior of the ocular. They penetrate the rim of the micrometer diaphragm without being attached to it. The diaphragm is moved up and down by the action of an endless screw which penetrates it, and whose upper extremity terminates in a large milled head. The periphery of the milled head slightly exceeds the periphery of the lens-mount, and so renders possible easy turning of the screw. A millimetre scale, placed inside the ocular, near one of the stems, indicates the height of the focus, and the milled head is divided so as to give fractions of a millimetre.

Fig. 44 shows a simplified form, in which the diaphragm is supported only by the screw, which is flattened on one side, and carries a millimetre graduation. The inconvenience is that if, in focussing, the diaphragm is not properly set, the upper lens must be unscrewed, and the diaphragm raised or lowered. These operations must be repeated until success. But, when once found, the focus is not lost.

The inventor has also tried an intermediate form, which seems the best of all. As in fig. 43, it has an exterior milled head, but, as in fig. 44, it rejects the guide-stems and trusts to the endless screw alone.

Movable Ocular Diaphragms.*—M. Malassez has designed a series of diaphragms applicable to any ocular, and capable of transforming it into any variety of eye-piece, micrometric or otherwise. He describes several of his attempts to attain his object, and the following are the final results:—

(i.) *Indicator Diaphragm.*†—A piece of blackened cork was introduced into an ocular and placed just above the ordinary diaphragm. The indicator was put on its upper surface, and consisted of a sort of watch-hand pointed at one extremity and pierced at the other; an ordinary pin passed through the hole secured the indicator to the cork, but the relative largeness of the hole easily permitted movements of the pin in the plane of the diaphragm. To confine these movements within suitable limits, two pin-heads were set in the cork in proper positions. When the indicator was in contact with one of these stops the point was in the centre of the diaphragm opening; when in contact with the other it was out of the field altogether. By inclining the ocular the indicator could be got to move and assume the desired position. Any slight inequality on the surface of the cork was useful in preserving the indicator in position (fig. 45). In a more perfect form M. Malassez makes everything of metal. The internal diameter is small enough to allow insertion into any current eye-piece, e.g. those of Zeiss. It is fitted with three or four small springs which, starting from the periphery and bending outwards, serve to keep the instrument steady, while the curved upper extremities enable the finger to withdraw it easily. The indicator consists of a small basal piece into a groove of which a fine hair fits. The adjustment of the indicator is as before, and of course it would be necessary to remove the ocular from the draw-tube in order to set the indicator.

(ii.) *Thread Diaphragm.*—Of this there are two models. The first

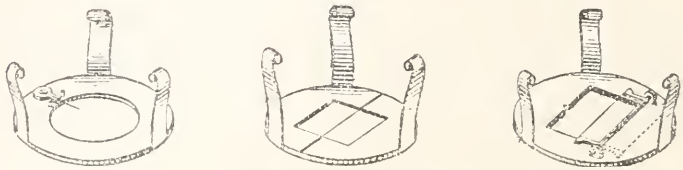
* Arch. Anat. Micr., 1900, pp. 436–56 (6 figs.).

† Thread diaphragms date from 1838, and indicator diaphragms from 1848. *Vide* Quekett, p. 130 (1st edition).—Ed.

(fig. 46) is a metallic diaphragm surmounted by three or four springs slightly divergent, as in the indicator diaphragm. But the opening is square or rectangular and carries a thread on its upper face, set so as to be nearer to one of the parallel sides than the other. M. Malassez considers that this quadrangular opening affords a surer means of searching a field than a circular one, and the unequal division renders it easier to keep a check on computation.

In the second model (fig. 47) the thread is movable, and, as in the indicator diaphragm, a slight inclination of the ocular causes appear-

Fig. 45. Fig. 46. Fig. 47.



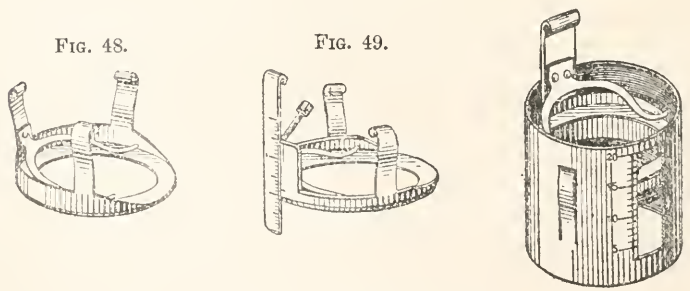
ance or disappearance of the thread. As will be understood from the figure, the framework of the thread folds back through an angle of 180°.

(iii.) *Diaphragm with Movable Glass Slip.* — In this case the diaphragm is intended to receive any kind of glass micrometer, squared or otherwise. M. Malassez has designed two types.

The first type (fig. 48) has a general resemblance to the preceding; but the three springs are set at unequal distances around the periphery

Fig. 50.

Fig. 48. Fig. 49.



in order to leave a wide space between two for the insertion of the micrometer slip. The periphery also is made with a small vertical flange, except at the above gap. The slip is kept in position by means of a semicircular spring, whose two extremities gently press on it. It is advisable to set the slip with the ruled surface downwards. The arrangement works excellently when the diaphragm is always used by the same person; but if persons of different visual power have to use the diaphragm, or if, for any other reason, the focus has to be varied, further construction is necessary. In one method M. Malassez screws

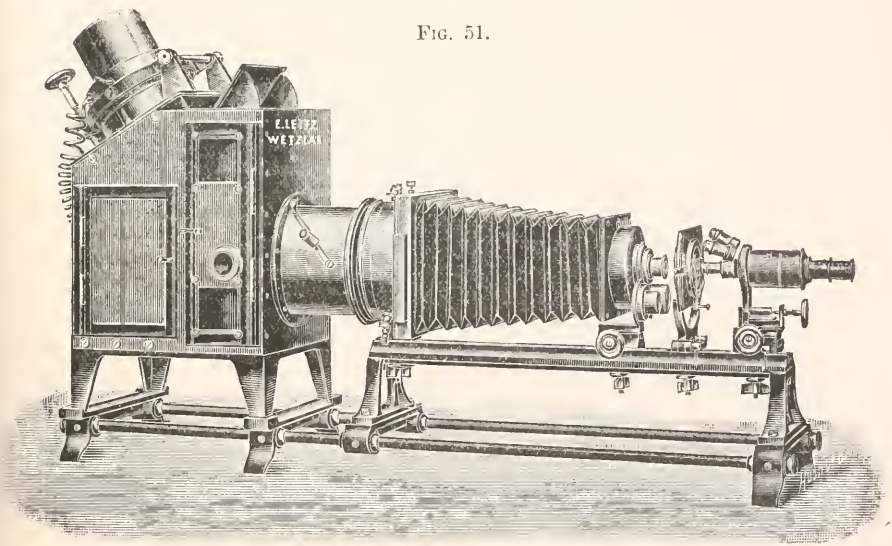
the fixed diaphragm of the ocular up or down, and a millimetre scale and graduations on the flange of the diaphragm itself permit an adjustment to tenths of a millimetre. The focus, once found, should be noted, and can then always be recovered. In another arrangement he pushes the fixed diaphragm down on to the mount of the lower lens, and the movable diaphragm has been so modified (fig. 49) that it rests directly on the displaced diaphragm. The movable diaphragm is slightly altered in construction so as to carry a millimetre scale, and its arrangement will be easily understood from the figure.

In the second type (fig. 50) the three vertical springs are reduced to one, which is rather broad, and its curved extremity is useful for handling the diaphragm. Moreover, this vertical stem is provided with a screw thread, by means of which it may be screwed up or down inside a short tube, which acts as its holder and is dropped down on to the mount of the lower lens. Vertical springs set in the thickness of this tube serve to keep it steady in its place. There is a vertical millimetre scale, and the flange of the diaphragm is also divided, so that adjustment is possible to the tenth of a millimetre. A vertical window permits the exact position of the glass slip to be known.

(3) Illuminating and other Apparatus.

Leitz' Large Projection Apparatus. — In this apparatus (fig. 51) the Schuckert electric projection lamp is employed. The lamp requires

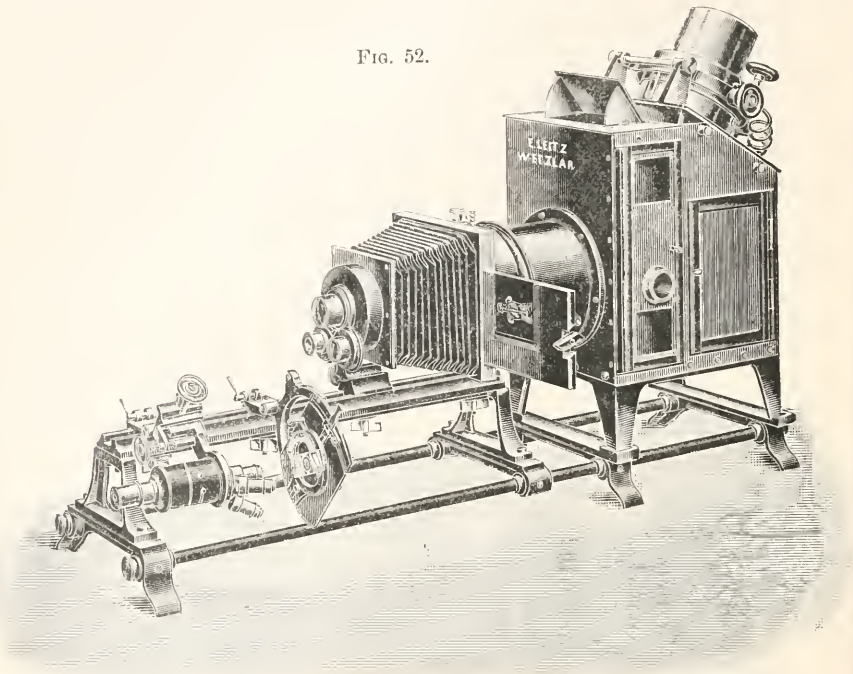
Fig. 51.



a constant electric current of 12–20 amperes, and connected with it is a triple condenser of 150 mm. diameter. Various contrivances permit very accurate adjustment of the lamp and condenser. For example, two thumbscrews control the positions of the carbons, so that the luminous point may be readily brought into the exact optical axis of the con-

denser; moreover, the two inner lenses of the condenser are movable, and are controlled by two knobs, as shown in the diagram. This adjustment of condenser lenses removes chromatic aberration, and the rays of light emerge in moderate convergence. As ordinarily employed

Fig. 52.



for direct projection from the preparation, the apparatus consists of the optical bench, with the following parts:—

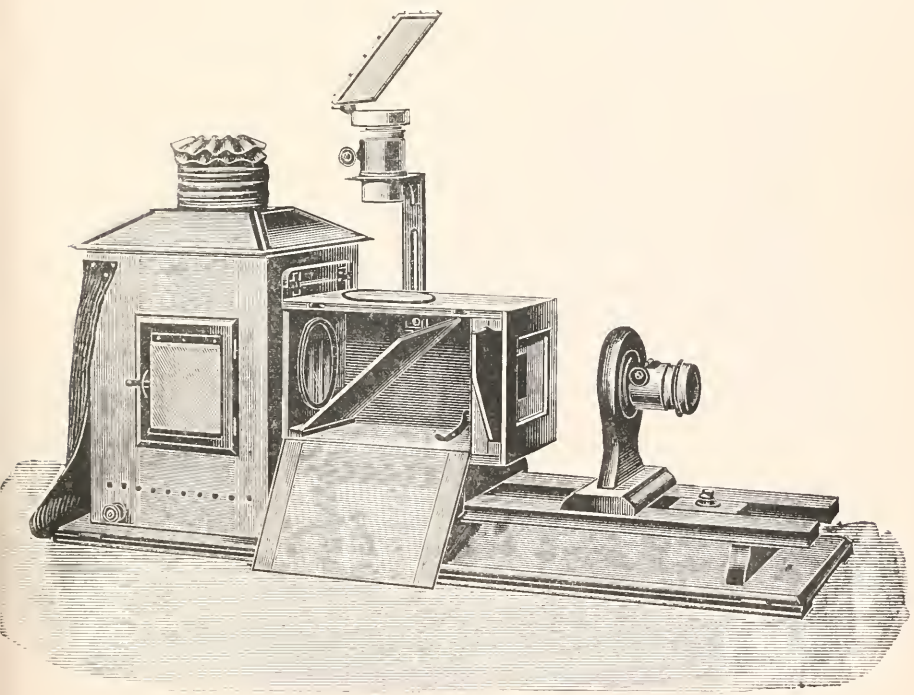
1. A large cooling-cell, kept cool by a current of running water.
2. The bellows, with tube.
3. The Microscope condenser (especially needed when high powers are employed, say $\frac{5}{12}$ to $\frac{1}{2}$) and diaphragm holder (sufficient for low-power work; a small rack-and-pinion suffices for adjustment.
4. The object-stage and small cooler. The preparation rests on the cooler, and protection from heat is thereby afforded to the most delicate specimens; the adjustment of the object permits any desired part to be brought accurately into the field.
5. The objective-carrier, with triple nose-piece, a broad projection-tube, and a diaphragm for the purpose of narrowing the broad tube. A narrow tube, which screws into the broad one, permits use of oculars if desired; the adjustments are by rack-and-pinion and micrometer screws.
6. Wooden cover, with cloth curtain, which fits over the diaphragm-carrier, stage, and objectives, to shield off any light which might escape at the sides.

With this projection apparatus all powers of Microscope objectives may be employed, including the $\frac{1}{12}$ oil-immersion. The picture, even when the highest powers are used and the screen is at a distance of 12 feet from the apparatus, is of sufficient clearness and brightness to be available for demonstration to a large audience.

For lantern-slide projection the objective-stage and objective-carrier are swung out of the way by means of specially provided joints (fig. 52), and a special projection lens of 300 mm. focal distance is screwed into the diaphragm-holder and a slide-carrier inserted into the bellows-frame. When so arranged the projection can be made upon a screen 30 feet distant, over the heads of the audience.

Liesegang's Universal Projection Apparatus.*—The inventor claims that his apparatus is unique of its kind. It is intended, firstly, for the direct projection of lantern pictures; secondly, for vertical projection; thirdly, for the projection of opaque objects; fourthly, for the projection

Fig. 53.



of physical phenomena by means of parallel light; fifthly, for microscopic and polariscopic projection; and finally, for cinematographic projection.

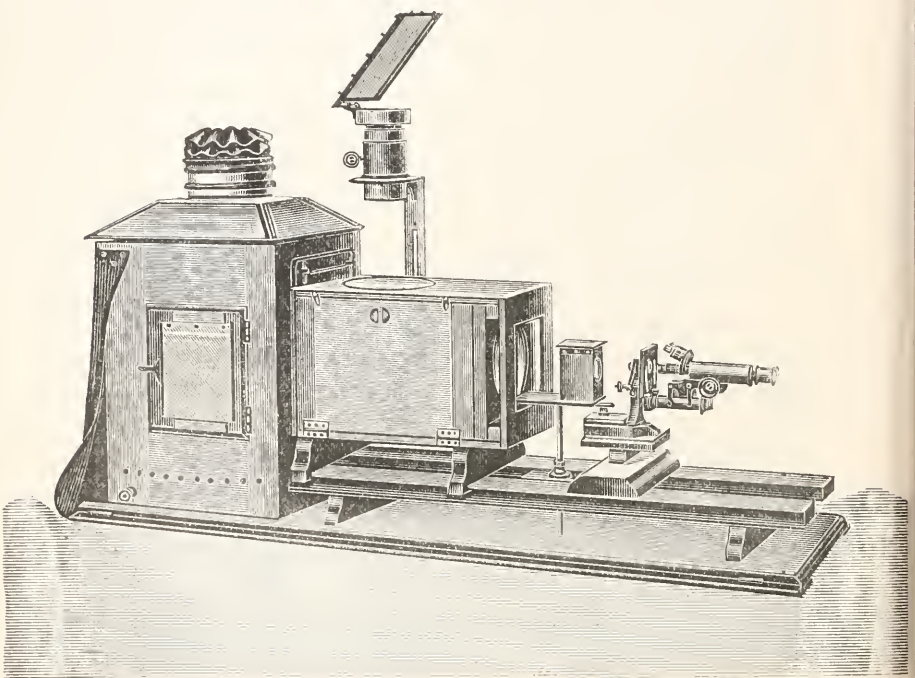
The apparatus consists of a box, which serves for the reception of

* Central. Zeit. f. Optik u. Mech., 1900, pp. 222–6 (8 figs.).

the light source, and in its front wall are two condensing lenses, which render the issuing light rays parallel, or nearly so. The optical bench takes the form of a pair of parallel wooden bars. For attaining the different kinds of projection, two boxes equipped with lenses and mirrors are provided—the vertical box and the episcopic box. These are used, as required, singly or together in line, and are placed in front of the issuing light beams. For direct projection there is also an objective on a suitable carrier.

Figs. 53 and 54 show how direct and vertical and microscopic projections are obtained. The "vertical box" is, in fig. 53, seen *in situ*, the

Fig. 54.



sloping mirror being arranged for throwing the light upwards through a second condenser on to a different projection lens; a sloping mirror above this projects horizontally an image of any object placed in the focus of the projection lens. When the mirror inside the vertical box is clamped down, the whole of the upper part obviously passes out of gear, the light passes out at the side of the box, and there is direct projection. The change in position of the inside mirror is readily and instantaneously effected.

When used for microscopic projection, a lens is required for focussing the light rays on to the substage condenser, and the arrangement will be easily understood from fig. 54. The vertical projection apparatus

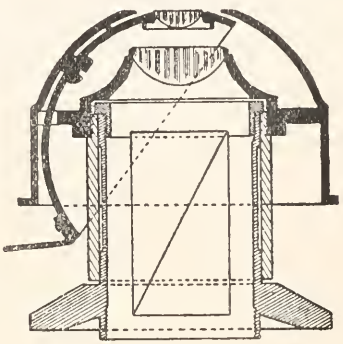
is a useful auxiliary, as it is always at hand for purposes of small magnification.

Details of the other uses of the instrument are omitted here, as scarcely falling within the province of microscopy.

An arc lamp "volta" is recommended as the best source of light.

Combined Condenser and Polariser for Petrographical Microscopes.* —Mr. W. L. Patterson's arrangement consists of a double lens condensing system, and a Nicol prism mounted as shown in fig. 55. The upper condensing lens is mounted on a revolving arm, so that it may, at the will of the operator, be instantly thrown in or out of the optical axis by a lever: a suitable stop being provided for bringing it to a central position. The lower lens is mounted at the proper distance below the upper surface of the apparatus, so that, when the upper lens is moved out of optical axis, the lower lens focusses upon the slide, thus avoiding the necessity of re-focusing the condenser system when changing from the double to single combination. The Nicol prism is mounted in a revolving sleeve with graduated collar, and a stop to indicate zero, or the position when the prisms are crossed.

Fig. 55.



The author claims the following advantages over other similar contrivances:

1. It is not necessary to increase the size or thickness of the Microscope stage.

2. The attachment is always in focus when one or both lenses are used.

3. Compactness and freedom from liability to disturbance while stage or slide is being operated.

(6) Miscellaneous.

New Form of Loup-holder.†—M. Malassez has aimed at producing a portable and inexpensive loup-holder, of a nature such that a travelling Microscope could be used as it stands. Fig. 56 shows one of his arrangements. The weight of the loup and its holder is counterbalanced by a fairly heavy ball sliding on a quadrangular stem, whose extremity screws into the collar of the holder. The rackwork and micrometric screw of the Microscope are, as is readily seen in the figure, available for focussing and adjustment. In order to be able to fit in loups of different diameters, the inventor makes use of a kind of small vice with parallel grip, actuated by a screw. The whole arrangement allows to the worker great freedom of position, and especially secures his face from contact with the apparatus.

For the convenience of those who may prefer the loup-holder to be

* Journ. App. Micr., 1901, p. 1155 (1 fig.).
† Arch. Anat. Micr., 1900, pp. 424–8 (2 figs.).

quite independent of their Microscope, M. Malassez has arranged (fig. 57) a heavy foot and a parallelogram holder (the same as in fig. 56), which terminates in a toothed wheel engaging in an endless screw fixed on the foot. By turning this screw the parallelogram can be raised or depressed, and thus the loup can be mechanically adjusted.

Fig. 56.

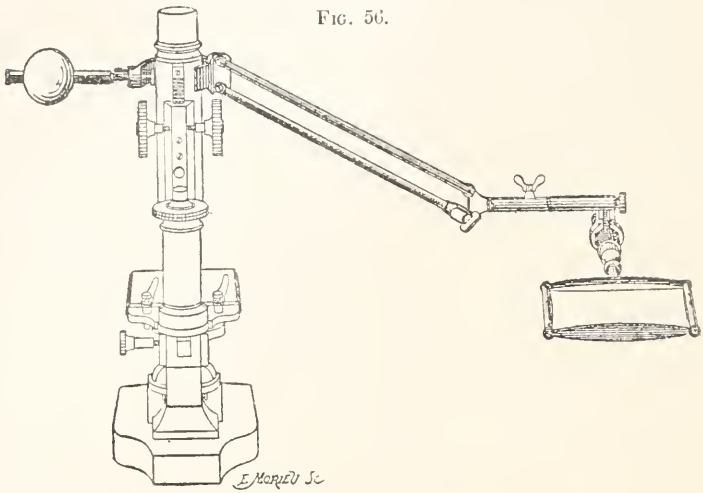
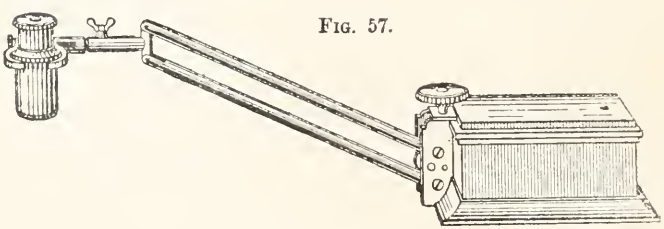


Fig. 57.



B. Technique.*

(1) Collecting Objects, including Culture Processes.

Sand-Filter for Agar.†—Th. Paul has found that sand is an excellent material for filtering agar. He has devised a sand-filter, the construction of which is as follows:—The apparatus consists of a couple of enamelled iron vessels, one of which fits on the top of the other (see fig. 58). The bottom of the vessel is sieved, and this vessel contains five strata of gravel and sand; first, coarse and fine gravel, then sand, and

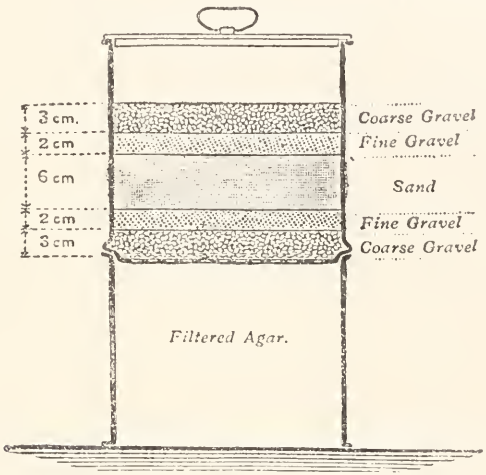
* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

† Münch. Med. Wochenschr., 1901, No. 3. See Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 270–1 (1 fig.).

then coarse and fine gravel again. Each stratum is separated by a layer of gauze.

Boiling hot water is first run through the apparatus. It is then placed in a steamer until the whole is heated to 100°, after which the boiling-hot agar may be introduced. The apparatus acts very rapidly, and turns out quite clear agar.

Fig. 58.



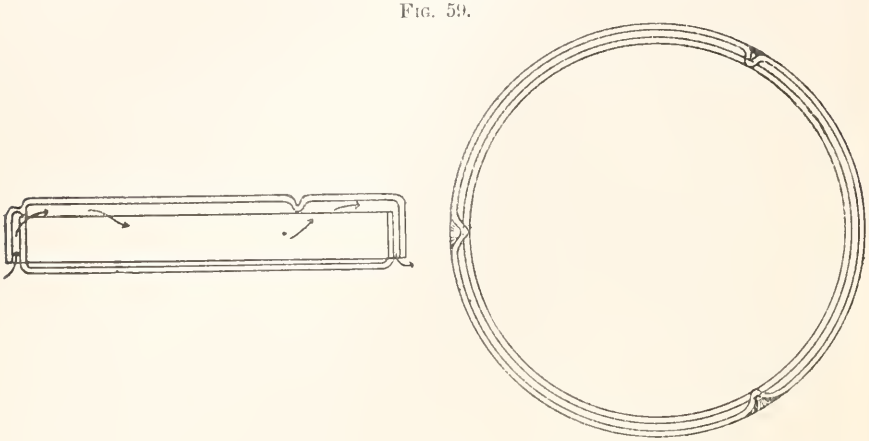
New Method of Obtaining Pure Cultures.* — S. L. Schouten has devised a delicate procedure for obtaining pure cultures of bacteria by selecting an individual cell with the aid of the Microscope. An extremely thin layer of vaselin is spread on a cover-glass. On the cover-glass are placed a drop of very dilute culture and a drop of sterile nutrient medium. The cover-glass is then placed in a moist chamber, which is perforated on two sides. Through the apertures pass two small glass hooklets, by means of which the culture drops in the chamber can be manipulated. The chamber is then placed under the Microscope (oil-immersion), when the culture-drop and the medium-drop will be seen lying close together, and the water in the chamber as minute droplets on the vaselin layer. The bacteria are sought for and isolated by means of one of the hooklets, which are worked by micrometer screws. In this way a single bacterium is fished out and deposited in one of the water-droplets. When the operator is satisfied that there is only one bacterium, the microbe is transferred by means of the other glass hooklet to the drop of culture-medium. The glass needles are about 5 μ thick, and the hooklets about 30 μ diameter.

By this method the fission of a single bacterium, the formation of a colony, and so on, can be observed, and the isolation effected in a liquid medium, which is not possible by Koch's method.

* Verslagen van het Geneesk. Congres, 1899. See Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 363-4.

Ventilated Dish for Bacterial Cultures.*—G. C. Whipple has devised a ventilated dish (see fig. 59), the cover of which is supported about 2 mm. above the lower plate by means of three projections. These projections are indentations in the glass cover, and are obtained by heat-

Fig. 59.



ing the edge and pressing the softened glass with a sharp point. The sides of the cover are made deeper than in the Petri dish by an amount equal to that which the cover is raised above the dish. With the cover thus elevated these obtain free circulation of air. These dishes are suitable for anaerobic as well as aerobic cultivations.

Incoagulable Blood as a Culture-Medium.†—F. J. Bose recommends incoagulable blood for the cultivation of certain parasites, such as *Coccidium oviforme*, and those of cancer, vaccinia, and syphilis. Blood is rendered incoagulable by means of extract of leech-heads. The powdered extract obtained by hardening the leech-heads in absolute alcohol is boiled with water, and after filtration is preserved in sterilised bottles. It is used either by adding it to the drawn blood, or by injecting it into the veins of animals.

Medium for Cultivating Chromogenic Bacteria.‡—E. M. Chamot and G. Thiry recommend the following procedure for the cultivation of chromogenic bacteria. Large potatoes, and such as are known to become mealy and porous on boiling, are selected. These are boiled with their skins on till cooked through. The water is then poured off and the potatoes allowed to cool, after which they are peeled and cut into slices 1 to 2 cm. thick. The slices are immersed for about 18 hours in a dilute solution of sodium hydroxide. The slices are drained and then transferred to covered glass capsules (100 mm. diam. and 50 mm. deep); a little water is added, and the medium steam-sterilised on three successive days. The strength of the sodium hydroxide solution is given as

* Journ. Applied Microscopy, iv. (1901) pp. 1197–8.
† C.R. Soc. de Biol de Paris, lii. (1900) pp. 1052–5.
‡ Bot. Gazette, xxx. (1900) pp. 380–2.

0·25 to 0·5 per cent., and it also contains a little calcium phosphate. The potato becomes stained throughout of a deep indigo colour. After becoming nearly black the pigment fades, ultimately assuming a dirty-brown hue. The blue pigment is soluble in water and dilute alcohol. Dilute alcohol is used for extracting the pigment from the medium; the alcoholic extract is passed through a porcelain filter. The pigment is purified by precipitation with alcohol and re-dissolving in water, the procedure being repeated several times.

Cultivation of Ducrey's Bacillus.—G. Maréchal* obtained, on ascitic serum, pure cultures of the bacillus found in soft chancres, Ducrey's bacillus. The serum was used alone, and in conjunction with agar, gelatin, ox and horse serum. The microbe had the typical figure of 8 appearance. When transferred to slightly acid urine it became five or six times the usual length, and often presented appearances similar to the streptobacillus of Unna. When pure cultures were injected into the peritoneal sac of guinea-pigs, the animals died in 12 hours, while subcutaneous inoculations reproduced the appearances of soft chancre.

F. Besançon, V. Griffon, and L. Le Sourd † recommend "sang gelose" for cultivating the bacillus of soft chancre, as typical colonies develope in 24 hours, and attain their full growth in 48 hours. The medium is rabbit's blood mixed with agar.‡

Cultivation of Microbes of Vaccinia and Variola. — Dr. S. M. Copeman § used collodion capsules filled with beef-broth. These, having been inoculated with a trace of glycerinated vaccine-lymph, were sealed up and placed within the peritoneal sac of rabbits and dogs. In successful cases (i.e. when the capsules did not rupture) it was found that an appreciable amount of serum albumen had dialysed through. On making film preparations of such unruptured capsules and staining with methylen-blue, numerous zoogloea masses were detected. These masses consisted of bodies resembling spores, only the periphery of which took the stain. These apparently represent the resting stage of the specific microbe. The contents of these capsules produced a typical eruption of vaccinia in the calf. Organisms similar in appearance were observed in the epithelium of vesicles in vaccinia of the calf and in human smallpox.

Dr. M. Funck ‖ has found in vaccinia and variola a protozoon, *Sporidium vaccinale*, which may be conveniently examined in emulsions of glycerinated vaccine with bouillon or physiological salt solution. The organism occurs as—(1) round bodies 2–10 μ in diameter, of a brilliant green colour, and exhibiting slow movements; (2) brilliantly green spherules 1–3 μ in diameter, packed within epidermal cells; (3) raspberry like bodies, with a diameter of 25 μ or more. These cysts are full of spores, and are termed sporoblasts. These sporoblasts were isolated by the following procedure:—Some pure vaccine was spread on a disc of ordinary agar and incubated for 24 hours. The preparation was then placed under a Microscope and the sporoblasts fished out with a platinum wire. The spores were made into an emulsion with bouillon and

* C.R. Soc. Biol. de Paris, lii. (1900) pp. 1115–7.
† Tom. cit., pp. 1048–51. ‡ See this Journal, 1900, p. 391.
§ Brit. Med. Journ., 1901, i. p. 450. ‖ Tom. cit., pp. 448–9.

inoculated on a calf, which about the tenth day exhibited the characteristic pustules.

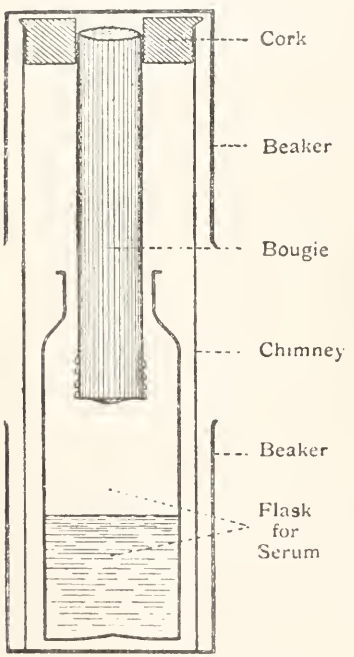
Medium for Bacteriological Examination of Water.* — Dr. P. Müller finds that far more species of water bacteria develope on albumose-agar (Heyden's *Nährstoff*) than on ordinary alkaline nutrient bouillon, and that the difference in the number of germs developed in the two media is greater when the water is less impure than in waters much contaminated.

(2) Preparing Objects.

Permanent Preparations of Bacterial Cultures.† — Dr. Th. Paul makes permanent preparations of cultures in Petri dishes after the following manner:—The cover of the culture-dish is grooved so as to fit accurately into the upper edge of the dish. The cultures are killed with pure formalin. A circular piece of filter paper soaked in formalin is placed over the dish and the lid put on, after which the whole is placed in a tin box. A vessel filled with formalin is also placed inside the box. In a few days the culture is quite dead. The cover is then fastened on. The groove is filled with finely powdered white sealing-wax. The lid is placed in a hot-air steriliser to melt the wax. Meanwhile, the dish is placed upside down on a hot metal plate, so as to heat the edge of the dish. When ready the dish is inserted into the groove and pressed down. When cold the cover and dish are firmly united, and the apparatus is rendered perfectly air-tight.

If a large number of preparations are required a special gas-stove is advisable.

Fig. 60.



Method for obtaining Sterile Blood-Serum.‡ — C. G. Schoneboom obtains sterile serum by filtering through a porcelain bougie without artificial pressure. One end of an ordinary lamp-chimney is plugged with a cork, which is perforated to admit the bougie, the lower end of the latter dipping into a flask or other suitable vessel (see fig. 60). The chimney is placed inside a beaker, and its upper end covered with another. Some dozen or so of these apparatus are put up, and having been placed on a hot-air steriliser at 160° for an hour, are allowed to cool in a quiet room or cellar. The

* Arch. f. Hygiene, xxxviii. (1900) pp. 350–66.
† Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 25–9 (3 figs.).
‡ Tom. cit., pp. 210–1 (1 fig.).

serum may be poured off two or three times a day. The bougies are cleaned by standing them in water, frequently changed, for some days, and then sterilizing them in a muffle furnace.

