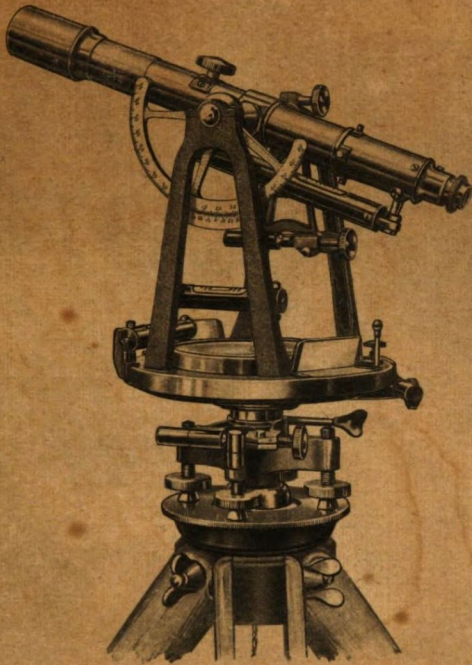


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BUFF

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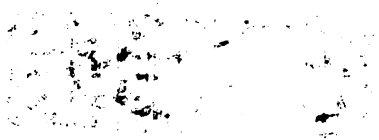
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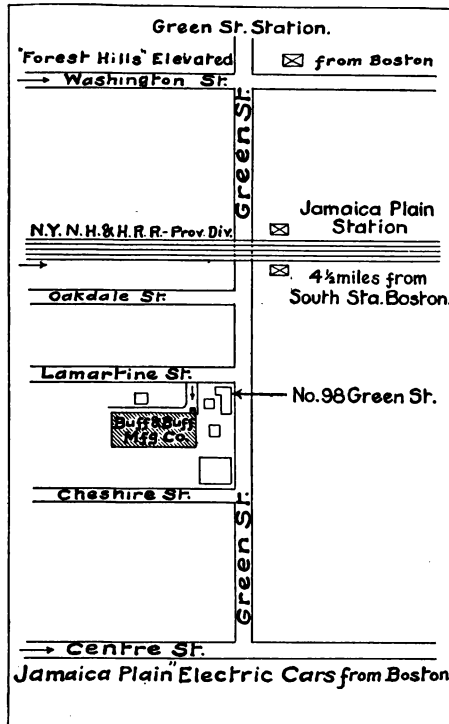
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INDEX PAGE 124.

[a]

HOW TO REACH US



Tradition
Highest Reputation
Intrinsic Merit

{ "IF AN ENGINEER GET ALL
 THESE THREE IN A TRAN-
 SIT, HIS CHOICE WILL BE A
 'BUFF.'"

BUFF & BUFF MFG. CO.

GEO. L. BUFF Manager
LOUIS F. BUFF . . . Secretary
H. A. BUFF, Repair Department

W. J. BUFF, Manager
New York Branch, 50 Church St.

M. S. JORDAN, Manager
1742 Monadnock Bldg., Chicago

A CATALOG OF SURVEYING INSTRUMENTS



1916

BUFF & BUFF MFG. CO.
JAMAICA PLAIN STATION
BOSTON, MASSACHUSETTS, U. S. A.

~~Private Property~~

Copyright 1915
by the
Buff & Buff Manufacturing Co.
Boston, Massachusetts

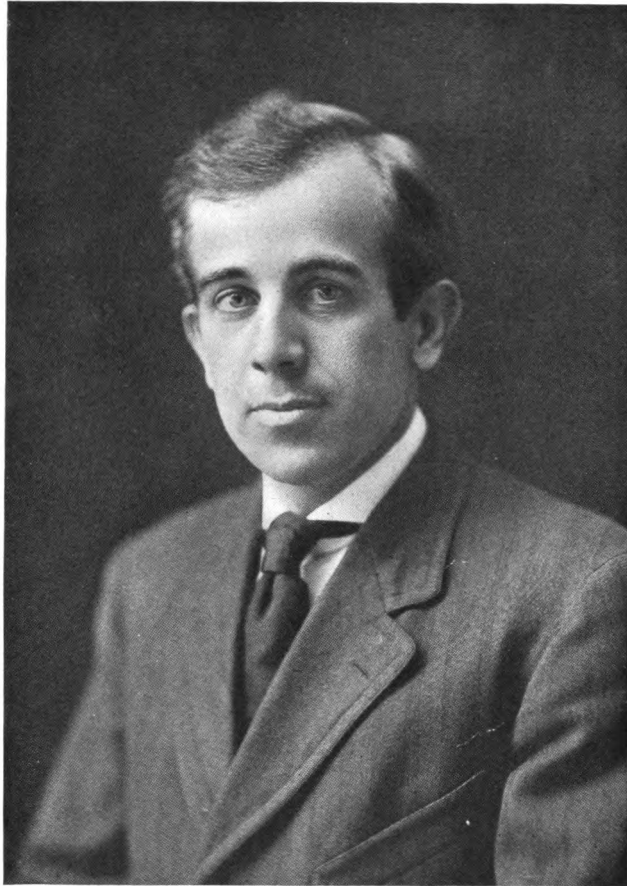
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GEO. L. BUFF.

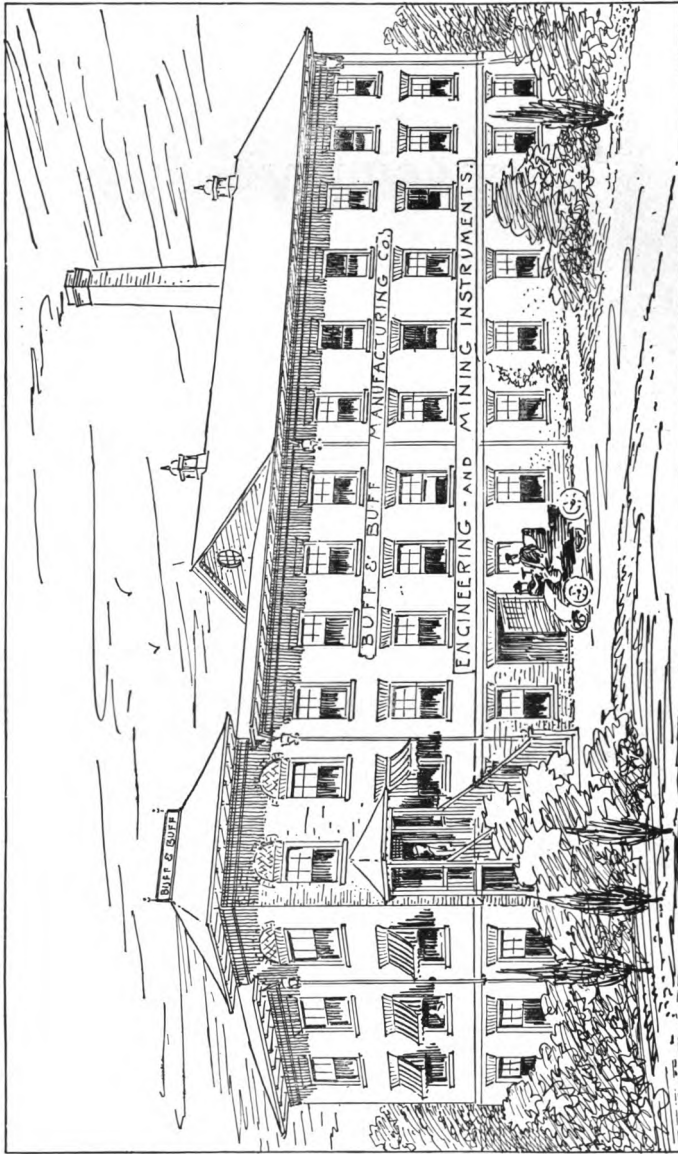
Our present Manager and formerly senior partner of
Buff and Berger from 1871 to 1898.

215491



LOUIS F. BUFF.

Works Manager.



THE MOST PRECISE INSTRUMENT SHOPS IN THE WORLD.

View Looking West, Jamaica Plain Shop.

Like the instrument, the home of the "Buff" is typical of solidity, rigidity and adaptability. Its location, well to the south of Boston, is one of absolute freedom from electrical disturbances.

STABILITY

Buff instruments are as perfect in material and construction as anything can be, — yet a perfect instrument may be slightly injured in transportation.

A good agent will recognize and repair any such injury before he delivers the instrument. It will take him but a few minutes. Unless you are sure of your agent's ability we advise direct purchase, making but one straight shipment from maker to engineer.

This is Distinctly the
AGE OF THE SPECIALIST

The Buff Shops Make Only the
Buff Transit and Buff Levels

This book is a catalog only. All engineering data, examples, etc., are in our
"Adjustment Treatise."



Where Buff Instruments Originate.

OUR senior manager, Mr. Geo. L. Buff, who supervises the construction and adjustment of each and every instrument which leaves our shops, began the manufacture and incidentally continued the study of Levels and Theodolites in York, England, in 1858.

Perceiving with a prophetic genius that supremacy in instrument making was to cross the Atlantic, he, in 1864, left England and came to New York City. There he associated himself with the best and most successful instrument makers in America.

Having seen the best in Europe and this country, he then went into business for himself. In 1871 he established a partnership in order to better incorporate some of his own improved ideas in a transit. In 1898 he dissolved that firm and established the present concern of which he is general manager.

Thus from the best in Europe and America Mr. Buff has selected the best, has added many improvements of his own, all of which have culminated in the supreme result — "*The Buff Precise Transit.*"

In the manufacture of the Buff Transit quality alone is considered. We claim for our product the greatest accuracy obtainable, owing to the improved precision machinery which we use, improved methods of construction, and to the accuracy of our new, unrivalled dividing engines. These are under the exacting and personal supervision of our Mr. Louis F. Buff.

A BUFF INSTRUMENT IS ALWAYS WORTH
WHAT YOU PAY FOR IT.



To the Engineering Profession.

AFTER an experience extending over many years in the manufacture of thousands of engineering and astronomical instruments, it seems unnecessary in presenting this catalogue to enlarge upon the success attained. The number produced and the increasing demand speak for their international popularity and intrinsic worth. We give, therefore, outlines only of the types of construction, the particular features, and brief descriptions of the different styles regularly made.

The illustrations are by half-tones direct from photographs.

We call attention to the abridged nature of this catalogue, since we believe the universal tendency to pad technical literature by voluminous recording of unimportant facts is a real and serious defect, and one which every writer should strive to overcome.

For remarks on adjustments of our instruments see other book. Our complete Adjustment Treatise is sent gratis on request.

For convenience in communicating, see cable code, page 123.

For information on repairs, see page 116.

NOTE. We make a specialty of telegraph orders shipped at short notice.

Testimonials.

ORDINARY printed testimonials are of little value. They are easily obtained and often antiquated or suitably colored. We have scores of letters which would serve as true testimonials, if we were to print them. To any one desiring to ascertain the merits of our instruments, we shall be pleased to send the names and addresses of those in his vicinity who have our make, and who will give opinions which will be valuable, because based on experience and unbiased by solicitation.



The "Buff Precise Transit."

THE BUFF TRANSIT is not the product of to-day nor of a few years, but the crowning result of over forty years' experience in dealing with a very critical clientele. The instrument shows it.

Buff Transits meet with minimum atmospheric resistance, for the construction is such as to cut the air — not to obstruct it and collect dust as the standards and forms of most instruments do. Our instruments are as nearly as possible dust proof.

Buff instruments will withstand a greater degree of heat and moisture without impairment of their accuracy than others, owing to their superior metal, precise method of assembling, and final finish.

The density of the metals, combined with the superior grade of workmanship in the construction, enables Buff instruments to withstand most severe shocks without disturbing the adjustments.

Suffice it to say, therefore: "The best instrument procurable is the cheapest in the end."

By its use, annoying and expensive repetition is avoided.

REMEMBER

The hardest and toughest metals are alone employed.

*In instruments, as in men, a good name is the thing to depend on—
a good name built on years of test and proved service.
Buff instruments have this.*



“Buff” Economy.

There are two ways of practicing economy.

One way — consider price only.

The other way — consider results.

IN our opinion unless an engineer uses the best make of instrument for his work, he might well buy the cheapest possible; there is no middle ground.

The high grade of materials and workmanship employed in Buff instruments makes them cost a great deal more to build than any other instrument.

In price they are not cheap, but their highly effective service assures their usefulness through all seasons; their unusual economy and low repair-cost make them the most economical of all instruments.

The engineer who buys the “Buff” secures full value in gold, silver, hardest and toughest metals, and the finest workmanship.

In a few words he obtains:

That prestige accorded all owners of a “Buff” transit.

Durability and long life of at least 25 years. (There is no reason why a “Buff” will be worn out in fifty years)

Real, tried and proven accuracy by the best engineers in this country and the world.

Great saving in time and money, due to accurate work the first time, at greater speed, and no loss due to repetition on account of instrumental errors.

Buff Accessibility.

Accessibility is a vital point. While it is a fact that Buff instruments do not require frequent lubrication or cleaning, there are some occasions when ready accessibility is imperative.

Buff accessibility is perfect. One stout nut removed, and the centers are ready for examination.



“Buff” Characteristics.

Under this heading we discuss the four vital parts of the engineers' transit —

- A. CENTERS. p. 10-12.
- B. GRADUATIONS. p. 14-15.
- C. TELESCOPE. p. 19-20.
- D. SPIRIT LEVELS. p. 21.

And then the secondary ones of—

- 1. COMPASS NEEDLE. p. 22.
- 2. GRADIENTER ATTACHMENT. p. 22.
- 3. STADIA. p. 24-25.
- 4. VARIATION PLATE. p. 26.
- 5. TRIPOD. p. 26.
- 6. PLUMB BOB. p. 26.
- 7. FINAL FINISH. p. 27.

See P. 52 for Mining Transits.

One glance is sufficient. Few words are needed. You have only to know the “BUFF KIND” to become charmed with the advanced design, the severe conceptions—rigid, bold, ample in bearing. They are not copies—they are original, and thoroughly consistent in their originality. *Lightness combined with strength* of each member, and rare mechanical treatment, at once place them on a plane heretofore hardly approximated.

An Engineer may figure to save \$10.00 or \$20.00 by purchasing a cheap instrument, but he rarely appreciates what that false economy will cost him.



“Buff” Centers.

Next to accuracy of graduations it is important that the centers be true frustums of accurately circular cones and fitted to retain that theoretical accuracy. They should be constructed of the hardest possible metals.

Aluminum bronze, containing 90% copper, is extensively applied in our instruments on account of its great tensile strength.

That our centers are accurately conical frustums, we are convinced by repeated and exhaustive tests, and moreover we are satisfied that they are so in every instrument, because of the methods we employ in turning them — upon “dead center lathes” — being precision lathes without spindles, and merely having a dead head-stock, with immovable center, and tail-stock center, between which the work is rotated.

That they are fitted to retain that accuracy — we take especial pride in stating, — because :

1. The long tapers, possible in our instruments, terminating in the broad flanges, are both theoretically and practically the best.

2. These long tapers — theoretically correct — are in practice most carefully and perfectly fitted by the expenditure of much expert labor. Upon the nicety of this fit depends the accuracy and longevity of the entire instrument.

That the different metals employed in their construction are the best for the purpose, the experience of 50 years dictates. The three widely different compositions of phosphor-bronze, gun metal and hard red composition are the metals chosen for the engineer's transit, since each has for the next respectively, the least co-efficient of friction, and the minimum difference of the co-efficients of expansion and contraction. All these three mixtures can only be compared in strength and hardness to tempered steel.

For the Wye level centers — where the presence of iron is not prohibitory, — an option has been recently offered, at a slight additional expense, of a hardened steel center in a socket of superior annealed charcoal iron.

It is unnecessary to say that these metals are the best possible for any center — when their presence is not objectionable, — since this combination is universally adopted for all large astronomical instruments, and provides :

1. The minimum co-eff. of expansion of any two metals.
2. The minimum difference of the co-eff. of expansion of each.
3. The minimum co-eff. of friction.

“The workmanship shows great fidelity to detail, while the fits are a revelation in the ethics of finest scientific construction.”



“Buff” Materials and Construction.

EVERY single part of every Buff transit is made of the best material, and of the most approved design known to the scientific arts.

Buff shop practice means the best, coupled with the most rigid testing.

A Buff owner so rarely has to take his instrument apart that he seldom sees those pieces upon whose design and proper construction a smooth-operating and powerful instrument absolutely depends.

The horizontal limb, vernier plates, standards and outer center as well as all clamps and screws are of hardened composition bronze having a high tensile strength.

There is no maker in this country who uses as high-grade metal.

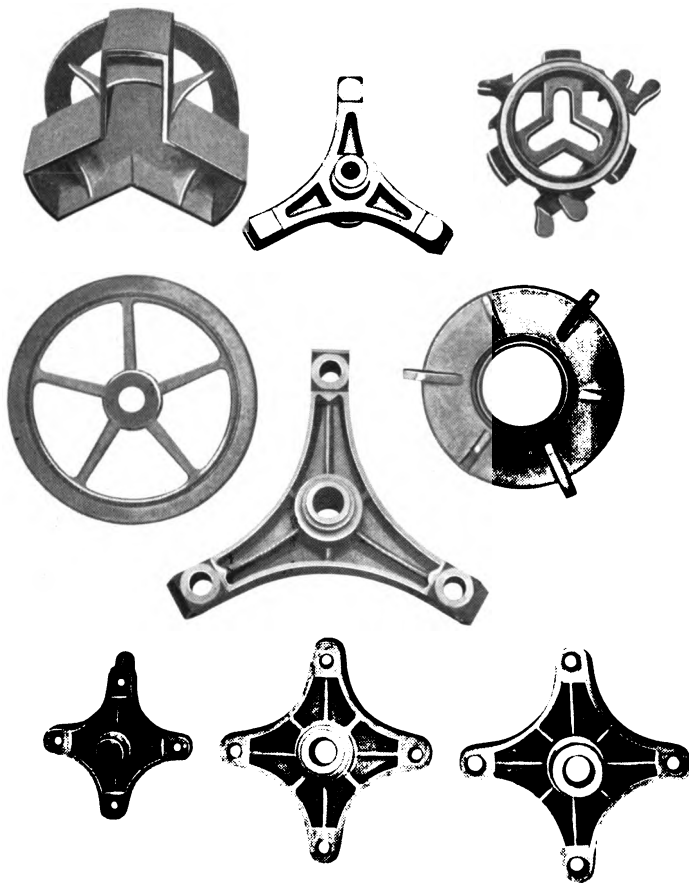
Telescopes, axles and inner centers are all bell metal. Not a soft or yellow brass casting is used anywhere on the Buff transits.

There is no better metal than the phosphor bronze used in the intermediate centers.

Instrument makers dislike to handle this material as it is tough, slow to turn and extremely hard on dies. It is the next thing to Tobin bronze and can only be machined by using powerful and accurate lathes. Buff bearings are throughout our instruments. They are the best and most expensive bearings made in the world. They are the real secret of the 50 year life of the Buff.

This putting of money without stint into quality and refinement gives Buff instruments their unsurpassed durability.

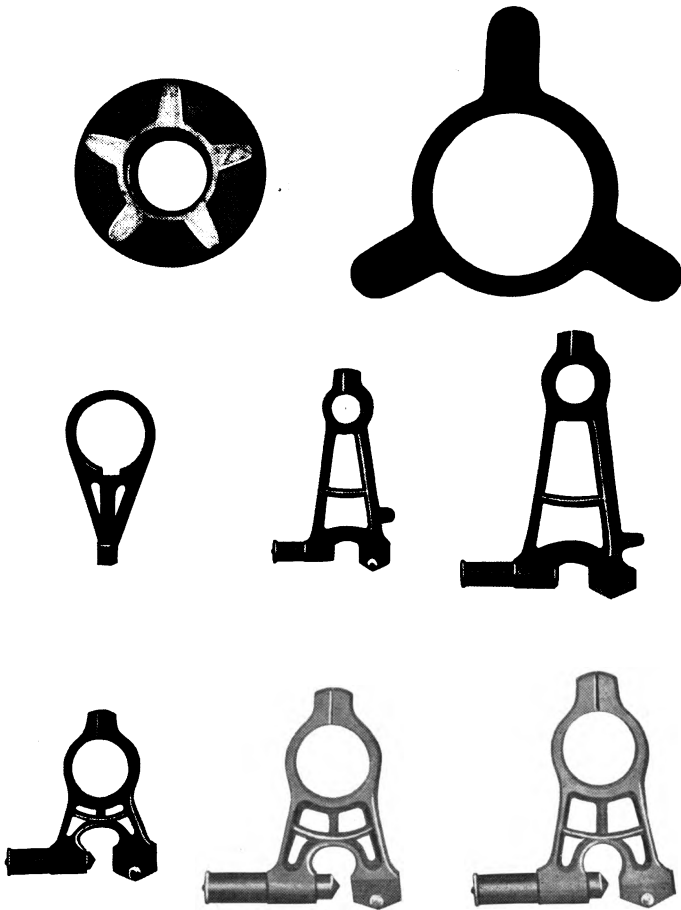
*A Transit that an Engineer is
Proud to Own.*



In all of our instruments the inside finish is even better than the outside, and the whole is handled in the careful, precise, workmanlike manner that alone gives accuracy and permanency to the completed transit. Certainly the ordinary has been forgotten.



“Buff” Clamps Show Great Strength as well as Grace of Design.



All of Bell metal — phosphor and other bronzes of the hardest grades, which trebles the cost of work.

“Buff” Graduations.

For view of Graduating Engine — See page 91

FEATURES WHEREIN our graduations excel, are :

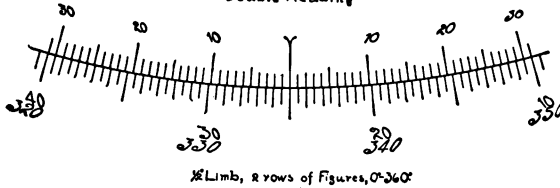
1. The absolute and equi-distant spacing of the division line.
2. The uniform thickness of line at all parts of the circle.
3. The fitting together of the verniers and graduations.

The CORRECTNESS of the SPACING — as performed upon our dividing-engines built by our senior member — we are able to guarantee within $1\frac{1}{2}''$ of arc. This represents an error of less than $\frac{1}{34000}$ part of an inch. Errors smaller than this would be manifestly impossible for human ingenuity to eliminate, since other factors must be taken into consideration, and these are respectively :

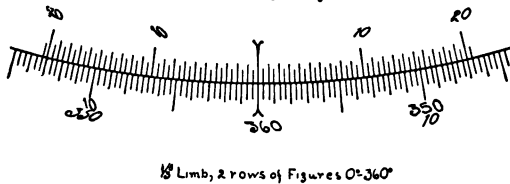
Owing to the precaution exercised, these errors are *virtually* negative.

