

PRECISION
ENGINEERING
INSTRUMENTS

WM. AINSWORTH & SONS

THE PRECISION FACTORY

DENVER, COLORADO.

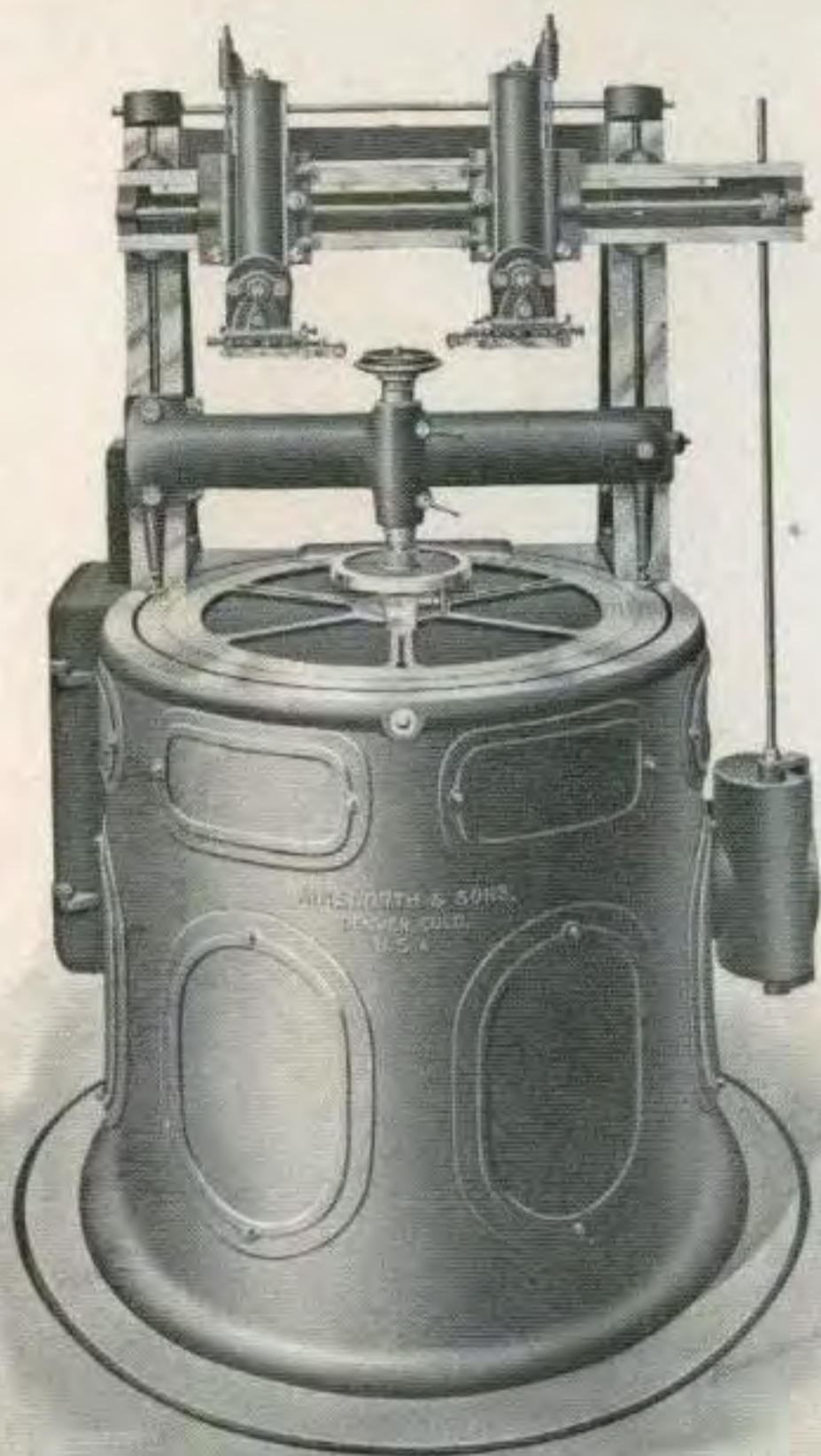
U. S. A.

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Catalog BX
OF
Precision
Engineering and Surveying
Instruments

THE PRECISION FACTORY

Wm. Ainsworth & Sons
Denver, Colorado
U. S. A.



30-INCH AUTOMATIC DIVIDING ENGINE

This machine was designed and built in the tool department of our factory and has many special features not to be found in any other engine. It operates upon two pieces of work simultaneously, is massive, rigid and capable of producing circles each division of which is, in its theoretical position, to within one second of arc, it being the most accurate circular dividing engine yet produced.

POINTS OF SUPERIORITY

ON the following pages we show numerous details of our instruments, believing as we do that the more familiar an engineer becomes with the instruments he uses the more likely he is to purchase an AINSWORTH, owing to its evident superiority.

The **Object Slide** or draw tube of our instrument is cylindrical and of uniform diameter from end to end to within .0001 inch—.001 mm; the periphery of the objective is true with its optical axis; the inside and outside of the cell is true, and the cylindrical bearing of the cell in the object head is true with the outside diameter of the tube, to within the above limits, with the result that all parts are interchangeable and remain in collimation throughout their entire



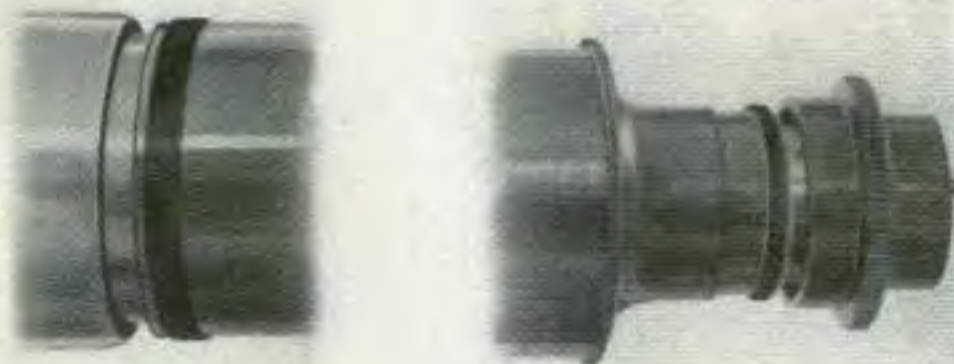
travel. Without the aid of improved and special machinery—much of which has been devel-

oped by ourselves—together with a rigid inspection of parts after each operation this result cannot be attained. We do not depend upon the threads on the outside of the cell and inside of the object head for a fit, but instead provide a cylindrical bearing which brings the parts into accurate alignment. In the longitudinal opening opposite the rack may be seen a flat spring which automatically takes up all wear, keeping the rack and pinion always in mesh, besides providing a wide bearing for the pinion saddle, thus eliminating most of the wear. The object slide and main telescope tube are of dissimilar alloys to eliminate friction.

The **Pinion, Head and Saddle** are separated in the engraving to better illustrate their construction. The pinion and saddle are of different alloys and the end thrust is taken up between fibre washers on the pinion and in the pinion head. This construction insures great durability and requires little or no lubrication. The pinion having a taper bearing, however, can be easily refitted when worn.



Velvet Wipers are provided in addition to the usual dust protection for telescope, which wipe the inside of the dust guards on the eye-piece and objective ends of the telescope. In the engravings the parts are shown extended beyond their normal working positions.



The Telescope Axis is of hard bell metal, cored out as shown, so as to reduce weight without sacrificing strength. Great pains are taken in machining this part, as the hole for the main telescope



tube must be bored and reamed perpendicular to, and equidistant from the axis bearings, so as to bring the telescope directly over the center of the instrument. With such precision is this work done that complete telescopes

are assembled from parts and come into collimation without any fitting whatever. This serves to illustrate a degree of precision that has not yet been attained outside of our own factory, and besides facilitating assembling, enables an engineer to make many repairs in the field, with duplicate parts supplied from the factory, thereby effecting a saving in time and transportation charges.

The Grooved Telescope Axis Bearing used on our instruments has from three to five times the bearing surface of any other style, with absolutely no end play, even when badly worn, and in case of accident renders great service in holding the instrument together, thereby lessening the damage.



The Telescope Axis Clamp is held in position by a nut threaded onto the axis. This, in a great measure, overcomes the shifting of



the telescope when clamping and unclamping. The usual construction is the provision of a loose washer or nothing at all for this purpose.

The Axis Clamp and Tangent shows plainly the construction of the gib clamps used throughout on our instruments. With this construction a slight turn of the clamp screw is sufficient to

clamp or unclamp with absolute certainty, whereas a split clamp usually requires an additional quarter or half turn after the clamping surfaces are in contact, to make sure that it holds, and then usually carries the instrument off the line, owing to the fact that the two halves do not spring equally.

The Gradienter is of the usual construction, but with a movable dial held in position by a nut and friction washer, so that with the cross wires on a point the dial can be revolved to zero and all readings taken direct without computation. All gradienter screws are reproductions of our standard precision screw, which has an error of less than .0005 inch per foot.



This screw is also used in the construction of the reference gages and master taps, and dies, so essential for the production of interchangeable threads.

The Compass Needle is of the usual bar construction now used in the best instruments, which is conceded to be the best possible construction. For this purpose we use nothing but the best



magnet steel, carefully tempered, magnetized and aged in the manner prescribed by makers of high grade electrical instruments.

The Vernier Cover Glass and Shade are attached to the instrument with the fewest possible parts. The cover glass is of polished crystal glass, beveled on its upper edges and set one-half



into the plate in waterproof cement. There are no clips nor frames to hold water and by slipping the shade up a little the entire surface can be wiped off. The Vernier shade is of ground glass which reflects a white light onto

the graduations and is the most satisfactory material for this purpose, although we can supply metal, celluloid or mirror reflectors.

The Needle Lift and Variation Plate Pinion are neatly disposed of, showing that even the small details have received infinite care in the design and construction of our instruments. Both of these parts are set close to the compass box to prevent the entrance of dust and each is held rigidly to the plate with two screws.



The Lower Clamp and Tangent is of excellent design and well shows the convenient arrangement of the clamp and tangent screws, they being so arranged that in no position of the plates will they be inaccessible. All of our tangent screws, clamp screws, plungers and springs are made of phosphor bronze, which insures their durability as well as their ability to withstand rough usage. Springs of this material do not set nor lose their elasticity as do those of other metals.



The repairing of several hundred instruments annually has aided us materially in the design of our instruments; enabling us to embody those features only that have proven equal to the demands of modern engineering practice.

The Leveling Head well illustrates the advantages accruing from the use of gages, jigs and fixtures, as owing to the accuracy with which these parts are machined, as well as to their proper design, it is impossible to cramp our leveling head in any position, making it unnecessary to loosen all of the screws when leveling up; this is the greatest objection ever raised against the four-screw or American type of leveling head. Thousands of instruments of this general design have been constructed and about one in one thousand constructed with sufficient accuracy to avoid cramping, which rapidly wears the leveling screws and occasionally cramps the centers.



Here again interchangeability plays an important part, as each part being made to gage; twenty-five, fifty or one hundred complete leveling heads may be assembled from stock parts without fitting and not one of them will cramp or bind in any position.

The Vernier Plate construction is well shown by the view of its under side, the material being hard phosphor bronze. By milling instead of turning the vernier seats we are enabled to extend our ribs $\frac{1}{2}$ -inch—12.5 mm. further out on either side of the center, to the reinforcing ring which just clears the limb; this also brings the standard foot screws inside of this ring, where they can be reinforced to further provide against damage in case of accident. The compass box is cast solid on the plate which



it reinforces, and the standards are attached as closely as possible to it, and just inside the ring at the outside ends of the ribs. This, like many other features of our instruments, is of more expensive construction, but we have excellence rather than cost of manufacture constantly in view.



The Limb Clamp is of the usual gib construction and well reinforced, as the illustration shows, thereby permitting a reduction in weight without sacrificing rigidity.

The Lower Center, although light, is well ribbed and has ample strength for the performance of its function. We use a check nut to hold the half ball up to its shoulder, this being a matter that is overlooked entirely by some makers, with the result that the constant clamping of the leveling screws loosens the half ball and gradually works it off; oft-

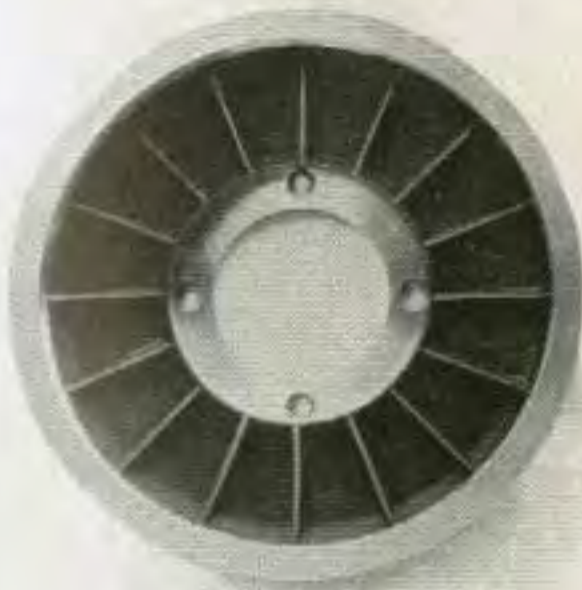
times this goes unnoticed until the entire upper part of the instrument falls apart. Some makers put a locking screw, half into the ball and half into the lower center; this is poor construction, and if forced in a little further at one time than at another it will force the metal of the lower center into the taper bearing, thereby damaging the centers to a greater or less extent.