New Method of Fixing Blood-Films.*—W. F. Whitney recommends a modified Zenker's fluid (potassium bichrom. 2; sodii sulph. 1; water 100; this is saturated with sublimate while warm and 5 p.c. glacial acetic acid added at time of fusing). The author substitutes 5 p.c. nitric acid for the acetic acid. The fluid is dropped on the film and allowed to act for a few seconds, or while counting twenty. It is then washed in running water, and afterwards the triacid stain applied for about 3 minutes.

New Method for Isolating the Typhoid Bacillus from Water.†—Dr. L. Remy's method for isolating the typhoid bacillus consists of two procedures, the direct and the indirect.

A. Direct.—To a tube of differential gelatin, i.e. containing 0·5 per thousand H_2SO_4, lactose 3 p.c., phenol 0·25 per thousand, are added $\frac{1}{20}$, $\frac{1}{10}$, $\frac{1}{2}$ ccm. of water, according to its origin. This makes plate i. Plate ii. is made with the same gelatin, but contains 0·5 per 1000 of carbolic acid. As better results are obtained from large plates, it is advisable to use, instead of 10 ccm. of gelatin, 25 or 50 ccm., and add 2·5 ccm. of water, or more.

B. Indirect.—10, 20, 50 ccm., according to the water to be analysed, are introduced into a flask containing carbolised acidulated bouillon. The proportion should be such that the mixture of bouillon and water contains 0·5 per 1000 of sulphuric and carbolic acids. After 22–24 hours at 25°–30°, differential plates are made. To these 0·25 and 0·5 per 1000 carbolic acid are added. The plates are kept at 20°. On the second or third day the colonies may be examined. Those which are deep bluish or bluish-white usually contain typical typhoid bacteria. If there be few colonies, they should be re-sown in bouillon heated to 35°–37°. When the gelatin cube is liquefied, the tube is shaken and then kept at 25°–30°. It should be particularly noted that typhoid bacteria from water often form scums on bouillon.

(3) Cutting, including Imbedding and Microtomes.

Improvised Microtome.‡—J. L. Powers describes a microtome devised by Dr. Shurtleff, and as it is intended for home manufacture, and possibly for consumption, it may be advisable to adopt the writer's own terms:—"The first essential is, of course, a knife, and while a regular section razor is preferable, an ordinary razor will answer. In the absence of either, however, I have seen a shoe-knife successfully used, but in this case the back was strengthened by soldering a knitting-needle on one side, and a rod cut from a stove-poker on the other. Assuming, then, that a knife is at hand, the next requisite is the holder, which consists of a piece of wood about 4 by 7 in., having a U-shaped cut-out at the top, 2 in. wide and 3 in. deep. This leaves two prongs each an inch wide, into which small wire nails are driven, so that the razor R may rest upon them when it is in

* Journ. Boston Soc. Med. Sci., v. (1901) pp. 341–2.

† Ann. Inst. Pasteur, xv. (1901) pp. 145–60. See also this Journal, 1900, p. 639.

‡ Journ. Applied Microscopy, iv. (1901) pp. 1163–4 (2 figs.).

position. Spring clips of some sort hold the razor firmly in place. For the clips stout wire an eighth of an inch thick is good. Each wire may be fastened to the board by double-pointed tacks. Near the bottom of the board, and in the centre, is the screw S (fig. 61). A common screw will answer, but a fine-threaded screw, passing through a nut, is better. In either case, however, a large disc may be soldered to the screw-head for increased delicacy in operation. The 'holder' complete is now, by means of a pair of hooks and eyes, to be made attachable to the end of a box, so that turning the screw gives a delicate movement to the razor. The screw-point should work against a small metal plate on the box. Tension is secured with a rubber band or spiral spring. Reference to the diagram (figs. 61, 62) will make the idea clear. The 'holder' should be so placed that the razor-edge will be two or more inches higher than the top of the box. Now, when an adjustable object-holder is provided, the microtome is completed. To make the object-holder, a board somewhat shorter than the box, a block, and a straight-grained stick about half an inch in cross-section, are necessary. Fasten the block near one end of the board, nail the stick to the block

Fig. 61.

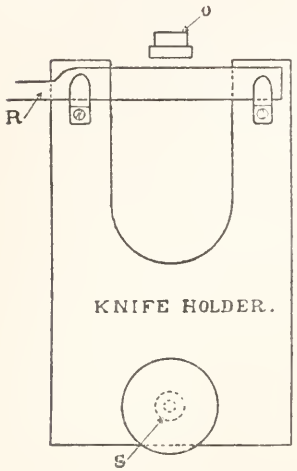
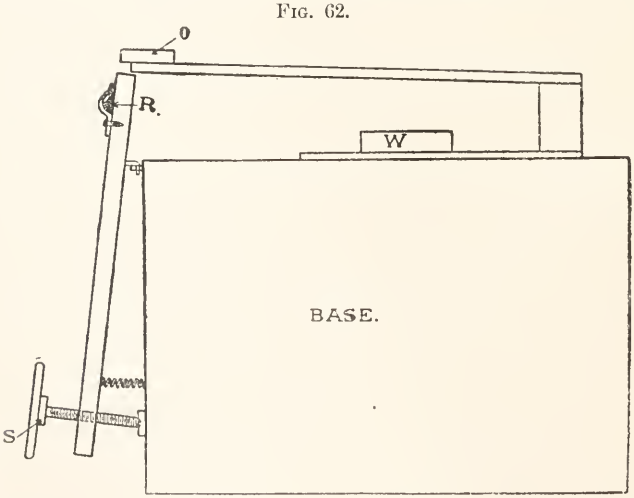


Fig. 62.



(as indicated in the diagram), and the microtome is ready for service. In use the paraffin block O is fastened to the end of the stick with melted paraffin, and proper adjustments are made with reference to the

razor. Then downward pressure on the stick cuts the section, while clockwise movement of the screw regulates the thickness. Serial sections are readily made if the paraffin block is carefully squared; but for this work the object-holder should be steadied by a weight W of five or six pounds."

(4) Staining and Injecting.

Spore Staining.* — Dr. H. Marx stains spores in the following simple manner :—A large loopful of culture or the condensation water is placed on a cover-glass and carbol-fuchsin added. The mixture is boiled four or five times successively, after which it is evaporated down to dryness. The preparation is then decolorised in 25 p.c. nitric acid, and after-stained with Loeffler's methylen-blue.

By this procedure are stained not only spores actually formed but such as are in process of formation.

Simple Method for Staining Flagella.†—Dr. A. Peppler describes a method for staining flagella, and gives numerous instances of its success. The mordant is composed of tannin and chromic acid, and is made by adding 15 parts of an aqueous sulphuric-acid-free 2·5 p.c. solution of chromic acid to a solution of 20 parts tannin in 80 distilled water. The latter is prepared by heating in a water-bath and cooling down to 20°. The chromic acid is added in small portions and continually stirred the while. After standing for four to six days the mordant is filtered. The staining solutions recommended are carbol-gentian-violet, and carbol-fuchsin. For all bacteria except the spore-formers it is advisable to use slides and not cover-glasses. Instructions are given that the slides must be perfectly clean, after which follow details for making the films from agar cultures. The films are air-dried and fixed in the usual way. The mordanting and staining are carried out at room temperature. The mordant is poured or filtered over the slide and allowed to act for one to five minutes, according to the age of the culture and other circumstances. The mordant is then poured off and the slide washed in running water. The still wet slide is next stained, the solution being allowed to act for two minutes. The slide is thereupon washed and dried without delay on filter-paper.

Anilin-blue for Staining Bacteria.‡ — MM. Guiraud and Gautié recommend a saturated aqueous solution of anilin-blue for staining bacteria. The films are made in the usual way and then the stain poured on. The cover-glass is heated two or three times successively until the stain vaporises, after which it is washed in water and mounted.

Staining Gonococci with Neutral Red.—R. Herz § uses a 0·5 p.c. aqueous solution of neutral red placed on the slide, and on this is put a cover-glass with a drop of pus.

P. Richter ‖ uses 0·25 p.c. aqueous solution of neutral red, made with the aid of heat. The air-dried unfixed film is stained with a cold solution.

* Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 11, 12 (3 figs.).
† Tom. cit., pp. 345-55.
‡ C.R. Soc. de Biol. de Paris, liii. (1901) pp. 190–2.
§ Prag. Med. Wochenschr., 1900, No. 10.
‖ Dermatol. Zeitschr., vii. (1900) No. 2. See Centralbl. Bakt., xxviii. (1900) p. 711.

Method of Distinguishing Bacillus Coli Communis from Bacillus Typhosus by the use of Neutral Red.* — W. Hunter has found that *Bacillus coli communis* possesses, to a marked degree, the power of reducing neutral red, producing a superb canary-yellow fluorescent colour of the medium. The *Bacillus enteritidis* Gaertn. also produces this reaction, and is probably only a variety of *B. coli*. *Bacillus typhosus* and the common pathogenic microbes do not give the reaction. By means of neutral red the presence of *B. coli* can be diagnosed with certainty within from 12 to 24 hours, and it is possible, by means of this reagent, to distinguish members of the coli group from those of the typhoid group.

This method appears to be applicable only to tubes and not to plate cultures. The most satisfactory medium is glucose-agar with 0·3 p.c. of glucose. From 0·1 to 0·5 ccm. of a saturated aqueous solution of neutral red are added to 10 ccm. of the medium.

Diagnostic Staining of the Malaria Parasite.†—Dr. R. Reinhold suggests that the films should be made by having the blood on the back of the cover-slip which is drawn along the slide, so that the blood follows instead of being pushed along.

In fresh films he uses a solution made of 100 ccm. of water and 0·2 p.c. soda. This is heated, and to the boiling fluid 0·3 p.c. methylen-blue (Höchst) is added. The solution is allowed to cool, and filtered 48 hours later.

For films 4 weeks or more old, 1 p.c. methylen-blue must be added.

Staining Diphtheria Bacteria.‡—Dr. Piorkowski recommends the following procedure:—Stain for 1 minute in Loeffler's methylen-blue slightly warmed. Decolorise with 3 p.c. hydrochloric-acid-alcohol 5 seconds, wash with water, and after-stain with 1 p.c. aqueous eosin solution for 5 seconds. The superfluous water is removed by filter paper. The preparations are to be examined in water, as the polar and central granules are better seen.

Modification of the Romanowski-Ruge Method of Staining Protozoa.§—W. Hanna recommends Berestneff's modification of Romanowski's method for staining the *Plasmodium malariæ* and other Protozoa. A 1 p.c. aqueous solution of methylen-blue (Höchst) containing 0·3 p.c. carbonate of soda, is heated for 3 hours in a water-bath and filtered. One ccm. of this solution is mixed with 1·5 ccm. of a 1 p.c. aqueous solution of methylen-blue, and to this mixture are added 5 ccm. of a 1 p.c. aqueous solution of eosin (extra B A Höchst). Old preparations of semilunar bodies and *Halteridium Danielewskii* require 15 to 20 hours at laboratory (? incubator) temperature. Young forms stain in 15 to 20 minutes in alcohol, followed by gentle heating for 15 to 20 minutes. The preparations are placed in the following solution for 2 to 5 seconds:—10 ccm. methylen-blue 1 p.c., 200 ccm. distilled water, and 0·25 ccm. acetic acid. They are next washed and dried, and then dipped for from 5 to 20 seconds in absolute alcohol, after which they are washed again in water.

* Lancet, 1901, i. pp. 613–5.
† Deutsch. Med. Wochenschr., xxvi. (1900) pp. 447–8 (1 fig.).
‡ Zeitschr. f. angew. Mikr., vi. (1901) pp. 281–3. § Lancet, 1901, i. p. 1010.

Fresh malaria blood-films fixed in alcohol are stained by this mixture diluted with 2 to 4 volumes of water in 5 minutes without heat, followed by gentle heating for 5 to 10 minutes. For Trypanosoma blood the mixture is used undiluted, or diluted with 2 volumes of water.

(6) Miscellaneous.

Platinum Needles with Capped Handles for Bacteriological Purposes.*—Prof. A. Meyer says that it is advantageous to have a platinum

Fig. 63.

cap to needle-holders. The cap, as shown in the illustration (fig. 63), fits over the end of a glass handle. The needles may be straight, with a loop or with a spatula end.

Convenient Source of Artificial Light for the Laboratory Table.†—W. Krauss has devised an easily adjusted light for the laboratory table which does not interfere with daylight. The device consists in reflecting the light of a ground glass incandescent bulb from a mirror arranged at a convenient angle. The bulb may be placed on the table or beneath it. In the latter case a trapdoor must be cut in the table and the mirror fixed to the under surface of the flap.

Ostwald's Thermoregulator.‡—Th. Paul has adapted W. Ostwald's thermoregulator to incubators. The apparatus, which is extremely easy to manage and of simple construction, consists of two parts, a tube and a top-piece. The tube is filled with 10 p.c. chloride of calcium solution. The top-piece is practically a U-shaped tube containing mercury, one arm of which is connected with the calcium chloride cylinder and the other with the gas arrangement.

The special advantages are that it is easily cleaned and that it works very satisfactorily.

Paraffin Blocks for Celloidin Sections.§—W. W. Babcock has found that paraffin with a high melting point forms a ready and suitable basis for celloidin blocks. The paraffin cake is scored on one surface by a series of oblique incisions, with another set of incisions at right angles. In this way a surface is covered with slanting teeth sufficient to hold the celloidin block when stuck on in the usual way.

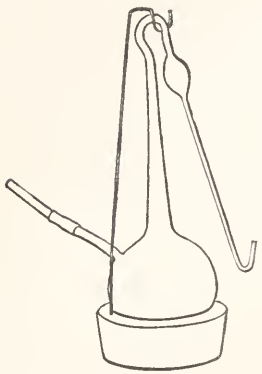
Camera Lucida for Counting Blood-Corpuscles.‖—Dr. A. L. Benedict recommends the camera lucida for counting blood-corpuscles. The lines of a hæmacytometer are drawn on a piece of cardboard by means of the camera, and the count made by reflecting the lines back on to

* Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 260–1.
† Journ. App. Microscopy, iii. (1900) pp. 1086–7 (1 fig.).
‡ Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 129–33 (1 fig.).
§ Journ. App. Microscopy, iii. (1900) pp. 1090–1. ‖ Tom. cit., pp. 1087–9.

the microscopic field. To make the lines as plain as possible, a green background with lines in red is used.

Device for Supporting Pasteur Flasks.*—Miss K. E. Golden has devised a support for Pasteur flasks which as the illustration (fig. 64) shows permits greater freedom and safety in manipulation than is obtained by the ordinary collar support. The device consists of a wooden disc 5½ in. in diameter and 2 in. thick. The disc is hollowed out into a concavity suitable for the bottom of the flask. One end of a piece of heavy brass wire is fastened into the base, the other being adapted to the bend of the tube so that the flask is supported in the erect position.

Fig. 64.



Demonstrating Presence of Bacillus typhosus in the Blood of Typhoid Fever Patients.†—Dr. M. Auerbach and Dr. E. Unger succeeded in demonstrating the presence of *B. typhosus* in blood taken aseptically from the median vein, seven times out of ten trials. They used about 300 ccm. of ordinary bouillon, and added to each flask 10, 20 or 30 drops of blood. Hanging-drops taken from the flasks were examined 18–24 hours afterwards, and if negative again 24 hours later. Identification was further assured by cultivation on agar slopes, milk, and grape-sugar-bouillon.

Margin of Error in Bacteriological Diagnosis.‡—Dr. J. O. Symes remarks that at the present time there is danger lest undue importance be attached to bacteriological diagnosis. With regard to typhoid it is not generally recognised that all cases do not give the same reaction, that the agglutination phenomenon may not present itself until late in the disease, or that it may be present at one period and absent at another. In diphtheria the finding of the Klebs-Lœffler bacillus is of value in cases presenting doubtful clinical symptoms, but is of less importance when symptoms of disease are absent or when the exact nature of the organism is doubtful. Failure to find the bacillus is only of value when confirmed by repeated observations.

In cases of general blood infection a bacteriological examination is often of the greatest value. The blood (not less than 2 ccm.) should be drawn from a vein by means of a sterile syringe and then spread over the surface of agar or other media and incubated. If rigid aseptic precautions are observed the margin of error is very small, and though a negative result cannot be accepted as proof of the absence of organisms, a positive result is of the highest importance.

In the examination of serous fluids, pus or section of tissues for tubercle bacilli, the margin of error is very great if reliance be placed on negative results. In actual practice the only organism likely to cause

* Journ. App. Microscopy, iv. (1901) p. 1157 (1 fig.).
† Deutsche Med. Wochenschr., xxvi. (1900) p. 796.
‡ Brit. Med. Journ., 1901, i. pp. 451-2.

confusion is the smegma bacillus; hence if the urine is to be examined for tubercle bacilli, it should be drawn off with aseptic precautions, and the acid-decolorised films further treated with alcohol for at least 30 minutes.

Error in diagnosis is frequently due to the fact that cultures only are made and no films prepared. For example, the films may show an organism which has failed to grow because the composition or the environment of the media has been unsuitable. Whenever possible films should be prepared and stab cultures made in glucose media.

Action of Formalin on Foul-brood of Bees. * — Prof. B. Galli-Valerio has found that hives infected with *Bacillus alvei* may be effectively purified by the action of formalin vapour. The applications are frequent and discontinuous. The formalin is applied by means of a spray apparatus specially constructed for the purpose.

Experimental Vaccinia.†—Dr. A. Calmette and Dr. C. Guérin have reinvestigated the observations of Gailleton and others relative to the receptivity of the rabbit for vaccinia. They find that the inoculation of vaccine on a rabbit is always followed by a confluent eruption of lymph-vesicles, provided that the skin be merely shaved and not scratched. The rabbit is an excellent control for ascertaining the virulence of vaccine derived from heifers and infants, and also of glycerinated vaccine. Only the skin participates in the multiplication of the vaccine elements. Aseptic vaccines may be obtained by inserting the virus in the peritoneal sac of rabbits after previous injection of bouillon. After a few hours the vaccine is purified of bacteria by the agency of leucocytes, which do not affect the vaccine virus.

Photography by Means of Photo-Bacteria.‡—R. Dubois has taken photographs by the light emitted from cultures of photobacteria. Ten to twelve hours were required to obtain a good negative, which shows that the number of chemical rays is very small in proportion to the light rays. The same remark applies to the heat rays.

Relation of the Chemical Composition and Microscopical Structure to the Physical Properties of Iron and Steel.§—In the course of his report at the third International Congress of Chemists at Vienna, H. Juptner von Jonstorff summarises the structural characters, which may be microscopically distinguished in pure carbon steel, as follows:—

1. Blow-holes.
   (*a*) If rough, they are empty, or contain air.
   (*b*) If smooth, they contain hydrogen and carbon monoxide.
2. Slag.
3. Graphite, in thick flakes, which in section appear as straight or crooked lines; they are often detached by the polishing, and leave "graphite crevices" easily seen under the Microscope; only found in iron rich in carbon.
4. Ferrite, i.e., pure (or nearly pure) iron; only found in steel poor in carbon.

* Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 127-9 (2 figs.).
† Ann. Inst. Pasteur, xv. (1901) pp. 161–8.
‡ C.R. Soc. de Biol. de Paris, liii. (1901) pp. 133–4.
§ Metallographist, i. (1899) pp. 222–47 (4 figs.).

5. Cementite, i.e. the separated carbide of iron, Fe_3C; occurs in steels rich in carbon.

6. Martensite; probably a solution of Fe_3C in iron; occurs only in steel hardened above 600° or 700° C.

7. Austenite, an alloy rich in carbon, less hard than 5 and 6, and, in the author's opinion, a solution of elementary carbon in iron; as yet has been only found in steel containing over 1 p.c. of carbon, and suddenly cooled from a high temperature.

8. Pearlite, a mixture of ferrite and cementite, to which perhaps may be added sorbite; it may be lamellar or granular.

9. Sorbite appears, under certain conditions in pearlite as a third constituent; it may be some residual martensite, which did not have time to be decomposed into ferrite and cementite.

10. Troostite is found as a jagged and stringy constituent between martensite and cementite, and may hold a relation to these constituents similar to that held by ferrite to cementite in pearlite.

Microstructure of Manganese Steel.*—Mr. F. C. Lau illustrates by four photomicrographs the appearance and disappearance of certain mysterious dark discs in quenched manganese steel. He believes that these discs are composed of cementite which, in the case of manganese steel, would be a double carbide of iron and manganese. He has occasionally noticed a similar appearance in carbon steels, with the difference that the discs appear white and brilliant.

Microscopic Structure of Gold and Gold Alloys.†—Thos. Andrews finds, by means of numerous etchings and micrometer measurements, that pure gold crystallises in the regular cubic system and its modifications.

Gold alloyed with bismuth, lead, silicon, tellurium, or potassium, was also examined, the composition being generally 99·80 p.c. of gold to 0·20 of the baser metal. In all cases crystals of pure gold were found to be imbedded in a more or less intricate meshwork of alloy, thus throwing light upon the known changes in its physical properties. This alloy is the eutectic. The author discusses the views of other writers on gold alloys.

Microstructure of Alloys of Iron and Nickel.‡—M. Osmond finds that these alloys may be divided into three groups:—(1) those not containing above 8 p.c. of nickel; (2) those containing from 12 to 25 p.c. of nickel; and (3) the non-magnetic alloys containing about 25 p.c. of nickel, and those which resume their magnetic properties owing to an excess of nickel (30 to 50 p.c.). The author finds that the study of the microstructure of these alloys confirms the classification based on their mechanical properties. Additional evidence is afforded that the principal properties of steels are a function of the position of their points of transformation on the scale of temperature. Alloys of iron and nickel are also found to acquire the interesting property of schistosity under forging. This is revealed by all etching methods, giving rise to the formation of bands alternately more or less attacked, surrounding each

* Metallographist, i. (1899) pp. 337–9 (4 figs.).

† Tom. cit., pp. 105–25 (10 figs.).

‡ Comptes Rendus, May 9, 1898; and Metallographist, i. (1899) pp. 69–71.

other, and making it possible to follow the distribution of the distortion produced by forging or rolling.

Micro-Chemical Examination of Lead-Antimony Alloys. * — J. E. Stead has made a laborious investigation of these compounds. He finds that the eutectic alloy has a percentage composition of 12·8 of antimony and 87·2 of lead, corresponding nearly with the formula Pb_4Sb. Its fusible point was 247° C., and specific gravity 10·48. Microscopicay examination of the eutectic showed a structure similar to that of other well-investigated alloys. At fairly equable distances apart, what appeared to be laminæ radiated from nuclei and continued in right lines until met by similar radiations from other nuclei. The appearance is similar to that of nodules of pyrites with radial structure or spherulites in obsidian. Further examination showed that these laminæ split up into excessively fine rod-like bodies, which, but for their absolute opacity, might be mistaken for certain forms of bacteria. It appears certain then that the eutectic alloy is composed of alternate laminæ of lead and antimony, each lamina being itself composed of crystals. In spite of the composition Pb_4S, there does not appear to be chemical union between the lead and the antimony.

Study of White Alloys called Antifriction.†—M. Charpy, after an exhaustive investigation, concludes that all the alloys used for antifrictional purposes possess the same general characteristics; they are composed of hard grains imbedded in a plastic alloy. This constitution fulfils the two requirements of bearing alloys: the load is carried by the hard grains which have a low coefficient of friction, and the "cutting" (*grippement*) of which can take place only with great difficulty; the plasticity of the cement makes it possible for the bearing to adjust itself closely round the shaft, thus avoiding local pressures which are the principal cause of accidents. Such constitution may be produced in binary alloys, the hard grains being made up by a single metal such as antimony, or by a definite compound such as antimonide of zinc. It is generally preferable, however, to use ternary mixtures, because, owing to the complex composition of the cement, the constitution possessing the required qualities may be more readily obtained.

Microstructure of Cementation. ‡ — Professor J. O. Arnold, after a thorough micrographic study of cemented iron bars, arrives at the following provisional conclusions:—(1) That the diffusion of carbon in the process of cementation presents two distinct varieties of "interpenetration": (*a*) The interpenetration of the substance corresponding with the formula $Fe_{24}C$ and pure iron; (*b*) the interpenetration of the normal carbide Fe_3C and the sub-carbide $Fe_{24}C$. (2) That the interpenetration of $Fe_{24}C$ and iron is more rapid, and takes place at a lower temperature than the interpenetration of $Fe_{24}C$ and Fe_3C. (3) (*a*) That the interpenetration of $Fe_{24}C$ and Fe begins at Ar_2 (about 750° C.), and is coincident with the evolution *in vacuo* of gases from the iron: (*b*) that the interpenetration of $Fe_{24}C$ and Fe_3C does not take place till a temperature of about 950° C. has been reached.

* Metallographist, i. (1899) pp. 179–92 (2 figs.).
† Tom. cit., pp. 9–55 (29 figs.). ‡ Tom. cit., pp. 56–69 (11 figs.).

Diffusion of Elements in Iron. * — Professor J. O. Arnold and A. M'William have conducted experiments for the investigation of this remarkable phenomenon. It has been known since 1897 that when steel and wrought iron are heated *in vacuo* for some time the steel not only loses carbon to the iron, but that the loss by the steel is exactly equal to the gain by the iron. Hence the question arises whether the carbon exists under such condition in a melted state and passes as an elementary substance, or whether it diffuses as a carbide. The authors have elaborately investigated the subject, and their conclusions drawn from their photomicrographic observations are strongly in favour of the probability of the diffusion of the carbon as a carbide. This property seems also to be shared by the sulphide and oxy-sulphide.

Bibliography.

Fifth Report of the Alloys Research Committee.
[Professor Sir W. C. Roberts-Austen in this report produces the series of typical photomicrographs of irons and steels, which will form a useful reference set.] *Metallographist*, i. (1899) pp. 186–222 (66 figs.).

The Relation between the Microstructure of Rolled Steel and its Physical Properties.
[Several controversial letters on this subject.]
Metallographist, i. (1899) pp. 71–9.

Clamer, G. H.—**The Microstructure of Bearing Metals.**
Journ. Franklin Inst., 1898, p. 188; and *Metallographist*, i. (1899) pp. 139–49.

Heyn, E.—**Microstructure of Steel.**
[Contains some 45 photomicrographs, illustrating many aspects of the subject.]
Stahl und Eisen, Aug. 1 and 15, 1899: and *Metallographist*, i. (1900) pp. 52–64, with the complete set of photomicrographs.

Morse, R. G.—**The Effect of Heat-treatment upon the Physical Properties and the Microstructure of Medium Carbon Steel.**
[The author gives a careful account of his experiments, but thinks that, in the present state of knowledge, it is unwise to draw conclusions.]
Metallographist, i. (1900) pp. 130–45 (23 figs.).

Osmond, F.—**Influence of Low Temperatures upon certain Steels.**
[Contains a photomicrograph of a cemented carbon steel quenched at 1050° C. in liquid air.] *Metallographist*, i. (1899) pp. 258–61 (1 pl.).

Osmond, F.—**On the Crystallography of Iron.**
[A very useful treatise on the subject.]
Annales des Mines, Jan. 1900; and *Metallographist*, i. (1900) pp. 181–220 and 275–90 (55 figs.).

Outerbridge, A. E., Jun.—**A Study of the Microstructure of Bronzes.**
Journ. Franklin Inst., 1899, p. 18; and *Metallographist*, i. (1899) pp. 150–2.

Perillon, M.—**Microscopic Metallography of Steel.**
[The author describes briefly the microstructure of steel, recognising the presence of six constituents:—ferrite, pearlite, cementite, martensite, troostite, and austenite.]
Bull. Soc. de l'Industrie Minérale, xii. (1898) p. 469; and *Metallographist*, i. (1899) pp. 155–7.

Roberts-Austen, Sir W. C.—**Importance of the Microscopical Study of Metals.**
Extract from Presidential Address before Iron and Steel Institute, May 1899; and *Metallographist*, i. (1899) pp. 340–5.

" " **On the Action of the Projectile and of the Explosives on the Tube of Steel Guns.**
[The author discusses some of the difficulties likely to be solved by micrographic analysis.] *Metallographist*, i. (1899) pp. 125–9

* Metallographist, i. (1899) pp. 278–305.

SAUVEUR, A.—**Microstructure of Coke and Charcoal Pig Irons.**
[Discusses whether these can be microscopically distinguished.]
Metallographist, i. (1900) pp. 154–6 (2 figs.).

" " **The Constitution of Hardened Steel.**
[A. Sauveur criticises the experiments and conclusions of Messrs. Arnold and M'William on this subject (see p. 344), and dissents from their views.] *Metallographist*, i. (1899) pp. 305–14 (6 figs.).

STEAD, J. E.—**Brittleness produced in Soft Steel by Annealing.**
[A valuable discussion of the subject, illustrated by excellent diagrams and photomicrographs.]
Metallographist, i. (1899) pp. 85–105 (8 figs. and 1 pl.).

" " **Microstructure of Alloys.**
[The author has continued his study of this subject. He mainly treats of alloys of antimony and copper, and briefly of alloys of antimony-tin and copper-tin. The antimony-copper alloys are of no practical value, and were examined for theoretical reasons only. The results are illustrated by 12 very clear photomicrographs.]
Metallographist, i. (1899) pp. 314–34 (12 figs.).

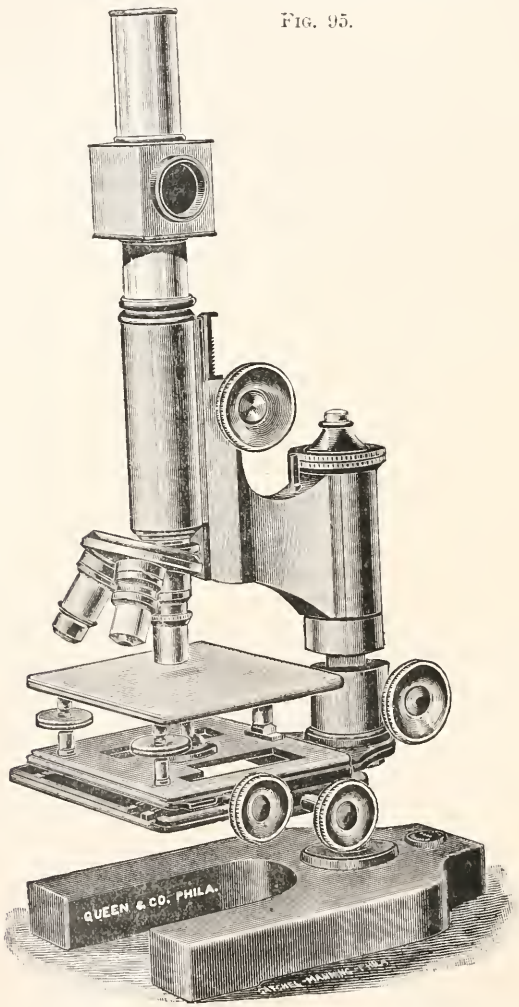
MICROSCOPY.

A. Instruments, Accessories, &c.*

(1) Stands.

Queen Microscope for Physical Laboratory Metal Examinations.—This instrument is made entirely of brass, highly finished. The coarse

Fig. 95.



* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

adjustment is by diagonal rack-and-pinion; the fine by a delicate micrometer screw with graduated head. The draw-tube is nickelled and graduated, and the body-tube into which it fits is felt-lined.

Three methods of illumination are used:—(1) A large thin glass vertical illuminator, fitting into the top of the draw-tube, as shown in fig. 95. (2) The thin glass vertical illuminator of English form, used just above the objective; and (3) a Zeiss vertical illuminating prism used in same position as (2). Each of these has its special advantages, and all are generally supplied with the instrument.

The stage is double. A large mechanical stage, with ample movements in both directions, has attached to it, by means of levelling screws, an upper plate without central opening. On this is placed the metal to be examined.

The compound stage, as thus constructed, is attached to the main post of the Microscope by a strong sleeve with separate rack movement. This permits the object to be brought into focus without disturbing either the optical part of the instrument or the position of the light. This is a very important feature. The entire stand revolves upon the base, and the stage may also be swung out separately if desired.

The outfit includes two eye-pieces, three objectives with revolving triple dust-proof nose-piece, and stand complete; in a polished mahogany case, with lock.

Günther's New Loup Stand.*—C. Benda describes this stand, consisting of a metal pillar of 32 cm. in length, standing on a solid fairly heavy metal plate (20 × 13 cm.). On this moves a rotatory sleeve, pushable up and down, and clamped by screws. The sleeve is firmly connected with a horizontal arm of about 40 cm. in length, so that this is movable in all directions about the vertical pillar. The arm consists of two limbs, approximately equal in length, and connected by a hinge-joint, movable in the horizontal plane. The distal limb is hollow, and receives the loup-stalk 20 cm. long. This stalk can be drawn out, reversed, and clamped by screws. The loup can thus be set and secured in any position. The loup supplied has a diameter of 9 cm., and a focus of 10 cm.