1. Errors due to temperature changes, though this change be inside of 1° F.
2. Errors due to the personal equation in setting up, levelling and centering the circle of the transit upon the dividing-engine.

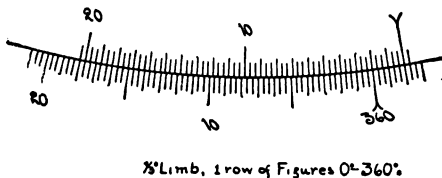
Vernier to Single Minutes
Double Reading



Vernier to 30 Seconds
Double Reading



Vernier to 20 Seconds
Single Reading



The three most usual forms of verniers.



The UNIFORMITY of the GRADUATION LINE — as placed upon our circles and verniers, — we deem the special features of our graduations next to spacing. We claim this because :

1. The delicately poised mechanism, supporting the finely ground cutter, is of such rigid construction.
2. The long experience dictating the proper combination of cutting angles ensures that the cutter is ground to the angles, which will cut the last line equally as wide as the first.

The FINAL FITTING TOGETHER of the GRADUATION and VERNIERS, as performed by ourselves, is guaranteed.

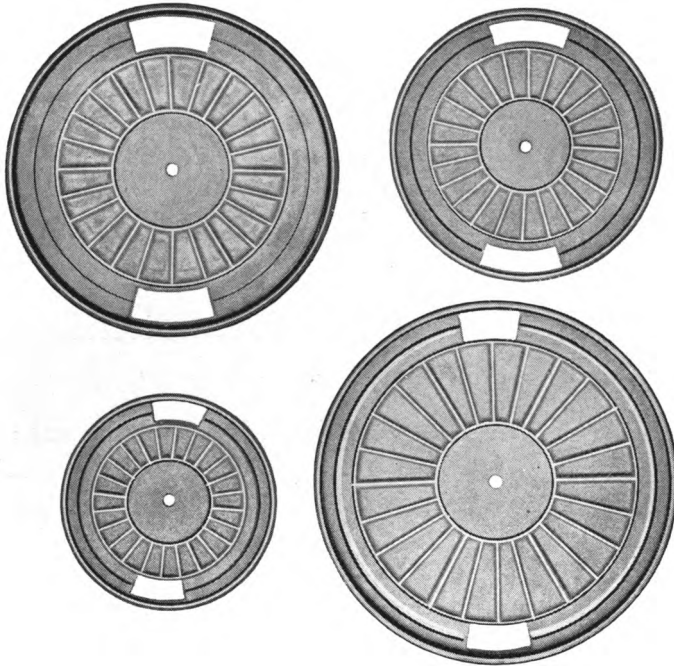
All graduations are silvered with a dull, frosted finish of peculiar and agreeable whiteness, facilitating rapid reading in the field. If solid silver graduations are specified the same dull finish is given the silver. This is a feature found only in our transits.

The figuring on our graduation is particularly plain and legible, especially on mining instruments, and is always inclined in the direction it should be read.

REGULAR SIZES OF THE "BUFF" TRANSIT.

	Weight.	Dia. of Graduation.	Length Needle.	Power Erecting Telescope.	Power Inverting Telescope.	Length of Telescope.
No. 1	14 lbs.	6½ in.	4½ in.	26.5	29.	12
No. 2	10 lbs.	5½ in.	3¾ in.	22.5	25.	10¾
No. 3	7 lbs.	4½ in.	3¼ in.	18.	21.	8
No. 4	5 lbs.	4 in.	2¾ in.	17.	20.	8

Sizes and diameters of the different transits are measured at the edge of graduation.

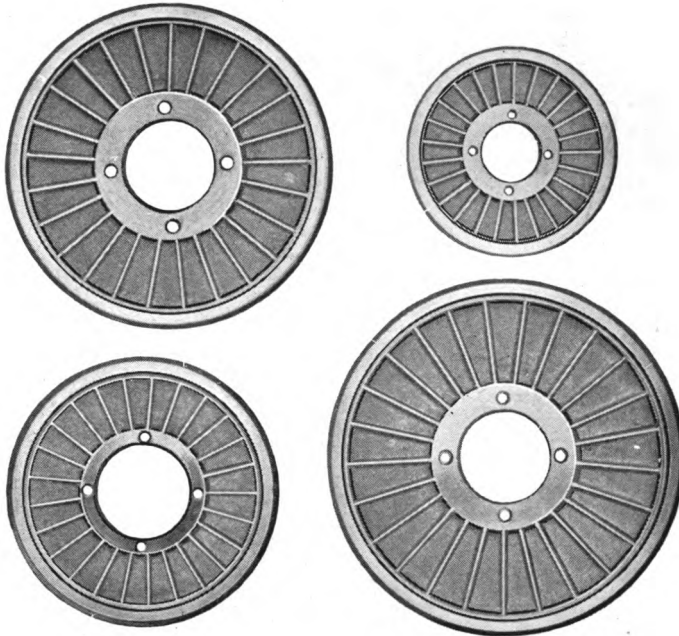


THE PLATES.

To which are attached the verniers which read off the circular graduations.

This plate has an outer flange fitting over the horizontal limb — absolutely dust-proof — but cleared from contact in such a way that a severe fall, directly on edge of plate, cannot injure the limb graduation.

The life knowledge, years of scientific study, and gradual and constant evolution of the design and form of each smallest part is the reason why the Buff Transit is so satisfactory to every Buff owner.



THE HORIZONTAL LIMB.

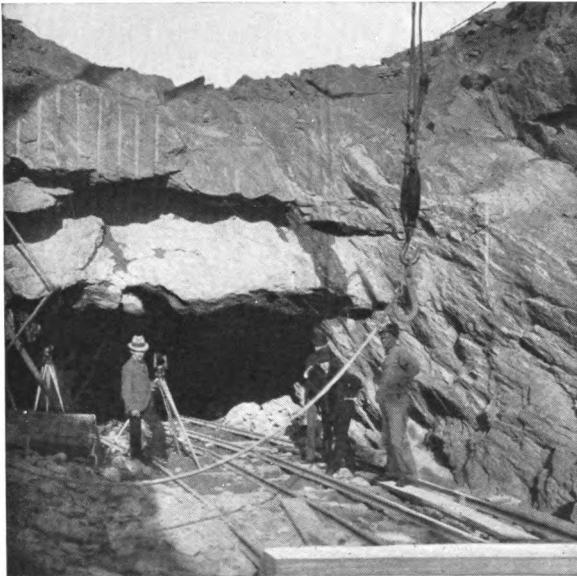
Showing uniformity of ribbing.

The special characteristics of our phosphor bronze are :

1. Its freedom from corrosion, which is largely due to its freedom from zinc.
2. *Its high qualities as a mechanical constructive material.*
3. *Its low friction co-efficient.*
4. Our stock of machined castings is so large that all metal is thoroughly aged.



The above name on an engineer's transit is proof of the perfection in every smallest detail of the "Engineer's Best Friend." As one instance of this accuracy, notice, in the photograph, the use of this particular make of instrument on the largest piece of construction work in the world today, several hundred of these instruments having been chosen by the eminent engineers in charge.



**RAPID TRANSIT TUNNEL EXCAVATION
NEW YORK CITY.**



“Buff” Telescopes.

The telescope of an engineer's transit is an important part of the foundation on which success or failure to a great extent depends. Any transit, however perfect its other vital parts may be, or however carefully it is constructed, or however finely it is finished, if defective so far as its telescope is concerned, will be a source of annoyance to the engineer.

In adapting our form of telescope to the re-calculated system of lenses and diaphragms of the different sizes of transit, we have been governed by the other factors that go to make that particular instrument, such as the fineness of graduations and sensitiveness of spirit level, thus obtaining that harmonious whole in which every element is consistent with the other.

To accomplish this, we have greatly improved the entire lens system by instituting somewhat longer focus objectives, giving :

1. Much more satisfactory working combination.
2. Vastly improved illumination.
3. Slightly greater power.
4. Flatter and sharper defined field.

Additional points secured in our telescopes :

5. Reversibility at both ends.
6. Perfect balance in all positions.

The power we chose for each of the several transit telescopes is that one by which the slightest motion of either vernier or bubbles is easily noticeable by movement of the cross wires in the field of view. A higher power is useless, and can only result in decreased illumination. A lower power, on the other hand, does not develop the maximum capacities of the other dependent features of a first-class instrument.

In our terrestrial (erecting) telescope, for the regular No. 1 size transit, we obtain a power of 26.5 diameters with $1\frac{1}{4}$ -inch aperture objective.

In the 18-inch Engineer's Wye Level, with the larger objective of $1\frac{3}{8}$ -inch and the greatly increased available focal depth, a power of 36 diameters is obtained.

The eye-piece for all terrestrial mountings is constructed of a combination of four lenses giving an unsurpassed large field which has all possible illumination,



since full size diaphragms are used (no attempt being made, as is common with other makers, to decrease the diaphragm at the expense of light to gain definition). This, of course, necessitates the very finest workmanship on the eye-piece lenses.

For the astronomical telescope we have adopted an admirable eye-piece which is a modification of the Kellner. It is modified insomuch as a somewhat longer working focus is obtained which in field practice prevents the engineer from any chance breaking of the cross-wires when setting in focus.

To obtain this it is necessary to make the field lens a double one.

For large flat field with the full aperture admitting the full quota of light, this modified Kellner is unsurpassed.

In conclusion, the factors aiding us greatly in the matter of good glasses in our telescope are:

1. That every eye-piece and objective, before being accepted by us, is tested on a special apparatus and compared with known and standard glasses of excellent and tried qualities, and to this standard each must conform.

2. That both eye-pieces and objectives are made by one and the same celebrated Continental makers, who know no peer for quality (or price).

It is hardly necessary to state that nothing but the purest Jena glass of a suitable refractive index is used in our lenses.

All of our telescopes are provided with a center point on top of axle to permit centering of instrument from above.

SPECIAL.

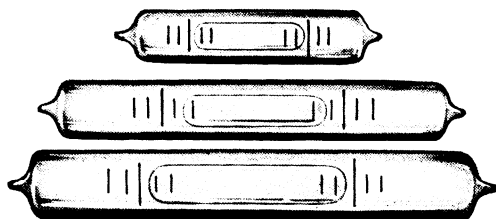
A true and valuable improvement on our telescope (one that is typical of our endeavor to simplify and not merely adopt subtrefuges), is the precise fit of our focussing slide into the main telescope tube. By development from the start, and by the use of improved machines in boring out and fitting, we obtain the great precision in permanent collimation so desirable. To insure a correct line of collimation for all distances, many devices have been made that work fairly well for a year or so, but fail when gummed by oil or clogged by dust or by uneven wear, owing to the original defects. The true and accurate fit of the inner slide into the outer tube throughout its length can alone satisfy the requirements of mechanical perfection in *perfect and permanent alignment*. Our fits are made not to a ten-thousandth but to a fifty-thousandth — *metal against metal* on the finest precision machines (see note below). The use of aluminum in the solar telescope we cannot favor, since the very few ounces saved in weight do not offset the inaccuracies and lack of permanency of such construction.

The non-friction construction of our tubes excels, and the final step taken by us to insure minimum wear, embodies a complete change in the choice of material. With this perfect wearing quality guaranteed, together with the perfect fit throughout its entire length, the accuracy of the telescope will not be affected by years of steady use.

NOTE. — In telescope construction, grinding or lapping with lead arbor and emery is not permissible.



“Buff” Spirit Levels.



BUBBLES.

In thoroughly developing the method of producing the spirit levels for our instrument it has been our aim to obtain much more uniform and reliable results than were formerly customary.

In consequence we have new machines, which are automatic grinding, and produce truer curves than could be ground by hand on lathe arbors.

Carefully testing and marking each bubble, we separate them into groups of definite sensitiveness, from which, according to the type of instrument, we select the preferred sensitometer number.

Incidentally, the method of grinding is precisely the reverse of hand work, and eliminates that objectionable heat of the hand when grinding with an arbor on the lathe. This heating plays a very important part in the accuracy of the vials and is accountable for some of the inaccuracies heretofore experienced.

In addition to the regular grades of sensitiveness we are prepared to furnish guaranteed spirit levels ranging down to $\frac{1}{2}$ second for the finest leveling instrument, and also for all astronomical uses.



The Compass.

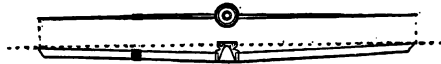
The compass circle in all our instruments is graduated to half degrees and is figured from 0 to 90 on each side of North and South.

The graduation and inside face of compass are heavily silvered.

On the south end of the needle, a fine coil of silver wire is wound to equalize the attraction due to dip. As the dip of the negative needle varies, we make the correction on the needle dependent upon the locality to which the instrument is to be shipped. The variation of the dip is taken from the government charts published each year.

The needle and its form, as made by us, play quite an important part in the accuracy which we claim for our compass. Long experience has developed the form (as in pen sketch) with bearing on delicate hardened steel pivot.

Special Swedish magnet steel only is used, treated also by our special process.



The Improved Gradienter Attachment.

As applied by us the gradienter attachment is guaranteed accurate within one-tenth of one per cent. This approximates the average of what can be expected of the stadia.

Thus, with equivalent accuracy, it has the several advantages of running definite grade lines with minimum work, and of measuring horizontal distance, difference of level and vertical angles.

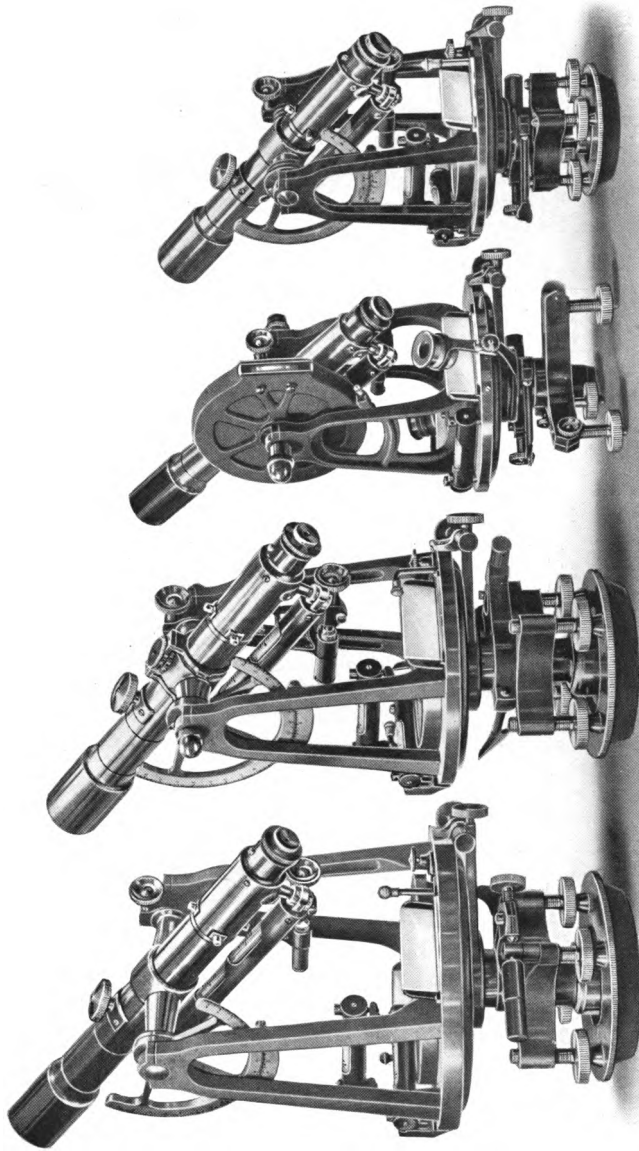
The attachment is certainly quite worthy a place on the complete engineer's transit.

As made by us, the gradienter dial is graduated so that two complete revolutions subtend one foot at one hundred feet. Or, in other words, if moved through two revolutions and sighting on a levelling rod at any distance, the difference of readings, multiplied by one hundred will give the actual distance in feet from the center of instrument.

The setting of a grade would be even simpler, for in that case the reading of the gradienter screw is taken with level-bubble standing in center of tube. The necessary revolutions of the screw from zero position would then be twice the grade in feet per hundred.

On the No. 3 and No. 4 sizes of transit, we have also perfected the gradienter attachment, but on these instruments the value of the graduation on the screw dial is for one revolution, one foot in one hundred feet, and for distance work the difference of rod readings, subtended by one revolution of the screw, would be multiplied by one hundred to obtain the distance in feet.

For railroad and general surveying it forms a valuable part of an engineer's equipment and can be employed in many problems.



No. 1. TRANSIT
 13½ lbs. 6¼ inch limb
 Power 26.5 diam.

No. 2. TRANSIT
 10 lbs. 5½ inch limb
 Power 22.5 diam.

No. 3. TRANSIT
 7 lbs. 4½ inch limb
 Power 18 diam.

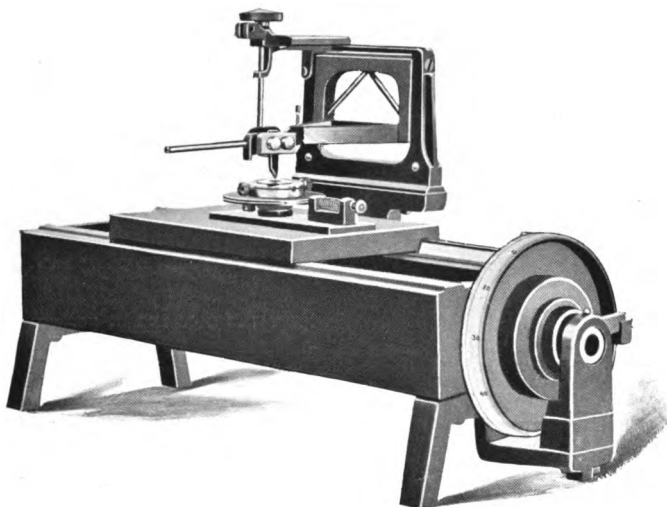
No. 4. TRANSIT
 5 lbs. 4 inch limb
 Power 17 diam.

ILLUSTRATIONS to assist in determination of size of Transit best suited to work



The Stadia.

In advocating the stadia wires in addition to the gradienter attachment we claim that one is fully equal to the other in accuracy of construction. The superiority of the stadia lies in the permanency of the stadia wires under all conditions, and this is due to simplicity. With the gradienter any resultant errors, owing to neglect to guard against backlash of the screw, may be of such frequent occurrence that the entire attachment will not be valued at its proper worth, simply because not given proper manipulation.



THE BUFF LONGITUDINAL GRADUATING MACHINE.

Reading to $\frac{1}{10000}$ part of an inch. For marking diaphragm for insertion of stadia wires.

In ruling the diaphragm for the insertion of the fixed stadia the objective, with which the stadia is used, is very carefully measured for its mean focal length on our special Focal-length Apparatus. Having this value in hundredths of an inch, the dependent value in fifty-thousandths of an inch is ruled off by the delicate drafting cutter in our diaphragm ruling apparatus.

This ruled diaphragm is then inserted under our special microscopic stand with the variable micrometer feed screw adjustments, and the proper thickness of spider's web is selected, cleansed, stretched and accurately placed in the tiny grooves previously ruled.

We say proper thickness of web because that is governed by the magnifying power of the respective telescope and the diameter of web that fulfils the proper requirements.

The diameter of an ordinary spider web is .001 inch.



Diameter of web as ordinarily used by other makers, .0002-.0003.

Diameter of minimum web for telescopes of our make, .0001 inch and less for finer astronomical instruments.

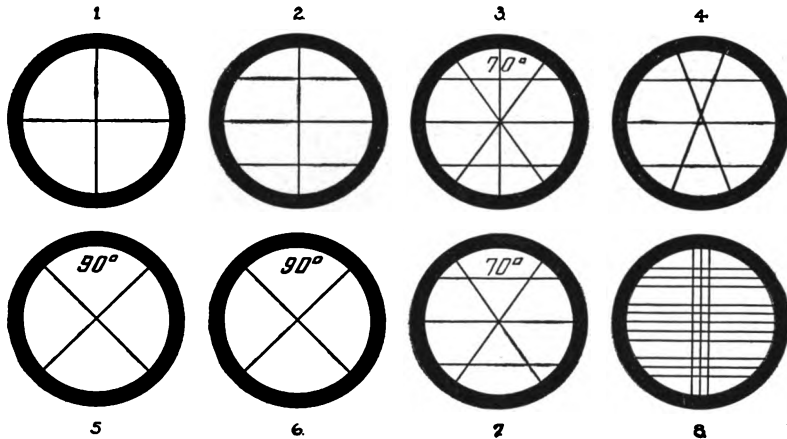
The cost of inserting the stadia in any of our new telescopes is \$3.00.

For the adjustable stadia wire the charge is \$10.00. This form we do not recommend since it is liable to derangement.

The constant, which is to be added to all stadia measurements can be accurately assumed as 1.5 times the focal length of the object-glass (with our system of lenses). Its individual value is supplied with every instrument.

Diagrams below show best arrangements for all cases of engineering and surveying practice.

Special arrangements can be supplied if specified.



Nos. 1, 5 or 6 are furnished as equipment.

2.	Stadia and cross wires	-	-	-	-	-	-	-	\$3.00
3.	" " diagonal wires 70°	-	-	-	-	-	-	-	4.00
4.	" " " 1/8" above intersection	-	-	-	-	-	-	-	4.00
7.	Triangulation	-	-	-	-	-	-	-	4.00
8.	Stellar observation	-	-	-	-	-	-	-	6.00



The Variation Plate.

The magnetic North varies in almost all parts of the world, and also the deviation is constantly on the increase or decline in a series of years.

To avoid the confusion arising from adding or subtracting the error to each reading we make an additional movable graduated ring, called the variation plate. The engineer, having such an arrangement, can pick up old lines on farm surveys, etc., with much ease, provided the variation giving the true meridian is set off by means of the milled head adjusting screw, East or West as the case may warrant.

The cost of this attachment as applied to our instrument is \$10.00.

Tripod.

Our latest form of split-leg tripod for our regular instruments, as recently designed, *is of one piece* of fine-grained white ash. The advantages of white ash are the straighter and closer grain and the better and more durable finish permissible.

The iron shoe provided on our regular tripods is of improved and superior design for field work. It embraces a projecting spur for the foot of suitable size to admit of easily pushing the leg to a firm bearing in the earth.

The bell-metal head holding the three legs together at the top, is a single casting strengthened by curved and powerful ribs adding grace and increasing the rigidity.

