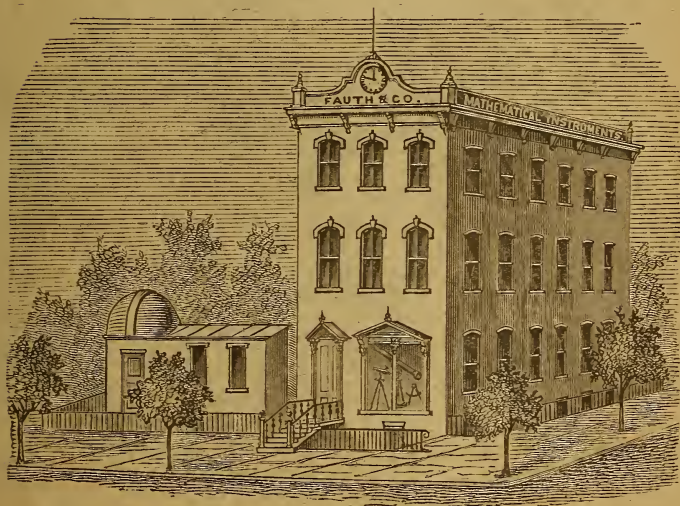


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CATALOGUE
OF
ASTRONOMICAL AND SURVEYING
INSTRUMENTS

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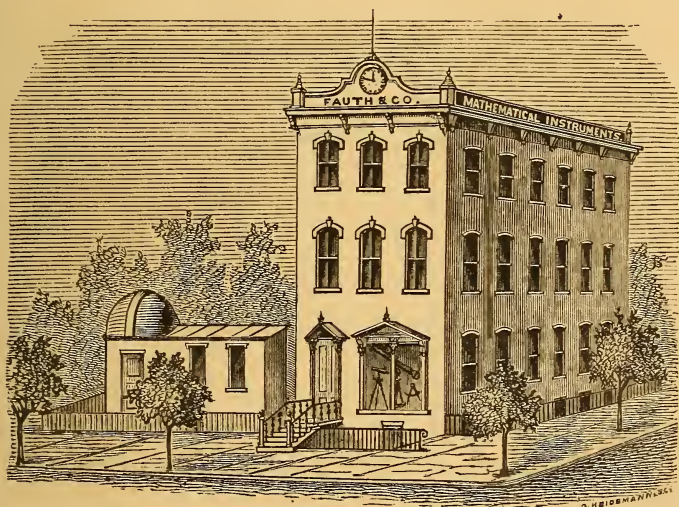
FRONTING CAPITOL PARK,

WASHINGTON, D. C.

CATALOGUE
OF
ASTRONOMICAL AND SURVEYING
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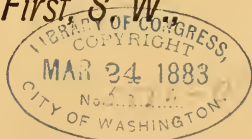
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FAUTH & Co.,



No. 59 B Street, Corner of First S. W.

FRONTING CAPITOL PARK,

WASHINGTON, D. C.



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International Exhibition,

PHILADELPHIA, 1876.

The United States Centennial Commission has examined the report of the Judges, and accepted the following reasons, and decreed an award in conformity therewith :

Philadelphia, December 14th, 1876.

REPORT ON AWARDS.

Product, ASTRONOMICAL AND SURVEYING INSTRUMENTS.

Exhibitor, FAUTH & CO., Washington, D. C., U. S.

The undersigned, having examined the product herein described, respectfully recommend the same to the U. S. Centennial Commission for Award, for the following reasons, viz. :

For excellence in design and construction of the Instruments exhibited—consisting of an 8-foot equatorial Telescope, completely mounted, with a 6½-inch object glass, by A. Clark & Sons; an Alt-Azimuth Instrument, with 12-inch horizontal circle read by three, and 10-inch vertical circle, read by two micrometer-microscopes with radial illumination, and provided with chambered levels of first-class accuracy; also a Transit-Theodolite, and a levelling Instrument of lesser size.

J. E. HILGARD,

Signature of the Judge.

APPROVAL OF GROUP JUDGES.

E. LEVASSEUR,
F. A. P. BARNARD,
JOSEPH HENRY,
P. F. KUPKA,

J. SCHIEDMEYER,
JAMES C. WATSON,
GEO. F. BRISTOW,
ED. FAVRE PERRET.

A true copy of the record.

[SEAL]

FRANCIS A. WALKER,

Chief of the Bureau of Awards.

Given by authority of the U. S. Centennial Commission.

A. T. GOSHORN,

Director General.

J. L. CAMPBELL,

Secretary.

J. R. HAWLEY,

President.





Fauth & Co. received the *only* gold medal awarded for Instruments at the Cincinnati Industrial Exposition in 1882 over all competitors.

INTRODUCTION.

IN presenting a new illustrated Catalogue and Price-List, we take this occasion of thanking our friends for past favors and to solicit a continuance of their patronage. Our constant aim is to improve our instruments, increase their accuracy and simplicity, and make their use pleasant and convenient.

This Catalogue contains only the more important of our manufactures, instruments and apparatus that have been designed for special purposes not being included. We do not wish to occupy space in printing testimonials: but for every instrument herein mentioned we refer to parties using them, who will testify as to their worth.

The prices are put as low as good workmanship and the best of materials will allow.

We use only the very best objectives, well corrected for chromatic and spherical aberration.

Our graduations are always on solid silver, unless otherwise mentioned, and we call special attention to the beauty and correctness of our divisions.

Our level vials are all ground, and their sensibility is in accordance with the use of the instrument for which they are intended. Our finest levels, which are chambered for the regulation of the bubble in changes of temperature, are ground to a radius from 900 to 1,200 feet, and are filled with pure ether. The report of the judges of the Centennial Exposition fully attests the excellence of our levels. Since then we have made great improvements in their manufacture, and can refer to numerous parties in different parts of the country as to their excellent performance.

The weight of our instruments is carefully considered in connection with their use. Those intended for purely astronomical or the higher grades of geodetic work, while not of excessive weight, are yet so constructed as to insure perfect stability. Those the use of which necessarily involves much transportation by hand are so constructed that, while the weight is materially decreased, the strength required is obtained by a judicious and careful distribution of the metal.

All portable instruments, with their accessories, are packed in neat boxes, firmly and conveniently arranged, so they can be put in and taken out without trouble.

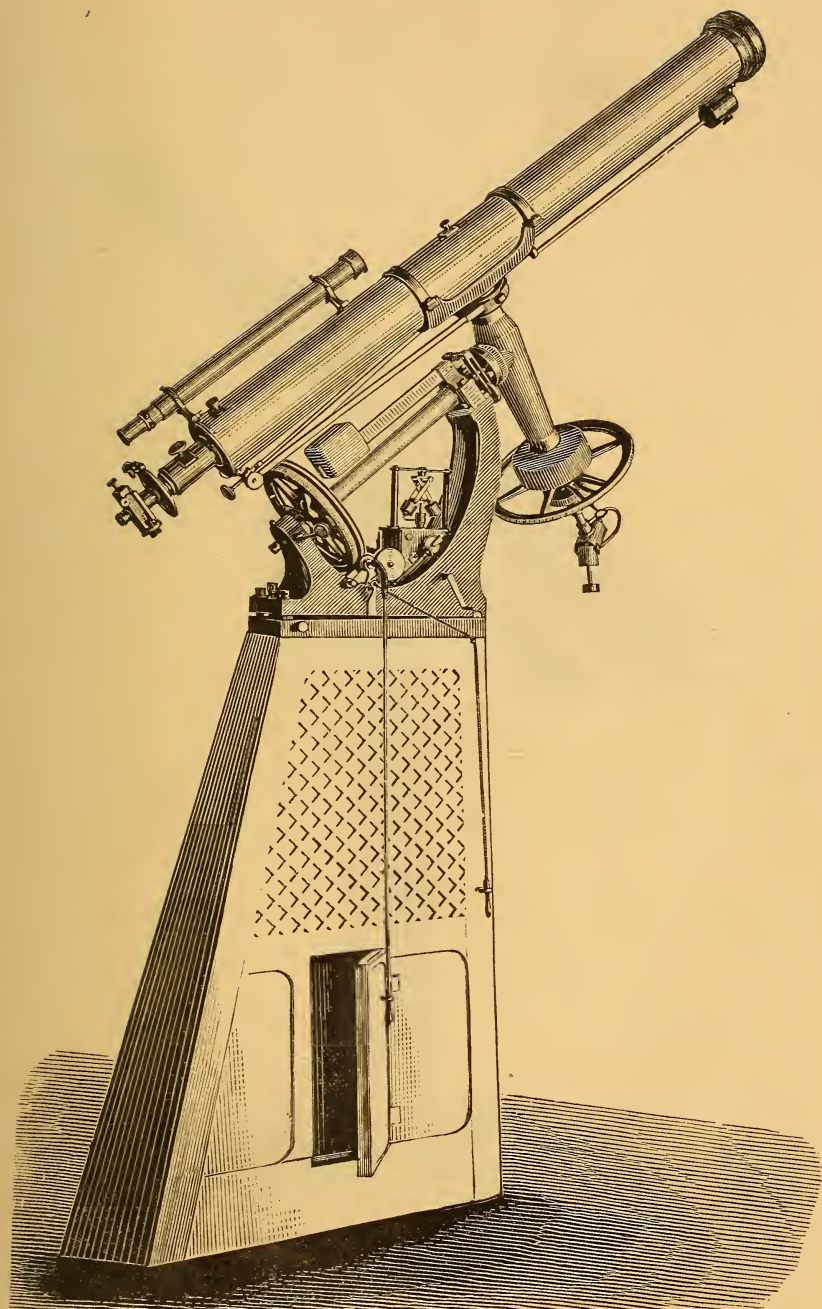
Terms net cash.

Deposits will be required on orders from persons unknown to us.

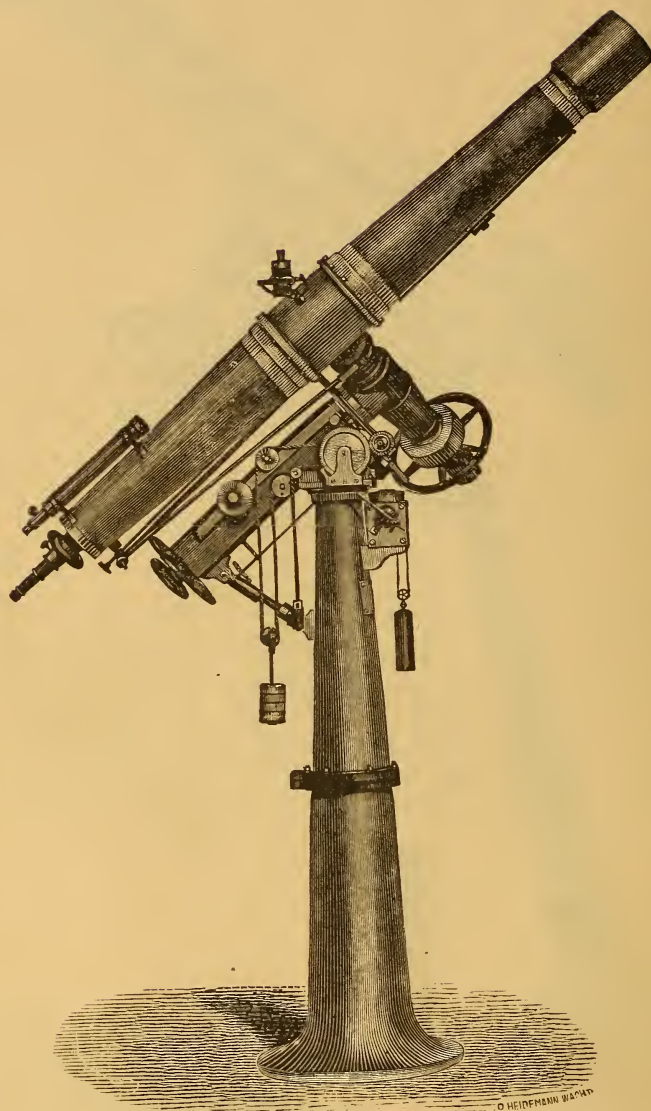
REFLECTORS.

Lovers of the study of Astronomy who cannot afford the necessarily great expense of a refractor will find much satisfaction in the use of a reflector.

Having had numerous inquiries for this class of instruments, we have arranged with Mr. I. A. Brashear to furnish us with his deservedly-celebrated speculas and flats, which we mount with or without clockwork, as purchasers may desire. We shall shortly issue a price-list of reflectors, and merely state in advance that a 6-inch one can be furnished for about \$200.00, ranging up to \$800.00 for a 15-inch, completely mounted on an equatorial stand without circles or clockwork.



No. 1.
EQUATORIAL.



No. 2.

EQUATORIAL.

Cuts Nos. 1 and 2 show two styles of Equatorials made by us.

No. 1 is intended to be mounted on a brick or stone pier, which is especially to be recommended for Telescopes of large size. We have, however, built several of them with iron piers. No. 1 is then like No. 2, complete in itself, ready to be set up in the observatory.

We have added several important improvements to these instruments:

The Telescope can be moved in R. A. without stopping the clock or disengaging the worm. When moved sufficiently the clock acts again with the regular rate, without previous clamping. If desired, an additional R. A. circle is provided, driven by an auxiliary clock-work, which is kept running. An index shows the R. A. of the point to which the Telescope is then directed.

The rate of the driving-clock is readily changed from sidereal to lunar.

Our Equatorials are constructed with the utmost exactness, and every one is provided with the following accessories:

FINDER.—A number of micrometrical and astronomical eye-pieces; transit eye-pieces and sun-shades; improved position micrometer, with parallactic eye-piece movement, fine movement for spider line, and rapid movement for entire micrometer to traverse the field. The micrometer head is divided on silver; the whole revolutions are read off on a separate dial, which, in our opinion, is the prettiest device for recording whole turns. The position circle is divided on silver, reading by opposing verniers and microscopes to minutes or hundredths of a degree. Clamps and tangent-screws, or, if desired, rack and pinion movement.

LARGE DECLINATION AND HOUR CIRCLES, divided on silver, and reading with two verniers and microscopes to five seconds of arc and single seconds of time respectively. Coarse graduation, with pointer, for convenience in setting, is put on the edge.

DRIVING-CLOCK with conical pendulum connected with polar axis; can be thrown in and out of gear from eye-end of Telescope; additional tangent-screw motion in R. A. and Decl. by means of rods and handles. Illuminating lamps attached to end of declination axis.

No. 1.—Equatorial Telescope, of 4-inch aperture, with six eye-			
	pieces, fitted up as above.....		\$975 00
" 2.—	Same, without clock-work or micrometer.....		700 00
" 3.—	" 5-inch aperture.....		1,400 00
" 4.—	" without clock-work and micrometer.....		1,100 00
" 5.—	" 6-inch aperture.....		1,800 00
" 6.—	" without clock-work and micrometer.....		1,500 00
" 7.—	" 7-inch aperture.....		2,500 00
" 8.—	" 8 " "		3,000 00
" 9.—	" 9 " "		4,000 00
" 10.—	" 10 " "		5,500 00

The prices of larger instruments may be had on application.