The Center is of hard bell metal, finished in the most careful manner. Our facilities for this work are such that we are enabled to guarantee a maximum eccentricity of not to exceed five seconds for the three parts, center, socket and lower center—less than two seconds for each part—and we occasionally get these parts so close that we cannot detect the eccentricity; this is of especial importance when sighting at or near vertical, as any eccentricity affects the height of the standards, causing considerable errors.

The Limb is of hard phosphor bronze, well ribbed and having a solid silver surface for the graduations. We exercise great care in

the construction of our limbs and vertical circles, thoroughly seasoning them before graduating, it being a well-known fact that metal, to a certain extent, like wood, requires seasoning, and unless this is done previous to the final finishing operation considerable errors will oftentimes result.



Our Tripod Head is of skeleton construction, the material being hard phosphor bronze, above mentioned, which we use throughout for the principal parts of our instruments even to the screws holding the centers, plates and standards together, thereby insuring greater rigidity, particularly in case of accident.



Finish.—Our standard finish will be: Telescope, vertical circle, vernier plate, limb and shifting center, lacquered; standards, clamps, tangents, level tubes, lower center, bottom plate and tripod head, black; vertical circle guard, enameled. Parts will, however, be finished in any style desired at small additional cost.

Lenses.—We use only the highest grade lenses, ground especially for us.

Levels.—All our levels are ground on an automatic machine, calibrated and graduated so that each division on the level represents an equal number of seconds.

Graduation.—Our circles (excepting the compass circles) are divided on solid silver on the most accurate dividing engine in the world.



Shifting Center.—All our instruments have this device for bringing plumb bob over point when setting up.

Inspection.—Each part is inspected and gaged after each operation, and each group of parts, such as the telescope, centers and leveling head during assembling, insuring that all parts used are within the established error limits and of strictly first-class workmanship and material.

Alterations.—We shall endeavor to carry a complete stock of all instruments listed in this bulletin for immediate shipment, but will gladly make any changes or alterations at reasonable cost, and as quickly as possible. For extras, alterations and attachments regularly supplied see pages 50 to 58.

Simplicity.—Next to accuracy and durability this feature is most important, and for that reason we have constructed our instruments with the fewest possible parts, preferring rather to build an instrument so carefully that all parts would assemble into their proper positions than to provide numerous adjustments to bring carelessly made parts into alignment.

Guaranty.—We guarantee our instruments to be constructed of first-class material, by skilled workmen, and will replace any defective part free of cost at the factory.

Instruments on Approval.—We will send any of our regular instruments to responsible parties anywhere on approval, and for comparison with those of other makers.

In Conclusion we desire to say that our main effort will be along the line of increased accuracy, fully realizing as we do that in engineering instruments there must be a standard of precision; one pre-eminent instrument to which all others can be referred for comparison, and

WE HAVE ESTABLISHED THAT STANDARD AND SHALL MAINTAIN IT.

WM. AINSWORTH & SONS.

SIZE B TRANSITS

OUR 5-inch—12.7 cm. limb is a medium weight, general purpose instrument, not too large for mountain and mining work and not too small for railroad work and general land surveying, where, owing to its excellent construction, results exceeding in accuracy those attained by the use of larger instruments of other makers are not uncommon.

Limb.—Graduated in half degrees on solid silver and regularly furnished with two rows of numbers; the inner row in quadrants 0 to 90 each way and the outer row 0 to 360, inclined in the direction in which they should be read.

Verniers.—Reading to one minute with figures inclined in the direction in which they should be read, placed at 30 degrees angle with telescope and provided with beveled crystal glass cover glasses and ground glass shades.

Compass.—Graduated in half degrees and numbered in quadrants 0 to 90 each way, with 3½-inch—9 cm. needle and variation plate.

Telescope.—10-inch—25.4 cm. long, with 25-power erecting or inverting achromatic eye-piece and 1¼-inch—31.5 mm. diameter objective, giving a large, flat, well lighted field. It is balanced and both eye and objective ends transit. Erecting eyepieces will be furnished unless otherwise ordered.

Cross Wires.—Of spider web, carefully stretched and anchored, give the best results, but platinum will be used when specified.

Plate Levels.—2¼-inch—5.7 cm. long, with graduated vials of 90 seconds sensibility. More or less sensitive vials will be supplied when ordered.

Weight.—Of transit, net, 9¾ pounds—4.4 kilos; of transit and carrying case, 16 pounds—7.3 kilos; of tripod, net, 7½ pounds—3.4 kilos; packed in two boxes for shipment, 60 pounds—27 kilos. Instrument packed in zinc lined case for export and tripod boxed, 70 pounds—31 kilos.

Dimensions.—Instrument, boxed, 12 x 15 x 21 inches—2.2 cu. ft.—30 x 38 x 53 cm.; extension tripod, boxed, 6 x 7 x 43 inches—1 cu. ft.—15 x 17 x 109 cm.

For alterations, extras and attachments see pages 50 to 58.



TYPE BB TRANSIT

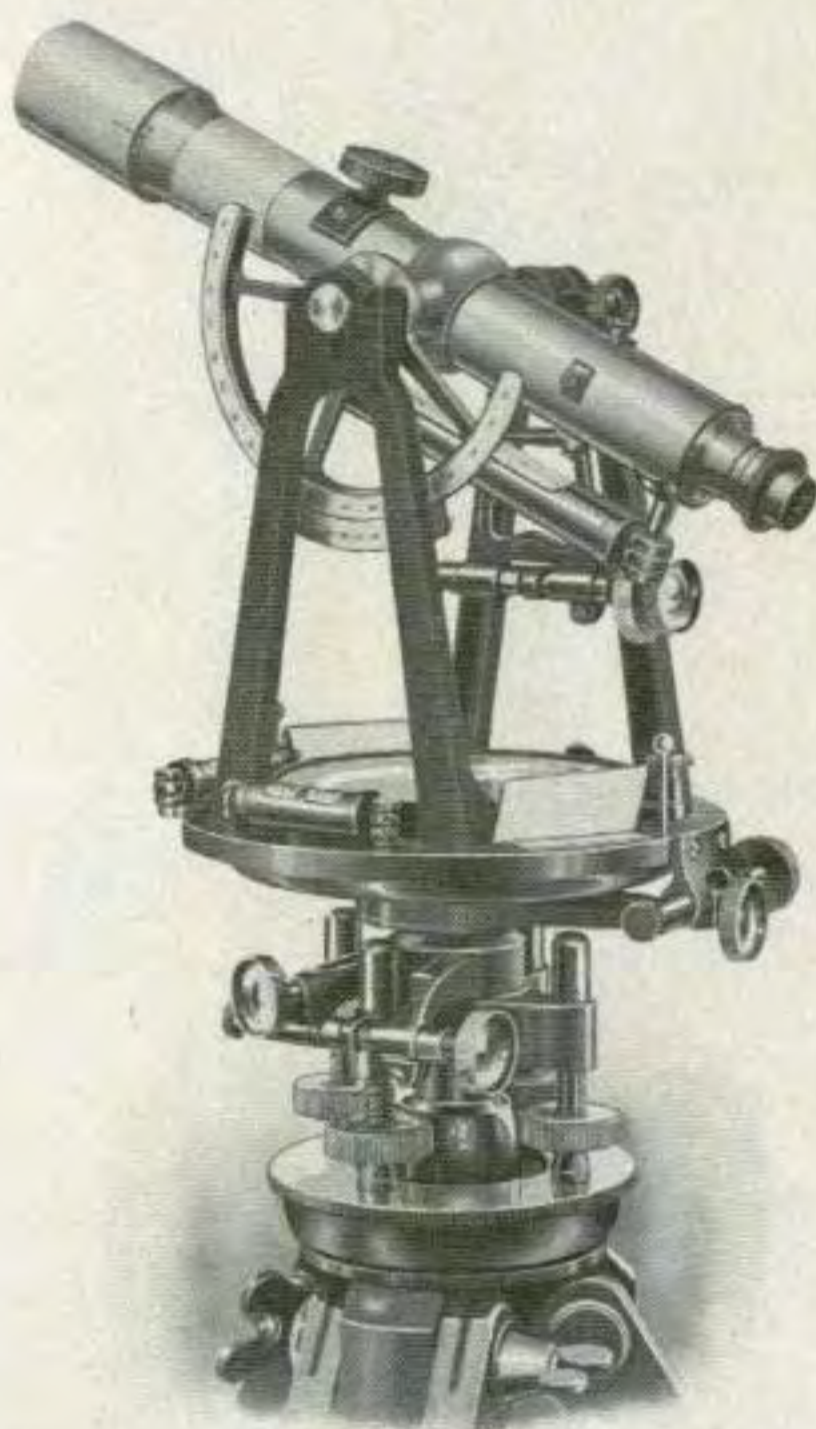
5-inch—12.7 cm. limb.
Code Word "Babichon."

Has 5-inch—12.7 cm. telescope level vial, and telescope axis clamp and tangent; otherwise as described on preceding page. Price complete, with extension tripod. \$225.00—£46 14 0

TYPE BA PLAIN TRANSIT

Code Word Babe.

Same as type BB above, but without telescope level and axis clamp and tangent, otherwise as described on preceding page. Price complete, with extension tripod. \$200.00—£41 10 0
For alterations, extras and attachments see pages 50 to 58.



TYPE BC TRANSIT

5-inch—12.7 cm. limb.

Code Word Babillage.

Has 5-inch—12.7 cm. 30 seconds telescope level vial, axis clamp and tangent, gradienter and 2¼-inch—5.7 cm. vertical arc graduated on solid silver with vernier reading to one minute; otherwise as described on page 13.

Price complete, with extension tripod. \$240.00—£49 16 0

For alterations, extras and attachments see pages 50 to 58



TYPE BD TRANSIT

5-inch—12.7 cm. limb.

Code Word Babbling.

Has 5-inch—12.7 cm. 30 seconds telescope level, axis clamp and tangent, gradienter, 4½-inch—11.5 cm. vertical circle, graduated on solid silver with vernier reading to one minute and aluminum guard; otherwise as described on page 13.

Price complete, with extension tripod. \$250.00—£51 17 0

For alterations, extras and attachments see pages 50 to 58.

TYPE BE TRANSIT

5-inch—12.7 cm. limb.

Code Word **Bungle**.

This instrument is similar in all respects to type BD on opposite page, excepting that the telescope axis is threaded on either end to take a 7½-inch—19 cm., 20-power side telescope and counterweight.

The instrument is like type BF on the following page, excepting that the telescope can be used on the side only, the telescope axis having no vertical extensions.

Weight of instrument, net, 11½ pounds—5.2 kilos; with carrying case 18¼ pounds—8.3 kilos; otherwise the weights and dimensions on page 13 apply.

Price complete, with side telescope, counterweight and extension tripod..... \$ 290.00—£60 3 0

TYPE BF TRANSIT

With interchangeable Auxiliary Telescope.

5-inch—12.7 cm. limb.

Code Word **Babiote**.

Similar in all respects to type BD on opposite page, but with telescope axis so constructed as to permit of the use of the 7½-inch—19 cm., 20-power auxiliary telescope as either a top or side telescope for horizontal and vertical angles respectively, thereby eliminating the constant—distance from center of main to center of auxiliary telescope.

Weight of instrument, net, 12 pounds—5.4 kilos; with carrying case 18¾ pounds—8.5 kilos; otherwise the weights and dimensions on page 13 apply.

Price complete, with auxiliary telescope, counterweight and extension tripod..... \$310.00—£64 6 0

For alterations, extras and attachments see pages 50 to 58.



TYPE BF TRANSIT

With Interchangeable Auxiliary Telescope.
5-inch—12.7 cm. limb.

Code Word **Babiolo**.

For description see preceding page.

Price complete, with auxiliary telescope, counterweight and extension tripod \$310.00—£64 6 0

Reflectors for illuminating cross wires extra, see No. 79, page 57.

For alterations, extras and attachments see pages 50 to 58.



TYPE BF TRANSIT

With Interchangeable Auxiliary Telescope.

5-inch—12.7 cm. limb.

Code Word Babiole.

For description and price see preceding pages.

For alterations, extras and attachments see pages 50 to 58.

SIZE B THEODOLITES

ON the following pages we show our line of 5-inch—12.7 cm. theodolites, which, aside from the construction of the standard, are similar in all respects to the foregoing line of transits. The U or theodolite standard is superior in point of rigidity and accuracy to the usual double standards universally used, and in case of accident holds the instrument together better, thereby resulting in considerably less damage to it.



PLAN OF VERNIER PLATE

Showing arrangement of compass, verniers, plate levels—the parallel level is obscured by the standard—tangent motion and variation pinion

Limb.—Is graduated in half degrees on solid silver and regularly furnished with two rows of numbers; the inner row in quadrants 0 to 90 each way and the outer row 0 to 360, inclined in the

direction in which they should read. Verniers reading to one minute are placed at 30 degrees angle with telescope.