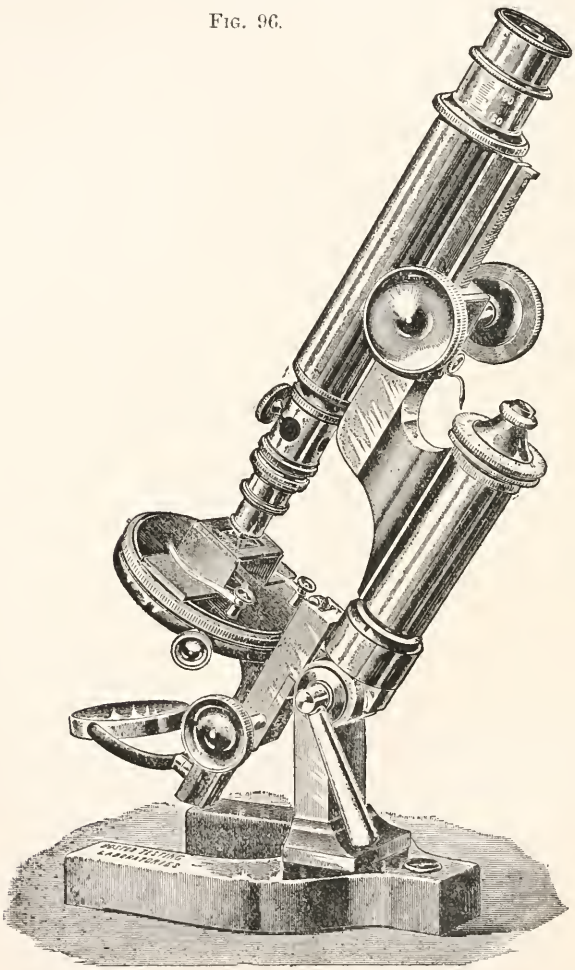
Special Stand and Specimen-holder for the Microscopical Examination of Metals.—For the microscopical examination of metals vertically reflected light must be used,—that is, light reflected downward by means of a vertical illuminator placed between the nose-piece of the Microscope and the objective. The source of light, condensing lenses, &c., must be so arranged that the beam of light will enter the vertical illuminator. With the ordinary stand any change of objective, or a change in the thickness of the piece under examination, necessitates a corresponding lowering or raising of the tube and, therefore, of the vertical illuminator attached to it. The beam of light then no longer enters the illuminator as it should, and the source of light and other illuminating appliances must be raised or lowered. To obviate this troublesome manipulation, the stand (fig. 96) used in the Boston Testing Laboratory, Boston, U.S.A., is provided with a stage capable of up and down motion by rack-

* Arch. f. Anat. u. Phys., 1900, pp. 179-80; and Zeitschr. f. wiss. Mikr., 1900, pp. 199-200.

and-pinion, by means of which the coarse adjustment is regulated. The position of the vertical illuminator, once fixed, need never be disturbed. The motion due to the fine adjustment may be neglected.

The above motion of the stage, moreover, greatly increases the working distance of the stand; this is very important, as it permits the examination of very thick pieces of metal.

Fig. 96.



By means of the special holder it is possible to place immediately on the stage, in the proper position to be examined, any sample of metal, no matter how irregular its shape, thus doing away with all tedious mounting of irregular specimens, or with the cutting of two parallel surfaces.

(2) Eye-pieces and Objectives.

HARTWIG, H.—**Zur Berechnung dreitheiliger Fernrohr- und Mikroskopobjective.** (On the Calculation of Three-lensed Telescope and Microscope Objectives.) *Zeitschr. f. Instrumentenk.*, XX. (1900) p. 230.

STREHL, K.—**Studien an Mikroskopobjectiven.** (Studies on Microscope Objectives.) [The author makes a series of comparisons on the combinations of objectives and oculars from two firms whom he calls X and Y. Elaborate tables of results are given.] *Zeitschr. f. wiss. Mikr.*, XVII. (1900) pp. 425–32.

(4) Photomicrography.

A First Book of the Lens.—C. Welborne Piper's book * with the above title is intended to be an elementary treatise on the action and use of the photographic lens. Its title accurately expresses the scope of the work, and the various diagrams are very clear and instructive. The subject of lens combination is very fully illustrated. The topics of the ten chapters are :—Light and optics ; action of lenses ; focal points and distances ; combining lenses ; aberration ; scale ; intensity and illumination ; depth ; focussing scales ; measuring lenses ; types of lenses. There is also an appendix of tables.

Lantern-Slide Making.†—Number 22 of the "Amateur Photographer" library consists of a handy little volume, by the Rev. F. C. Lambert, M.A., under the above title. The book, which seems very clearly and concisely written, is expressly intended to be a guide to those who are as yet quite ignorant of the subject. At the same time it is hoped that the experienced worker may here and there pick up a useful stray hint. The work is divided into twenty chapters, with an appendix.

CHEYNEY, J. S.—**Photomicrography.** *Micr. Bull.*, 1900, p. 17.

(5) Microscopical Optics and Manipulation.

STREHL, K.—**Theorie der allgemeinen Mikroskopischen Abbildung.** (Theory of the Microscopical Image.) Erlangen (Blaesing), 1900, 8vo, 38 pp.

(6) Miscellaneous.

LAUNOIS, P. E.—**Les Origines du Microscope. Leeuwenhoek, sa vie, son œuvre.** *Comptes Rendus de l'Assoc. Française*, Sess. 28, pt. 1, p. 82.

B. Technique.‡

(1) Collecting Objects, including Culture Processes.

New Incubator.§—Dr. N. Gertler has patented an ingenious form of thermostat which is specially suited for medical men (fig. 97). The case is double, and is made of wood, the interspace being filled with felt or with infusorial earth. The heater or thermophore is brick-shaped, and is placed on the floor of the apparatus. It is made of metal, is

* Hazell, Watson, and Viney, 170 pp. and 67 figs.

† Hazell, Watson, and Viney, 144 pp. and 27 figs.

‡ This subdivision contains (1) Collecting Objects, including Culture Processes ; (2) Preparing Objects ; (3) Cutting, including Imbedding and Microtomes ; (4) Staining and Injecting ; (5) Mounting, including slides, preservative fluids, &c. ; (6) Miscellaneous.

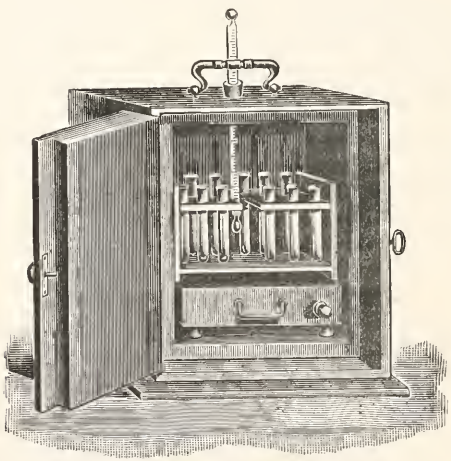
§ Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 668–72 (1 fig.).

provided with two handles, and an opening which is closed hermetically by means of a screw. This heater is filled with acetate of soda. Besides the door there is only one aperture, that for the thermometer. The apparatus is easily put into working order. The heater is put into boiling water for 30, 45 or 60 minutes, according as it is desired to keep up the temperature for 24, 36 or 48 hours. After the boiling is finished the heater is wiped and put into the incubator.

The apparatus will accommodate about twenty-four test-tubes placed in a suitable stand. If the stand be not used it is advisable to put some cardboard on the heater.

The apparatus may also be used as a heat reservoir, by boiling the heater for an hour, and afterwards further heating it over a spirit-lamp until the temperature is above 100° C. The heater is then placed in the incubator, care being taken not to shake it. When required for use

Fig. 97.



the heater is shaken, and if this do not suffice, an iron wire is inserted through the screw-hole and the contents stirred up. The heater instantly becomes warm. In this way the apparatus can be got ready some time before it is required for use. A list of the commoner pathogenic organisms which have been cultivated successfully by means of this apparatus is given.

Electrically Heated Incubator.*—F. Hanfland has devised an incubator which is heated and regulated by the electric current. In the water-jacket are inserted a number of copper tubes in which the heaters connected by wires from the battery are placed. The regulating apparatus consists of an electromagnet which actuates a mercury break by means of a lever when the temperature rises higher than that for which the regulator is set.

* Zeitschr. f. wiss. Mikr., xvii. (1900) pp. 440–2 (1 fig.).

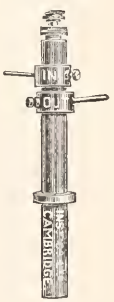
Improved Culture Media.*—Prof. Deycke and Dr. Voigtländer, as the result of studies on the preparation of culture media, recommend the following.

(1) An albuminate nutrient medium. 200 grm. of fat-free horse-flesh are finely minced and rubbed up with 250 ccm. of 3 p.c. caustic soda, and then incubated in an Erlenmeyer's flask for 24–30 hours. The filtrate is neutralised with hydrochloric acid and diluted to 3 litres. Next, 7·5 grm. salt and 150 grm. glycerin are added to the solution, which, after having been alkalinised with soda solution, is worked up with agar or gelatin. For some microbes the addition of 1·5–2 p.c. grape-sugar is necessary.

(2) A pancreatised medium. A pig's pancreas was chopped up and placed on ice for 24 hours, and then treated for several days with a mixture of 40 grm. glycerin and 160 ccm. water. The expressed juice was used in the preparation. 200 grm. of meat were treated as above, and then with 0·25 p.c. dry carbonate of soda. After sterilisation the mixture was digested, 50 grm. of pancreatic juice for 7–10 hours at 37°. The solution was neutralised with hydrochloric acid, diluted with water to 3 litres, and worked up with glycerin and agar into a substratum.

Steel Gas Regulator.†—The Cambridge Scientific Instrument Company now supply a steel gas regulator of new design for maintaining incubators, baths, and sterilisers at a constant temperature (fig. 98). Its advantages are:—(1) the ease with which it is adjusted; (2) the risk of breakage is reduced to a minimum; (3) the facility for making direct metallic communication with the gas supply, thus avoiding the use of rubber tubing and consequent risk of fire. The instructions for use are as follows. Unscrew and remove the top milled head, then remove the small screw half-way down the steel barrel. Fill the regulator with mercury until it runs out of the screw-hole. Replace the screw firmly and also the top milled head, and see that the gland nut is screwed down tightly to ensure a gas-tight fit. The adjustment for temperature is made by the top milled head. To lower the temperature at which the regulator is to work, slightly turn the milled head in the direction of the hands of a watch; to raise the temperature the head is turned in the opposite direction. The top pipe is the inlet and the lower one the outlet for the gas. A small by-pass prevents the gas flame from being extinguished when the main gas supply is cut off.

Fig. 98.



Simple Device for Distributing Equal Quantities of Culture Media.‡—A. Robin contrived the ingenious apparatus shown in fig. 99, which is self-explanatory. The end of the rubber tubing *a* is connected with a funnel into which the culture medium is poured.

Modification of Kabrhel's Method of Anaerobic Cultivation.§—The modification suggested by Dr. St. Růžička consists in filling the

* Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 617–27.

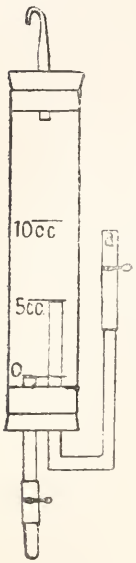
† List, 1901, pp. 13–14 (1 fig.).

‡ Proc. Soc. Amer. Bacteriol., 1900. See Centralbl. Bakt., 1te Abt., xxix. (1901) p. 492 (1 fig.).

§ Centralbl. Bakt., 1te Abt., xxix. (1901) p. 672.

pyrogallol dishes with distilled water instead of with potassium hydrate solution. Pieces of potassium hydrate are dropped in the water only just before the bell-jar is put over the rest of the apparatus. By this procedure the pyrogallol solution does not turn black or turbid. It remains clear and becomes brown only. This serves also as an indication of the complete removal of the oxygen.

FIG. 99.



Method of rapidly Filtering Nutrient Agar.*—Dr. S. Růžička describes the method initiated by A. Hoza for rapidly filtering agar. ½ kilogramme of finely chopped meat and 1 litre of distilled water are allowed to stand for 24 hours in a cool place. The fluid is then squeezed through linen, and 10 grm. pepton and 5 grm. salt are added. The mixture, placed in a glass flask plugged with cotton-wool, is steam-sterilised for ½ hour, and then boiled on the open fire for 1½ hours. The next steps are to neutralise and warm for 20 minutes over a small flame. Thereupon it is filtered again, and to the filtrate 15 grm. of finely divided agar are added, and the contents of the flask boiled for 1½ hours over an open flame. The flask is then placed for 2 hours on a Koch's steamer, after which the contents are hot-filtered, care being taken not to disturb the sediment.

Cultivation of Gonococcus on Agar.†—Dr. L. Nicolaysen mentions two cases of gonorrhœal joint affection from which the *Gonococcus* was cultivated on agar. The joints were punctured, and the exudation, sown in ascites bouillon and on ordinary agar, was incubated at 37°. The resulting growth presented the cultural characters and microscopical appearances of *Gonococcus*. From this the author argues that the received opinion that *Gonococcus* never grows on agar, or that if a coccus do grow on agar it is not *Gonococcus*, can no longer be maintained.

(2) Preparing Objects.

Preparing Bacterial Cultures for Museum Specimens.‡ — Prof. H. W. Conn puts 2 p.c. agar in large test-tubes which are tilted so as to make slants. The tubes are left undisturbed for from 6 to 8 weeks, in order to allow the surplus moisture to evaporate. They are then inoculated in long streaks, and immediately sealed up with plaster of Paris and paraffin. The cultures grow for a few days, then cease growing and remain unaltered indefinitely. No disinfectant is needed. The method is satisfactory, except for the fact that the moisture in the tube condenses with changes of temperature, rendering the tube cloudy.

Preparation of Radulæ.§ — K. Diederichs remarks that snails are best killed in boiling water. When large, the foot, liver, and stomach should be removed. The head and rest of the body are then boiled in

* Centralbl. Bakt., 1te Abt., xxix. (1901) p. 673.
† Nord. Med. Arkiv., xxxiv. (1901) Afd. ii. Häft i. No. 5.
‡ Proc. Soc. Amer. Bacteriol., 1900. See Centralbl. Bakt., 1te Abt., xxix. (1901) p. 497.
§ Zeitschr. f. angew. Mikr., vii. (1901) pp. 29–30.

caustic potash until the whole mass is softened. When the mass is washed in water the radula is easily removed. If any dirt be found adhering to it, the radula should be re-boiled in dilute caustic potash. In dealing with small snails care should be taken, as the organ is very fragile. The preparation may be mounted unstained in glycerin jelly or in isinglass. If it is to be mounted in balsam it must be stained, and picro-carmin is best suited for these objects. Ranvier's and Weigert's formulæ are recommended. For the larger kinds of snail the radula should be immersed in the solution undiluted for 2 or 3 hours. For the smaller kinds the solution should be diluted one-half with distilled water, and allowed to act for 3–6 hours. Should the preparation be over-stained, the excess of colour may be removed by means of dilute warm caustic potash. The stained preparations are then treated in the usual way with alcohol, and mounted in xylol-balsam.

(3) Cutting, including Imbedding and Microtomes.

Method of making Sections of Nervous Tissue.*—Dr. S. Tschernischeff recommends the following method † for making sections of nervous tissue. A piece of spinal cord about 1 cm. thick, fixed by any method, is dehydrated in absolute alcohol for 24 hours, and for another 24 hours in anilin. The anilin is removed by immersion in a mixture of alcohol (1) and ether (2). After 24 hours the preparation is transferred to the clove-oil-ether-celloidin solution diluted with an equal bulk of ether. The medium is inspissated to the consistence of sour cream by removing the cover of the vessel. After a few hours the preparation is placed in benzol, and finally in 80 to 86 p.c. alcohol, until it has attained the required consistence.

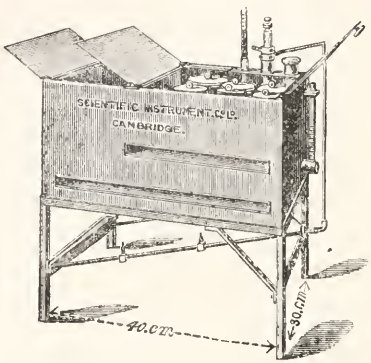
Instead of celloidin the author tried colloxylin, and found it possessed several advantages over the former. The solution is made as follows:—10 grm. of dry colloxylin are placed in a mixture of 10 ccm. of oil of cloves, and 50 to 60 ccm. of ethyl-ether. Absolute alcohol is also added drop by drop (but not more than 1 ccm.) to make the colloxylin dissolve quickly. A piece of spinal cord which has been dehydrated in alcohol and anilin is placed in the colloxylin solution freely diluted with ethyl-ether for 24 hours. The cover of the vessel is then removed to allow the solution to thicken. After a few hours the piece is transferred to 85 p.c. alcohol. Colloxylin sections are quite as good as those made by celloidin imbedding.

Imbedding Bath. ‡—The Cambridge Scientific Instrument Company make an imbedding bath of new design (fig. 100). It consists of two upper compartments with copper lids, one for specimen jars, small bottles, etc., the other for four large and three small porcelain crucibles with lids, and space for two or three watch-glasses. It has two drying shelves for slides, thermometer, gas regulator, and glass gauge to show the height of water in the bath. The bath is supported on a strongly made iron stand with two gas burners beneath, and is fitted with rubber tubing and Page's glass regulator. It can also be fitted with metal

* Zeitschr. f. wiss. Mikr., xvii. (1900) pp. 449–51.
† A modification of Stefanow's. Cf. this Journal, 1900, p. 728.
‡ List, 1901, p. 12 (1 fig.).

tubing and steel regulator, thus reducing the risk of fire to a minimum, and also with electric heater and regulator.

Fig. 100.



(4) Staining and Injecting.

New Blood Stain.*—R. C. Rosenberger finds that phloxin stains the granules of leucocytes, and recommends the following mixture. Saturated aqueous solution of methylen-blue 5 parts, saturated aqueous solution of phloxin 2 parts, alcohol (95 p.c.) 3 parts, distilled water 6 parts. The stain should be shaken before using. It works well after fixation by heat, alcohol, or ether and alcohol. Stain 1 to 4 minutes, wash, dry, mount in balsam.

Staining Blood-films.†—Dr. A. E. von Willebrand has devised the following method for the simultaneous staining of blood-films with eosin and methylen-blue. The solution is composed of equal bulks of 0·5 p.c. eosin dissolved in 70 p.c. alcohol and saturated aqueous solution of methylen-blue. To this 1 p.c. acetic acid is added drop by drop until the eosin staining appears; as a rule, 10 to 15 drops of the acetic acid are sufficient to effect the development. Before use the solution must be filtered. The films should be fixed by dry heat, by absolute alcohol, or by 1 p.c. formol-alcohol. The staining takes from 5 to 10 minutes, during which time it is advisable to heat the staining fluid until it vaporises. The erythrocytes are red; nuclei dark blue; neutrophile granules violet; acidophiles red; and plasma granules deep blue.

Staining Diphtheria Bacilli. ‡ — Dr. H. van de Rovaart finds that Loeffler's alkaline-methylen-blue solution heated for 1–1½ minutes gives better results than the acetic acid solution recommended by Neisser. He regards the after treatment with 3 p.c. hydrochloric acid alcohol as an unnecessary complication, and advises instead contrast-staining with

* Philadelphia Med. Journ., vii. (1901) p. 448. See Journ. Applied Microscopy, iv. (1901) p. 1305. † Deutsche Med. Wochenschr., xxvii. (1901) pp. 57–8.
‡ Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 574–5.

vesuvin solution heated for 1–1½ minutes. By this method the granules and the bacterial body are more deeply stained than by the Neisser method.

(6) Miscellaneous.

New Fermentation Tube.*—A. Robin devised the apparatus which is shown in the accompanying illustration (fig. 101). The side tube *c* is packed with non-absorbent cotton; the arm A of the U tube is filled with mercury; the tube B is filled with the culture, and then the rubber stopper holding the side tube *c* and the straight tube *d* is tightly inserted. When this is done, the end of *d* which serves for the escape of air displaced by the stopper is sealed in the flame. The gas generated in B escapes into A, displacing the mercury. To determine the CO_2 ratio,

Fig. 101.

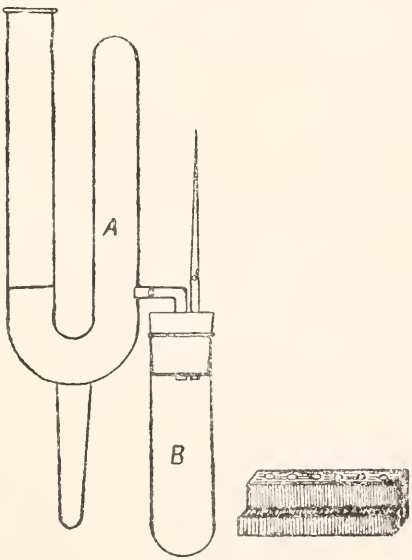
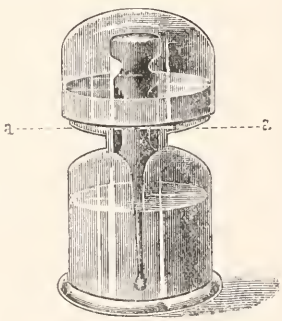


Fig. 102.



the tube B is filled up to the rubber stopper. Two fermentation tubes are used. In one the arm A is filled with mercury, and the other with a saturated solution of sodium or potassium hydrate, this being readily accomplished by inclining the U tube. The CO_2 passing through the caustic solution is absorbed, and the unabsorbed gas (H) is left; from this the ratio is easily determined.

Bottle for Cedar Oil.†—In Schuberg's bottle for keeping cedar oil the stopper has two grooves (*a a* in fig. 102), so that any excess may drain downwards. This prevents the oil from running over the neck and making the outside greasy. A glass cap fits over the neck. When travelling, the stopper should be replaced by a cork.

* Proc. Soc. Amer. Bacteriol., 1900. See Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 491–2 (1 fig.).

† Zeitschr. f. angew. Mikr. vii. (1901) pp. 45–6 (1 fig.).

Isolating Bacillus typhosus from Soil.*—Dr. S. Martin now uses ordinary peptone broth in test-tubes, adds a small portion of the soil, and then incubates for 4–6 hours at 37°. At the end of this time the medium is usually slightly turbid. It is then brushed, without recharging the brush, over the surface of six agar plates. Each plate is examined under a low power after 24 hours incubation, and those colonies which have any resemblance to typhoid are studied further. The examinations of one testing extend over a period of three weeks. Each colony is examined microscopically, and a broth culture made. This culture is tested for indol after a lapse of 3 or 4 days, and from it are also made sub-cultures on agar slopes, shake-glucose-gelatin, milk, and potato. If the sub-cultures show typical typhoid bacilli, the micro-organisms are further tested by determining the number of flagella, and by the serum reaction.

Value of Plating as a means of Determining the Number of Bacteria in Drinking Water.†—W. C. C. Pakes finds that plating upon ordinary gelatin, whether made with distilled or ordinary tap-water, gives no necessary criterion of the number of bacteria present. As far as possible the gelatin should be made without meat extractives, with the water to be examined, or with a sample of water similar in mineral constitution. As a corollary to the foregoing, the only satisfactory method of determining the contamination of water by sewage is to ascertain the number of sewage organisms present in the water.

New Hæmoglobinometer.‡—Dr. A. Dare describes a new instrument for estimating the quantity of hæmoglobin. Unmixed blood is used, and the stratum is of constant thickness. The essential parts of the instrument are an automatic pipette and a graduated colour-screen to calculate directly the percentage of hæmoglobin. The blood and the comparison screen are placed side by side and inspected through a lens fitted into a telescoping camera-tube. By means of a screw the colour scale is rotated until the two tints correspond.

Method for Increasing the Number of Tubercle Bacilli in Sputum and Urine.§—Jochneann, after mentioning some artificial media intended for the cultivation of the tubercle bacillus, points out that Heyden-agar, by preventing the growth of other microbes, acts electively towards tubercle. It seems to act best when slightly acidulated with lactic acid, an orange-red pigment being formed. So, too, with acid Heyden-broth, the growth was more copious than when the reaction was alkaline. For increasing the number of bacilli in a sample of sputum he used the following medium:—Heyden nutrient 5 grm., salt 5 grm., glycerin 30 grm., normal soda solution 5 ccm., distilled water 1000 ccm.; 20 ccm. of this bouillon were mixed with 10 ccm. of sputum, and incubated for 24 hours at 37°. Then 3 ccm. of carbolic acid were added and the sediment examined in the usual way. In the case of urine the sediment obtained by centrifuging is treated in a similar manner.

* Local Gov. Board Rep. 1899–1900 (1901) pp. 531–4.
† Centralbl. Bakt., 2te Abt., vii. (1901) pp. 386–91.
‡ Bull. Johns Hopkins Hosp., xii. (1901) pp. 24–5.
§ Hygienische Rundschau, x. (1900) pp. 969–81. See Bot. Centralbl., lxxxv. (1901) pp. 343–4.

Orienting Small Opaque Objects.*—Dr. R. W. Hoffmann, after mentioning his method of orienting very small objects,† states that opaque objects imbedded in collodion-clove-oil mixture can be oriented easily if the procedure be carried out in 90 p.c. alcohol. When objects are difficult to cut as well as opaque—such as embryos of worms, insects' eggs, eggs and embryos of certain mollusca—he advises that the specimen should first be saturated with thick celloidin and afterwards the mass treated with oil of cloves. The objects are then placed on a slip of glass and oriented under 90 p.c. alcohol.

Employment of Projection Apparatus for Demonstrating Vital Processes.‡—Prof. W. Pfeffer advocates the use of a projection apparatus for demonstrating vital processes of living organisms to large classes. The apparatus employed is constructed by several firms, to whose catalogues reference should be made for particulars as to the details.

The most interesting feature in the author's arrangement is for cooling the light. This is in the first place passed through a tank of water 200 mm. thick, kept cool by means of ice. In order to decrease the heat still further the light is also filtered through a nearly saturated solution of iron sulphate, by which most of the heat rays are removed.

Although some of the light rays are extinguished in the process, there is ample illumination even for high magnifications. The distance required varies from 3–4½ metres both for micro- and macro-projection. Suitable carriers are provided for adapting the different preparations to the apparatus, and an erecting arrangement converts the reversed position of the specimen into the natural.

The apparatus is adapted for demonstrating swarming movements, galvanotaxis, the streaming of protoplasm, plasmolysis, growth, and various movements in plants.

Bacteriological Examination for Diphtheria.§—Dr. L. Cobbett states that, as the result of a very large number of bacteriological examinations (950), when one has become well acquainted with the range of the morphological variation of the diphtheria bacillus, it is fairly easy to distinguish it from all others (that is, if the acid-producing but non-virulent bacillus which resembles the Loeffler bacillus in all other ways, be admitted as an attenuated diphtheria bacillus). The bacillus of Hoffmann is the only one which presents any difficulty, and this could, as a rule, be excluded on morphological grounds alone. In cases of difficulty the formation of acid in glucose media appears to be the final test to distinguish between the true diphtheria bacillus, whether virulent or non-virulent, and the pseudo-bacilli. The medium used was alkalised serum to which 1 p.c. of glucose was added. Both horse and ox serum were used. The earliest visible growth of diphtheria bacilli was observed in six hours, and the latest in three days. For staining, Loeffler's methylen-blue was used, diluted with two or three volumes of water, the cover-glass preparations being mounted in the staining fluid. The groups of bacilli decolorised the fluid around them,

* Zeitsch. f. wiss. Mikr., xvii. (1900) pp. 443–9.
† See this Journal, 1899, p. 238.
‡ Pringsheim's Jahrb. f. wiss. Bot., xxxv. (1900) pp. 711–45 (7 figs.).
§ Journ. of Hygiene, i. (1901) pp. 235–59 (3 pls.).

so that they appeared as if mounted on a colourless fluid. Cover-glass preparations, from broth cultures, before being stained, were dipped in 5 p.c. acetic acid for ten seconds and washed in water, to which a few drops of ammonia had been added to more rapidly remove the acid.

Resolution of Amphipleura pellucida.* — Mr. A. A. Merlin states that, by increasing the solid axial illuminating cone from $\frac{3}{4}$ to $\frac{5}{6}$ of the total aperture of a dry apochromatic, 4 mm., with a 27 eye-piece, he was able to hold for short intervals, with slightly averted vision, the transverse striæ on *Amphipleura pellucida*, first when it was mounted in realgar, then dry, and finally in balsam. The following difficult valves in Moller's balsam-mounted type slide were in the same manner also resolved, viz. the dots on the hoop of *Navicula major; Navicula crassinervis; Grammatophora oceanica = G. subtilissima;* and *Nitzschia sigmatella*. The author has not seen the most difficult structural features with a lesser cone, and says that the closing down of the cone, while greatly strengthening the contrast of the coarser, causes the finer detail to disappear altogether, and materially reduces the separating power of the objective. An acetate of copper screen was used throughout these investigations.

Origin of certain Colour Phenomena typically shown by Actinocyclus Ralfsii.†—J. Rheinberg gives a very satisfactory explanation of the colour effects seen when certain diatoms, notably *A. Ralfsii*, are viewed by transmitted light, and by an objective aperture not greater than 0·45 N.A. Experiments showed that the phenomena were not connected either with polarising or with diffraction effects. The thickness of the diatom placed the possibility of film colours out of the question. Ultimately "interference" suggested itself as the cause. Mr. Rheinberg's diagrams show how the light rays, in passing through the inequalities on the surface of the diatom, or through its apertures, or through the mounting medium, are sufficiently retarded in various parts to produce "interference" fringes. Other diatoms of suitable thickness will show similar phenomena, and for a mount of any specific medium a minimum and a maximum limit can be assigned. A great many diatom valves are of a thickness below the necessary limit, or only slightly exceed it, and assume a pale yellow-brown tint (that being the first colour in the series) e.g. *Pleurosigma angulatum*, mounted dry. The limits vary with the difference in refractive index of the diatom silex and its medium. The greater the differences, the smaller is the minimum limit for the occurrence of colour. The technical name for the whole phenomenon is "the colours of mixed plates." ‡

Progress in Metallography.§—Henri le Chatelier proposes an improved method of preparing polishing powders. The best material, as far as speed of polishing is concerned, he finds is alumina, prepared by calcining ammonium alum; but oxide of chromium, obtained from the combustion of bichromate of ammonium, answers fairly well in the treatment of iron and steel, and is better than alumina for soft metals

* Journ. Quek. Micr. Club, viii. (1901) pp. 1–6. See also *ante*, p. 397.
† Tom. cit., pp. 13–24 (11 figs.). ‡ Preston, Theory of Light, p. 205.
§ Bull. Soc. d'Encouragement, Sept. 1900; and Nature, lxiii. (1901) pp. 232–3 (3 figs.).

such as copper. The powder is mixed with soap into a paste, and can now be bought in tubes such as are used for oil colours. The powders obtained by calcination of the above materials are treated with nitric acid, washed thoroughly, and allowed to settle in distilled water containing 0·2 p.c. of ammonia. When treating 10 grm. of powder in a litre flask, $\frac{9}{10}$ths of the liquid are siphoned off at the following intervals of time: $\frac{1}{4}$-hour, 1 hour, 4 hours, 24 hours, and 8 days. The third deposit is useful in polishing hard metals, such as iron, but the fifth and last deposit affords the best polishing powder. The soap preparations are applied in the ordinary way to discs of wood or metal covered with skin or cloth and capable of being revolved at high velocity, the whole operation of polishing proper being carried through by their aid in 5 minutes.

For examining and photographing the polished and etched specimens under the Microscope, M. le Chatelier proposes the use of monochromatic light, such as that derived from an electric arc in mercury vapour, with suitable screens between the source of light and the object to be illuminated; but it appears doubtful whether enough light can be obtained in this way for high magnification.

M. le Chatelier proposes to shorten the search for typical alloys by melting together two superposed layers, each consisting of a pure metal, the lighter one being on the top. If no alloys are formed of greater density than the heavier metal, and the crucible is allowed to cool undisturbed, a culot can be obtained which, on being sawn through vertically, shows a complete gradation from one pure metal to the other, passing through the whole series of alloys, which can then be studied in one specimen.

New Reagents for the Micrographic Study of Carburised Iron.* —MM. Osmond and Cartaud have, after numerous trials, discovered a reagent of more constant strength than liquorice juice for etching iron. They recommend a dilute solution of nitrate of ammonium (2 parts in weight of the crystallised salt to 100 parts of water). A piece of parchment spread tightly over a smooth board is soaked with this solution, and the polished surface of the specimen is rubbed upon it until sufficiently etched. It is not necessary to add any sulphate of calcium. When the parchment becomes dry a little water is poured over it. The results are exactly those produced by the extract of liquorice, and the various constituents are identified as follows:—

(1) Pearlite by the unequal depth of etching of its two components, and sorbite by its coloration, varying from light yellow to dark brown.

(2) Troostite by its yellow, brown, or blue bands merging into one another.

(3) Martensite by its characteristic needles, which are the better defined the less the carbon in the metal.

(4) Ferrite by its division into grains, and the heterogeneous appearance of these grains.

(5) Austenite, and especially cementite, remain unacted upon.

There are difficulties in the application which can be overcome by perseverance and experience. Concentration of the solution, pressure, speed, and quality of the parchment, all affect the result.

* Metallographist, 1900, pp. 1–3.