No. II.

PORTABLE EQUATORIAL.

Astronomical Telescope, mounted equatorially on a strong tripod stand, with or without circles and tangent-screw motion.

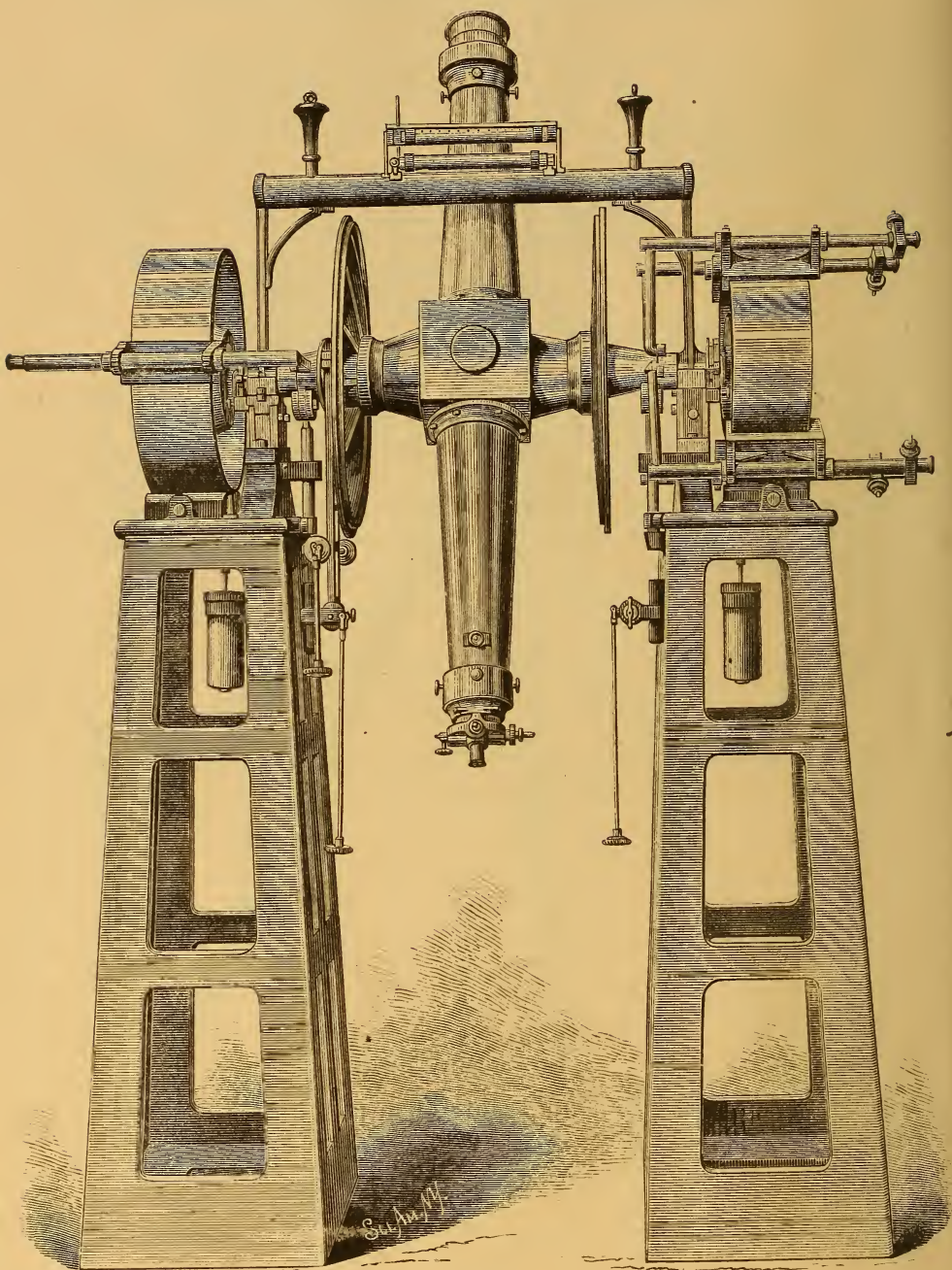
No. 11.—Equatorial Telescope, of 3-inch aperture, mounted as above, with finder, silvered circles, tangent-screw motion, sun-shade, terrestrial and astronomical eye-pieces.....	\$300 00
No. 12.—Same, without circles or tangent-screw motion.....	220 00
No. 13.—Same, 4-inch aperture, like No. 11.....	400 00
No. 14.—Same, without circles, etc.....	320 00

RECONNOITRING DRAW-TELESCOPE.

These are very convenient to carry. The Telescope, which has a fine objective of two inches aperture, closes up in a leather case about 12 inches long, with straps attached, and is easily fastened to the stand by a circular clamp. The stand has a small divided circle for roughly measuring angles. Stadia wires are inserted in the eye-piece for measuring distances. The stand, when folded, forms a round staff of about 2 inches diameter.

No. 15.—Reconnoitring Draw-Telescope, 2-inch aperture, as described above.....	\$80 00
NOTE.—If Heliotrope fixtures are desired, (see cut No. 62,) consisting of two plate-glass mirrors and two sight-rings, it increases the price.....	20 00
Clamp and screw attachment, to screw into a tree or post, extra.	7 50
The above Telescope, without the stand.....	30 00

FIXED TRANSIT INSTRUMENTS.



No. 16.

TRANSIT CIRCLE.

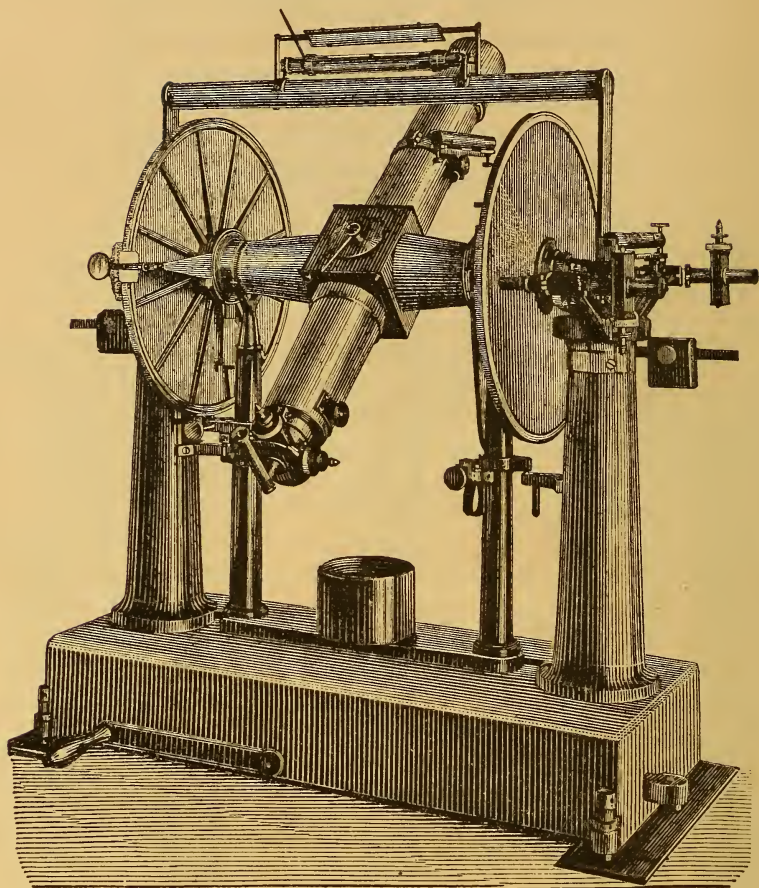
- No. 16.—Transit Circle, with Telescope of about 8 feet focal length and 6 inches aperture. Circles three feet in diameter, one divided into five-minute spaces, which are read off by means of 4 micrometer-microscopes to single seconds. The microscope-holder is in the form of a pulley concentric with the circles, allowing the ready shifting of the microscopes to any part of the graduation. The other circle serves as a finder, and is provided with a coarse graduation. Clamp and tangents by means of rods and handles. Illumination regulated by means of a milled head near eye-end. The pivots are about two inches in diameter, made of hardened steel or phosphor bronze. The level, of best quality, is read by means of a mirror. R. A. and Decl. micrometer with parallactic eye-piece motion. Iron piers coated with asbestos and covered with mahogany; the cut shows it without this covering. Six micrometer eye-pieces and one diagonal. Price.....\$4,000 00
- No. 17.—Same, without circles and microscopes; two 6-inch setting circles with level alidades attached near the eye-end..... 2,500 00
- No. 18.—Same as No. 16; telescope 5 inches aperture; circles 30 inches diameter; 4 microscopes..... 3,000 00
- No. 19.—Same, without the large circles, but with two finders. 2,000 00
- No. 20.—Transit Circle, with telescope of 4 inches aperture; circles 24 inches diameter; in other respects like No. 16... 2,400 00
- No. 21.—Same, without the large circles, but with two finders. 1,900 00
- Collimators, revolving in Y's, with sensitive level over telescope; micrometer eye-piece according to size of objective, from.....\$250.00 upwards.

The above prices include reversing apparatus and observing chair, with arrangement to raise and lower the back.

NOTE.—These instruments can be mounted upon stone or brick piers, which is, perhaps, the better plan.

When, in 1877, we made the Princeton Meridian Circle, we guaranteed the graduation to be within one second. A critical examination by Prof. C. A. Young shows the graduation to be much better than that. Since then we have improved our Dividing Engine to such an extent that we guarantee our graduation to be within one quarter second.

SMALLER TRANSITS.

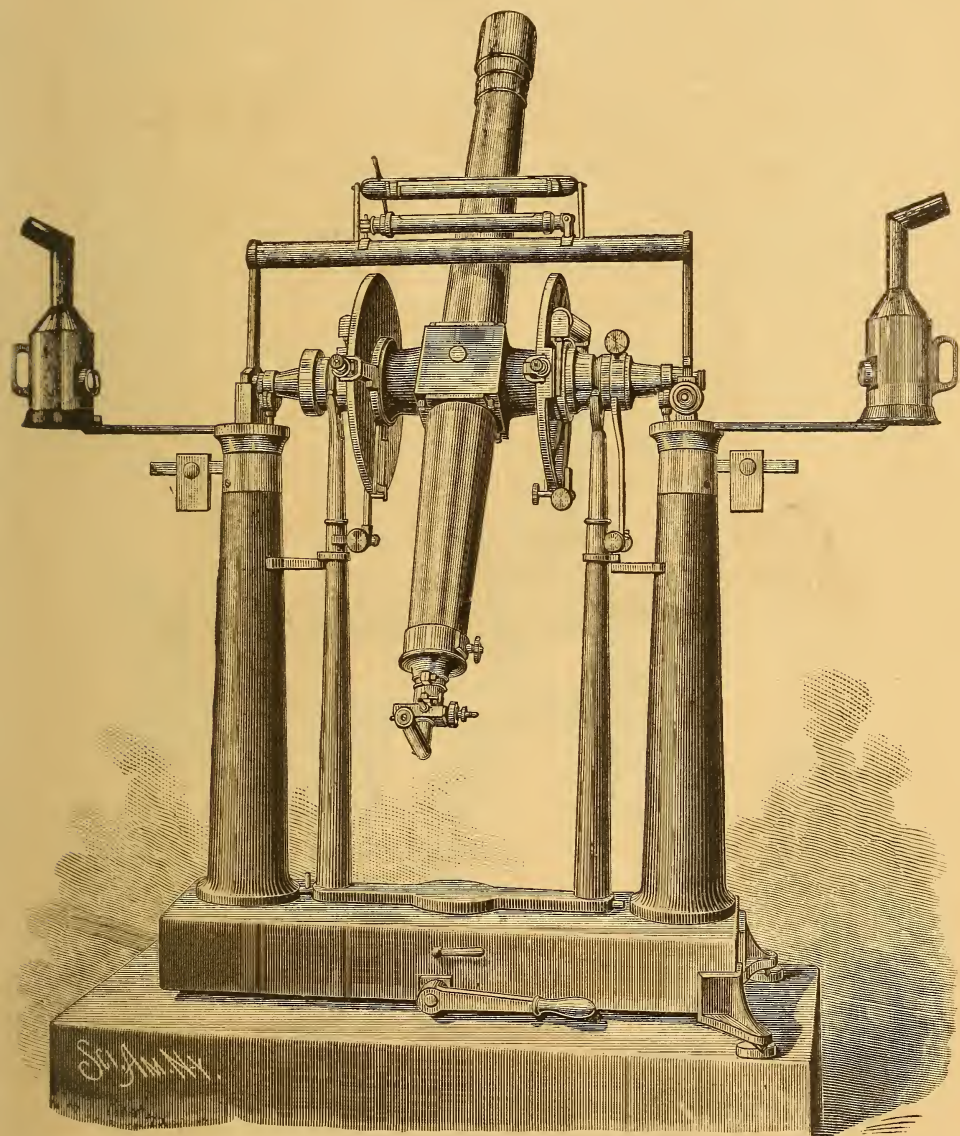


No. 22.

TRANSIT CIRCLE.

No. 22.—Transit Circle, of three inches aperture, and circles of 16 inches diameter. One of the circles is coarsely divided on the edge, and serves as a finder. The other is divided into 5-minute spaces, read by two micrometer-microscopes to single seconds. The micrometers can be transferred from one pier to the other. Sensitive striding level, read by means of a mirror. R. A. and Decl. micrometer, level over micrometer-holder; a level is attached to the telescope for measuring differences of zenith distances. The reversing apparatus allows the instrument to be reversed with the greatest ease. The iron stand is provided with the necessary adjusting

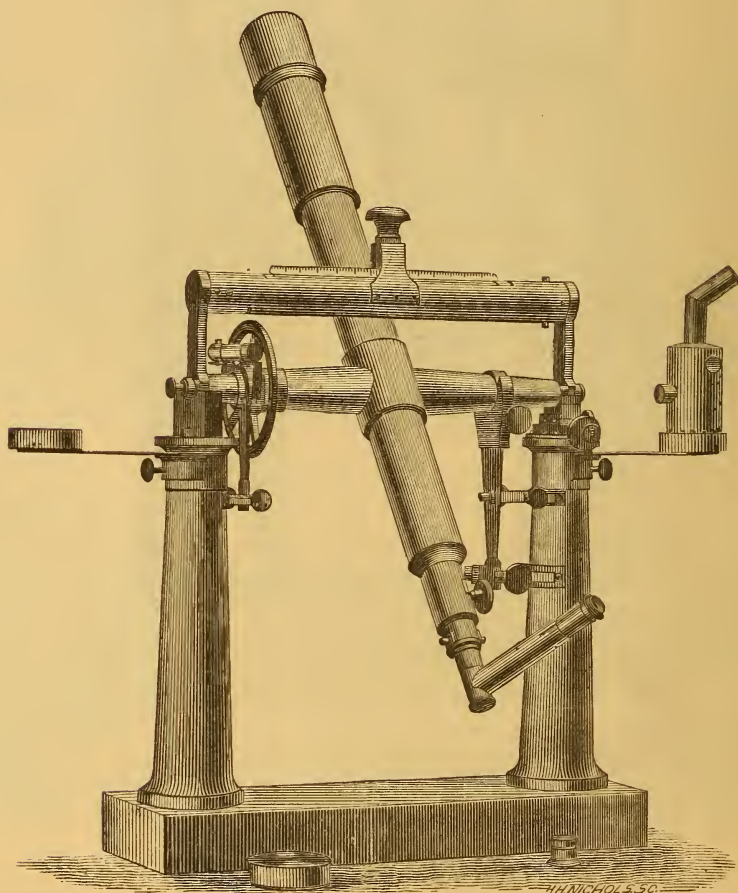
screws for moving in altitude and azimuth. The instrument is complete in itself, ready to be put on pier, and is provided with mercury basin, diagonal, direct and collimating eye-piece, lamps, etc. Price.....\$1,650 00
 No. 23.—The same, with four-inch telescope..... 1,800 00



No. 24.