Compass.—Graduated in half degrees and numbered in quadrants 0 to 90 each way, with 2½-inch—6.4 cm. needle, and variation plate actuated by pinion motion.

Telescope.—10-inch—25.4 cm. long, with 25-power erecting or inverting achromatic eyepiece and 1¼-inch—31.5 mm. diameter objective, giving a large, flat, well lighted field. It is balanced and both eye and objective ends transit. Erecting eyepieces will be furnished unless otherwise ordered.

Cross Wires.—Of spider web, carefully stretched and anchored, usually furnished, but platinum wires will be furnished when specified.

Plate Levels.—2¼-inch—5.7 cm. long, with graduated vials of 90 seconds sensibility. More or less sensitive vials will be supplied when ordered.

Packed, together with sunshade, wrench, plumb-bob, screw driver, magnifying glass and adjusting pins, in mahogany case with leather carrying strap.

Weight.—Of transit, net, 10¼ pounds—4.6 kilos; of transit and carrying case, 16½ pounds—7.5 kilos; of tripod, net, 7½ pounds—3.4 kilos; packed in two boxes for shipment, 60 pounds—27 kilos. Instrument packed in zinc lined case for export and tripod boxed, 70 pounds—31 kilos.

Dimensions.—Instrument, boxed, 12 x 15 x 21 inches—2.2 cu. ft.—30 x 38 x 53 cm.; extension tripod, boxed, 6 x 7 x 43 inches—1 cu. ft.—15 x 17 x 109 cm.

This type of instrument can be provided with reversible telescope axis, see No. 74, page 57.

TYPE BU PLAIN THEODOLITE

Code Word Bugbear.

As above described.

Price complete, with extension tripod.....\$210.00—£43 6 0

For alterations, extras and attachments see pages 50 to 58.



TYPE BV THEODOLITE

5-inch—12.7 cm. limb.

Code Word Buggy.

Has 5-inch—12.7 cm. 30 seconds telescope level vial, axis clamp and tangent and gradienter; otherwise as described on preceding pages.

Price complete, with extension tripod.....\$235.00—£48 15 0

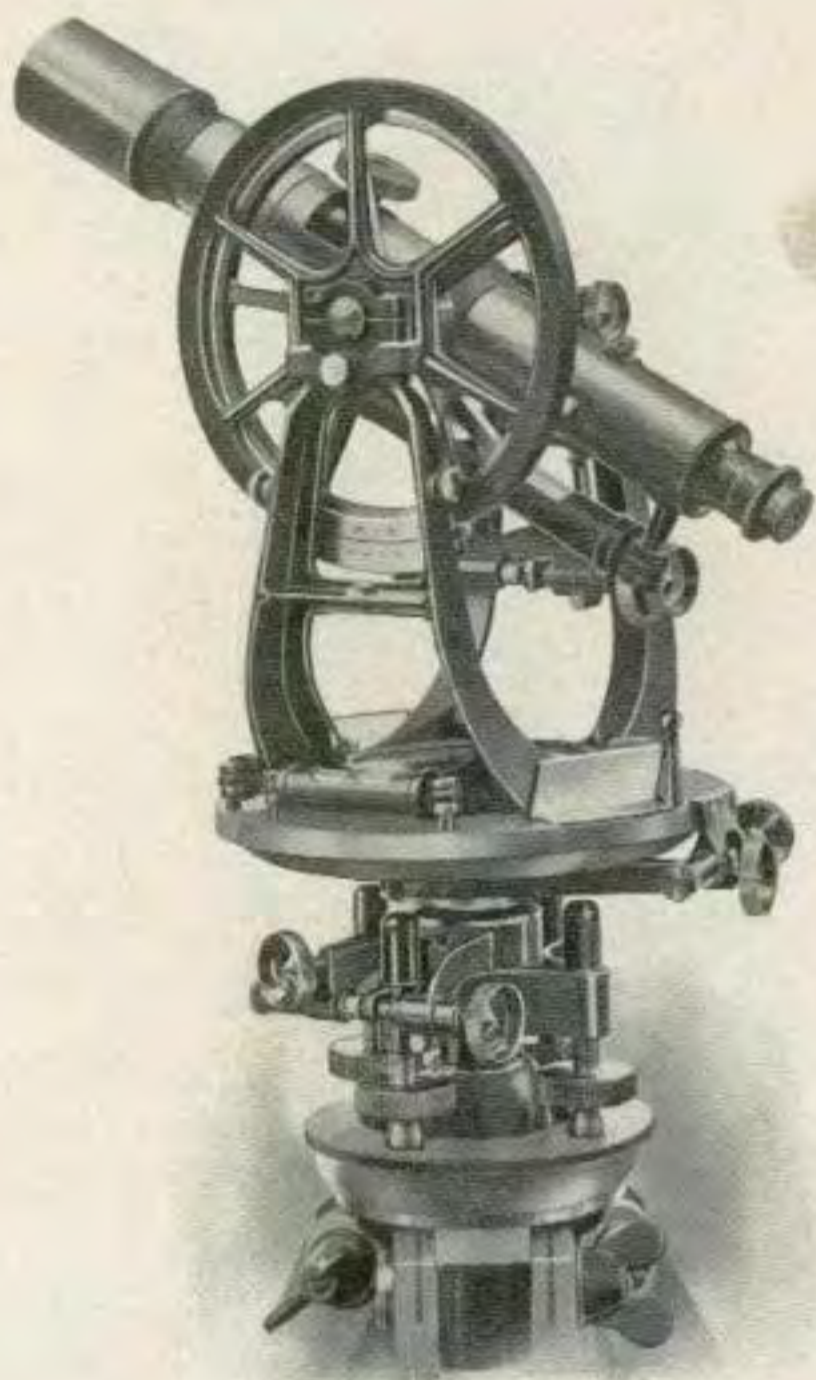
TYPE BW THEODOLITE

Code Word Buglehorn.

Same as type BV, but with 2½-inch—5.7 cm. vertical arc, graduated on solid silver, with vernier reading to one minute.

Price complete, with extension tripod.....\$250.00—£51 17 0

For alterations, extras and attachments see pages 50 to 58.



TYPE BX THEODOLITE

5-inch—12.7 cm. limb.

Code Word Bulger.

Has 5-inch—12.7 cm. vertical circle graduated on solid silver, with vernier reading to one minute and aluminum guard; 5-inch—12.7 cm. 30 seconds telescope level, axis clamp and tangent and gradienter; otherwise as described on pages 20 and 21.

Price complete, with extension tripod.....\$260.00—£53 18 0

For alterations, extras and attachments see pages 50 to 58.



TYPE BZ MINING THEODOLITE

5-inch—12.7 cm. limb.

With Interchangeable Auxiliary Telescope.

Code Word Bulged.

This instrument is similar in all respects to type BX on opposite page, excepting that it has a 7½-inch—19 cm., 20-power auxiliary telescope, with counterweight, that can be used as either a top or side telescope.

Weight.—Net, 12½ pounds—5.6 kilos, otherwise the description on pages 20 and 21 applies.

Price complete, with auxiliary telescope, counterweight and extension tripod, but without reflectors \$325.00—£67 8 0

For alterations, extras and attachments see pages 50 to 58.



TYPE BZ MINING THEODOLITE

5-inch—12.7 cm. limb.

With Interchangeable Auxiliary Telescope.

Code Word **Bulged.**

Showing auxiliary telescope used as top telescope.

For description, prices, etc., see preceding pages.

For alterations, extras and attachments see pages 50 to 58.

SIZE C AND D TRANSITS

OUR 4½ and 4-inch—11.5 and 10.2 cm. transits, described on the pages immediately following, are best adapted for use in mines and in mountainous country where portability and light weight is most desirable.

These instruments are constructed in the same careful manner as our larger instruments, which they equal in accuracy corresponding to their size.

Limb.—Is graduated in half degrees on solid silver and regularly furnished with two rows of figures; the inner row in quadrants 0 to 90 each way and the outer row 0 to 360, inclined in the direction in which they should be read. Verniers reading to one minute are placed at 30 degrees angle with telescope.

Compass.—Graduated in half degrees and numbered in quadrants 0 to 90 each way, with 3 and 2½-inch—7.6 and 6.3 cm. needles on the 4½ and 4-inch—11.5 and 10.2 cm. instruments respectively, and variation plate.

Telescope.—8-inch—23 cm. long, with 20-power erecting or inverting achromatic eye-piece and 1½-inch—29 mm. objective, giving a large, flat, well lighted field. It is balanced and both eye and objective ends transit. Erecting eyepieces furnished unless otherwise ordered.

Cross Wires.—Of spider web, carefully stretched, are usually furnished, but platinum wires will be furnished when specified.

Plate Levels.—2-inch—5 cm. long, with graduated vials of 1½ to 2 minutes sensibility. More or less sensitive vials will be furnished when ordered.

Packed, together with sunshade, wrench, plumb-bob, screw driver, magnifying glass and adjusting pins, in mahogany case.

Weight.—Of transit, net, 4½-inch—11.5 cm., 6¼ pounds—2.8 kilos; 4-inch—10.2 cm., 5¾ pounds—2.6 kilos; of transit and carrying case, 11 pounds—5 kilos; of tripod, net, 5 pounds—2.3 kilos; packed in two boxes for shipment, 45 pounds—20 kilos; instrument packed in zinc lined case for export and tripod boxed, 50 pounds—22 kilos.

Dimensions.—Instrument, boxed, 12 x 12 x 20 inches—1.6 cu. ft.—30 x 30 x 50 cm.; extension tripod boxed, 5 x 6 x 40 inches—.7 cu. ft.—12 x 15 x 91 cm.



TYPE CB TRANSIT

4½-inch—11.5 cm. limb.

Code Word **Bullace.**

Has 4-inch—10.2 cm. 30 seconds telescope level, axis clamp and tangent and gradienter; otherwise the description on the preceding page applies.

Price complete, with extension tripod \$220.00—£45 13 0

TYPE CA PLAIN TRANSIT

Code Word **Bulldog.**

Similar to type CB above, but without telescope level, axis clamp and tangent and gradienter. See preceding page for complete description.

Price complete, with extension tripod \$195.00—£40 9 0

For alterations, extras and attachments see pages 50 to 58.



TYPE CC TRANSIT

4½-inch—11.5 cm. limb.

Code Word **Bullock.**

Has 2¼-inch—5.7 cm. vertical arc, 4-inch—10 cm. 30 seconds telescope level vial, telescope axis clamp and tangent and grader; otherwise as described on page 26.

Price complete, with extension tripod \$235.00—£48 15 0

For alterations, extras and attachments see pages 50 to 58.



TYPE CD TRANSIT

4½-inch—11.5 cm. limb.
Code Word Bulrush.

Has 4½-inch—11.5 cm. vertical circle, graduated on solid silver, with vernier reading to one minute, aluminum guard, 4-inch—10 cm. 30 seconds telescope level, axis clamp and tangent and gradienter; otherwise as described on page 26.

Price complete, with extension tripod..... \$245.00—£50 16 0

TYPE CE MINING TRANSIT

4½-inch—11.5 cm. limb.
Code Word Bumper.

Similar to type CD, but provided with 6-inch—15.2 cm., 18-power side telescope and counter weight for underground work.

Weight.—7¼ pounds—3.3 kilos.

Price complete, with auxiliary telescope, counterweight and extension tripod..... \$280.00—£58 2 0

For alterations, extras and attachments see pages 50 to 58.



TYPE CF MINING TRANSIT

4½-inch—11.5 cm. limb.

With Interchangeable Auxiliary Telescope.

Code Word Bunch.

This instrument is similar in all respects to type CD on foregoing page, excepting that it is provided with a 6-inch, 15.2 cm. interchangeable auxiliary telescope with counterweight for mine surveying; otherwise as described on page 26.

Weight.—Net, 7½ pounds—3.4 kilos.

Price complete, with auxiliary telescope, counterweight and extension tripod,..... \$305.00—£63 3 0

Reflectors for illuminating cross wires extra.

For alterations, extras and attachments see pages 50 to 58.



TYPE CF MINING TRANSIT

4½-inch—11.5 cm. limb.

With Interchangeable Auxiliary Telescope.

Code Word Bunch.

Showing auxiliary telescope used as a top telescope.
For complete description and price see preceding pages.
For alterations, extras and attachments see pages 50 to 58.



TYPE DD TRANSIT

4-inch—10 cm. limb.

Code Word **Barbolt.**

This instrument is similar to type CD shown on page 29, with further description on page 26, excepting weight, which, owing to its smaller size, is $5\frac{3}{4}$ pounds—2.6 kilos.

Price complete, with extension tripod \$245.00—£50 16 0

This instrument can also be furnished without the various attachments shown, at prices corresponding to types CA, CB and CC, shown on the foregoing pages.

TYPE DE MINING TRANSIT

Code Word **Burdock.**

Same as above, but with 6-inch—15.2 cm. side telescope and counterweight; otherwise as described on page 26.

Weight.— $6\frac{3}{4}$ pounds—3 kilos.

Price complete, with auxiliary telescope, counterweight and extension tripod \$280.00—£58 2 0

For alterations, extras and attachments see pages 50 to 58.



