

Seventieth Edition

Part Second

CATALOGUE
OF
ENGINEERING INSTRUMENTS
AND
MATERIALS



QUEEN & CO., Incorporated

1010 CHESTNUT AND 1011 Sansom Streets

PHILADELPHIA, PA., U. S. A.

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QUEEN & CO., INCORPORATED.

PHILADELPHIA, 1897.

Seventieth Edition

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CATALOGUE

OF

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1010 CHESTNUT AND 1011 SANSON STREETS

PHILADELPHIA, PA., U. S. A.

NEW YORK OFFICE,
116 FULTON STREET.

COMPLETE CATALOGUE
SENT ON APPLICATION

Engineering Instruments.

We illustrate and describe in the following pages a complete line of Transits, Levels and their accessories, adapted to the use of the Railroad or City Engineer, Surveyor, Architect or Builder. These instruments are wholly made in our own factories, of our own design, the result of many years experience with all kinds and makes of Engineering Instruments, and have had our best efforts and personal supervision. Unlike some makes of engineering instruments, which are sold at moderate prices, our instruments are hand-made and not machine assembled.

The exceptionally low price at which we have been enabled to put our instruments has not resulted from any lowering of the standard of workmanship but from the employment of labor-saving tools of a high order by which the time of skilled workmen has been economized, thus enabling us to produce instruments which we confidently assert are unsurpassed by any engineering instruments made in this country to-day, at prices which are far below the prices of other makers for the same class of instruments.

The castings for the various parts of the Transits and Levels are made in our own foundry from formulæ, the result of exhaustive experiments to determine the best metal for the several uses to which the different parts are put.

Our long experience in optical work has enabled us to achieve exceptional results in the Optical qualities of the Telescopes of our Transits and Levels, and the highest power consistent with good field and light has been secured.

It is to be observed in this connection that high power is not alone the most desirable quality in a telescope, and even when high power is, by the finest possible optical combination, united with a large field and good light, there are conditions where the power of such a telescope is a barrier to its use, as in foggy weather, when the fog itself is magnified in the same ratio as the object.

It follows from this, therefore, that on our Eastern coast and in the Southern States, for the greater portion of the year, a telescope of comparatively low power, but of fine optical qualities can be used on more days and with greater satisfaction than one of high power. On the Western plains telescopes of much higher power are available.

We should be glad if engineers, in ordering, would state whether they desire to have a telescope with "usual" or "high" power.

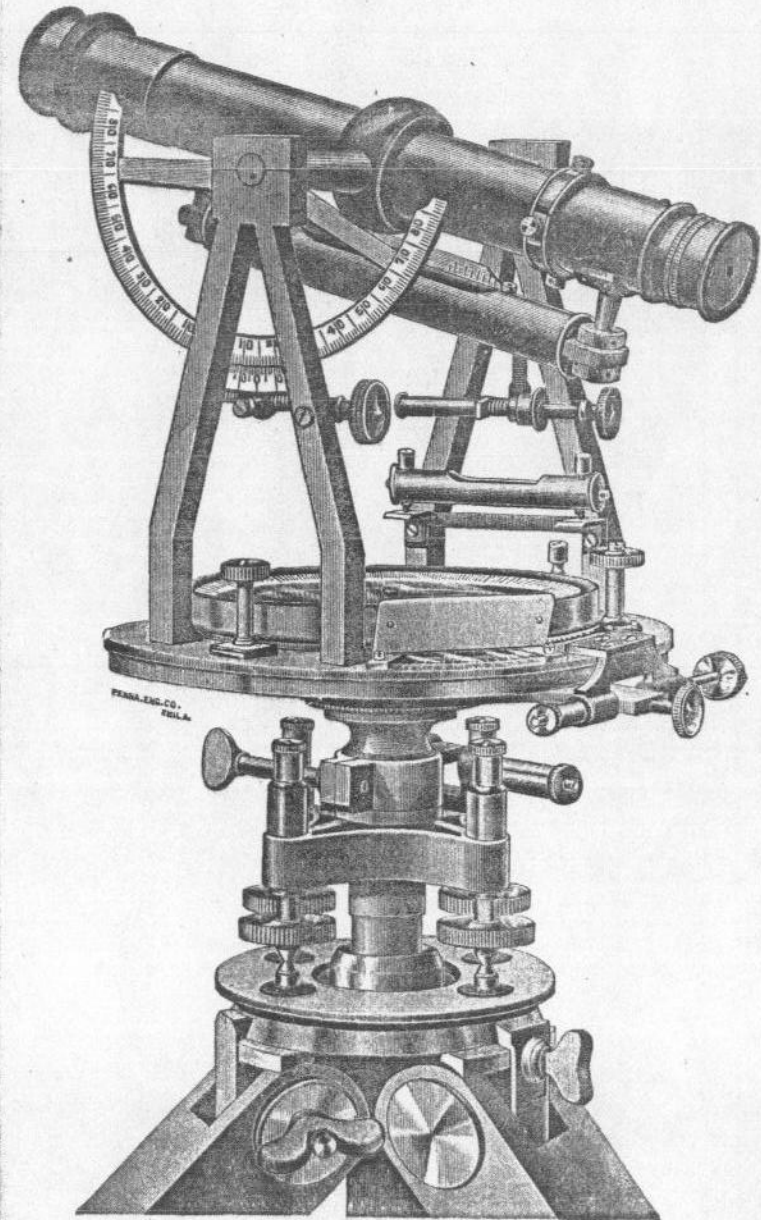
Particular attention is directed to our new, Complete Engineers' Transit, our new Surveyors' Transit and to our new Builders' Transit. Our new line of compasses with levelling screws and tripods are also worthy of attention.

Our Engineers' Aneroids, compensated and specially tested and adjusted for use in engineering, are arranged by us to read in absolute coincidence with the mercurial column, and in accuracy of work and non-liability to get out of order are unequaled.

Queen & Co., Inc.

Philadelphia, Jan. 1, 1896.

"Queen" Full Engineers' Transit.



A 1500

The "Queen" Full Engineers' Transit.

The illustration on previous page, illustrates our Improved Engineers' Transit. This instrument is especially constructed for city and railway engineering, and is recommended for work of the highest class.

The top plate and horizontal circle are made of special rolled brass, which gives them uniform density, and the necessary hardness on surface and edge for graduations, thus permitting the cutter or knife to travel uniformly, producing equal thickness to lines of graduations. The uniform density of the metal also gives the instrument an even expansion and contraction in extreme temperature, and holds the horizontal circle and vernier graduations in secure adjustment. The horizontal circle (graduated edge) is six and three quarter inches diameter and divided into half degrees, reading by double verniers to minutes; verniers are placed opposite at an angle of thirty-five degrees to the telescope. The figures on the limb and verniers are inclined in the direction they should be read; and are placed on the limb in two rows, from 0 to 360 in opposite directions. The graduations are silvered and protected by plate glass covers and also have reflecting shades over the verniers.

The compass needle is 5 inches, made of special magnet steel and of such a shape as to retain great magnetic power, also of proportioned lightness to insure sensitiveness. It swings on a jeweled centre, supported by a hardened and well pointed steel centre pin.

The casting of the compass ring, as well as all the castings used in our instruments, are cast in our own foundry, and of new metal absolutely free from iron. The compass ring is graduated into half degrees and figured in quadrants. It is also slightly inclined, which facilitates a much easier reading of the divisions on the edge.

The telescope is twelve inches long, having an objective $1\frac{3}{8}$ inches clear aperture, well corrected, giving a perfectly flat field, free from spherical and chromatic aberration. The eye piece has four lenses ground with the greatest accuracy from special formulae and mounted to give the maximum of power with the largest flat field and greatest light. The magnifying power is from twenty to twenty-four diameters, but higher or lower powers can be furnished if specially ordered.

It is provided with our patented screw focussing arrangement which adjusts the focus of the cross web in line of collimation with precision and smoothness, thus preventing paralax. This arrangement is the more valuable the higher the power used. A slide protector or sleeve covering is put on the object slide of the telescope to prevent dirt and grit from being carried into the tubes.

The telescope is well balanced and reversible at both ends, and is fitted with a six-inch finely ground and sensitive level with graduated scale.

The telescope axle is of best Bell Metal, having its bearings ground in the Standards. The arc is fitted to the telescope axle and graduated into half degrees with vernier reading to single minutes, also having tangent screw to facilitate the reading of the vernier. The telescope axle clamp is fitted on opposite side to the arc, and has a spring box which exerts an equal pressure on the clamp opposite the tangent screw.

The spirit levels are specially ground and are exceedingly sensitive and accurate.

The centres are long and compound, and made of anti-friction metal. The innerspindle is attached by a large flange to the vernier or upper plate, turning in the outer socket which is attached to the horizontal circle. The action of the centre clamp is entirely central, and when the plates are clamped together the whole instrument revolves in the socket of the leveling head.

The centres are turned between dead-centres to ensure the greatest concentricity; and will not show any displacement of the bubble when the lower centre is revolved. The tangent screws are of fine pitch and free of play, and spring boxes take the place of the old style opposing screws.

The leveling head consists of red metal, ribbed castings, wherein lightness and strength are combined. The four leveling screws have 36 threads to the inch, and are provided with dust-proof caps to prevent unnecessary wear and injury by dust or sand. They are also fitted on the lower end with a ball jointed cap so that the tripod plate will not be subject to unnecessary wear.

The instrument has a shifting plate and is fastened to tripod by means of three beveled clamps, one of which is adjustable, or, if preferred, the instrument will be made to screw on the tripod head without extra charge. The tripod head is one single casting and the legs are well seasoned wood, straight grained and shod with iron points.

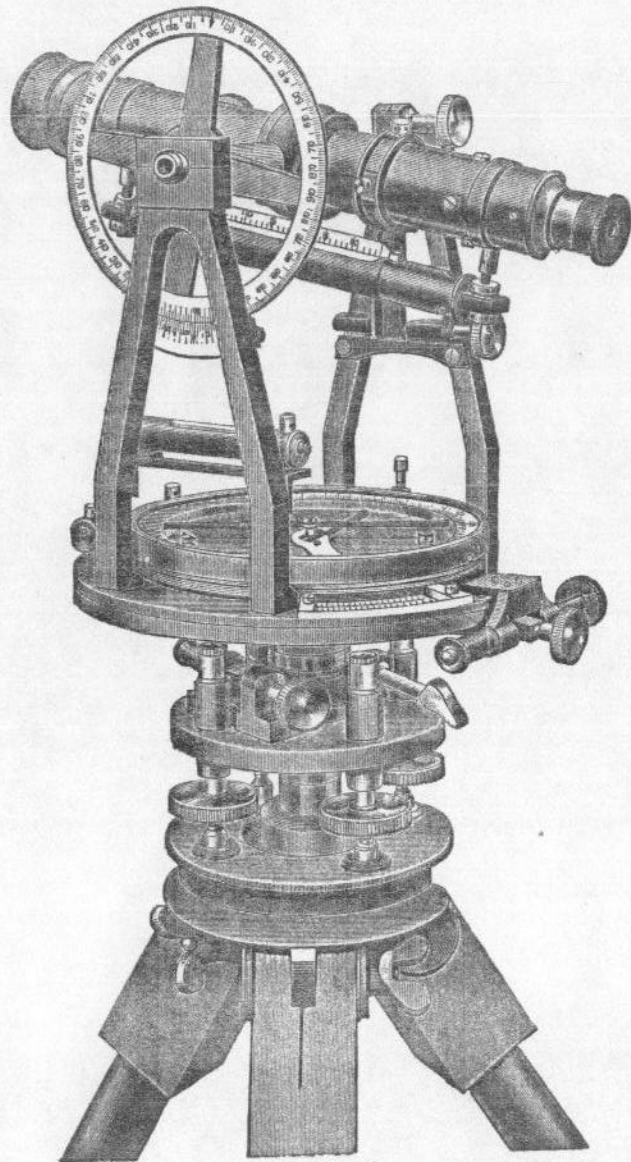
The transit is securely packed in a cherry box with strong leather carrying straps. The box contains plumb bob, magnifying glass, two screw drivers and two adjusting pins.

	Price.
A 1500, Complete Improved Transit as above description	\$180 00
A 1501, " " with variation plates	185 00
A 1502, " " with graduations on solid silver	200 00
A 1502½, " " graduated to 20 seconds on solid silver, with adjustable magnifiers for reading verniers	225 00
Weight of Transits, 17½ lbs.; with Tripod, 25 lbs.	
A 1503. Plain Improved Transit, same as A 1500, only without Vertical Arc, Level on Telescope and Clamp and Tangent to Telescope Avis	150 00

Extras for Engineers Transit.

Gradienter	18 00
Stadia wires	5 00
Reflector for illuminating cross wires	4 00
Extension tripod	15 00
Solar attachment	65 00

"Queen" New Surveyors' Transit.



A 1508

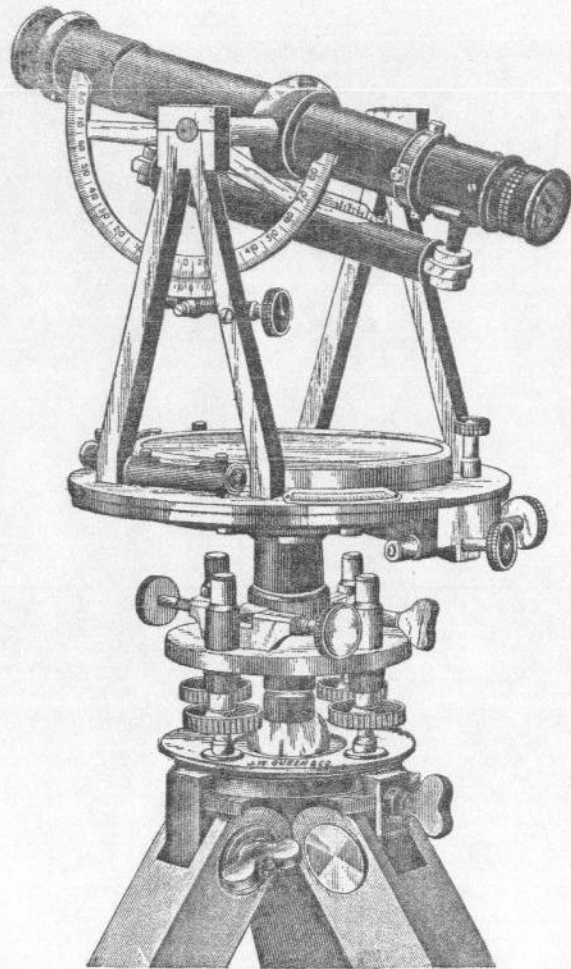
The "Queen" New Surveyors' Transit.

The illustration on opposite page represents our new Surveyors' Transit which is especially designed for use of surveyors for country and city work. This instrument is provided with our special form of combination centre, which possesses the advantages of the flat centres in withstanding rough handling, together with the greater accuracy of the long centres. The optical qualities of the telescope are the same as in the telescopes of all our high grade instruments, which are unsurpassed for power and definition. The instrument also possesses the most modern improvements, such as shifting tripod plate, capped and packed dust proof levelling screws, central clamp and compensating springs opposite all tangent screws. The instrument is always supplied with a variation compass and has five-inch needle. The horizontal circle is $6\frac{3}{8}$ " diameter, graduated into $\frac{1}{2}$ degrees, reading by opposite verniers to single minutes. The telescope is eleven inches long, having large field and much light, with about twenty-two diameters magnifying power, and has a six-inch accurate and sensitive ground level with graduated scales. The axle to telescope is fitted and ground in V bearings on the standards. A vertical circle $4\frac{1}{2}$ inches diameter, graduated to half degrees, reading by vernier to single minutes.