3-INCH TRANSIT.

- No. 24.—Transit Instrument, of 3 inches aperture, about $3\frac{1}{2}$ feet focus. The axis carries two 12-inch circles, one reading to 10 seconds, the other to minutes; both are divided on the edge. The fine circle carries the latitude level. The striding level over the axis is read by means of a mirror. The iron stand has the necessary adjustments for altitude and azimuth. Reversing apparatus, mercurial basin, diagonal, direct and collimating eye-pieces, lamps, etc. Price..\$1,000 00
- No. 25.—The same, with telescope of 3 inches aperture and about $3\frac{1}{2}$ feet focal length. 6-inch setting circle, with level alidade on axis; delicate striding level; glass micrometer instead of spider lines; direct and diagonal eye-piece, with parallactic movement; improved clamp. One of the Y's can be moved in azimuth, the other in altitude, and there be firmly clamped. Reversing apparatus, lamps, etc..... 790 00



No. 26.

Cut No. 26 represents a smaller Transit of $2\frac{1}{2}$ inches aperture, and about 30 inches focus. The axis carries a 6-inch finding circle, with level alidade; the striding level is chambered and reads to single seconds; glass diaphragm; direct and diagonal eye-pieces, with sun-shades, lamps, etc. The instrument is adjustable in altitude and azimuth, and is in all respects, except in size, like the preceding ones. Price of this instrument, without reversing apparatus.....\$600 00

SMALL TRANSITS.

Small Transits, suitable for watch and clock makers for taking time. The stand is similar to the one shown on cut No. 26. The Y's have no adjustment, and the telescope is without clamp or circle; a good striding level, prismatic eye-piece with sunshade and glass micrometer are provided.

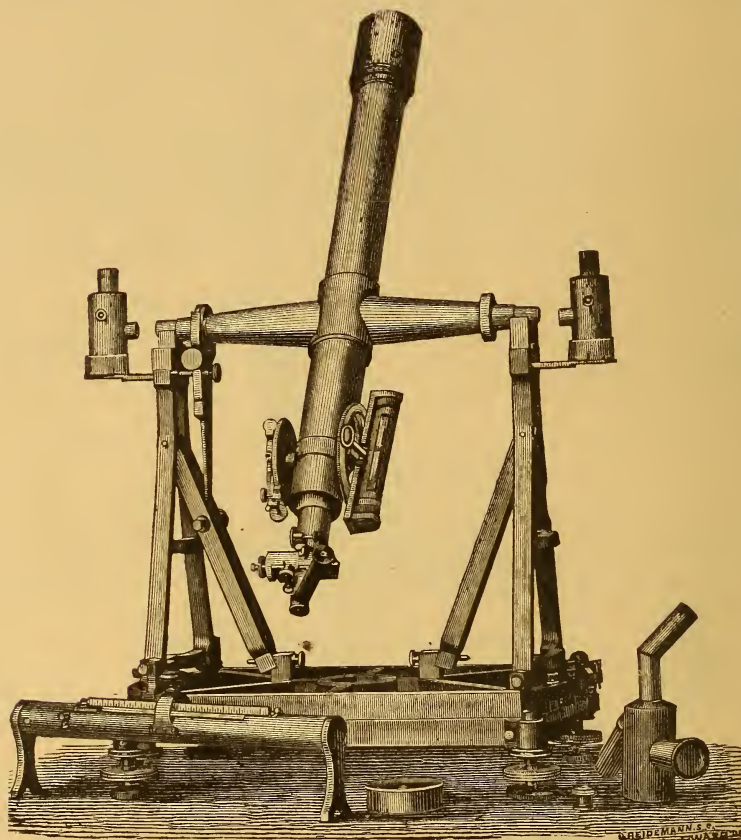
No. 27.—Transit, with telescope of $1\frac{1}{2}$ inches aperture, 16 inches focus.....\$165 00
 No. 28.—Same, with telescope of $1\frac{1}{4}$ inches aperture..... 140 00

DIPLEIDOSCOPIES.

These small instruments are excellent for the determination of time; the telescope is about 4 inches in length; the stand is provided with adjustments to get it into the meridian. Price.\$35 00

PORTABLE INSTRUMENTS.

All the following Field instruments are packed complete in boxes and provided with the following accessories: Shade, screw-drivers, adjusting-pins, plumb-bob, reading-glass, and dust brush.

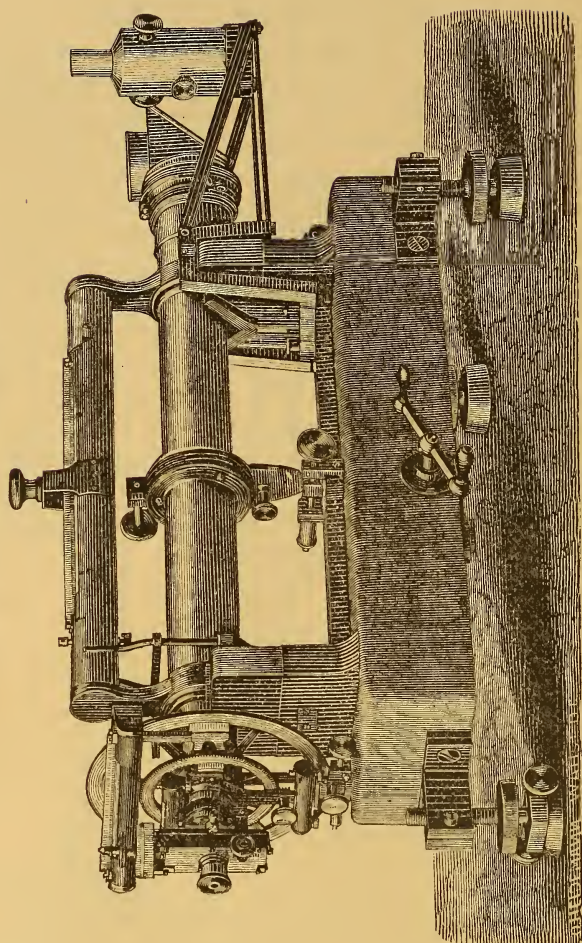


No. 29.

COMBINED TRANSIT AND ZENITH INSTRUMENT,
as devised by Prof. G. Davidson, U. S. C. & G. S.

No. 29.—The frame of this instrument consists of two parts, the upper part with the uprights revolving upon the lower, to which it can be firmly clamped if used as a Transit. When used as a Zenith instrument, the clamp-screws are removed; stops and tangent-screw motion for turning it exactly 180° around are provided. Two verniers and scale are attached to the upper and lower base. The telescope has a clear aperture of $2\frac{1}{2}$ inches, and about 28 inches focal length. It is provided with micrometric eye-piece; two setting circles, divided on silver, and reading to minutes, attached to the telescope-tube near the eye-end; one of these carries the delicate zenith level, which reads to single seconds and is chambered; in addition, also, an ordinary finding level. The clamp is the latest improved pattern, and need not be carried around with the telescope when reversing. The pivots are of phosphor bronze, and finished with the utmost care; bearings are agate. The illumination is effected through the pivots; the striding level is chambered, and reads to single seconds. A Ramsden eye-piece, diagonal eye-piece, two illuminating and one reading lamp, are provided. The stand folds and is packed in box with the telescope. Price, complete.....\$990 00

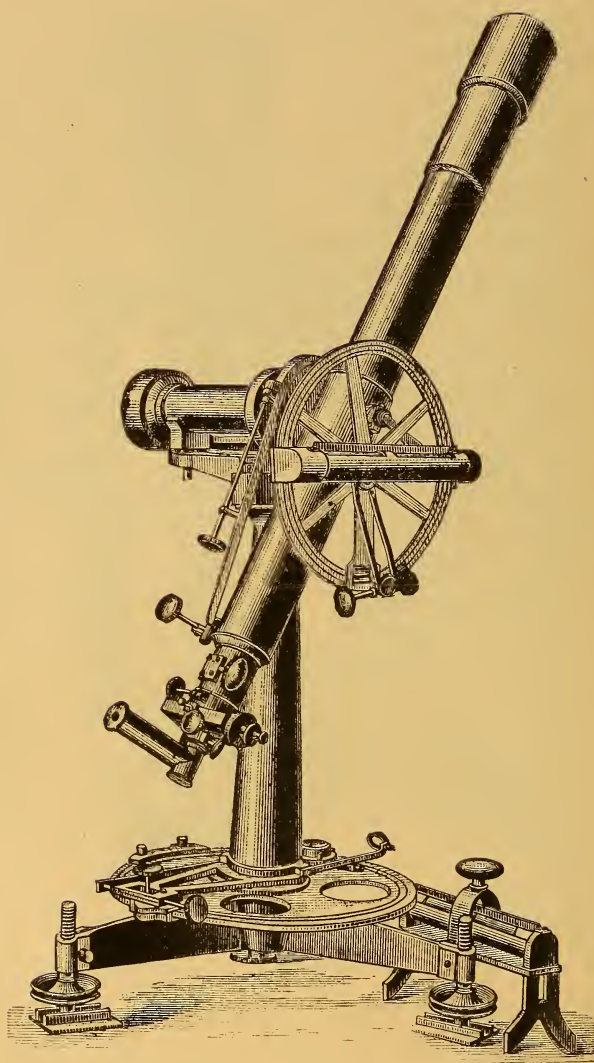
THE COAST SURVEY PRISMATIC TRANSIT.



No. 30.

This form of transit, suggested by Steinheil, designed by G. N. Sægmüller, was made by us for the United States Coast Survey. It is intended to be set up in the prime vertical, the telescope pointing east and west. By the use of a prismatic objective, any star passing the meridian will be reflected and seen in the field when the instrument is set up correctly; by turning it in its bearings it will sweep the meridian. The pivot-rings are of phosphor bronze, and, to avoid flexure as much as possible, these rings are again connected by a tube, so that the telescope body is really double. By one of the three setting-screws the instrument is moved in azimuth. It is provided with a reversing apparatus, which also carries the illuminating lamp. The fine level over the telescope is held by a projection from the reversing apparatus, which secures the great advantage, that the level need not be taken off on reversing the instrument; it remains on whether observing in the zenith or horizon. The setting-circle is attached behind the micrometric eye-piece with level alidade, divided on silver, and reading to minutes. It also carries the latitude level, which is chambered, and reads to single seconds. This instrument, being very simple and portable, is especially adapted for work in a rough or mountainous country.

No. 30.—Telescope of $2\frac{1}{2}$ inch clear aperture, packed complete in box, with two eye-pieces, illuminating and reading lamp, and all accessories. \$790 00

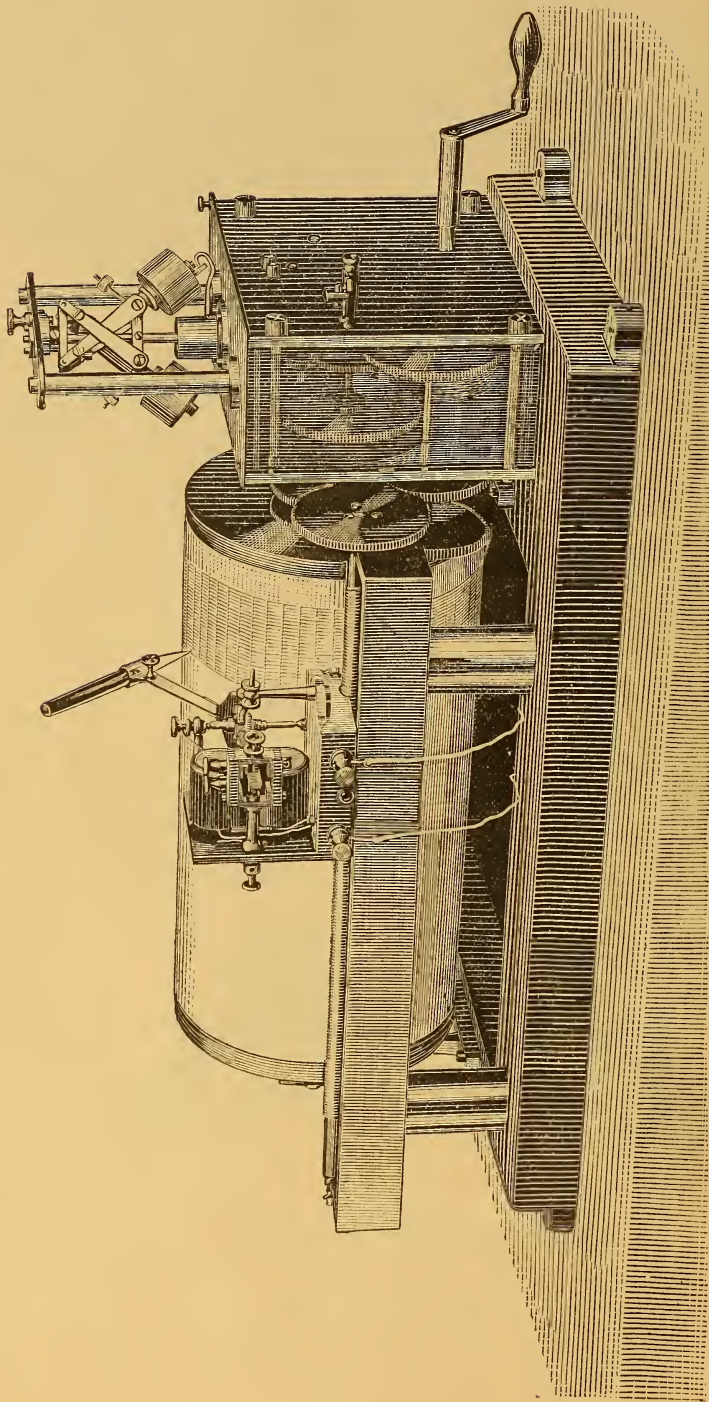


No. 31.