TYPE DF MINING TRANSIT

4-inch—10 cm. limb.

With Interchangeable Auxiliary Telescope.

Code Word Burgess.

Similar to type CF, described on preceding pages, 30 and 26.

Weight.—7 pounds—3.1 kilos.

Price complete, with auxiliary telescope, counterweight and extension tripod \$305.00—£63 3 0

Reflectors for illuminating cross wires extra.

For alterations, extras and attachments see pages 50 to 58.



TYPE DF MINING TRANSIT

4-inch—10 cm. limb.

With Interchangeable Auxiliary Telescope.

Code Word Burgess.

Showing auxiliary telescope used as a top telescope for underground surveying.

For prices and description see preceding pages, 26 and 30.

For alterations, extras and attachments see pages 50 to 58.

SIZE C THEODOLITES

Our 4½-inch—11.5 cm. theodolites are similar in design to the larger sizes shown on the preceding pages, but more compact owing to the reduction in size.

For plan of vernier plate showing compass see page 20.

Limb.—Is graduated in half degrees on solid silver and regularly furnished with two rows of numbers; the inner row in quadrants 0 to 90 each way and the outer row 0 to 360, inclined in the direction in which they should read. Verniers reading to one minute are placed at 30 degrees angle with telescope.

Compass.—Graduated in half degrees and numbered in quadrants 0 to 90 each way, with 2¼ inch—5.8 cm. needle.

Telescope.—8-inch—20.3 cm. long, with 20-power erecting or inverting achromatic eyepiece and 1½-inch—29 mm. diameter objective, giving a large, flat, well lighted field. It is balanced and both eye and objective ends transit. Erecting eyepieces will be furnished unless otherwise ordered.

Cross Wires.—Of spider web, carefully stretched and anchored, usually furnished, but platinum wires will be furnished when specified.

Plate Levels.—2-inch—5.7 cm. long, with graduated vials of 90 seconds sensibility. More or less sensitive vials will be supplied when ordered.

Packed, together with sunshade, wrench, plumb-bob, screw driver, magnifying glass and adjusting pins, in mahogany case with leather carrying strap.

Weight.—Of instrument, net, 6¼ pounds—2.8 kilos; of instrument and carrying case, 11 pounds—5 kilos; of tripod, net, 5 pounds—2.3 kilos; packed in two boxes for shipment, 45 pounds—20 kilos. Instrument packed in zinc lined case for export and tripod boxed, 50 pounds—22 kilos.

Dimensions.—Instrument, boxed, 12 x 12 x 20 inches—1.6 cu. ft.—30 x 30 x 50 cm.; extension tripod, boxed, 5 x 6 x 40 inches—.7 cu. ft.—12 x 15 x 91 cm.

This type of instrument can be provided with reversible telescope axis; see No. 74, page 57.

For alterations, extras and attachments see pages 50 to 58.

TYPE CU PLAIN THEODOLITE

4½-inch—11.5 cm. limb.

Code Word **Bully**.

As described on preceding page and without the various attachments shown on opposite page.

Price complete with extension tripod.....\$200.00—£43 6 0

TYPE CV THEODOLITE

4½-inch—11.5 cm. limb.

Code Word **Bulky**.

As described on preceding page, but with 4-inch—10 cm. telescope level, telescope axis clamp and tangent and gradienter, but without other attachments shown on opposite page.

Price complete, with extension tripod.....\$235.00—£48 15 0

TYPE CW THEODOLITE

4½-inch—11.5 cm. limb.

Code Word **Bulin**.

As described on preceding page, but with 4-inch—10 cm. telescope level, telescope axis clamp and tangent, gradienter and 2¼-inch—5.7 cm. vertical arc (not edge graduation) and vernier with graduations on solid silver, but without other attachments shown on opposite page.

Price complete, with extension tripod.....\$250.00—£51 17 0

TYPE CX THEODOLITE

4½-inch—11.5 cm. limb.

Code Word **Budge**.

As illustrated and described on opposite page, but without auxiliary telescope attachment, edge graduation for vertical circle and reflector for illuminating cross wires, otherwise description on preceding page applies.

Price complete, with extension tripod.....\$260.00—£53 18 0

TYPE CY THEODOLITE

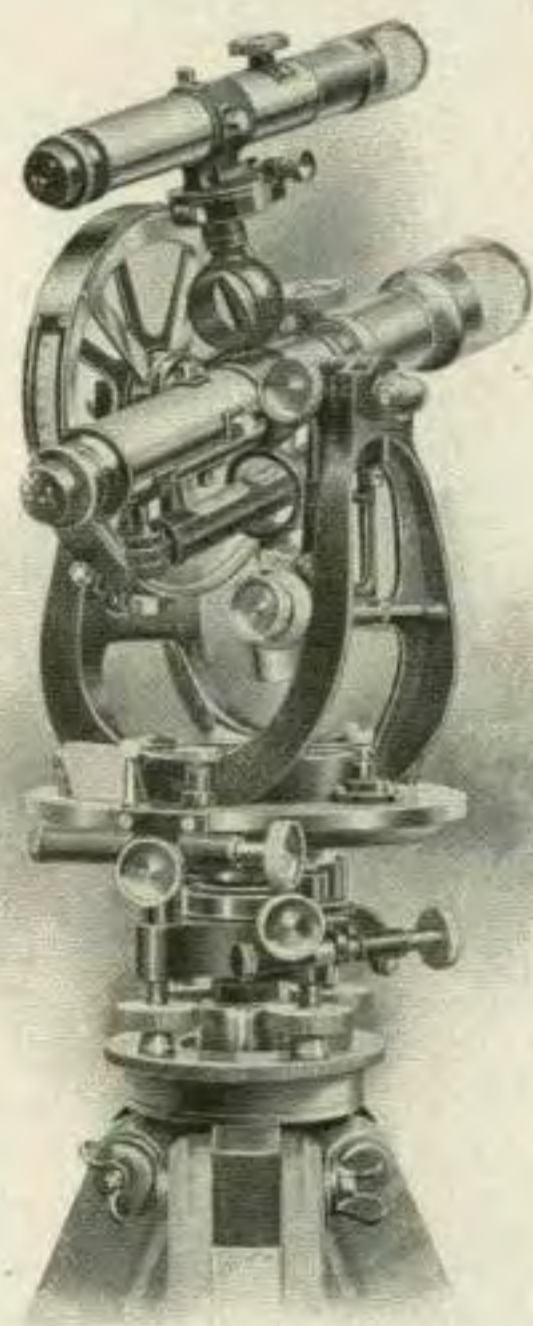
4½-inch—11.5 cm. limb.

Code Word **Buck**.

As illustrated and described on opposite page, but with side telescope attachment only (not interchangeable), and without edge graduation on vertical circle and reflectors for illuminating cross wires; otherwise as described on preceding page.

Price complete, with extension tripod.....\$300.00—£62 5 0

For alterations, extras and attachments see pages 50 to 58.



TYPE CZ THEODOLITE

4½-inch—11.5 cm. limb.

With Interchangeable Auxiliary Telescope.

Code Word Bume.

Has 4½-inch—11.5 cm. vertical circle with guard, 4-inch—10 cm. 30 seconds telescope level, 6-inch—15.2 cm. auxiliary telescope with counterweight, axis clamp and tangent and gradienter.

Weight, net, 9 pounds—4 kilos, otherwise as described on page 35.

Price complete, with extension tripod..... \$325.00—£67 8 0

Reflectors for illuminating cross wires and edge graduation on vertical circle extra.

For alterations, extras and attachments see pages 50 to 58.

STANDARD GRADE INSTRUMENTS

IN the construction of our precision instruments, all parts being made to gages with error limits of but .0001-inch—.001 mm. in some instances, it will be at once apparent that occasionally parts will be produced that do not come within the limits established for these instruments.

Take the production of draw tubes or object slides as an instance. Occasionally when setting up a machine from one to ten or a dozen of these parts will be finished too small or with the outside of the tube eccentric, with the bearing surface of the lens cell, inside the object head, to exceed .0001-inch—.001 mm.

It would be unwarranted extravagance to throw these parts away; no maker does, nor could he afford to, but if his output consists of high grade instruments only, these parts go into the so-called high grade instruments.

We use such of these parts as are not damaged, in the construction of our standard grade instruments, together with lense systems which may be slightly deficient in definition, color correction or flatness of field, and level vials whose curvature varies slightly, thereby maintaining the standard of our precision instruments at prices below what we could otherwise. It will be seen, however, that we cannot guarantee strict interchangeability for this line, but they will be more nearly so than are those of other makers.

The parts for both grades are made up at the same time, of the same material, by the same workmen, in the same careful manner, with a view to using them in our precision instruments only, but for the reason above stated some of these parts cannot be used and maintain the standard of our precision instruments.

In conclusion, permit us to say that our standard grade instruments are inferior to our precision instruments only and that we guarantee them equal in every respect and superior in many details to the high grade instruments of other makers.



TYPE BN PLAIN TRANSIT

Standard Grade.

5-inch—12.7 cm. limb.

Code Word Burglar.

Similar in every detail, excepting finish, to type BA, described on pages 13 and 14.

Finish.—All parts bronzed, excepting screws, limb and shifting center, which are finished bright.

Price complete, with extension tripod.....\$180.00—£37 7 0

For alterations, extras and attachments see pages 50 to 58.



TYPE BO TRANSIT

Standard Grade.

5-inch—12.7 cm. limb.

Code Word Barker.

Has 5-inch—12.7 cm. 30 seconds telescope level and axis clamp and tangent. Otherwise as described on page 13, excepting finish.

Finish.—Bronze, excepting limb, screws and shifting center, which are finished bright; otherwise description on page 13 applies.

Price complete, with extension tripod.....\$205.00—£42 11 0

For alterations, extras and attachments see pages 50 to 58.



TYPE BP TRANSIT

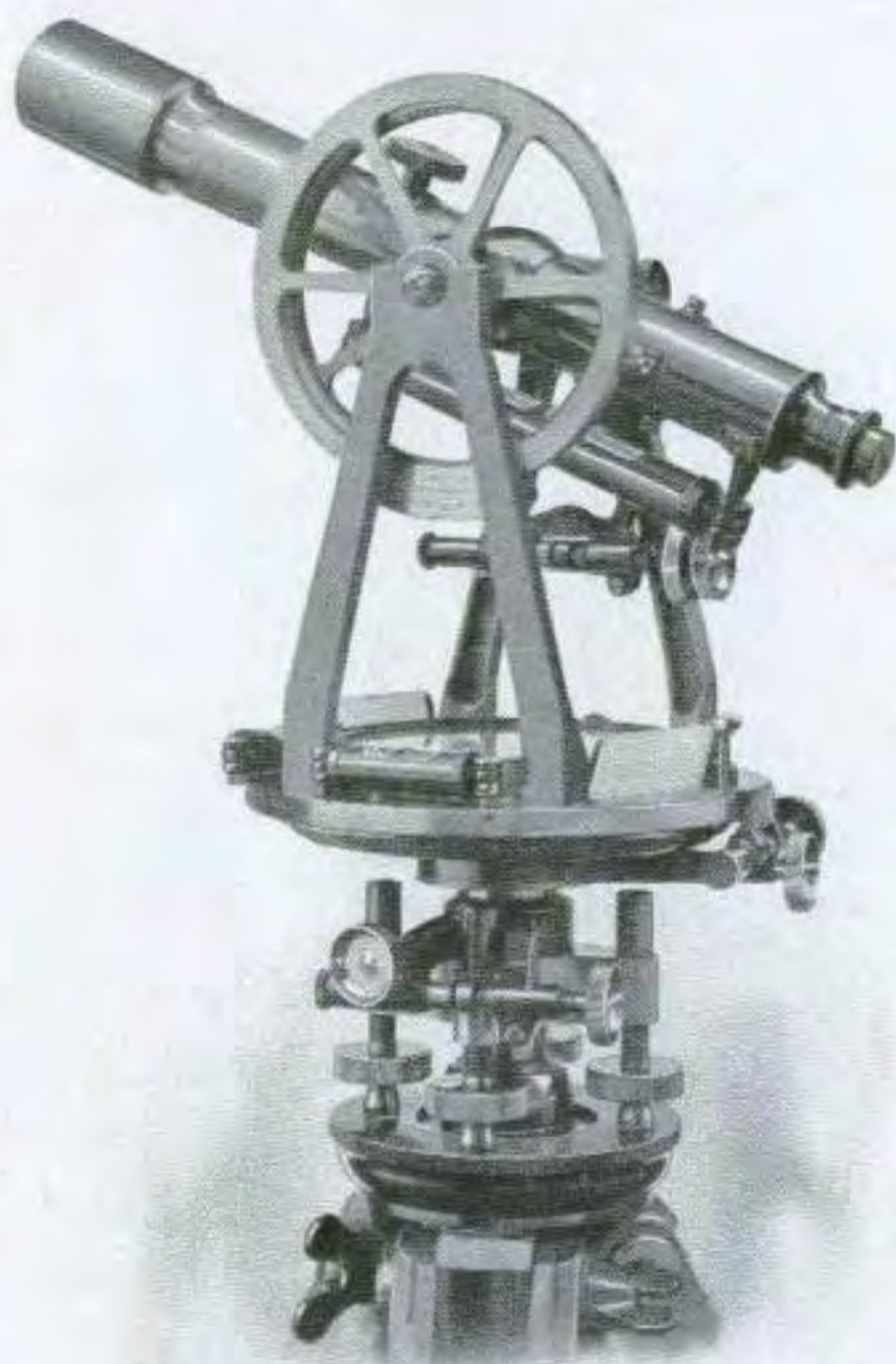
Standard Grade.
5-inch—12.7 cm. limb.
Code Word Burlesque.