Austenite may be distinguished from martensite by immersing the metal in a solution of ammonium chloride (a 10 p.c. solution for instance), while it is connected with the positive pole of a bichromate cell, the negative pole consisting of a piece of platinum foil, or of lead, or of iron foil. The specimen is examined every ten seconds until the etching is sufficiently deep. A very dilute solution of hydrochloric acid may also be used, but the use of a battery is always desirable, as it increases the regularity of the chemical action. In both cases martensite is first coloured, successively yellow, brown, and black.

Micro-structure of Steel Quenched from the Melting-Point. * — Mr. F. C. Lan has obtained two excellent photographs very clearly illustrative of steel structure; the martensite is in large masses and visible by low magnification. A third photograph shows the remarkable change in structure due to presence of tungsten.

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[J. E. Stead considers that this may be studied under the following sections:—(1) Preliminary preparations of the specimens. (2) Methods of polishing. (3) Etching the specimens. (4) Mounting the specimens. (5) Necessary Microscope accessories. (6) Photographing the developed structures. (7) Lists of apparatus. The treatment of the subject under these heads is expressly intended to help investigators; and the author's advice, on account of his eminence, is naturally of the greatest value to microscopists who are interested in metallography.]
Proc. Cleveland Institution of Engineers, Feb. 26, 1900; and *Metallographist*, 1900, pp. 220–44 (8 figs.).

* Metallographist, 1900, pp. 244–6 (3 figs.).

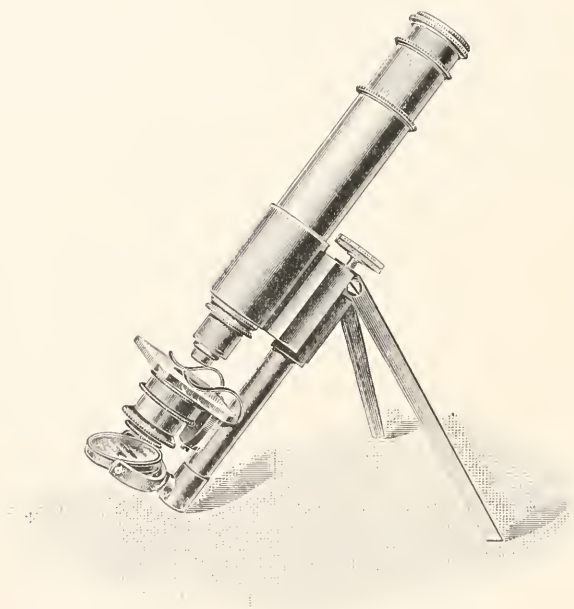
NOTE.

Note on a Travelling and Sea-side Microscope.

By Mr. A. A. C. Eliot Merlin.

As will be seen from the annexed figure (fig. 103), this form ot travelling Microscope is by no means new. It having, however, fallen into disuse and been superseded by more elaborate although less portable and less steady instruments, the object of this present

Fig. 103.



communication is to draw attention to some of its advantages, in the hope that a demand for this class of portable Microscope may again arise.

The original design was worked out by Mr. Moginie, of Mr. Charles Baker's establishment, and is first described in a paper * read before the Royal Microscopical Society on January 9th, 1867, by Mr. J. Newton Tomkins, F.R.C.S., F.Z.S., F.R.M.S. As made by

* See Microscopical Journal, 1867, vol. xv. p. 20.

Baker, the instrument had tubular legs constructed to hold pipettes, and the body was of sufficient diameter to take large-sized eye-pieces.

The modified form figured was constructed by Messrs. J. Swift and Son, and was catalogued by that firm until recently. The body and draw-tube, together with an eye-piece adapter, extend to $8\frac{1}{2}$ in. and close to $4\frac{1}{4}$ in. The spread of the folding tripod foot is $5\frac{1}{2}$ in. The stage turns on a well-made pivot for convenience in packing; plane and concave mirrors are furnished; while the whole instrument, which is remarkably well finished, and weighs only 1 lb. 2 oz., packs into a leather-covered box measuring $6\frac{1}{2}$ by $2\frac{3}{4}$ by $2\frac{1}{4}$ in. A really good micrometer screw fine adjustment is provided, working on a triangular bar; this moves the body steadily and smoothly without lateral shake even when high-power objectives are employed.

The writer has had a small achromatic condenser added of N.A. 1·0, furnished with an iris diaphragm and a fitting to carry either central stops, slots, or a green-glass light-modifier. The top lens of the condenser system is removable for low-power work. Thus fitted the instrument is admirably adapted for all purposes to which the more elaborate descriptions of travelling Microscopes are usually put, and will allow of the employment of even oil-immersion objectives.

An additional tripod foot is sometimes provided, in order that the Microscope may be used in an upright position when necessary.

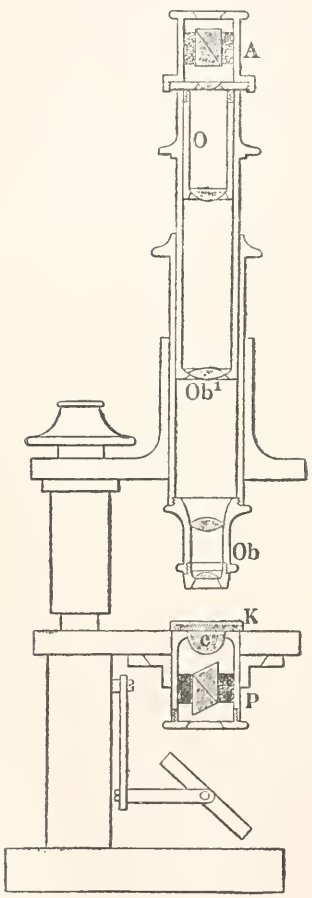
MICROSCOPY.

A. Instruments, Accessories, &c.*

(1) Stands.

Ordinary Microscope arranged for Axial Images of Doubly Refracting Bodies.†—Prof. L. Dippel, after referring to the importance of applying microscopic investigation to organic preparations, and after mentioning the assistance derivable from polarised light, describes how inquirers, not provided with special petrological or polarisation Microscopes, may yet make successful use of an ordinary working instrument.

Fig. 104.



Instead of a Bertrand's lens, he inserts into the long tube an auxiliary Microscope of about 80 mm. focus, in connection with a weak ocular (2 Zeiss) of 30–25 mm. focus, set in the ordinary short draw-out tube. The arrangement is seen in fig. 104:—P, the polariser; C, the condenser; K, the crystal plate; Ob, the objective system of the Microscope; Ob′, the objective system of the auxiliary Microscope; O, the ocular; A, the analyser.

In order to convert rectilinearly polarised into right-handed circularly polarised light, a quadrant mica slip is introduced between the polariser and analyser, in such a way that its axial plane makes an angle of 45° with the plane of rotation with the two crossed polarising prisms. The author gives ten figures of the results obtained by his apparatus; they include both uniaxial and biaxial crystals taken in different planes.

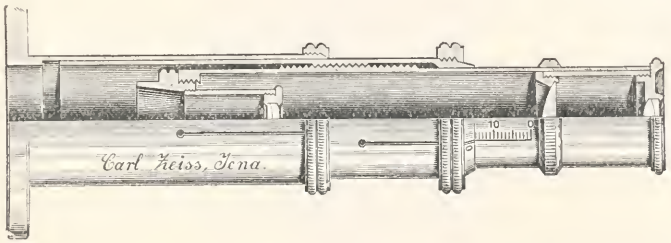
Zeiss' Focussing Microscopes.—In many cases it is found that the ordinary focussing glass fails to satisfy the requirements of copying processes. Sometimes the magnification is not sufficient, or

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

† Zeitschr. wiss. Mikr., 1900, pp. 145–55 (11 figs.). A similar arrangement was described in Journ. R.M.S., 1892, pp. 683–4.

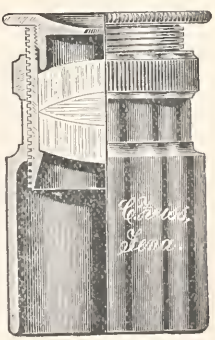
inconvenience may be experienced in using the lens owing to the necessity of having to bring the eyes close to the object under examination. The focussing Microscope (fig. 105) is intended to obviate both faults, as it has a magnifying power equal to about 28 diameters, and allows of the eye being kept at a convenient distance from the object. The instrument is fitted with a double action for rough and fine focussing. When used, it is firmly held with the left hand between the base-plate and the nearest milled clamping ring, and the clamping ring is then loosened. The tube is then held with the right hand at the fixed milled band

Fig. 105.



above the zero mark of the millimetric scale, and roughly focussed by sliding the tube in or out of the sleeve held in the left hand; the clamping ring is then tightened. The fine focus is then obtained by screwing the tube in or out of the second or upper sleeve. Before this can be done, the second clamping ring (situated on the $\frac{1}{10}$ division outside of the tube) must be loosened. The millimetre scale on the tube, in conjunction with another graduation on the upper edge of the sleeve, enables one to read at a glance quantities as small as $\frac{1}{10}$ mm., and to estimate correctly $\frac{1}{100}$ mm., so that the most minute differences of distance between two objects can be estimated almost down to $\frac{1}{100}$ mm.

Fig. 106.



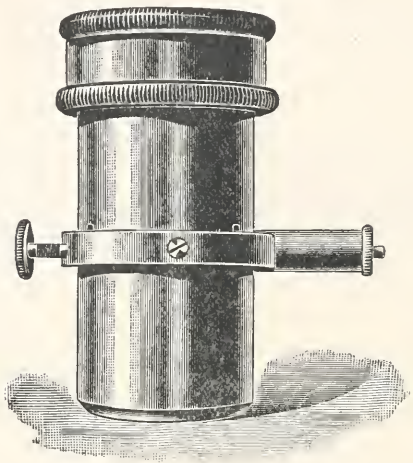
Zeiss' Focussing Glass.—This apparatus is an auxiliary, primarily intended for viewing transparent objects, either for sharply focussing the picture on the ground glass screen, or for testing negatives required for copying processes as to their precision and quality. The lens is supplied in the form of mount shown in fig. 106, and in three magnifying powers, viz. 6, 10, 16 diameters. The first and second are preferable for focussing, the second and third are for the examination of negatives. When used, the milled clamping ring is first unscrewed, and the instrument placed upon the ground glass screen or negative; the lens is then sharply focussed by screwing the cell in or out by means of its projecting upper edge. Subsequent disturbance is prevented by carefully screwing the clamping ring back again.

Kohn, R.—**Versuche über eine Elektrochemische Mikroskopie und ihre Anwendung auf Pflanzenphysiologie.** (Investigations concerning an Electrochemical Microscopy and its application to Plant Physiology.)
Prag (H. Mercy Sohn), 1901, 36 pp.

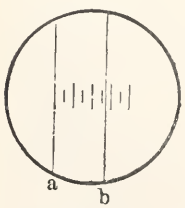
(2) Eye-pieces and Objectives.

Hartwich's New Ocular Micrometer.*—Prof. Hartwich, of Zurich, has designed his instrument to facilitate measurements in those cases

Fig. 107.



where the general tint of the preparation renders difficult the perception of the micrometer lines. The sliding part, instead of containing two movable threads, has only one movable *b*; the second thread *a* being fixed over the zero of the scale (fig. 108). The movable thread is worked by an exterior micrometer screw (fig. 107). It cannot be brought nearer to the fixed thread than the first graduation, and thus the minimum reading is unity; in the other direction it can be moved to the fullest extent (50 divisions). The object must be adjusted on the stage so that one boundary is under the fixed thread; *b* is then moved into position. The eye-piece is then raised, if necessary, in order to read the distance between the threads. In another form of the instrument both threads are movable, and each is manipulated by a separate micrometer screw.

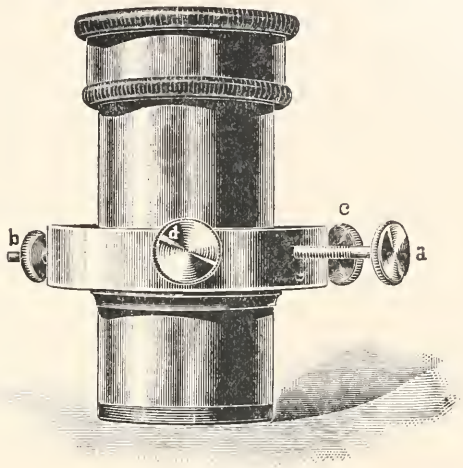


Hartwich's new Micrometer Ocular with Fixed Object-Stage.†—Messrs. Zulauff and Tschokke, the makers of Hartwich's micrometer above described, have adapted the instrument for the use of a Microscope with fixed object-stage. The arrangement for a movable thread remains unaltered. It is pushed forward by the screw *a* (fig. 109), and pushed back by the spiral spring *b*, when the screw is reversed. Instead of a

* Zeitschr. wiss. Mikr., xvii. (1900) pp. 156–8 (2 figs.).
† Tom. cit., pp. 432–5 (2 figs.).

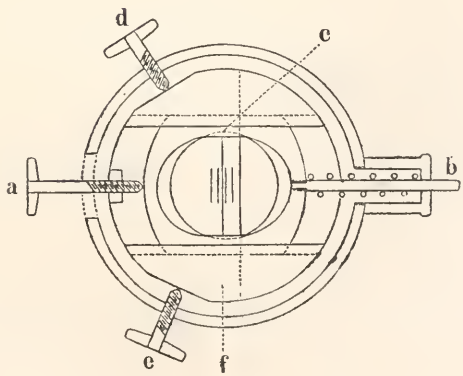
second movable thread, the whole ocular micrometer is moved by the two screws *a* and *e* (fig. 110); the arrangement being contained in the box which is clearly shown in the lower part of fig. 109. In use the object

Fig. 109.



is brought exactly into the midst of the field, and by means of the two screws *a* and *e* the first division of the scale is brought over one of the

Fig. 110.



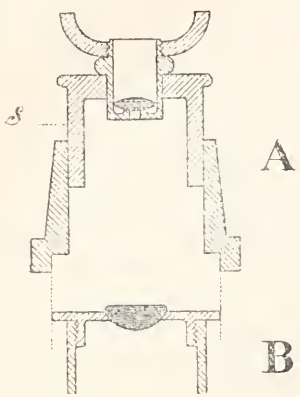
boundaries of the object to be measured; the other movable thread is then brought into position by means of *a* and *b*; and the whole is raised and the reading taken.

Strehl, K.—**Theorie des Zweilinsigen Objectivs.** (Theory of the Two-Lensed Objective.) *Zeitschr. f. Instrumentk.*, XXII. (1901) p. 10.

(3) Illuminating and other Apparatus.

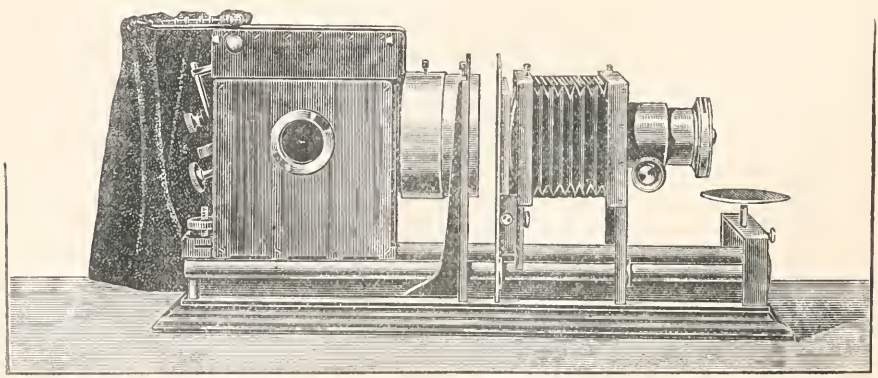
New Arrangement for Viewing Diffraction Spectra. * — Mr. J. Rheinberg finds that the best method of viewing diffraction spectra is to mount in a short tube the objective of one of the 7*s.* 6*d.* toy Microscopes, which is in effect a lens of about ¼ in. focus stopped down to an actual aperture of about 1 mm. This diffraction ocular, as it may be called, shows the spectra splendidly, magnifying them at the same time. It gives plenty of light, and the spectra cannot shift. Fig. 111 clearly shows the arrangement. A is the ocular fitting on to the top of B, the usual eye-piece. The sliding collar *s* allows of adjustment to any power eye-piece. The spectra viewed in this way are not those formed at the back of the objective, but those re-formed above the eye-piece.

Fig. 111.



Sanger, Shepherd, & Co.'s Improved Optical Lantern.—Fig. 112 shows a lantern of the highest class especially suited to the requirements of a scientist. The whole of the framework is extremely rigid. The lantern body is entirely constructed of metal truly finished to gauge; the stage for jet or arc lamp fits the body accurately, and is provided with every adjustment. The optical base consists of a series of stout truly-fitted brass tubes, all of which, with the exception of the

Fig. 112.



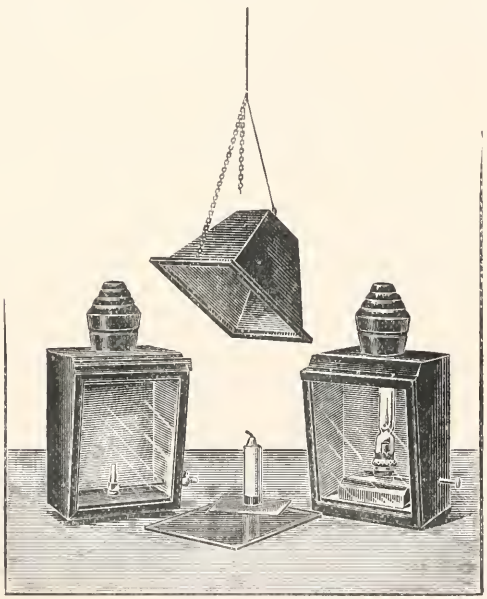
rear pair, are entirely removable. The condensers are fitted in bayonet-clutch cells; they can be instantly changed, and are carried by a plate fitted to the large stout cast-brass uprights. The slide stage is carried

* Journ. Quek. Micr. Club, 1901, pp. 63–4 (1 fig.).

by a separate pair of tubes, and can be brought close up to the condenser, or pushed forward to allow of the use of an alum or glycerin tank. A vertical adjustment is provided for the stage platform, so that carriers of varying depths can be accurately centred and levelled without the use of packing pieces. A third pair of tubes carries the optical front, fitted with movable slip-up panels for easy exchange of objectives, or Microscope, polariscope, or spectroscope fronts.

Sanger, Shepherd, & Co.'s Safe Lights for Dark Room Illumination.— These (fig. 113) are in reality lanterns of japanned tin plate frame, and are adapted for candle, paraffin, or gas. The burner

Fig. 113.



can be adjusted from the outside. The glass forms a light-filter; it is made by combining fired stained glasses, and is therefore somewhat thicker than the usual coloured glass. The filters are made in four tints suitable for plates of different kinds of sensitiveness.

Müller's Rotary Slide Carrier. * — Dr. Müller, of Tübingen, seeks to overcome the difficulties attendant on the usual to-and-fro push carrier for lantern slides. His apparatus consists of a vertical frame of about 38 cm. diameter rotary about a horizontal axis A, and the whole is set on a bearer T which is clamped on to the optical bench. In the frame are four circular perforations (dotted in figs. 114 and 115) of 13·5 cm. diameter, so arranged that their centres pass successively through the optical axis as the frame is rotated, a catch H fitting into

* Zeitschr. wiss. Mikr., xvii. (1900) pp. 162–6 (2 figs.).

Fig. 114.

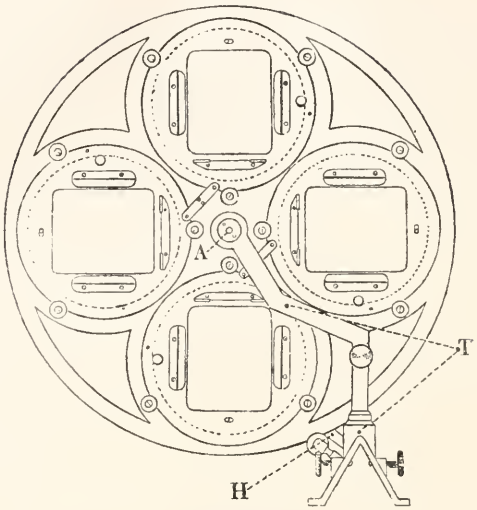
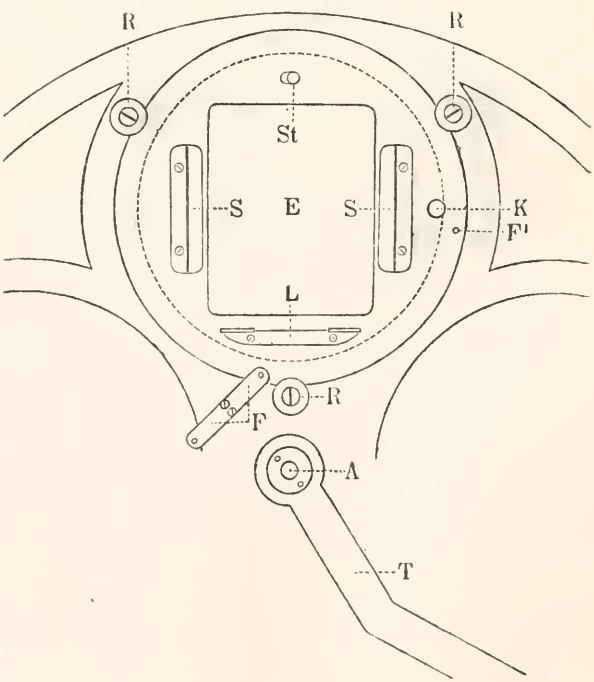
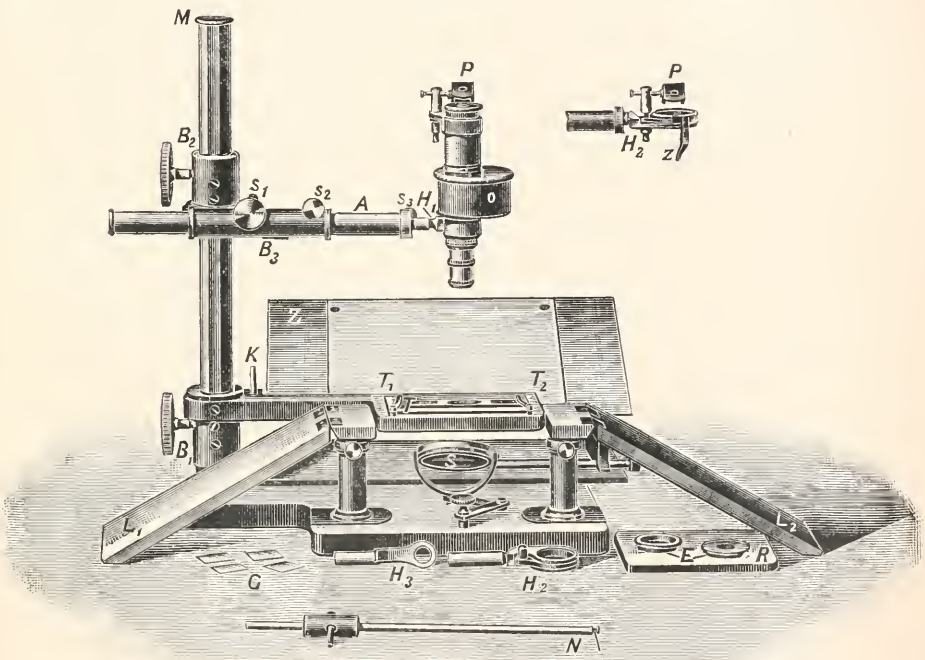


Fig. 115.



a slot and stopping the rotation at the right moment. On this frame are four smaller round plates, the exchange plates, of 15 cm. diameter, which rotate easily between the three rollers R (fig. 115); they are rectangularly perforated at E, and bear the clips S for a slide. The knob K serves for the proper adjustment of the exchange plate with its slide. The security of the slide is provided for by the grooved clips S on the long sides, and by a projecting fillet on the inner short side of the orifice; the other short side has a spring pin over which the slide is pushed, which then immediately rises and holds the slide. The dimensions of the orifice are 7·5 by 9 cm.

Fig. 116.



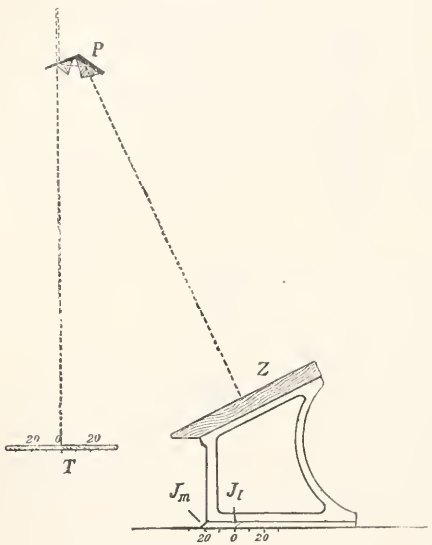
The great advantage of the arrangement is that the operator has thorough control over the insertion of the slides without leaning over the instrument.

Berger's Drawing Apparatus for Small Magnifications.*—This apparatus is shown in fig. 116. On a cast-iron base-plate stands a strong metal pillar M, on which slide two collars B_1 and B_2. To B_1 a frame-shaped object-table is attached; it can be swung aside by the pin K, and replaced by an object placed on the base-plate. In the frame of the

* Zeitschr. f. Instrumentenk., 1901, pp. 171–5 (3 figs.).

object-table a glass plate can be set, or a small drawing-board when the apparatus is to be used for drawing to a reduced scale. With transparent objects illumination is effected by a mirror S, or by a piece of white paper. The collar B_2 bears on its under side a hollow cylinder, in which works a rod carrying at its distal end the Microscope with reversing eye-piece. The Microscope fits loosely into ring-shaped holders H_1, H_2, H_3, and may be replaced by spectacle glasses of various strengths or by ordinary loups. The drawing-prism (camera lucida) is fastened on to the ocular tube of the Microscope in the usual way, the right position being indicated by a pin, over which the slit of the clamping-ring slides. The Microscope is so set in the holder H that the rotation-pin of the drawing-prism is parallel to the front edge of the drawing-board. This drawing-board Z is placed on a perforated desk-shaped frame, which slopes at an angle of 25° to the horizon, and which, sliding in a groove of the ground-plate, can be pushed backwards and forwards perpendicularly to the front edge of the object-table, and can be clamped in any desired position. In order to attain a drawing of uniform magnification, it is necessary that the distance between the pupil of the drawing-prism (a small circular opening of the prism-holder) and the drawing-plan should be constant. There are two scales T_1 T_2 on opposite sides of the object-table, and two similar scales (fig. 117) on the drawing-frame, and two on the base-plate. When the adjustments are made, a line joining the two zeros on the object-table will be parallel to the zero line on the drawing-frame. When, therefore, the arm A of the Microscope is moved in and out of its sheath B_3, the whole of the object can be searched and delineated on the drawing-board.

Fig. 117.



Acetylene Gas for Bacteriological Laboratories. * — C. H. Higgins advocates the use of acetylene gas for isolated bacteriological laboratories. For general purposes it is preferable to ordinary coal gas, and makes a most excellent artificial light for microscopical work, its spectrum being very nearly identical with that of the sun, lacking only the ultra-violet rays. The form of generator advised is one in which, by a mechanical arrangement, the carbide is dropped into a large body of

* Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 794–7.

water; from this generator it is passed into a gas-holder. When the gas is used up the gas-holder falls, and this action causes another charge of carbide to drop into the water. The generator should have two gas mains, one of 2-in. pressure for lighting and incubator purposes, and another of 4-in. pressure for Bunsen burners and gas stoves.

ENGELMANN, TH. W.—**Ueber ein Mikrospektralobjectiv mit Normalspectrum.** *Arch. f. Anat. u. Physiol.*, 1900, *Physiol. Abth. Supp.*, p. 338.

WEINSCHENK, DR. ERNST—**Anleitung zum Gebrauch des Polarisationsmikroskops.** (Guide to the use of the Polarising Microscope.)
[The author seems to have written a very thorough and valuable treatise.]
Herder (Freiburg im Breisgau), 123 pp. and 100 figs.

(4) Photomicrography.

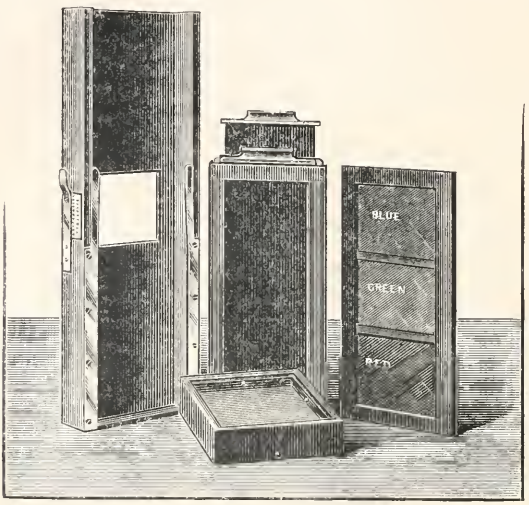
Instantaneous Photography of Growing Crystals. * — Th. W. Richards and E. H. Archibald, who have studied the growth of crystals by means of instantaneous photography, used Bausch and Lomb's outfit. Between the Microscope and camera was placed, in a light-tight box, a revolving shutter which allowed an exposure of a tenth of a second. A Henrici hot-air motor, combined with speed-reducing double pulleys, enabled the experimenter to use any rate of revolution desired. Two different arrangements were adopted, the first of which caused the successive impression of a bright image in a dark field, and the second registered dark images in a succession of bright fields. In carrying out the first of these two methods it was found more convenient to move the crystallising solution than to move the photographic plate. By the foregoing methods it was found possible to take very frequent photomicrographs of crystals during their birth and growth. An enlargement of over four thousand diameters was obtained, and both common and polarised light were used. Only substances with high melting points were examined, and the crystallisation was always from aqueous solution. No properly focussed image in any of the plates seemed to be devoid of crystalline structure. The growth in diameter during the first second of the crystal's life was found to be vastly greater than during the subsequent period. The authors' observations do not lend support to the notion that crystals develop from a transitory liquid phase.

Sanger, Shepherd, & Co.'s Process of Natural Colour Photography.— Fig. 118 represents the apparatus used by Messrs. Sanger, Shepherd, & Co. for colour-record negatives of any object. The apparatus known as a repeating-back is attached to any front-focussing quarter, half, or whole-plate camera by means of a panel cut to correspond, and interchangeable with the ordinary dark slide. This does not interfere with the use of the camera for ordinary work, while it allows of the attachment being adjusted for use in a few seconds. An outer case (on left of figure) carries the frame with the three colour filters and the double dark slide holding two spectrum plates. The colour-filter frame is furnished with lugs which engage with the dark slide so that both move together. The first exposure through the red filter is made with the filter-frame and dark slide at the right-hand end

* Proc. Amer. Acad. Arts and Sci., xxxvi. (1901) pp. 341–53 (3 pls.).

of the repeating-back. For the exposure through the green filter the frame and slide are pushed to the left hand until the pin of a spring latch drops into a depression in the colour-filter frame. For the blue filter exposure the colour-filter frame and dark slide are pushed completely over to the left.

Fig. 118.



Buxton's Photomicrographic Apparatus.* — The great feature in this arrangement (fig. 119) is that the table which carries the optical bench is made to revolve. This allows the operator to sit comfortably on a stool and make the rough focussing. This table is then swung into place, and the camera, on a second (fixed) table, is then adjusted. The separation and combination of tables renders necessary some special means of coupling the focussing rods of the fine adjustment, and the following method is adopted:—On the table of the optical bench, directly beneath the fine adjustment head of the Microscope, is situated a milled wheel on suitable standard, and a belt from this wheel extends to the fine adjustment head of the Microscope. Through the axis of the wheel is located a rod carrying at the end towards the camera a clutch which can be quickly connected with the focussing-rod of the camera by sliding adjustment operated by a milled head. The optical bench must, of course, be brought to its proper position with relation to the camera in order to make this connection, and for this purpose a lever, shown in the illustration, is provided.

Sanger, Shepherd, & Co.'s Filters for Photomicrography. — Fig. 120 shows this apparatus. The filters are made to order for any double stain in bacteriological work, so as to photograph the stains either in black or white. The green filters are especially recommended

* Journ. App. Micr., 1901, pp. 1366-72 (7 figs.).