ZENITH INSTRUMENT.

Above cut represents the form of Zenith Instrument as used in the U. S. C. & G. Survey and the U. S. Corps of Engineers. The telescope swings on a horizontal axis, which is fastened to a vertical axis, and can therefore be moved into any position. It is especially adapted for the determination of differences of zenith distances. The horizontal circle is provided with two stops, in order to bring the telescope into the meridian. The telescope carries a circle with the latitude level and is provided with a micrometer eye-piece. We make several sizes of these instruments.

- No. 31.—Zenith Instrument, of 2 inches aperture, about 28 inches focal length; 10-inch horizontal circle; striding level over horizontal axis; fine latitude level attached to circle; micrometer eye-piece; packed complete.....\$700 00
- No. 32.—Zenith Instrument, as above, with telescope of $1\frac{1}{2}$ inches aperture..... 350 00



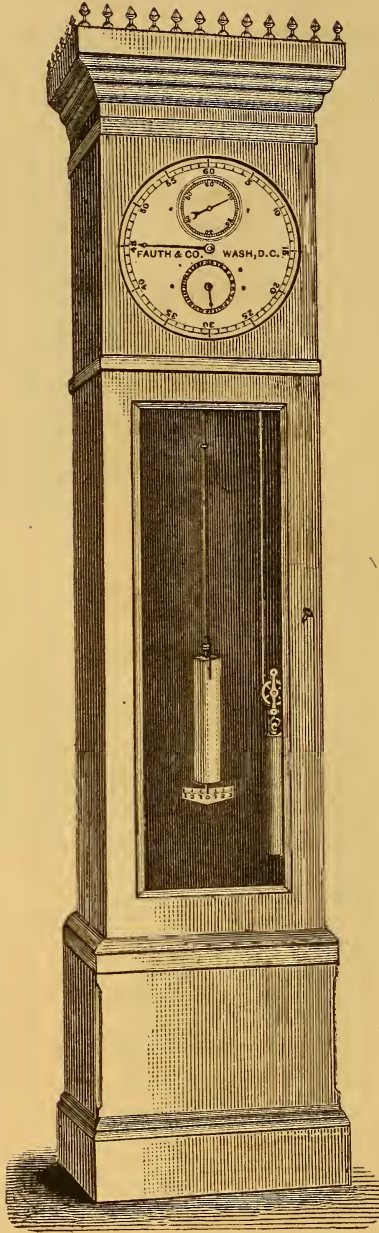
No. 33.

CHRONOGRAPH.

Cut No. 33 represents our style of Chronograph, which, for compactness and regularity of action, cannot be surpassed. It is noiseless in its action, and the governor regulates the speed so perfectly that the second marks form a perfect straight line. The cylinder is 14 inches long and 7 in diameter, and runs about $2\frac{1}{2}$ hours, with three feet fall and a weight of about 18 lbs. Sægmüller's maintaining power, however, allows the winding up without affecting the rate. The clock-work is strong enough to drive 3 or 4 cylinders, which can readily be attached. By pushing a button the speed of the cylinder is doubled, which is very convenient in exchanging clock-signals in longitude work. Price.....\$350 00

Each additional cylinder, with frame, carriage-slide, and magnet 150 00

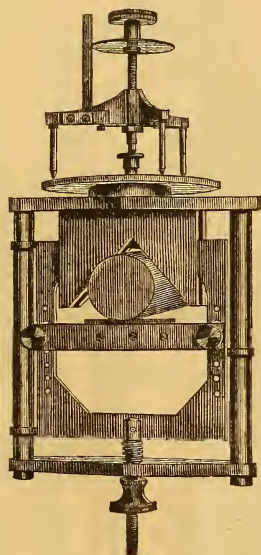
Chronograph paper for the above, per 100 sheets..... 1 50



No. 34.

ASTRONOMICAL CLOCK.

No. 34.—Astronomical Clock, with either Demmison's gravity or dead beat escapement with jewelled pallets. The pendulum is compensated and weighs about 40 lbs. We use Prof. C. A. Young's break circuit attachment, which gives no spark, thus saving the contact points from oxydation. Price.....\$450 00

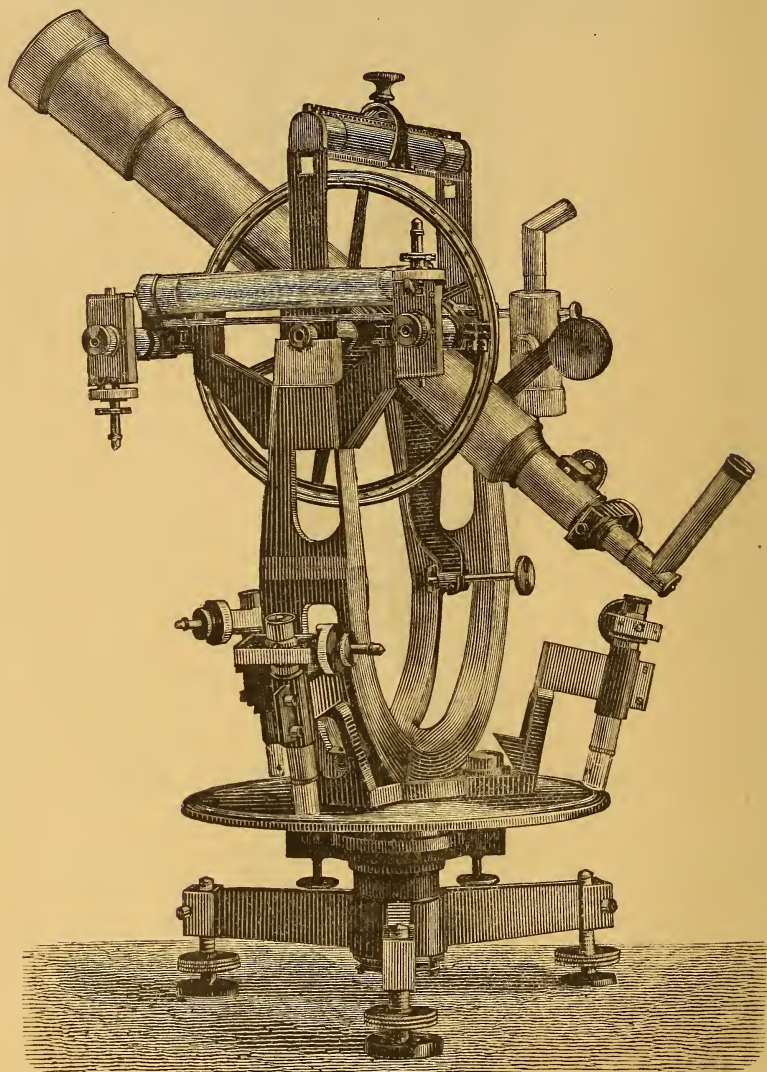


No. 35

SPHEROMETER,
as devised by Prof. Wm. Harkness, U. S. N.

A beautiful and exceedingly accurate instrument for measuring the inequality of pivots; much more reliable and expeditious than the contact level. As made by us, it will measure pivots from $2\frac{1}{2}$ inches down to the smallest size. The round glass disc on which the three legs rest is perfectly flat; the screw is made with the utmost exactness, bearing on a jewelled centre, and the nut is so constructed that there can be no dead motion. Price, in box.....\$50 00

INSTRUMENTS FOR MEASURING HORIZONTAL AND VERTICAL ANGLES.



From Gebbie & Barrie's "Masterpieces of the U. S. International Exhibition, 1876."

No. 36.

ALTITUDE AND AZIMUTH INSTRUMENT.

ALTITUDE AND AZIMUTH INSTRUMENTS.

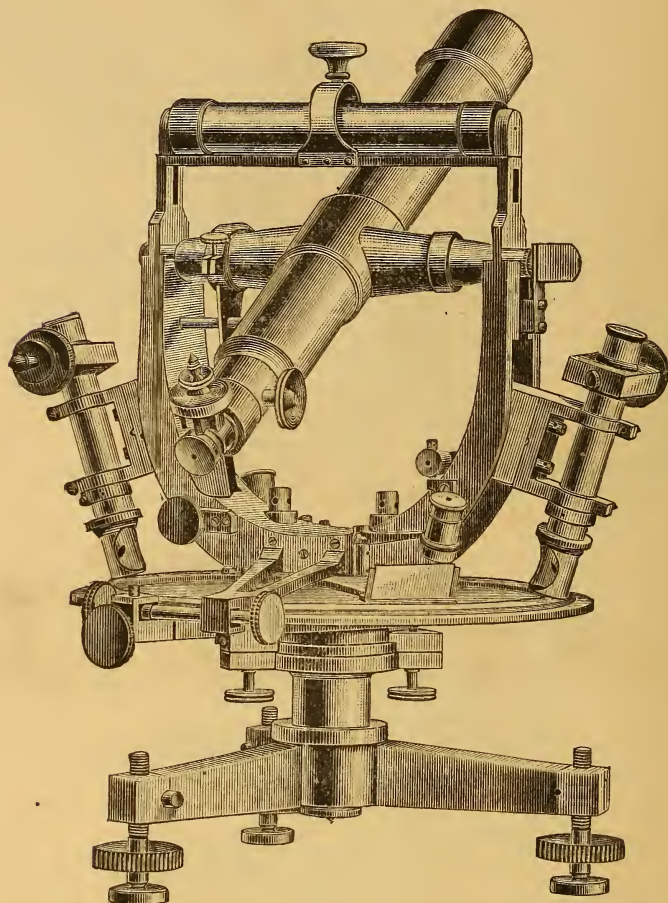
Cut No. 36 represents one of our instruments, which was on exhibition in the International Exhibition at Philadelphia, for which we received an award.

It is of superior construction, and differs from other instruments of this class in many important particulars. Not being a "repeating instrument," strictly speaking, and, therefore, not liable to the defects inherent to repeaters, yet both the horizontal and vertical circles can be shifted for position, so as to bring a different part of the graduation under the microscopes. The circles are divided on silver into five-minute spaces, reading by micrometer microscopes to single seconds. The standards radiate out from the centre, and are high enough to let the telescope swing through. The pivots of the telescope axis rest on agate, and are made of phosphor bronze; a delicate striding level, reading to seconds, over the pivots, is provided; illumination through pivots; the horizontality of the microscopes for vertical circle is controlled by a chambered level, reading to seconds.

Both circles are entirely free of clamps and tangent-screws, these being attached to a collar, so as not to produce any strain.

No. 36.—Altitude-Azimuth, as described above; horizontal circle eighteen, vertical circle twelve inches in diameter; former reading by three, and latter by two microscopes; telescope 3-inch clear aperture, 28 inches focal length, with micrometric eye-piece; levels are chambered, and read to seconds; packed complete in two boxes, with positive and diagonal eye-piece, two lamps, and all accessories.....		\$2,000 00
No. 37.—Same, without vertical circle, and standards only high enough for observation of polaris.....		1,200 00
No. 38.—Same as No. 36, and exactly like cut; horizontal circle twelve, vertical circle ten inches in diameter; former reading by three, latter by two microscopes. Telescope 2½-inch clear aperture, 24-inch focus; packed complete.....		1,300 00
No. 39.—Same, without vertical circle; standards as in No. 37; telescope 2-inch aperture; packed complete.....		800 00
No. 40.—Same as No. 39; circle reading by two instead of three microscopes.....		700 00
No. 41.—Same as No. 36, and shown on cut; horizontal circle ten, vertical circle seven inches in diameter; former reading by three microscopes to seconds, the latter, by means of level alidade, to ten seconds. Telescope swinging through 2 inches aperture, and about 18 inches focal length; packed complete.....		850 00

- No. 42.—Same, but without the vertical circle; telescope not swinging through; packed complete..... 650 00
- No. 43.—Same as No 42; the circle reading by two instead of three microscopes..... 550 00

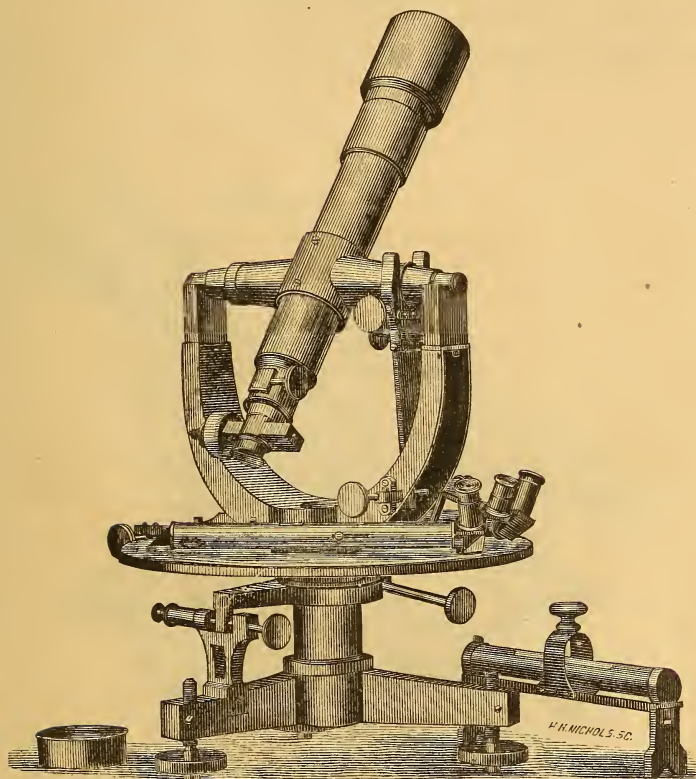


No. 44.

10-INCH THEODOLITE.

Cut No. 44 represents a Theodolite, of which we have made a great number. It is especially adapted for purposes of instruction, and is in every respect a first-class instrument. The circle—which shifts for position—is read by two micrometer-microscopes, and also two verniers; the telescope has an aperture of $1\frac{3}{4}$ inches and about 16 inches focus; improved clamp, sensitive striding level, and field illumination for azimuth observations. Packed complete.....\$550 00

THEODOLITES.



No. 45.

10-INCH REPEATING THEODOLITE.