The finish on our tripod is of the most approved type, being three coats of hard shellac, which are each rubbed down and dressed in oil, thus procuring an almost indestructible, permanent finish.

Our levels and transits both fit the same tripod.

Plumb-Bob

Similar to several other smaller, yet important details when assembled into the whole, is the accuracy of our plumb-bob. This depends upon care in making and a design permitting an unobstructed view of the point.

The care in the making produces a bob that will, when suspended and rotated, swing truly on a theoretical center.



This is obtained by having center of gravity low, fitting hole in top accurately to size of plumb string, and finishing carefully.

It excels in the following points:

1. Accuracy due to careful hand work.
2. Design and proportion permitting a low center of gravity and an unobstructed view of the point.
3. Thoroughness of construction from hardest bell-metal and a point of hardened and tempered tool steel (to avoid bending of point).

Finish.

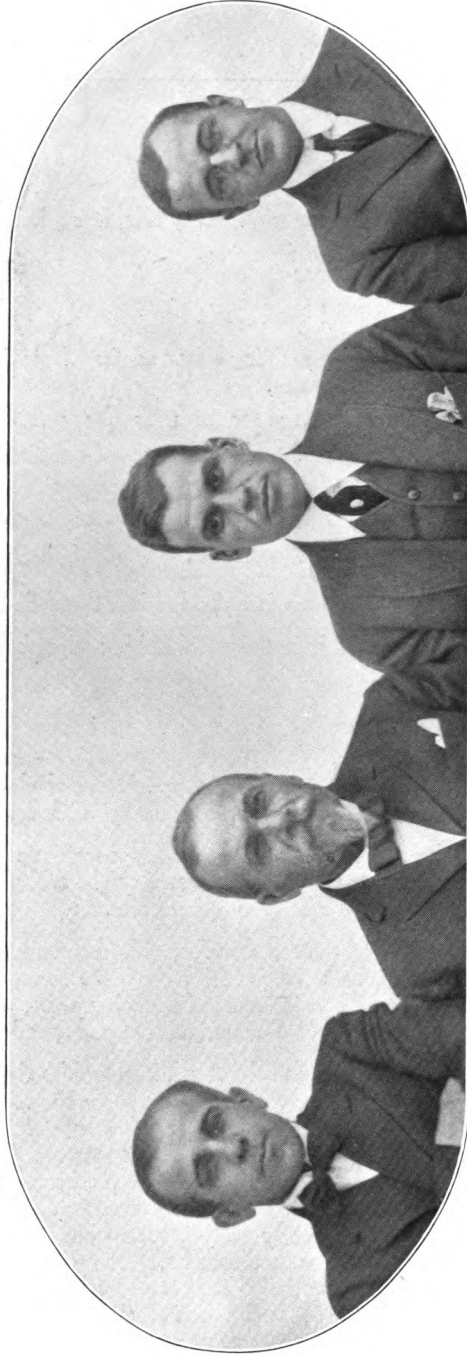
The finish of our instruments may be divided into three classes :

- A. *Bright Finish*—which is the usual finish and embraces polished surfaces throughout.
- B. *Dark Bronze Finish*—which is the handsome, dark-polished finish most suitable for mining work.
- C. *Cloth Finish*—which resembles a covering as of cloth and can be applied to any or all parts of the instruments as desired.

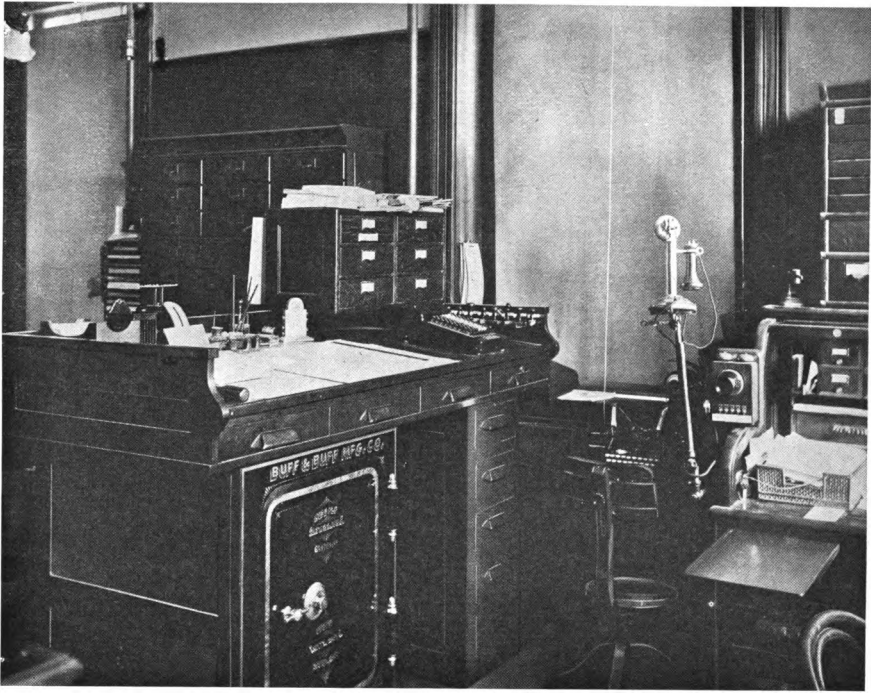
Our *Bright finish* is of pleasing lacquer color, so unique and characteristic of our instruments. It is not a glaring finish, but is bright enough to throw off all objectionable heat rays. It is a most permanent finish.

The *Bronze finish* is upon the same finely polished surface, but burnt a delicate brown with acid, and finely lacquered with white lacquer to preserve the rich tone of the brown. This one is suitable for mining work since it throws no reflections, adding thus materially to the manipulation and speed.

Cloth finish, so called, because to the touch it resembles cloth, is not real cloth but a finely prepared material of the requisite color, greenish brown, of which three separate coatings are applied with japan. It is a durable finish, for the reason that it is so firmly baked. This style is much desired for astronomical instruments, on account of the equable temperature possible. Since the necessity of finely polishing these surfaces to be cloth-finished is thereby unnecessary, the cost of thus finishing is lower than the two preceding styles. It is quite the equal of the bright finish and superior to the bronze in durability. Its freedom from ill effects of sudden changes in temperature, and also its cheap and ready restoration strongly advance its claim to recognition. It is also much in favor in the northern part of the country, during the winter months, on account of pleasing relief from the glaring white of the snow and negative reflecting properties.



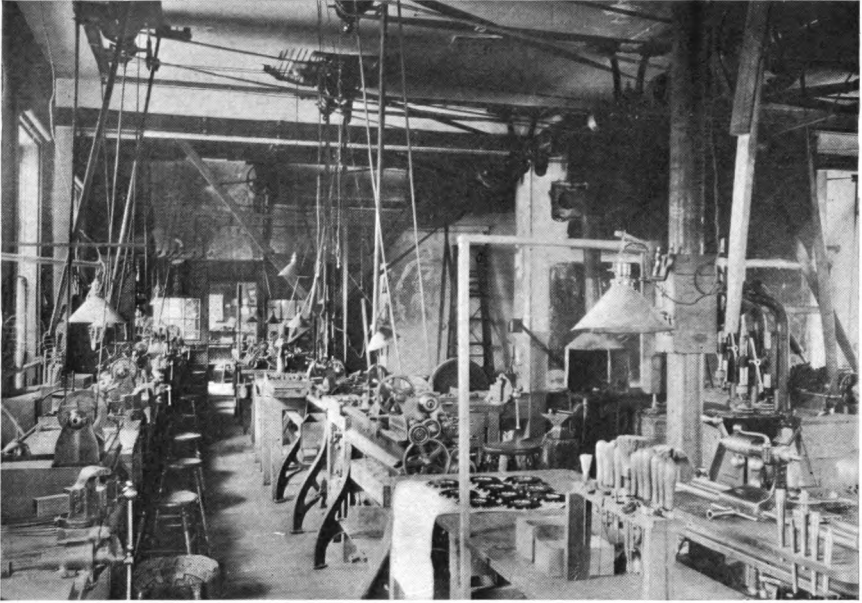
1. LOUIS F. BUFF — Works Manager since 1898
2. GEO. L. BUFF — General Manager
3. WM. J. BUFF — Manager, N. Y. Branch and Export
4. H. A. BUFF — Manager, Repair Department



BOOKKEEPING.

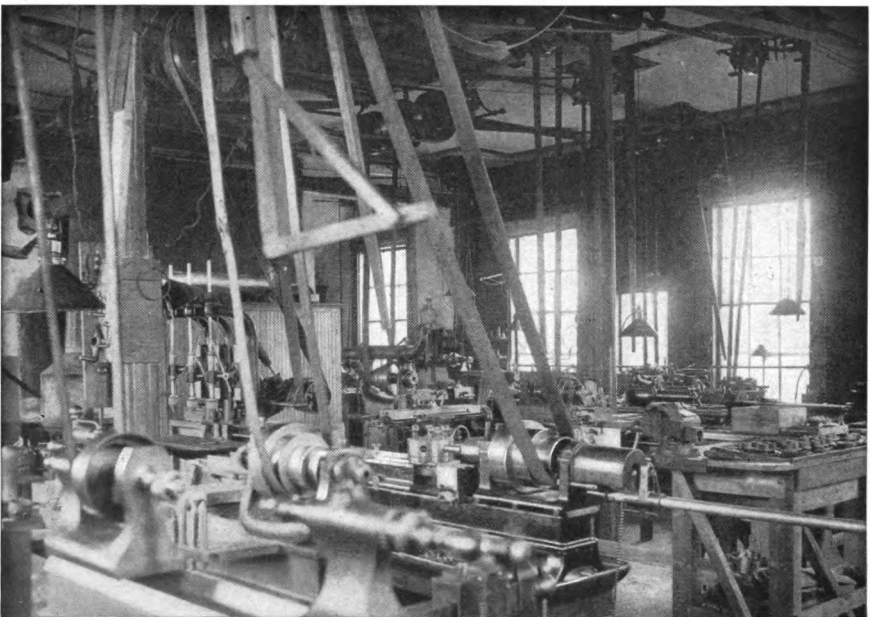


WEST SHOP — ENTRANCE.

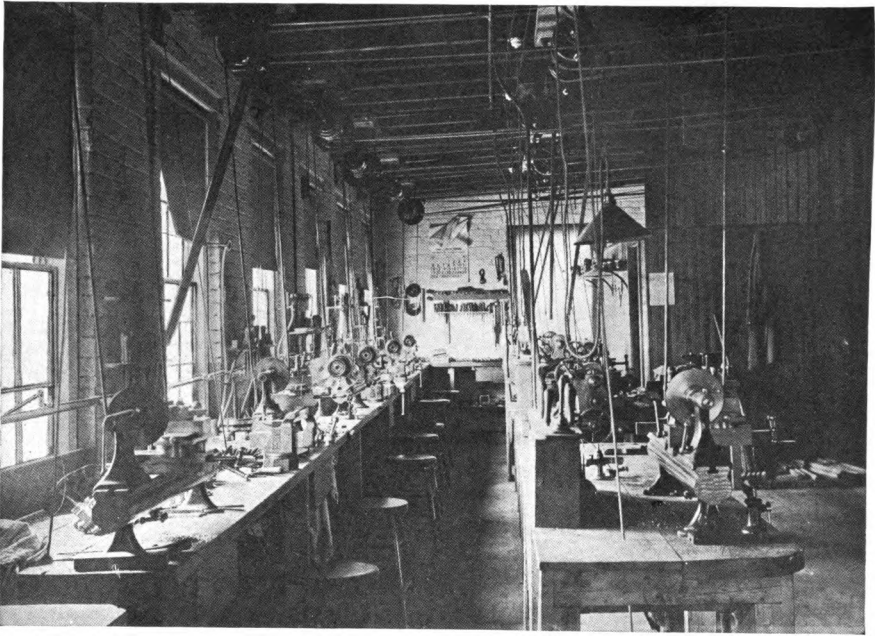


CIRCLES, CENTERS AND PARTS DEPARTMENT — Second Floor.

ADVANCED IDEAS IN OUR

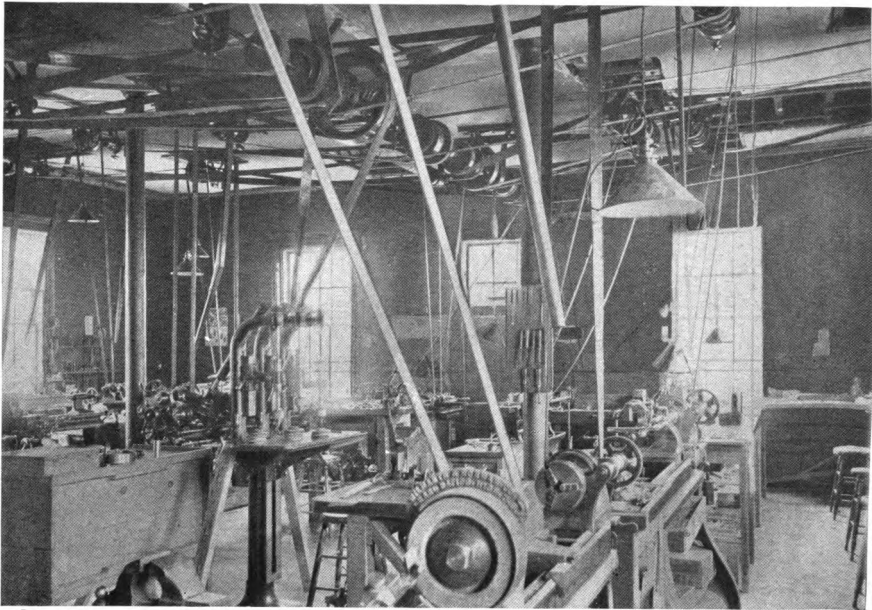


MACHINE AND MILLING DEPARTMENT — North Side, Second Floor.

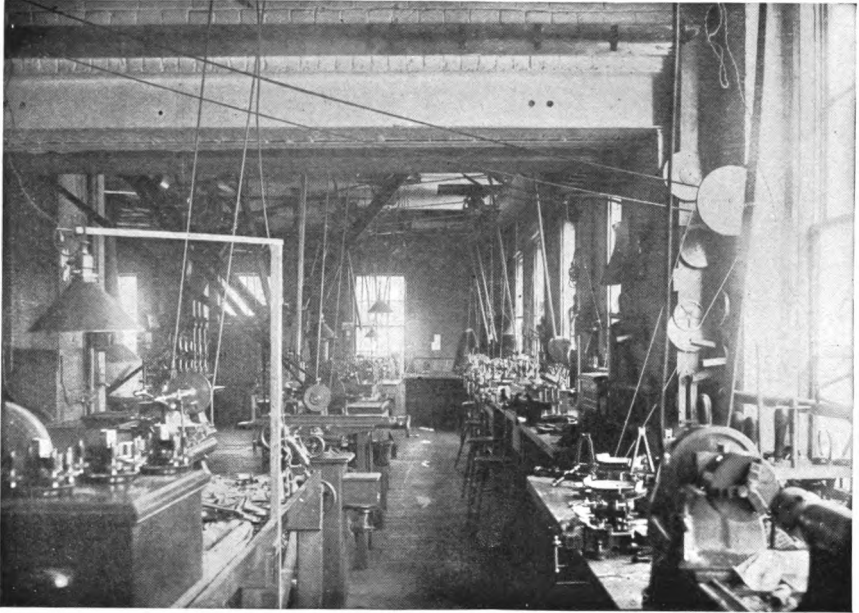


TELESCOPE AND LENS SHOP—Third Floor.

INSTRUMENT SHOPS.

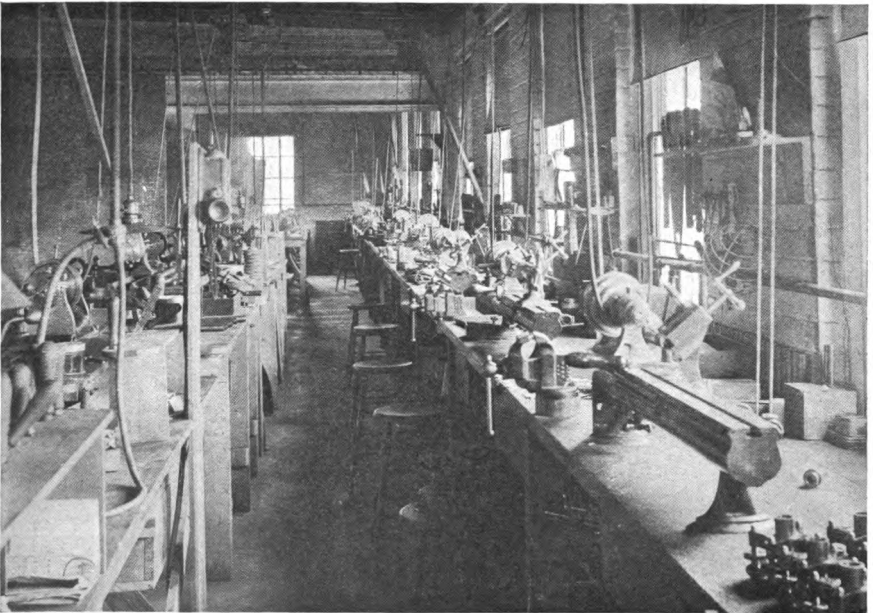


PRECISION GRINDING ROOMS—Second Floor.

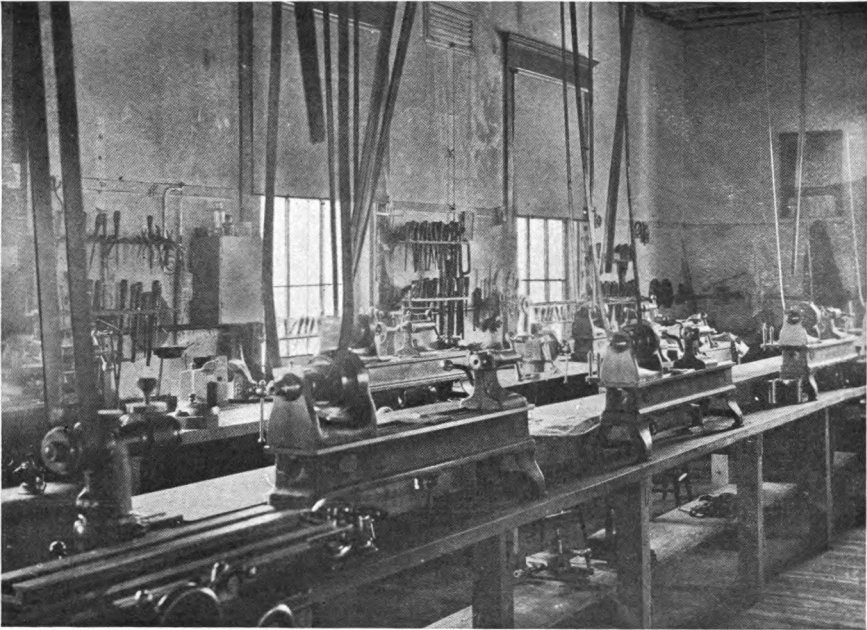


ASSEMBLING ROOM—Second Floor.

The "BUFF" TRANSIT is the instrument on which the

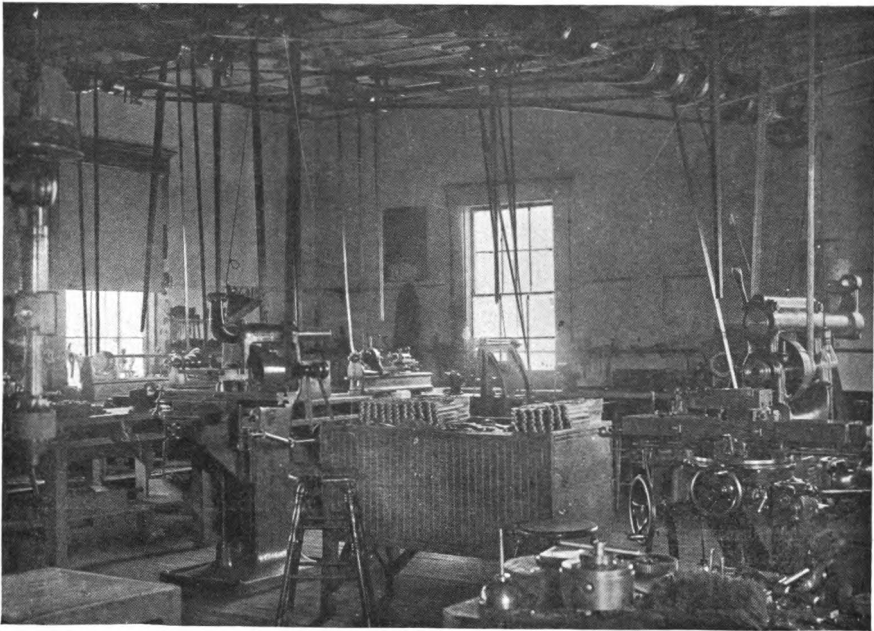


CENTER-MAKING DEPARTMENT—Third Floor.

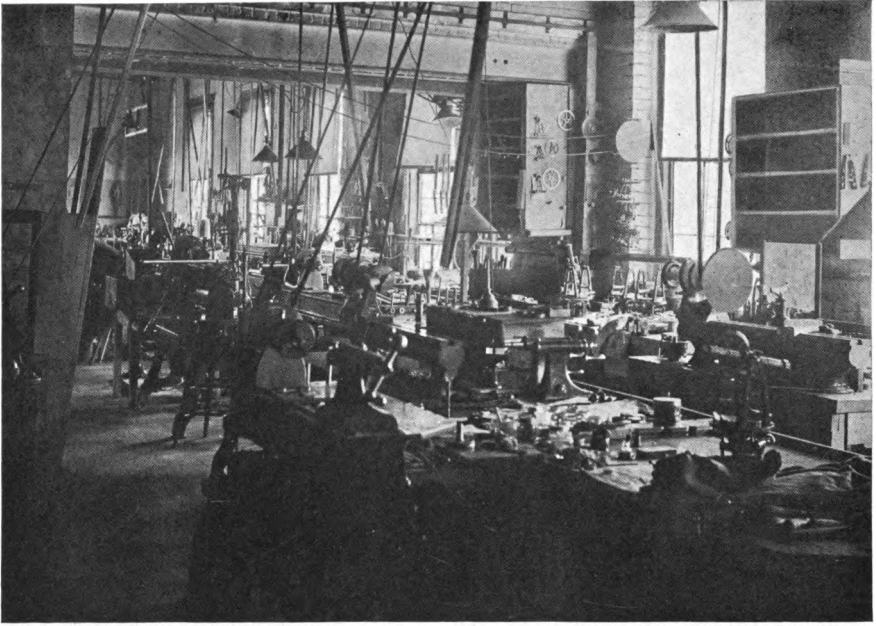


CLAMPS AND CIRCLES DEPARTMENT — Third Floor.