A 1508, New Surveyor's Transit as above description \$135 00

Extras for Surveyors' Transit.

Gradiometer	\$18 00
Stadia Wires	5 00
Extension Tripod	15 00
Solar Attachment	65 00



A 1525

The Queen Light Mountain Transit.

This instrument, introduced by us to meet the demand for a light transit for use in the mountains or under-ground mining work, has all the latest attachments of our improved engineers' instrument and differs from it only in lightness of construction and consequent portability.

The Light Mountain Transit has four-inch needle, double verniers placed at an angle of 35 degrees, which read to single minutes, with reflectors for illumination. Long centre, leveling screws, cap and pack so as to prevent injury from dust. The telescope is nine inches long, with power of 22 diameters, and has sensitive and carefully ground level attached. The telescope axle is provided with clamp and tangent screw and on opposite sides a vertical arc with vernier reading to single minutes.

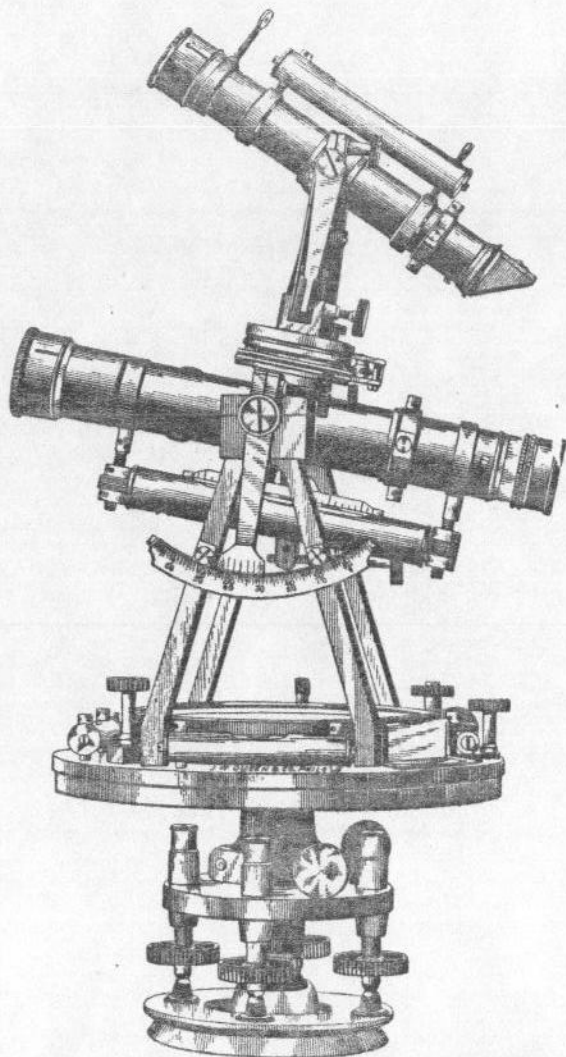
The instrument is packed in light cherry box, fitted with reading glass, sun shade, plumb bob, screw drivers and adjusting pin. The tripod is our improved patent adjustable leg tripod, fitted with clamp or screw head.

- A 1525, Light Mountain Transit as above \$185 00
 - A 1526, Plain Light Mountain Transit, as above, only without arc, level on telescope or clamp and tangent movement 150 00
- Weight of Transit, 11 lbs. ; with Tripod, 17 lbs.

Extra for Light Mountain Transit.

- Gradienter \$18 00
- Stadia Wires 5 00
- Reflector for illuminating cross wires 5 00
- Extra top or side telescope for vertical sighting 40 00
- Diagonal Prism for eye piece 10 00
- Solar attachment 65 00
- Sole-leather sling case with shoulder straps, for transit 3 00

Solar Transits.



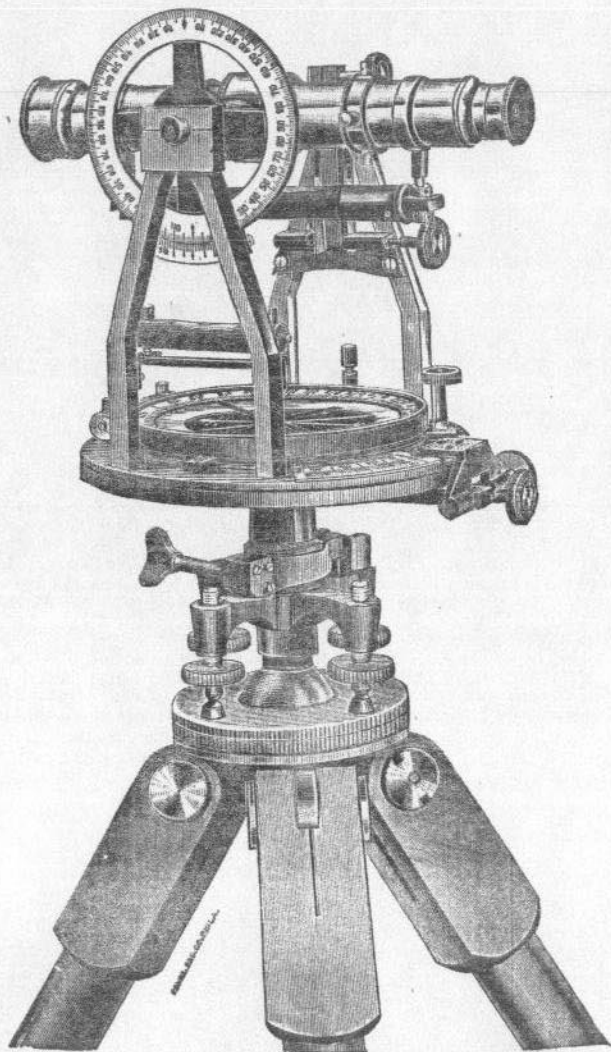
A 1520.

The Solar Attachment.

The Solar Attachment as shown in the opposite cut consists of a small telescope mounted on a horizontal axis, which rests upon two standards connected to a circular base. This base is the socket of the so-called Polar Axis, and is attachable at its lower extremity to the horizontal axis of the Telescope. The Solar Telescope is thus capable of being turned on its own Horizontal axis and on its Polar axis. A small level is applied parallel to the Solar Telescope. Two pointers are also attached for use as a specie of finder. the sun appearing the field of view of the telescope when the shadow of one of these pointers is thrown on the other. The Solar Telescope is provided with a right angle prism for conveniently observing the sun when it is at a considerable altitude. It is, of course, provided with shade glasses for the purpose of reducing the intensity of the Solar rays transmitted. The small graduated circle sometimes attached to the Polar axis enables the hour angle to be read off. Clamp and tangent are provided both for the vertical and for the hour angle movement. For instructions as to how the Solar is used we refer you to our Engineers' Manual.

- | | |
|---|----------|
| A 1520, Improved Engineers' Transit, same as A 1500 with Solar Attachment | \$250 00 |
| A 1521, New Surveyors' Transit, same as A 1508 with Solar Attachment | 200 00 |
| A 1522, Light Mountain Transit, same as No. 1525 with Solar Attachment | 250 00 |

“Queen” Builders’ Transit.



A 1530

The Builders’ Transit.

The Builders’ Transit, as recently designed by us, fills a long felt want among architects and builders, as it is often desirable to determine a point in a vertical plane above or below the object observed; or points on either side and in line of the centre of the instrument. The construction is compact, light and well adapted for all work for which ordinary levels and transits are required.

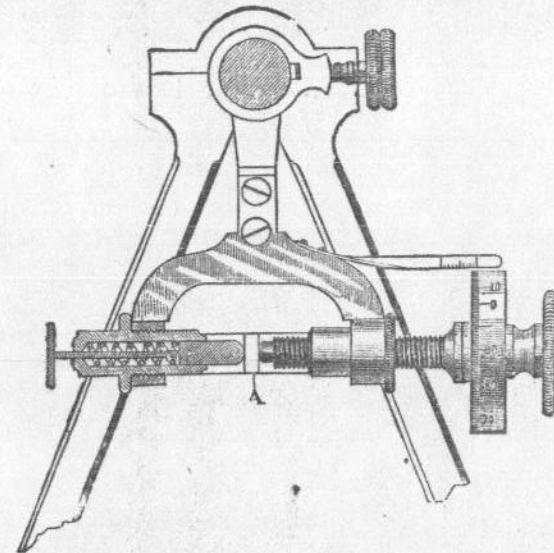
This transit is supplied with a variation compass, and has a four-inch needle. The horizontal circle is 5½ inches in diameter, graduated in half degrees reading by one vernier to single minutes. The telescope is eight inches long, with fine optical power, large field and abundance of light; has 4½ inch ground level, vertical circle 3½ inches diameter, and clamp and tangent screw to axis of telescope. The instrument is securely packed in cherry wood box, fitted with reading glass, plumb bob, screw driver and adjusting pins, and is furnished with solid leg tripod with screw head attachment.

A 1530, Builders’ Transit as above \$100 00

Extras for Builders’ Transits.

Gradienter	\$18 00
Stadia Wires	5 00
Extension Tripod	15 00
Solar Attachment	65 00
Shifting Centre	7 50

GRADIENTER.

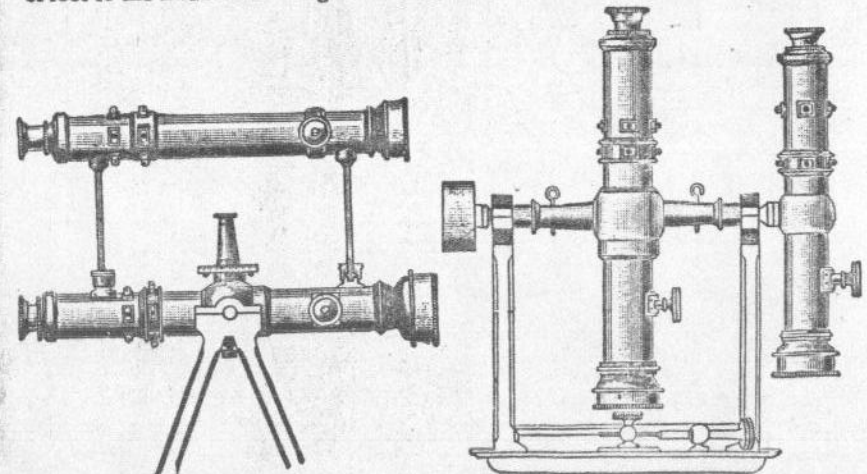


A 1535 Gradienter, as above \$18 00

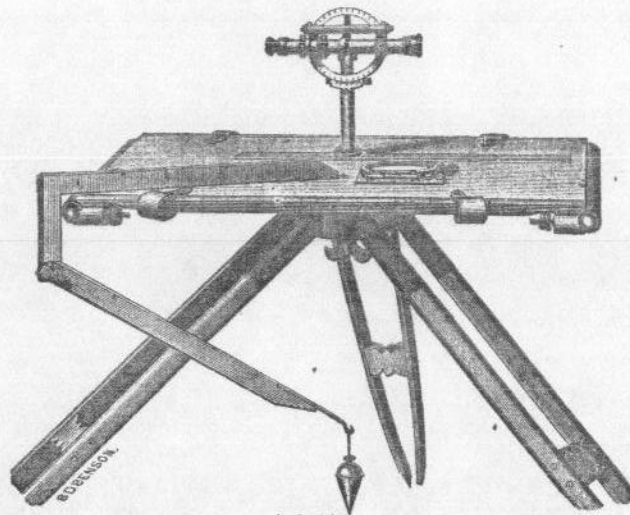
This attachment consists mainly of a screw attached to the semi-circular expanded arm of the ordinary clamp of the telescope axis; the screw is accurately cut to a given number of threads, and passing through a nut in one side of the arm presses against a little stud, *A*, fixed to the inside surface of the right hand standard.

As the value of the screw thread is such that a complete revolution will move the horizontal cross-wire of the telescope over a space of one foot on a rod at a distance of one hundred feet, it is clear that when the screw is turned through fifty spaces on the graduated head, the wire will pass over fifty one-hundredths, or one-half a foot on the rod, and so on in the same proportion.

In this way the Gradienter can be used in the measurement of distances. Grades can also be established with great facility, as follows: 1st, level the instrument; bring the telescope level to its centre by the clamp of the gradienter-screw; move the graduated head until its zero is brought to the edge of the scale; and then turn off as many spaces on the head as there are hundredths of feet to the hundred in the grade to be established.



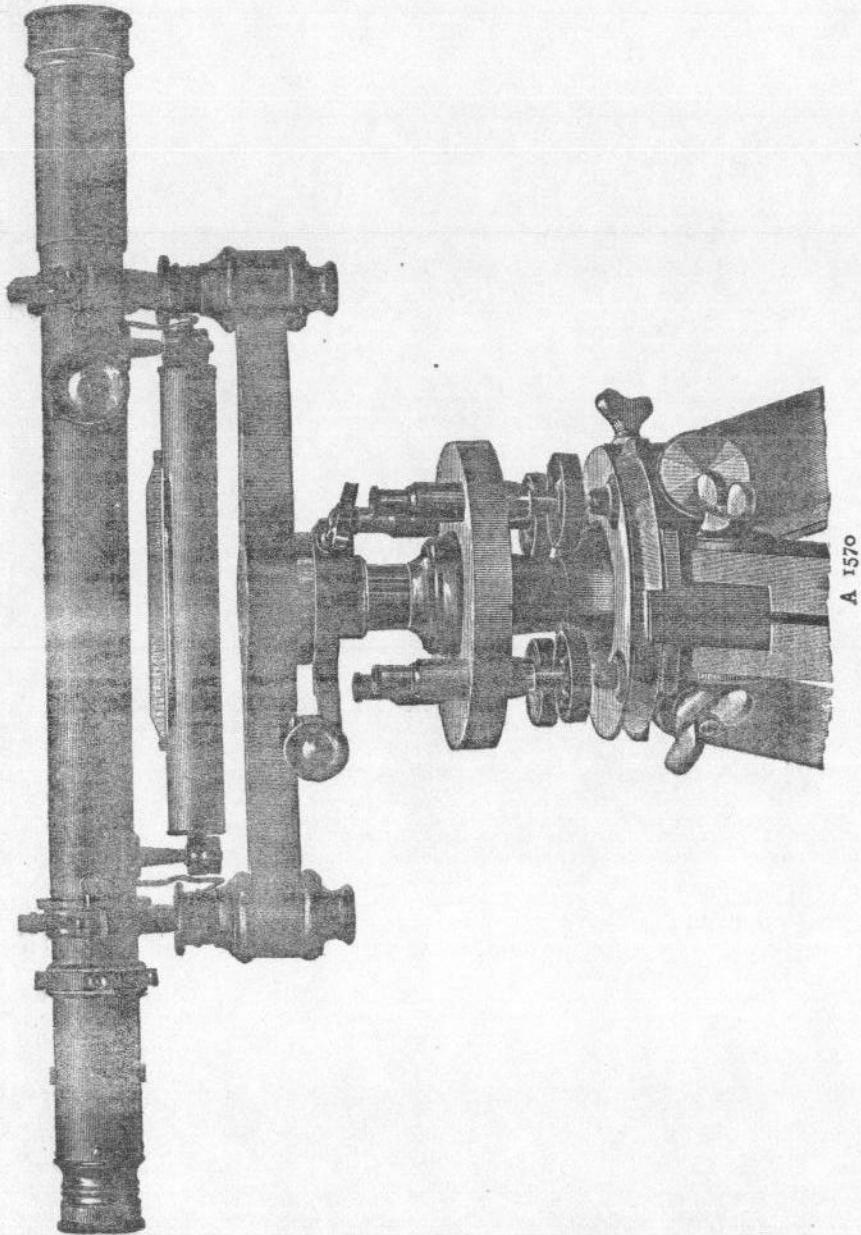
PLANE TABLES.