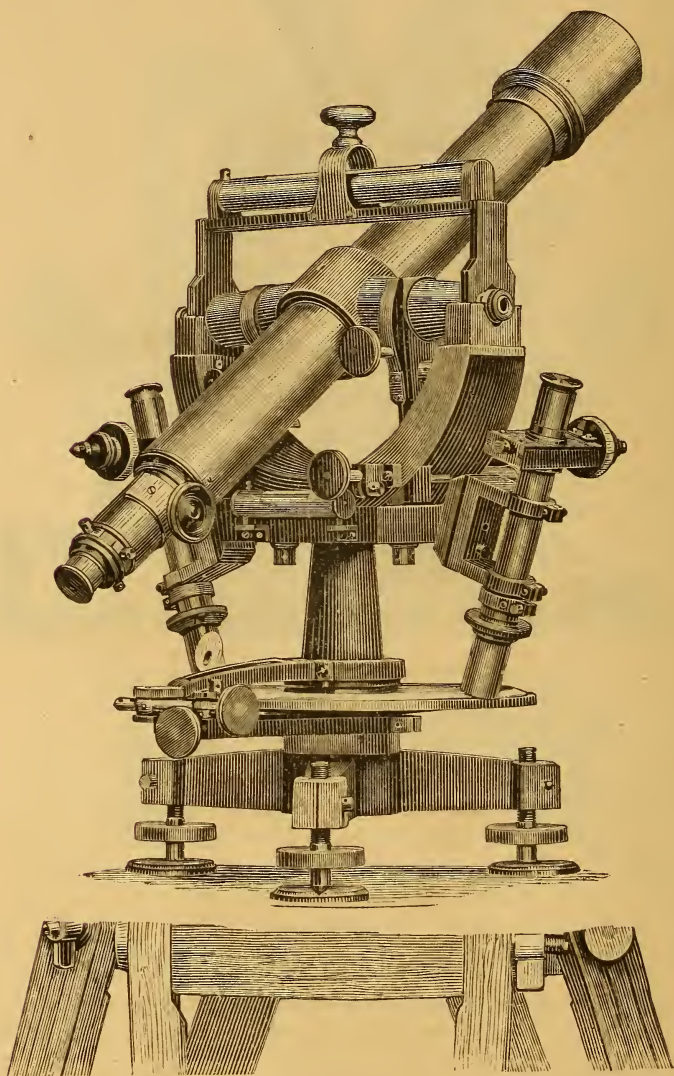
No. 45.—This cut represents a 10-inch Repeating Theodolite, as made by us for the U. S. C. & Geodetic Survey. Circle is 10 inches diameter, reading by two verniers and microscopes to 5 or 10 seconds. The telescope is of $1\frac{3}{4}$ inches aperture and about 16 inches focus; improved clamps and tangent-screws; sensitive level over telescope, and field illumination for azimuth observations. Packed complete.....\$150 00

In cut 45 the verniers are read off by means of a prismatic arrangement, the instrument having been designed for a particular purpose. The above price does not include this nor the eye-piece micrometer.

No. 46.—Eight-inch Repeating Theodolite, like No. 45. Two verniers reading to 5 or 10 seconds; telescope $1\frac{1}{2}$ -inch aperture and 15 inches focus, with delicate striding level. Packed complete.....\$375 00

NOTE.—If any of the above instruments are to read to 5 seconds instead of 10, the cost will be \$25.00 additional. The circles can also be provided with cover at an increase of \$10.00.

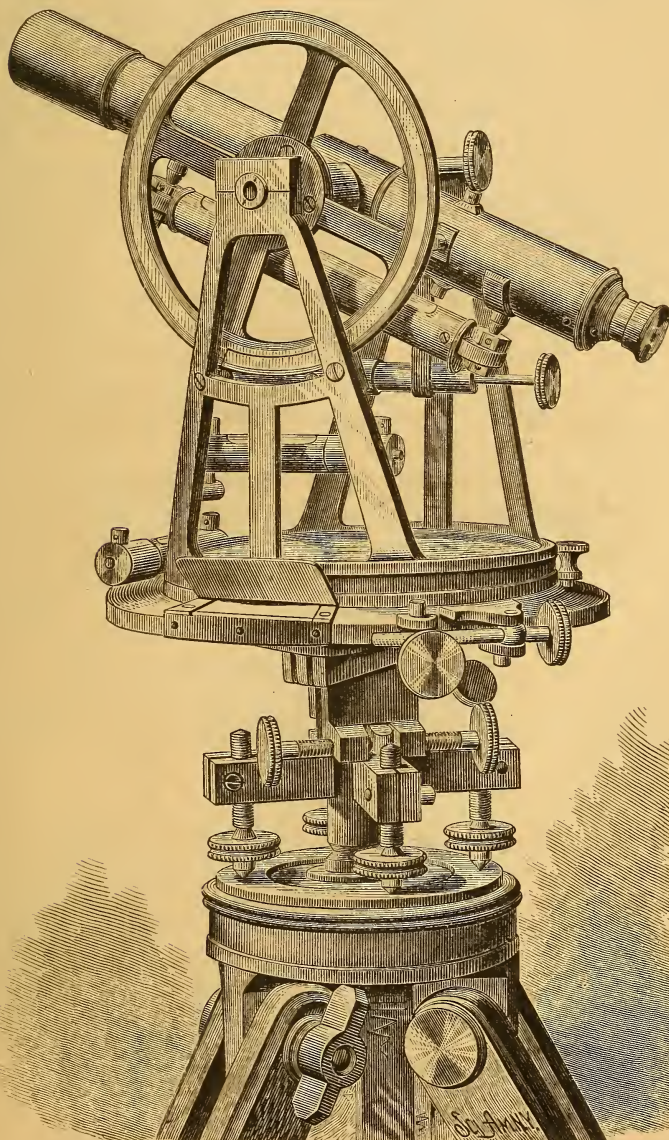
Strong double-leg tripods for any of the above instruments. . . . \$15 00



No. 47.

8-INCH THEODOLITE.

No. 47.—Represents an 8-inch Theodolite, of which quite a number have been made by us for the U. S. C. & G. Survey. The circle, which shifts for position, is 8 inches diameter, divided into 10-minute spaces, and is read by means of two micrometer-microscopes. The telescope has an aperture of $1\frac{3}{4}$ inches and about 18 inches focus. Improved clamp, sensitive striding level, and field illumination. Price, with stand.....\$425 00



No. 48.

ENGINEER'S TRANSIT.

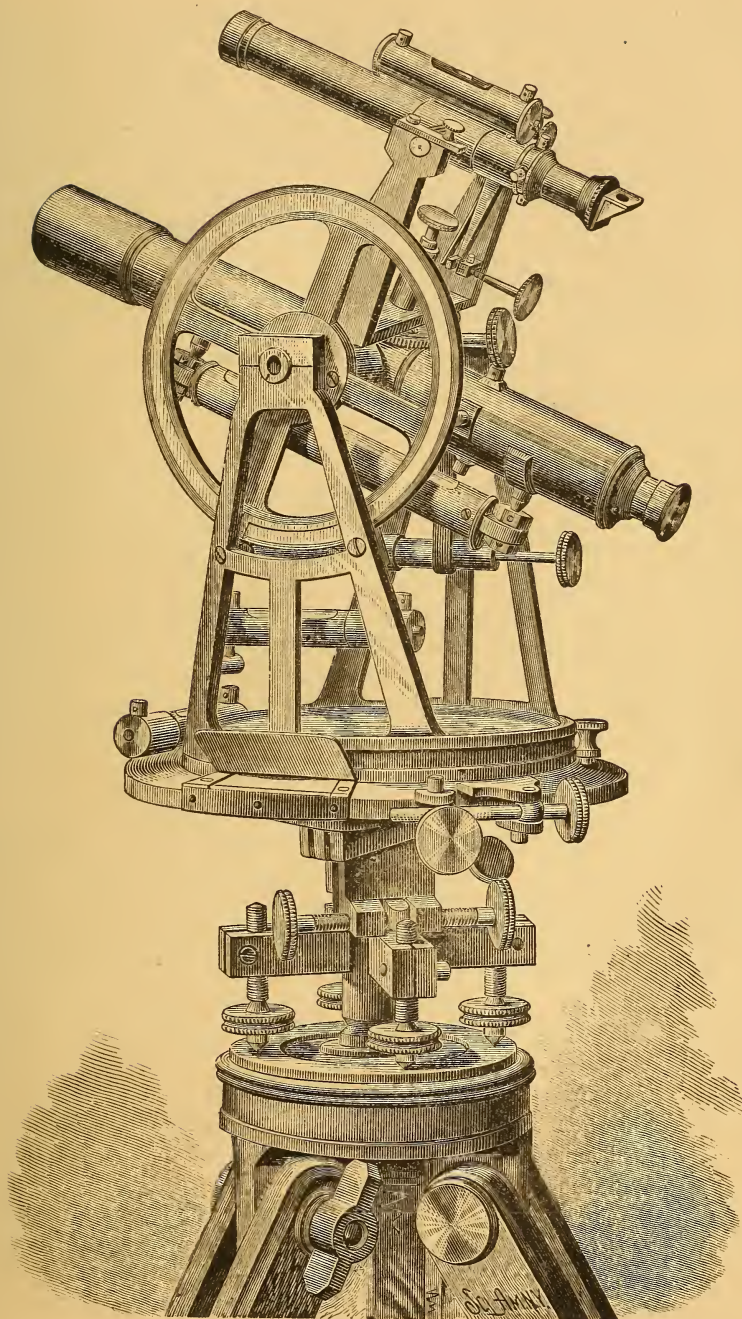
The preceding cut represents one of our complete high-grade Engineer Transits. It differs from those of the ordinary construction in its great lightness and strength, by judicious ribbing and bracing and the use of hard metal. The standards are not of the common construction, but are cast in one piece on a ring fitting tightly around the compass ring. Each Y has three legs, the two outer ones being curved so as to stand well in towards the centre of the plate, while the middle one is directly under the bearing. By thus casting a great many parts in the whole, which are usually made in pieces and screwed together, the instrument, while it is very much stronger, stays also better in adjustment. The centres are long, compound, and of hard metal; the graduation is on solid silver: the telescope is balanced in axis and reverses at both ends: shows objects erect unless otherwise ordered; it is perfectly achromatic, defines sharply, and magnifies 22 diameters; the tangent-screws are made of German silver and work with a beautiful smooth motion, without any dead play; compass needle 5 inches long, swinging on jewelled centre. Ground levels.

No. 48.—Transit, as shown in cut. Circles $6\frac{3}{4}$ inches diameter, divided on silver, reading by two verniers to 30 seconds; ivory shades to throw light on the verniers. The compass plate reaches over and forms a cover for the circle; the vertical circle is read to minutes. Telescope reverses at both ends, has an aperture of $1\frac{1}{8}$ inches with either terrestrial or astronomical eye-piece; the compass needle is 5 inches long; sensitive level on telescope; Stadia lines for distance measurements; centring arrangement for bringing instrument over a given point; adjustable plumb-bob. The instrument completely packed, with tripod.....\$275 00

NOTE.—The above instrument we also make with three instead of four levelling screws, double verniers on vertical circle, striding level over telescope axis, and horizontal circle reading to 10 seconds; field illumination. Price.....\$350 00

SOLAR ATTACHMENT.

We take pleasure in bringing before the engineering profession a new form of Solar Attachment, invented and patented by G. N. Sægmüller, which is the simplest and most accurate ever devised. Attached to any Engineer's Transit, the true meridian and deviation of the needle can be obtained with far greater accuracy than with any solar attachment yet invented.



No. 49.

TRANSIT, WITH SOLAR ATTACHMENT.

The foregoing cut represents the "Solar Attachment" fixed to an Engineer's Transit. It consists essentially of a small telescope and level, the telescope being mounted in standards, in which it can be elevated or depressed. The standard revolves around an axis, called the polar axis, which is fastened to the telescope axis of the Transit Instrument. The telescope, called the "solar telescope," can thus be moved in altitude and azimuth. It is provided with shade-glasses to subdue the glare of the sun, as well as a prism to observe with greater ease when the declination is far north. Two pointers attached to the telescope to approximately set the instrument are so adjusted that when the shadow of the one is thrown on the other the sun will appear in the field of view.

Adjustment of the Apparatus.

This is very simple, and requires less work even than to adjust the common Transit.

First. Attach the "polar axis" to the main telescope axis in the centre at right angles to the line of collimation. The base of this axis is provided with three adjusting-screws for this purpose; by means of the level on the solar telescope this condition can be readily and accurately tested.

Second. Point the transit telescope—which instrument we assume to be in adjustment—exactly horizontal and bisect any distant object. The transit level will then be in the middle of the scale. Point the "solar telescope" also horizontally by observing the same object, and adjust its level to read zero, for which purpose the usual adjusting-screws are provided.

Directions for using the Attachment.

First. Take the declination of the sun as given in the Nautical Almanac for the given day and hour, and correct it for refraction and hourly change. Incline the *transit telescope* until this amount is indicated by its vertical arc. If the declination of the sun is north, depress it; if south, elevate it. Without disturbing the position of the transit telescope bring the solar telescope to a horizontal position by means of its level. The two telescopes will now form an angle which equals the amount of the declination.

Second. Without disturbing the *relative* positions of the two telescopes, incline them and set the vernier to the latitude of the place.

The vertical axis of the "solar attachment" will then point to the pole, the apparatus being in fact a small Equatorial.

By moving the transit and the "solar attachment" around their respective *vertical* axis, the image of the sun will be brought into the field of the solar telescope, and after accurately bisecting it the *transit telescope must be in the meridian, and the compass-needle indicates its deviation at that place.*

Advantages of the "Solar Attachment" over the Old Form.

First. It is more accurate.

Second. It is simpler and easier of adjustment.

Third. It is much cheaper.

It is superior to all forms hitherto used as the transit is to the ordinary compass, or as a telescope is to common sights. For the ordinary surveyor's compass the degree of accuracy of the old attachment will answer, although even on a compass our "solar attachment" would be an improvement.

When angles are laid off with a transit, however, it is certainly going back a step to attempt to establish a meridian with a less precise instrument, or one that has less pointing power.

The sights of an ordinary solar compass consist merely of a small lens and a piece of silver with lines ruled on it placed in its focus. This is simply a *very primitive* telescope, since the exact coincidence of the sun's image with the lines has to be determined by the unaided eye, or at best with a simple magnifying glass.

That far greater precision can be attained by means of a suitable telescope is apparent; in fact, the *power* of the solar telescope is in keeping with the transit telescope, as it should be.

A glance at the cut will show that the "solar attachment" is far simpler than the ordinary form. By raising or depressing, it can be set to north or south declination. To effect this with the ordinary solar compass *two sets of primitive telescopes*—one answering for north, the other for south declination—are provided, which are difficult to adjust.