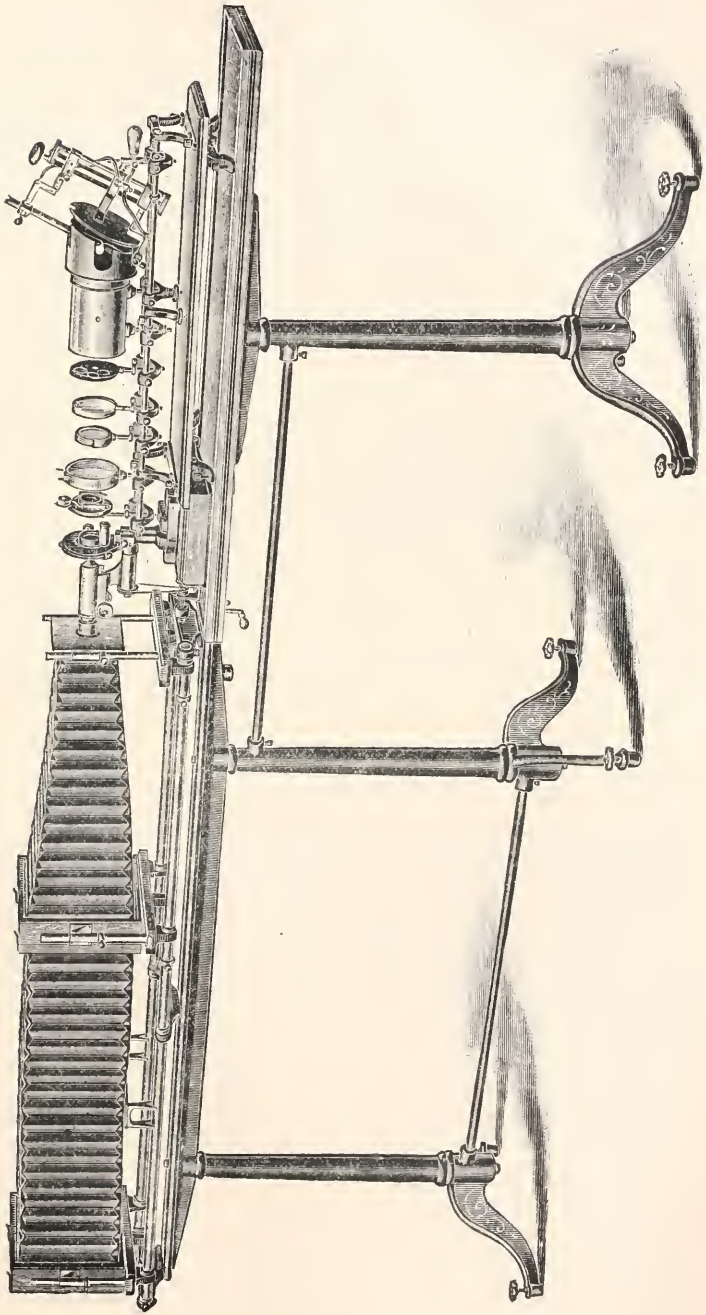
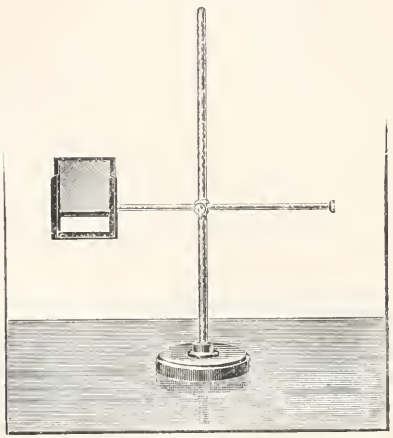


FIG. 119.

for improving the definition of imperfectly corrected objectives. Red, orange, yellow, and blue filters are also made.

Fig. 120.



(6) Miscellaneous.

Cheyney, J. S.—On the Proper Thickness of Cover-Glass.
Micr. Bull., 1901, Feb. p. 1.

Zeiss, C.—Ein neuer beweglicher Objecttisch. (A new Movable Object-stage.)
Zeitschr. f. Instrumentenk., XX. (1900) p. 325

B. Technique.*

(2) Preparing Objects.

Fixation of Embryonic and Young Cartilage.† — As well as the ordinary fixatives, E. Retterer uses the following solutions for observing transitional stages of cartilage. Mixture A : 3 p.c. chromic acid solution 66 vols. ; formol 33 vols. ; acetic acid 8 vols. Mixture B : 5 p.c. platinum chloride solution 50 vols. ; formol 50 vols. ; acetic acid 3 vols. Fresh rib cartilages of young animals, guinea-pigs, rabbits, or cats, were immersed in one or other of these solutions for 6 to 12 hours. They were then washed in water, dehydrated in alcohol, and treated for sectioning in the usual manner.

Fixing Flagellata.‡ — H. Plenge fixes Flagellata in the following ways. A drop of the culture fluid containing Flagellata is pipetted on to a slide and spread out into a thin layer. The organisms are then killed with osmic acid vapour or by the addition of a drop of 1 p.c. osmic acid solution to the water. A cover-glass provided with four wax

* This subdivision contains (1) Collecting Objects, including Culture Processes ; (2) Preparing Objects ; (3) Cutting, including Imbedding and Microtomes ; (4) Staining and Injecting ; (5) Mounting, including slides, preservative fluids, &c. ; (6) Miscellaneous.

† Journ. Anat. et Phys., xxxvi. (1900). See Zeitschr. wiss. Mikr., xviii. (1901) pp. 71–3. ‡ Zeitschr. angew. Mikr., vii. (1901) pp. 19–20.

feet is put on. Water is first run through, and afterwards the different staining fluids. This procedure is tedious, and involves great loss of material. A better method is to lay a drop of the culture fluid on a slide or on a cover-glass, and kill the animals with osmic acid vapour or by means of a drop of some other fixative such as cold saturated sublimate solution, Hermann's fluid, or picrosulphuric acid. The fluid is allowed to evaporate in the air until only a trace of moisture remains. The slide or cover-glass is then placed in absolute alcohol for 24 hours, to which, if sublimate have been used, some tincture of iodine must be added. The preparations are then treated like stuck-on sections, and there is no considerable loss of material. If the culture fluid contains a large quantity of bacteria, these organisms may be washed off with alcohol when the layer has not completely dried.

Fixing Blood Preparations with Chloroform.*—O. Josuë has found chloroform to be an excellent fixative for blood-films. The film is prepared in the usual way, dried in the air, and then immersed in chloroform for about two minutes. It is then allowed to dry, and afterwards stained and mounted.

Method for Examining Ocelli of Insects.†—W. Redikozew adopted the following procedure. Immediately after decapitation the heads were fixed in picrosulphuric acid, picro-acetic acid, sublimate, or in sublimate with 2 p.c. acetic acid. After washing out the fixative, the objects were preserved in 70 p.c. alcohol. The preparations were stained with a combination of borax-carmine and Lyons-blue, by immersing the object for 24 hours in borax-carmine and incubating at 45°, and then extracting for one or two hours with 1 p.c. hydrochloric acid. The mass was then imbedded and sectioned. The sections were after-stained for one or two minutes in $\frac{1}{4}$ p.c. Lyons-blue solution in 70 p.c. alcohol.

For isolating the ocelli the following maceration fluids were used. NaCl solution with 0·2 p.c. acetic acid, incubated at 45°; 0·005 p.c. chromic acid; 10 p.c. alcohol; also eau de Javelle much diluted. Pigment was removed by means of 25 p.c. nitric acid or by a mixture of chromic and acetic acid. For softening the cuticula for sections, eau de Javelle, though satisfactory, requires to be used with great care, and the mouth and the opening in neck must be stopped with paraffin.

Method of Finding Tubercle Bacilli in Sputum.‡ — De Lannoïse and A. Girard place the sputum in about 10 times its bulk of eau de Javelle diluted to one-third, and shake the mixture energetically from time to time. It is then allowed to sediment for 24 hours, or better is centrifuged. To the sediment, which amounts to about 2–3 ccm., are added 5 or 6 drops of normal NaHO or KHO. In this way NaCl is formed. The tube is then filled up with sterilised water and centrifuged again. The sediment is spread on slips or slides and treated in the usual way.

Behaviour of Spores and Fat-Drops in Bacteria to Eau de Javelle and Chloral hydrate Solution. § — Prof. A. Meyer has already pointed

* C.R. Soc. Biol., liii. (1901) p. 642.
† Zeitschr. wiss. Zool., lxviii. (1900) pp. 581–624 (2 pls.).
‡ Archiv. Gén. de Méd., 1900, Supplement to Oct. No.
§ Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 809–10. Cf. this Journal, 1900, p. 370.

out that fat is an important reserve-substance of bacteria, being deposited in the form of drops in the cytoplasm of these plants. He had also found that these fat-drops are an important criterion for many species, but that at certain stages the appearances of spores and fat-drops so closely resembled each other that they could not be distinguished by the ordinary known reactions. He now finds that a solution of 5 grm. chloral hydrate in 2 grm. water is an excellent medium for distinguishing between fat-drops and spores. If, for example, a sporange of *Bacillus tumescens* which contains both a spore and fat-drops, be placed in this reagent, the fat is at once dissolved, while the spore stands out quite distinctly. This procedure renders unnecessary any special method for staining spores; for if the material be treated by the choral solution, it brings out the spore too distinctly to be mistaken for anything else.

Eau de Javelle also has a characteristic reaction to ripe spores and fat-drops. If some bacterial material containing both spores and fat-drops be stirred up with a drop of Javelle's solution, it will be found that the protoplast of the sporanges and of the bacterial oidia is dissolved, while the membrane is at first unaffected. Like the membrane of the spore, bacterial fat is also resistant to the action of eau de Javelle, and by means of this reagent can be macrochemically isolated. Bacterial fat then is easily soluble in chloral hydrate, and is only slowly attacked by eau de Javelle.

(3) Cutting, including Imbedding and Microtomes.

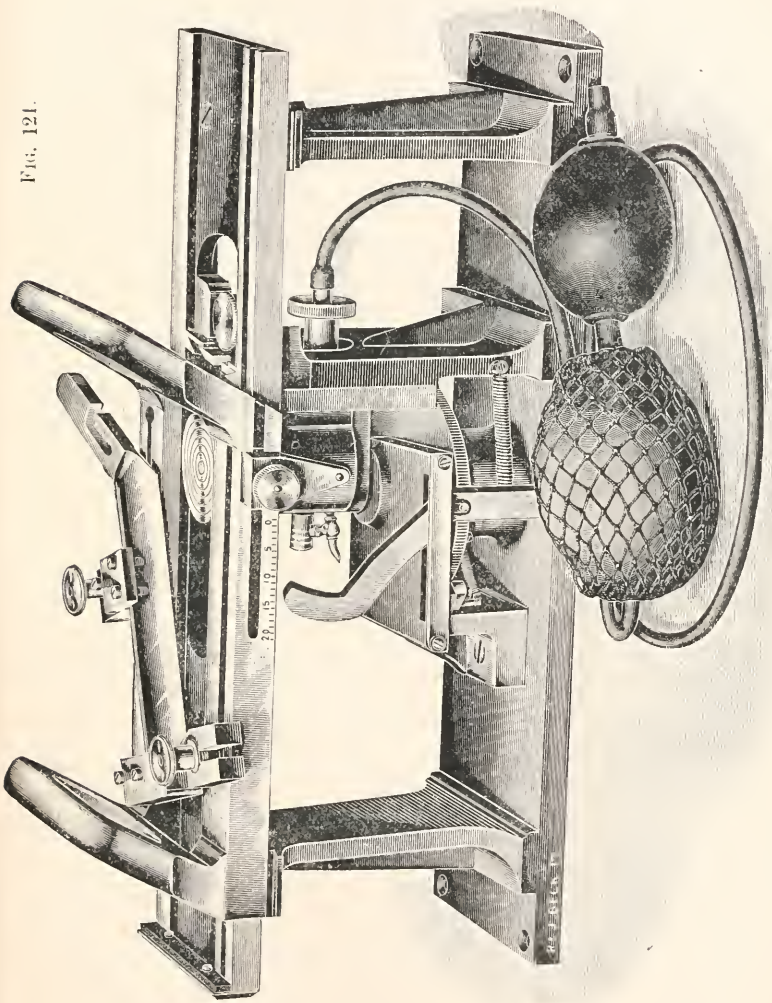
Delépine Improved Microtome.*—Messrs. R. and J. Beck have made some additions and improvement to the Delépine microtome previously described (fig. 121). The knife-carrier and rails are longer, the stand is of larger size, and has an extra supporting upright. The knife-carrier is 9 in. long, and is provided with two handles, forming a tie at each end. The whole is made from one solid gun-metal casting. The carrier has a travel of 7½ in. without leaving the rails. Along the upper faces of the carrier are two grooves in which run the clamps holding the razor. These may be placed so that the razor is either at right angles or at any obliquity to the angle of cut, the razor being held rigidly at each end. The clamps are so arranged that they are higher than the knife-edge, and thus the entire length of a 6-in. blade may be used for an oblique cut. The blade itself may be tilted by the set-screws of the clamp. The illustration shows the instrument arranged for the oblique knife.

Fiori's Automatic Microtome.†—Prof. A. Fiori has devised an automatic microtome (fig. 122) in which, by a double and simultaneous movement of the knife-bearer and object-carrier, the knife and preparation are made to meet in a very neat way. The movement is a gliding one, and is therefore similar to that of the sliding microtomes, though obtained in a different way and by means of a lighter instrument. The principal features in this instrument are that the knife-carrier has fixed to its lower end a grooved plate with a handle at one end. In the

* R. and J. Beck's List, 1901. Cf. this Journal, 1900, p. 128.
† Malpighia, xiv. (1900) pp. 411–24 (6 figs.).

groove works a knob projecting from the under surface of the vertical axis of the object-carrier. When the knife-carrier moves, the object-holder is borne along the groove towards the edge of the knife. According to the relative positions of the knife and the groove, so is the

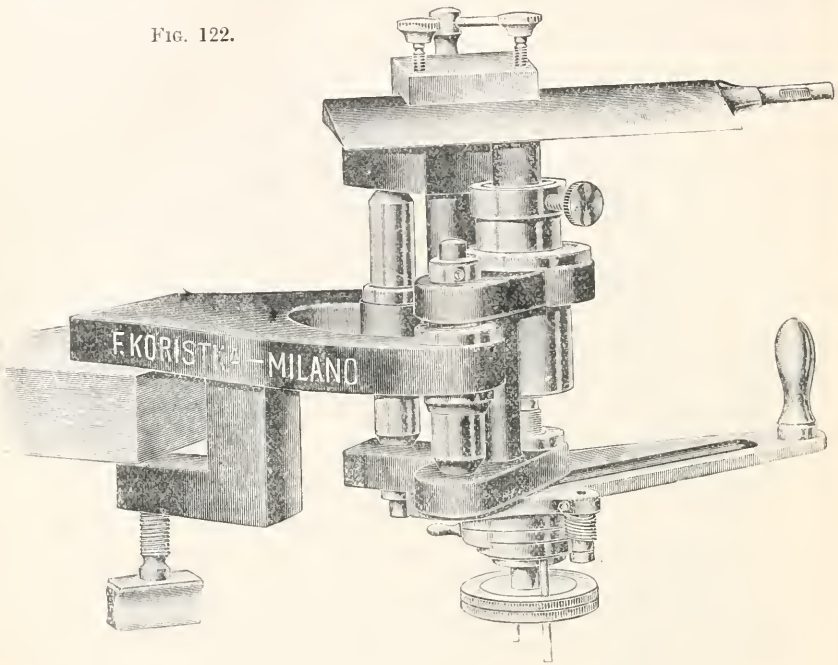
Fig. 121.



length of the movement of the object-carrier—indeed this movement may be reduced to zero. To the micrometer screw is attached a toothed wheel which is actuated by a hook fixed to the grooved plate. This arrangement effects the automatic raising of the preparation, and may be made to vary from 0·005 mm. to 0·1 mm. The gape of the jaws of

the object-carrier is 14 mm.; the greatest length of the run of the preparation along the knife-edge is 11 cm. Any razor can be used in this microtome.

Fig. 122.



New Freezing Microtome for use with Carbon Dioxide Tanks.*—Prof. C. R. Bardeen has devised a microtome for use with carbon dioxide tanks. The illustrations show the machine ready for use, and the apparatus in section (figs. 123, 124). The apparatus is supported by the nozzle of the carbon dioxide tank, and the valve of the tank controls the escape of gas into the tube K D. From this tube the gas escapes into the chamber beneath the microtome plate, and makes its way out through a spiral passage. By this device the maximum freezing power is secured.

The mechanism for regulating the thickness of the sections consists of a movable wheel I, which moves up and down on a screw-thread, cut 25 threads to the inch, one revolution of the wheel, therefore, raising or lowing it a millimetre. The margin of the wheel is divided up into spaces representing 20 microns. The knife slides on glass guides.

The advantages claimed for this apparatus are that but little carbon dioxide is wasted; the temperature of the freezing stage can be controlled, the machine and tank may be readily carried about. It is simple in design, strong, and unlikely to get out of order.

* Bausch and Lomb's Cat. B, 16th edition; also Journ. App. Microscopy, iv. (1901) pp. 1320–3 (2 figs.).

FIG. 123.

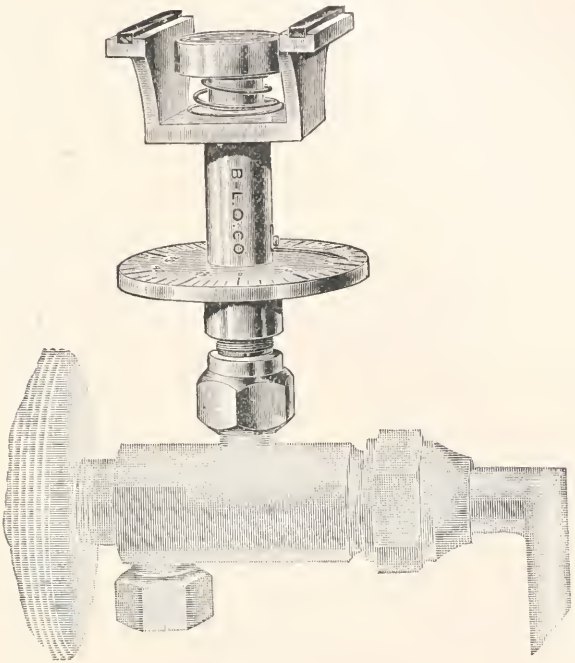
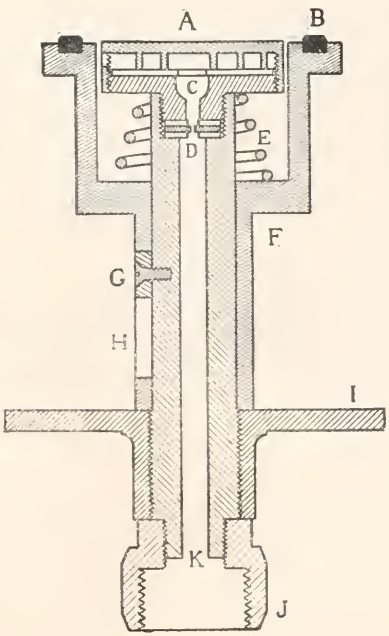


FIG. 124.



Minot Automatic Precision Microtome.*—This microtome is adapted for paraffin and celloidin preparations. Its present form (fig. 125) embodies several important improvements. The feeding arrangement and

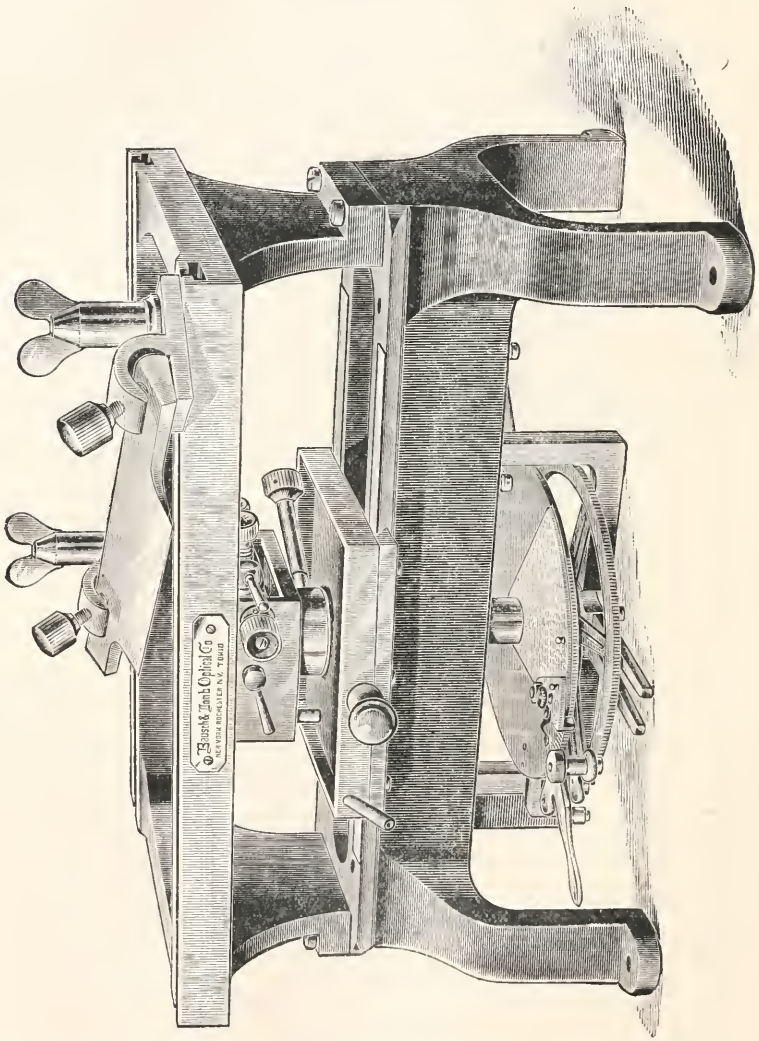


Fig. 125.

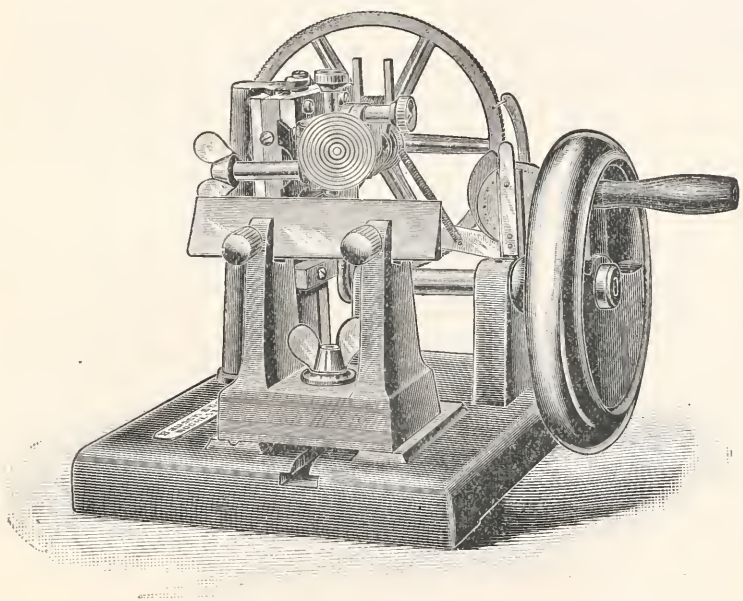
object-carriage are on a massive and solid base, above this being the knife-frame. The knife-clamps are adjustable in four grooves in the sides of the frame, so that the knife, which is 315 mm. long, may be set at any

* Bausch and Lomb's Cat. B, 16th ed., pp. 10, 11; and also Journ. App. Microscopy, iv. (1901) pp. 1318-20. Cf. this Journal, 1899, p. 104.

angle and in any position. The object-holder is the Naples universal clamp. The vertical motion of the feed-screw is transmitted to the object-carrier through a triangular prism. The object once adjusted, cutting is effected by backward and forward motion of the carriage. The feed ranges from 1 to 60 microns. The knife is bilaterally symmetrical in section, the edge is straight, and the handles by which the knife is clamped to the frame are continuations of the blade itself and have the same angles.

Minot Automatic Rotary Microtome.*—In this instrument (fig. 126) several improvements have been made, and increased accuracy has been

Fig. 126.



obtained by means of better tools for planing the sliding surfaces, cutting the micrometer screw, and cutting the teeth of the feed-wheel. Other improvements have rendered the microtome more convenient to use, the most important being alterations in connection with the automatic feed, the addition of a brake, the provision of a split nut for the micrometer screw, which closes automatically, and more careful balancing of the main wheel.

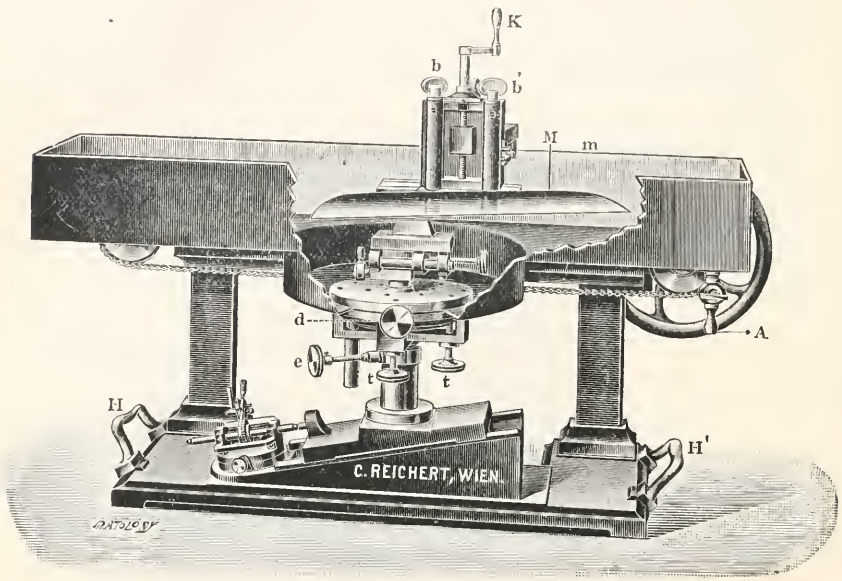
Microtome for Cutting under Water.†—Dr. J. Starlinger describes C. Reichert's microtome for cutting under water. The body is made out of cast iron, and the smaller parts are nickel-plated. The most im-

* Bausch and Lomb's Cat. B, 16th ed., pp. 8 and 9; also Journ. App. Microscopy, iv. (1901) pp. 1317–8.

† Zeitschr. wiss. Mikr., xvii. (1900) pp. 435–40 (3 figs.).

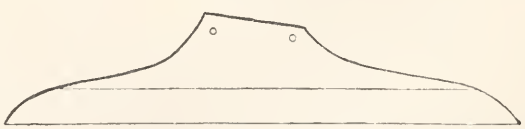
portant features are the knife-carrier, the object-carrier, and the micrometer. The knife-carrier works along a slide, and has a sweep of 40 cm. long. In raising the knife the coarse adjustment is made by a screw, the fine adjustment by moving the object-carrier upwards on the inclined

Fig. 127.



plane (fig. 127), by means of the micrometer screw. Perhaps the most interesting feature is the novel shape of the knife (fig. 128). It is 28 cm. long, and cuts perfect sections 9 to 11 cm. in size. The instrument may be used as an ordinary microtome by merely removing the

Fig. 128.



clamp and reservoir. The microtome is easily manipulated, its construction is strong, and it produces faultless sections of large size.

Reichert's new Microtome with Inclined Plane and Endless-working Micrometer Screw.*—The great advantages of the construction of this microtome (fig. 129) are not merely that the object-holder works on an inclined plane, and in a strong frame between two swallow-tailed metal guides, but that the micrometer screw, when it has worked out,

* Zeitschr. wiss. Mikr., xvii. (1900) pp. 159–62 (1 fig.).

can, by means of a simple and ingenious arrangement, be rotated through 180°, so that a kind of perpetual motion results.

The microtome is made of cast iron of suitable strength and stability, and the knife-slide has a working distance of 28 cm. The knife-slide,

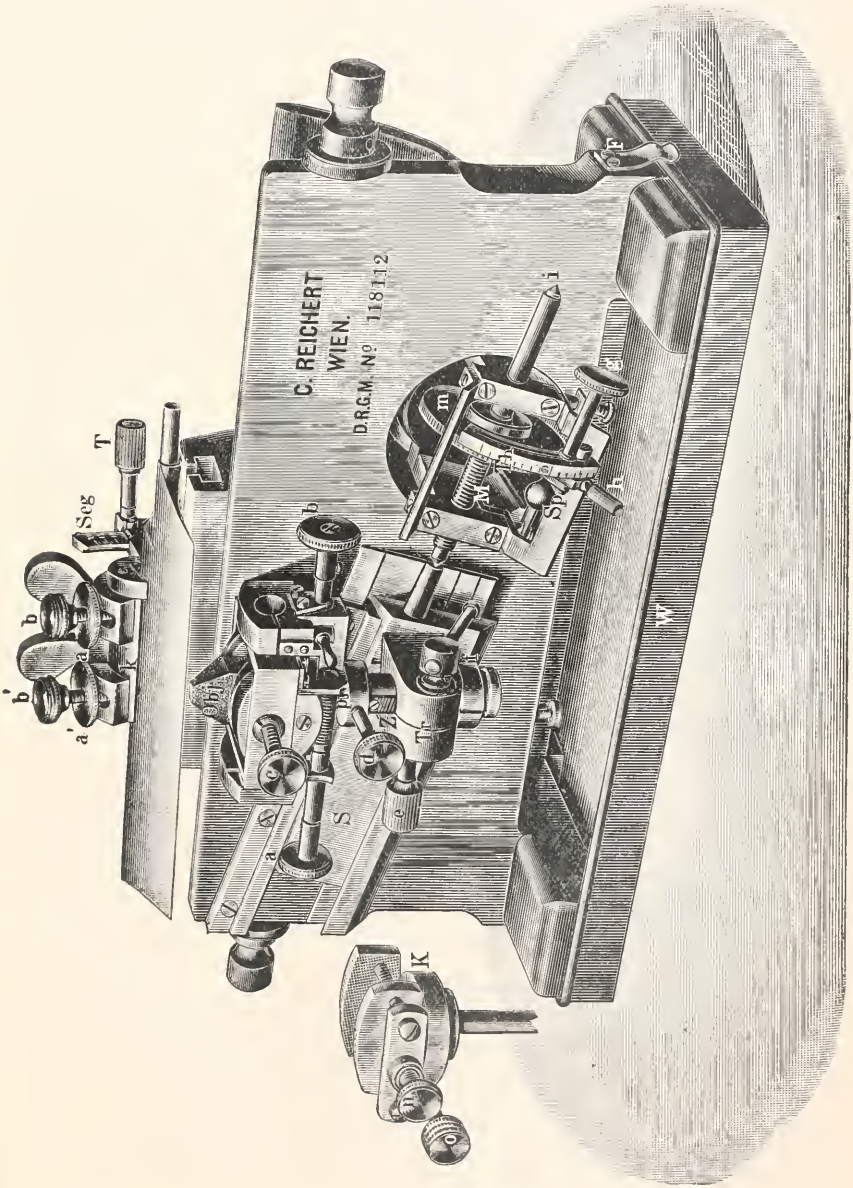


FIG. 129.

on three accurately worked projecting guides, is also heavy, and is thoroughly secured by means of a clamp; a slip of the knife in the cutting of hard objects is impossible.

The object-slide, 7·5 cm. long, is solidly built, and moves on an inclined plane only 12·5 cm. long, which makes an angle of 15° with the horizon. It moves with perfect safety and rigidity between two metal guides, and on account of the inclination of its path, the horizontal projection of its movement is proportionately slow.

The object-holder is easily adjustable in the three directions of space, in the vertical by rack-and-pinion, and can, by the simple action of a screw *d*, be set higher or lower, or even removed altogether.

The micrometer screw is fixed, that is, it is never necessary to remove it from the mother screw. The fine adjustment is by a micrometer screw of the construction usual with microtomes; a circular sheath with accurately divided toothed periphery enveloping the screw. A circular segment *h*, graduated in degrees, can be pushed into position, and adjusted so that the number of teeth (1 tooth = 1 μ) can be set. By moving the handle *h*, the upper end of the circular segment strikes against a metal cross-piece, which serves as a stop, and thus rotates the toothed wheel, and moves on the micrometer-screw so that uniformly thick sections are automatically obtained. When the micrometer-screw is quite run out, it can, in a circular notch of the vertical guide of the microtome, be rotated through 180°, and then commence again, the other end of the micrometer-screw being now in contact with the object-slide. Thus the result is an uninterrupted working of this screw. In order to acquire contact with the micrometer-screw in this new position, the object-slide must be pushed back about 25 mm. The corresponding slight difference (about 7 mm.) of height between knife-edge and cutting plane of the preparation can now be easily set right by means of the pinion *Tr*.

The arrangement is especially useful in serial-section making.

(4) Staining and Injecting.

New Reaction for Woody Tissue. * — C. Mäule has found that woody tissue, treated with permanganate of potash, followed by hydrochloric acid and ammonia, turns red. 1 grm. of permanganate is dissolved in 100 ccm. water, and the sections are immersed for 5 minutes. They are then decolorised in HCl for 2 or 3 minutes. After the addition of ammonia, or holding them over a bottle containing ammonia, they turn red. The reaction may be hastened by heating the permanganate on the slide, and instead of ammonia caustic potash or soda may be used. The time the permanganate takes to act varies with different plants, the Coniferæ being especially resistant.

Researches with Neutral Red. † — Prof. S. Mayer reports on some researches made with neutral red, a pigment which in many cases will impart an *intra vitam* staining to cell-granules. According to Mayer, the pigment is not poisonous, and is possessed of great staining power. Frog and salamander larvæ were immersed in dilute solutions, and soon

* Fünfstück's Beitr. z. wiss. Bot., iv. (1900) pp. 176–85. See Zeitschr. wiss. Mikr., xviii. (1901) pp. 108–10.

† SB. Prager Vereins "Lotos." See Zeitschr. wiss. Mikr., vii. (1901) pp. 20–1.

acquired a red colour, which they retained for a long time after removal to pure water. Salamanders were injected in the peritoneal sac, and frogs and toads in the dorsal lymph-sac. Mammals received an injection of 0·1 grm. to 100 ccm. of a 0·5 p.c. salt solution either in the jugular vein or subcutaneously. It was found that not only cell-granules, but also many other parts, were stained; among these may be mentioned the nuclei of the nervous system, the cells of hyaline cartilage, fat-cells, and sarcolemma. The most striking reaction was the staining of degenerated nerve-fibres. After death the red colour changes to yellow in many organs.