Has $2\frac{1}{4}$ -inch—5.7 cm. vertical arc graduated on solid silver, with vernier reading to one minute, 5-inch—12.7 cm. 30 seconds telescope level, axis clamp and tangent and gradienter; otherwise description on page 13 applies, excepting finish.

Finish.—Bronze, excepting arc, limb, screws and shifting center, which are finished bright.

Price complete, with extension tripod. \$220.00—£45 13 0

For alterations, extras and attachments see pages 50 to 58.



TYPE BQ TRANSIT

Standard Grade.

5-inch—12.7 cm. limb.

Code Word *Burletta*.

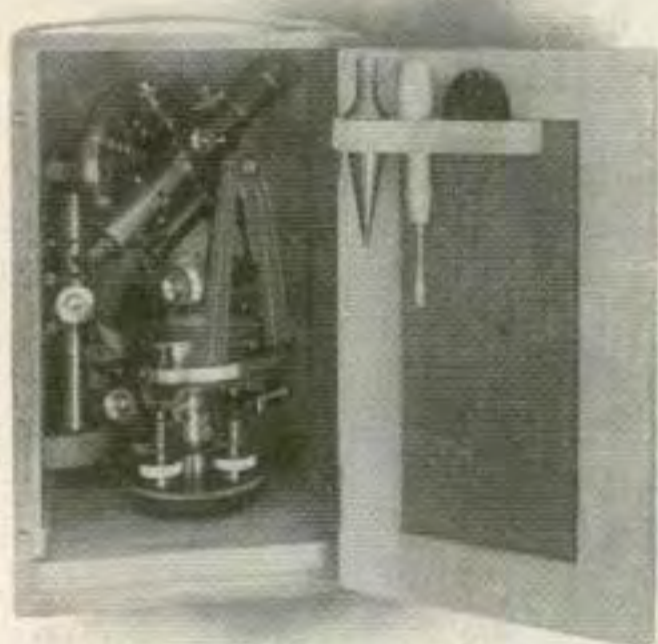
Has $4\frac{1}{2}$ -inch—11.5 cm. vertical circle, with aluminum guard, 5-inch—12.7 cm. 30 seconds telescope level, axis clamp and tangent and gradienter.

Finish.—Bronze, excepting vertical circle, limb, screws and shifting center, which are finished bright; otherwise description on page 13 applies.

Price complete, with extension tripod. \$230.00—£47 15 0

For alterations, extras and attachments see pages 50 to 58.

CARRYING CASES



Unless otherwise instructed our instruments will be furnished packed in polished mahogany carrying cases with leather carrying strap. See type A.

TYPE A CARRYING CASE.
Code Word Burly.

We will, however, pack instruments flat in type B case without extra charge, if so instructed.

Leather cover extra
\$10.00—£2 1 0
Code Word Basking.



TYPE B CARRYING CASE.
Code Word Burnable.

WYE LEVELS

IN the construction of our levels, as in our transits, only the hardest bronze alloys are used, all parts are made to gage, and with the exception of the centers strictly interchangeable.

Simplicity is a most desirable feature in engineering instruments, and we believe we have succeeded in making a wye level with the fewest possible parts. By working to within limits of from .0001 to .00005 inch—.0025 to .0013 mm., we have produced a telescope that will remain in collimation throughout its entire travel without making use of the objectionable object slide adjustment, which as yet no other maker has.

The Telescope Main Tube is of hard drawn tubing with long bearings carefully lapped true with the bell metal collars, which are also true and of uniform diameter, to within .00005 inch—.0013 mm. The forward end carries a tube of slightly larger diameter to which the dust cap and sunshade are attached and which protects the object slide against the entrance of dust throughout its entire travel, as well as the rack and pinion against damage when attaching or detaching a tightly fitting cap or sunshade.

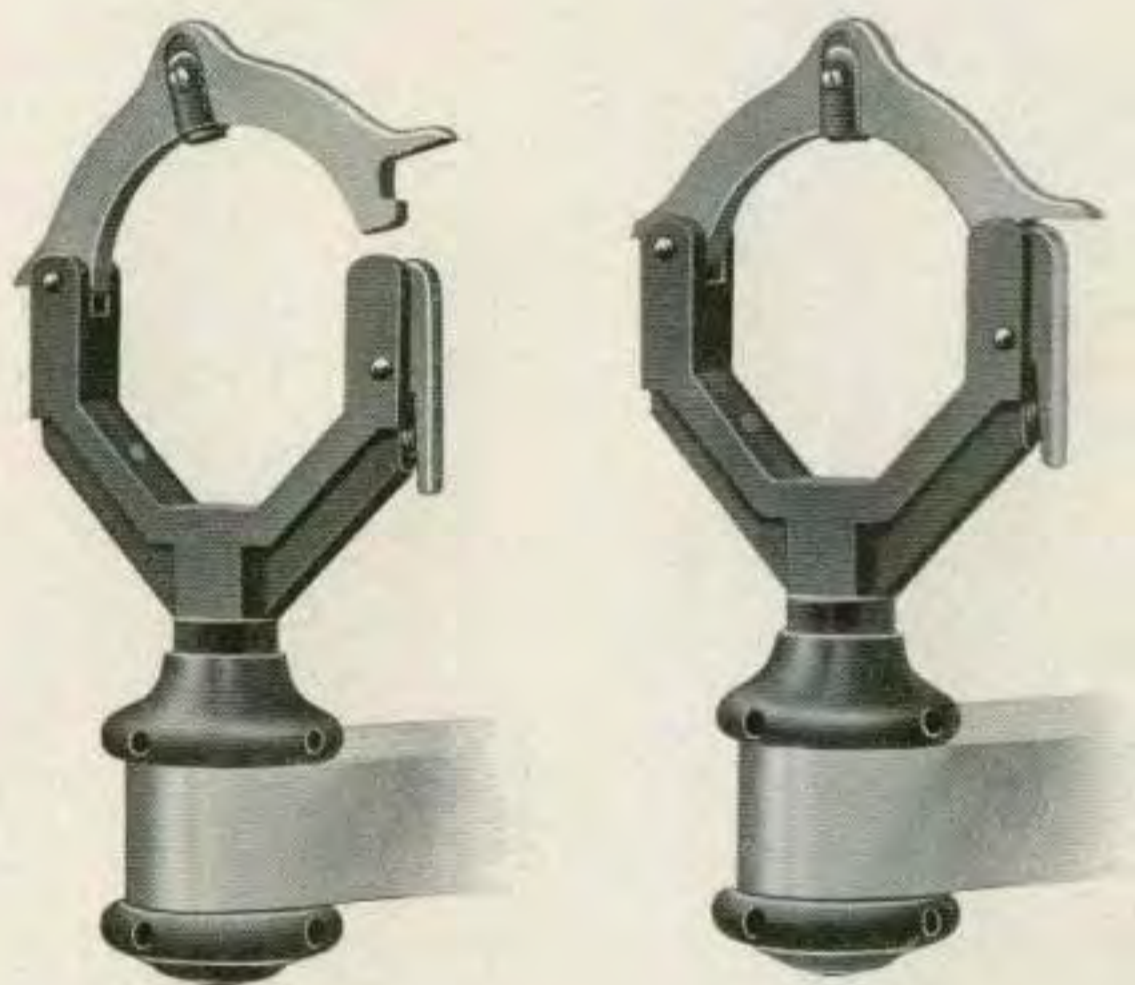
The Object Slide and head are formed of one piece of hard drawn phosphor bronze tubing, that portion forming the slide being reduced by rolling, which increases the density and hardness of the metal and thereby its durability. A felt wiper on the front end of the slide, in constant contact with the interior of the protecting tube above mentioned, affords complete dust protection.

The Lens System is the highest grade obtainable, with achromatic objective and erecting (or inverting) eyepiece having a large, flat, well illuminated field.

The Pinion Head and Saddle are of the same construction as used on our transits, having taper bearing with fibre thrust washers.

The Levels are ground on automatic machines, with graduations on glass and usually furnished of 5, 10, 15, 20 or 30 seconds sensibility for each 1-10 inch—2.5 mm. division; we do not, however, recommend levels of higher sensibility than 20 seconds for ordinary work, owing to the increased time required for setting up and adjusting.

The Wyes are of hard phosphor bronze, and while lighter are somewhat stronger than the usual construction. The clips are of improved design, carrying fibre tipped spring plungers that hold the telescope firmly in the wyes, and provided with improved

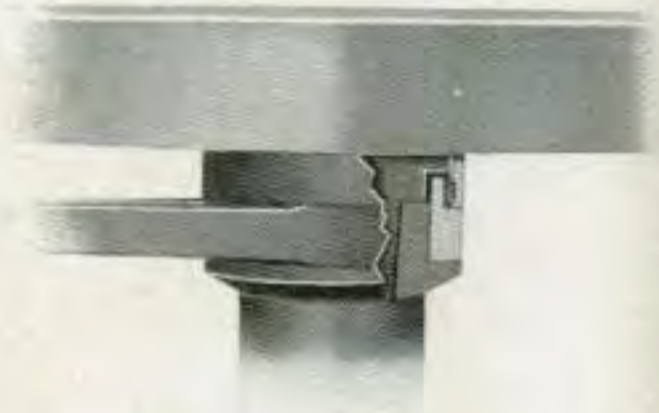


spring latches that lock them solidly, besides affording an easy and rapid means of unlocking the clips for adjusting and packing—the telescope being removed from the wyes when placed in carrying case—without the use of loose parts.

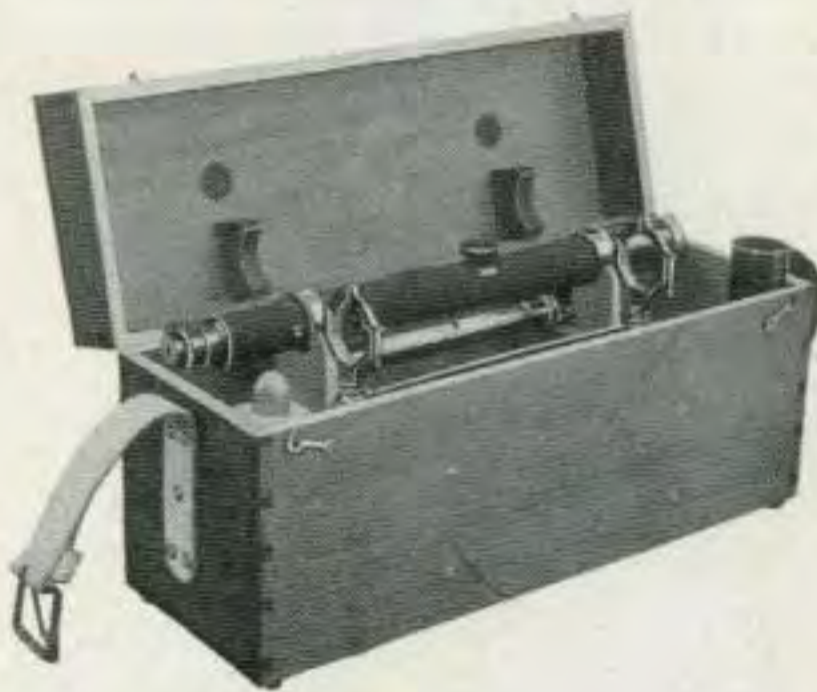
The Spindle is of hard bell metal, of large diameter and extra long, with ample provision for refitting in case of wear or accident.

The Leveling Head, as in our transits, is so constructed that it cannot be cramped in any position, this feature greatly reducing the wear on the leveling screws and inconvenience in setting up, besides rendering it unnecessary to loosen all screws when leveling.

The Dust Ring here shown in section, consists of a light piece of tubing threaded onto the spindle and carrying in a groove on its inner surface a narrow felt ring which is in constant contact with an upwardly projecting ring or boss on the clamp and affords complete dust protection to the spindle and clamp bearings.