Buff & Buff Mfg. Co. specialize at their Jamaica Plain shops.

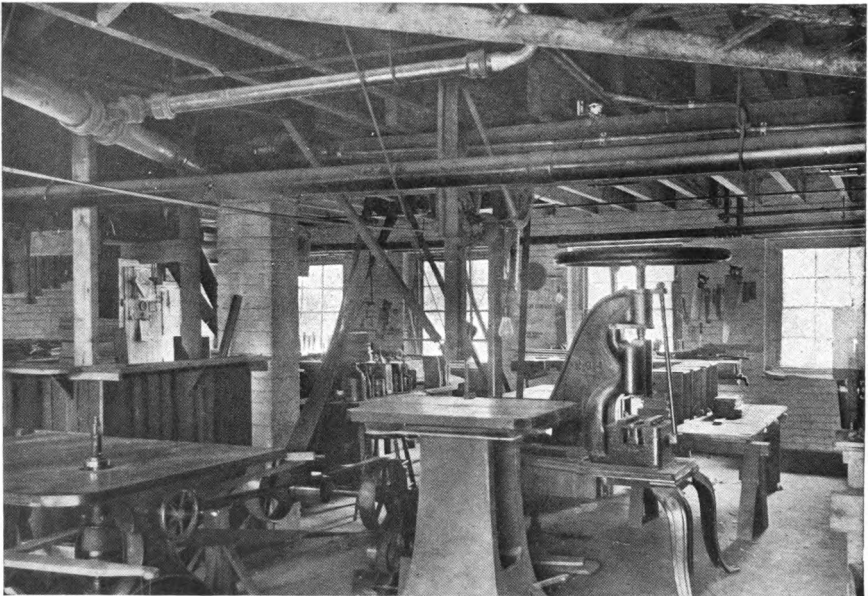


MILLING MACHINE DEPARTMENT — Third Floor.



CENTER ASSEMBLING — Second Floor.

Other Departments
GRADUATING — EXPERIMENTAL — SHIPPING —



MOULDING AND WOODWORKING — First Floor.



REPAIR DEPARTMENT.

Not Shown.

POWER PLANT — VARNISH ROOM — STOCK ROOMS.



SECRETARY'S OFFICE.



The Buff "Precise" Transit.

The "Buff" Precise Transit has behind it an unparalleled history of years of uninterrupted success, which demonstrates the correctness of the design and the accuracies of construction.

It is the foundation of our large and growing business, and it is because of the completeness with which it has always fulfilled our most sanguine expectations that we are always encouraged to extend our facilities for the manufacture in larger numbers.

The "Buff" instrument has kept pace with the growth of business in this country, showing that it covers a field peculiarly its own, and has inherent advantages.

Consequently, we not only continue to build "Buff" instruments with the same scrupulous care, but are to-day building them better in every point where the experience with transits of this particular type has indicated that improvement was possible. Incidentally, this instrument comes more nearly than any other to being purely elementary in design and grace of finish. That it has thrived for so many years, suggests the possession of tangible merit, easily discernible by those whose good sense enables them to discriminate between a superior and an average transit.

With an unusually skilled force of men especially belonging to the instrument makers of the world, we stand in a position to offer our customers the best possible.

ITS ECONOMY.

In point of economy the "Buff" Precise Transit is unequalled by any other transit made.

We know that it is the only single instrument, which is adapted to wide variety of use.

We know that it will always accommodate itself to adverse circumstances and offer up clear work at all times with its more powerful telescope.

We know that it will preserve its adjustments unimpaired for a longer time owing to the rare skill with which its centers are constructed of the toughest metals.



Specifications of Four Regular Sizes of the "Buff" Transit.

	Size No. 1	Size No. 2	Size No. 3	Size No. 4
Weight	13½ lbs.	10 lbs.	7 lbs.	5 lbs.
Dia. of Grad	6¼ in.	5½ in.	4½ in.	4 in.
Length of Needle	4½ in.	3½ in.	3½ in.	2½ in.
Power Erect. Telescope	26.5 dia.	22.5 dia.	18 dia.	17 dia.
Power Invert. Telescope	29 dia.	25 dia.	21 dia.	20 dia.
Length of Telescope	12 in.	10¾ in.	8 in.	8 in.
Length Level Bubble	6 in.	5½ in.	4 in.	4 in.
Dia. Telescope Aperture	1¼ in.	1¼ in.	1½ in.	1½ in.

We want you to see the "Buff." To see it is to come in contact with an affirmative argument that gives emphasis and reality to the claims we make.

SPECIFICATIONS — No. 1 A TRANSIT, page 39

Graduation, 6¼ inch diameter, with two opposite double reading verniers to minutes, placed at *either 30° or 90° to line of sight*. Two rows of opposite inclined figures 0°-360°. Graduations silvered and covered by pure crystal plate glass.

Telescope, *erecting or inverting*, is balanced and reverses at either end; 12 inches long, 1¼ inch aperture, with power of 26.5 dia. improved eye-piece, unsurpassed large clear field. Center point is provided on top of telescope to permit of accurate centering from above. Adjustment for vertical plane, and line of collimation correct for all distances.

Sensitive level bubble, 6 inches long, with clamp and tangent to telescope.

Improved lower and upper spring tangent clamps.

Shifting center with ¾ inch adjustment.

Spirit levels truly ground by special machine, rated and sensitive.

Standards are cloth finished.

Long taper centers with broad flanges and of hardest bell metal and phosphor bronze.

Compass needle is 4½ inches long and of accepted form.

Compass graduation is silvered and figured with a single row 0-90 on each side of N. and S.

Tripod improved; split leg with wing-nuts, weight 7½ lbs.

The Mahogany instrument box is provided with strap, brass lock, and hooks, and contains plumb-bob, pocket magnifier, sun-shade, wrench, screw-driver, adjusting pins, etc.

No. 1 a Transit weighs 13½ lbs.

The recollection of quality remains long after price is forgotten.



EXTRAS TO NO. 1 SIZE TRANSIT.

Graduation, horizontal circle, solid silver	\$10.00
“ “ “ reading to 30”	10.00
“ “ “ “ 20”	20.00
“ “ “ “ 10”	30.00
“ vertical circle, solid silver	5.00
Standards finished and polished bright (like telescope)	5.00
Improved gradienter attachment	5.00
Reversion level, for levelling with telescope reversed	12.50
Fixed stadia wires, guaranteed 1 ft. in 100 ft.	3.00
Variation plate and ring	10.00
Short Focus lens attachment. No. 1 lens, \$8.00; No. 2 lens, \$8.00	16.00
Dust caps to levelling screws	3.00
Silk waterproof bag to cover instrument	1.00
Superfine watch oil, per bottle . . . . .	.25
Extra extension tripod 9½ lbs.	16.00
Extra regular tripod 7½ lbs.	16.00
Reflector shade for cross wires	4.00

The transit, as illustrated, represents the highest perfection of the instrument makers' art. Accuracy, quality, finish and equitable price have obtained for it exclusive use on the largest works in progress at the present time.

The sensitiveness of the spirit level attachment is equivalent to that of many wye levels, and allows of high accuracy in levelling up to 200 feet sights.

Remember every ounce of metal in the Buff transit is *as if of hardest and toughest steel.*

NOTE— We do not claim to harden and temper the copper bronzes as of medieval history, but we have succeeded, for many years, in so perfecting our private mixtures, that our different metals are practically the equivalent of steel.



6¼ INCH BUFF PRECISE TRANSIT. No. 1 A.

Patented Nov. 6, 1900; Nov. 13, 1900; Feb. 3, 1903.

Price, as in cut, **\$210.00.** For specifications see page 37.

Code-Word — THEODITE.

No. 1. Plain Railroad Transit (without bubble or clamp to telescope), **\$180.00.**

Code-Word — THEOCAT.



6¼ INCH BUFF "PRECISE" TRANSIT. No. 1 B.
(Design Patented.)

Price, \$225.00. For exact specifications see page 37.

Code-Word — THEODAS. See page 123 for Code.



THE BUFF "PRECISE" TRANSIT.

(Design Patented.)

No. 1 c.

Price, \$234.00. For exact specifications see page 37. The 5 inch full circle reading to minutes is protected by aluminum guard.

Code-Word—THEODUSE. See Code, page 123.



6¼ INCH PENNSYLVANIA "PRECISE." No. 1 D.
For Tunnel Alignment Work.

Price, \$210.00. For specifications and extras see pages 37 and 38. Can also be equipped with 2½ inch compass of type as shown on page 43. Black Leather Finish for U telescope standards, \$5.00 extra.

Code-Word — THEOPENN. See Code, page 123.

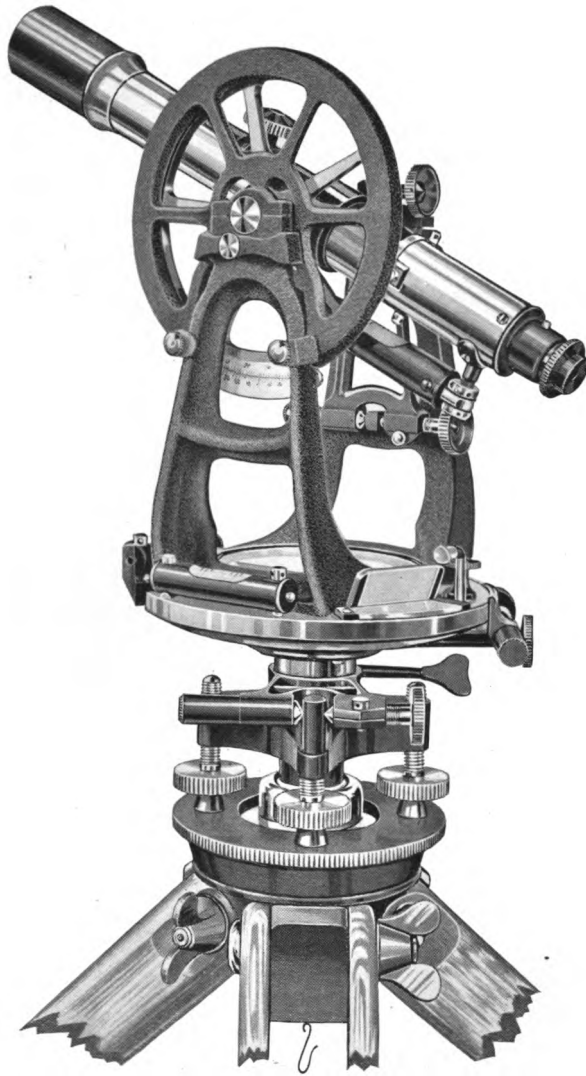


6¼ INCH MODEL 15.

This style is one of the finest designs, combining the U standards and maximum size of compass and low center of gravity.

As shown, price, **\$248.00**. Specifications, page 37.

Code-Word—THEODO. See Code, page 123.



5 $\frac{1}{8}$ INCH MODEL 25.

This style combines the U standards and a maximum size of compass needle, 3 $\frac{1}{4}$ inches long. Weight, 9 lbs.

As shown, price, **\$248.00**. See page 46 for general specifications.

Code-Word — TRANDO.



5 1/8 INCH BUFF "PRECISE" TRANSIT. No. 2 B.

This size of Engineers' Transit in design is identical with the regular larger size, but on account of decreased size and weight is admirably adapted for work of a reliable nature where a lighter weight instrument is desirable.

Price, \$225.00 and per specifications page 46.

Code-Word — TRANDATE.



SPECIFICATIONS.

No. 2 b.

Graduation, $5\frac{1}{8}$ inch diameter with two double opposite verniers to minutes, placed at either 30° or 90° to line of sight. Two rows of figures 0-360 inclined. Graduations are silvered and covered by pure crystal plate glass. Vertical arc 5 inch diameter and reading to minutes by one double vernier.

Telescope, erecting or inverting, is perfectly balanced, and reverses at both ends. Length is $10\frac{3}{4}$ inches with aperture of $1\frac{1}{2}$ inch, and power of 22.5 dia. Eye-piece gives sharply-defined field of improved illumination.

Sensitive level bubble, $5\frac{1}{2}$ inches long with clamp and tangent to telescope. Adjustment for vertical plane of telescope and line of collimation correct for all distances. Center point is provided on top of telescope.

Improved lower and upper spring tangent clamps and shifting center with $\frac{5}{8}$ inch adjustment.

Standards are cloth finished.

Long taper centers with wide flanges.

Compass needle $3\frac{3}{4}$ inches long and of preferred form.

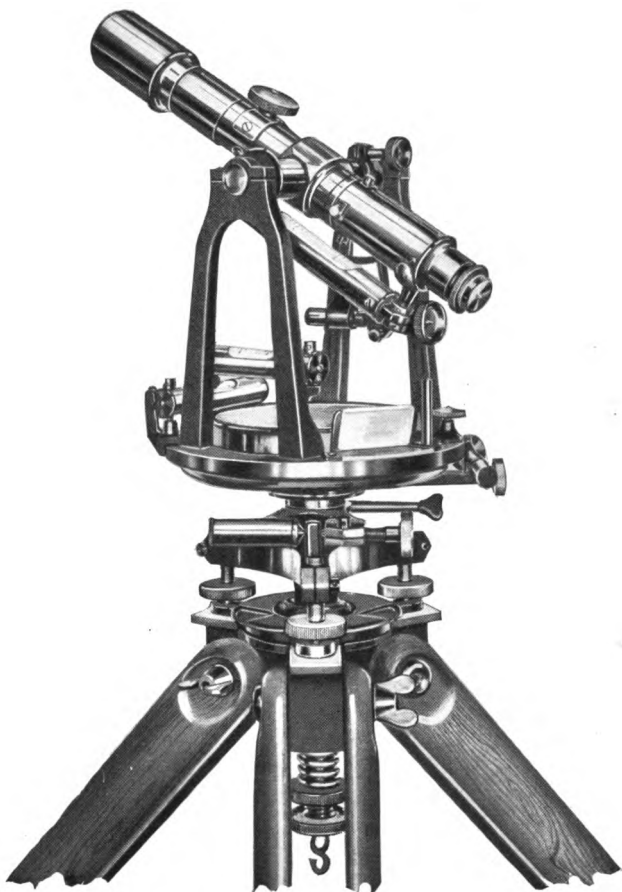
Tripod improved, split-leg form with thumb-nuts, weight 7 lbs.

Mahogany case is fitted with strap, lock and hooks, and contains plumb-bob, pocket magnifier, sun-shade, wrench, screw-driver, etc.

Option. Aluminum tripod head, reduces weight $1\frac{1}{4}$ lbs.

EXTRAS TO NO. 2 SIZE OF TRANSIT.

Graduation, horizontal circle, solid silver	\$10.00
" " " reading to 30"	10.00
" " " " " 20"	20.00
Edge graduation for vertical circle, 5 in. dia. (see p. 58)	10.00
Graduation, vertical circle, solid silver	5.00
" " " reading to 30"	5.00
Standards finished bright or bronzed	5.00
Extra extension tripod, weight $9\frac{1}{2}$ lbs.	16.00
Ground glass shades to vernier	3.00
Gradiometer attachment	5.00
Stadia wires, fixed	3.00
Variation plate and ring	10.00
Silk waterproof bag to cover instrument	1.00
Superfine watch oil, to lubricate centers . . . . .	.25
Reflector shade for cross wires	4.00
Short Focus lens attachment	16.00



4½ INCH BUFF. No. 3 A.
With Three-Screw Center.

Price, \$205.00.

This style to order only and with any extras as required.

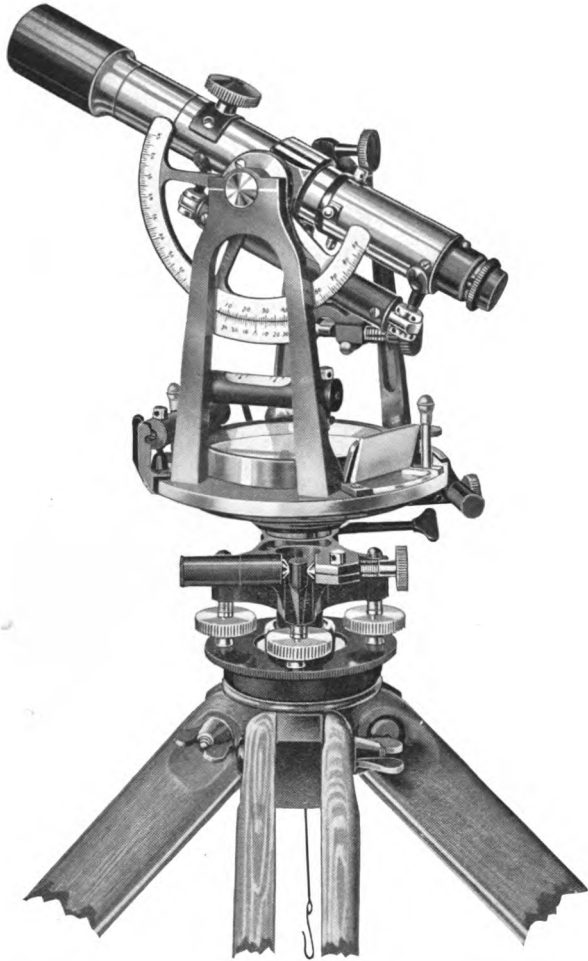
SPECIFICATIONS. No. 3 TRANSITS.

Graduations, 4½ inch diameter with two double opposite verniers to minutes, placed at 30° to line of sight. Two rows opposite inclined figures 0-360. Graduations are silvered and covered by pure plate glass.

Telescope, erecting or inverting, is balanced and reverses at both ends, 8 inches long, with 1⅛ inch aperture and power of 20. Improved eye-piece gives large, clear field. Level attachment includes bubble 4 inches long fixed to telescope, and with clamp and tangent adjustment.

Line of collimation correct for all distances. Shifting centers. Standards are cloth finished. Tripod has extension legs, or our improved stiff legs, if ordered. Compass magnetic needle is 3¼ inches long and graduations are silvered with one row of figures 0-90.

The mahogany instrument case is equipped with lock, strap, and hooks, and contains plumb-bob, pocket magnifier, sun-shade, wrench, screw-driver, adjusting pins, etc. Weight of No. 3 transit, 6 pounds.



BUFF RECONNAISSANCE TRANSIT. No. 3 B.

Price, \$215.00.

Code-Word — TRIO.

See page 56 for transit with full vertical circle.

The difference of one-half inch in the diameter of the No. 3 and No. 4 is slight, but the difference on the graduation is more noticeable. The No. 3 has an increase of three-quarters of an inch in the length of needle.



EXTRAS TO NO. 3 AND 4 SIZE TRANSITS.

Graduation, horizontal circle, solid silver	\$10.00
“ “ “ reading to 30”	10.00
“ vertical circle, solid silver	5.00
Ground glass shades to vernier	3.00
Standards, hand polished and finished bright or bronze	5.00
Gradienter attachment, improved, guaranteed accurate	5.00
Stadia wires, fixed, 1 ft. to 100 ft.	3.00
Two reading glasses to Hor. circle, same style as page 61	12.00
Aluminum guard for circle, as in mountain transit, page 56	4.00
Prism, attachable to eye-piece, No. 1,	8.00
Prism, attachable to eye-piece, pivoted combination, No. 2,	12.00
Leather cover over case, sole leather, with carrying straps	9.00 to 12.00
Canvas cover with leather ends for extension tripod	4.75
Detachable side-telescope with counterpoise	35.00
Silk bag to cover transit, and bottle of superfine watch oil	1.25
Striding level to complete transit	15.00
Variation plate and ring	10.00
Reflector shade for illuminating cross wires	4.00
Short Focus lens attachment, No. 1, \$8.00; No. 2, \$8.00	16.00
Trivit — for setting on beams	3.50

We prefer to make these instruments with inverting eye-pieces, knowing that thereby the greater satisfaction will be obtained. If a detachable side-telescope is ordered, it should be on the instrument having the U-shaped standards.

For the use of explorers and reconnaissance surveyors, needing additional power, we offer in No. 3 transit an able instrument that can be used with the greatest satisfaction and accuracy in results.



4½ INCH "BUFF" EDGE WET MINE TRANSIT. No. 3 W.

Edge Graduation, \$10.00.

Protected for wet mine use, \$10.00.

Jointed Reading Glass, \$5.00.

Total, \$249.00 as shown.

Note the liberal design and stability. Also the positive look of distinction.



EXTRA SMALL RECONNAISSANCE TRANSIT. No. 4 B.

Weight complete, 5 pounds.

Price, \$215.00.

Code-Word — RECON.

SPECIFICATIONS.

Graduation, 4 inches diameter. Telescope power, 18 diameter. Compass needle, $2\frac{1}{2}$ inches long. All other specifications are identical with those for the No. 3 size. The compactness of the No. 4 peculiarly adapts it for explorers and reconnaissance surveys. It makes the neatest set on the market.

Can have U-shaped standards if desired.

See page 49 for list of extras.



“Buff” Mining Transits.

The noticeable advancement that has taken place in the design and efficiency of the small and medium sized engineers' transit, during the past few years in particular, is easily traced to the increased demand for a superior mining transit of higher power and greater accuracy.

The elements entering into the design and construction to obtain these ends with absolute rigidity are more numerous and conflicting than is commonly thought, but have been so successfully gained in the new “Buff” as to completely meet and satisfy all requirements. Engineers contemplating purchase, however, must not overlook facts and base their calculations arbitrarily upon power and relative weight, without considering that, particularly for mining uses, power is not so much desired (sights are shorter than for surface work) as light and definition. The design is strictly up-to-date in every detail, and in modified form is of the same type as our larger triangulation instruments, that permit utmost rigidity consistent with weight and ensuring most efficient operation.

In every way they are built with the same exactitude of fit, to withstand hard usage under mining conditions, and with reasonable care give splendid service for many years.

The following engravings will show to the critical engineer points of excellence sought for and secured.