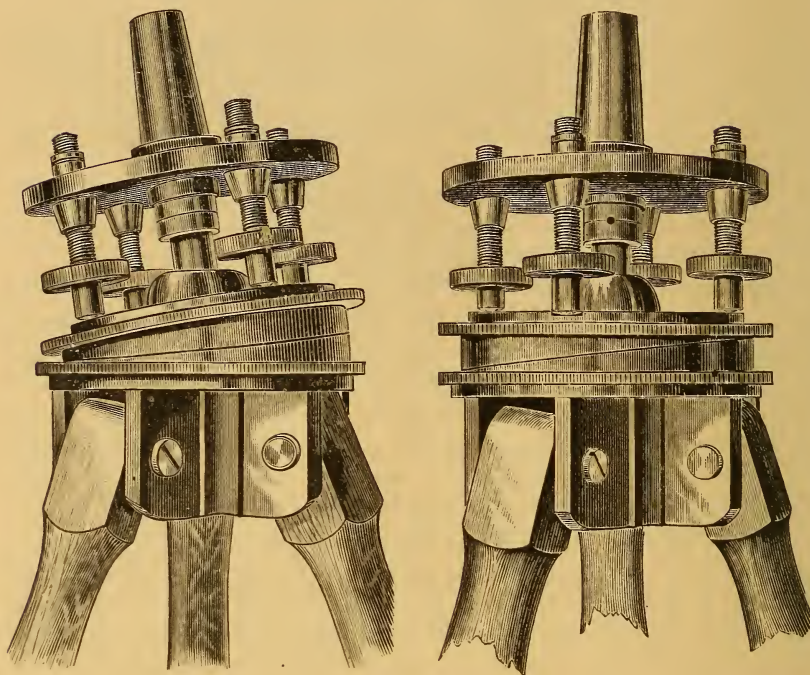
The addition of the level on the solar telescope dispenses with the declination arc altogether, the arc or circle on the transit also serving for that purpose in conjunction with it.

This "solar attachment" is in fact the only one which should be used in connection with a Transit Instrument. *It solves the solar problem*, as has been attested by the leading astronomers and engineers who have seen and used it.

Price of Solar Attachment, complete, with sun-shades	\$40 00
Rectangular Prism to attach to eye-piece	5 50

NEW QUICK-LEVELLING TRIPOD-HEAD, WITH SHIFTING-PLATE.

PATENTED BY G. N. SEGTMULLER, WASHINGTON, D. C.

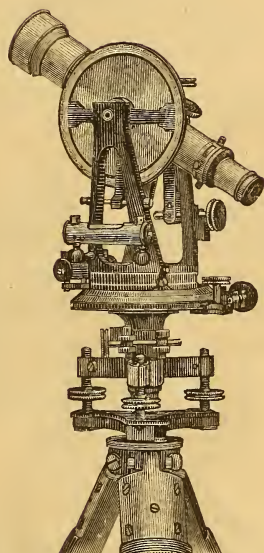


No. 50.

The engravings represent a new form of Quick-Levelling Tripod, which is the simplest and most convenient yet devised. It consists of two circular discs, which are wedge-shaped—that is, thicker on one side than the other. They are interposed between the levelling-screws and tripod-head proper. By turning one or the other of them around their common centre the instrument can gradually be brought to a vertical position. The final levelling touches are given by means of the usual levelling-screws, which at the same time clamp the instrument firmly. *The great advantage of this Quick-Levelling Tripod over other forms is that the instrument will not fall over even if it is not clamped, and no accident on this account can occur.*

It can be attached to any transit or leveling instrument.

Price.....	\$10 00
If ordered with a new instrument.....	7 50



No. 51.

RECONNOISSANCE AND MINING TRANSIT.

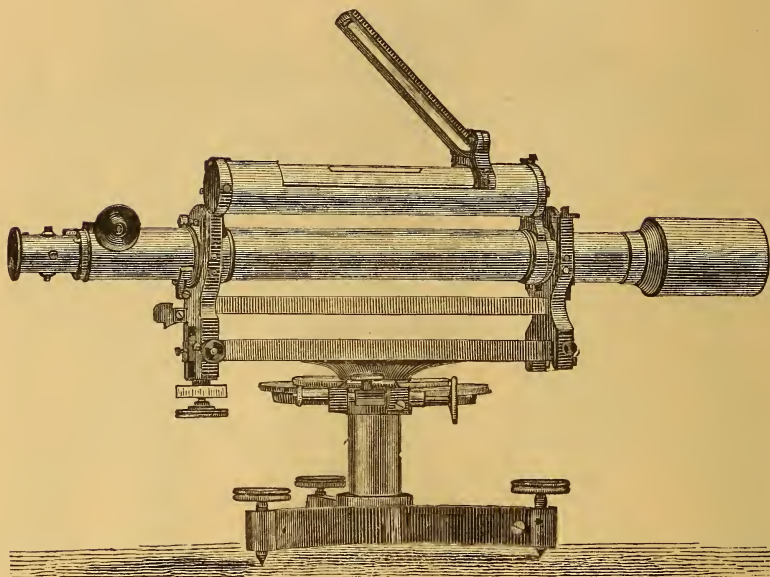
This cut represents a complete Transit Theodolite, which is especially adapted for reconnoitring purposes, as it only weighs about 5 lbs. Horizontal and vertical circles are 4 inches diameter, graduated on silver, and both reading by opposing verniers to single minutes. The telescope has an aperture of $1\frac{1}{8}$ inches and magnifies about 20 diameter.

Price, completely packed, with stand.....\$200 00

EXTRAS FOR MINING TRANSITS.

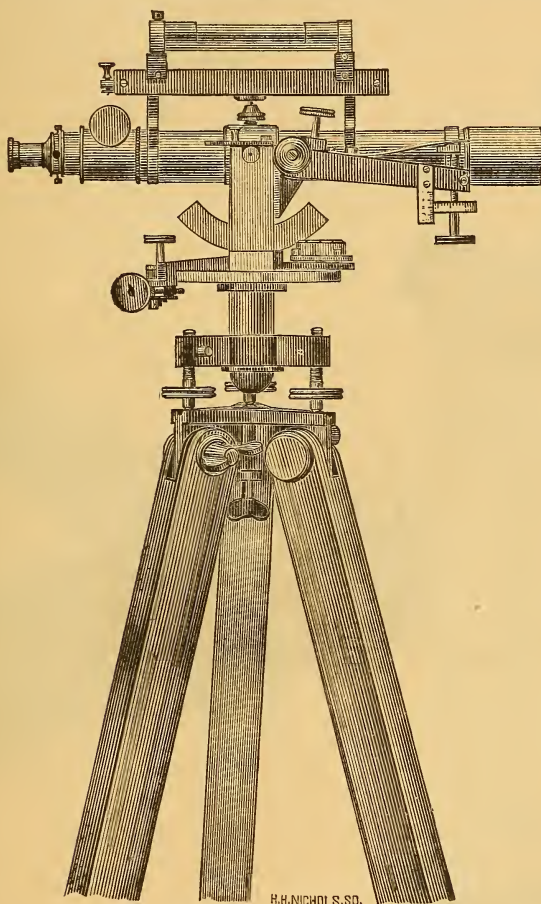
Diagonal eye-piece, with adapter.....	\$20 00
Illumination for telescope.....	10 00
Brass lamp.....	8 50
Plummet lamp, in gimbals, per pair.....	25 00

LEVELLING INSTRUMENTS.

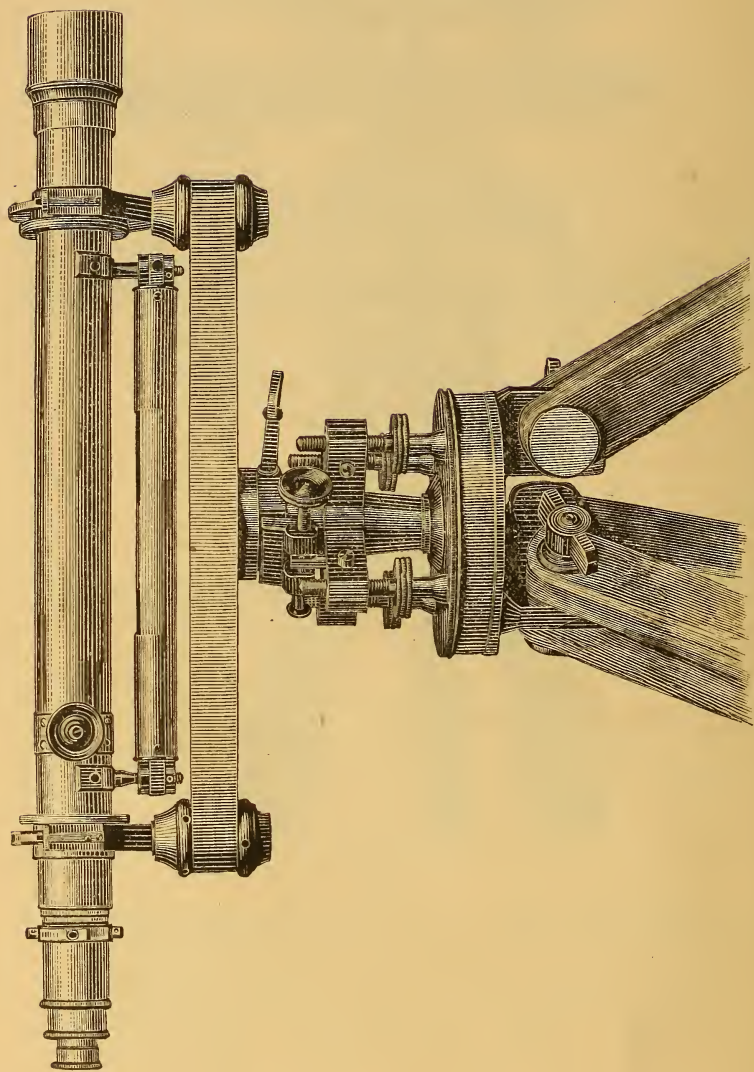


No. 52.

No. 52.—Level of Precision, as made by us for U. S. C. & G. Survey, for the most exact work, can also be used as a gradientor, the micrometer screw for raising or depressing the telescope being made with the utmost exactness, and being provided with a graduated head. The telescope has an aperture of $1\frac{1}{2}$ inches, and 16 inches focus, with two astronomical eye-pieces, magnifying 40 and 60 times respectively. The pivot-rings are of phosphor bronze, and rest on agate. The striding level is chambered, and one division equals 3 seconds of arc. The horizontal circle, of five inches diameter, divided on silver, reads to 30 seconds; the centre is of steel; clamp and spring tangent motion. Completely packed, with tripod.....\$250 00

LEVELLING INSTRUMENT AND GRADIENTOR.**No. 53.**

No. 53.—Telescope $1\frac{1}{4}$ inch aperture, 10 inches focal length ; 4-inch horizontal circle, vertical arc, both divided on silver and reading to minutes. By means of the gradientor attachment, angles of depression or elevation can be measured with great precision, as well as distances taken. The compass needle is 5 inches long, in oblong box under the striding-level ; this latter is ground and very sensitive. Packed complete in box, with all accessories, tripod stand.....\$225 00



No. 54.

ENGINEERS' Y LEVEL.

The above cut represents a Y level of the most approved form. The telescope has an aperture of $1\frac{1}{4}$ inches, and is about 16 inches long. It rests in the Ys on hard bell metal rings; the level bubble is very sensitive; centre long and compound; four levelling screws.

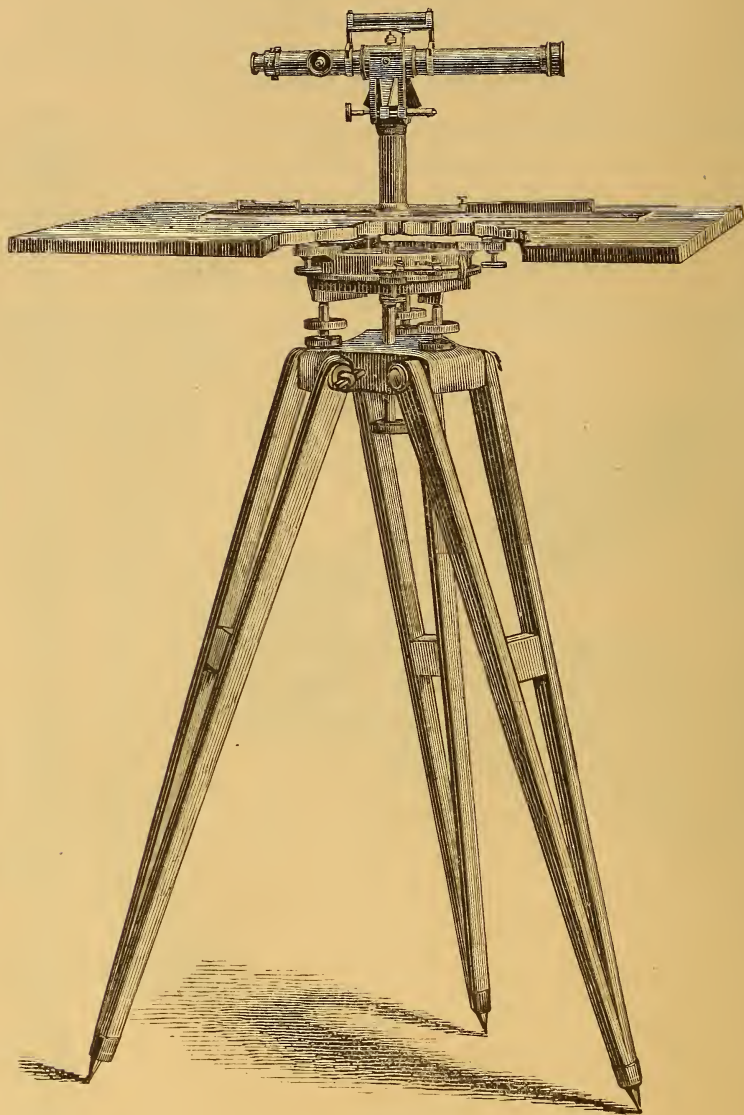
Price, packed complete.....	\$145 00
Locke's Hand Level, in case, German silver.....	\$12 00
“ “ “ brass.....	10 00

LEVELLING RODS AND CHAINS.

Philadelphia Levelling Rod.....	\$18 00
New York “ “	16 00
Boston “ “	16 00
Grumman's Patent Chain, W. G. 18, with spring, level, thermom- eter, brass handles; weight $\frac{3}{4}$ lbs., 50 feet.....	17 00
Land Chains, W. G. 8, brass handles, 50 feet.....	3 50
Same, 100 feet.....	5 50
“ W. G. 12, 100 feet, bronzed links.....	11 50
Chains in feet or meters to any length; compared with the U. S. Standard.	

STEEL TAPES.

Steel Tapes, in leather case, $\frac{1}{2}$ inch wide, divided in 1-10ths or 1-12ths and links or metres, 100 feet.....	\$16 00
50 feet.....	8 50
Pocket Tape, in nickel case, divided in 1-10ths or 1-12ths and meters, 25 feet.....	6 00

PLANE TABLE.

No. 55.