Modification of the Iron Hæmatoxylin Staining Method. * — A. Ch. Haemers immerses the whole object in a 5 p.c. solution of iron alum for 2–8 days. After having been quickly washed in distilled water, the piece is transferred to 1 p.c. hæmatoxylin solution for 4–8 days. During this period the fluid should be renewed two or three times. After removal the preparation is washed in water and dehydrated in alcohol of increasing strength. When the spirit is no longer cloudy, it may be imbedded in paraffin or celloidin. The sections may be contrast stained with Lichtgrün or with fuchsin. This method is successful after fixing with chrom-osmic-acetic acid, with platinum-osmic-acetic acid, or with Müller's fluid.

Intra vitam Staining of Micro-organisms. †—A. Cortes, who has recorded numerous observations showing the utility of *intra vitam* staining, has now published drawings of numerous examples of micro-organisms stained while alive with methylen-blue and other pigments.

Staining Tubercle Bacilli and Spores by the Aid of Potassium percarbonate and Hydrogen peroxide. ‡ — Dr. A. Müller has found that for demonstrating tubercle bacilli in fuchsin-stained preparations, the treatment with acid may be omitted, and replaced by potassium percarbonate $K_2C_2O_6$, or still better, by alkaline peroxide of hydrogen. The preparations do not suffer by protracted action of these reagents, and the procedure is therefore specially suitable for material which contains very few tubercle bacilli. The same reagents can be used with advantage in spore-staining. After staining the film with carbol-fuchsin, the cover-glass is washed with dilute spirit (60–70 p.c.), or with water, and is then transferred to a freshly made 5–10 p.c. solution of potassium percarbonate for at least a quarter of an hour, after which it is washed with water and stained with methylen-blue. Peroxide of hydrogen alkalinised immediately before use by means of soda or potash solution acts more rapidly and effectively than the potassium percarbonate. For spores, the method gives better results with anilin-water-fuchsin than with phenol-fuchsin.

Staining with Brazilin.§—Prof. S. J. Hickson gives the following method for staining with brazilin ($C_{16}H_{14}O_5$), which is extracted from the wood of *Cæsalpinia echinata*.

The sections are placed in a solution of iron-alum (1 p.c. iron-alum

* Zeitschr. wiss. Mikr., xviii. (1901) pp. 33–4.

† C.R. Assoc. Française Avance. des Sci., 1900, 9 pp., 3 pls., and 19 figs.. Cf. this Journal, 1900, p. 625. ‡ Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 791–4.

§ Quart. Journ. Micr. Sci., xliv. (1901) pp. 469–71.

in 70 p.c. alcohol) for one to three hours, and then, after slight washing in 70 p.c. alcohol, in a 0·5 p.c. solution of pure brazilin in 70 p.c. spirit. Three to sixteen hours are required to give a good sharp definition. After staining, the sections are washed in pure 70 p.c. spirit, passed through the usual stages, and mounted. Over iron-hæmatoxylin this method possesses two advantages: the sections are never taken down into water, and the number of washings is considerably reduced. The results are satisfactory, for not only is brazilin a definite chromatin stain, but in nearly all tissues some parts of the cytoplasm are also stained, though of a different colour, and with some tissues it is a triple stain.

Methylen-Azur and the Red Reaction of Methylen-Blue. * — Dr. L. Michaelis points out that the metachromatism of alkaline methylen-blue solutions is due to the presence of the decomposition product methylen-azur, called by Nocht "the red from methylen-blue," while methylen-red is an impurity introduced in or unremoved by manufacture. He has devised the following method of making an azur-methylen-blue. 2 grm. of medicinal methylen-blue are dissolved in 200 ccm. of water, and to the solution 10 ccm. $\frac{1}{10}$ normal soda solution are added. The solution is then heated and kept boiling for $\frac{1}{4}$ hour. The fluid is allowed to stand till it cools, when 10 ccm. $\frac{1}{10}$ normal sulphuric acid are added, after which it is filtered.

For staining purposes one part of the solution is mixed with 5 parts 1 per thousand eosin solution and the mixture well shaken. The preparations are left in the solution for $\frac{1}{4}$ hour, after which they are washed in water, dried, and mounted. Differentiation in alcohol or in eosin solution is unnecessary.

Microscopic Injections with Cold Fluid Gelatin.†—Dr. J. Tandler prepares a stained injection mass which remains fluid in the following way:—5 grm. of finely divided pure gelatin are soaked in 100 grm. of distilled water and afterwards heated. When the gelatin is melted, Berlin-blue is added, and then 5–6 grm. of potassium iodide are gradually worked in. As a rule the mass will keep fluid and injectable down to 17° C., but should it set, the addition of more iodide will prevent the recurrence. Some crystals of thymol should be added, and the mass preserved in stoppered bottles. The animals should be injected immediately after death, and then the pieces to be preserved are immersed in 5 p.c. formol. This fixative is very advantageous for staining and decalcification afterwards, as the chemical changes which take place are very slight.

(5) Mounting, including Slides, Preservative Fluids, &c.

New Formula for Preserving Zoological and Anatomical Specimens.‡—G. Marpmann finds that by adopting the following formula the alcohol may be omitted from his method. The preparations are first immersed in the following mixture:—sodium fluoride 50; formaldehyde (40 p.c.) 20; water 1 litre. From this fixative solution they are transferred to the preservative fluid, composed of glycerin 28° B 5 litres;

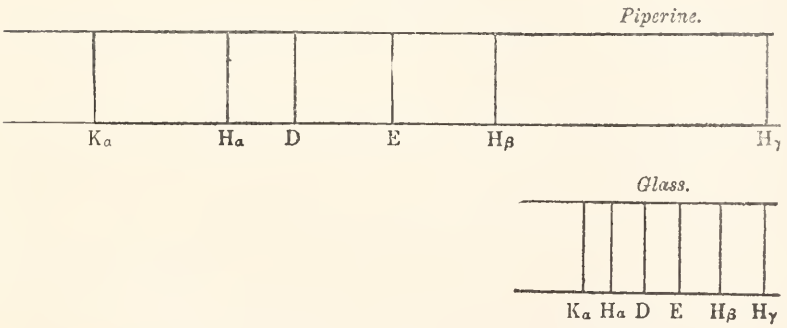
* Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 763–9.
† Zeitschr. wiss. Mikr., xviii. (1901) pp. 22–4 (1 pl.).
‡ Zeitschr. angew. Mikr., vii. (1901) p. 14. Cf. this Journal, 1899. p. 456.

water 10 litres; magnesium chloride 1 kilo; sodium fluoride 0·2 kilo. In this fluid zoological preparations, especially reptiles, preserve their natural colours, as also do most anatomical preparations. Should the preserved material require to be sectioned, it must be treated with water 3 or 4 times to extract the preservative and then immersed in alcohols of increasing strength. If soap be used the material may be imbedded direct.

Colloid Form of Piperine, its Refractive and Dispersive Powers.* —H. G. Madan has found that, in order to ensure with approximate certainty the conversion of crystalloid piperine into colloid piperine, an exposure to a temperature of not much less than 180° for a period of not much less than one hour is required. Prepared in this way piperine will retain for at least 2½ years the colloid condition without alteration, closely resembling ordinary "rosin" (colophony) in appearance, but not quite so brittle.

Colloid piperine possesses a higher refractivity than most other resins

Fig. 130.



Comparative length of the spectra of piperine and glass.

or resin-like substances, and its dispersive power is still more remarkable, = 0·142. The diagram (fig. 130) shows the extent of the piperine spectrum as compared with that given by a prism of dense flint glass having the same refracting angle. From its high refractivity piperine seemed likely to be useful in the construction of certain kinds of polarising prisms, but owing to the extraordinarily high dispersive power, the critical angles for the different rays of the visual spectrum differ so widely that the prism is practically useless unless monochromatic light be employed.

(6) Miscellaneous.

Polarised Light for Investigating Nerve-Fibres.†— K. Brodmann has investigated the appearances of normal and of degenerated nerve-fibres by the aid of polarised light. The principal feature of normal nerve-fibres was their strongly negative double refraction, while degenerated nerves lost this attribute in proportion to the amount of degenera-

* Trans. Chem. Soc., lxxix. (1901) pp. 922–7 (1 fig.).
† Neurol. Centralbl., xix. (1900) p. 1154.

tion; so that when excessive the reversal of the characters of negative double refraction is obtained.

Degenerated fibres in a nerve-trunk can be detected by this method, which is quite simple and satisfactory.

Cooling Paraffin Section Blocks.* — The useful device of smearing the surface of the paraffin block to prevent the curling of sections is, says R. von Lendenfeld, attended with two inconveniences; one is that you must wait while the paraffin sets, the other that the block softens from the repeated application of hot paraffin.

These inconveniences may be obviated by directing a current of cool air on the block. A rubber tube is connected at one end with a water-bellows, the other with a glass tube drawn out to a point. The tube is provided with a stop-cock to regulate the pressure of air. The air passes through a Woulff's bottle to the tube; in the bottle are placed pieces of ice to cool the air.

Methods in Plant Histology.†—Prof. C. J. Chamberlain's work on histological technique for botanical students will be very acceptable to many workers. The first part deals with the principles and processes of microtechnique, while the second part is devoted to the application of the principles to special cases. In the first part are considered the apparatus; the reagents for killing, fixing, and staining; the procedures necessary in the paraffin, celloidin, and glycerin methods. In the second part a series of forms has been selected for demonstration, which will serve not merely for practice in microscopical technique, but will also furnish the student with preparations for a fairly satisfactory study of plant structures from the Algæ up to the Angiosperms.

Chabry's Apparatus.‡—Fr. Kopsch describes an improved Chabry's apparatus for observing ova and minute objects. The alterations chiefly consist in mechanical improvements, the apparatus being practically the same as that previously described in this Journal.

Methods of Determining the Abundance of Bacillus coli communis in River Water.§—Prof. E. O. Jordan adopted two methods: one, the carbol-broth method for highly polluted waters; the other the dextrose-broth method for relatively pure waters. In the first procedure a measured quantity of water in carbol-broth was submitted to a preliminary incubation. The broth was prepared by adding 1 ccm. of 1 p.c. solution of carbolic acid in sterile water to tubes containing 9 ccm. of sterile broth. The broth was first rendered neutral to phenolphthalein, and then acidified by the addition of 5·5 ccm. of normal acid per litre.

1 ccm. of a suitable dilution of the water was added to a tube and incubated at 38° C. for 18–24 hours. Plates were then made of litmus-lactose-agar (5 ccm. normal alkali per litre). If red colonies developed on the medium at 38° C., they were transferred to tubes and tested for gas formation, indol-production, coagulation of milk, and liquefaction of gelatin.

In the alternative procedure, the water was introduced directly into

* Zeitschr. wiss. Mikr., xviii. (1901) pp. 18–9.

† Univ. Chicago Press, 1901, vi. and 159 pp. and 74 figs.

‡ Internat. Monatschr. Anat. u. Phys., xvii. (1900) pp. 125–37 (2 figs.). Cf. this Journal, 1888, p. 801.

§ Journ. Hygiene, i. (1901) pp. 295–320.

dextrose-broth fermentation tubes without preliminary incubation. This broth was prepared with fresh meat, from which the muscle sugar had been removed by Smith's method, and to this sugar-free broth 1 p.c. of dextrose was subsequently added. The broth was made neutral to phenolphthalein. After inoculation with the water the tubes were incubated at 38° C. for 48 hours, gas readings being taken at 24 hour intervals. At the end of 48 hours all tubes showing the formation of gas were removed from the incubator, cooled to room temperature, and the absorption of CO_2 determined by the addition of a 2 p.c. solution of NaOH.

Method of Isolating the Typhoid Bacillus.* — R. Cambier noticed that typhoid bacilli pass through the pores of coarse porcelain in times proportionate to their motility, and also that the typhoid pass through more quickly than other bacteria. This observation was applied to the isolation of typhoid bacilli in the following manner. A bougie filter containing the suspected water is immersed in clear bouillon and incubated at 38°. Directly the bouillon becomes turbid, a small portion is pipetted off and cultivated on other media, such as milk, potato, etc., and further tested by means of the serum reaction. In this way typhoid bacilli have been easily detected in Seine and Marne water. The method is also applicable to stools.

In connection with this method the author states that the typhoid bacilli isolated by the foregoing procedure were agglutinated only by strong doses of very active serum. This, however, does not afford any ground for contesting their typhoid nature; for he has found that when coli and typhoid bacilli have lived in association, the typhoid requires a strong serum to agglutinate it, and the coli acquires the property of becoming agglutinated by typhoid serum.

Technical Microscopy.†—Prof. T. F. Hanausek's Text-book of Technical Microscopy is the first German manual which embraces the whole subject since the appearance of Wiesner's Introduction to Technical Microscopy in 1867. The reader is presumed to possess more than a mere rudimentary knowledge of animal and vegetable histology, and of chemistry, since this text-book appeals more to advanced workers, and is made to comprise more information in a given space than could be done if elementary principles had to be discussed. The work is divided into two parts: the first deals briefly with the Microscope and its accessory apparatus, and with the necessary reagents; in the second portion is described the microscopy of the more important types of raw material, such as starch, animal and vegetable fibres, stems, roots, leaves, flower, fruit, seeds, bone, teeth, and horn.

The last chapter deals rather curtly with micro-chemical analyses. The volume is well printed and illustrated.

Technology of Microscopic Metallography.‡ — Prof. Le Chatelier, in the course of a paper full of practical details on the above subject, describes a special Microscope made for him by Pellin, of Paris. Its construction, with the complete illuminating apparatus, is shown in

* Comptes Rendus, cxxxii. (1901) pp. 1442–4.
† Stuttgart, 1901, x. and 456 pp. and 256 figs.
‡ Metallographist, 1901, pp. 1–22 (19 figs.).

fig. 131. A is the piece of metal under examination; B, the support; C, the fine adjustment for focussing the objective; D, the objective; E, totally reflecting prism; F, the eye-piece; G, a movable tube carry-

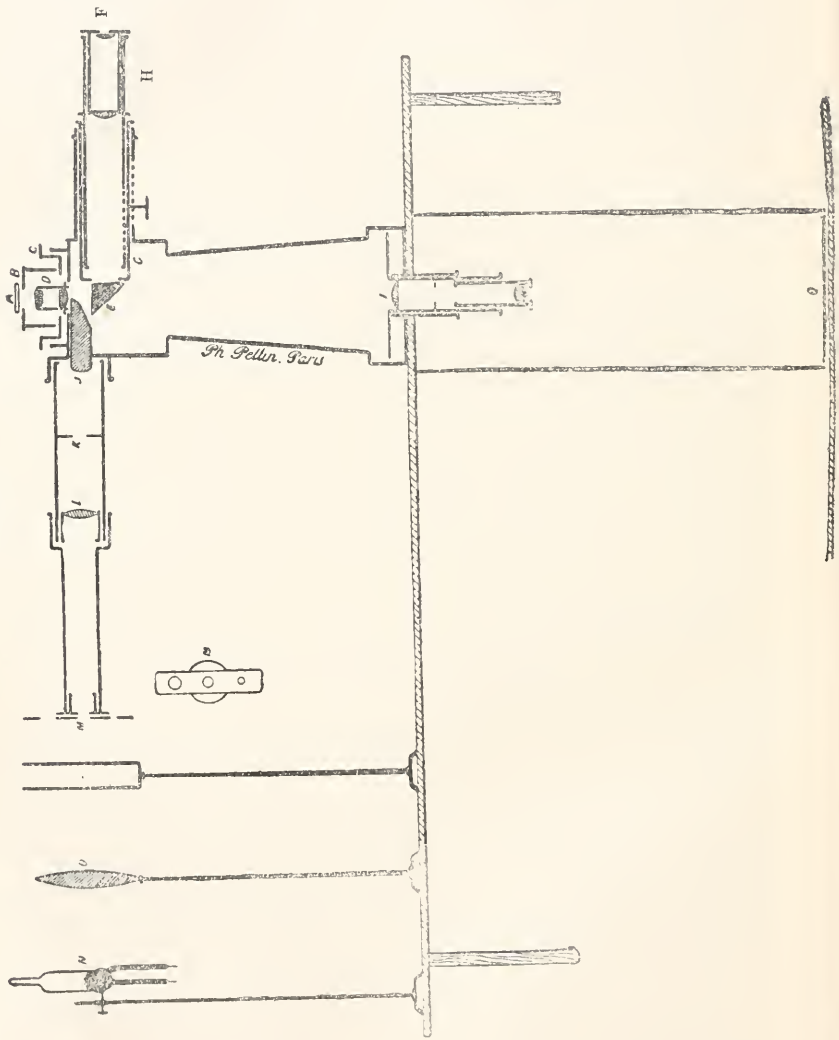


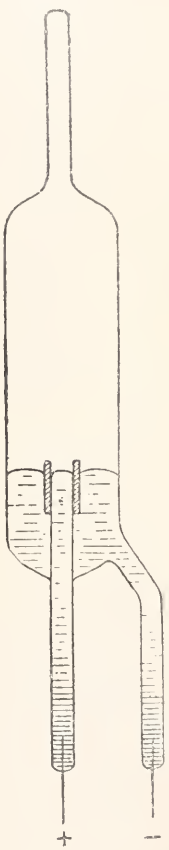
Fig. 131.

ing the prism; H, the tube carrying the eye-piece; J, the illuminating prism; K, the iris diaphragm; L, the condensing lens; M, the diaphragm; N, the source of light; O, the lens; P, the absorbing cells; Q, the photographic plate. The objective D is directed upward, so that, if necessary, very bulky pieces may be examined; moreover, it is only

necessary to prepare one flat surface in the specimen. The eye-piece is placed horizontally, and receives the image by the reflection of a totally reflecting prism E placed under the objective. The examination can, therefore, be conveniently carried on while the operator is sitting in front of a table.

The adjustment is done through a screw collar surrounding the objective and receiving the support B. The surface under examination must be absolutely perpendicular to the axis of the objective. The supports which rest upon three points have a very uniform thickness, so that the preparation is in the proper position. In a Microscope for the examination of metal the illuminating arrangement requires the most delicate regulation, and it is generally accomplished tentatively by adjusting a number of movable pieces. But in this instrument only two adjustments are required, the proper *opening* and proper *position* of a single diaphragm M placed in such a way that its *opening* regulates the angle of the beam of light which falls upon the preparation. This angle must vary with the nature and the quality of the objective. The greater the angle, the greater the effect of the spherical aberration; and, on the contrary, the smaller the angle, the greater the chromatic aberration. The best definition is obtained with a certain mean angle which must be found tentatively in each case. The *position* of the diaphragm M regulates the mean inclination of the beam of light falling upon the preparation. To obtain the greatest clearness, its direction should be nearly vertical; but in order to reduce the amount of light reflected by the lenses, and sent back to the eye, it is necessary to give a more inclined direction to the beam of light. If the inclination is what it should be, most of the light reflected in this way is stopped by the illuminating prism itself. This diaphragm M is placed at the principal focus of the complex optical system made of the objective D, the illuminating prism J, and the lens L. To ascertain its proper position, the image of a luminous point placed at a distance of two or three metres above the objective is located by means of a magnifying glass. This determination is done once for all for each objective, and the corresponding position, in each case, of the draw-tube carrying the diaphragm is noted.

Fig. 132.



As a source of light, if the object is to be viewed only with the eye, a Welsbach lamp is the most convenient. For photomicrography, the whole of the photographic outfit is placed vertically below the objective. If white light is to be used, a Welsbach lamp, an acetylene flame, or an oxyhydrogen light are very satisfactory. But it is preferable to use a monochromatic source of light, because so-called achromatic and apochromatic objectives are never completely free from chromatic aberration. A

mercury arc in vacuum lamp gives excellent results. The form used by the author is shown in fig. 132. The upper vacuum space is very large, so as to increase the radiating surface, and therefore decrease the heating of the lamp. The central tube is covered with a refractory coating which greatly lengthens the life of the lamp. With a projection eye-piece an exposure of from one to two minutes is required. This lamp should preferably be worked by a continuous current. The difference of electro-motive force between the two poles varies from 15 to 25 volts as the lamp gets heated. Three amperes is the best current intensity for normal work.

Fig. 133, plate IX., is an interesting example of abnormal structure in grey cast iron, etched with tincture of iodine. It was photographed by the above apparatus, and the magnification is 660 diameters.

Iron and Phosphorus.*—J. E. Stead, after an extensive examination of samples of phosphorised iron, finds that they may be conveniently divided into 4 classes, according to the percentage amount of phosphorus. (1) From 0 to 1·70 p.c. (2) From 1·70 to 10·2 p.c. (3) From 10·2 to 15·58 p.c. (4) From 15·58 to 21·68 p.c. Alloys containing much above 21 p.c. of phosphorus have not been investigated, as they are of little metallurgical value. The selected photomicrographs will give an idea of the micro-structure.

Fig. 134, plate IX., is the type of all the metals in the first class. The crystalline grains are polygonal, and are solid solutions of Fe_3P in iron. The grains, under like conditions of heating and cooling, increase in size with the increase of phosphorus (× 50).

Fig. 135 contained about 8 p.c. of phosphorus. The broad light parts are crystallites of the metal containing about 1·7 p.c. phosphorus. The white mottled ground mass is the eutectic containing 10·2 p.c. phosphorus (× 250).

Fig. 136, plate X., contained 10·2 p.c. phosphorus, and is the eutectic of phosphorus and iron. It has only one critical point at about 950° C. (× 350).

Fig. 137 contained 11·07 p.c. phosphorus, and shows sections of rhombic or oblique idiomorphic crystals of Fe_3P imbedded in a ground mass of the eutectic (× 60).

Mr. Stead's second paper is wholly based upon micro-structure, and is illustrated by a series of important photomicrographs. He summarises his results under eleven heads, which are briefly :—

(1) That on melting saturated solid solutions of iron phosphide in iron with carbon, the latter causes a separation of the phosphide near to the point of solidification, which appears in the solid metal as a eutectic in irregular-shaped areas. A residuum always remains in solid solution.

(2) That the residuum appears to be retained in the pearlite.

(3) That a portion of the iron phosphide in steels containing less than 0·10 p.c. of phosphorus is thrown out of solution by carbon when it exceeds 0·9 p.c., and the phosphide so separated is liable to form a brittle cell-structure enveloping the grain, yielding a more or less fragile mass.

* Metallographist, 1901, pp. 89–114, 199–236 (27 figs.).

MICROSCOPY.

A. Instruments, Accessories, &c.*

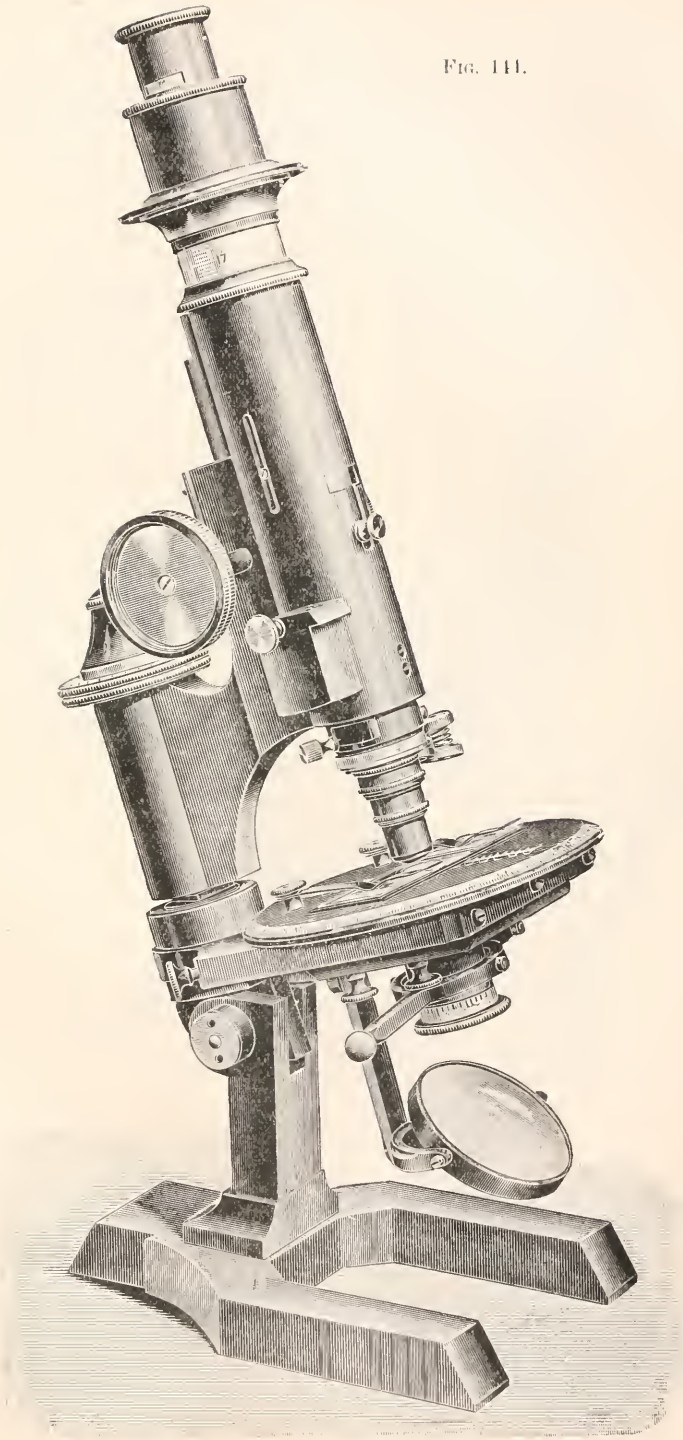
(1) Stands.

Seibert's New Microscope for Crystallography and Petrography.—In this large model (fig. 144), simplicity of construction, economy in cost, and suitability of purpose, have been especially kept in view. The stand is hinged for inclination and clamped by a small lever. The coarse adjustment is by rack-and-pinion, and the fine by a micrometer screw, whose head is graduated for thickness measurements. The draw-out tube has millimetre graduations. The circular object-stage (diameter 105 mm.) is rotary, graduated, and provided with a vernier and centering screws. The stage is marked with two perpendicular radii for orienting the object, and the illumination is by plane and concave mirrors. There are two analysers. One is applied above the ocular, and has graduations and a vernier. The other can be inserted into the tube directly over the objective; the consequent change in the focal length of the objective is compensated by a long focus lens on the top of the prism, so that, after the insertion of the analyser, no new adjustment of the objective is required. The prisms of the analysers have right-angled end planes, and give a very large field. The polariser is placed in a small sleeve under the stage, and has a lever arrangement for adjustment of height. The rotation of the nicol is controlled by a screw working in a groove. Over the polariser is a doublet condenser for axial images. A Bertrand lens can be used for magnifying the axial images, and for this purpose is inserted from above into the tube as far as the diaphragm of the draw-tube. The oculars are specially constructed for polarisation work. A screw engages in a notch in the tube, so fixing the direction of the cross threads, and this direction is made visible by a stroke on the outer rim of the mount. Other strokes mark the angles of 45°. The illustration shows a spring attachment of the objective. This arrangement, which is not peculiar to this particular class of instrument, gives accurate adjustment combined with easy and rapid facility of exchange.

Beck's London Microscope.—Fig. 145 represents this instrument, which was exhibited at the meeting of the Society held on October 15th. It has inclining joint, first-class fine and coarse adjustments, a divided draw-tube, removable mechanical stage, giving 2-in. horizontal and 1-in. vertical movements, with finder divisions, rack-and-pinion focussing substage, ebonite top stage, double mirror, and is absolutely rigid. The back leg of the base slides in, the side legs close up, the stage and mechanical stage both remove and pack in the bottom of the leather case, and the triple nose-piece swings round.

* This subdivision contains (1) Stands; (2) Eye-pieces and Objectives; (3) Illuminating and other Apparatus; (4) Photomicrography; (5) Microscopical Optics and Manipulation; (6) Miscellaneous.

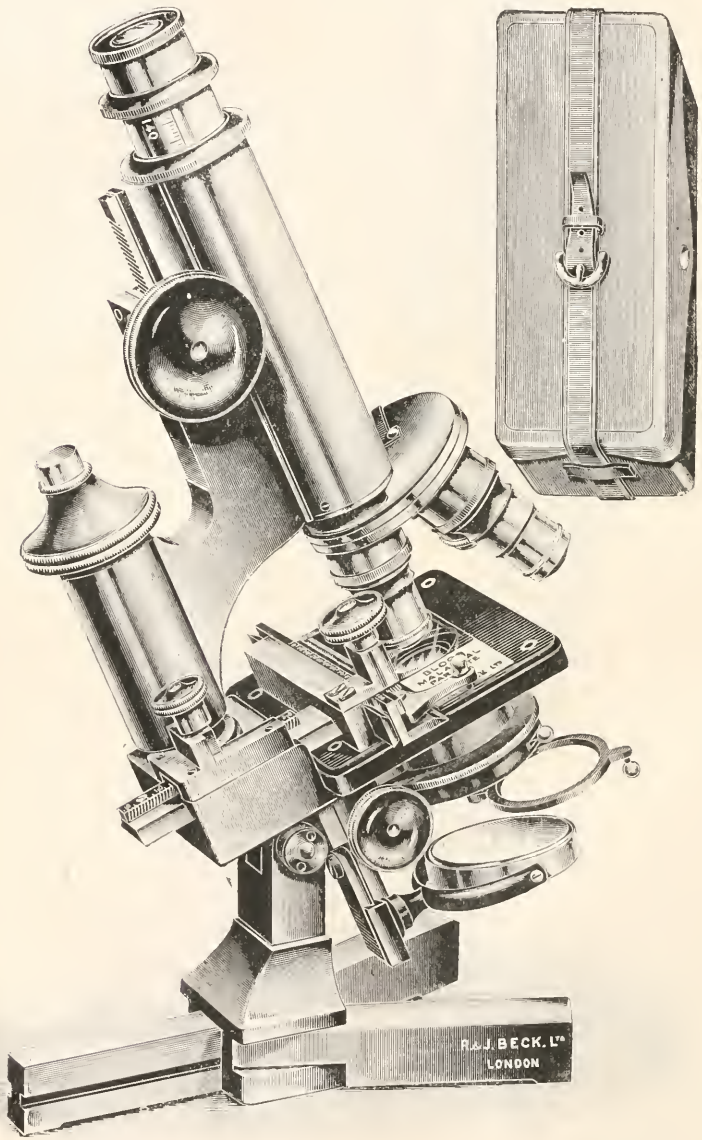
Fig. 111.



3 A 2

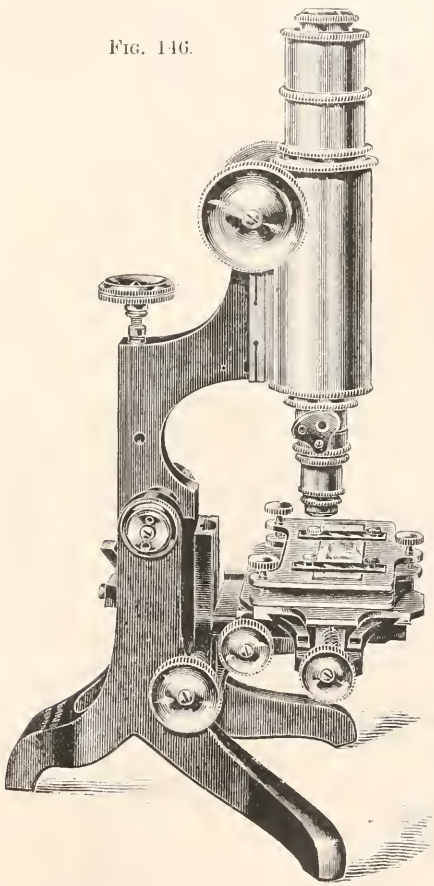
The special advantage of this instrument is its great portability, when packed into its comparatively small leather case, as shown in the illustration, measuring about $2\frac{1}{4}$ by $4\frac{1}{2}$ by $9\frac{1}{2}$ in.

Fig. 115.