A 1531

No.	Description	PRICE
1.	Plane Table, board 24x30 inches, mounted on large tripod, with leveling socket and clamp, and with plumbing-bar, plummet, and clasps for paper,	\$45.00
	Combined compass and levels, with square base,	15.00
	Alidade with compass sights,	15.00
	Total,	\$75.00
2.	Plane Table, with board, etc., same as No. 1,	\$45.00
	Combined compass and levels,	15.00
	Alidade, same as No. 1, supplied with telescopic sight, with stadia, vertical circle to 5 minutes, level, and clamp and tangent,	50.00
	Total,	\$110.00
3.	Plane Table, with board, etc., same as No. 1,	\$45 00
	Combined compass and levels,	15.00
	Alidade, with telescope 9 inches long, power 20 diameters, with stadia, vertical circle to 5 minutes, level on telescope, and clamp and tangent, mounted on column as in engraving,	70.00
	Total,	\$130.00
4.	Plane Table, with board, etc., same as No. 1,	\$45.00
	Combined compass and levels,	15.00
	Alidade, with telescope 11 inches long, with stadia, 4½-inch vertical circle on silver to 1 minute, level on telescope, and clamp and tangent, on column, power of telescope 24 diameters,	90.00
	Total,	\$150.00
5.	Set of three leveling screws for any of the above-named Plane Tables, extra,	10.00
6.	Clamp and tangent, for movement in azimuth, extra,	5.00

"Queen" Engineers' Level.



Improved Engineers' Y Level.

The illustration on previous page represents our Engineers' Y Level of the most improved construction, with telescope of the finest optical qualities, and is made in three lengths, either 18, 20 or 22 inches long, and is mounted in proportional Y supports and different lengths of bars. The telescope has object glass $1\frac{1}{4}$ inch diameter with magnifying power about 35 to 45 diameters, as may be ordered. It has improved and patented screw adjustment to eye piece of telescope for focusing cross wires. The draw tube is provided with dust cap to prevent dirt or grit from entering the body tube.

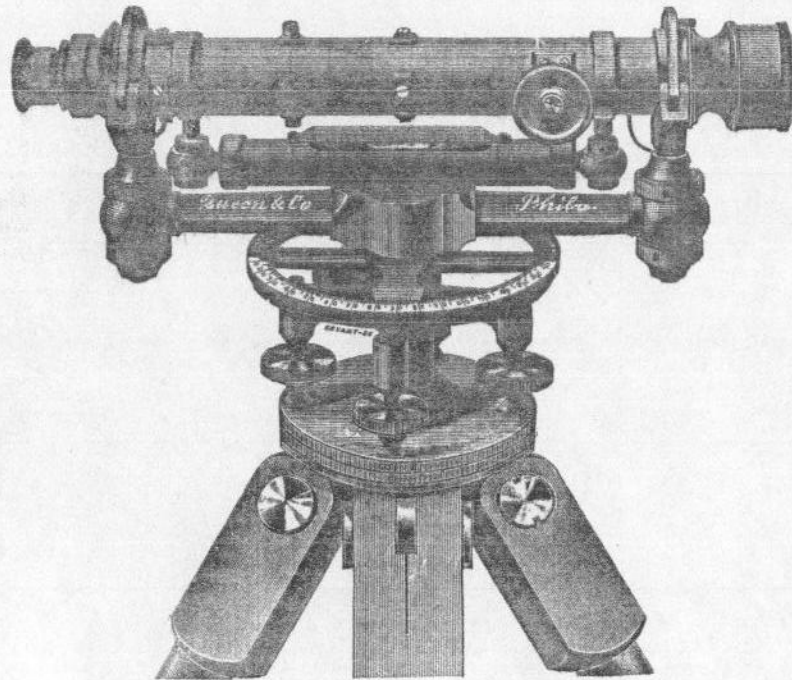
An eight-inch level is securely mounted on the under side of the telescope and is made of well seasoned glass, uniformly ground and graduated in tenths of inches. The run of bubble over one division of the scale is equal to 15 seconds elevation.

The telescope revolves truly in the Y's, and has bell metal collars at each end which are turned between dead centres of exactly the same diameter. These collars rest in the Y's and are held in position by clips which are hinged on the Y's and lock with taper-pins. One Y dip is furnished with a horizontal stud fitting into a semi-cylindric cut on the flange of the rim of the telescope, insuring the accurate position of the vertical wire. The Y's are large and strong, made of the best bell metal, each Y having two nuts, one of which is adjustable with the ordinary steel pin. The level bar is made square of fine bronze, and so proportioned as to have the greatest strength in the parts most subject to severe strain. The centre is made of bell metal and is extra long to increase steadiness. The leveling screws are made large with broad edge and concave to avoid unnecessary weight, and are capped and packed to prevent injury from dust. The level is fastened on tripod either by bevel clamps or by screw as may be desired.

The instrument is packed erect in box which contains sun-shade, wrench, a screw driver and adjusting pins.

No.	Price.
A 1570, Engineers' Y Level, 18-inch telescope complete, with tripod, as above	\$110 00
A 1571, Engineers' Y Level, 20-inch telescope complete, with tripod, as above	110 00
A 1572, Engineers' Y Level, 22-inch telescope, complete, with tripod. .	115 00
A 1573, Light Engineers' Y Level, 15-inch telescope, has the same general arrangement as the regular engineers' level, but the leveling head remains attached to the spindle, and the whole instrument is somewhat smaller and lighter; complete, with tripod .	100 00

"Queen" Architect Level.

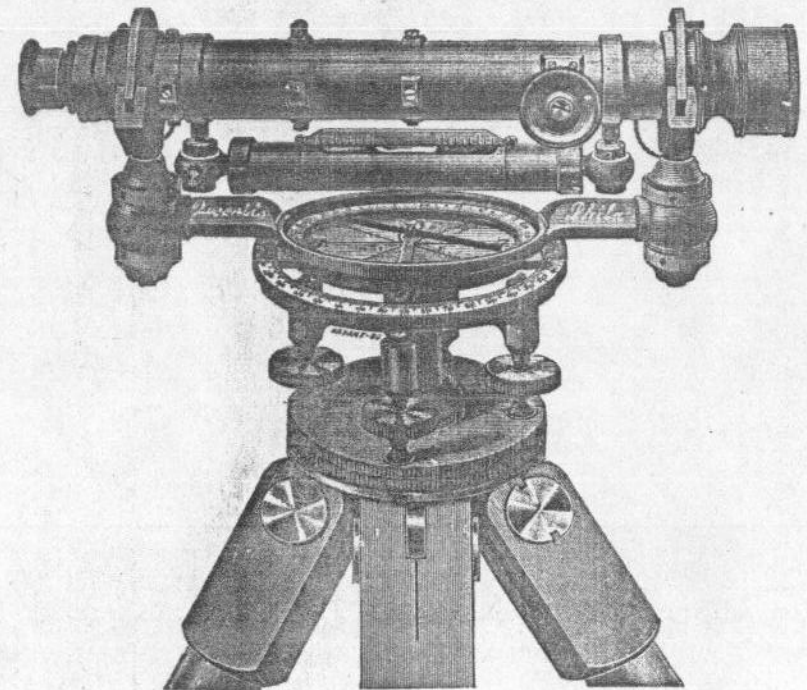


A 1576

The Architects' Level as illustrated above is an admirable instrument, and can be highly recommended, as it has met with a very large sale among architects, builders, millwrights and others engaged in construction, and among engineers and surveyors, by whom it is used in city work. The telescope is 12 inches long, of the finest optical qualities and has magnifying power of about 25 diameters. It has truly ground level of medium sensitiveness which is graduated and securely mounted under the telescope. The telescope has red metal collars, which rest in the Y's and are held in position by clips which are hinged and locked the same as in the engineers' level. The instrument turns upon a horizontal circle 3 inches in diameter, graduated from 0 to 90 each way, and is read to five minutes by a vernier which is fixed to the spindle. The instrument is screwed on tripod and is packed in box fitted with sun shade, plumb bob, reading glass, screw driver, adjusting pins and metal trivet.

A 1576, Architect's Level as above, price \$50.00

"Queen" Architect Compass Level.

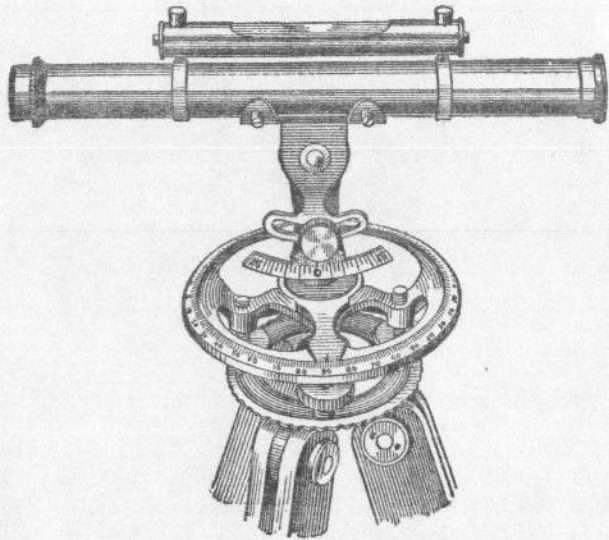


A 1577

This instrument is similar to the Architects' Level, before described, but is fitted with compass with $3\frac{1}{2}$ inch needle. This is so arranged that it adds practically nothing to the weight or bulk, and does not interfere with the portability of the instrument, whilst its value in many kinds of work is obvious. The instrument is screwed on a tripod and packed in a box fitted with sun shade, plumb bob, reading glass, screw drivers, adjusting pin and metal trivet.

A 1577, Architects' Compass Level, as above . . . \$65.00

The "Queen" Land Level.



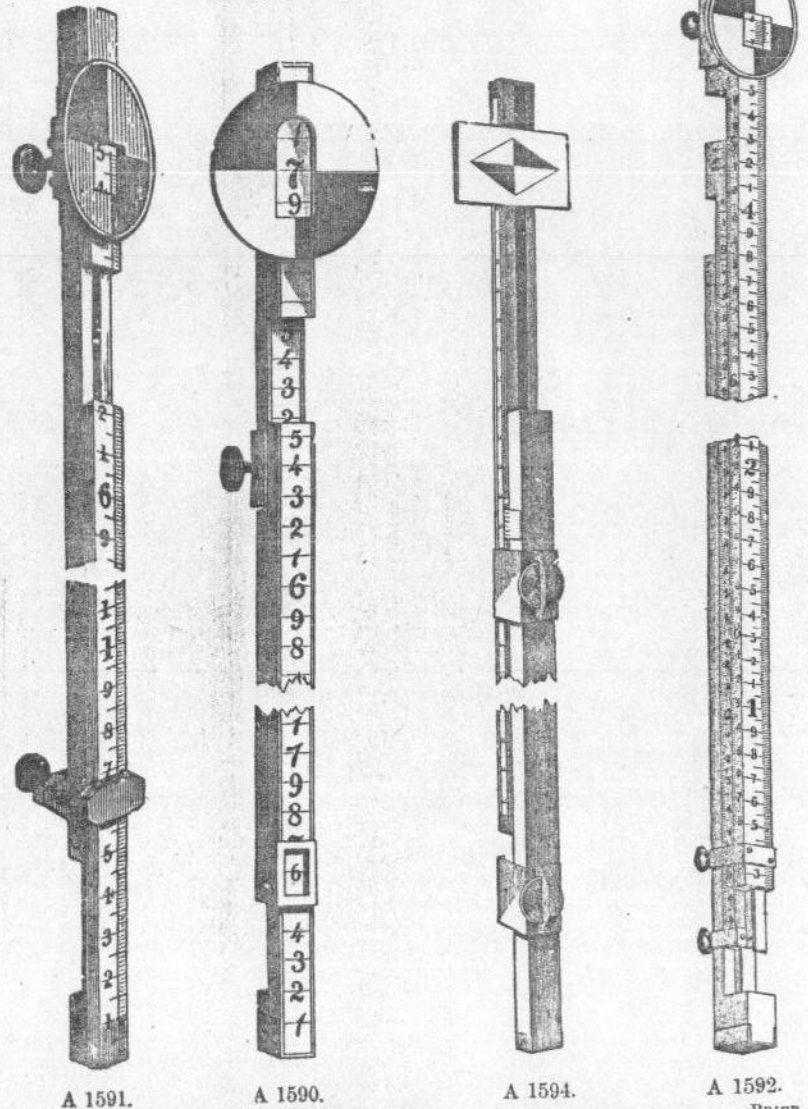
A 1581

The Queen Land Level as recently introduced by us, is the only low-priced instrument on the market that combines all the working features of the finer engineering transits and levels. This complete little instrument, as shown in the above illustration, is practically indispensable to engineers, county surveyors, farmers, landscape gardeners and planters. It is a great labor saver to the wheelwright in lining and setting up shafting, to the builder and bricklayer a valuable substitute for the primitive level board formerly used in setting up foundations, floors, sills and running grades. It is also an excellent instrument for the scholar, illustrating the elementary principles of engineering and surveying. It can be used for angulation, level lines, grading streets, sewers and drains.

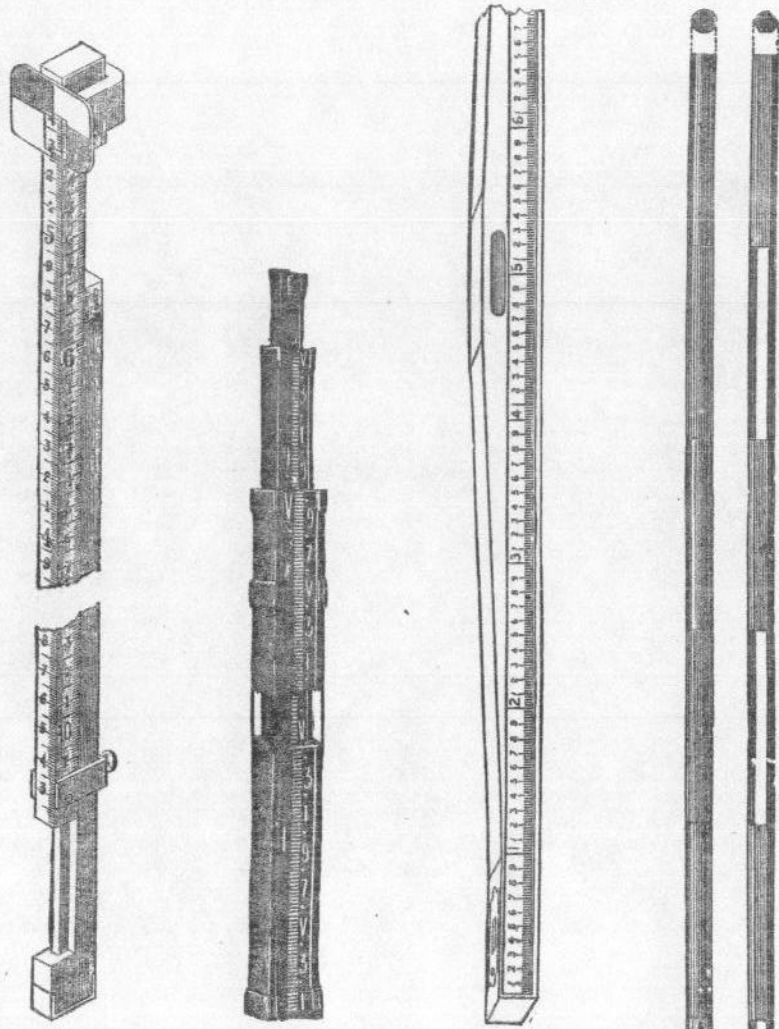
The construction is extremely simple, having as few parts as possible and combines compactness and efficiency so that anybody can at once work it successfully and without special explanations. The telescope is 8½ inches long having achromatic objectives, with magnifying power ten times. The eye-piece has four (4) lenses showing objects in their natural position. The cross wires are fixed in the telescope so that there is no danger of their losing the adjustment. The level is mounted on top of the telescope and is provided with adjusting screws. The telescope and level are securely mounted on a swivel bearing which permits of an elevation or inclination of the telescope 25 degrees from the level line, and can be clamped in any position. The levelling frame is provided with four (4) levelling screws whose lower ends are ball jointed and graduated into degrees. The socket is carefully fitted to the centre of the levelling frame and is also provided with a clamp screw. The arc is cast on this socket and graduated into degrees. The lower end of the levelling plate has a half ball which connects the tripod plate to the upper part like in the case of the regular transits and levels. The instrument is screwed to a substantial tripod and is packed in a wooden carrying case making it exceedingly portable.