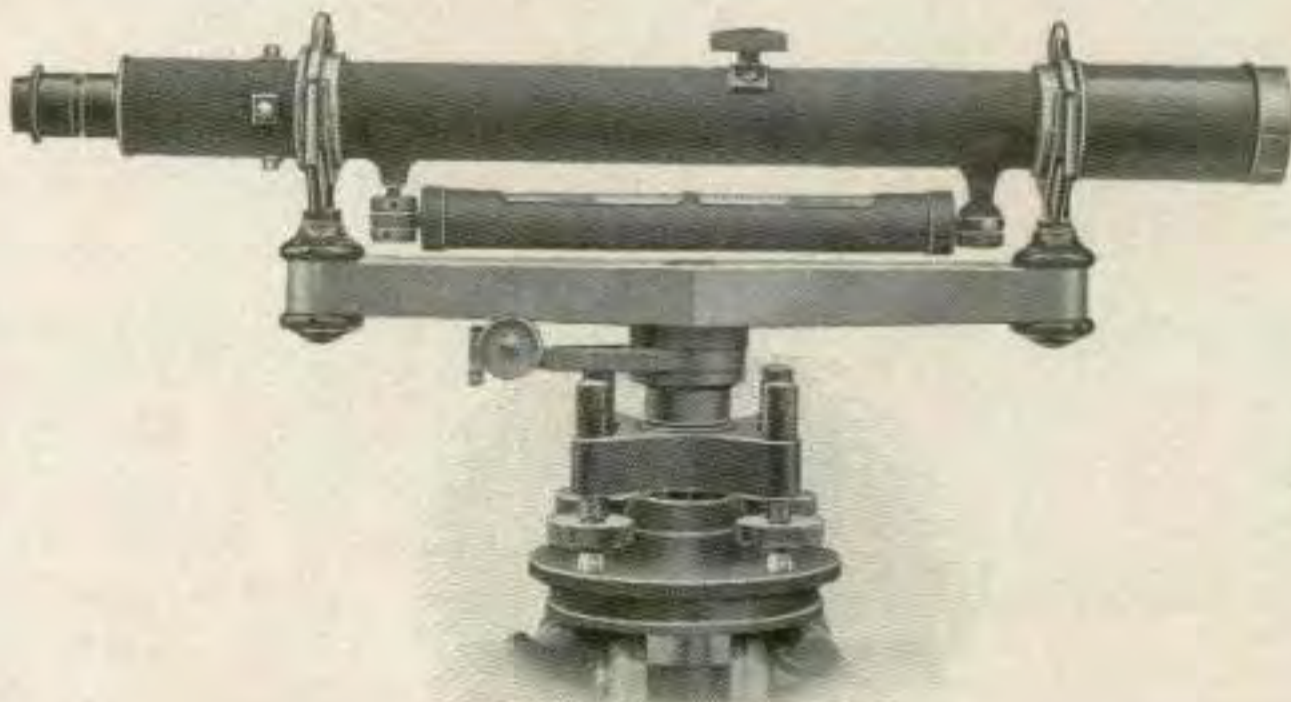
Finish.—Telescope cloth finished, eyepiece, objective hood, wyes, level, clamp, lower, center and bottom plate black; wye clips, bar, tangent and leveling screws bright.



Packed together with the usual accessories in mahogany carrying case as shown, with telescope removed from the wyes and held securely by the collars in felt covered blocks, which prevents damaging the wye collars when carrying and in transit.

Alterations from our standard types will be made with as little delay as possible and at reasonable cost. For extras and attachments for wye levels see page 59.

Instruments on Approval.—We will send our standard instruments to responsible parties anywhere on approval or for comparison with the instruments of other makers.



**TYPE YC
18-INCH WYE LEVEL**

Code Word Beckon.

Has 18-inch—46 cm. 35 power erecting (or inverting if ordered) telescope, 8-inch—20.5 cm., 20 seconds level, improved wye clip latches, clamp and tangent, and dust guard. Can be focused on point within 8 feet—2.5 meter; otherwise as described on preceding pages. A—10 seconds, code word **Bedew**, or 15 seconds, code word **Bedlam**; level vial will be furnished without extra charge instead of the 20 seconds vial regularly supplied.

Weight of level, net, 10 pounds—4.5 kilos; level in carrying case 18 pounds—8.1 kilos; tripod, net, 8 pounds—3.6 kilos; packed in two boxes for domestic shipment 65 pounds—30 kilos; instrument packed in zinc lined case, tripod boxed, for export, 70 pounds—32 kilos.

Dimensions.—Instrument boxed 12x24x14 inches—2.3 cu. ft.—30x61x36 cm.; tripod boxed 7x7x63 inches—1.9 cu. ft.—18x18x105 cm.

Price complete, with solid tripod \$140.00—£29 0 0

For alterations, extras and attachments see page 59.

RAILROAD WYE LEVELS

OWING to the large demand for a good wye level at a reasonable price we have brought out a new instrument of simple and substantial construction.



The Center, Bar and Wyes are cast in one piece of hard phosphor bronze, as here shown, which increases the rigidity, at the same time decreasing the cost of manufacture.

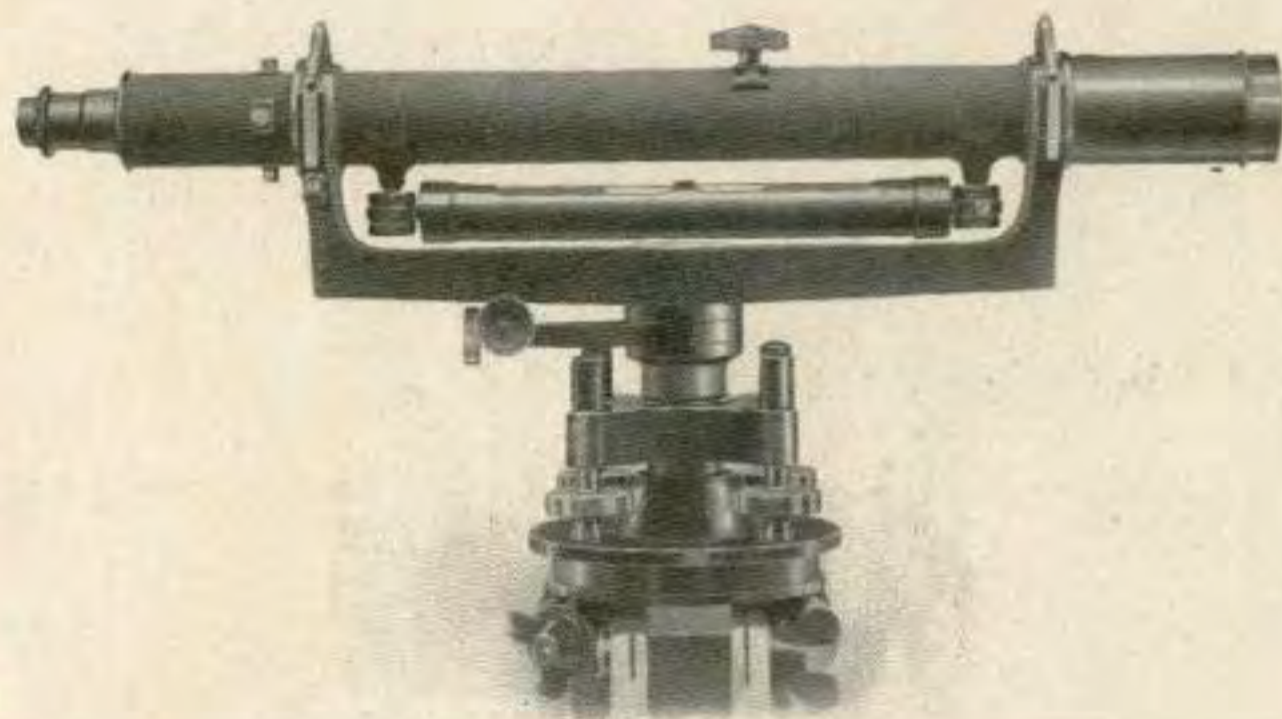
The Adjustable Wye on the eye-piece end of the bar is constructed as shown. The two adjusting screws are opposite the contact points of the wye collars and a stiff spring follows up the screws, providing a bearing for the collars practically as solid as the fixed wye.

The Telescopes are the same as used for our precision instruments, but those that do not come within the error limits established for the higher grade instruments are laid aside for use in our railroad levels. These are in no way defective, and although the same selection is made of other parts common to both instruments, we will guarantee this instrument equal in accuracy and workmanship to the best instruments of other makers.

Finish.—Telescope and bar cloth finished. Wyes, level, clamp, leveling head and bottom plate black. Wye clips, tangent and leveling screws bright.

Packed with usual accessories in poplar carrying case, with telescope resting in wyes,





**TYPE YF
18-INCH RAILROAD WYE LEVEL**

Code Word Becloud.

Has 18-inch—46 cm. 30 to 35 power erecting (inverting if ordered) telescope, 8-inch—30 seconds level, improved wye clip latches, dust guard, and wyes, bar and spindle cast in one piece. Can be focused on a point within 8 feet—2.5 meter. Otherwise as described on preceding page.

Weight of level, net, 9½ pounds—4.3 kilos. All other weights and dimensions the same as for type YC on page 47.

Price complete, with solid tripod.....\$110.00—£22 16 0

For alterations, extras and attachments see page 59.

EXTRAS AND ATTACHMENTS

WHILE we recommend the purchase of standard instruments shown in the foregoing pages, where immediate delivery is desired, we have designed our instruments with a view to supplying a great variety of attachments with minimum delay, and are always glad to make any alterations required—which we as instrument makers believe will not detract from the accuracy of our instruments—at reasonable cost.

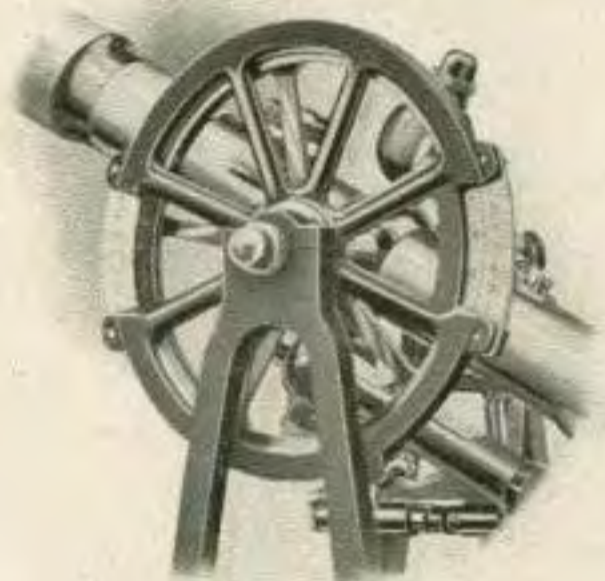
On the following pages we show a considerable number of extras and attachments, many of which we can furnish immediately from stock, but in addition to these we are prepared to supply any others required.

Arcs and Circles.—Graduated on solid silver with verniers reading to one minute unless otherwise specified.

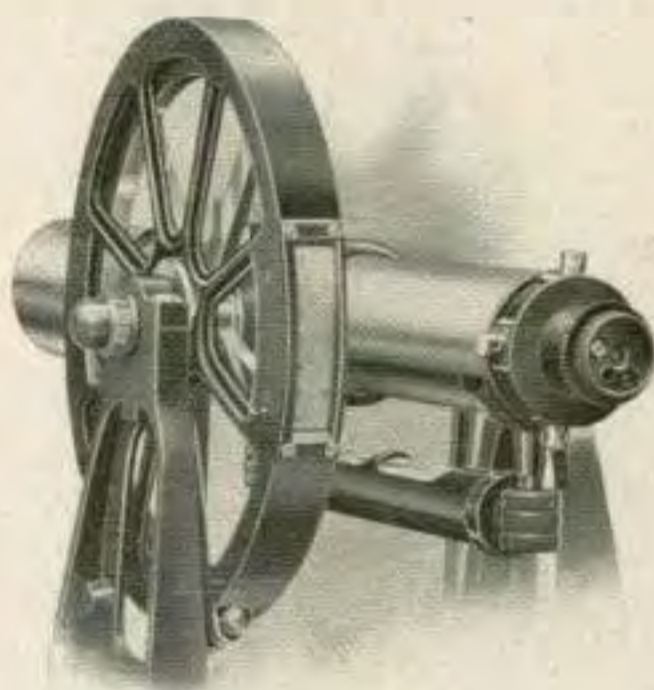
No.

1—2¼-inch—5.7 cm. vertical arc, code word Babishly	\$15.00—£3 2 0
2—2½-inch—6.4 cm. vertical arc, code word Baboso	16.00— 3 7 0
2a—3-inch—7.6 cm. vertical arc, code word Baborn	18.00— 3 15 0
3—4-inch—10 cm. vertical circle, code word Babordais	18.00— 3 15 0
5—4½-inch—11.5 cm. vertical circle, code word Baccated	18.00— 3 15 0
7—5-inch—12.7 cm. vertical circle, code word Backbite	20.00— 4 3 0
9—6-inch—15.2 cm. vertical circle, code word Backbone	25.00— 5 4 0
11—Aluminum guard for 4½, 5 or 6-inch vertical circle, code word Backslide	5.00— 1 1 0

EXTRAS AND ATTACHMENTS



No. 13



No. 19a

Arcs and Circles—Continued.

13—Adjustable opposite verniers for either 5 or 6-inch—12.7 or 15.2 cm. circle on guard, code word **Backward** \$20.00—£4 3 0

Graduations—

15—Limb with verniers reading to 30", code word **Badge**..... 10.00 2 2 0

17—Limb with verniers reading to 20", code word **Badgion**..... 20.00 4 3 0

19—Vertical circle with verniers reading to 30", code word **Baffler**..... 10.00 2 2 0

19a—Edge graduation on vertical circle, code word **Bafouer**..... 10.00— 2 2 0

(We only recommend 30" graduations on 5 and 6-inch vertical circles with opposite verniers.)