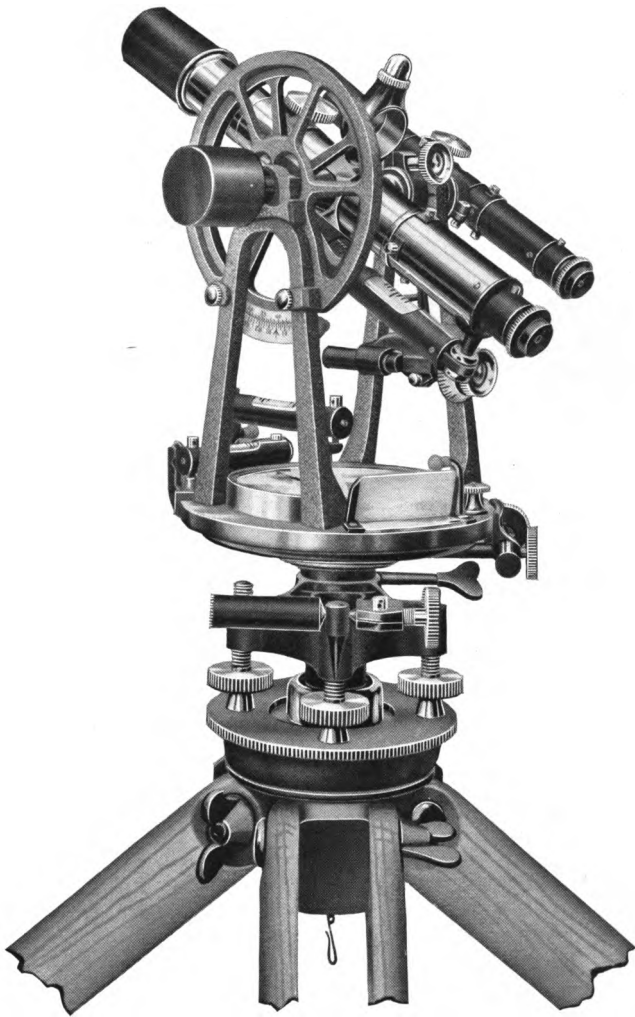
Accessories and attachments are perfect and very complete. The hard bronze finish, highly pleasing without being elaborate, is of the practical kind, consistent with everyday service in mines.

MINING INSTRUMENT.

No effort has been made to cheapen these instruments at any point, the result being instruments constructed by superior labor under superior supervision, which must give *superior service for many years.*

The following engravings from photographs of our instruments actually built clearly indicate to the critical engineer where their superiority of design exists, and why the “Buff” so invariably meets and successfully undergoes the most severe conditions of usage without injury.

Our aim is not to manufacture instruments so that we may get the business of repairing them when they fail through poor design and workmanship, *but it is to keep them out of our own and other repair shops indefinitely.*



THE "BUFF" PRECISE MINE TRANSIT. No. 2 F.

Weight as in cut, $12\frac{1}{2}$ lbs.

Extension Tripod, $9\frac{1}{2}$ lbs.

Price with extension tripod, etc., **\$234.00.**

Top and side telescope, **\$45.00 extra.**

All figuring on graduations especially clear and legible for rapid, accurate work.

Code-Word — **TRANDOLITE.** See Code, page 123.

For new-style Mining Target see page 103.



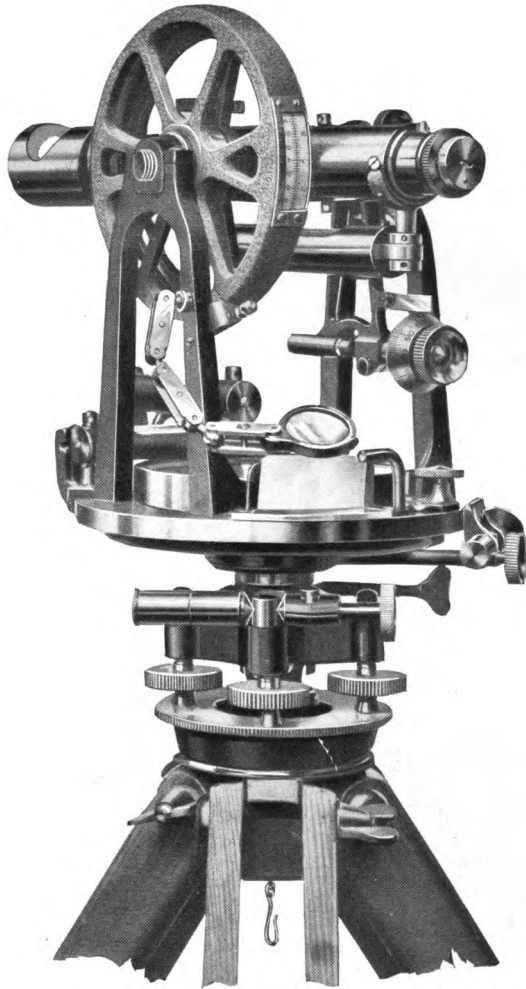
SPECIFICATIONS.

No. 2 f

- Horizontal circle $5\frac{1}{8}$ inch diameter, with double opposite verniers reading to minutes on graduation which is silvered. Full vertical circle with guard.
- Needle $3\frac{3}{4}$ inches long and of improved form.
- Standard cloth finish.
- Telescope, $10\frac{3}{4}$ inches long and aperture of $1\frac{1}{4}$ inch.
- Power of 22 dia. with erecting eye-piece.
- Sensitive level bubble $5\frac{1}{2}$ inches long to telescope, with clamp and tangent adjustment.
- Verniers may be either at 30° or 90° to line of sight.
- Weight of instrument complete $12\frac{1}{2}$ lbs., extension tripod, $9\frac{1}{2}$ lbs., regular tripod, 7 lbs.
- Aluminum protection guard for circle.
- Weight and size are the only difference from the No. 1, being in every detail equally thorough in construction.
- Mahogany case, with fittings as for No. 1 transit and with extension tripod.
- For different forms of cross wires see page 25.

EXTRAS TO MOUNTAIN TRANSIT No. 2.

Ground glass shades, to facilitate reading of vernier	\$3.00
Standards finished and polished bright or bronze	5.00
Fixed stadia (see p. 25)	3.00
Gradiometer attachment, improved	5.00
Graduations, horizontal circle on solid silver	10.00
Graduations on vertical circle on solid silver	5.00
Edge graduations, vertical circle, one double reading vernier	10.00
Horizontal circle graduated to $30''$	10.00
Variation plate, with ring	10.00
Leather cover, at cost to us	11.00
Leather cover, with straps	14.50
Silk waterproof bag to cover transit	1.00
Superfine watch oil, to lubricate centers and axle . . . . .	.25
Saegmuller Solar attachment	50.00
Prism, attached to eye-piece	8.00
Prism combination pivoted, with colored glasses	12.00
Short focus Lens Attachment, 2 sets in combination	16.00
Trivet, for setting instrument on beams, etc., in longitudinal passages, 2 inch, 3 inch and 6 inch legs	3.50
Complete Mining Target, with lamp and tripod (send for special circular),	90.00
Detachable side telescope with counterpoise	35.00
Extra regular tripod	16.00
Extra $\frac{1}{2}$ length tripod	13.00
Plummet-lamp, improved form	9.00
Bracket — for use in mines — instead of tripod — heavy bronze castings complete and ready for instrument to be attached	10.00
Reflector shade for cross wires	4.00
Right angle sight provided through axle — for offsetting	5.00

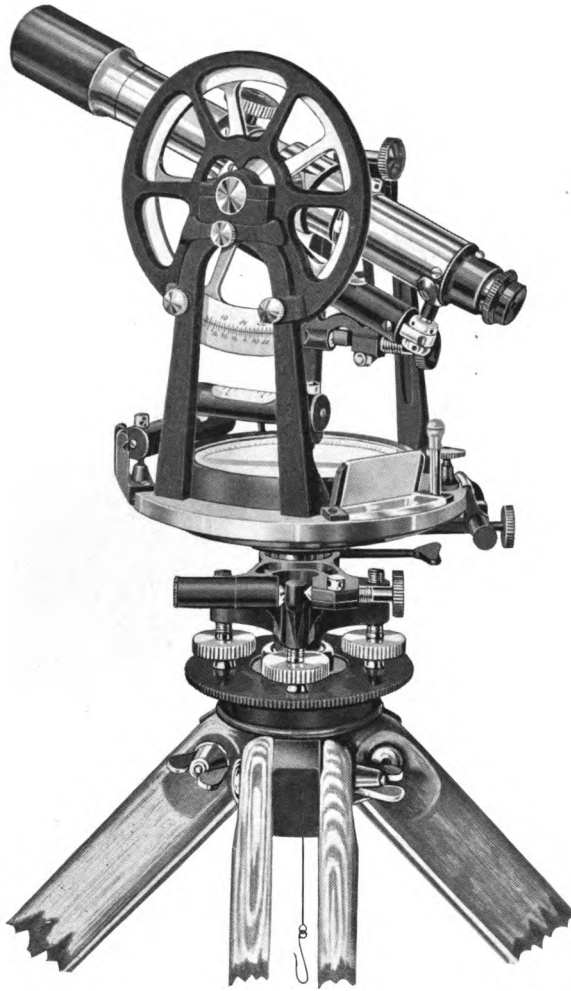


4½ INCH ROCKY MOUNTAIN FAVORITE. No. 3 G.

Complete as shown with edge graduation, \$234.00.

**Universal jointed reading glass for either horizontal or vertical graduations,
\$5.00. Gradiometer, \$5.00.**

Code-Word — TRIGONATE.



THE "ROCKY MOUNTAIN FAVORITE." No. 3 C.

Weight as in cut, without side telescope, 7 lbs. Extension Tripod, 7 lbs.
Superior graduations guaranteed. Unexcelled Telescopes.

Four and a half inch diameter at edge of graduation.

Price, \$224.00.

Price, complete, with full vertical circle, bubble and guard, extension tripod, etc.
See specification, page 47.

Code-Word — TRIGON. See Code, page 123.



**SPECIFICATIONS No. 3 SIZE "ROCKY MOUNTAIN
FAVORITE."**

Horizontal circle $4\frac{1}{2}$ inch dia. at edge of graduation with double opposite verniers reading to minutes on silvered surface.

Needle is $3\frac{1}{4}$ inches long.

Standards are cloth finished.

Telescope is 8 inches long with $1\frac{1}{8}$ inch aperture of power of 18.

Sensitive level bubble to telescope is 4 inches long, and provided with clamp and tangent adjustment.

Verniers may be either at 30° or 90° to line of sight.

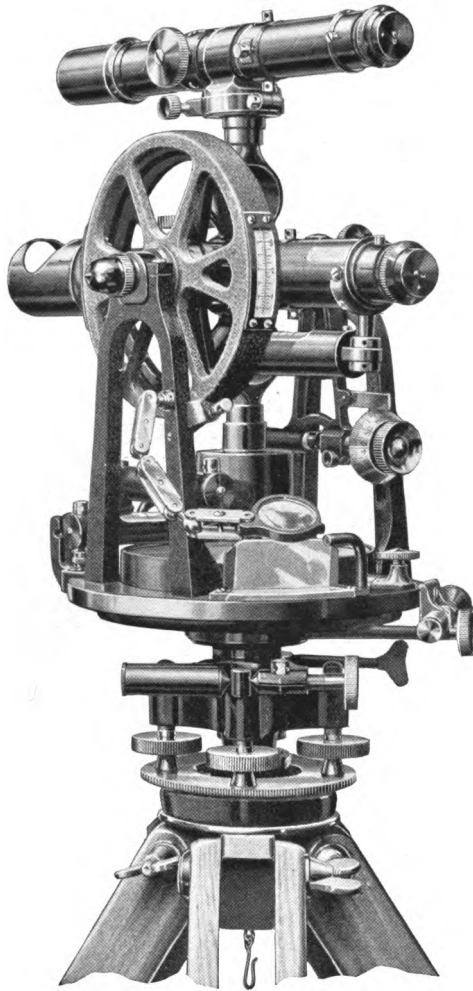
Vertical circle reads to minutes and is protected by an aluminum guard.

Weight of instrument complete is 7 lbs., extension tripod 7 lbs., regular stiff leg tripod 5 lbs.

Instrument complete in mahogany case with plumb-bob and adjuster, pocket reading glass, screw-driver, wrenches and adjusting pins, etc. Price, \$224.00.

EXTRAS TO No. 3 MINING TRANSIT.

Solid silver graduations to horizontal circle	\$10.00
Solid silver graduations to vertical circle	5.00
Edge graduation to vertical circle, one double reading vernier	10.00
Dust-proof cover of celluloid for both sides completing enclosure of vertical circle	3.00
Horizontal circle graduated to $30''$	10.00
Standards, hand polished, bright or bronze	5.00
Gradienter attachment, complete	5.00
Fixed Stadia Wires	3.00
Ground glass shades to vernier	3.00
Variation plate with ring	10.00
Silk waterproof cover for instrument	1.00
Superfine watch oil for lubrication . . . . .	.25
Reflector shade for illuminating cross wires	4.00
Trivet for setting instrument on beams	3.50
Reading glasses for horizontal circle	12.00



4½ INCH MINE TRANSIT. No. 3 T.

Price, \$234.00. See page 57 for specifications and extras.

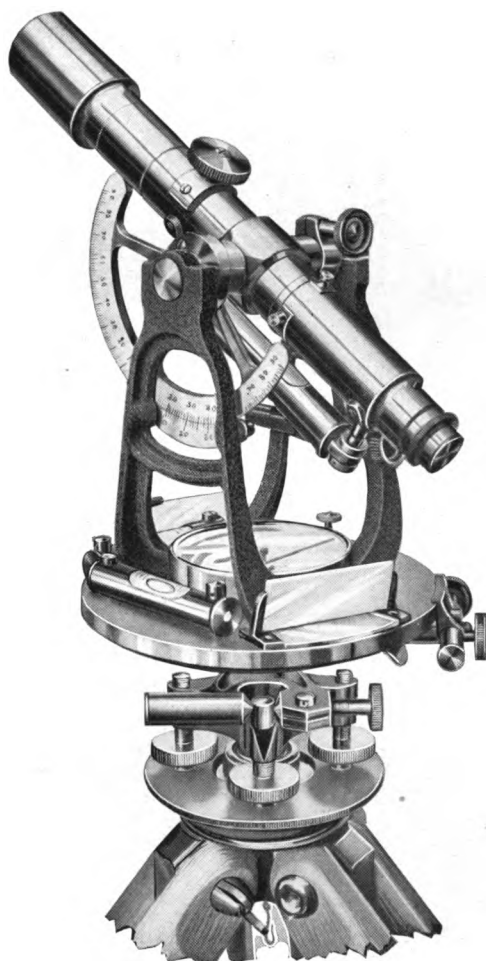
Includes edge graduation.

Code-Word — TRIUMPH.

EXTRAS.

Top and Side Telescope (Interchangeable and Detachable), \$45.00.

Note. — Transit equipped with interchangeable threaded axle only when top and side telescope is ordered.



4½ INCH MODEL. No. 35.

Designed for conservation engineers and fine mountain work where extreme conditions require extra strength and rigidity to withstand a strong breeze. Recommended for use with solar attachment. See page 92.

Price, \$238.00.

Code-Word — TRISQUARE.



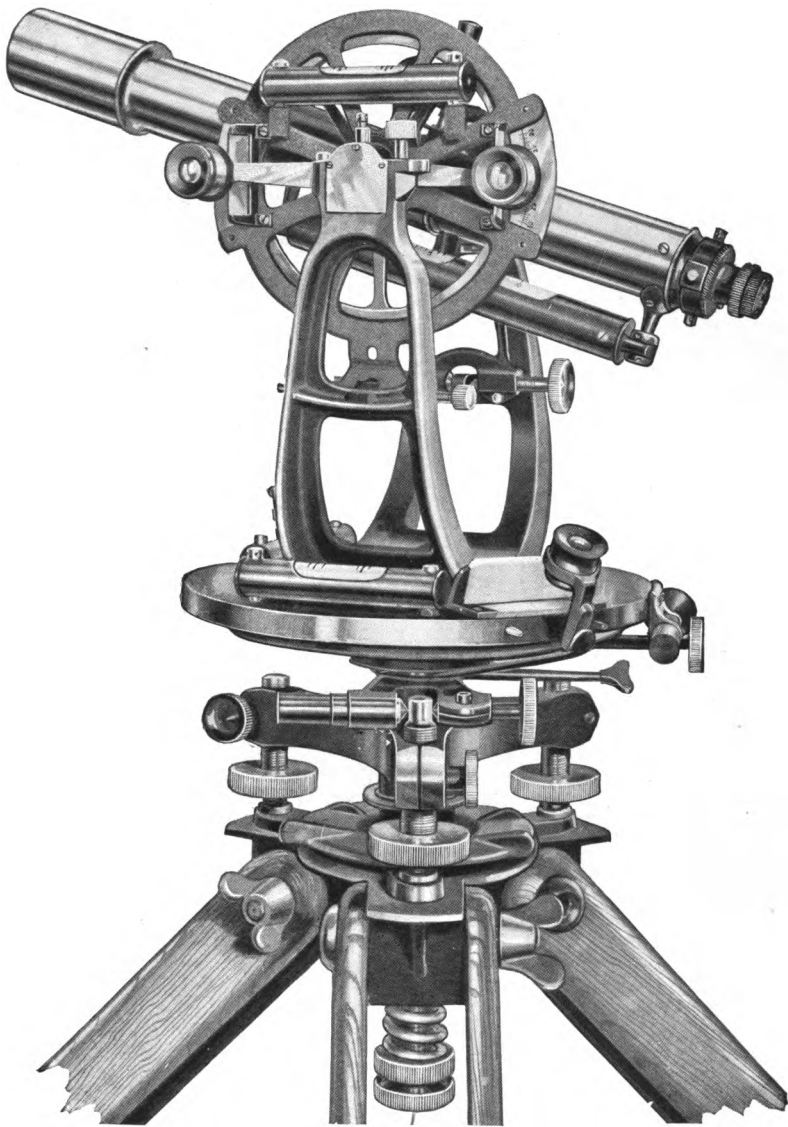
THE "BUFF" MINE TRANSIT. No. 2 H.
U-shape standards.

Price, without Compass, \$234.00.

Code-Word — TRANDALUS.

Edge Graduation, to vertical circle, made to order only	\$10.00
Double Opposite Verniers, vertical circle	20.00
Auxiliary Bubble, vertical circle	10.00
2¼ inch Compass	20.00

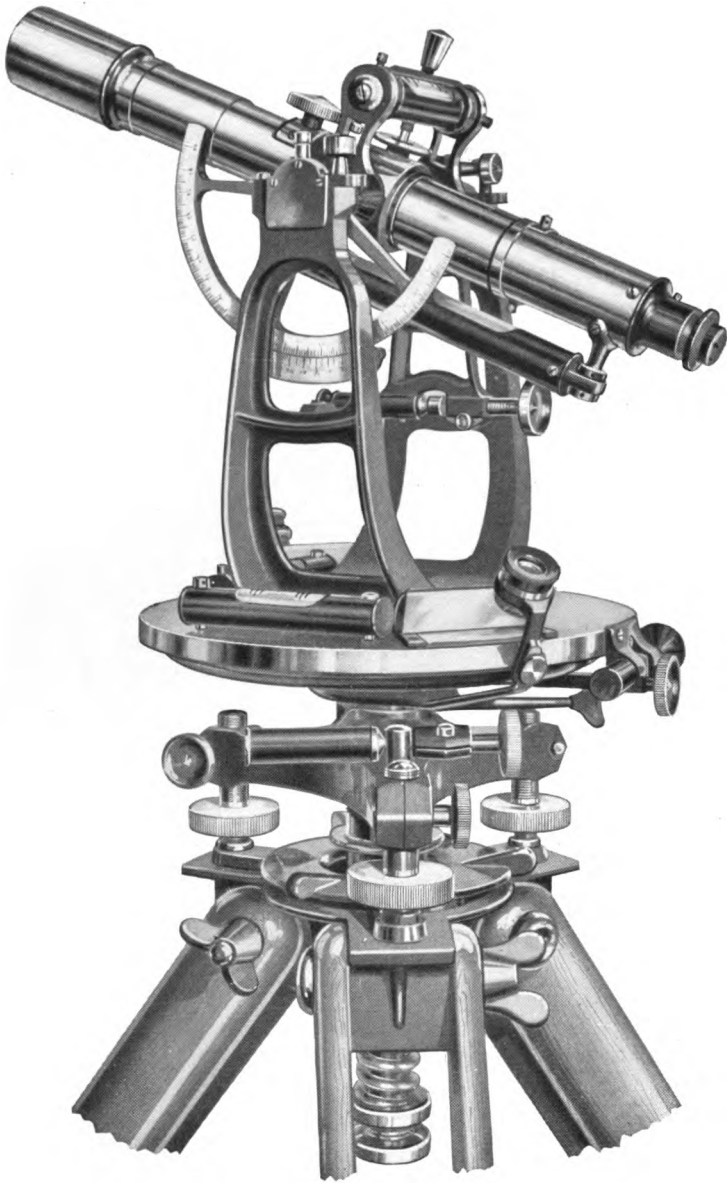
The best balanced and most consistent transit, embodying extreme compactness and graceful design.



BUFF 8 INCH TRIANGULATING THEODOLITE. No. 82.

As made for U. S. Geodetic Survey. For prices see page 63.

Base price, Theodolite, \$270.00.



"BUFF" 6¼ INCH TRIANGULATION THEODOLITE. No. 80.
Base price of Transit, \$240.00.
Code-Word — TRIANGULATE.



Triangulation Theodolites.

Designed for use in cities and triangulating.

SPECIFICATIONS FOR No. 80.

Graduation, $6\frac{1}{4}$ inches in diameter with two double opposite verniers to $30''$ and placed at 30° to line of sight. Graduations on solid silver and protected by crystal plate glass. Two rows of figures in opposite directions.

Telescope, $12\frac{1}{2}$ inch; power 29; aperture, $1\frac{1}{4}$ inch improved eye-piece. Reversible in standards and bearings, and erecting or inverting image.

Improved horizontal tangent clamps.
Four levelling screws.
Shifting center.

Finish, bright or bronze throughout.
Improved form of tripod and mahogany case.

Price for plain transit, \$240.00. ($6\frac{1}{4}''$ hor. circle.)

TABLE OF SIZES AND PRICES.

Horizontal Circle Diameter	Illustration on Page	Base Price for Plain Theodolite	Code-Word
No. 80 $6\frac{1}{4}$ inch to $30''$	62	\$240	Triangulate
No. 81 7 inch to $30''$	65	255	Triangle
No. 82 8 inch to $30''$	61	270	Triangutite
No. 83 10 inch to $30''$	66 and 67	300	Trianthodite

The BASE PRICE includes an instrument per "SPECIFICATIONS" above.