Baker's Engineering Microscope.—This Microscope (fig. 146) has been specially designed for the examination and photography of metals, and is adapted for the examination of opaque objects only. It has diagonal rack-and-pinion coarse, and micrometer screw and lever fine adjustments, but no means of substage illumination, and no stage aperture. Illumination of the object is effected, when using low powers'

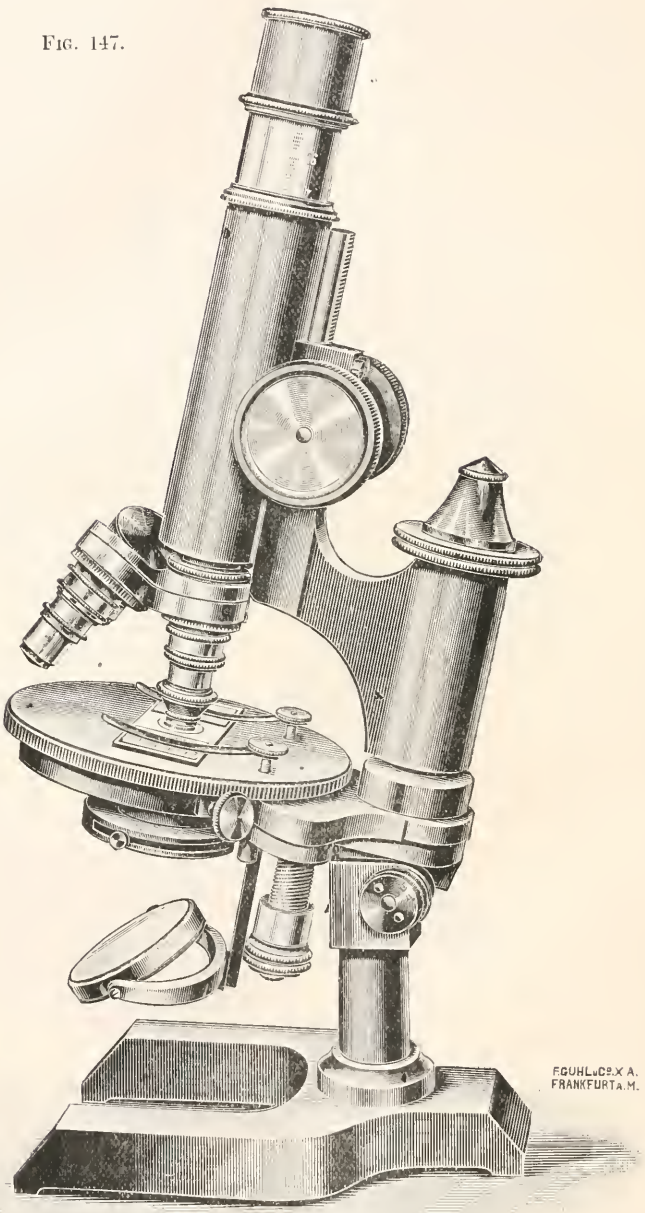
FIG. 146.



by diffused daylight or artificial light; when using the higher powers, by means of a vertical illuminator, with diaphragms for regulating the amount of illumination. The stage is provided with levelling screws.

Seibert's New Microscope, No. 5 A.—This is a new instrument (fig. 147) of medium size, intended for scientists of all grades who wish to carry out exact work with the best objectives and auxiliary apparatus. The stand is sold at a very low price. The pillar is jointed for incliua-

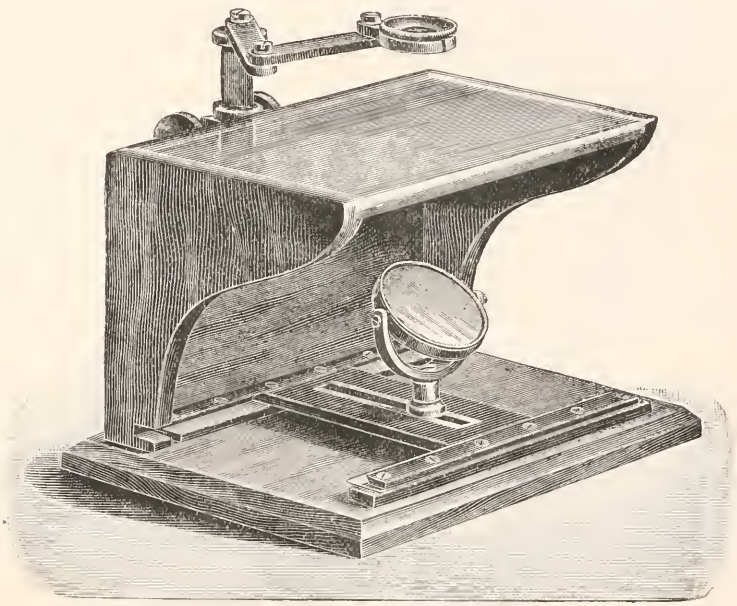
Fig. 147.



tion. The coarse adjustment is by rack-and-pinion, and the fine by micrometer screw. The circular rotating stage is fitted with centering screws. The draw-tube is graduated. The instrument has an Abbe's illuminating apparatus and iris diaphragm, which can be focussed by means of a screw-head under the stage. When the condenser is sufficiently screwed down, further rotation puts it aside. Under the iris is a slotted ring for receiving a coloured glass disc.

Seibert's Preparation Microscope.—This instrument (fig. 148) is mainly intended for the preliminary inspection and sampling of large objects. The stage is of glass, 18 by 12 cm. The adjustment is by

Fig. 148.

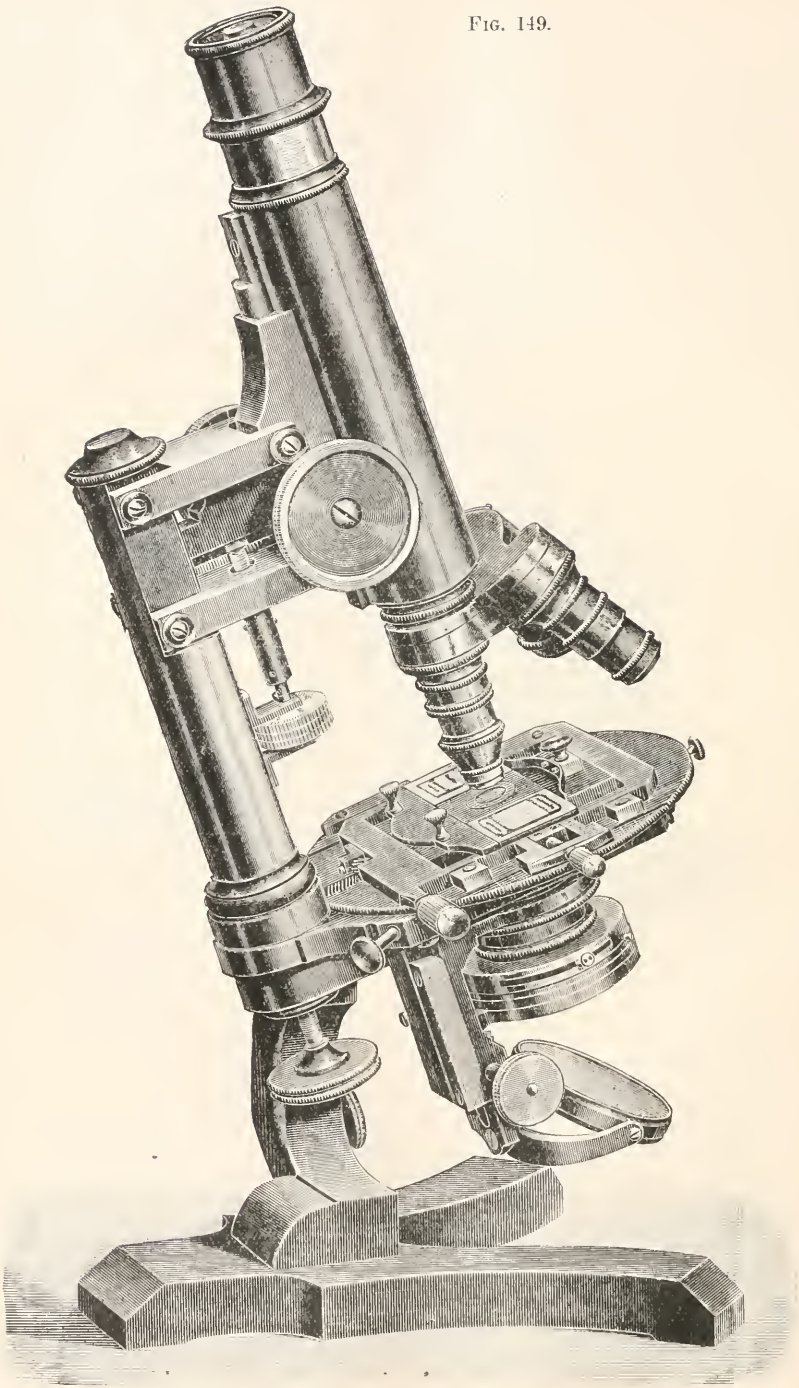


rack-and-pinion. By means of a three-jointed arm the loup can be easily arranged for exploring every part of the object. The mirror is movable, and can be pushed in all horizontal directions.

Micrometer Screws and Fine Adjustments as applied to Modern Stands.*—Prof. G. Marpmann introduces his article with some historical remarks. He attributes the modern stand to Vincent Chevalier, further developed by his son Charles and his nephew Arthur. These Chevalier stands go back to 1824, and reach their highest perfection in Strauss' grand Microscope of 1834, which has stage and substage, mirror, coarse and fine adjustments, as in the instruments of to-day. The chief difference lies in the shape of the pillar, which in the old stands is half round and with modern ones prismatic. In all the pillar is firmly

* Zeitschr. angew. Mikr., vii. (1901) pp. 33–8 (2 figs.).

Fig. 149.



connected with the stage, and the movable parts and tube depend on the pillar. The disadvantage common to all these models is that the micrometric movement, after a time, gets worn, and the fine adjustment no longer works with accuracy. A second disadvantage is in the position of the micrometer screw, which ought to be placed vertically below the stage. This arrangement was actually adopted by the Parisian firm of Trécourt, Bouquet, and Oberhäuser in 1830; and Oberhäuser, after his separation from his partners, introduced the same arrangement in all his instruments between 1847 and 1857. The only Continental firm which makes larger stands with the micrometer below the stage, as the author thinks it should be, is that of W. and H. Seibert, of Wetzlar.

Fig. 150.

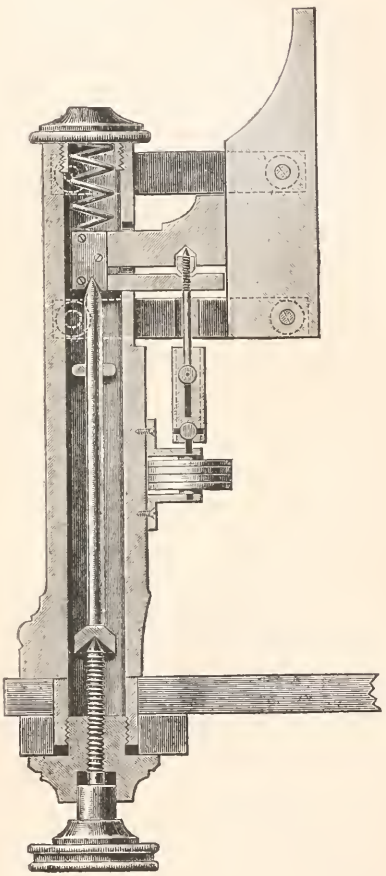


Fig. 149 shows Seibert's large model with three adjustments. The coarser adjustment is by rack-and-pinion; the fine, with parallelogram movement, is under the stage; the third adjustment is an extremely slow motion for delicate observations with the highest powers. Fig. 150 shows the two fine adjustments. The least fine of these is a micrometer screw, and its action securely moves the whole pillar and tube on the foot; its rotation about ten times as coarse as that of the third adjustment.

(2) Eye-pieces and Objectives.

Kreidl's New Stereoscopic Loup * (fig. 151).—The four totally reflecting planes m, m', n, n' of the four prisms P, P', p, p' act as mirrors, by means of which the rays $o\,c$ and $o\,c'$, coming from the point o of the object, are reflected after their passage through the achromatic magnifying lenses $a\,b\,c$, $a'\,b\,c'$. After two reflections these rays emerge parallel or nearly so. An object at o, the common focus of the two central rays, is magnified to the right eye in the direction A' o', and to the left eye in the direction A o. The angle enclosed by the two

* Zeitschr. wiss. Mikr., xviii. (1901) pp. 10–4 (1 fig.).

optical axes of the achromatic lenses is approximately equal to the angle between rays diverging to the eyes from a point at the distance

Fig. 151.

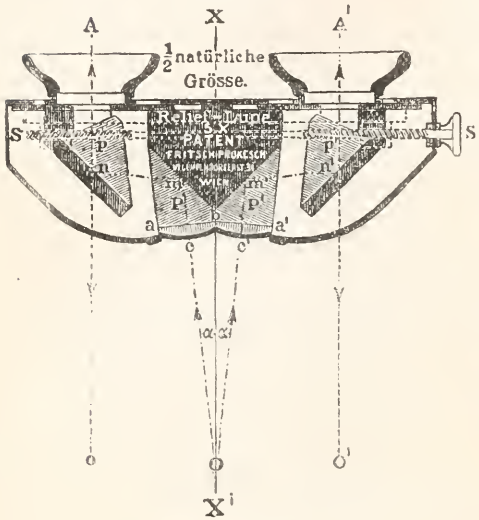


Fig. 152.

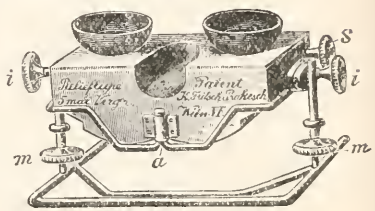


Fig. 153.

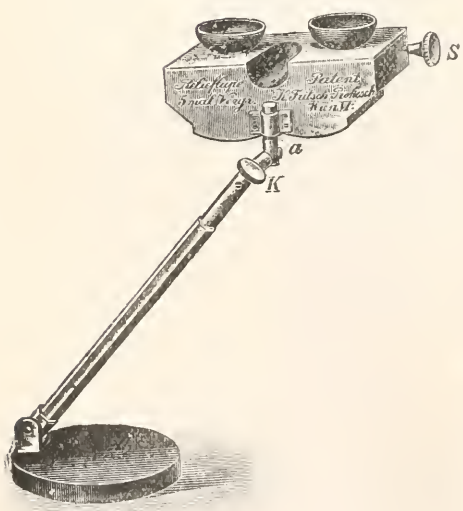
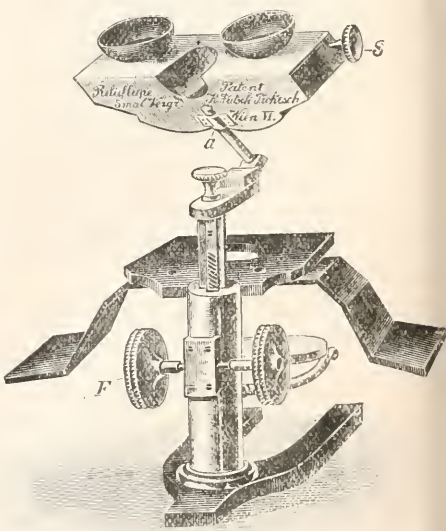


Fig. 154.

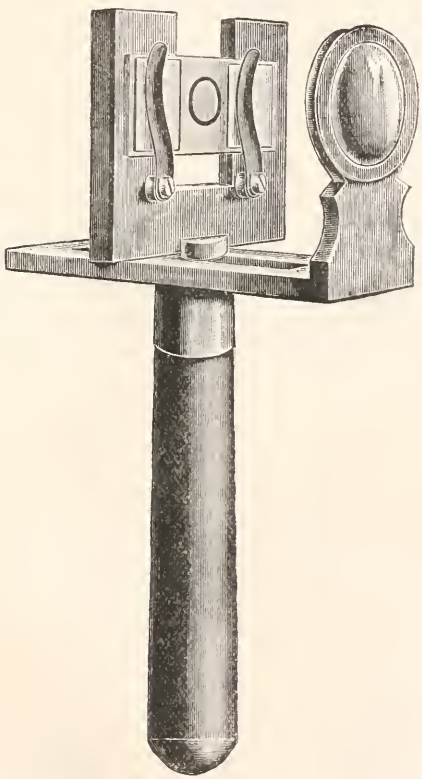


of normal distinct vision. The screw S S′ allows the emergent rays to be accommodated to the distance between the observer's pupils. This

last peculiarity and the device of the two inclined lenses constitute the chief novelties of the instrument.

The loup may be mounted in various ways. In fig. 152 it is fitted on a simple frame, and this forms a pocket instrument. In fig. 153 it is seen on a simple stand; and in fig. 154 it is arranged for more elaborate work. The figures of these mountings seem to explain themselves so clearly that detailed description is not necessary. The instrument is manufactured by Fritsch of Vienna.

Fig. 155.

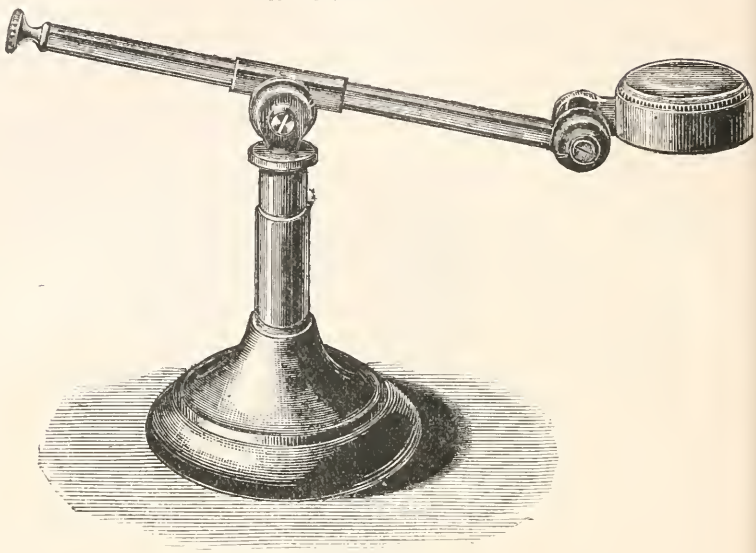


Seibert's New Demonstration Loup. — In this apparatus (fig. 155) the loup is set in a right-angled carrier, whose base is pierced by a rectangular slot. In this slot slides a screw, which serves as the tongue of the object-carrier. When the focus has been found by sliding the object-carrier into the proper position, the whole is tightened up by rotation of the wooden handle.

Seibert's Loup Stand.—In this apparatus (fig. 156), which is upon Fritsch's model, the pillar allows an elevation of the whole stand as well as a rotation of the loup arm. This arm can, by a push-motion

through a clamping sleeve, be lengthened or shortened. The hinging of the loup permits its adjustment in all positions.

Fig. 156.



(3) Illuminating and other Apparatus.

Seibert's Illuminating Apparatus.—This apparatus (fig. 157) is of simple character and of special construction. The condenser has an aperture of 1·10. By the opening and closing of the iris-diaphragm the central illumination may be graduated as required. The oblique illumination is obtained by the adjustment of a mirror.

Fig. 157.

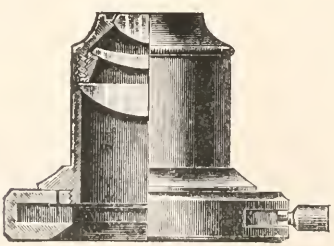


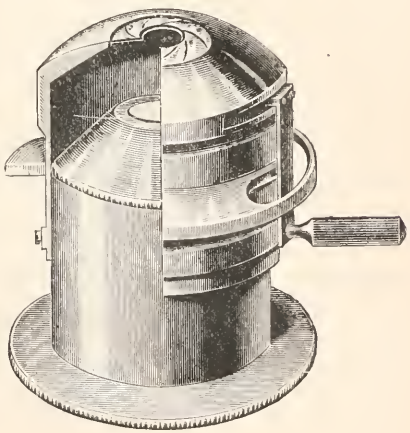
Fig. 158.

Watson's Universal Condenser.—The object of Messrs. W. Watson and Sons is to produce a condenser as suitable for low and medium as for high-power objectives. The apparatus (fig. 158) has a total aper-

ture of 0·98, and if the exact thickness of slip for which the condenser is corrected be used, its total aperture is aplanatic. A special feature is that the field-lens is not so limited in size as to interfere with the quick work necessary for histological and diagnostic purposes, as it is $\frac{9}{10}$ in. in diameter. The front lens mount has been so shaped as to obviate, as far as possible, any obstruction of the mechanical stage. The back lens, which does the correcting, is a triple one, and is the system adopted by Messrs. Watson in their series of holoscopic objectives and oil-immersion condenser. The carrier is the same as that used for the Abbe illuminator, and will interchange with it. It has iris diaphragm and rotating cell for coloured glasses, black patch stops, &c.

Seibert's Cylinder Iris Diaphragm. — This (fig. 159) is intended as a substitute for the ordinary diaphragm stop of the Abbe illuminating apparatus, and consists of an iris with domed steel plates. It is fitted in the upper part of the sleeve collar of the condenser system, and during the use of the latter is out of action. When its use is required, the condenser is screwed out, and the iris brought to the desired aperture by pushing a lateral knob. The position of this stop is exactly the same as that of Abbe's diaphragm, and the plates, when completely closed, touch the object-slide.

Fig. 159.



Weinschenk's Guide to the Use of the Polarising Microscope. — This book deserves a fuller notice than that given to it in the Bibliographical list.* It claims to be a condensed general treatment of the subject. Special commercial and technical applications of polarisation are unnoticed. The main divisions of the book are:—The Polarising Microscope in general; the adjustment of the Polarising Microscope; observations with ordinary light; observations with parallel polarised light; observations with converging polarised light; twin images and optical anomalies; Appendix—Auxiliary Apparatus. The chapters are illustrated with a large number of explanatory diagrams. There are also representations of a great many forms of polarising apparatus collected mainly from the catalogues of Nachet, Seibert, Voight and Hochgesang, and Zeiss.

(4) Photomicrography.

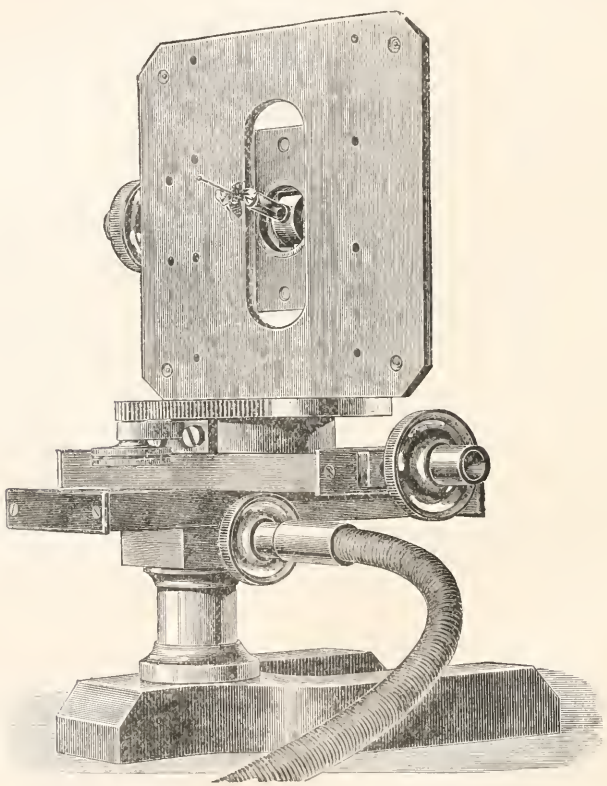
Wandolleck's New Object-holder for Photomicrography.† — The intention of this apparatus is to facilitate the photography of solid objects. On a horse-shoe Microscope foot of the usual shape and size (fig. 160) a small vertical pillar carries, by means of a dove-tailed wedge,

* Cf. this Journal, *ante*, p. 587.

† Zeitschr. wiss. Mikr., xviii. (1901) pp. 1–9 (2 figs.).

a sliding-piece actuated by rack-and-pinion. Another sliding-piece is at right angles to this, and carries a cylindrical plug, which in its turn is connected to the toothed cylindrical disc on which the vertical stage stands. This stage is perforated by a rectangular notch with semi-circular ends, and the object-slide, itself circularly perforated, carries the actual holder, and is operated by a rack-and-pinion. As each of the parts is capable of independent movement, the object-holder can receive

Fig. 160.

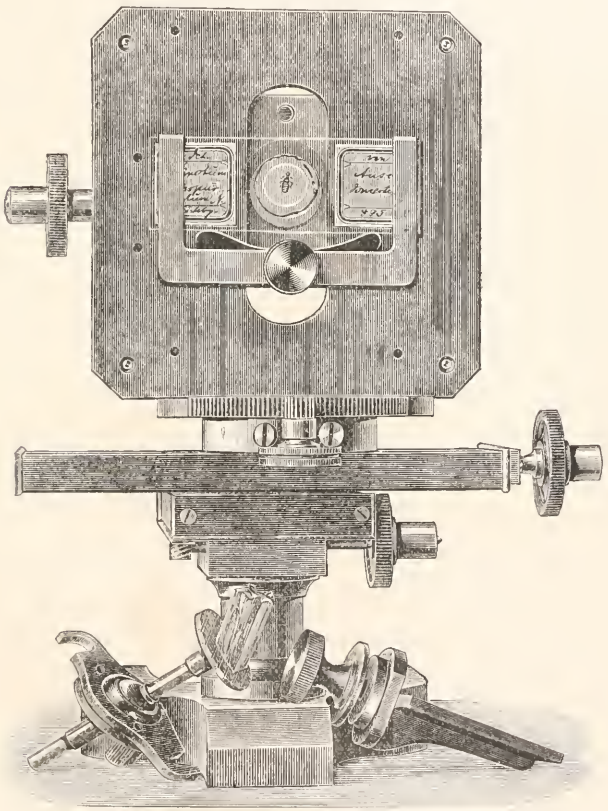


at least six different adjustments. The object is set on a small glass tube fitting into a suitable hole in a kind of wheel, and this arrangement removes it from the region of shadows. The teeth on the circular base permit of the quadrantal vertical rotation of the object-table.* The apparatus may be used for photography of transparent objects, as in fig. 161.

* A photograph of *Dædalochila avara* has been submitted to us as a specimen of the capabilities of Dr. Wandolleck's arrangement, and it seems very good.—[Ed.]

Methods of Producing Enlargements and Lantern Slides of Microscopic Objects for Class Demonstrations.*—The method practised by J. Aspinwall is the result of an attempt to produce photomicrographs of considerable magnification, and yet of great depth of focus, while using lenses of high resolving power. Use an objective of medium power, say a $\frac{1}{4}$ in., making the negative of a diameter of $1\frac{1}{2}$–2 in. In a lantern-slide camera enlarge from one-half to three-quarters of the

Fig. 161.



central area of the negative to twice its diameter on a Paget lantern-slide plate. By another enlargement from this positive a negative of any diameter can be secured. The enlarging lens must be well stopped down. In making the original negative use an objective without the ocular, and, instead of the substage condenser of high angle, an ordinary objective, say, of 1 in. focus, with a beam of light at a very low angle.

* Trans. Amer. Micr. Soc., xxii. (1901) pp. 41–7.

For making the lantern-slide the Paget plate gives the best results, and the warmer tones of brown, purple, and red are superior to black and white effects. Proper matting is of the greatest importance; the mat should be capable of being cut to suit the subject, e.g. the Boston. The developer is made up as follows:—Hydrochinon 100 grm., sodium sulphate 400 grm., sodium carbonate 400 grm., water 20 oz. The dilution of the developer is made as follows. (1) for black tone: developer 1 oz., water 2 oz., 10 p.c. solution of bromide 1–2 drops; exposure 20 seconds. (2) For brown tone: developer 1 oz., water 4 oz., bromide 5–8 drops; exposure 1½–2 minutes. (3) For red tone: developer 1 oz., water 8 oz., bromide 15–25 drops; exposure 5–15 minutes. (4) For purple tone: over-exposure and No. 2 dilution. The temperature of the developer should be from 70° to 80°. In making slides the best results are obtained by using a reducing and enlarging camera in preference to making slides by contact with the negative. When the section is well differentiated, the following procedure is advised:—A lantern-slide is made with the reddest tone obtainable. After fixing and washing, but before the slide is dry, it is toned in a gold-bath made as follows: (1) sulphocyanide of ammonium 200 grains, water 32 oz., carbonate of soda 2 grains; (2) chloride of gold 15 grains, water 1 oz. Add 4 drops of No. 2 to 2 oz. of No. 1, and immerse the red slide long enough to permit the gold to attack the lighter deposit of silver in the film. The temperature of the gold-bath should be from 72° to 76°. After fixing the Paget plate, swab it over with a tuft of cotton immersed in a solution of ferricyanide of potash of the colour of very pale sherry.

For making the enlargement a rather weak negative is used. Parallel light is obtained by means of an arc lamp and a condenser so arranged that the arc is at its focus. Only the central portion of the condenser is used. The finest medium focus, double series, view lens is used for projection, and it is well stopped down, say, to F.–16. A paper made by Eastman is tacked to a board absolutely at right angles to the axis of the projection beam, and enough time is given to ensure the obtaining of every detail of the image. Developing is done in adurol, one portion of developer to about 30 of water, and bromide added according to the character of the image required. Then wash, and place in a weak solution of hypo, with a saturated solution of chrome-alum added in the proportion of 1 to 20. A very weak solution of formalin may be used after the print has been partially washed upon removal of the hypo solution. Wash thoroughly, and hang up to dry. Adurol gives a brownish tone just off a black, and imparts life to the image.

In making enlargements from a negative with clear glass surrounding the microscopic image, the light of the arc lamp should be cut off from the surrounding area by backing the negative with dense yellow paper cut to the requisite size. The size of the image on the negative should be reduced by allowing the paper to lap down upon the image. This gives a clear cut edge to the circle when enlarged upon the bromide paper.

B. Technique.*

(1) Collecting Objects, including Culture Processes.

New Apparatus for Cultivating Anaerobes. † — Dr. Herman has devised an apparatus for anaerobic cultivation which works very satisfactorily and is easily manipulated. It consists of twin flasks connected by a tube. Each flask has also a separate neck into which fits a caoutchouc stopper. In one flask is placed the medium, in the other the pyrogallate solution.

Glucoproteins as Cultivation Media for Micro-organisms. ‡ — C. Lepierre states that nearly all microbes, pathogenic or not, grow perfectly well in liquid media in which the nitrogen is exclusively furnished by the α-glucoproteins. The composition of the media used is as follows:—Water 100 grm.; glucoprotein (from C_6 to C_{11}) 1·5–2 grm., used alone or with the addition of 2–3 grm. of glycerin, glucose, or saccharose; chloride of sodium 0·5 grm.; sulphate of magnesium 0·5 grm.; glycerophosphate of calcium 0·2–0·3 grm.; bicarbonate of potassium 0·1–0·2 grm. In these media 22 pathogenic and 23 saprophytic fungi were successfully cultivated. Some microbes exhibited a preference for certain glucoproteins; e.g. anthrax, plague, tetanus grew well on media in C_8 and C_9, while tubercle preferred those in C_{10} and C_{11}.

Method for Rapid Solution of Gelatin and Agar in the Preparation of Nutrient Media.§—Dr. J. W. H. Eyre, in the course of some observations on the standardisation of nutrient media, mentioned the following method which he had recently adopted for the more rapid solution of gelatin and agar in the preparation of the nutrient media rendered solid by the addition of these substances, and which, although still in the trial stage, can be strongly recommended. The method is better explained by describing the preparation of an actual batch of 1000 ccm. of 2 p.c. agar.

500 grm. of lean beef, finely minced, were added to 1000 ccm. of distilled water in a 3-litre flask, which was placed in a water-bath, and the temperature of its contents raised to and kept at 45° C. for 20 minutes; then rapidly raised to 100° C., and maintained there for 10 minutes. The mixture was then filtered, and the filtrate found to amount to 650 ccm. 10 grm. of pepton, 5 grm. of salt, and 20 grm. of powdered agar were weighed out, mixed, and made into a thick paste with 150 ccm. distilled water, then added to the 650 ccm. of *Fleischwasser* in the flask, which was returned to the water-bath. By the side of this was arranged a 10-litre tin can (with copper bottom, such as is used in the preparation of distilled water), filled with boiling water, and fitted with a long safety tube and a delivery tube, bent twice at right angles, sufficiently long to reach to the bottom of the interior of the flask. The

* This subdivision contains (1) Collecting Objects, including Culture Processes; (2) Preparing Objects; (3) Cutting, including Imbedding and Microtomes; (4) Staining and Injecting; (5) Mounting, including slides, preservative fluids, &c.; (6) Miscellaneous.

† Bull. Acad. Roy. Méd. de Belgique, xv. (1901) pp. 259–63 (3 figs.).

‡ Comptes Rendus, cxxxiii. (1901) pp. 113–6.

§ Brit. Med. Journ., 1901, ii. pp. 788–91.

water in the can was kept vigorously boiling, and steam at 100° C consequently bubbling through the medium mass for 25 minutes, by which time complete solution of the agar had been effected. (If one had been preparing 10 p.c. or 12 p.c. gelatin instead of agar, bubbling the steam through for a period of 10 minutes would have been ample.) The medium mass was then rapidly cooled to 15° C. in a normal measuring flask, and found to amount to 900 ccm. A further 100 ccm. of distilled water was then added, the medium melted up, titrated, and controlled, and the reaction estimated as being + 20. Dekanormal soda solution 0·95 ccm. was therefore added to produce a reaction of + 10 in the 950 ccm. of medium remaining in the flask, and the medium egged, steamed, filtered, tubed, and sterilised in the usual way. The reaction of the finished medium was finally estimated as + 10.

Cultivation of Amœbæ.* — H. Zaubitzer obtained amœbæ from straw infusion where they were in symbiosis with a bacterium. Cultivations were made from the sporocyst stage at 15°–20° C. The most suitable of the liquid media tried were 1 p.c. Heyden-water and 2·5 p.c. somatose solution; of the solid, 1 p.c. Heyden-agar and 2·5 p.c. somatose-agar. Fucus crispus was much less favourable. Examinations were made in hanging drops, after staining with methylen-blue and eosin, and after Delafield's hæmatoxylin and methylen-blue. Pure cultures, free from bacteria destroyed with 20 p.c. soda solution, were not obtained.