EXTRAS AND ATTACHMENTS

Numbering on Graduations—Figures inclined in the direction in which they should be read.

20-	{	0	10 — 80	90	80 — 10	0	10 — 80	90	80 — 10	0	Inner row
		360	350 — 280	270	260 — 190	180	170 — 100	90	80 — 10	0	Outer row

Code Word **Bagman**

20a	{	0	10 — 80	90	100 — 170	180	190 — 260	270	280 — 350	360	Inner row
		360	350 — 280	270	260 — 190	180	170 — 100	90	80 — 10	0	Outer row

Code Word **Bague**

20b-	0	10 — 80	90	80 — 10	0	10 — 80	90	80 — 10	0	Single row
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Code Word **Bailment**

20c-	360	350 — 280	270	260 — 190	180	170 — 100	90	80 — 10	0	Single row
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Code Word **Baiser**

Unless otherwise ordered instruments will be furnished with limbs numbered as per No. 20, and vertical circles as per No. 20b, the vernier reading 0 when telescope is level. We make no extra charge, however, for engraving whatever figures are desired.

Reading Glasses—

21—For vertical arc or circle vernier, code word

Bagatelle.....\$ 5.00—£1 1 0

23—For opposite vertical circle verniers, code word

Bagpipe..... 10.00— 2 2 0

25—For limb verniers, code word **Bailiff**..... 12.00— 2 10 0

Levels—With graduations on vial.



No. 27.

27—5-inch—12.7 cm. 30" reversion level, code

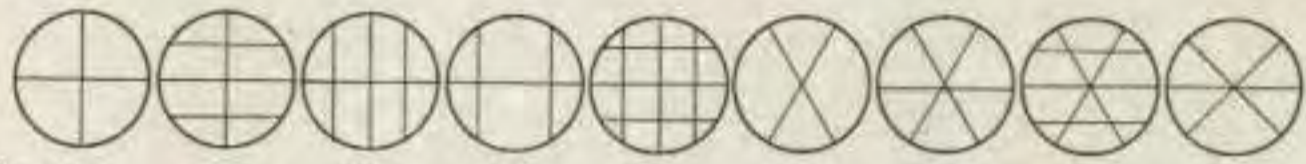
word **Bairn**.....\$15.00—£3 2 0

EXTRAS AND ATTACHMENTS

Levels—Continued.

No.		
29	5-inch—12.7 cm. 15" reversion level, code word Bait	\$20.00—£4 3 0
31	3-inch—7.6 cm. 30" latitude level, code word Bakery	10.00— 2 2 0
33	3-inch—7.6 cm. 30" striding level, code word Balane	10.00— 2 2 0
35	3-inch—7.6 cm. 15" striding level, code word Balcony	12.00— 2 10 0

Cross Wires and Stadia.—Spider web furnished unless platinum is specified.



No. 36	Plain cross wires, usually furnished in all regular instruments, code word Balder	\$ 2.00—£0 8 0
37	Fixed stadia, code word Baldness	3.00— 0 12 0
37a	Fixed vertical stadia, code word Baleore ..	3.00— 0 12 0
37b	Fixed vertical stadia without vertical cross wire, code word Balister	3.00— 0 12 0
37c	Solar wires for direct observation, also used in connection with the Davis Solar Screen, No. 69, code word Balisage	5.00— 1 0 0
37d	Cross wires, 60° angle, code word Ballistic ..	3.00— 0 12 0
37e	Cross wires, 60° angle, and level wire below intersection, useful for accurate tunnel work, code word Ballot	3.00— 0 12 0
37f	Cross wires, 60° angle, with level wire and stadia, code word Balourd	5.00— 1 0 0
37g	Cross wires, 90° angle, with level wire through intersection, code word Ballast	3.00— 0 12 0
39	Adjustable stadia, code word Baleful	7.00— 1 9 0
41	Fixed disappearing stadia, code word Balk .	6.00— 1 5 0
43	Adjustable disappearing stadia, code word Ballad	8.00— 1 13 0

NOTE.—The above stadia and cross wires are most used but we are prepared to furnish reticles ruled for any other arrangement. For most purposes we recommend fixed rather than adjustable stadia as being less liable to derangement.

EXTRAS AND ATTACHMENTS

Eye Pieces — We show herewith our new **STRAIGHTLINE PRISM SYSTEM** which is superior to the usual Porro prism construction, as the inversion of the rays requires but three reflections as against four with the Porro system, and this with 25 per cent. less glass, which results in a material decrease in the amount of light absorbed by the system.



No. 44—Detail.

Its construction permits of placing the prisms and eye-piece in line with the objective, thus rendering the system more sightly, and being entirely enclosed in the telescope tube as here shown, is afforded much better protection than is possible with the Porro system.



No. 44—Assembled.

Its advantage over the usual erecting eye-piece is that it admits more light, increases the power, and hence gives better definition.

Being placed between the objective and the cross wires, however, it is necessary that it be

maintained in collimation, but this is necessary with any prism system when used in the telescope of a surveying instrument.

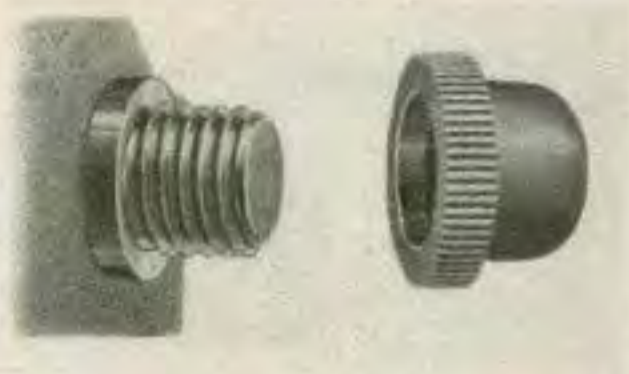
Its use instead of the inverting eye-piece, while it gives increased power, is hardly to be recommended.

No.

- | | | |
|-----|--|-----------------|
| 44 | —Prismatic eye-piece, code word Bambin | \$20.00—£4 3 0 |
| 44a | —Inverting eye-piece, code word Bandbox | No charge. |
| 44b | —Diagonal eye-piece with colored glass, code word Barcn | \$ 8.00—£1 13 0 |

EXTRAS AND ATTACHMENTS

Auxiliary Telescopes—Top or Side.



No. 45

No.		
45—	Telescope axis threaded on each end for side telescope and counterweight, code word Balloon	\$ 3.00—£0 12 0
47—	Telescope axis for interchangeable top and side telescope, see type BF, code word Balmy	20.00— 4 3 0
49—	10-inch—25.4 cm., 25-power, 1¼-inch—32 mm. objective, erecting telescope, code word Balsom	40.00— 8 6 0
51—	10-inch—25.4 cm., 25-power, 1¼-inch—32 mm. objective, inverting telescope, code word Balzane	40.00— 8 6 0
53—	7½-inch—19 cm., 20-power, 1½-inch—28.5 mm. objective, erecting telescope, code word Bandit	35.00— 7 6 0
55—	7½-inch—19 cm., 20-power, 1½-inch—28.5 mm. objective, inverting telescope, code word Baneful	35.00— 7 6 0
57—	6-inch—15.2 cm., 18-power, 1⅜-inch—21 mm. objective, erecting telescope, code word Banish	30.00— 6 5 0
59—	6-inch—15.2 cm., 18-power, 1⅜-inch—21 mm. objective, inverting telescope, code word Banner	30.00— 6 5 0
61—	4-inch—10.2 cm., 18-power, 1⅜-inch—21 mm. objective, telescope (inverting only), code word Bantam	30.00— 6 5 0

NOTE.—No. 61 is short enough so that when used as top telescope it will transit to sight fore and back sight.

EXTRAS AND ATTACHMENTS

Solar Attachments—



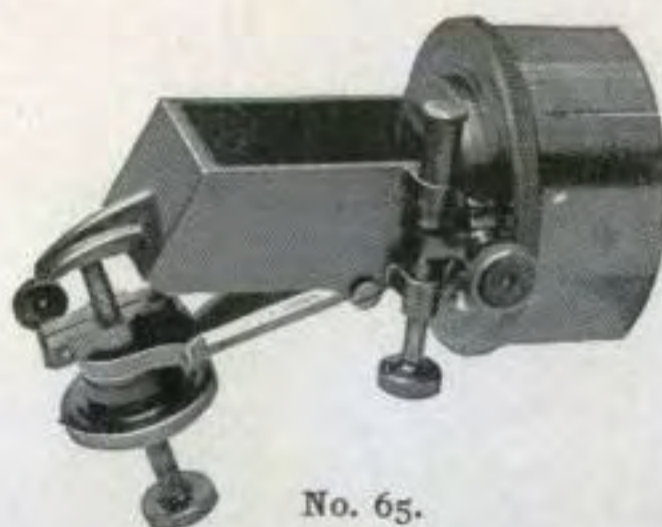
No. 63.

No.

63—Improved Saegmuller type solar attachment

of aluminum, code word Barber.....\$55.00—£11 9 0

Attaching extra, code word Barley..... 10.00— 2 2 0



No. 65.

EXTRAS AND ATTACHMENTS

Solar Attachments—Continued.

No.

65—Shattuck Double Reflecting Solar Attachment.			
This solar is the most convenient, accurate and reliable solar attachment made, overcoming by its optical construction the polar axis adjustments so necessary for the accurate operation of all other solar attachments (fully described in catalogue C, sent on request). Price, including cap for attaching to transit, code word Barb			
	\$30.00—	£ 6 5 0	
67 —Burt solar attachment, code word Barking ...	50.00—	10 8 0	
Attaching extra, code word Barley	10.00—	2 2 0	
69 —Davis solar screen, code word Barnacle ...	6.00—	1 5 0	
Attaching to old transit extra.....	4.00—	0 16 0	
73 —Colored glass in eye-piece shutter, for direct solar observation, code word Baronet	1.00—	0 4 0	

Miscellaneous—

No.

74 —Reversible telescope axis, code word Battish .	5.00—	1 1 0	
74a—Tangent motion for vertical circle vernier or verniers on guard for instrument with reversible telescope axis, code word Bearer ..	10.00—	2 2 0	
75 —Telescope axis clamp and tangent, code word Barracks	10.00—	2 0 0	
77 —Gradienter (screw with dial and index only), code word Barrier	5.00—	1 1 0	
79 —Reflector for illuminating cross wires, code word Basalt	4.00—	0 16 0	
81 —Waterproof cover, code word Bashful	1.00—	0 4 0	
82 —Bottle of transit oil, code word Bastion25—	0 1 0	

Tripods, Covers, Etc.—

No.

83 —Plain tripod, code word Bascule	10.00—	2 2 0	
84 —Extension tripod, weight 5 pounds—2.3 kilos, code word Bathing	15.00—	3 2 0	

EXTRAS AND ATTACHMENTS



No. 85

No. 85a

Tripods, Covers, Etc.—Continued.

No.

85	—Extension tripod, weight 7½ pounds—3.4 kilos, code word Basket	\$15.00—£3 2 0
85a	—Extension tripod, weight 9½ pounds—4.3 kilos, code word Baying	15.00— 3 2 0
85b	—Extension tripod, same as No. 85a, but extra length for tall person, weight 10 pounds— 4.5 kilos, code word Beachy16.00— 3 7 0
<p>NOTE.—Our tripods are so constructed as to enable us to supply either of two sizes for each instrument. Tripod No. 84 is usually supplied with our size C and D instruments, but we can also supply tripod No. 85; tripod No. 85 is regularly furnished with our size B instruments, but No. 85a can also be supplied.</p>		
88	—Leather cover for carrying case, code word Basking	\$10.00—£2 2 0
89	—Leather cover for extension tripod, code word Batable	9.00— 1 17 0
91	—Canvas cover for extension tripod, code word Bateless	4.00— 0 17 0

EXTRAS AND ATTACHMENTS FOR WYE LEVELS

The following parts are carried in stock and alterations can usually be made without delay.

Levels.—The following levels will be furnished in lieu of those in specifications at the prices below.

No.

101—8-inch, 5 seconds level, code word Bedeck . . .	\$ 5.00—£1 1 0
103—8-inch, 10 seconds level, code word Bedew . . .	3.00— 0 12 0
105—8-inch, 15 seconds level, code word Bedlam . . .	2.00— 0 8 0
107—8-inch, 20 seconds level, code word Bedote . . .	1.00— 0 4 0

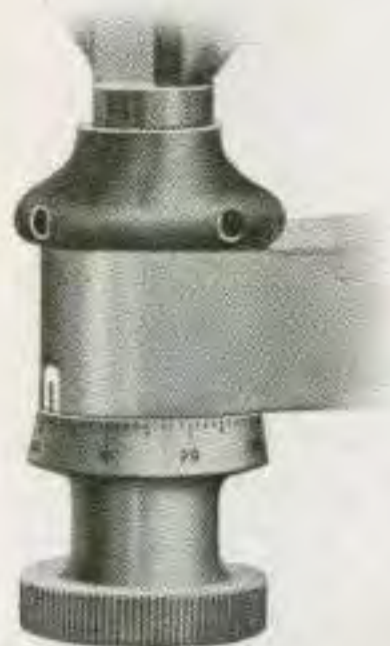
Reversion Levels.