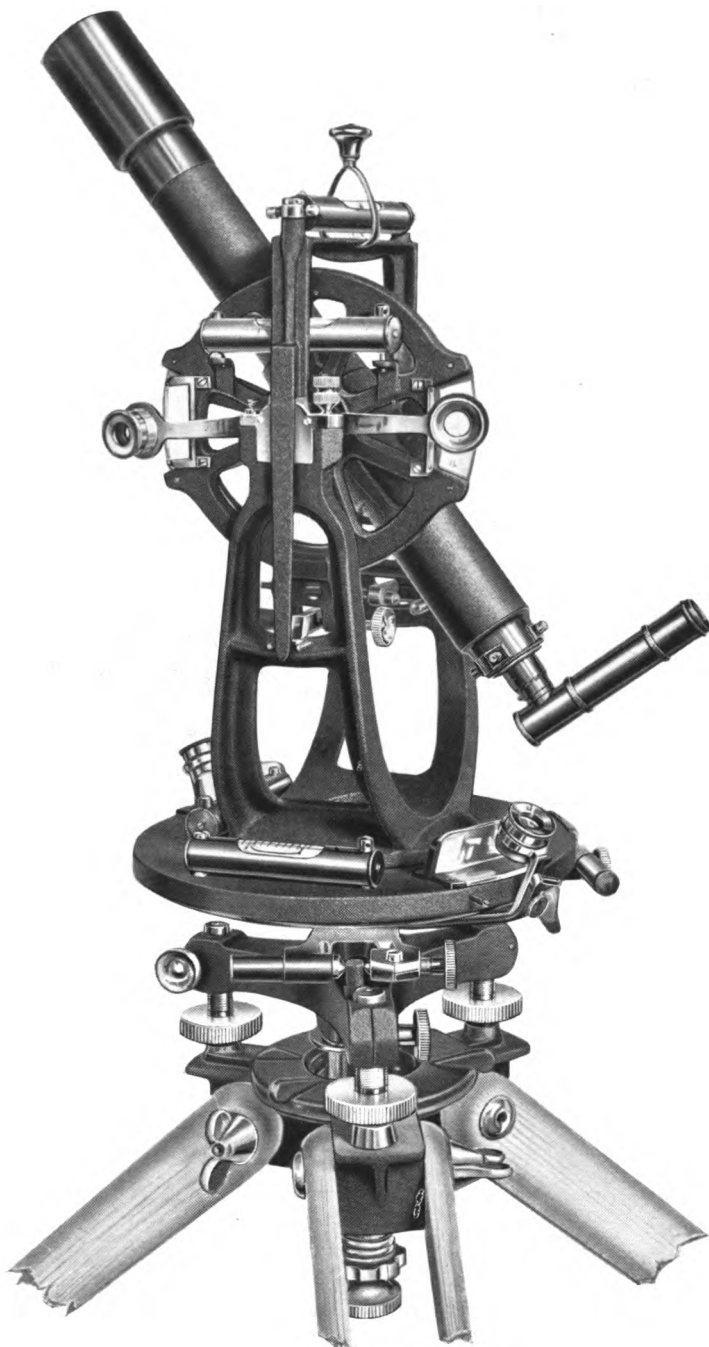
EXTRAS. (Common to all sizes.)

Inverting Image Telescopes are furnished unless Erecting is specified.

Item 1.	Larger $1\frac{3}{8}''$ Aperture Telescope, per page 61	\$8.00
" 2.	Larger $1\frac{1}{2}''$ Aperture Telescope	12.00
" 3.	Horizontal Graduation reading to $20''$	10.00
" 4.	Horizontal Graduation reading to $10''$	20.00
" 5.	Horizontal Graduation reading to $5''$	50.00
" 6.	Horizontal Reading Glasses (\$12) and Shades (\$3), per pages 61 and 62	15.00
" 7.	Vertical Reading Glasses (\$12) and Shades (\$3), per page 61	15.00
" 8.	Vertical Arc, per page 62, reading to minutes	20.00
" 9.	Vertical Arc, per page 62, reading to $30''$	25.00
" 10.	Vertical Circle reading to minutes	25.00
" 11.	Vertical Circle with Double Opposite Verniers, per page 61,—\$25 plus \$20	45.00
" 12.	Latitude Level to Vertical Circle, per page 61	10.00
" 13.	Shifting Center for Three Levelling Screw Arrangement, extra	5.00
" 14.	Striding Level, per pages 61 and 62	20.00
" 15.	$6\frac{1}{2}$ inch Spirit Level (\$17.50) and Reversible Clamp with Slow Motion Screw (\$17.50),—price for both attached to Telescope (see page 62)	35.00

When making inquiry for exact price, specify by numbers, thus: "Scandia Trianthodite with items 2, 4, 5, 8, 13, 14, 15."

(Note.— See Telegraph Code, page 123.)

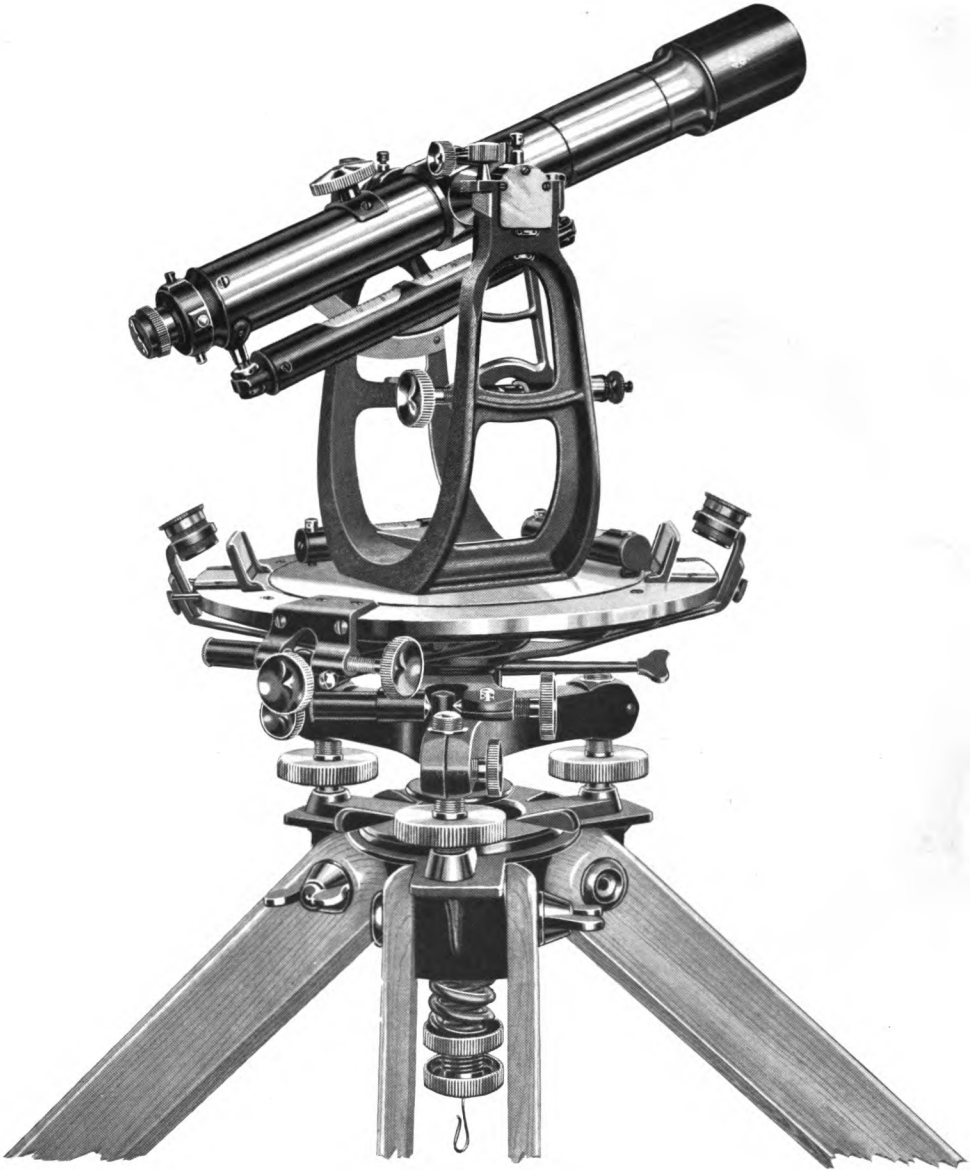


7 INCH THEODOLITE.

United States Coast Survey Model— with Complete Equipment.

Price, \$542.00.

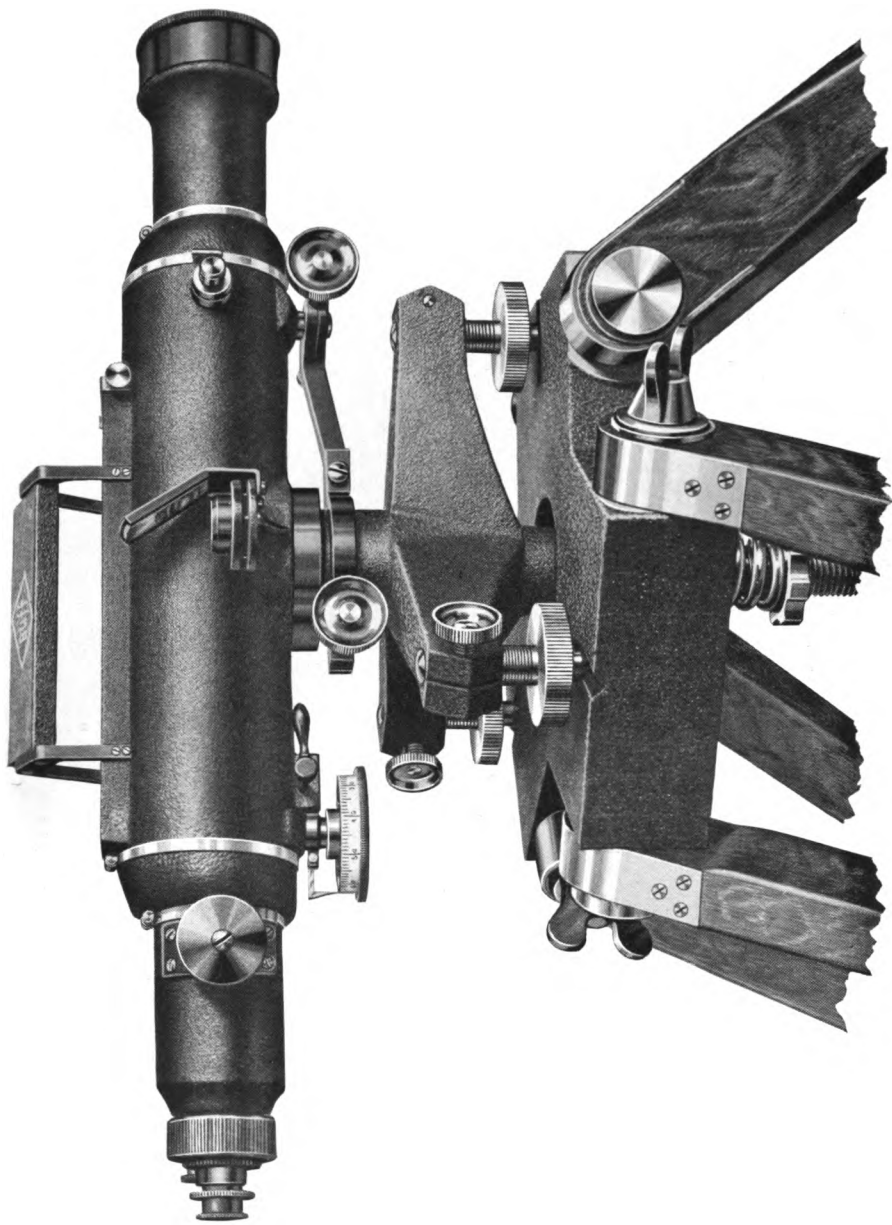
Send for Special Circular.



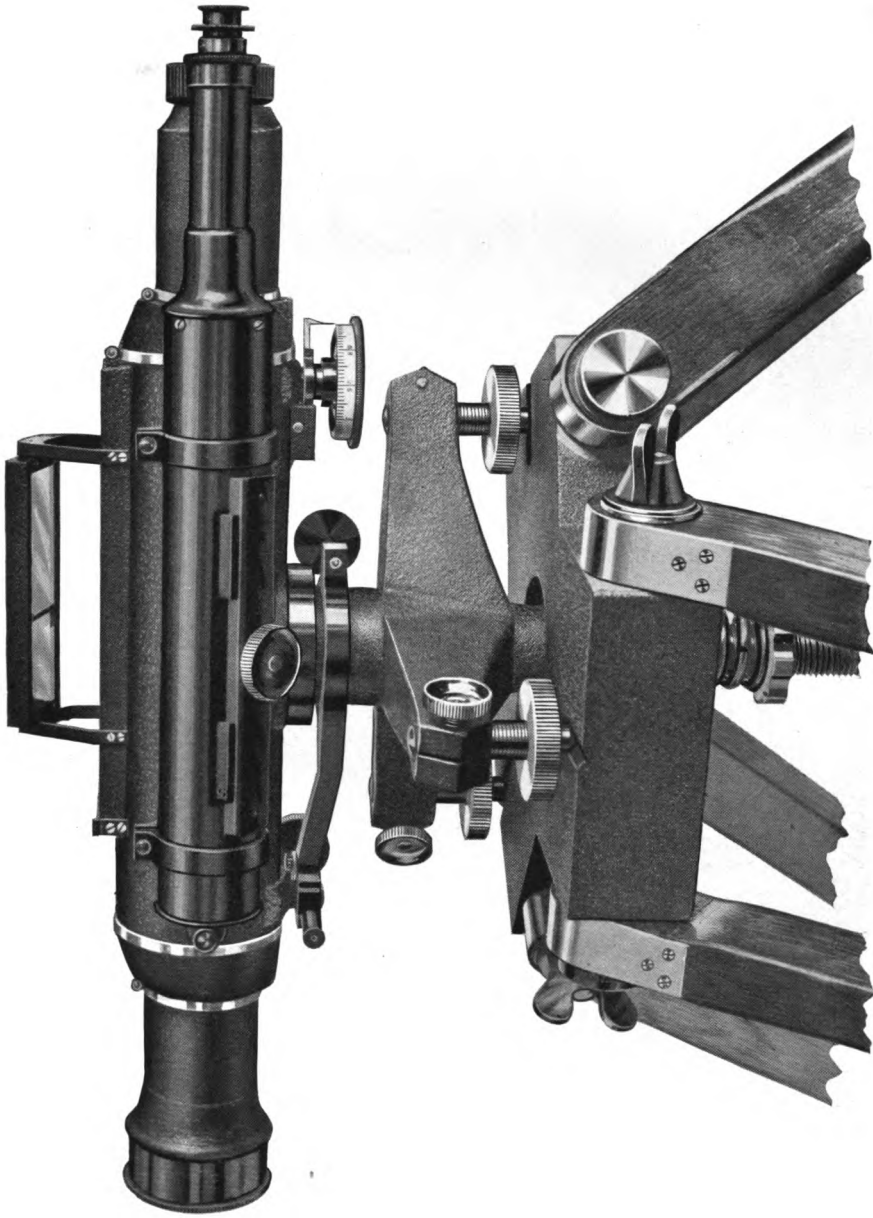
10 INCH TRIANGULATION THEODOLITE.

Base Price of Plain Theodolite, \$300.00.

Weight, 12 $\frac{3}{4}$ lbs. Detailed description on page 63.



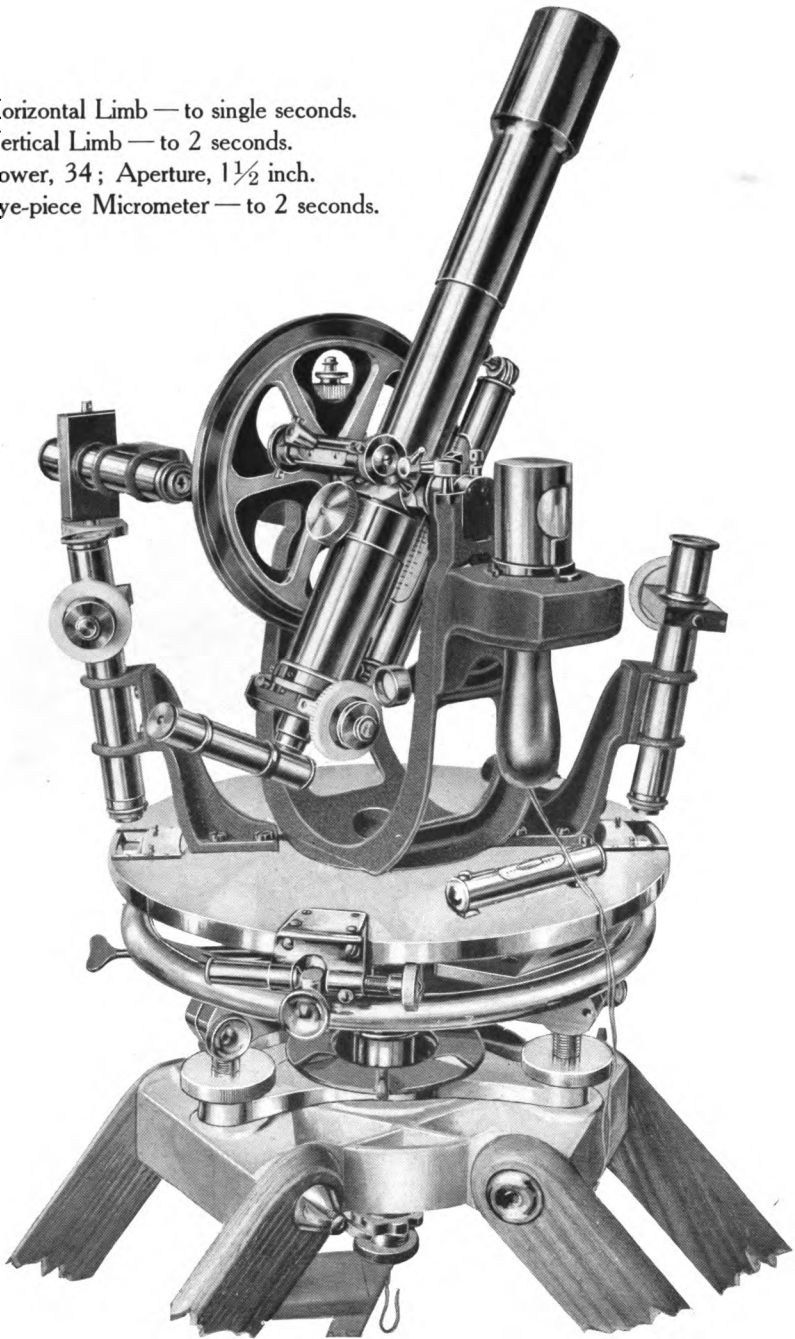
“Coast Survey Precise Level,” with complete equipment, and including Prismatic Bubble. Sighting Tube; weight of level 13 pounds; weight of tripod 20 pounds \$300.
This level is the genuine U. S. Coast and Geodetic Survey Precise Level. It is approved and accepted by that Department.



It is constructed of invar metal, and in consequence—the field results have established a remarkable record. 91 miles per month as an average speed with 250 foot sights and double set of observations and with an accuracy per mile inside of two thousandths—is regularly expected of this Level.

We supply a "Precise" Level Rod Coast Survey pattern, carefully made and guaranteed, and with complete equipment at \$50.

Horizontal Limb — to single seconds.
Vertical Limb — to 2 seconds.
Power, 34; Aperture, $1\frac{1}{2}$ inch.
Eye-piece Micrometer — to 2 seconds.



10 INCH ALT. AZIMUTH.

A complete Observatory Instrument of compact size and at moderate cost.

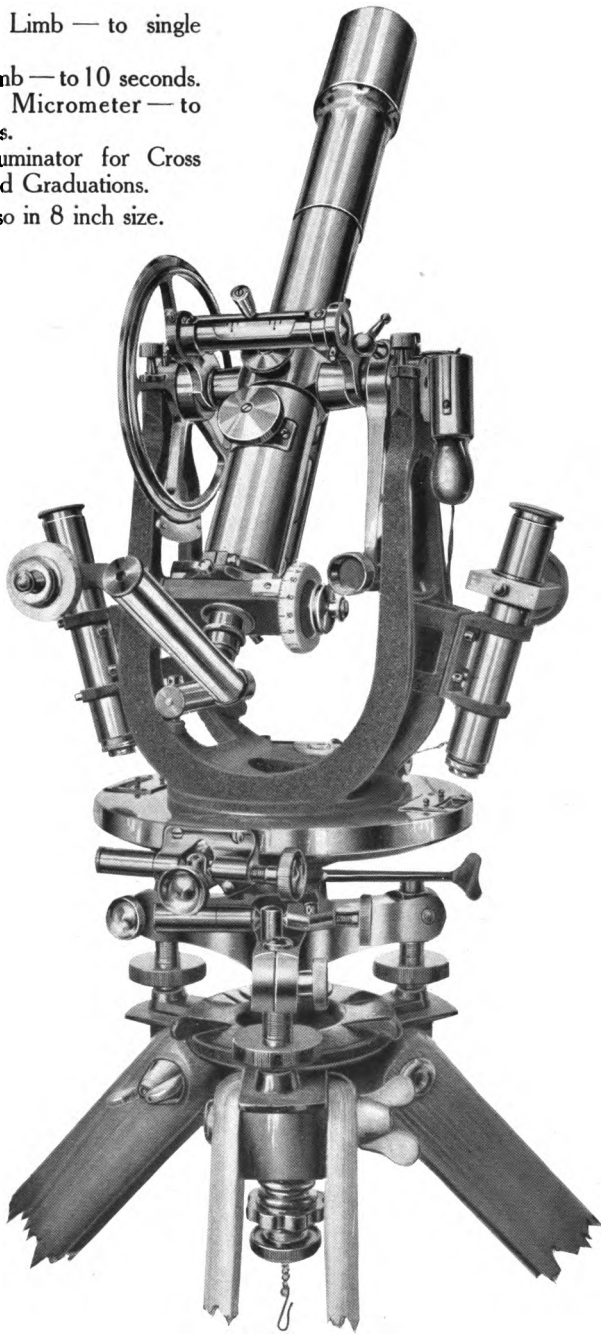
Horizontal Limb — to single seconds.

Vertical Limb — to 10 seconds.

Eye-piece Micrometer — to 2 seconds.

Electric Illuminator for Cross Wires and Graduations.

Made also in 8 inch size.



6 INCH ALT. AZIMUTH.

For College Observations.



Hydrographers' Wye Level.