Acid Media for Cultivating Tubercle Bacilli.† — G. Jochmann finds that media which are prepared with meat-water possess a favourable degree of acidity. Media which are naturally alkaline or neutral should be first tested for the neutral point with litmus, and then acidulated with 1 p.c. lactic acid; 10 drops to 50 ccm., or about 10 ccm. 1 p.c. lactic acid to 1 litre of medium.

Culture of Gonococcus.—Dr. H. H. Young‡ records the successful cultivation of *Gonococcus* from cases of arthritis, abscess, cystitis, pyonephrosis, and peritonitis. The medium used was hydrocele-agar. The sterile fluid obtained aseptically may be kept for use in stoppered bottles. Agar slants are autoclaved for 5 minutes, and then put into water-bath at 55°. Hydrocele fluid is then poured into a tube in the proportion of a little more than one to two.

M. Wassermann§ made successful cultivations of *Gonococcus* from vegetations of the aortic valves on human blood-agar.

Dr. N. M. Harris and Dr. W. H. Dabney‖ report a case of endocarditis from which the *Gonococcus* was successfully cultivated.

Insects as Living Substratum for Cultivating Infectious Diseases of Man and Animals.¶—C. von Holub states that he has used insects as cultivation media for the past two years, and has found them an

* Arch. f. Hygiene, 1901, No. 2. See Centralbl. Bakt., 1te Abt., xxx (1901). p. 311.

† Hygien. Rundschau, 1901, No. 1. See Centralbl. Bakt., 1te Abt., xxix. (1901) p. 958.

‡ Johns Hopkins Hosp. Rep., ix. (1900) pp. 677–707.

§ Münch. Med. Wochenschr., 1901, No. 8. See Centralbl. Bakt., 1te Abt., xxix. (1901) p. 913.

‖ Johns Hopkins Hosp. Bull., xii. (1901) pp. 68–77.

¶ Centralbl. Bakt., 1te Abt., xxx. (1901) pp. 281–7.

excellent substratum for the bacillus of soft chancre, of syphilis, and other infective diseases of man and animals. The insects employed have been Orthoptera, Rhynchota, Hemiptera, Coleoptera, Lepidoptera, Diptera, Hymenoptera. The insects lived on the average for about 2 weeks. Inoculations were effected with a fine sharp sterilised needle in the heart, tracheal apertures, in the fat-bodies, between two thoracic segments as far from the digestive and reproductive organs as possible. The insects must be kept, especially in summer-time, in a moist atmosphere. Cultivated in insects the bacillus of soft chancre becomes shorter, gradually being transformed into cocci. It is also more difficult to stain than when obtained directly from a bubo. Although successful cultivations of syphilis were obtained, the results are not yet published.

(2) Preparing Objects.

Rapid Method for Making Slides of Amœbæ. * — M. A. Willcox removes amœbæ from detritus by means of a thin-walled dipper under a magnification of some 20 diameters. The amœba is then dropped on a slip, and, the excess of water having been removed, the animal is fixed with a drop of picric-alcohol (saturated solution of picric acid in 50 p.c. alcohol), after which it is dehydrated with alcohols of increasing strength. This done, the amœba is fixed to the slip with a droplet of very dilute collodion, after which the preparation is hardened in 80 p.c. alcohol. It may then be stained with borax-carmine, hæmatoxylin, &c. Amylic alcohol should be used for dehydration. If the specimen be large, supports may be necessary. Mount in balsam.

Preparation of Crystals as Microscopic Objects. † — S. E. Dowdy gives three principal methods for making preparations of crystals. The first consists of evaporating down a saturated solution of the salt until enough moisture has been driven off to enable the crystals to form rapidly on cooling. Make a saturated solution of the salt in distilled water, and deposit a drop with a pipette in the centre of a slide. Slope the slide to make a film, and remove superfluous fluid with blotting-paper. Hold the slide over a flame until a thin film of salt forms at the edges, then withdraw and allow to cool, and examine under Microscope. If satisfactory, mount in balsam. If the salt be insoluble in water, other suitable solvents are used. These evaporate without the aid of heat. Crystals formed from such solutions will probably require a different mounting medium, such as castor oil, or one in which they are not soluble. Another method is to dissolve gelatin or gum acacia in distilled water, and to add to this a few drops of a saturated aqueous solution of the salt. A drop of the warm mixture is then deposited on a slide, the superfluous fluid drained off, and the slide put aside to cool. Any salt soluble in water is suitable for this procedure.

The second principal method is by fusion. Place a small quantity, say of salicin, on the centre of a slide, and heat over the flame until it just fuses, withdraw before it chars, and allow it to cool gradually, and if successful mount in balsam. Crystals of fatty substances, such as spermaceti, paraffin, &c., are preparable in a similar way. When melted

* Journ. Applied Microscopy, iv. (1901) p. 1450.
† Pharm. Journ., lxvi. (1901) p. 198.

press on a cover-slip, the crystals forming as the mass cools. These crystals may be watched forming under the Microscope any number of times by simply warming the slide.

The third principal method is confined to those substances which are easily volatilised and crystallise on cooling. Some benzoic acid, say, is placed in a dry narrow test-tube, and heated over the flame until it volatilises. The tube is then inverted and made to stand on a slide. The crystals form on the part of the slide covered by the tube, and, if satisfactory, can be mounted in the usual way.

Modelling and Reconstruction Method. * — Florence R. Sabin's paper on the structure of the medulla, pons, and mid-brain of the newborn is preceded by a clear description of the wax-modelling and reconstruction method, which will be found very useful by those interested in this procedure.

Killing and Preserving Slugs. † — O. Goldfuss mentions the following procedures for killing slugs. The animals may be killed in the extended condition by placing them in a glass vessel filled with water, and capable of being hermetically closed by means of a glass plate. Twenty-four to thirty hours usually suffice, but the action is more rapid if a little carbolic acid be added to the water. Even better results are obtained by adding a few drops of kreolin or of lysol, or 2–5 parts of 5 p.c. cocaine. As a preservative, alcohol, when used alone, hardens too much; but 60–70 p.c. alcohol, with a certain percentage of glycerin, is a good preservative fluid. 3–5 p.c. formalin, to which about 5 p.c. of alcohol or some glycerin is added, will be found extremely useful.

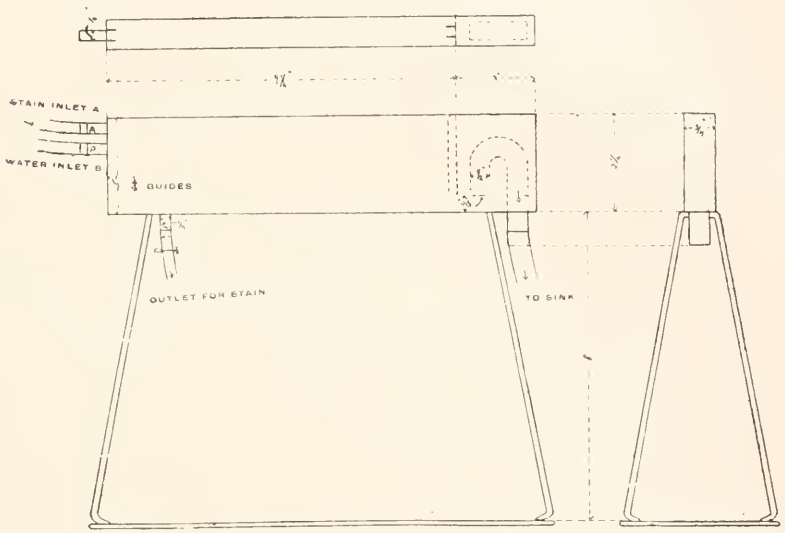
(4) Staining and Injecting.

Apparatus and Method for rapidly Staining large numbers of Sputum Specimens. ‡ — B. R. Rickards designed the apparatus shown in fig. 162. It consists of a long narrow copper bath, mounted on legs which are inclined and terminate in a broad base weighted with lead to ensure stability. At one end near the top are two inlets; the upper one A for the admission of the stain, the lower one B for the water. In the bottom of the bath is a small outlet C for the stain, closed by means of a rubber tube and a pinch-cock. At the other end of the bath, partitioned off by a false wall, is a $\frac{1}{2}$ in. siphon, the inner end of which is left at least $\frac{3}{8}$ in. from the bottom, to prevent the effect of capillarity. The bottom of the bath is 8 in. above the base. The entire apparatus is nickel-plated. Instead of the ordinary slide, a piece of thin plate glass 9 by 3 in. is used. It is etched as shown in the diagram, fig. 163; the rough surface above the spacings is for writing the names of patients with a blue pencil. Several of these plates can be manipulated simultaneously. Carbol-fuchsin and Loeffler's methylen-blue are used for staining, and 3 p.c. HCl in 95 p.c. alcohol as the decoloriser. The technique is as follows. Carbol-fuchsin is admitted through A until the bath is about two-thirds full. The bath is then heated by means of a Bunsen's burner, and while the heating is in

* Johns Hopkins Hosp. Rep., ix. (1900) pp. 925–1045 (8 pls. and 45 figs.).
† Zeitschr. angew. Mikr., vii. (1901) pp. 85–90.
‡ Journ. Boston Soc. Med. Sci., v. (1901) pp. 391–4 (2 figs.).

progress the specimens are smeared on the plate and dried. The plate is then placed in the bath. In about four minutes at 50° C. the specimens are stained, and then the fuchsin is withdrawn through C. Water is then admitted through B, and having been siphoned off

Fig. 162.



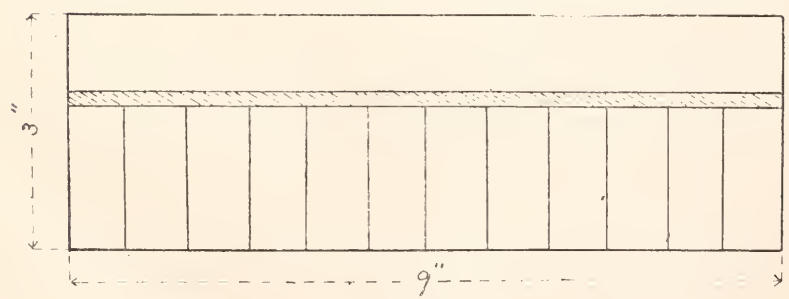


Fig. 163.

two or three times, the preparations are decolorised. The decolorising is performed in glass trays, and when finished, the plate is replaced in the bath and washed. It is then withdrawn, dried, stained with methylen-blue, and examined.

Ammonium Persulphate as a Decolorising Fluid for Staining Spores and Sputum.* — Dr. R. L. Pitfield recommends a solution of ammonium persulphate which acts by oxidation. To demonstrate spores

* Philadelphia Med. Journ., vii. (1901) p. 872.

the film is stained with carbol-fuchsin or with anilin-oil-gentian-violet or fuchsin. The cover-slip should lie in the boiling stain for at least one minute. Then wash, and run on the following solution:—Ammonium persulphate 5 grm.; alcohol 95 p.c., 50 ccm.; H_2O, 10 ccm. At the end of half a minute wash and counter-stain. The preparation will show red or violet spores and bacilli coloured with the contrast stain. Sputum may be stained by the foregoing method, but if pushed too far the tubercle bacilli may be decolorised.

New Staining Method.*—Dr. A. Spuler has devised the following procedure. Finely-powdered cochineal is boiled with distilled water, filtered, and evaporated nearly to dryness. Alcohol is then added, and the mixture filtered and evaporated down. The residue is dissolved in distilled water, and the solution filtered. Pieces of tissue which have been fixed in the usual way are immersed in this staining solution and incubated for 24 hours. On removal they are washed and then mordanted in dilute iron-alum solution. After having been thoroughly washed they are imbedded and sectioned. The sections present pictures like pen-and-ink drawings, the nuclei and cell contours being extremely well stained.

Modification of Gram's Method.†—Dr. C. Kisskalt shows that by using amyl-alcohol most bacteria can be stained by Gram's method, the exceptions being *Bacterium vulgare*, *Bacillus pyocyaneus*, and three vibrios, *V. choleræ*, *V. Metchnikovi*, and *V. albensis*. In all thirty-nine bacteria were tested, and the results are given in a table, at one end of which stands methyl-alcohol followed by ethyl, propyl, butyl, and amyl, in the order given.

Modification of Hoyer's Thionin Stain.‡ — Dr. P. Hári's modification of Hoyer's staining for mucus is carried out in the following way. From the sections, which are all prepared from the celloidin method, all the celloidin must be completely removed by means of ether and ether-alcohol. The ether is extracted by treatment with absolute alcohol for 5 minutes. The sections are then washed in water for 3 minutes, after which they are immersed for 10–12 minutes in the sublimate solution used for fixing the material (sublimate 7, salt 0·5, water 100). The sections are next washed in absolute alcohol for about half a minute, and for a similar time in water, after which they are transferred to a freshly filtered 1 p.c. aqueous solution of thionin for 3–4 minutes. The over-stained sections are washed in water until the dye is no longer given off, and are then immersed in absolute alcohol for a similar object. The sections are then further decolorised in a mixture of equal parts of oil of cloves and carbol-xylol (acid carbol 1, xylol 2). In rather less than a minute the sections are placed on a slide and examined under a low power, to ascertain if the colour reaction has succeeded. As a rule the last process requires to be repeated twice or thrice. The desired effect is attained when the other tissue elements are blue and the mucus cells are red-violet. The carbol-xylol is removed by means of xylol.

* Deutsche Med. Wochenschr., xxvii. (1901) Beilage, p. 116.
† Centralbl. Bakt., 1te Abt., xxx. (1901) pp. 281–4.
‡ Arch. Mikr. Anat. u. Entwickl., lviii. (1901) pp. 678–85.

Simple and Rapid Method of Producing Romanowsky Staining of Blood-Films.*—Dr. W. B. Leishman prepares the stain in the following way. Solution A: A 1 p.c. solution of medicinal methylen-blue (Grübler) in distilled water is alkalised by the addition of 0·5 p.c. sodium carbonate. Solution B consists of a 0·1 p.c. solution of extra B A eosin (Grübler) in distilled water. Equal volumes of the two solutions are mixed in a large open vessel and allowed to stand for from 6–12 hours, being stirred from time to time with a glass rod. The precipitate is then collected on a filter, washed with distilled water, and the insoluble residue collected, dried, and powdered. The powder pigment is dissolved in methyl-alcohol in the proportion of 0·15 p.c., and the solution kept in stoppered glass bottles.

Three or four drops of the solution are deposited on a blood-film prepared in the usual way. In about $\frac{1}{2}$ minute 6 or 8 drops of distilled water are added and allowed to mix with the staining solution. After allowing it to act for about 5 minutes, the stain is washed off with distilled water. The preparation may now be examined either wet or after drying without heat, and mounting in balsam.

Neutral Red for Detecting Bacillus coli in Water. — Dr. R. H. Makgill † concludes from his experiments that neutral red media afford a rapid and delicate test of the presence of *Bacillus coli* in water. By using varying quantities of water a rough estimate can be obtained of the number present, allowance being made for the influence of inhibiting organisms. Where a fair sample of water is examined, a negative result may be taken as evidence of the absence of *B. coli*. Further investigation is needed to decide whether or not a positive reaction always indicates the presence of *B. coli*; but the writer has not observed any case in which this bacillus was absent from a sample of water which gave a typical positive reaction.

Dr. W. G. Savage, ‡ who has also investigated the same subject, finds that a positive neutral red reaction obtained by the method adopted, while not absolutely diagnostic of *B. coli*, yet in the vast majority of cases points to the presence of that organism. A negative neutral red reaction does not certainly exclude *B. coli*, but renders its presence highly improbable. The test is readily applied, and is of great value in the routine examination of water.

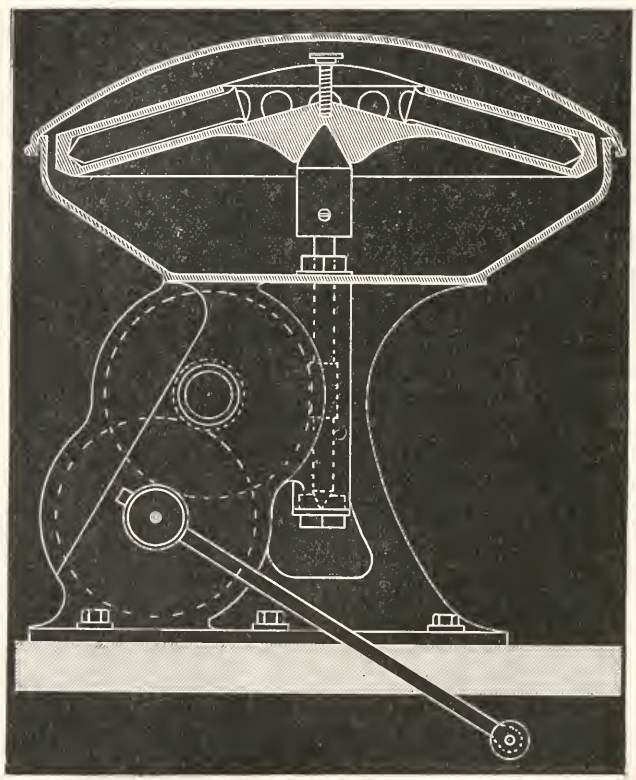
(6) Miscellaneous.

New Centrifuge for Bacteriological Work. § — Dr. J. W. H. Eyre has devised a machine (fig. 164) which is easy of manipulation and fulfils the following requirements. The tubes are of such capacity as will enable from 250–500 ccm. of milk to be manipulated at one time. It has a rate of 2500–3000 revolutions per minute. The gearing is so arranged that the requisite speed is obtained by 40 or 50 revolutions of the crank-handle per minute. The handle is provided with a special clutch, so that, on ceasing to turn, the machine is not stopped. The tube-bearing portion of the machine is a metal disc of sufficient weight to ensure good "flank" movement.

* Brit. Med. Journ, 1901, ii. pp. 757–8.
† Journ. Hygiene, i. (1901) pp. 430–6. ‡ Tom. cit., pp. 437–50.
§ Brit. Med. Journ., 1901, ii. pp. 773–4 (1 fig.).

The machine may be said to consist of three portions—the motion, the bearing spindle, and the disc. The motion is enclosed in a metal box, which is filled up with oil, so that the gearing wheels are running in a regular oil-bath. It consists of one pair of spur-wheels and a pair of screw-wheels, which transmit movement to the upright spindle through a smaller wheel, and the gearing is so arranged that one revolution of the driving wheel—corresponding, of course, to one revolution of the handle—is equivalent, in round numbers, to 50 revolutions

Fig. 164.



the bearing spindle, so that 40 turns of the handle per minute give a speed of about 2000 revolutions of the disc in the same time, and the labour involved in producing this speed is well within the powers of the ordinary laboratory boy.

The handle is attached to the spindle of the driving wheel by means of a short screw with a quick thread, so that, on ceasing to turn the handle and holding it steady, two or three revolutions of the driving spindle completely unship the handle and leave it free in the hand.

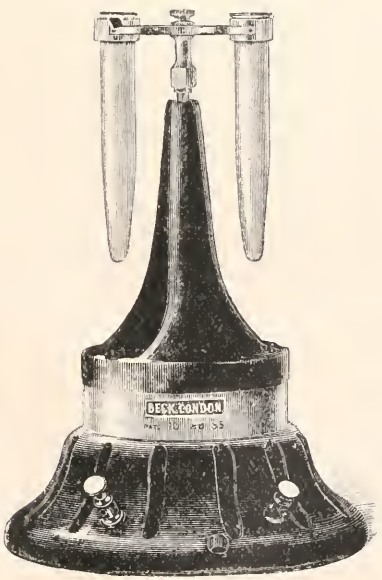
The upright spindle is surmounted by a gun-metal cup containing a cone-shaped block of vulcanised rubber, renewable at will, upon which

in turn rests the metal disc, carrying the centrifugal tubes. This disc is of cast steel, 14 in. in diameter, and weighing 50 lb., drilled to carry twelve stout glass tubes, $6\frac{1}{4}$ by $1\frac{1}{8}$ in. each, holding rather over 50 ccm. of milk. The disc, it will be noticed, is not *fastened* to the bearing spindle, it merely has a conical cup in the centre of its under surface, which receives the rubber cone that forms the head of the spindle, the friction clutch being quite sufficient to transmit the speed to the disc without the least diminution. This rubber head, on account of the amount of play it allows, serves a very important function, in that it renders the machine practically self-centering and automatic in its balancing. For instance, if only two tubes full of milk are placed in the machine, even in two contiguous holes, the machine can be run as rapidly and as smoothly as when the disc is either empty or completely filled with tubes.

The central aperture in the disc, through which the tubes are introduced, is closed by a copper cap which screws into the body of the disc, and the disc itself is enclosed in a copper basin, with a loose cover; both these details being introduced in order to lessen the air resistance the machine has to overcome.

Electric High-speed Centrifuge.—Fig. 165 represents this instrument, constructed by Messrs. R. and J. Beck (Ltd.), which was exhibited

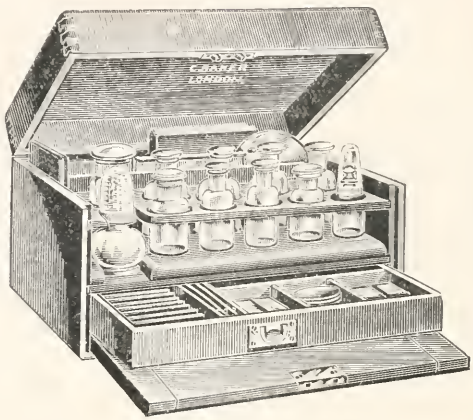
Fig. 165.



at the Meeting of the Society on October 15th. It may be made to run by an electric current at a very high rate of speed, regulated within certain limits by the interposition of different resistances.

Mounting Cabinet.—Messrs. C. Baker have provided a mounting cabinet (fig. 166), consisting of a strong well-finished mahogany case,

Fig. 166.



polished inside and out, 13¼ by 8¾ by 7¼ in., with hinged front, drawer, and lock and key, containing bottles of reagents, instruments, &c., of which a list is supplied in their Catalogue for 1902.

Combined Slide and Cover-glass Forceps.* — L. N. Boston has devised a forceps which can be used as a slide- and slip-holder. It is made of brass. The method of using the forceps is shown in the illustrations (figs. 167, 168).

Fig. 167.

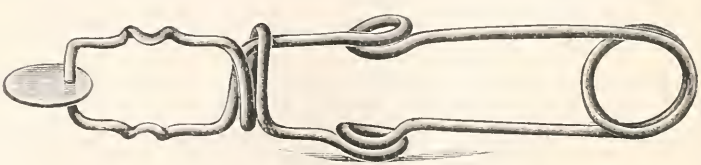


Fig. 168.

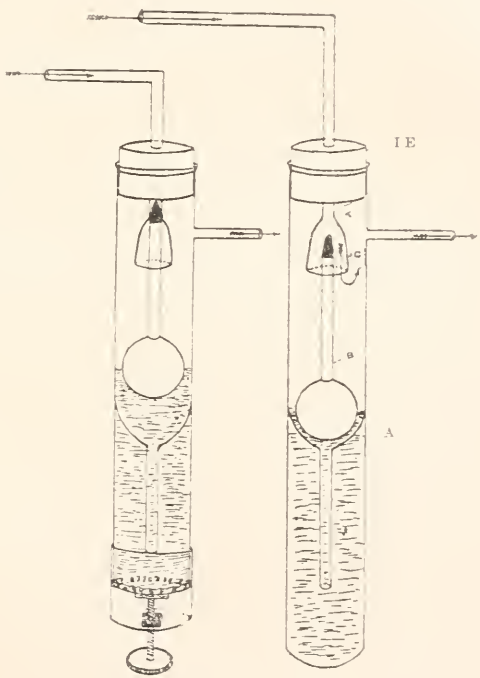
New Thermo-Regulator.†—T. Palmer describes a thermo-regulator (fig. 169) which gives satisfactory results with Jung's air steriliser.

* Journ. Applied Microscopy, iv. (1901) p. 1436 (2 figs.).

† Tom cit., p. 1449 (2 figs.).

l E is a rubber cork through which passes the tube T which terminates in a cup-shaped expansion C. B is a glass float, the upper end of which closes T when it rises, and drops into A when it descends. A is a cup with a tube dipping into the mercury. When the apparatus is in work, the heat causes the mercury to rise into the cup A, so that the float B ascends into the tube T, thus cutting off the gas supply. The form of the right-hand figure is serviceable for only one temperature, but by interposing a metal cap and screw (as shown in the left-hand figure) acting on a leather diaphragm, the apparatus may be regulated for any temperature.

Fig. 169.



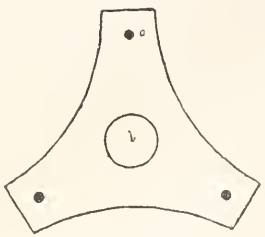
Birge's Cone Net.* — E. A. Birge describes how to make a cone-shaped net for collecting small aquatic organisms, and R. H. Wolcott describes some modifications which have served to render this apparatus more useful. For the details of the construction the original should be consulted.

Raising the Melting-point of Gelatin by means of Formalin.† — Dr. H. J. van't Hoff found that the addition of formalin raises the melting-point of gelatin. The addition of 1 to 1750 produces a gelatin which liquefies in a water-bath at 40°, while in the proportion of 1 to 500 (1 drop of 40 p.c. formalin to 10 grm. gelatin) the mass retains its solidity in boiling water.

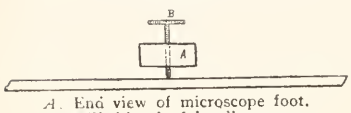
* Journ. Applied Microscopy, iv. (1901) pp. 1405–9 (7 figs.).
† Centralbl. Bakt., 1te Abt., xxx. (1901) p. 368.

Device for Levelling the Microscope.*—T. O. Reynolds shows the ingenious device (fig. 170) for levelling a Microscope when used for liquid preparations. The expense of a spirit-level may be saved by means of a glass slip on which are placed a few drops of water containing particles of opaque material. The apparatus is levelled by means of the three screws, and the desired position is indicated when currents are no longer perceptible.

Fig. 170.



Microscope Foot.
a. Threaded hole for leveling screw.
b Microscope pillar.



A. End view of microscope foot.
B. Milled head of leveling screw

Method for Demonstrating the Structure of Bacteria.†—In his researches on the structure of bacteria, Prof. K. Nakanishi adopted the same method which he found suitable for the demonstration of the malaria parasite. This method consists in making a film of the stain on a slide. A saturated aqueous solution of methylen-blue is deposited on a slide and allowed to dry. In this way a thin layer of pigment is formed. A droplet of blood is deposited on a cover-glass, and the latter on the staining film. Fluids containing bacteria are treated in a similar way. Bouillon cultures are the most suitable. Cultivations on solid media require to be suspended in some fluid in which the pigment is easily soluble. For methylen-blue, blood-serum, ascitic fluid, &c., may be used. The author, however, found that distilled water answered very well.

Klein's Method of Counting Bacteria, and some Applications thereof.‡—This method consists in mixing 0·1 to 1 ccm. of the fluid containing bacteria with the same quantity of staining fluid. After the lapse of a minute a portion is removed with a platinum loop of known size. A film smeared on a cover-slip is dried and mounted in the usual way. The number of bacteria in a cubic centimetre was calculated after counting 50 fields under the Microscope. For this purpose it is necessary to know how many fields go to 1 square centimetre of cover-glass.

F. H. Hehewerth made the number to be 5656. The author contrasts the results obtained by this method with Koch's plate method, and finds that Klein's procedure gives a greater number of organisms; this may be accounted for by the fact that when a preparation is stained after being fixed, a large number of bacteria are washed away. For fluids which contain few bacteria Klein's method is not to be recommended, and a perfect method of counting bacteria has yet to be devised.

The author employed the method for determining the duration of bacterial generations, and their increase in certain periods of time on different media and at different temperatures.

The author measured the size of bacteria, and found that the length and breadth were extremely variable even in quite fresh cultures.

By comparing the results of the Klein and Koch procedures, the

* Journ. Applied Microscopy, iv. (1901) p. 1458 (2 figs.).
† Centralbl. Bakt., 1te Abt., xxx. (1901) pp. 98–102.
‡ Op. cit., xxix. (1901) pp. 72–3 and 914.

number of bacteria in a culture which were no longer capable of development was easily determined.

Method for Distinguishing between different Kinds of Blood. * — Dr. Uhlenhuth's method promises to fill up a gap which has long been vacant in the technique of forensic medicine. Before dealing with human blood, the author experimented with the blood of cattle. At intervals of 6–8 days he injected 10 ccm. of defibrinated ox-blood into the peritoneal sac of rabbits—five times in all. Eighteen different blood-solutions were then tested in the following way:—The blood was diluted with water until the fluid was of a faint red hue (about 1 p.c.). The solution was filtered, and the filtrate mixed with an equal bulk of 1·6 per cent. salt solution. The accurate admixture is of great importance.

To about 2 ccm. of this blood-solution 6–8 drops of the serum of a rabbit previously treated with ox-blood were added. In such solutions an obvious and increasing cloudiness arose. All other blood solutions remained clear, as did also the untreated normal rabbit's blood.

The method was then extended to human blood. Rabbits were injected with human blood. A turbidity arose only in those solutions to which human blood was added. Only a trace of blood was necessary to bring about the reaction, and blood which had been dried on a board for four weeks produced a positive result.

Piorkowski's Method of Detecting Typhoid Bacilli.† — A. Peppler carefully tested Piorkowski's method for demonstrating the presence of typhoid bacilli, and arrived at the conclusion that, though of considerable merit, it was not always satisfactory; for a negative result does not disprove the presence of typhoid; and even if the colonies appear characteristic, there is no certainty that they may not be those of some other bacterium, so that further tests are necessary.

In the course of the investigation, a new bacterium, designated *Bacterium alcalifaciens*, was isolated by means of phenolphthalein-urine-gelatin, and this organism was employed to render urine alkaline in the preparation of the urine-gelatin.

Acid-free Cement.‡ — 250 grm. of powdered dammar resin are dissolved in 1 litre of petroleum ether in a spacious flask, and then ¼ litre of 10 p.c. NaHO are added. The mixture is well shaken and boiled for 10 minutes, and then, after having been allowed to settle, the perfectly acid-free ethereal solution is filtered off.

Iron and Phosphorus.§—J. E. Stead gives parts iii. and iv. of his researches. Part iii. deals with the constitution and microstructure of pig metals containing iron, carbon, and phosphorus. The author arrives at the following conclusions (*inter alia*):—(1) That with the aid of the Microscope it is possible to detect the phosphide eutectic in pig irons, even when the amount is as low as 0·03 per cent.; (2) that in white irons it is necessary to use the heat-tinting process to enable the cementite to be distinguished from the phosphide.

Part iv. deals with the diffusion of phosphide of iron in iron, and

* Deutsche Med. Wochenschr., xxvii. (1901) pp. 82-3.

† Inaug. Diss. Erlangen, 1901, 8vo, 77 pp. See Centralbl. Bakt., 1te Abt., xxix. (1901) pp. 879–81; Bot. Centrabl., lxxxvi. (1901) pp. 182–3. Cf. this Journal, 1900, p. 639.

‡ Zeitschr. angew. Mikr., vii. (1901) p. 102.

§ Metallographist, 1901, pp. 332–60 (2 figs.). Cf. this Journal, *ante*, p. 608.

the conclusions arrived at are:—(1) That the observations of Arnold and MacWilliam, proving that solid phosphide of iron does diffuse when in the solid state into solid iron, under certain conditions, have been fully confirmed; (2) that if time is given, the quantity which will diffuse into iron is very considerable, amounting to what is equivalent to about 1 per cent. of phosphorus; (3) that it still remains to be proved at what temperature diffusion commences. The paper includes valuable and elaborate appendices on eutectics, solid solutions, heat-tinting, and bibliography.

Clinical Pathology and Practical Morbid Histology.*—T. Strangeways Pigg's Manual of Clinical Pathology and Morbid Histology is a very practical and most useful little work; and, though intended for the use of students of medicine, will be found of considerable assistance to other workers in bacteriology and histology. It includes methods for the examination of blood, sputum, diphtheria, ringworm, gonorrhœa, pus, bacteria, and urine. There is also a *resumé* of the procedures required in practical histology, in which the following stages are given with much clearness:—Fixing and hardening tissues, decalcification, imbedding in paraffin and celloidin, cutting sections on a freezing microtome or a Cambridge rocking microtome, and on a sliding microtome. Staining frozen sections with alum-carmine and with hæmatein. Staining paraffin and celloidin sections. Staining sections for fatty changes, for amyloid changes, for micro-organisms, for free iron; of nervous tissue; staining elastic tissue.

At the end is a list of 53 formulæ, which are in constant use in the laboratory. The paragraphs on the blood are preceded by two coloured plates showing normal and abnormal erythrocytes and leucocytes, with descriptions by Hon. G. Scott. This will be found extremely valuable to those interested in this special department.

Demonstrations of Microscopic Manipulation. — For the benefit of amateurs as yet unacquainted with the full resources of the instrument, Messrs. Baker (244 High Holborn) have set aside four afternoons in each month (except July, August, and September) for the demonstration of microscopic manipulation. These demonstrations will be given on the 1st and 3rd Friday, and the 2nd and 4th Tuesday in each month, from 3 p.m. to 6 p.m., the demonstration on each Tuesday being the same as that on the preceding Friday. These demonstrations will be entirely without charge; full particulars are given in Messrs. Bakers' Catalogue for 1902.

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* London, Strangeways and Sons, 1901, 2nd ed., 107 pp., 7 pls., and 6 figs.