- A 1580, Queen Land Level, for horizontal angles \$20.00
- A 1581, Queen Land Level, for horizontal and vertical angles 25.00

LEVELING RODS.



No.	Description	Price
A 1590.	Philadelphia Rod, made of seasoned mahogany, 7 1/5 feet closed, sliding to 13 feet.	\$14.00
A 1590 1/2.	Philadelphia Rod, 4 feet closed, sliding to 7 feet.	12.00
A 1591.	New York Rod, made of satin wood, 6 1/5 feet closed, sliding to 12 feet.	14.00
A 1592	New York Rod, in 3 parts, 5 feet closed, sliding to 13 feet.	18.00
A 1593.	Do. do. 4 do. 5 feet closed, sliding to 16 feet.	20.00
A 1594	Do. do. 6 feet closed, sliding to 11 feet.	14.00



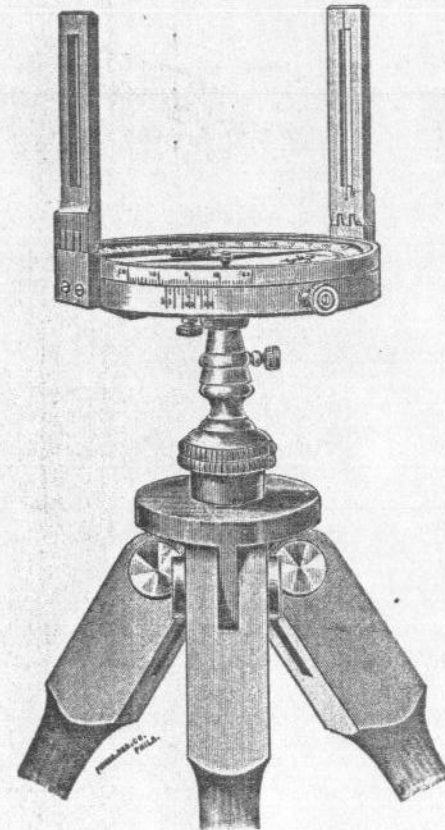
A 1595.

A 1596.

A 1597.

No.	PRICE.
A 1595. Architect's Rod, reading to inches and 16ths, 5½ feet closed, sliding to 10 feet,	\$6.00
A 1596. Telescopic Rod, 5 feet long, sliding to 14 feet,	24.00
A 1597. Cross Section Rod, 10 feet long, with level bulb at each end,	10.00
A 1598. Telemeter or Stadia Rod, 6 feet closed, opening to 12 feet,	12.00
A 1599. Ranging Pole, 6 feet long, with steel-pointed shoe and divided off in feet, which are painted red and white alternately,	A 1599. 2.00
A 1600. Ranging Pole, 8 feet long, . . . . .	. . . . . 2.25
A 1601. Ranging Pole, 10 feet long, . . . . .	. . . . . 2.50
A 1602. Aligning or Ranging Pole, 6 feet long, hung in gimbals, . . . . .	. . . . . 4.00

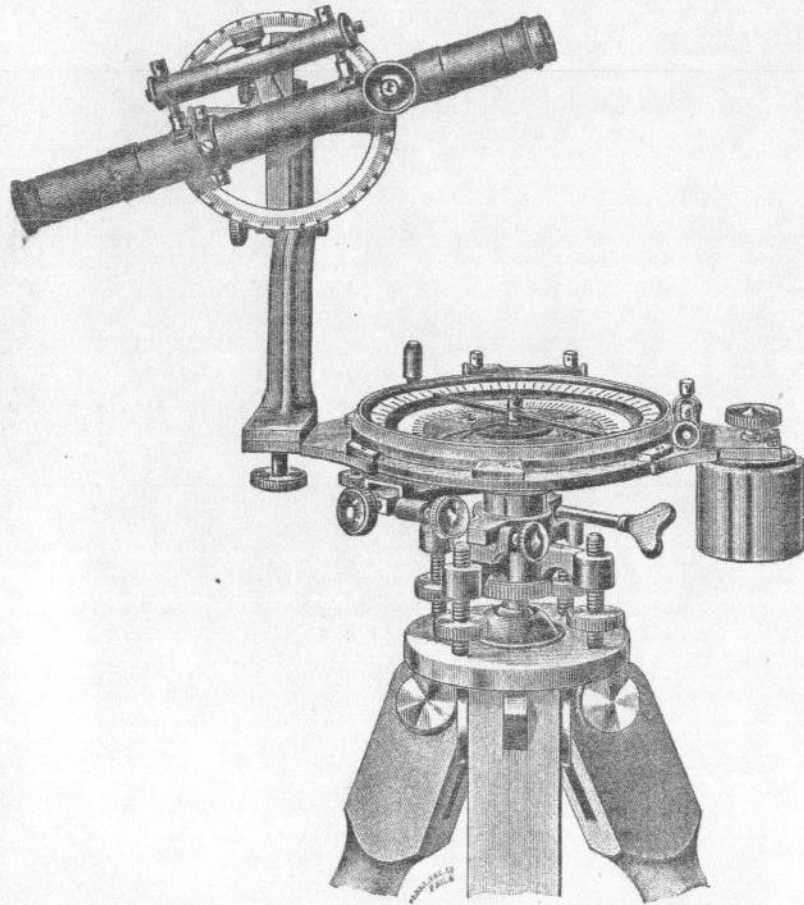
Pocket Surveyors' Compass.



A 1610

A 1610, Surveying Compass, with folding sights, needle 3½ inches long, nonius on side of compass, box for adding and subtracting magnetic variations, two straight levels, Jacob Staff' mountings	\$16 00
A 1611, Same as above, but with 4½-inch needle	18 00
A 1612, Surveying Compass, same as No. 1610, but without nonius, needle 3½ inches long	13 50
A 1613, Surveying Compass, same as No. A 1612, without levels and nonius, needle 3½ inches long	12 00
A 1614, Surveying Compass, same as No. A 1613, but needle 2½ inches long	10 00
Tripod, with cherry legs, for any of above compasses	7 00

Vernier Surveyors' Compass with Telescope.



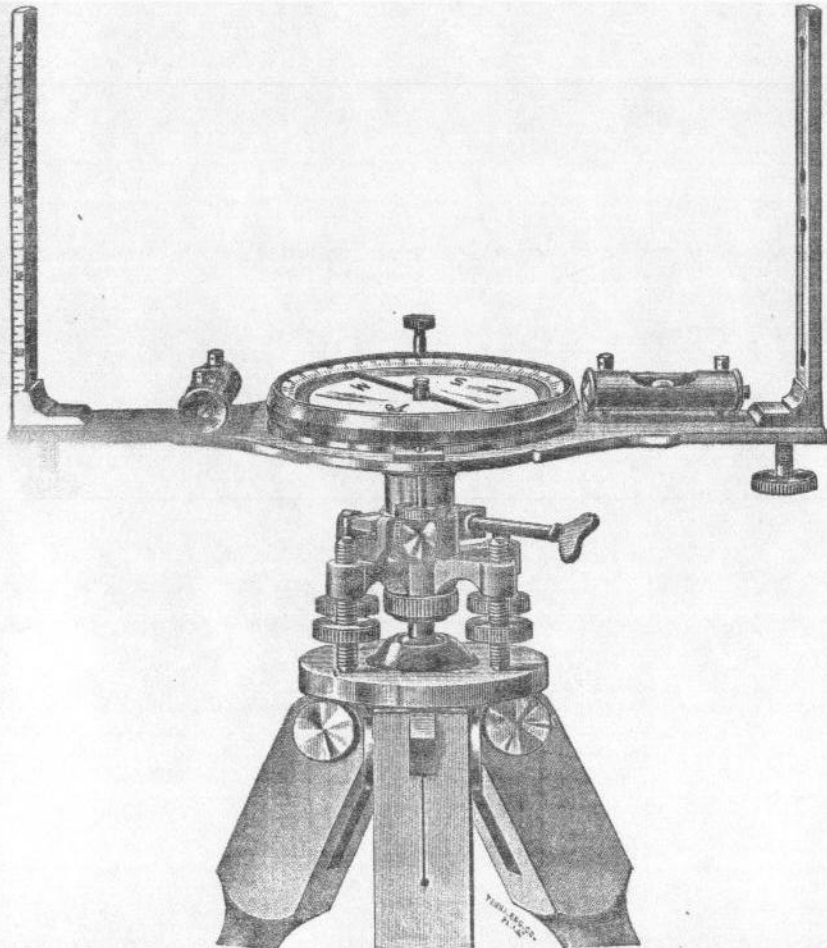
A 1615

The Variation Compass with Telescope.

The Variation Compass with Telescope is a valuable combination for surveyors, as it is not only a surveyors' compass, but combines the practical working features of the transit. The needle is four inches long, and the graduated compass ring is slightly inclined to facilitate the reading of the needle. A variation plate is attached and is operated by loosening the clamp screw so that the compass ring can be moved in Azimuth to set off the magnetic variations of the needle. It also has a circle for reading horizontal angles, graduated into half degrees, under the glass cover of the telescope box; the vernier of which reads to one minute, and is fastened to the centre, becoming part of the main socket. A clamp and tangent screw with opposing spring is attached to facilitate the reading of the vernier. Two ground glass levels are placed at right angles on top plate. The telescope is 9 inches long, of fine optical quality, with magnifying power of about 20 diameters. It has rack focusing and sliding tube for eye piece. A truly ground level is attached on top of telescope. The vertical circle is graduated in half degrees and reads by vernier to three minutes. The telescope revolves for back sighting and has clamp and tangent attachment. The telescope supports are screwed in same place as the sights and are balanced on opposite sides by a counterpoise. The sights are also furnished, and are graduated into one-half degrees on the edge for angles of elevation or depression. The lower part has four leveling screws and clamp and tangent movement. The instrument is readily attached to the tripod by a screw fastened on head of tripod. The telescope and sights are detachable and packed in case with the compass. The box is fitted with plumb bob, screw drivers, wrench, etc.

A 1615, Vernier Compass with telescope and tripod and levelling screws complete, as above \$75 00

The Plain Compass.



A 1616

The Plain Compass.

The Plain Compass as now made with all our extra attachments and furnished at a very slightly increased price, can be highly recommended, as it enables the surveyor to accomplish twice the amount of work that can be done by the old form. The needle is made in three different lengths, four, five and six inches, and the plates are thirteen, fourteen and fifteen inches long respectively. The compass rim is slightly inclined to facilitate the reading of the needle, and is graduated into one-half degrees, figured in quadrants. Two ground glass levels are placed at right angles on top plate. The sights are graduated into half degrees on the edge for angles of elevation or depression. The lower part has four leveling screws and clamp and tangent movement. The instrument is readily attached to the tripod by a screw fastened on the head of tripod. The sights are detachable and are packed in case with the instrument. The case is fitted with plumb bob, screw drivers, wrench, etc.

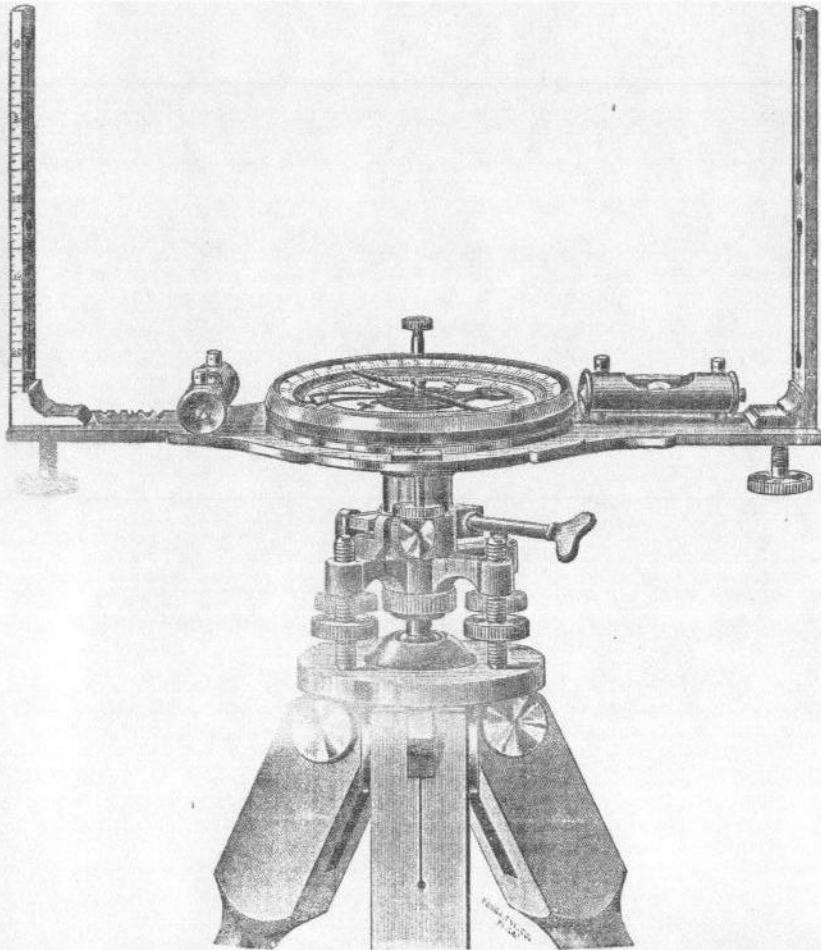
- A 1616, Plain Surveying Compass, 4-inch needle, 13-inch plate, as above, with tripod and leveling screws, complete \$30 00
 A 1617, Plain Surveyors' Compass, 5-inch needle, 14-inch plate, as above, with tripod and leveling screws, complete 35 00
 A 1618, Plain Surveyors' Compass, 6-inch needle, 15-inch plate, as above, with tripod and leveling screws, complete 40 00

The Variation Compass.

The Variation Compass is constructed on the same model as the Plain Compass, but has in addition a variation plate which is placed on compass plate and is operated by loosening the clamp screw so that the compass rim can be moved in Azimuth to set off the magnetic variation of the needle.

- A 1619, Variation Compass, 4-inch needle, 13-inch plate, as above, with tripod and leveling screws, complete \$35 00
 A 1620, Variation Compass, 5-inch needle, 14-inch plate, as above, with tripod and leveling screws, complete 40 00
 A 1621, Variation Compass, 6-inch needle, 15-inch plate, as above, with tripod and leveling screws, complete 45 00
 Any of these compasses can be furnished with ball and socket joint instead of leveling screws and Jacob Staff mounting, at a reduction of \$5.00.