The hydrographers' wye level is similar in construction to the engineers' wye level, except that three levelling screws are provided instead of four. The sensitiveness of the spirit level is somewhat increased, being from 8" to 10" for 1 div. of scale. The weight is 1 lb. more, owing to the larger form of tripod. Telescope and bubble are cloth finished. Price, complete, \$158.00.

The general preference is given to this three levelling screw instrument, because for bench levelling the bubble and the line of sight are more easily controlled. Frequently the levels have a sensitiveness of a single second of arc for a division of $\frac{1}{50}$ of an inch. We are prepared to attach our auxiliary micrometer screw to even further facilitate the ease and accuracy of manipulations. Price and description as per list.

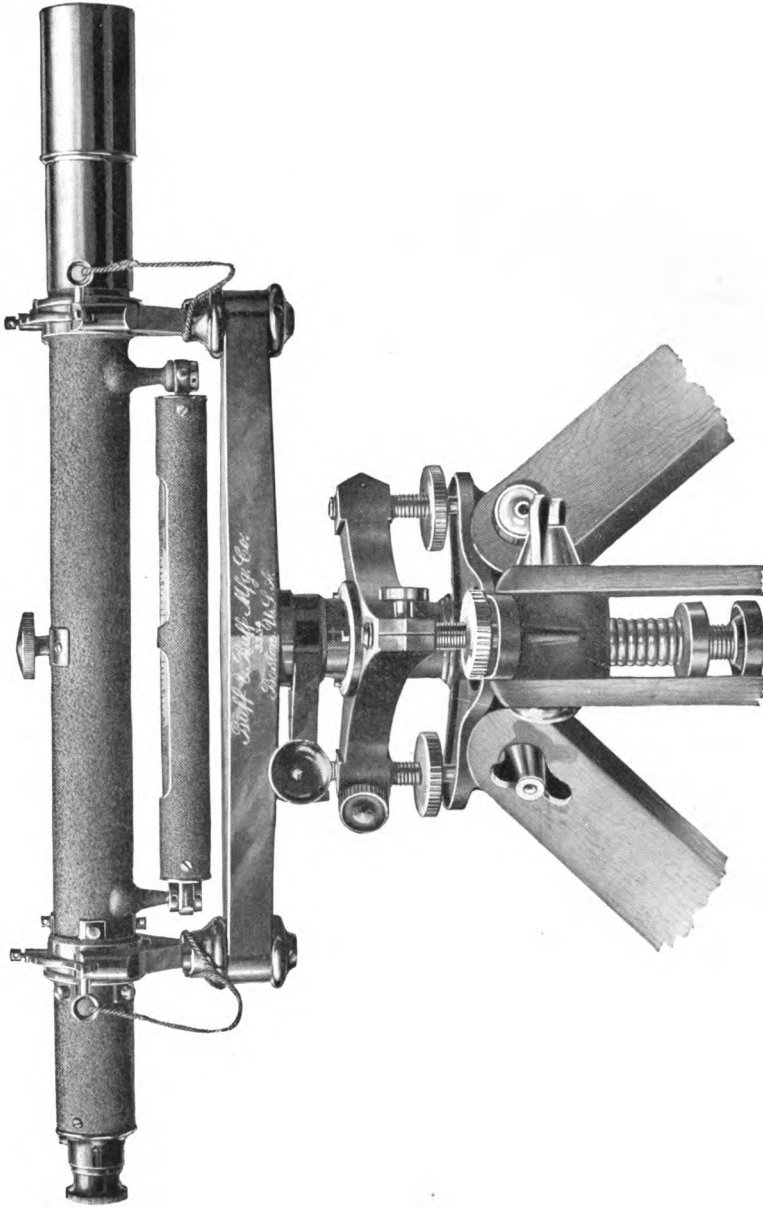
STEEL CENTER IN ANNEALED IRON.

This new adoption of the steel center in a socket of annealed iron (though an old practice in the construction of large astronomical instruments as giving the ideal non-friction and non-expansive bearing) is one that has been withheld from application to engineers' levels heretofore, because of the great expense involved in setting up the precision grinding machines necessary to fit the hardened steel center. The shop cost of making such a center for a level is greater than one of bell metal or phosphor-bronze, for the reason that the hardened steel center requires to be ground with special apparatus and consumes more time in the final fitting. It is superior, because more permanent even than the regular Buff center of bell metal, which has been so far ahead of other makes in durability.

The prime advantage, however, is in the small and equal coefficient of expansion, ensuring freedom from the errors due to atmospheric changes.

EXTRAS TO HYDROGRAPHERS' WYE LEVEL.

Hardened steel center in annealed iron	\$10.00
Hardened steel center, in phosphor-bronze	10.00
Fixed stadia wires	3.00
Metal Mirror with universal joint (see cut page 72)	10.00
Extra sun-shade with smaller aperture	1.50
Gossamer waterproof bag	1.00
Bottle of fine watch oil . . . . .	.25
Auxiliary micrometer screw (see page 72)	18.00



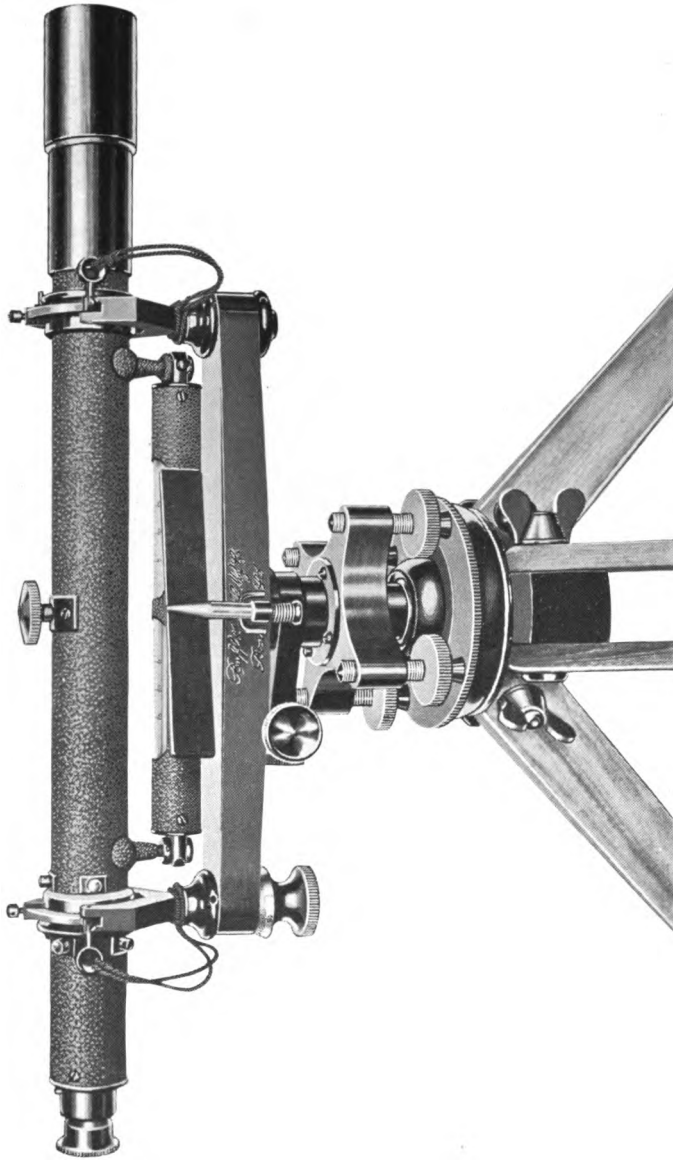
HYDROGRAPHERS' 18 INCH WYE LEVEL.

With three-leveling screw lower center.

Weight, complete, 12 lbs. Regular stiff-leg tripod, 8½ lbs.

Price, \$158.00.

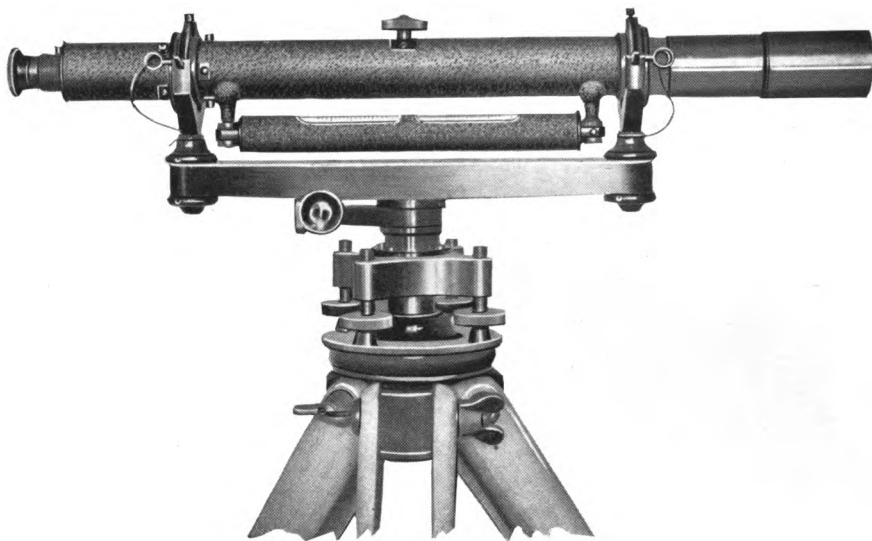
Code-Word — HYDROGRAPH. See page 123.



AUXILIARY MICROMETER-SCREW LEVEL. — PRICE, \$18.00 EXTRA. METAL MIRROR, \$10.00.

With one of the Y's movable by a graduated micrometer screw with index.

NOTE. — Besides permitting closest possible adjustment of each individual sight — without moving away from the eye-piece — the micrometer also permits instant and close correction of the height of the Wyes, constituting a most valuable feature. Our new form of entirely protected and spiral spring micrometer is original with us, and embodies features which make it entirely superior to our old form, which was also our own design.



ENGINEERS' 14½ INCH WYE LEVEL.

Code-Word—WYEING. See page 123.

Power, 28 diameters. Similar to the preceding style level and complete with box and tripod.
 Net price, \$125.00. Weight, 9½ lbs.
 Aluminum bar on this instrument reduces the weight to 8 lbs.

SPECIAL.

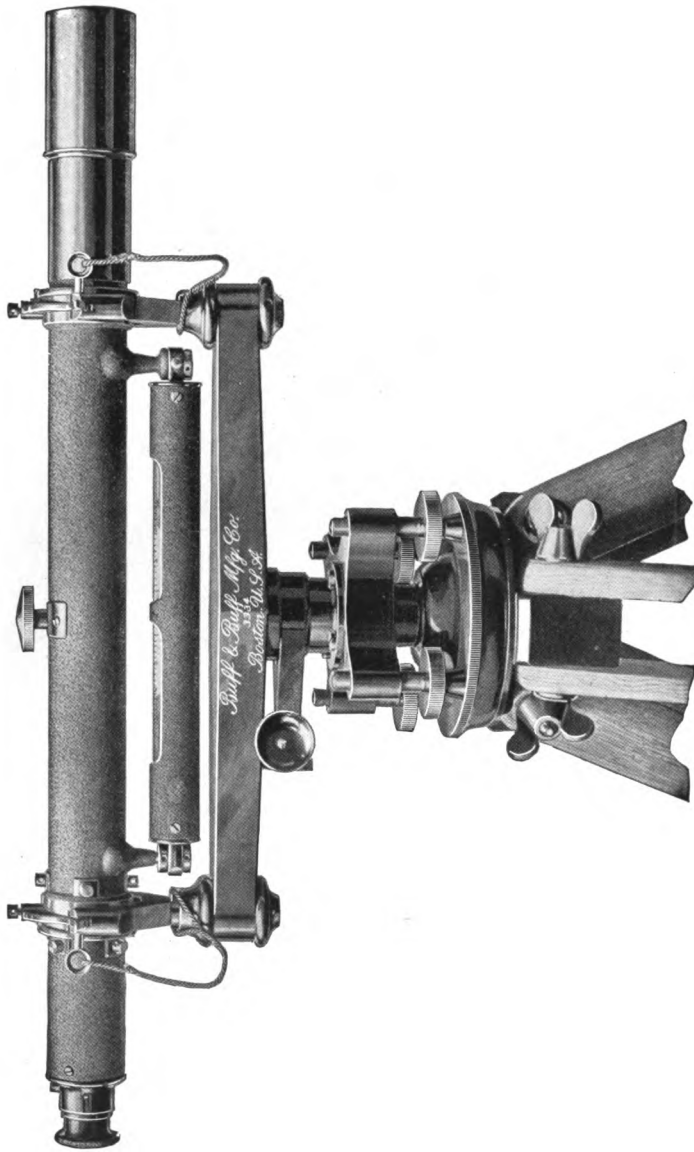
In all but one respect this level is fully the equal of its large prototype. But having a shorter telescope of less power, its sensitiveness is slightly cut down to correspond. The level bubble has the rating of 12 to 14 seconds sensitiveness.

Altogether this level is specially adapted to the closest work in mountain levelling where weight is an object, and where it is important to have a level capable of instant and accurate adjustment.

EXTRAS.

Stadia wires, fixed	\$3.00
Hardened steel center in socket of annealed iron	10.00
Extra sun-shade for use when sun's rays are too strong, having small aperture	1.50
Gossamer rubber bag, for protection against the weather	1.00
Bottle of superfine watch oil to lubricate the center . . . . .	.25

The clamp acts independent of the axis, so that it is impossible to throw the instrument out of adjustment when clamping.



ENGINEERS' 18 INCH WYE LEVEL.
Power, with erecting eye-piece, 36 diameters. Price, complete, \$140.00.
Can be supplied with 20 inch or 22 inch Telescope. Extra, \$5.00.
Code-Word—WYES. See Code, page 123.



ENGINEERS' 18-INCH WYE LEVEL.
(Power, 36 Diameters.)

Our regular 18-inch Wye Level is the longest level we make. The Precision Level, costing \$400.00, and made per specifications of the U.S. Coast and Geodetic Survey, has the same lenses and 18-inch long telescope. A longer telescope makes the element of gravity and overhang a serious consideration. The power of the 18-inch telescope is more than ample—hence no requirement is valid for greater length of telescope. Our Buff Level is constantly surprising the engineer on the remarkable results in his 6-, 10- or 15-mile circuit.

The Improved Telescope is eighteen inches long and has 1 3/8-inch objective, giving increased illumination and clearness. Protection to object slide. Erecting or inverting eye-piece gives large, flat field of view. Entire telescope and level tube are cloth finished. Phosphor-bronze contact points in wyes for the bell-metal collars. Regular bell-metal center in socket of phosphor-bronze. Line of collimation correct for all distances. Instrument finally adjusted to the finest possible accuracy with sun-shade in position and focused on mean distance. Complete in mahogany case with strap and hooks, sun-shade, wrench, screw-driver, adjusting pins, etc.

Unless otherwise ordered on this level, the sensitiveness of spirit level will be what is rated as 10 seconds to 1/10" travel on scale.

Weight of complete instrument, about 10 1/2 lbs. Tripod, 7 lbs.

Net Price, \$140.00

The best metals for surveying instruments are those which have coefficients of expansion equal to that of glass. This is important in order to retain the adjustments despite temperature changes.

Coefficient of glass per foot, for 1° Fah.	. . . . .	.00005 inch
" " steel per foot, for 1° Fah.	. . . . .	.00007 "
" " brass per foot, for 1° Fah.	. . . . .	.00012 "
" " aluminum	. . . . .	.00014 "

Steel or cast iron are nearest, and lighter and harder than brass. These metals might be adopted for the transit were it not for the compass needle. See following note for wye levels.

Note.—For the most precise uses, where a specially sensitive spirit level is specified, the steel and iron center (page 70) is strongly recommended as securing the most nearly perfect center theoretically as well as practically, and giving the ideal bearing.

EXTRAS.

Hardened steel center in phosphor-bronze socket	. . . . .	\$10.00
Hardened steel center in annealed iron	. . . . .	10.00
Fixed stadia wires	. . . . .	3.00
Extra sun-shade having aperture for use when the light is too bright for accurate work	. . . . .	1.50
Metal mirror, to read bubble without moving from eye-piece, silver-plated arms and jointed	. . . . .	10.00
Waterproof bag of rubber to protect the level from rain	. . . . .	1.00
Bottle of superfine watch oil to lubricate the centers	. . . . .	.25



Engineers' Dumpy Level

As equally accurate work can be done with a dumpy level of our improved make as with the regular Wye level, since the same sensitiveness of level bubble is put into this instrument and the same objective of the same focus and diameter, giving the same power of 32 diameters.

Particularly on work of a roughing-out nature, where liability to slight knocks is present that would seriously injure a Wye level, the possibilities of a compact dumpy level are at its best.

An engineer certainly can perform as close work with this level — and yet feel sure that his adjustments once made will keep so indefinitely.

The entire instrument is cloth finished above the levelling screws, including telescope and bubble.

The centers are of the regular type that we put into transits, being the hardest bell metal in phosphor-bronze, and most carefully fitted to a true bearing shoulder. A clamp screw for center is also provided.

The instrument is packed in a mahogany case, with sun-shade, screw-driver, wrench and adjusting pin.

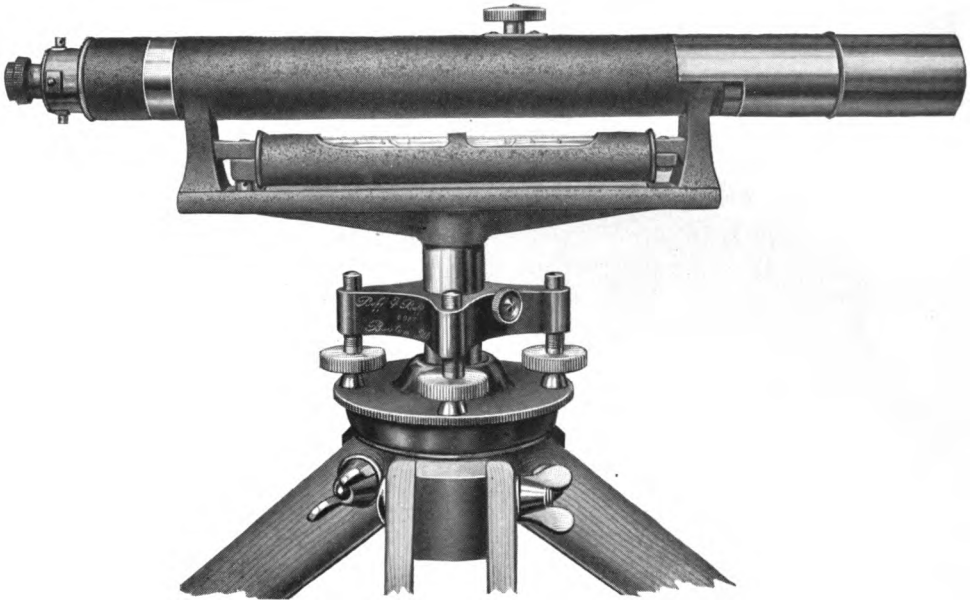
Weight of level, complete, $9\frac{1}{2}$ lbs.

Weight of tripod, regular type, 7 lbs.

Price, complete as above, \$100.00.

EXTRAS.

Stadia wires, fixed	\$3.00
Rubber cover of heavy sheeting, for protection against rain and the weather	1.00
Bottle of superfine watch oil to lubricate the center . . . . .	.25
Instrument provided with clamp and tangent screw (see page 74 for same style clamp fixed below bar of wye level)	11.50



ENGINEERS' 15½ INCH DUMPY LEVEL.

(Inverting Eye-Piece.)

Focussing screw placed on top. Protection to object-slide. Improved form of telescope barrel casting, of phosphor-bronze, ensuring great stability.

Center and lower bar of a single bell-metal casting, obtain utmost strength and permanency of adjustment.

Power, as above, 36 diameters. (Inverting eye-piece, as per cut, completes our most ideal lens system.) (For erecting eye-piece see next page.)

Price, with tripod and mahogany case, \$100.00. (For extras see page 76.)

Code-Word — DUMPUS.



ENGINEERS' 16½ INCH DUMPY LEVEL.

(Erecting Eye-Piece.)

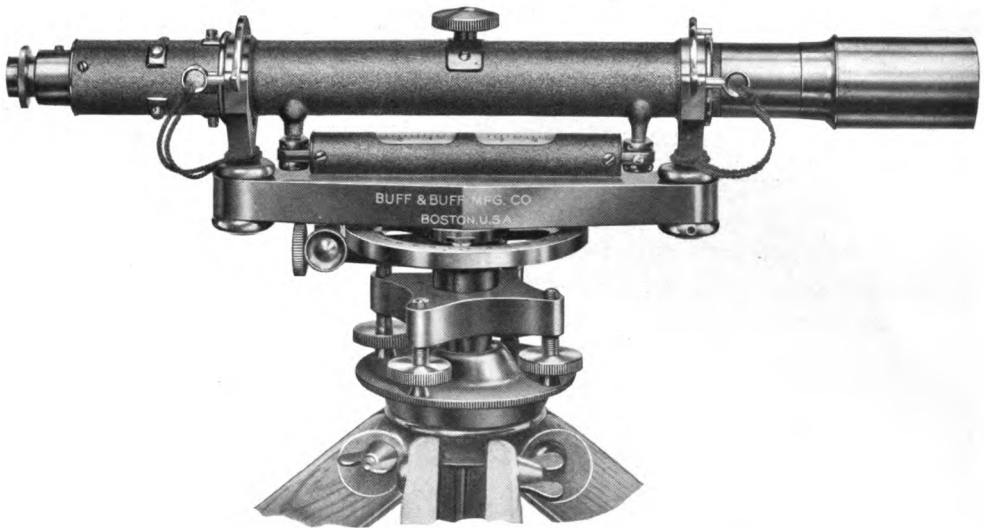
Remodelled design for cloth-finish posts, procuring maximum rigidity with least weight and graceful appearance. Recalculated lens system, obtaining sharply defined brilliant field.

Clamp screw to fix position of telescope.

With erecting eye-piece ; power, 32 diameters.

Price, with tripod and mahogany case, \$100.00. (For extras see page 76.)

Code-Word — DUMPAT.



14 INCH ENGINEERS' LEVEL. No. 20. \$75.00.

Power, 32 Diameters.

Believing emphatically that the time has come when mechanical engineers, architects and contractors are doing better and more accurate work, and consequently are requiring a more accurate levelling instrument, we have spent a considerable period in thoroughly perfecting a small wye level of extraordinary accuracy, both strong and durable, and at about one-half the cost of our regular 18 inch level.

"The recollection of quality remains long after price is forgotten."

SPECIFICATIONS.

14 inch length of telescope — with power of 32.

20 second bubble — permitting accurate reading to thousandths of a foot at 400 feet.