No. 55.—The above cut represents one of our Plane Tables with a portion of the board cut out to show the motion-work. The most simple and effective form of plane-table made. The bearing surface of the motion-work being 8 inches in diameter, the table, when clamped, is perfectly firm. The alidade rule is 20 inches in length, and carries a powerful telescope of $1\frac{1}{4}$

inches aperture, and 15 inches focus. For easier adjustment of collimation the telescope can be turned in its axis 180° without lifting it out of its bearings. The compass-box is detachable; needle 5 inches long; striding level reading to minutes. Stadia lines for measuring distances, beside the ordinary cross-line, are ruled on glass diaphragm. The vertical arc reads to minutes. The board is 24 by 30 inches, and is provided with an extra packing-box. The alidade packs in a box with a number of paper clamps, beside the usual accessories; the motion work is also securely packed in a box. Price, complete, with firm tripod stand.....\$300 00

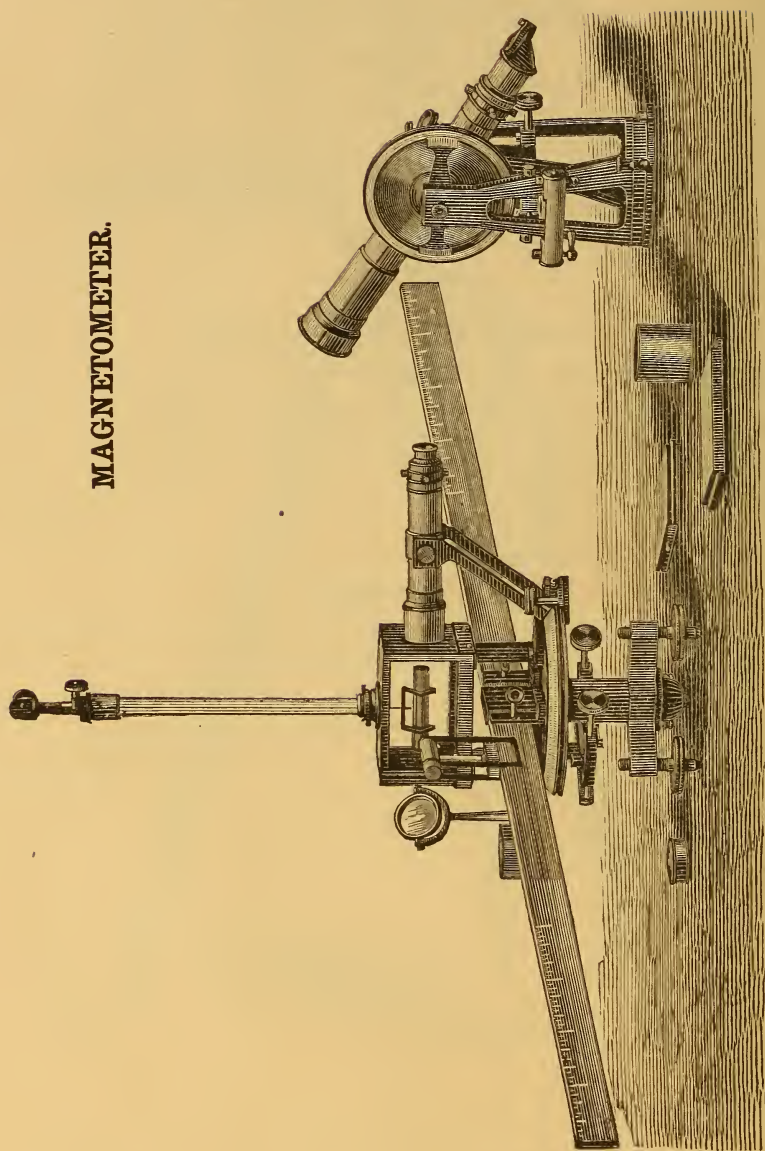
THREE-ARM PROTRACTORS.

Protractors, as made by us for the U. S. Coast & Geodetic Survey, with 6-inch circle, divided on silver, and reading to minutes; the arms have extension-pieces to make them 30 inches long; glass centre with pricking-hole. Complete, in box.....\$110 00

TIDE GAUGES.

Self-registering Tide Gauges, much improved, have been constructed by us for the U. S. Coast Survey and the U. S. Engineers.

The roller system runs in a metal frame; the large wheel is also of metal, and the clock is of superior construction with spring balance. Price.....\$350 00

MAGNETOMETER.

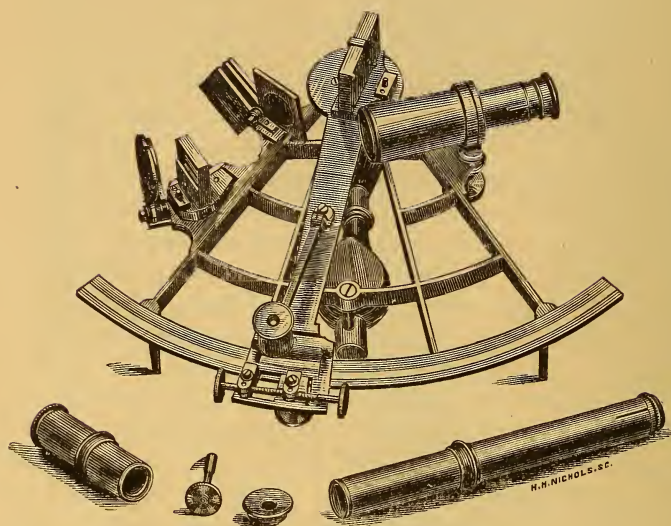
No. 56.

- No. 56.—Magnetometer, as made by us for the United States Coast and Geodetic Survey. The magnet-box and small telescope, by which the scale of the intensity-magnet is read off, is detachable from the vernier-plate, and the standards, with the telescope of $1\frac{1}{8}$ -inch aperture and 7 inches focus, can be substituted: it then forms a complete small Alt-Azimuth, large enough to get, with sufficient accuracy in magnetic work, time, azimuth and latitude. The circles are four inches in diameter, divided on silver, and reading by two opposing verniers to minutes. The telescope has prismatic eye-piece and sun-shade. The deflecting bar is of wood, four feet in length, in two pieces, so as to be easier to carry. It is divided to tenths of inches. The intensity-magnets have at one end a fine divided scale, (one division being equal to 5 minutes,) at the other end the collimating lens; the scale is viewed through the small telescope of $\frac{3}{4}$ -inch aperture and 3 inches focus; tenths of divisions can easily be estimated. Rack and pinion movement in the glass tube to raise and lower the stirrup carrying the magnet. A riding piece fits on the deflecting bar, upon which the deflecting magnet is placed; inertia-ring, twist-piece, beside all the usual accessories, go with the instrument. Price, complete, as shown on cut, packed in box, with tripod.....\$400 00
- No. 57.—Magnetometer, as made by us for U. S. Corps of Engineers, with only one telescope, used both for determining the magnetic and astronomical meridian. The magnet-box is detachable from the vernier plate, and telescope can then be used to observe for time or azimuth. Two collimating magnets, deflecting bar, and all accessories go with it. Price, completely packed, with tripod..... 250 00

DIP CIRCLE.

- No. 58.—Dip Circle, with two $3\frac{1}{2}$ -inch needles, swinging on agate and enclosed in glass case. Vertical circle 6 inches diameter, divided on silver, reading by two opposing verniers to minutes. Attached to the vernier arms are two reading microscopes to read off the magnets. The lower horizontal circle is also 6 inches in diameter, and reads to minutes. Packed complete in one box, with two large steel magnets and needle-holder for convenience in magnetizing the needles, with all the usual accessories..... 300 00

SEXTANT



No. 59.

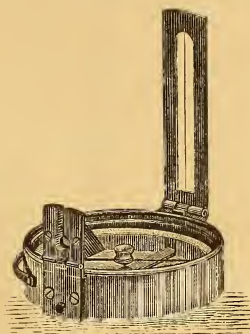
The above cut represents our style of Sextant, which, although very light, is an exceedingly accurate instrument.

No. 59.—Sextant of $7\frac{1}{2}$ inches radius, divided on silver, and reading to ten seconds; the cut shows all accessories, packed complete.....\$110 00

ARTIFICIAL HORIZON.

No. 60.—Artificial Horizon, with mercury-bottle and trough, rectangular plate-glass cover, packed in mahogany box..... \$25 00

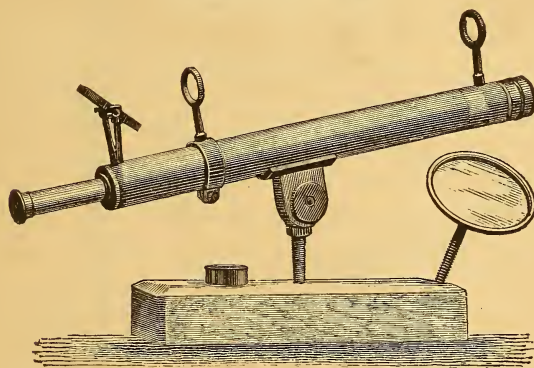
POCKET COMPASS.



No. 61.

No. 61.—Prismatic Compass, 3 inches in diameter, with divided ring on needle and folding sights; packed in neat case, very convenient for reconnoissance. \$25 00

HELIOTROPES.

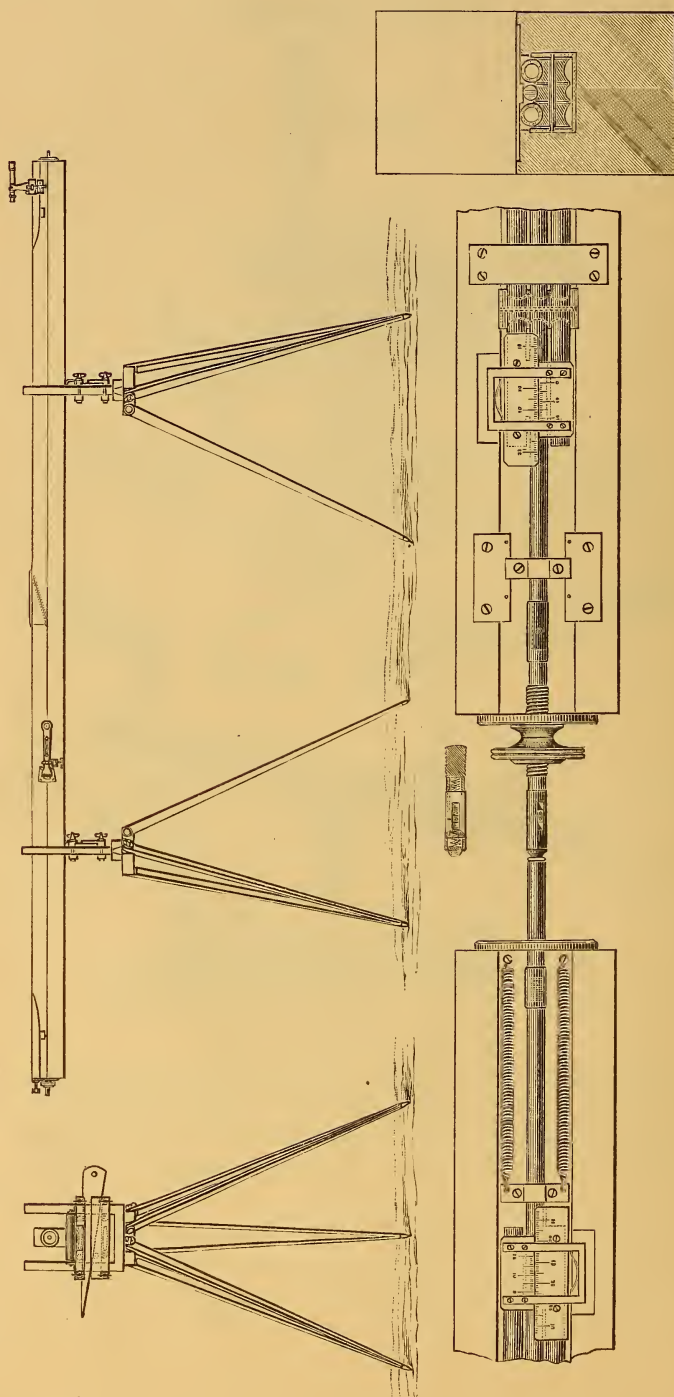


No. 62.

No. 62.—As made by us for the United States Coast and Geodetic Survey. The telescope body is an iron tube; a wood screw with joint is attached at the middle, so that the instrument can be screwed to any tree or post. Mirrors of plate-glass. Price, in box. \$30 00

No. 63.—Heliotrope, on tripod, with horizontal and vertical axis; a graduated circle allows angles to be read off. Price, in box. 75 00

No. 64.—Pocket Heliotrope, Steinheils, a beautiful instrument that requires no adjustment; in case. 20 00



No. 64.—FOUR METER CONTACT-SLIDE BASE APPARATUS, after the design of Prof. J. E. Hilgard, Sup't U. S. C. & G. Survey.

Cut No. 64 represents a perfected form of the Contact-Slide Base Apparatus, used in the C. & G. Survey, designed by Prof. J. E. Hilgard, Sup't of that Survey. We have made several of this pattern for colleges and Government Departments.

The apparatus consists of two measuring bars 4 meters long, exactly alike, supported on trestles. The measurement is made by bringing these bars successively in contact, which is effected by means of a screw motion and defined by the coincidence of lines on the rod and contact slide. Each bar consists of two pieces of wood about 8x14 c. m. square and a little less than 4 meters long, firmly screwed together. Between the pieces of wood is a brass frame carrying three rollers, on the central one of which rests a steel rod about 8 m. m. in diameter. On each side there is a zinc tube 9 m.m. diameter. The rod and tubes are supported throughout their length on similar systems of rollers. The zinc tubes form with the steel rod a metallic differential thermometer, and are so arranged that one tube is secured to one end of the rod, being free to expand in the other direction, the other tube being in a like manner fastened to the other end of the rod. The zinc tubes, therefore, with any change of temperature, expand or contract in opposing directions, and the amount by which the expansion of the zinc exceeds that of the steel is measured by a fine scale attached to the rod, while the zinc tube carries a corresponding vernier. The cut shows this arrangement, which is identical on both ends of the bars; a perforation in the wood of the bar allows this scale to be read. In addition to these metallic thermometers a mercurial thermometer is attached to the bar about midway of its length.

The rods and tubes thus forming a united whole are lengthwise movable on the rollers by means of a milled nut working in threads cut on the steel rod, which passes through a circular opening in the brass plate screwed to the wooden bar, and against which the nut presses. Two strong spiral springs pull the rods back, and the nut is always pressed against the plate.

One end of the rod is defined by a plain agate securely fastened to it; the other end carries the contact slide, having an agate with a horizontal knife edge. This slide is a short tube, fitting over the end of the rod, and pushed outward by a spiral spring. A slot in the tube shows an index plate, with a ruled line fastened to the rod.