The Railroad Compass.



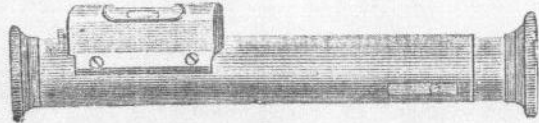
A 1622

The Vernier Railroad Compass.

The Vernier Railroad Compass is constructed on the same model as A 1615. The needle is made in three different lengths, four, five and six inches and the plates are thirteen, fourteen and fifteen inches long respectively. The compass rim is slightly inclined to facilitate the reading of the needle and is graduated in half degrees figured in quadrants. A Variation plate is attached and is operated by unloosening the clamp screw so that the compass rim can be moved in Azimuth to set off the magnetic variations of the needle. It also has a circle for reading horizontal angles, graduated into half degrees, under the glass cover of the compass box; the vernier of which reads to one minute and is fastened to the centre, becoming part of the main socket. A clamp and tangent screw with opposing spring is attached to facilitate the reading of the vernier. The sights are graduated into half degrees, on the edge for angles of elevation or depression. The lower part has four leveling screws and clamp and tangent movement. The instrument is readily attached to the tripod by a screw fastened on head of tripod. The sights are detachable and are packed in case with the compass. The box is fitted with plumb bob, screw drivers, wrench, etc.

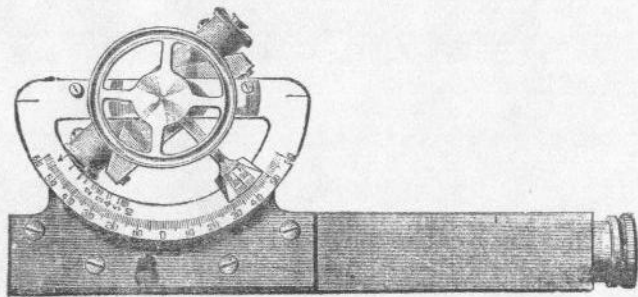
- | | |
|--|---------|
| A 1622, Vernier Railroad Compass, 4-inch needle, 13-inch plate, as above,
with tripod and leveling screws, complete | \$45 00 |
| A 1623, Vernier Railroad Compass, 5-inch needle, 14-inch plate, as above,
with tripod and leveling screws, complete | 55 00 |
| A 1624, Vernier Railroad Compass, 6-inch needle, 16-inch plate, as above,
with tripod and leveling screws, complete | 65 00 |

HAND LEVELS.



A 1650.

No.		PRICE.
A 1650.	Locke's Hand, brass,	\$7 00
A 1650½.	Do. brass, 2d quality,	4 00
A 1651.	Do. nickeled,	8 00
A 1652.	Do. German silver,	8 00



A 1653.

A 1653. Abney Level and Clinometer, a combination of the "Locke Hand Level," with the Clinometer, giving angles of elevation and slopes, in wood box, 13 50

DIRECTIONS FOR USE.

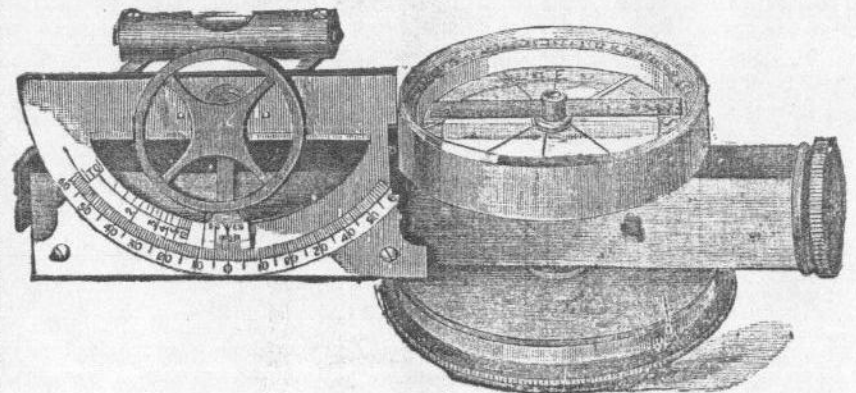
When the height of any object is required to be taken, a distance should be correctly measured from the object, say 100 feet, this forms the base line, and at which point the observer would stand; then, direct his vision through the tube of the level, and elevate it until the highest point of the object is seen bisected by the horizontal edge of the reflector within the tube. While holding it steadily in this position, the spirit level, which is attached to the axis of the arc should be turned upon its centre until the *Bubble* is seen reflected in the mirror, and also bisected by the horizontal edge of reflector, the alignment is then complete, and the height of object obtained by reading off the index of the arc.

The arc has two graduated scales upon it, one giving the angular measurement by degrees, and subdivided by the vernier divisions on the index. The other scale is figured 1 to 10 with their subdivisions, representing $\frac{1}{5}, \frac{1}{3}, \frac{1}{2}$, etc., of the length of the measured base, and is read off by the fiducial edge at the side of index. If, therefore, the edge coincides with division 4, the height of object would be $\frac{1}{4}$ of the base line, or 25 feet.

In using the Angle reading scale on arc, the following tables may be referred to:

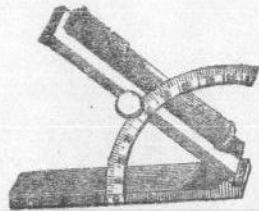
Angle 1° . . . gradient . . . 1 in 57.	Angle 12° . . . gradient . . . 1 in 4.7
" 1°30' . . . " . . . 1 " 38.	" 14° . . . " . . . 1 " 4.
" 2° . . . " . . . 1 " 28.6	" 16° . . . " . . . 1 " 3.4
" 2°30' . . . " . . . 1 " 22.8	" 18° . . . " . . . 1 " 3.
" 3° . . . " . . . 1 " 19.	" 20° . . . " . . . 1 " 2.7
" 3°30' . . . " . . . 1 " 16.2	" 22° . . . " . . . 1 " 2.4
" 4° . . . " . . . 1 " 14.3	" 24° . . . " . . . 1 " 2.2
" 4°30' . . . " . . . 1 " 12.6	" 26° . . . " . . . 1 " 2.
" 5° . . . " . . . 1 " 11.4	" 28° . . . " . . . 1 " 1.88
" 6° . . . " . . . 1 " 9.5	" 30° . . . " . . . 1 " 1.73
" 8° . . . " . . . 1 " 7.1	" 35° . . . " . . . 1 " 1.40
" 10° . . . " . . . 1 " 5.6	" 40° . . . " . . . 1 " 1.20
	" 45° . . . " . . . 1 " 1.1

When a slope or gradient is required to be set out to any given angle, the index of arc should be set by reference to the above tables, and the instrument placed upon the object to be inclined; this should then be raised or lowered until the *Bubble* is seen in the centre of spirit level, the required gradient being thus given.

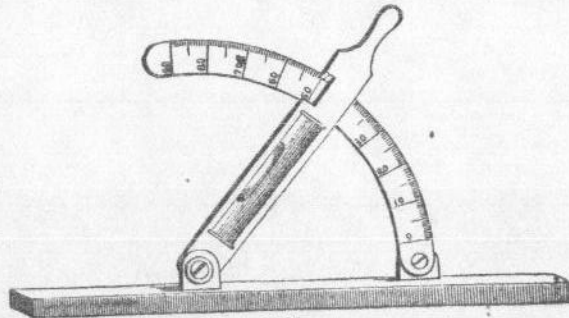


1653½.

No.	PRICE.
1653½. Abney's New Model Reflecting Level or Pocket Altimeter, improved, with compass, in box,	\$18 00

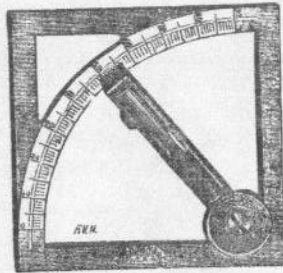


A 1654.



A 1655.

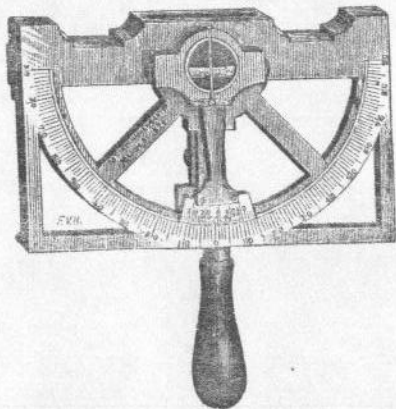
- | | | |
|---------|---|-------|
| A 1654. | CLINOMETER OR SLOPE LEVEL, small, in morocco box, | 8.00 |
| A 1655. | Do. do. large, do. | 12.00 |
| A 1656. | Do. do. do. with perpendicular sight, . | 15.00 |



A 1657.

- | | | |
|---------|--|---------|
| No. | | PRICE. |
| A 1657. | CLINOMETER, of square frame, with arc running diagonally across, in box, | \$12.00 |

This form gives the instrument great firmness, and either of the four sides can be used for ascertaining the slope, thus enabling one to take the inclination of the under side of a plane.



A 1658.

The "Queen" Machinists' Levels of Precision.



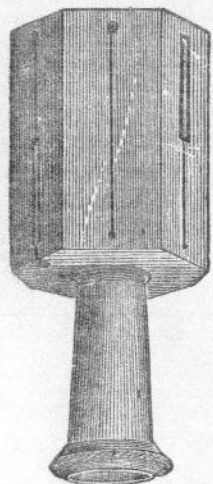
Spirit Levels are the most sensitive, and therefore most important, appliances for practically determining horizontal or vertical planes, and for measuring small angles. They replace and far excel the plumb line as formerly used for the same purpose. The production of an accurate spirit level is a work requiring much skill and patience and knowledge of the scientific principles involved. It includes principally the grinding of the curve and the sealing of the tube.

The sensitiveness of a level depends upon the radius of curvature, which in ground levels is mainly obtained by the grinding of the inner surface to the requisite curve, which practically is a difficult operation requiring special skill in its manipulation. The sensitiveness of a level varying directly as the radius of curvature, levels ground to a short radius give scarcely any displacement of the bubble for a small variation of the angle, while those of sufficiently long radius may be made to show an appreciable displacement of a bubble for an angular value of but a fraction of second of arc. The sensitiveness of levels is usually stated as so much deviation of the bubble per single division of one French ligne of 2.26 mm. in length.

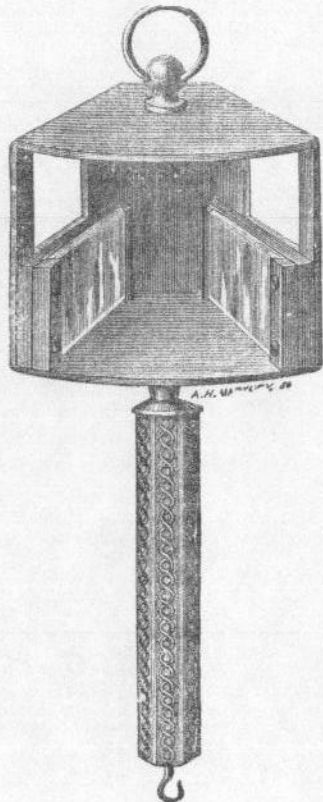
In furnishing our Machinists' Levels of Precision, we are prepared to supply a level of any requisite degree of curvature and consequently, any required degree of sensitiveness. Our Machinists' Levels of Precision are carefully mounted in iron case, with brass top and accurately planed surfaces, also are adjustable laterally and vertically. They are supplied with short cross level carefully ground, and the main bulb is graduated in inches and tenths.

This form of Spirit Level has long been recognized as the best constructed and most suitable form for setting up locomotives, stationary engines, boilers, planers, lathes and all fine machinery, and is guaranteed to give satisfaction.

Machinists' Level, 8 inches long	.....	\$ 8 00
" " 10 "	.....	10 00
" " 12 "	.....	12 00
" " 15 "	.....	15 00



A 1668.

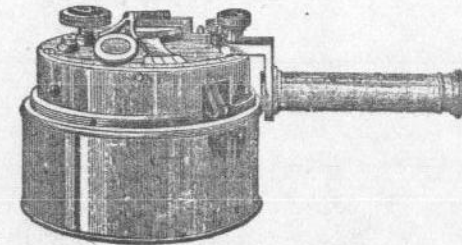


A 1672



A 1673

No.	DESCRIPTION	PRICE
A 1668.	CROSS STAFF HEAD, for turning right angles, in case, 2 3/4 inches, .	\$3.00
A 1669.	Do. do. do. do. do. 3 inches, .	3.50
A 1670.	Do. do. with magnetic compass, 3 inches, needle 1 3/4 inch, .	6.50
A 1671.	Do. do. with vertical axis and divided circle, to take angles 3 3/8 inch, .	12.00
A 1672.	REFLECTING HAND MIRROR, for turning right angles, .	7.50
A 1673.	RECTANGULAR PRISM, for right angles, 2 1/2 x 1 1/4 x 1 1/8 inches, in morocco case, .	5.00
A 1674.	SURVEYOR'S ANGLE MIRROR, for right angles, with a small plumb-bob. Size of instrument when packed, 3 3/4 x 2 x 1 1/4 inches, .	8.50
A 1675.	DOUBLE PRISM, to take angles of 90° and 45°, in morocco case, .	10.00

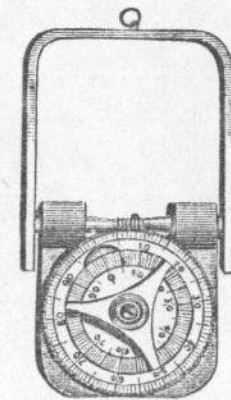


A 1680.

No.	DESCRIPTION	PRICE
A 1680.	POCKET SEXTANT, divided on silver, with telescope and tangent adjusting screw, etc., in leather sling case, .	\$42.50
A 1681.	Pocket Altazimuth, for travelers and military surveyors, . . .	50.00



A 1685.

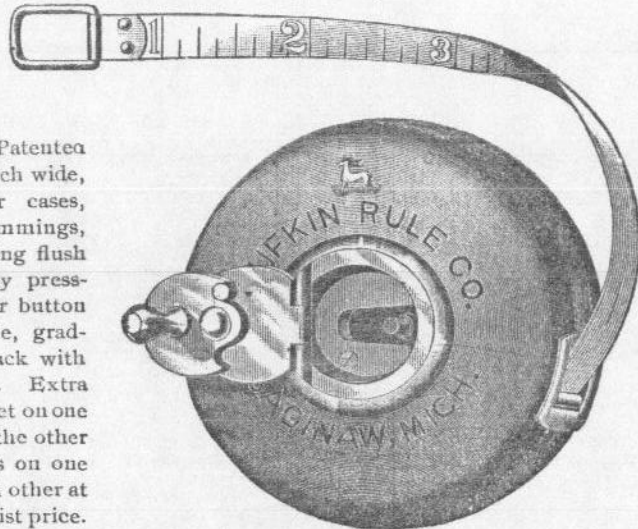


A 1688.