109—8-inch, 5 seconds level, code word Bedrid . . .	\$20.00..£4 3 0
111—8-inch, 10 seconds level, code word Bedside . . .	18.00— 3 15 0
113—8-inch, 15 seconds level, code word Beehive . . .	15.00— 3 2 0
115—8-inch, 20 seconds level, code word Beetle . . .	15.00— 3 2 0

Miscellaneous.

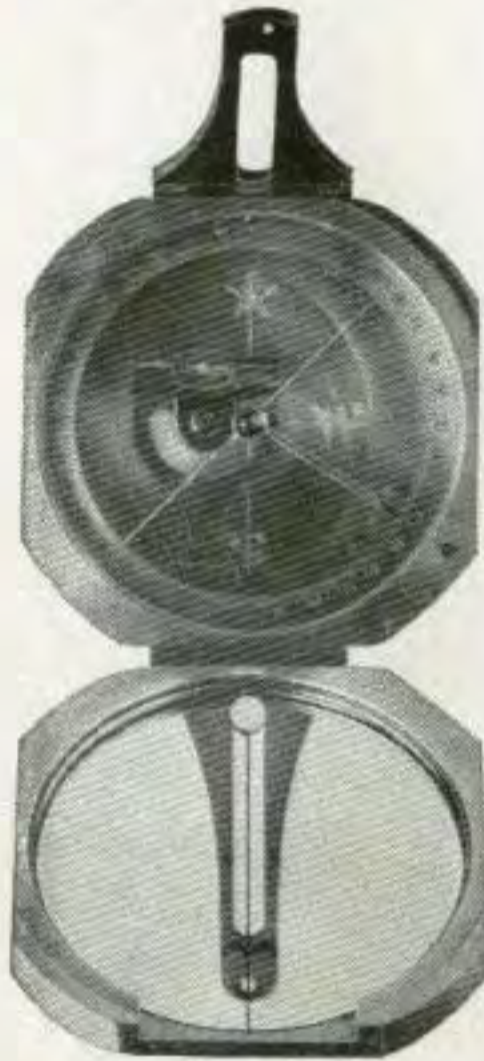
44a—Inverting eyepiece, code word Bandbox	No charge.
119—Detachable mirror for reading level, code word Beggar	\$10.00—£2 2 0
37—Fixed Stadia, code word Baldness	3.00— 0 12 0
121—Hardened steel center, code word Begird	5.00— 1 1 0

123—Micrometer screw for adjusting wye on eye end for very accurate leveling. When used in connection with mirror No. 119, operator can adjust level before each sight from eye end of instrument without changing position. Each division represents 5 seconds of arc.



	Code word Begone	10.00— 2 2 0
125—Waterproof Cover, code word Begot	1.00— 0 4 0	
85b—Extension tripod, code word Beachy	16.00— 3 7 0	

THE BRUNTON PATENT POCKET TRANSIT



This is the most convenient, compact and accurate pocket instrument made for preliminary surveying on the surface or underground. The above illustration shows operator's view when taking horizontal angles or courses. Sighting and reading accomplished simultaneously, thereby rendering unnecessary the use of a staff or tripod.

OVER 5,000 IN USE.

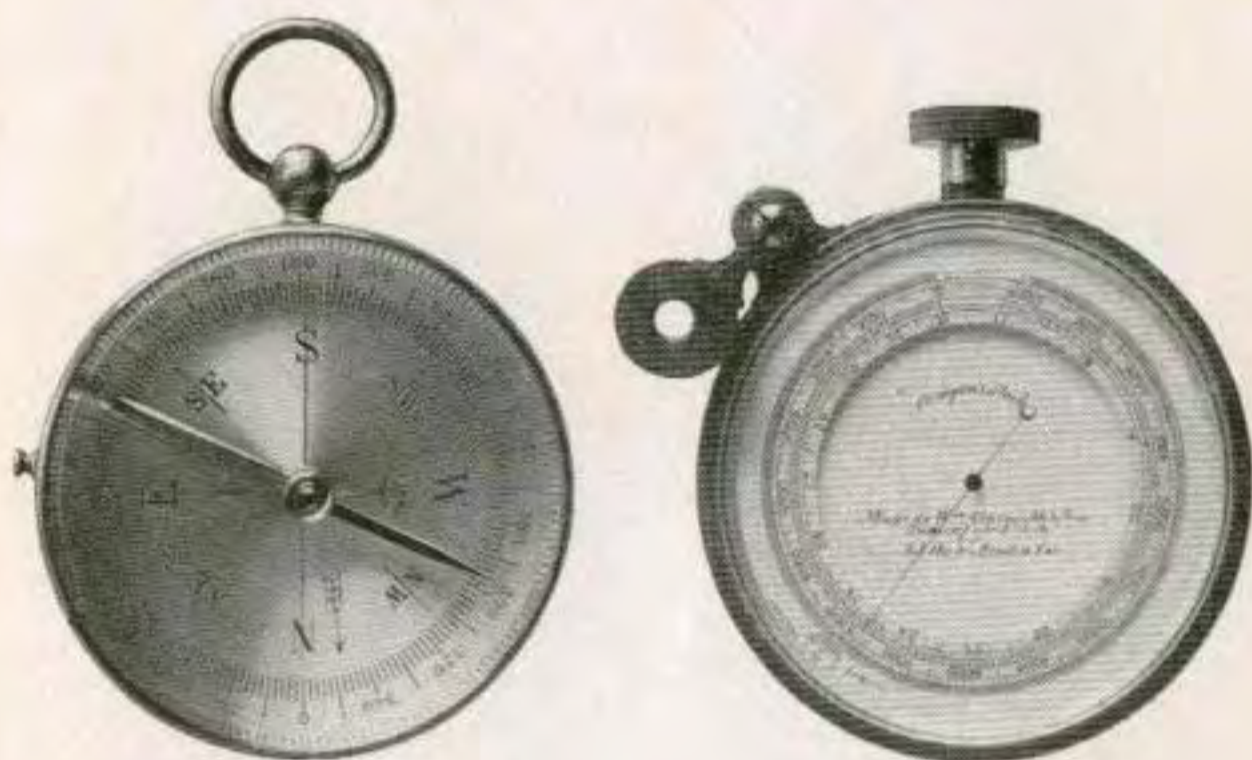
Closed for the pocket the instrument measures $2\frac{3}{4} \times 2\frac{3}{4} \times 1$ inches, $7 \times 7 \times 3$ cm., weight 8 ounces—220 grams. Weight, packed for domestic shipment, 10 ounces—285 grams; packed for export, 14 ounces—400 grams.

Price.....\$25.00—£5 1 0

Bulletin B, giving complete description of the instrument and its uses, sent on request.

We Carry a Complete Line

of Barometers, Clinometers, Sight and Pocket
Compasses, Tapes and Field
Supplies



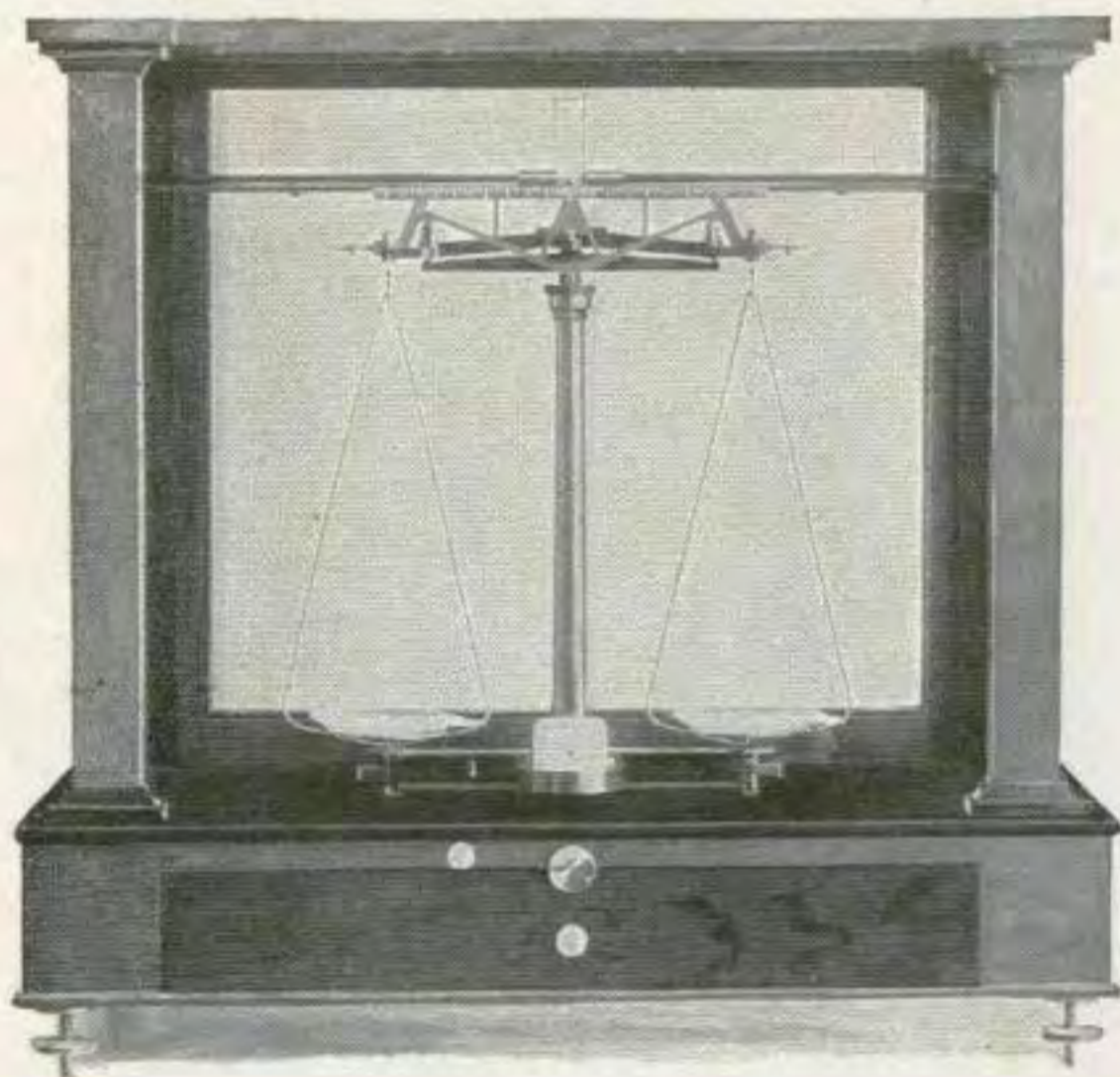
Illustrated and described in the following bulletins,
which will be sent on request.

- B—The Brunton Pat. Pocket Transit.
- E—Aneroid Barometers.
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FOR NEARLY THIRTY YEARS

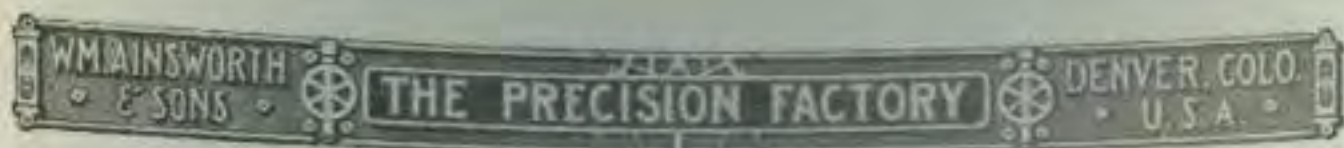
we have been making the

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Which are now the recognized standard throughout the world,
being used by the principal Government Mints and
Assay Offices, Smelting, Steel and Chemical
Works, Mines and Mills Everywhere

Catalogue A, describing our complete line, sent on request



TELEGRAPH CODE

Cable or Telegraphic Address, "Ainsworth, Denver." A. B. C.
 (4th ed.) McNeill, Lieber and Western Union Codes Used

	Code Word
What is the price of.....	Aaron
How soon can you ship.....	Abate
Can you ship immediately.....	Abase
What is the shipping weight.....	Abroad
Shall we ship immediately or hold for shipment with....	Abscond
We can ship immediately.....	Acid
Do not ship until you hear from us further.....	Acme
Will ship as soon as possible.....	Adore
We have shipped.....	Aerial
Telegraph cost of repairs upon receipt of instrument....	Aeronaut
Are awaiting your orders.....	Affable
Repair immediately.....	Affected
Repair immediately and return by express.....	Afflict
Shipped as per your instructions.....	Affray
Telegraph reply to our letter of.....	Affright
Send by mail.....	Afraid
Send by registered mail.....	Agile
Send by mail, special delivery.....	Aim
Ship by — express.....	Alarm
Ship by — freight.....	Alden
Have you shipped.....	Alert
We can ship — days after receipt of order.....	Alone
We can positively ship inside of — days and will ship sooner if possible.....	Altar
Trace shipment of.....	Altitude
Prepare for shipment by express.....	Altercate
Prepare for shipment by freight.....	Alterity
Prepare for export shipment.....	Altigrade
Shipping directions will follow by mail.....	Amaze
When can you ship our order of.....	Abeam
Duplicate last order.....	Adam