To align the bars properly a small telescope is placed on each bar, and can be adjusted to bring the line of collimation over the axis of the rod. The trestle, shown in the upper left hand corner of the illustration, consists of a strong tripod stand, carrying a frame with two upright guides for two crow slides, which are separated by a movable wedge. These cross slides can be clamped in any position. By moving the wedge, the bar resting between the uprights is either elevated or de-

pressed. To obtain smooth movements, friction rollers are provided. To move the bars sideways, a coarse screw takes hold of a projection on the lower side of the bar; by turning which, the bar can be moved laterally.

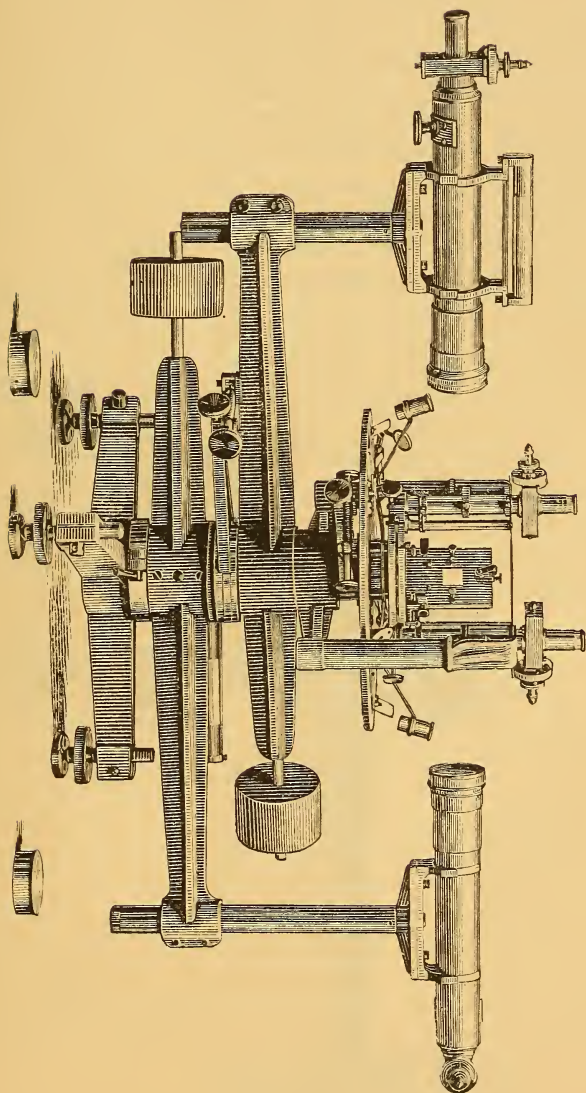
There are three pairs of trestles, alike in construction with the exception that the upper slide of the trestle intended for the forward end of the bar carries a roller on which the bar rests, while the other has a fixed semi-cylindrical surface for the support of the bar. In making the measurement, the bars being four meters in length, the stands are set up at distances of two meters, each bar being supported at one-fourth its length from the ends, as indicated by the painted black bands.

Each bar has a sector with level alidade attached to one side, by which its inclination can be read off to single minutes.

All base bars constructed by us are compared with U. S. standards.

Price of the whole apparatus, including two bars and six trestles.....	\$450 00
Price of simple 4 meter Standard Bar.....	90 00
“ of Abutting piece and Level Comparator to test bars....	125 00

NOTE.—Bars of the same construction, in feet instead of meters, can be furnished on order.



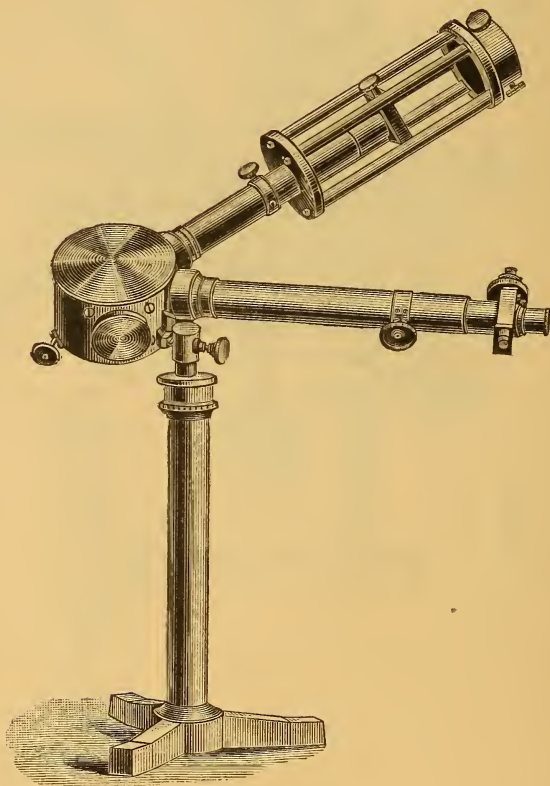
SPECTROMETER.

No. 65.

Cut No. 65 represents a very complete Spectrometer, according to the plan of Prof. C. A. Young.

We have made several sizes of this instrument, with circles from 12 to 18 inches in diameter, and telescopes from 2 to $2\frac{1}{2}$ inches aperture. The circle is graduated into 5 minute spaces and read by means of two micrometer-microscopes to single seconds; these microscopes are attached to the arm carrying the observing telescope. The collimating telescope can be turned on a separate axis by itself, and the whole instrument can be rotated on another axis. The grating table, which is provided with all the necessary adjustments, turns on a centre of its own and has attached to itself two verniers reading to five seconds on the graduation of the circle. Both telescopes turn in adjustable Y's, for which purpose a sensitive striding level is provided.

The price of these instruments varies, according to size,
from.....\$600 to \$1,200 00



No. 66.

SPECTROSCOPE.

The preceding cut represents the form of spectroscope as made by us. It answers both for physical and astronomical research, and is arranged to be used either with diffraction grating or prism. It consists of a circular box into which the collimator and observing telescope are screwed. The collimator slides in a tube so as to bring the slit into the focus of the objective. This tube is connected with the adapter by four stiff rods, leaving the slit easily accessible. The collimator tube is graduated into millimetres. Grating or prism can readily be placed in the box on a small table which has all the necessary adjustments. By means of a milled head, projecting through the bottom of the box, the grating or prism can be rapidly rotated. A slow motion can at once be obtained without previous clamping by turning a tangent-screw fitted into the periphery of the grating holder, which is held by friction to a plate to which the projecting knob is fastened. The amount of rotation is measured to single minutes by a graduation on bottom of box. When the grating is in use the collimator and view telescope are placed as shown on cut, forming an angle of about 38 degrees. When the prism—which is a dense flint—is to be used, the view telescope is changed and screwed into a collar on the side of the box. The two telescopes are then placed in a position of minimum deviation for the ultra-violet rays. The instrument can be put into any position by means of an universal joint. It is readily lifted off the stand when intended to be used with the telescope.

- No. 66—Spectroscope as above, with telescopes of one inch aperture, about 9 inches focus, extra dense flint glass prism. \$200 00
 No. 67—The same, with telescopes of 1½-inches aperture and 12 inches focus..... 250 00
 No. 68—Spectroscopes on the above plan, of much simpler construction, either for gratings or prisms..... 75 00
 No. 69—McLean's Star Spectroscopes, consisting of a cylindrical concave lens in front of a direct vision prism..... 25 00

This Star Spectroscope can also be used with above spectroscopes by attaching it opposite the observing telescope and taking off the collimator, making the instrument complete for stellar, solar, and physical work.

We are happy to state that we have made arrangements with Mr. D. C. Chapman, who is well known as having been Mr. Rutherford's assistant in the manufacture of diffraction gratings, to rule gratings for us. A new engine, provided with all the improvements which his familiarity with this kind of work suggested, is now being built by us.

EYE-PIECES AND MICROMETERS.

POSITIVE EYE-PIECES.

Ramsden— $\frac{1}{4}$ inch to $\frac{3}{4}$ inch equivalent, each.....	\$4 50
1 " $1\frac{1}{2}$ " " "	5 00
$1\frac{3}{4}$ " $2\frac{1}{4}$ " " "	6 00
Kellner (achromatic)— $\frac{1}{3}$ inch to $\frac{3}{4}$ inch equiv., each.....	6 00
1 " " " "	7 00
$1\frac{1}{4}$ " " " "	8 50
$1\frac{1}{2}$ " " " "	10 00
Steinheil (achromatic)— $\frac{1}{3}$ inch to $\frac{3}{4}$ inch equiv., each.....	9 00
1 " " " "	12 00

NEGATIVE EYE-PIECES.

Huyghens— $\frac{1}{4}$ inch to 1 inch equiv., each.....	\$5 00
$1\frac{1}{4}$ " $1\frac{1}{2}$ " " "	6 00
Airy (giving a large and perfectly flat field)— $\frac{1}{4}$ inch to $\frac{1}{2}$ inch equiv., each.....	6 00
$\frac{3}{4}$ inch equiv., each.....	7 00
1 " " " "	9 00
$1\frac{1}{4}$ " " " "	10 00
$1\frac{1}{2}$ " " " "	12 00
" " " "	16 00

TERRESTRIAL OR INVERTING EYE-PIECES FOR DIRECT VISION.

Fraunhofer— $\frac{1}{4}$ inch to $\frac{1}{2}$ inch equivalent, each.....	\$7 50
$\frac{3}{4}$ " " " "	8 00
1 " " " "	10 50
$1\frac{1}{2}$ " to 2 inches " "	15 00
Airy (large and perfectly flat field)— $\frac{1}{3}$ inch to $\frac{1}{2}$ inch equiv., each.....	8 50
$\frac{3}{4}$ inch equiv., each.....	10 00
1 " " " "	12 00
$1\frac{1}{2}$ " to 2 inches equiv., each.....	16 00

DIAGONAL TERRESTRIAL EYE-PIECES.

1 inch to $\frac{3}{4}$ inch equiv., each.....	\$18 00
1 " $1\frac{1}{2}$ " " "	20 00

REFLECTING PRISMS.

First surface reflecting prism (solar).....	\$15 00
$\frac{3}{8}$ inch square, mounted with sunshade.....	7 50
$\frac{1}{2}$ " " " " "	10 00

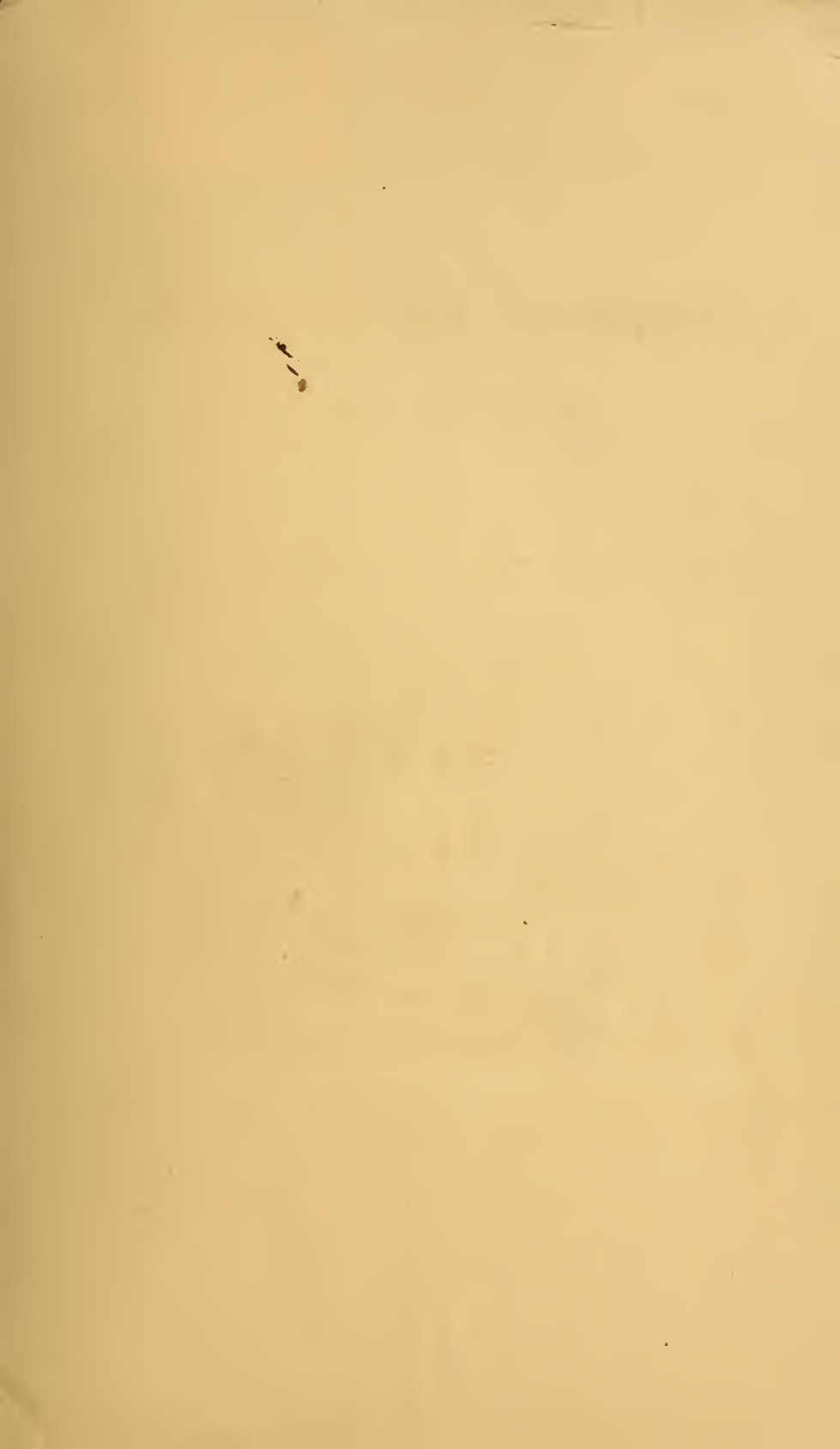
$\frac{3}{4}$ inch square, mounted with sunshade.....	15 00
1 " " " " "	20 00
Helioscopic eye-piece, Merz, modified by Prof. Young, according to size, from \$50 up.	

MICROMETERS.

Eye-piece micrometer, (filar,) each.....	\$50 00
Reading " with achromatic objective.....	65 00
Position " according to style, from \$75 up.	
Double image " " " from \$75 up.	
Compensation Slides, of neutral tint glass, according to size, from \$5 up.	

LEVEL VIALS,

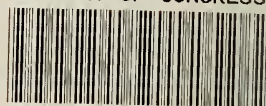
of all sizes and grades of sensitiveness, from \$0.75 to \$1.00 per inch.
 Chambered Levels, reading to seconds, from \$3 to \$5 per inch.



Q.B. 86

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