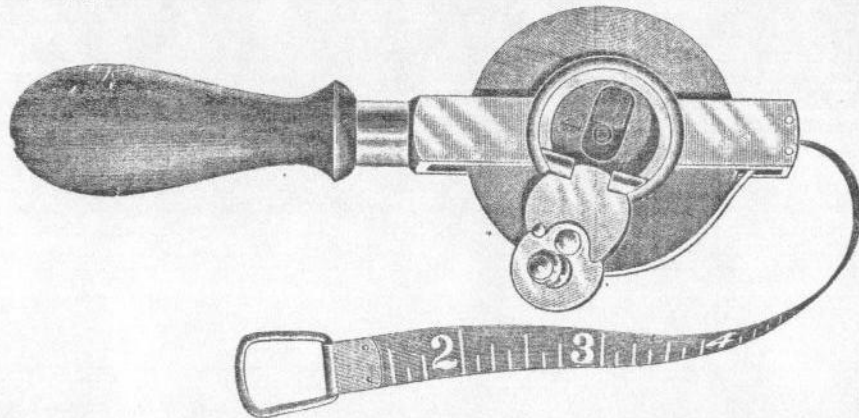
A 1685.	PEDOMETER, watch pattern, German silver case, registering distance walked up to 12 miles, .	4.50
A 1686.	PEDOMETER, watch pattern, German silver case, dial, with 2 hands, registering distance up to 100 miles, .	6.00
A 1687.	PEDOMETER, watch pattern, German silver case, with 3 hands, registering up to 1,000 miles, .	10.00
A 1688.	ODOMETER, for measuring distances traveled by carriage, in leather case, with strap,	15.00

"Reliable" Steel Tapes.

"Reliable" Patented Steel Tapes, $\frac{3}{8}$ inch wide, in hard leather cases, nickel-plated trimmings, with double folding flush handle, opened by pressing small pin or button on opposite side, graduated on the back with links and poles. Extra graduations of feet on one side, meters on the other or feet and 12ths on one side and 10ths on other at $2\frac{1}{2}$ c. per foot to list price.



A 1721,	Steel Tape,	25 feet long,	in 10ths or 12ths,	each	.....	\$4 50
A 1722,	"	33	"	"	"	5 20
A 1723,	"	40	"	"	"	6 00
A 1724,	"	50	"	"	"	7 20
A 1725,	"	60	"	"	"	9 20
A 1726,	"	75	"	"	"	10 40
A 1727,	"	100	"	"	"	12 80

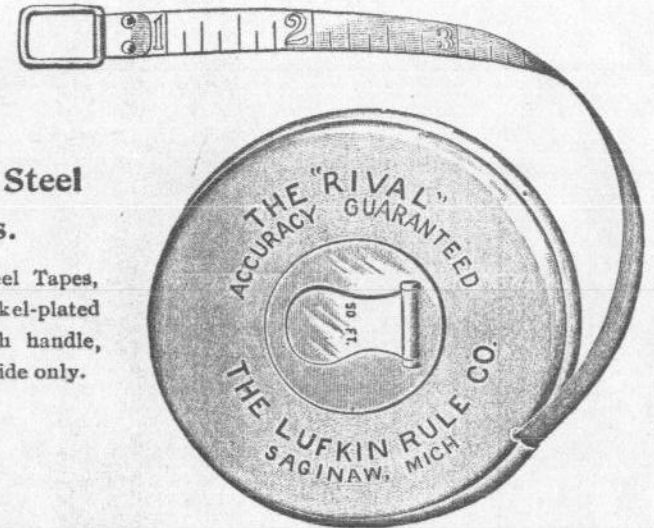


"Reliable" Frame Steel Tapes, $\frac{1}{2}$ inch wide, nickel-plated frames and trimmings, with double folding flush handle, opened by pressing small pin or button on opposite side, graduated on the back with links.

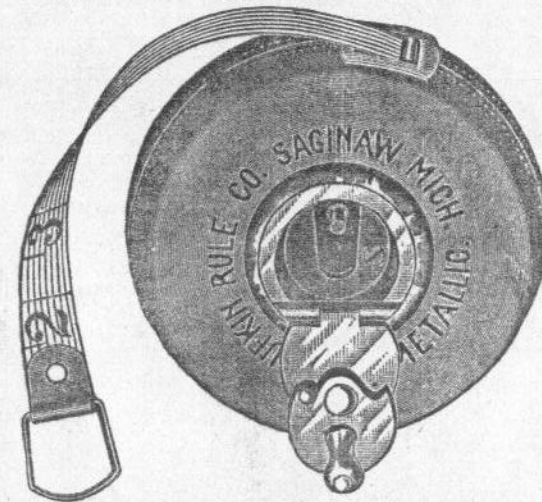
A 1728,	Steel Tape,	50 feet long,	in 10ths or 12ths,	each	.....	\$7 50
A 1729,	"	66	"	"	"	9 50
A 1730,	"	75	"	"	"	11 50
A 1731,	"	100	"	"	"	13 50

"Rival" Steel Tapes.

"Rival" Steel Tapes, $\frac{3}{8}$ in. wide, nickel-plated steel case, flush handle, graduated one side only.



A 1732,	Steel Tapes,	25 feet long,	in 10ths or 12ths,	each	.....	\$3 25
A 1733,	"	50	"	"	"	4 00
A 1734,	"	75	"	"	"	5 25
A 1735,	"	100	"	"	"	6 75

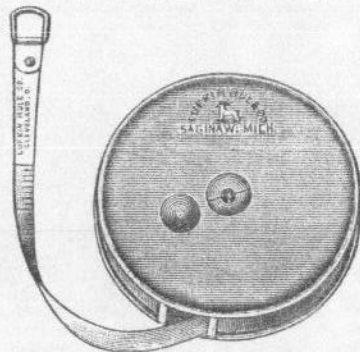


Metallic Tapes, $\frac{3}{8}$ in. wide, hard leather cases, with patent double folding flush handle, made of best woven linen, with Metallic Warp, graduated on back in links.

A 1736,	Metallic Tapes,	25 feet long,	in 10ths or 12ths,	each	.....	\$2 10
A 1737,	"	33	"	"	"	2 40
A 1738,	"	40	"	"	"	2 60
A 1739,	"	50	"	"	"	2 90
A 1740,	"	66	"	"	"	3 30
A 1741,	"	75	"	"	"	3 60
A 1742,	"	100	"	"	"	4 50

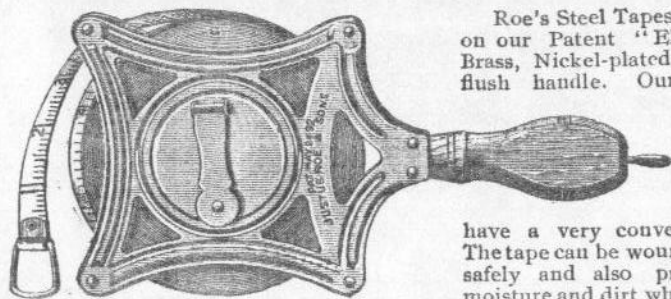
Pocket Steel Tapes.

German Silver Cases, Spring Wind, with Stop.



A 1743A, Pocket Tape, 1/4 in. wide, 36-in. long, in 1/16ths, each	1	25
A 1743B, " " " " " " " "	48	1 40
A 1743C, " " " " " " " "	60	1 50
A 1743D, " " " " " " " "	72	1 75
A 1743E, " " " " " " " "	7 feet	2 00
A 1743F, " " " " " " " "	9	2 25
A 1743G, " " " " " " " "	12	3 00
A 1744A, " " " " " " " "	36-in. long, in 1/16ths and meters, each	1 50
A 1744B, " " " " " " " "	48	1 75
A 1744C, " " " " " " " "	60	2 00
A 1744D, " " " " " " " "	72	2 25
A 1744E, " " " " " " " "	7 feet	2 50
A 1744F, " " " " " " " "	9	2 75
A 1744G, " " " " " " " "	12	3 50

Roe's Steel Tapes on our Patent "Electric" Reel.
Nickel-Plated.

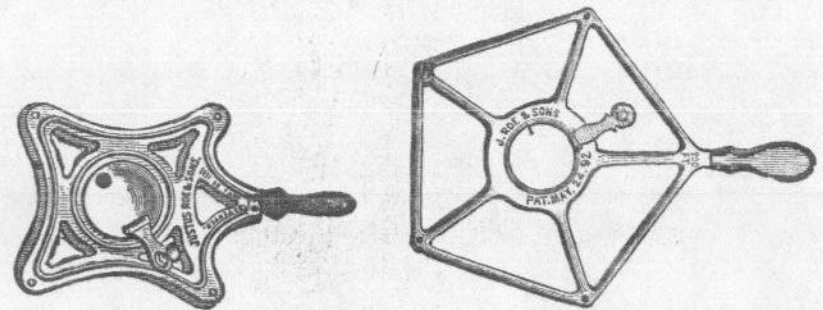


Roe's Steel Tapes, 1/2 inch wide, on our Patent "Electric" Reel, Brass, Nickel-plated, with folding flush handle. Our "Electric"

Reel has many advantages; they are stronger than leather cases and have a very convenient handle. The tape can be wound much more safely and also protected from moisture and dirt which destroy the tape when enclosed in a case.

A 1745A, Feet divided in 10ths, each	33	40	50	66	75	100 ft.
A 1745B, " " " " " "	5 00	5 75	6 75	8 50	9 50	12 00
A 1745C, " " 10ths, with Links, ea.	5 50	6 35	7 50	9 50	10 70	13 50
A 1845D, " " 12ths, " " " "	5 50	6 35	7 50	9 50	10 70	13 50
A 1745E, " " 12ths, " Metre, " " " "	5 50	6 35	7 50	9 50	10 70	13 50
A 1745F, " " 10ths, " " " "	5 50	6 35	7 50	9 50	10 70	13 50

Roe's Steel Tape Chains on Patent Electric Reel.



Roe's Steel Tape Chains on our Patent "Electric Reel. It allows the entire tape open to dry, and with it, the tape can be reeled or unreel as easily and readily, as the Linen or Metallic Tapes in cases. Also the tape can be easily detached and used without the reel. While in use, in mines or crowded thoroughfares, it is used the same as tapes in cases. All sizes except 200 and 300 feet can easily be carried in any average pocket.

We consider our Patent "Electric Reel" the best and most complete of any that has ever been made and recommend it in the highest terms.

		Plain.	Nickel Plated.	Alumi- nium Plated.
A 1746A, 100 feet long, every foot. End feet in tenths	5 00	6 00	7 00	
A 1746B, 100 " " " inches	5 00	6 00	7 00	
A 1746C, 100 " " " 5 feet. tenths	4 00	5 00	6 00	
A 1746D, 100 " " " 5 " inches	4 00	5 00	6 00	
A 1747A, 66 " " " link	5 00	6 00	6 50	
A 1747B, 66 " " " in Rods and tenths of a Rod	5 00	6 00	6 50	
A 1747C, 66 " " " every 5 links. Each end every link	4 00	5 00	5 50	
A 1748A, 50 " " " foot. End feet in tenths	4 00	5 00	5 50	
A 1748B, 50 " " " inches	4 00	5 00	5 50	
A 1748C, 60 " " " 5 feet. tenths	3 00	4 00	4 50	
A 1748D, 50 " " " 5 " inches	3 00	4 00	4 50	
A 1749A, 33 " " " link	3 00	4 00	4 50	
A 1749B, 33 " " " 5 links. Each end every link	2 50	3 00	3 50	
A 1750A, 200 " " " foot. End feet in tenths	7 50	9 00	10 50	
A 1750B, 200 " " " inches	7 50	9 00	10 50	
A 1750C, 200 " " " 5 feet. tenths	6 00	7 50	9 00	
A 1750D, 200 " " " 5 " inches	6 00	7 50	9 00	
A 1750A, 300 " " " foot. tenths or ins.	10 00	12 00	14 00	
A 1750B, 300 " " " 5 feet. tenths	8 00	10 00	12 00	
A 1751A, 400 " " " foot. tenths	12 50	15 00	17 50	
A 1751B, 400 " " " 5 feet. tenths	10 00	12 50	15 00	
A 1752A, 500 " " " foot. tenths	15 00	18 00	21 00	
A 1752B, 500 " " " 5 feet. tenths	12 00	15 00	18 00	
A 1753A, 100 feet, Electric Reel, without Tape	1 50			
A 1753B, 200 " " " " " "	2 00			
A 1753C, 300 " " " " " "	2 50			
Detachable Handles per pair				30

ENGINEER'S AND SURVEYOR'S CHAINS



A 1760.

No.						PRICE
A 1760.	Surveyor's Chain,	2 poles,	50 links,	No. 9, wire oval rings,		\$2.00
A 1761.	Do.	2 do.	40 do.	8, do.		2.75
A 1762.	Do.	2 do.	50 do.	8, do.		2.75
A 1763.	Do.	2 do.	50 do.	7, do.		3.75
A 1764.	Do.	4 do.	100 do.	9, do.		3.50
A 1765.	Do.	4 do.	100 do.	8, do.		4.50
A 1766.	Do.	4 do.	100 do.	7, do.		5.50
A 1767.	Do.	4 do.	100 do.	12, best steel wire, brazed links and rings,		10.00
A 1768.	Do.	2 do.	50 do.	12, best steel wire, brazed links and rings,		5.50
A 1769.	Engineer's Chain,	50 feet,	50 do.	7, wire,		4.00
A 1770.	Do.	100 do.	100 do.	7, do.		6.00
A 1771.	Do.	50 do.	50 do.	12, best steel wire, brazed links and rings,		6.00
A 1772.	Do.	100 do.	100 do.	12, best steel wire, brazed links and rings,		11.50

GRUMMAN'S VARA AND METER CHAINS.

A 1773.	66 feet,	No. 15,	tempered steel wire,	100 links,	weight 1 1/4 lbs., with 10 extra links,	9.00
A 1774.	33	do.	15,	do.	50 do. weight 3/4 lbs., with 5 extra links,	5.00
A 1775.	100	do.	15,	do.	100 do. weight 2 lbs., with 15 extra links,	11.50
A 1776.	50	do.	15,	do.	100 do. weight 1 lb., with 10 extra links,	6.00
A 1777.	33	do.	12, wire,	5 tallies,	5 extra links,	1 1/8 lbs., 5.50
A 1778.	66	do.	12, do.	10 do.	10 do.	3 do. 10.00
A 1779.	150	do.	12, do.	5 do.	5 do.	2 1/2 do. 6.00
A 1780.	00	do.	12, do.	10 do.	10 do.	4 1/2 do. 11.50
A 1781.	Spring Balance,	to use with either of above chains,				2.00
A 1782.	50 feet,	No. 18,	tempered steel wire,	100 links,	no rings, with Spring Balance, Level, and Thermometer, weight 3/4 lbs.,	15.00
A 1783.	10	Varas,	50 links,	No. 8, refined iron wire, each,		2.50
A 1784.	20	do.	100 do.	8, do.		4.00
A 1785.	10	do.	50 links,	brazed links and rings,	No. 12, tempered steel wire,	5.50
A 1786.	20	do.	100 do.	do.	do. 12. tempered steel wire,	10.00

MARKING PINS.



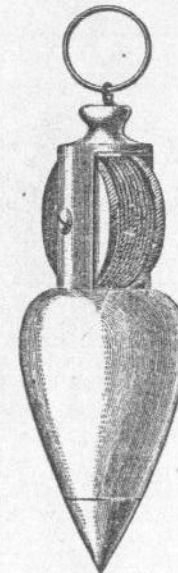
A 1793.

No.				PRICE
A 1790.	MARKING PINS,	No. 8 steel wire,	11 in a set, per set,	\$1.00
A 1791.	Do.	No. 7 iron wire,	11 in a set, per set,	.75
A 1792.	Do.	No. 6 steel wire,	11 in a set, per set,	2.00
A 1793.	Do.	tempered steel,	15 inches long, 3/8 inches wide, 11 in a set, per set,	7.50

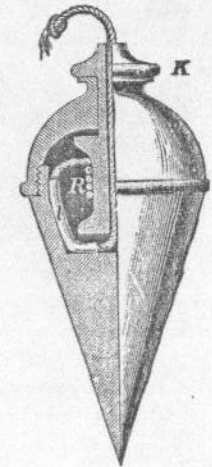
PLUMB BOBS.



A 1795.



A 1797.

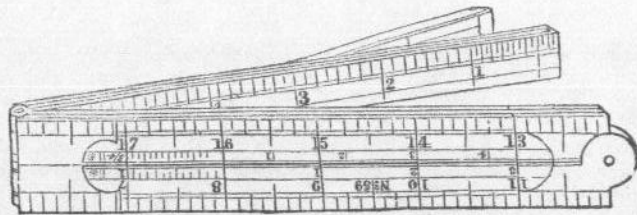


A 1799.

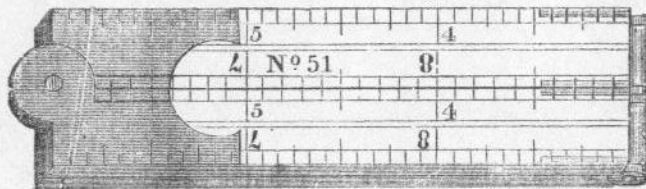
A 1794.	BRASS PLUMB BOB	6 ounce,	with steel point and screw cap, each	\$2.00
A 1795.	do.	9 do.	do.	2.25
A 1796.	do.	12 do.	do.	2.50
A 1797.	PATENT ADJUSTABLE PLUMB BOB (small),	8 ounce,		1.75
A 1798.	Do.	(large),	13 do.	2.25
A 1799.	PATENT ADJUSTABLE PLUMB BOB,	with concealed reel, around which the string is wound by turning the milled head on top. The friction upon the reel within will hold the bob at any desired point of the line,		2.50

Nos. A 1797 and A 1798 are constructed with a reel at the upper end, upon which the line may be kept, and by dropping the bob with a slight jerk, while the ring is held in the hand, any length of line may be reeled off. A spring, which has a bear-

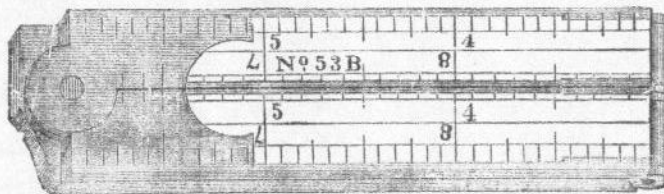
Pocket Rules.



- A 1800, Pocket Rule, boxwood, 1 foot, 4 fold, brass mountings \$0 15
- A 1801, " " " 2 " 4 " " " 30
- A 1802, " " " 1 " 4 brass-bound edges 30
- A 1803, " " " 2 " 4 " " " 65

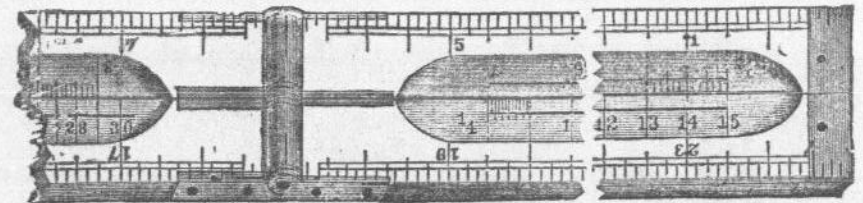


- A 1804, Pocket Rule, ivory, 1 foot, 4 fold, German silver mountings . . \$1 00
- A 1805, " " " 2 " 4 " " " 3 75
- A 1806, " " " 1 " 4 " " edges 1 75
- A 1807, " " " 2 " 4 " " " 5 00

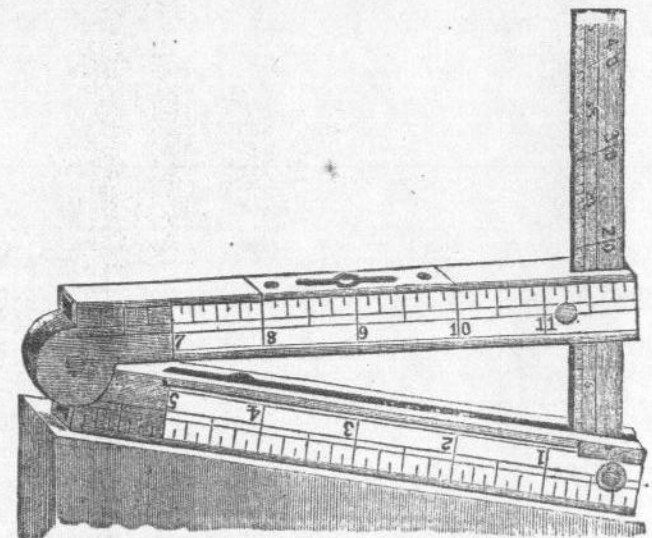


- A 1808, Caliper, boxwood, 1/2 foot, 2 fold, brass mountings \$0 25
- A 1809, " " " 1 " 4 " brass bound edges 75
- A 1810, " ivory, 1/2 " 2 " German silver mountings 75
- A 1811, " " 1 " 4 " " " 2 50

Pocket Rules.



- A 1812. Architects' Scale Rule, with beveled edges, boxwood, 2 feet, 4 fold, brass mountings, with scales on beveled edge, each \$1.25
- A 1813. Architects' scale rule, with beveled edges, ivory, German silver mounted, 2 feet, 4 fold, with scales on beveled edge, each 7.50

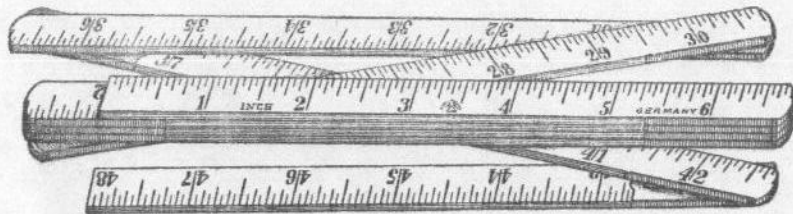


A 1828.

- A 1814. Combination Rule, One Foot, two Fold, boxwood. This is the most convenient and useful pocket-rule ever made; it combines in itself a Carpenter's Rule, Spirit Level, Square Plumb, Bevel Indicator Brace, Scale, Draughting Scale of equal parts, T Square, Protractor, Right-angle Triangle, and with a straight edge can be used as a Parallel Ruler, all the parts of which, in their separate applications, are perfectly reliable, 2.50

An explanation and directions for use accompanies each of the Combination Rules

Folding Pocket Rules.



A 11.

The Queen Folding Pocket Rules are provided with strong spring joints, which hold the rule in a straight line when open. Graduated in 16ths on both sides or 16ths and millimeters.

A 1815,	Folding Rule 2 feet, 4 fold div.	1-16 x 1-16, with springs	...	\$0 35
A 1816,	" " 3 " 6 "	" " " "	...	50
A 1817,	" " 4 " 8 "	" " " "	...	65
A 1818,	" " 5 " 10 "	" " " "	...	85
A 1819,	" " 6 " 12 "	" " " "	...	1 00
A 1820,	" " 8 " 16 "	" " " "	...	1 30
A 1821,	" " 4 " 8 "	1-16 x meter " "	...	65
A 1822,	" " 2 " 4 "	1-16 x 1-16 without springs	...	20
A 1823,	" " 3 " 6 "	" " " "	...	25
A 1824,	" " 4 " 8 "	" " " "	...	30

Folding Steel Pocket Rules.



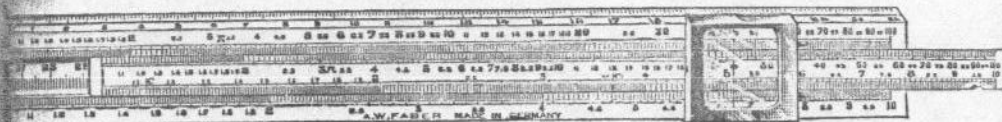
A 12.

The Folding Steel Pocket Rules are made of carefully tempered spring steel 3/8 in. wide. These rules are recommended as they are accurate, convenient and least bulky of any made.

A 1825,	Steel Rule 1 foot, 4 fold	...	\$0 25
A 1826,	" " 2 " 8 "	...	50
A 1827,	" " 3 " 12 "	...	75

A. W. FABER'S Improved Calculating Rule.

10 1/2 inches long.



A 13.

The favorable reception accorded to the Rules is in itself a proof of their utility. A slight alteration has recently been introduced in their shape; the present Rule being made with only one side beveled, the other side being at right angles. The width of the instrument has in this way been reduced to some extent, rendering it better adapted for pocket use and outdoor purposes.

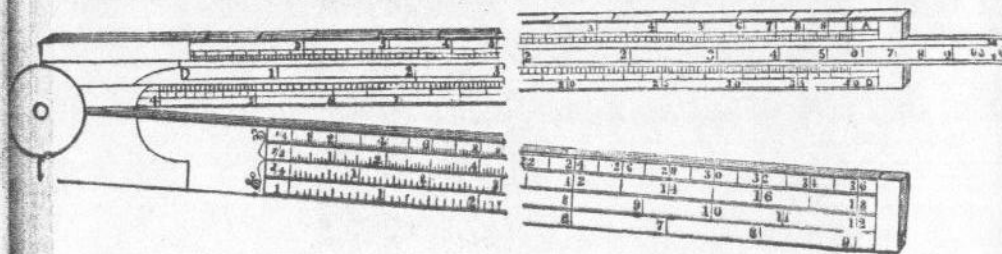
The-cross lines of which the scales consist have been bordered by lines running lengthways. This gives a more finished appearance.

As previously mentioned, a descriptive pamphlet, consisting of 26 printed pages and 8 sheets of diagrams, has been issued. It contains a full explanation of the Rule, and numerous examples showing the mode of using it, which, with the aid of the diagrams, will be of great service to those who wish to avail themselves of the instrument.

The number and variety of problems that can be worked out with the assistance of A. W. FABER'S Calculating Rule is almost endless.

The Rule is made of boxwood, and the traversing slide of nickeled metal. The figuring has been done with the utmost care and distinctness, so as to insure the greatest accuracy.

A 1828, Calculating Scale \$3 60



A 1829, Two Feet, two Folds, boxwood Slide Rule, Gunter's, \$1 25

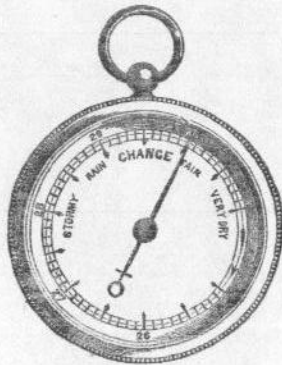
A 1830, Treatise on the Gunter's Slide and Engineers' Rules, showing their utility, and containing full and complete instructions enabling mechanics to make their own calculations. It is also particularly adapted to the use of persons having charge of cotton or woolen machinery, surveyors, and others. 200 pages, bound in cloth.

Price \$1.00 net. Sent by mail postpaid on receipt of price.

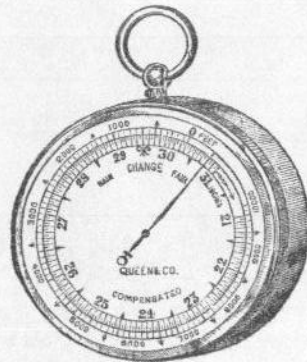
VERY ACCURATE POCKET ANEROID BAROMETERS.

Compensated and Specially Tested and Adjusted for Engineers' Use

These Aneroids have movable altitude scales, with silver enameled dials, and are in morocco cases.



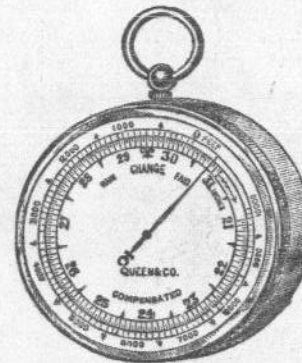
13500



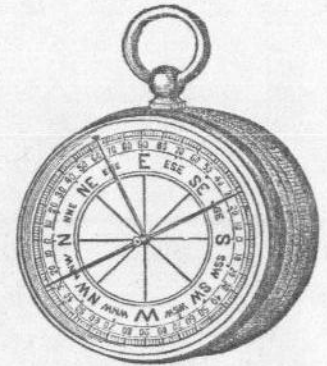
13505

13500.	PLAIN POCKET ANEROID,	1 1/4 in. diameter,	. . . . .	\$18 00
13501.	Do. do. do.	2 1/4 in. . . . .	. . . . .	17 00
13502.	Do. do. do.	1 3/4 in. diameter, with thermometer,	. . . . .	20 00
13503.	Do. do. do.	3 1/2 in. do. do.	. . . . .	21 00
13505.	POCKET MOUNTAIN ANEROID, compensated for temperature,	1 1/4 in. diameter, with altitude scale to 3000 feet,	. . . . .	20 00
13506.	Do. do. do.	5000 feet, . . . . .	. . . . .	20 00
13507.	Do. do. do.	10,000 " . . . . .	. . . . .	21 00
13508.	Do. do. do.	15,000 " . . . . .	. . . . .	24 00
13509.	Do. do. do.	20,000 " . . . . .	. . . . .	27 00
13510.	POCKET MOUNTAIN ANEROID, compensated for temperature, same as 13505, 2 1/2 inches diameter, with altitude scale to 3000 feet,	. . . . .	. . . . .	20 00
13511.	Do. do. do.	5000 feet, . . . . .	. . . . .	20 00
13512.	Do. do. do.	10,000 " . . . . .	. . . . .	21 00
13513.	Do. do. do.	15,000 " . . . . .	. . . . .	24 00
13514.	Do. do. do.	20,000 " . . . . .	. . . . .	27 00

GEOLOGICAL ANEROIDS.

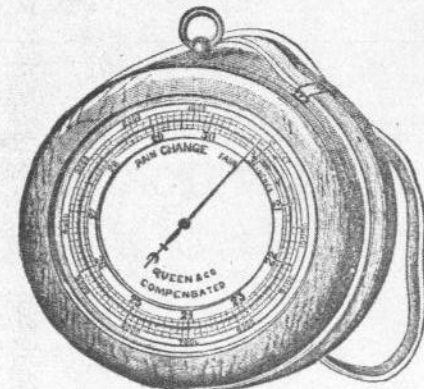


13515.
Front.



13515.
Back.

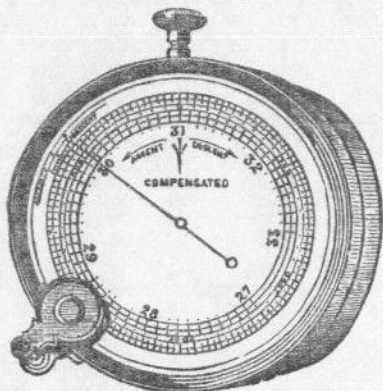
13515.	GEOLOGICAL ANEROID, compensated for temperature, silvered metal dial, with needle compass at back, 2 1/2 inches diameter, in leather sling case, with altitude scale to 5000 feet,	. . . . .	\$30 00
13516.	Do. do. 10,000 feet,	. . . . .	31 00
13517.	Do. do. 15,000 "	. . . . .	33 50



13520.

13520.	GEOLOGICAL ANEROID, compensated for temperature, with silvered metal dial, 5 in. diameter, in mahogany open face case, with leather strap, with altitude scale to 3,000 feet,	. . . . .	33 00
13521.	Do. do. 5,000 "	. . . . .	33 00
13522.	Do. do. 10,000 "	. . . . .	35 00
13523.	Do. do. 15,000 "	. . . . .	37 00
13524.	Do. do. with thermometer, altitude scale to 3000 feet	. . . . .	35 00
13525.	Do. do. 5,000 feet,	. . . . .	35 00
13526.	Do. do. 10,000 "	. . . . .	37 00
13527.	Do. do. 15,000 "	. . . . .	39 00

SURVEYING AND MINING ANEROIDS.



13530.

13530.	SURVEYING ANEROID, 5 in. diameter, compensated for temperature, silvered metal dial, graduated to hundredths, and reading by vernier to single feet, with magnifier, in leather sling case, with altitude scale to 5,000 feet,				\$50 00
13531.	Do do 10,000 feet,				55 00
13532.	Do do 15,000 "				60 00
13534.	MINING ANEROID, same as 13530, but arranged to register 2,000 feet below sea level to 4,000 above				50 00

THE SURVEYING AND MINING ANEROID has been designed and constructed specially for the use of Surveyors and Engineers, for the purpose of readily ascertaining slight variations in gradients, levels, &c., and from its extreme sensitiveness will be found of considerable utility in Mining and Surveying work generally.

By its extreme sensitiveness, the specialty claimed for this Instrument is an arrangement of the Scale of Altitudes which admits of subdivision by a Vernier, hitherto impracticable, owing to the Altitude Scale in ordinary use being a gradually diminishing one, to which a Vernier cannot be applied. In the present Instrument the action has been so adjusted as to give accurate readings upon a regular Scale of Altitudes, the Barometrical Scale of Inches having been made progressive so as to afford the correct relative readings with the Scale of Altitudes.

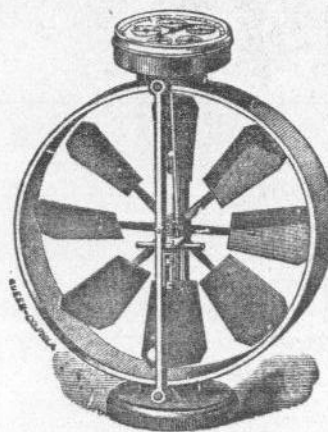
For Mining purposes the entire circle of the dial is graduated to represent 6 inches of the mercurial column, i.e., from 27 inches to 33. This scale will register about 2000 feet below sea-level to 4000 feet above; the finest divisions, hundredths of the Altitude Scale, represent 10 feet measurements, which can be again subdivided by the Vernier Scale to single feet. The Vernier Scale is moved by a rack-work adjustment, and a magnifying lens which rotates on the outer circumference of the Instrument facilitates the reading of minute quantities.

For Surface Surveying purposes, where it is not required to be used below sea level, the Instrument is made with the scale divided from 25 to 31 inches, thus giving an Altitude Scale of 5000 feet above sea-level only, and with this open scale and the assistance of the Vernier, the same minute readings can be easily taken.

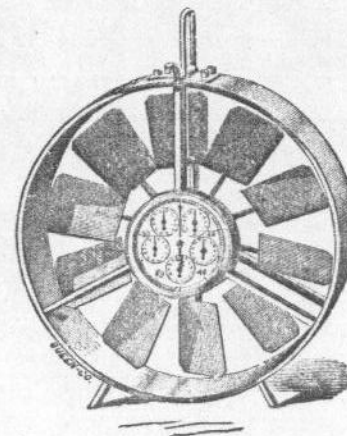
ANEMOMETERS.

FOR MEASURING THE VELOCITY OF CURRENTS OF AIR IN COAL MINES, AND VENTILATORS, FLUES, ETC., OF PUBLIC BUILDINGS.

The Anemometer, an instrument invented for the purpose of measuring the rate at which air moves in mines and ventilation passages, is now an indispensable adjunct of the former, the mining laws of most States requiring that a certain number of cubic feet of air shall be passed to the air-ways, and the Anemometer furnishing the most convenient and satisfactory mode by which the amount of air passing can be determined.

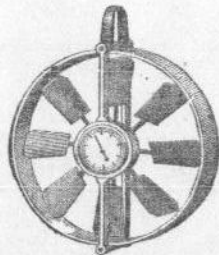


No. 14,500.



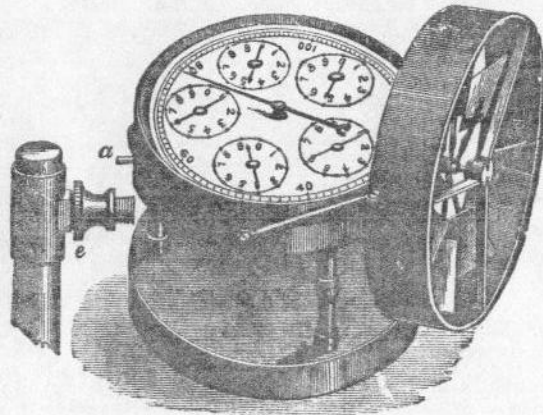
No. 14,505.

14,500.	BIRAM'S ANEMOMETER, 6 inches diameter, reading to ten million feet, with disconnecter, Fig. 1,	\$40 00
14,501.	BIRAM'S ANEMOMETER, 5 inches diameter, same as 14,500,	39 00
14,502.	BIRAM'S ANEMOMETER, 4 inches diameter, same as 14,500,	37 50
14,505.	BIRAM'S ANEMOMETER, 12 inches diameter, reading to ten million feet, with disconnecter,	45 00
14,506.	BIRAM'S ANEMOMETER, 6 inches diameter, same as 14,505,	40 00
14,507.	BIRAM'S ANEMOMETER, 4 inches diameter, same as 14,505,	37 50



No. 14,508

- 14,508. BIRAM'S ANEMOMETER, 6 inches diameter, reading to 1000 feet, with disconnecter, 25 0c
- 14,509. BIRAM'S ANEMOMETER, 6 inches diameter, reading to 1000 feet, without disconnecter, 22 50
- 14,510. BIRAM'S ANEMOMETER, 4 inches diameter, reading to 100 feet, 20 00
- 14,511. BIRAM'S ANEMOMETER, same as above, with disconnecter, 22 50

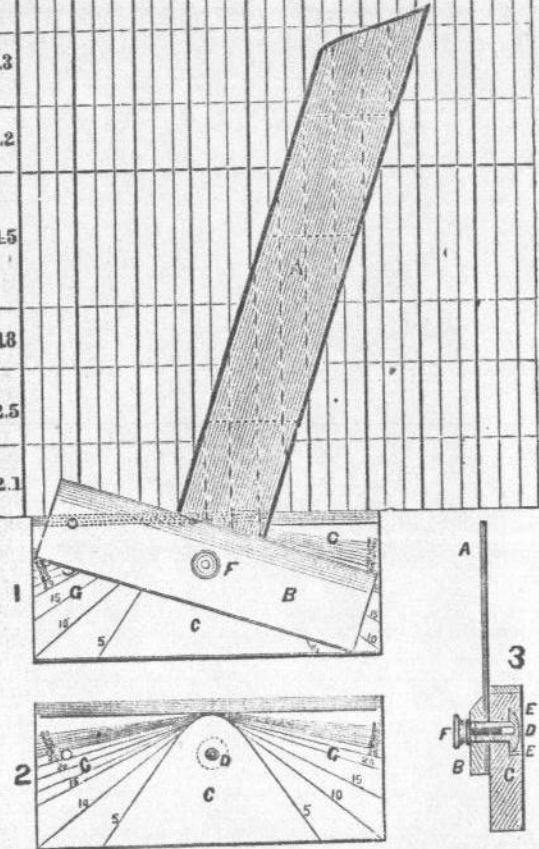


No. 14,515.

- 14. THE PORTABLE AIR METER, diameter of fan wheel 2 1/4 inches, with disconnecter, which is extensively used for testing the ventilation of HOSPITALS, SCHOOLS and PUBLIC BUILDINGS, forms also, an admirable Pocket Anemometer for tourists. The indications are obtained by the revolution of a series of fans (similar to those of Biram's Anemometer) acting first, upon a long hand capable of recording the velocity of fifty feet per minute on the large dial, divided to 100 feet, and then successively, by a train of wheels on the indices of five smaller dials, recording respectively, 100, 1,000, 10,000, 100,000 and 10,000,000 feet, or 1,893 miles, 30 0c
- 14,516. AIR METER, same as preceding, but reading only to 1,000 feet, 25 00
- 14,517. WATCH ANEMOMETER, very small and sensitive, outside dimensions 2 1/4 in. in white metal hunting case, 40 00
- 14,518. WATCH ANEMOMETER, same as above, in silver hunting case, 45 0c

TIME TABLE No.

	12 P. M.	1 A. M.	2
CLEVELAND.	00		
	25		
Case Ave	25		
Wilson Ave.....	35	10	
Glenville	50	15	
Coits	68	18	
COLLINWOOD	76	08	
Euclid.....	96	20	
Northwood.....	11.9	23	
Wickliff	14.1	22	
Willoughby	18.6	45	
Reynolds.....	20.4	18	
Mentor.....	22.9	2.5	
HEISLEY.....	25.0	2.1	



1185.

The above cut represents, Fig. 1, the "Speed Protractor," as set at a speed angle of 25 miles per hour, and part of a Chart Fig. 2 represents the lower head, C, with the speed scale, G, engraved on it. Fig. 3 is a cross section of the lower head, C, the upper and movable head, B, and part of the blade, A. The blade, A, is 42 inches long, made of hard rubber and backed with mahogany wood. The two heads, B and C, are made of steam-dried satin-wood and faced with ebony. Dimensions of lower head, C, 4x15 inches; of upper head, B, 2 1/2 x 14 1/2 inches. D, E, F, Fig. 3, represent the fixed brass pivot and thumbscrew, for setting the instrument at any required speed

1135. Hill's Railroad Time Charts.

The principal features of the Charts are:

1. The positively *mathematical correctness* of the spacing.
2. The *ease* with which the five minutes, half hour, and hour lines can be distinguished, as well as their perfect *clearness* and *cleanness*.
3. Their *enormous size* (28x50), admitting of larger hour-spaces than any chart at present in use.
4. The *excellence* of the *paper* on which they are printed, as well as its *peculiar tint*, rendering it peculiarly fit for night work, while its cardboard-like texture obviates the necessity for dampening and stretching, and the consequent distortion of the diagram.
5. Their *cheapness*, which enables us to furnish them to railroads in smaller quantities and at a lower price than they could be obtained by lithographic or any other process.

The "Speed Protractor," which is generally used with the Charts, needs hardly any recommendation. The *simplicity* of its construction, the *care* bestowed in its *manufacture*, its greater *accuracy* than that of the semicircular angle protractor, and its *low price*, speak for themselves.

The price of the Charts, without name of stations, station lines, and heading, is \$12.00 per quire; complete and ready for train plotting, the scale of prices is as follows, viz.:

50 Sheets,	. . . . .	\$50.00
100 do.	. . . . .	80 00
150 do.	. . . . .	110.00
200 do.	. . . . .	140.00
Speed Protractor,	. . . . .	10.00

In favoring us with an order for complete Charts, please send list of *stations* with intermediate *distances*, and *underscore* such stations as you may desire to have printed in *heavy type* on account of their importance.

The following is an extract from a letter of Mr. James Tillinghast, General Superintendent of the New York Central and Hudson River Railroad, to whose judgment Mr. Hill submitted both Charts and Protractor:

"NEW YORK CENTRAL AND HUDSON RIVER RAILROAD,
Gen'l Supt. Office, Albany, N. Y., Jan. 15th, 1876."

"ALBERT HILL, Esq.:

"Dear Sir:—I am in receipt of yours of the 14th inst., with sample of diagram of Chart sheets. * * * I have not found any better plan to secure accuracy in forming the basis or proof of time tables, for the reason that it presents to the eye in a clear, condensed form, all the trains the schedule is to cover, and in such manner that the station figures are *accurately* indicated, and from which the figures for the printed form can be *readily copied*.

"Your plan of 'Speed Protractor' is the *best* I have seen, and will be very useful in connection with the Charts, and I have no doubt that, with the facilities you mention for the production of charts *so accurately lined* as your process will produce, you will be able to secure orders. * * *

"Yours truly,

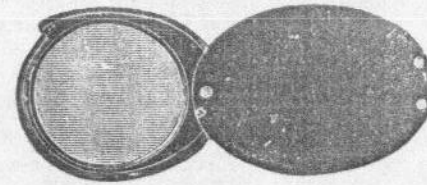
"JAMES TILLINGHAST."

The following is a list of some of the principal railroad companies by which these Charts have so far been adopted:

Pennsylvania Railroad.
Central Railroad of New Jersey.
Lake Shore and Michigan Southern Railroad.
Toledo, Wabash and Western Railway.
Cleveland, Tuscarawas and Wheeling Railroad, etc., etc.

If desired, we will send by mail, postage paid, a Chart of any of the above-named roads, as a sample.

POCKET MAGNIFYING GLASSES.



No.	1138.							PRICE
1136.	Hard Rubber case and frame, round form, 1 double convex lens, $\frac{3}{4}$ in. diam.	do.	do.	do.	1	do.	1	\$0.46
1137.	Do. do. do. do. do.	do.	do.	do.	1	do.	1	.60
1138.	Do. do. do. do. do.	do.	do.	do.	1	do.	1 $\frac{1}{2}$	.75
1139.	Do. do. do. do. do.	do.	do.	do.	1	do.	1 $\frac{1}{2}$	1.25
1140.	Do. do. do. do. do.	do.	do.	do.	2	do.	1	1.00
1141.	Do. do. do. do. do.	do.	do.	do.	2	do.	1 $\frac{1}{2}$	1.50
1142.	Do. do. do. bellows form, 1	do.	do.	do.	1	do.	1	.60
1143.	Do. do. do. do. do.	do.	do.	do.	1	do.	1	.75
1144.	Horn case, German silver frame, do.	do.	do.	do.	1	do.	1	1.00
1145.	Hard Rubber case and frame, do.	do.	do.	do.	2	do.	1	1.00
1146.	Do. do. do. do. do.	do.	do.	do.	2	do.	1	1.25
1147.	Horn case, German silver frame, do.	do.	do.	do.	2	do.	1	1.50
1148.	Hard Rubber case and frame, do.	do.	do.	do.	3	do.	1	1.50
1149.	Do. do. do. do. do.	do.	do.	do.	3	do.	1	1.75
1150.	Horn case, German silver frame, do.	do.	do.	do.	3	do.	1	2.00

Architecture, Carpentry and Building.

Bell.—*Carpentry Made Easy.*—Or, the Science and Art of Framing on a New and Improved System. With Specific Instructions for Building Balloon Frames, Barn Frames, Mill Frames, Warehouses, Church Spires, etc. Comprising also a System of Bridge Building, with Bills, Estimates of Cost, and Valuable Tables. Illustrated by forty-four plates, comprising nearly 200 figures. 8vo. \$5.00.

Birkmire.—Architectural Iron and Steel, and its Application in the Construction of Buildings. Fully illustrated from original designs. 8vo. \$3.00

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Birkmire.—Compound Riveted Girders as applied in Buildings. 8vo. \$2.00

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Brunner.—Cottages, or Hints on Economical Building, containing 24 plates of Medium and Low Cost Houses, and a Chapter on the Water Supply, Drainage, Sewerage, Heating and Ventilation, etc. 8vo. N.Y. \$1.00.

Bryan.—Architectural Proportion. A new system of proportion showing the relation between an order of architecture and a building of any kind. 4to. San Francisco. \$1.50.

Bullock.—*The American Cottage Builder.*—A Series of Designs, Plans and Specifications, from \$200 to \$20,000, for Homes for the People; together with Warming, Ventilation, Draining, Painting and Landscape Gardening. By John Bullock, Architect, Civil Engineer, Mechanician. Illustrated by 75 engravings. 326 pp., 8vo. \$3.00.

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