4 inch horizontal circle to single minutes.

Weight, $6\frac{1}{4}$ lbs.

Weight of Tripod, 6 lbs. Extension Tripod, extra, \$3.00.

Improved telescope affords increased illumination and clearness. Protection to object slide. Erect eye-piece gives large, flat field of view. Phosphor-bronze contact points in wyes and bell-metal collars. Ground bell-metal center in socket of phosphor-bronze. Line of collimation guaranteed correct for all distances. Instruments finely adjusted for instant field use with sun-shade in position. Complete in mahogany case with strap, hooks, sun-shade, wrench, screw-driver, adjusting pins, etc. Entire telescope and level are regularly cloth finished.

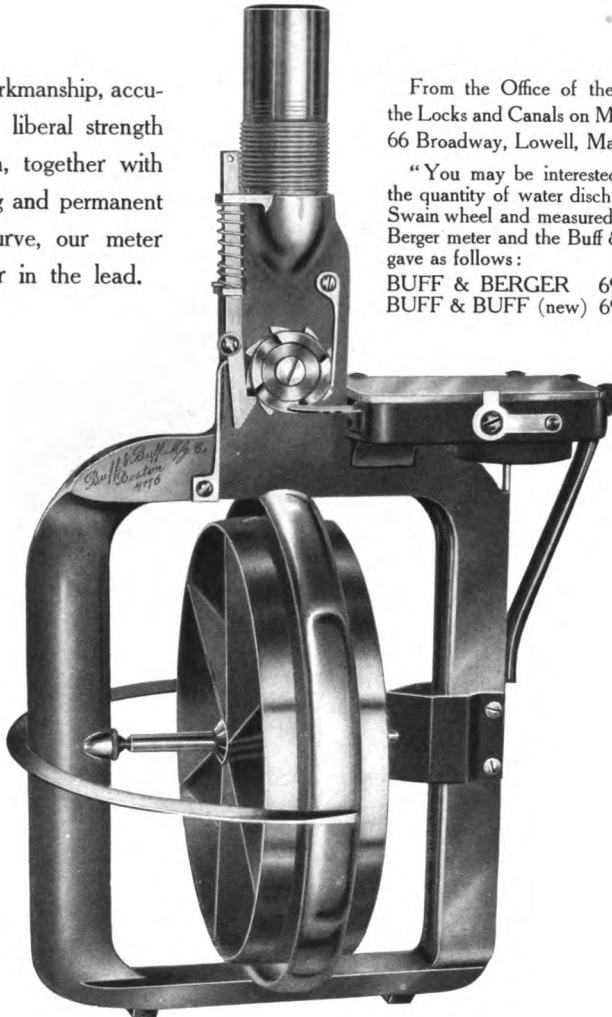


In workmanship, accuracy and liberal strength of design, together with unvarying and permanent rating curve, our meter stands far in the lead.

From the Office of the Proprietors of the Locks and Canals on Merrimack River, 66 Broadway, Lowell, Mass.:

"You may be interested to know that the quantity of water discharged by a 48" Swain wheel and measured by our Buff & Berger meter and the Buff & Buff you sent gave as follows:

BUFF & BERGER 69.21 c. f. p. s.
BUFF & BUFF (new) 69.31 c. f. p. s."

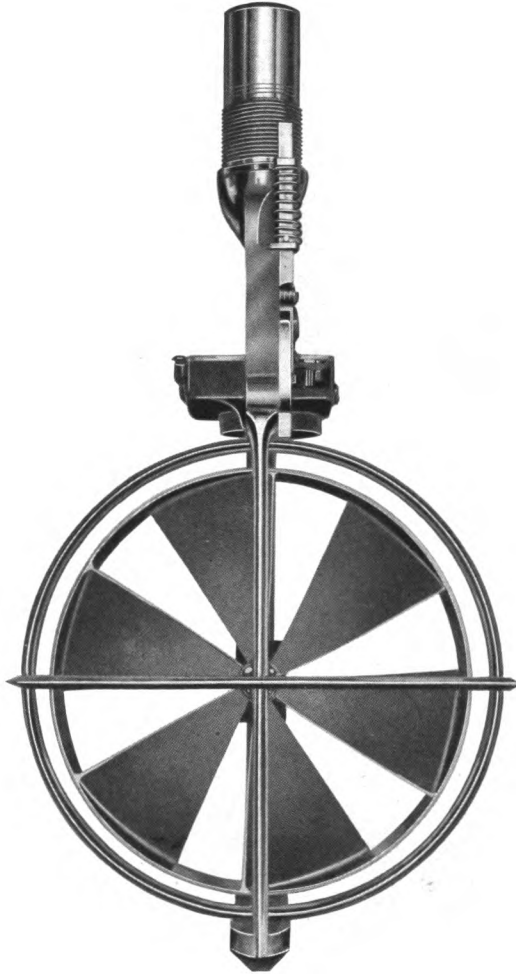


METER. No. 8.

(Side View.)

5 inch Wheel. Extreme Strength. Bevelled Edge. Sharp Guard Over Wheel.

Price, \$151.00.



METER. No. 8.

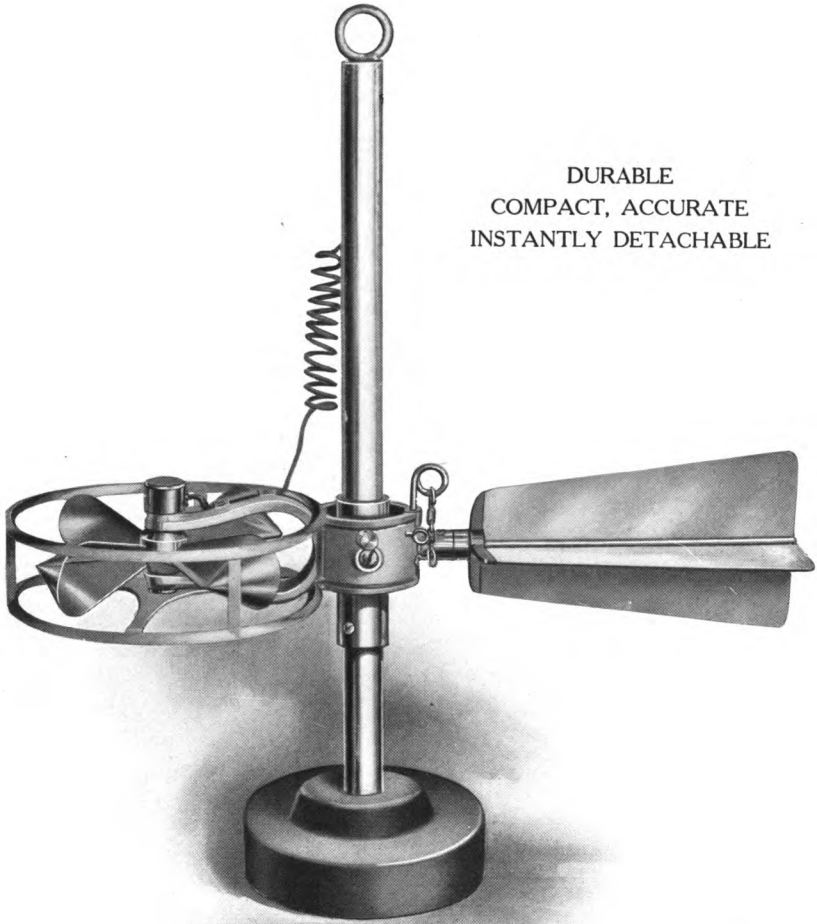
(End View.)

Vanes without a rim are not good practice for a meter used for flume measurements.

1. Theoretical Vanes — fixed in permanent position — assure reliable results. Begins to record at velocity of only $\frac{1}{10}$ of a foot per second. Recording mechanism works well at $\frac{2}{10}$ of a foot per second.
2. Flat sharp edges to cut water and avoid eddies.
3. All joints pinned and also solidly welded.
4. Iridium Bearings. All mechanism completely enclosed.

Price, No. 8 Meter, \$151.00.

For accessories see page 84.



DURABLE
COMPACT, ACCURATE
INSTANTLY DETACHABLE

GEN. ELLIS CURRENT-METER. No. 4.

Price, \$80.00.

Weight and Rod, etc., \$15.00.

This meter is of new and improved design and construction and is principally intended for deeper river and sea work. With 6 inch wheel. Its friction load is extremely light.



Current-Meters.

Several types of Current-Meters — both electrical and mechanical registering, as made by us in the past — have been to special order only. Since they have seldom been made again we have removed the cuts of them from this catalogue. The two more general forms are outlined below.

No. 4. Current-Meter with electrical register, after Gen. Ellis, embraces a meter applicable to deep-river measurements. (See page 82.)

No. 8. Current-Meter, after Arthur T. Safford. (See pages 80 and 81.)

For field manipulation of Current-Meters and instructions regarding rating of same see Chapter 14 of the 504-page "Treatise on Hydraulics," by Hughes and Safford, published by the Macmillan Company of New York in 1911.

This book we recommend as authoritative, and most carefully compiled.



ELECTRIC REGISTER.

Electric register for all our Current-Meters. Price, \$50.00. (Illustration above.)

Will register to 1,000 revolutions per minute, per special test.

With stop watch, \$7.50 extra.



Fteley & Stearns Meter, No. 8.

This meter was especially designed for observation upon rivers, streams, conduits, etc. The registering apparatus is mechanical, but for lengthy observation we equip it with electric counter. The wheels and mechanism are protected from all obstruction, and are completely encased. The operating cam is thrown in and out of gear by a string, alternate pulls engaging and disengaging the counting wheels.

The electrical connection is made by insulated cable to the commutator of the register wheel. The brush is of fine platinum wire and can be set so as to record whole or half revolutions.

Price of Meter No. 5, with complete recording mechanism, as shown in cut, with 12 feet of brass tubing in sections made to screw together, all complete in mahogany case, \$150.00. No. 8 Meter with rods, \$168.50.

EXTRAS.

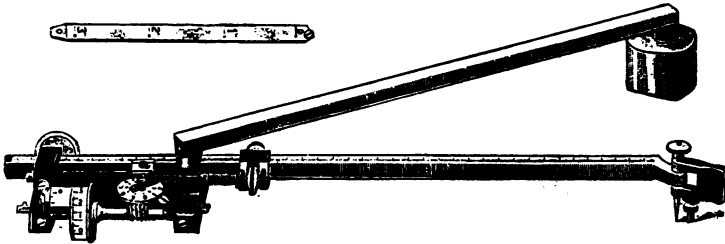
Price of electric counter reading to 999,999, with switch	\$50.00
Three dry cell battery in box with lock and strap	4.00
Three wet cell battery in box with lock and strap	7.00
Insulated copper wire for battery, double conductor under one cover, per foot . . . . .	.05
Brass tubing graduated to feet and tenths, and jointed in 4-foot lengths, per length	5.00
12 feet of brass tubing in three sections to screw together and with pin lock, all in case	17.50

The use of a good Current-Meter ensures the accuracy of results so important in conduit and river measurements, and our Fteley & Stearns meter is of the highest grade and guaranteed accurate.



Precision Planimeter.

Improved compensating construction of German silver and bronzed brass.



This compensating Planimeter is of new and modern construction, with adjustable tracer arm, fully guaranteed.

New form of pole weight,—testing rule, and fully rated and provided with table and settings, for standard U.S. measure. Morocco case and complete directions. Price complete, \$36.00.

The tracer arm is fully graduated to admit of finest possible settings so that allowance can be made in shrinkage in drawings. Index marks are also provided for standard settings in U.S. and metric measure. All parts of the planimeter are adjustable and provided with hardened steel screws, so that instrumental errors can be corrected.

The new construction of the ball joint gives the tracer-arm a motion of 180° both ways. The range of this instrument is therefore far greater than that of the usual planimeter, which has but 90° motion each way. With this planimeter too, all instrumental errors can be compensated by taking the mean of the measurements obtained with the pole on the left and with the pole on the right side of the tracer-arm.

The tracing point and the pole have both been improved upon—their construction can be clearly seen in the cut.

As these instruments will give not only the area of any figure, but also any multiple of such area and the sum of any number at one operation, they may be used to very great advantage in the calculation of cubical contents.

An original treatise by the maker for manipulating the planimeter is furnished gratis with each instrument.

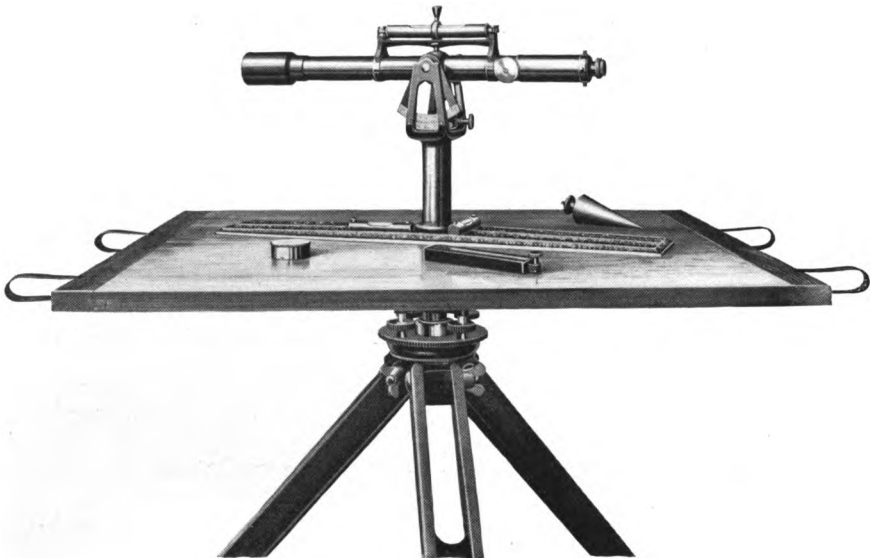
Although until recently somewhat neglected, this instrument has now received the general recognition that its design merits. This is clearly due to the accurate graduations and thorough workmanship now employed, and also to the careful instructions furnished with each instrument.

For cross-section and earthwork of all kinds, the saving of time in obtaining areas of cubic contents in inches, millimeters or acres, makes it indispensable to every engineering office.

For the most accurate measuring of indicator cards, this instrument is also especially adapted and recommended to the mechanical engineer. Price, \$36.00.

The "Buff" Plane Tables.

		Page	
Made in three sizes	{	No. 1, 16 inch Telescope Alidade only \$145.00	86
		No. 2, 12 " " " " 90.00	88
		No. 3, 8 " " " " 85.00	89



No. 1. 16 inch Inverting Telescope, 22 inch ruler with stadia	\$145.00
24 x 30 Drawing Board and all fasteners	12.00
Tripod and movement complete, Johnson quick-levelling head	35.00

When strength is combined with lightness in a Plane Table its field of usefulness is almost unlimited. When once acquainted with its general utility no other instrument can fill its place, and many problems in economic surveying can be solved by it.

Few engineers outside government circles have given much attention to the Plane Table, but for topography of every class, river and water works survey, in the design of sewerage systems and for all preliminary surveys it has no equal for speed, economy, and general effectiveness. For accomplishing desired results with the least expenditure the Plane Table is worthy the attention of all who have not yet made its acquaintance.

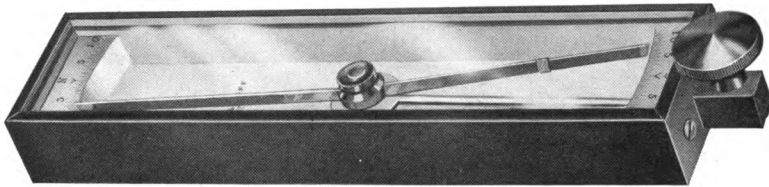
For information surveys the Plane Table is the best instrument to use.

The Telescope Alidade No. 1.

Its Construction.

The telescope is the best and most powerful for such work. It has a focal length of 16 inches and aperture of $1\frac{3}{8}$ inch with power of 35. It is equipped with stadia wires accurately set 1' in 100' and has a vertical arc of 5 inch radius with graduations on edge and read by vernier to single minutes placed so as to be read from eye end. The striding level is long and especially sensitive. The levelling bubbles are fixed to standard and ruler. The latter is arranged in skeleton form 22 inches long and with fiducial edge true and accurate. Lines can be ruled in the vertical plane of collimation. The adjustment of the line of collimation is made by reversing telescope laterally in its bearings.

Workmanship is of our highest grade, and finish is bright throughout. Price of alidade complete, \$145.00.



$\frac{3}{4}$ Size.

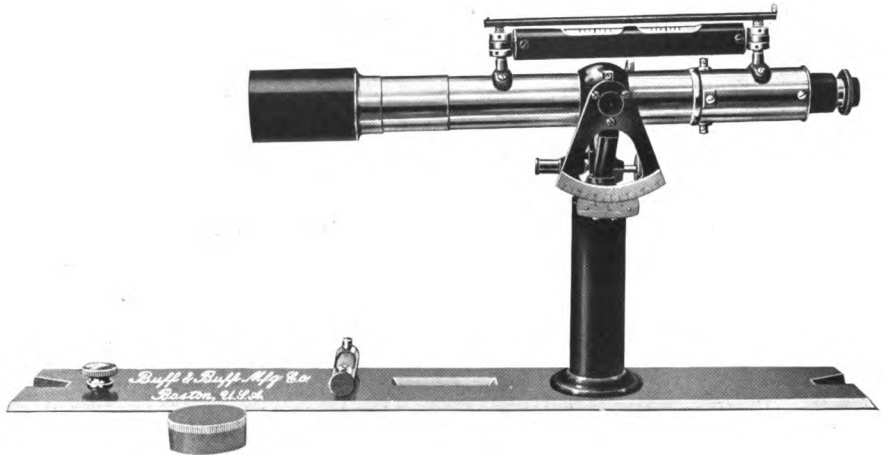
Plane Table Box Compass, \$20.00 extra.

THE TRIPOD AND MOVEMENT AND BOARD.

The method of levelling is instantaneous, and the board revolves in a horizontal ring bearing. All movement is clamped securely by but one wing nut of ample size. There is no tangent screw for slow motion, as table can be accurately set by hand employing the further edges of the board.

The entire movement, complete with legs, weighs a pound more than the regular tripod for a transit. The price complete of tripod and movement, including quick levelling arrangement, is \$45.00. Price of extra large tripod and movement (weight 19 pounds), \$70.00. Tangent and slow motion screw, \$18.00. See next page.

Weights:—Alidade with 16" telescope, in mahogany case . . . 7 lbs.
Lower levelling head and movement complete . . . $11\frac{1}{4}$ lbs.
24 x 30 plane table drawing board 3 lbs.



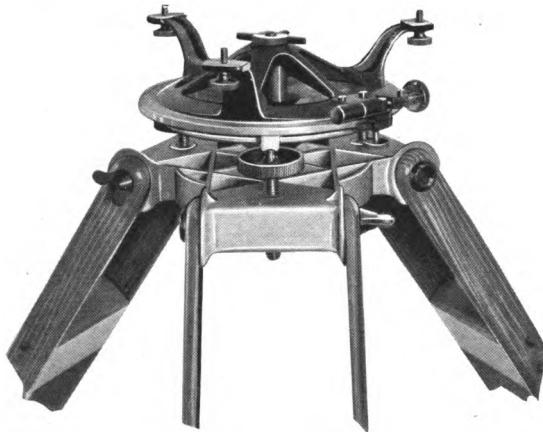
“Buff” Plane Table No. 2.

SPECIFICATIONS.

12" Telescope, Power 22, 18" Ruler	\$90.00
Quick Levelling Head	45.00
Drawing Board, 18" x 24", with fasteners	6.00

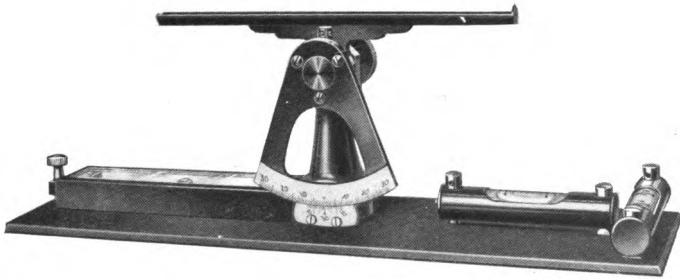
This complete instrument, in mahogany case, is an especially accurate one. Its weight is low, and it is designed throughout according to best and latest construction.

It conforms in every detail to the No. 1 size, which represents the perfection of accuracy and workmanship.



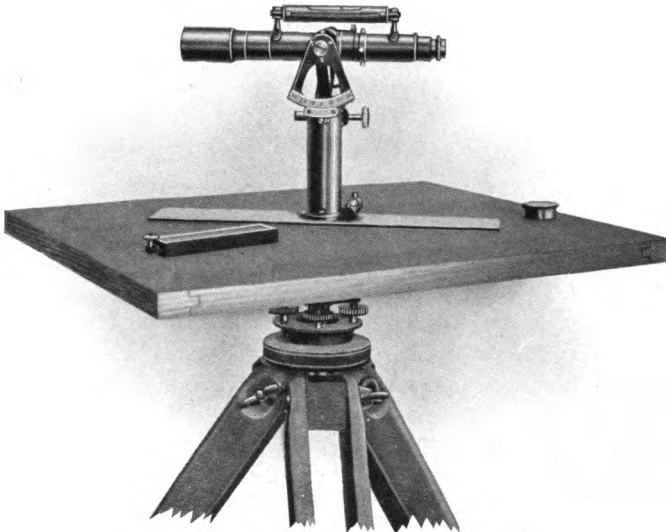
LARGE PLANE TABLE MOVEMENT, 1/6 SIZE.

Diameter of Support, 9 1/4"; Weight, 19 pounds	Price, \$70.00
Tangent and Slow Motion Screw (extra)	" 18.00
Plane Table Drawing Board, 24 x 30, with fasteners	" 12.00
Johnson Plane Table Movement	" 35.00



10 inch ALIDADE with Rifle Sights.

Base, 10 inches by 3 inches wide; Improved Rifle Sights permit accuracy equal to small telescope, permit rapid working; 2 Sensitive Plate Bubbles; Box Compass; 5 inch Radius Vertical Arc with Vernier Reading to minutes; Improved Mount and Thumb-Screw. Net complete, \$48.00.



"BUFF" PLANE TABLE. No. 3.

SPECIFICATIONS.

8" Erecting Telescope, 12" Ruler	\$85.00
Drawing Board, 15" x 18", with fasteners	6.00
Tripod and Quick Levelling Head	35.00

This complete Plane Table is of moderate cost, but of our regular accuracy of workmanship. It is strong and light in weight.



Our 1903 Graduating Engine.

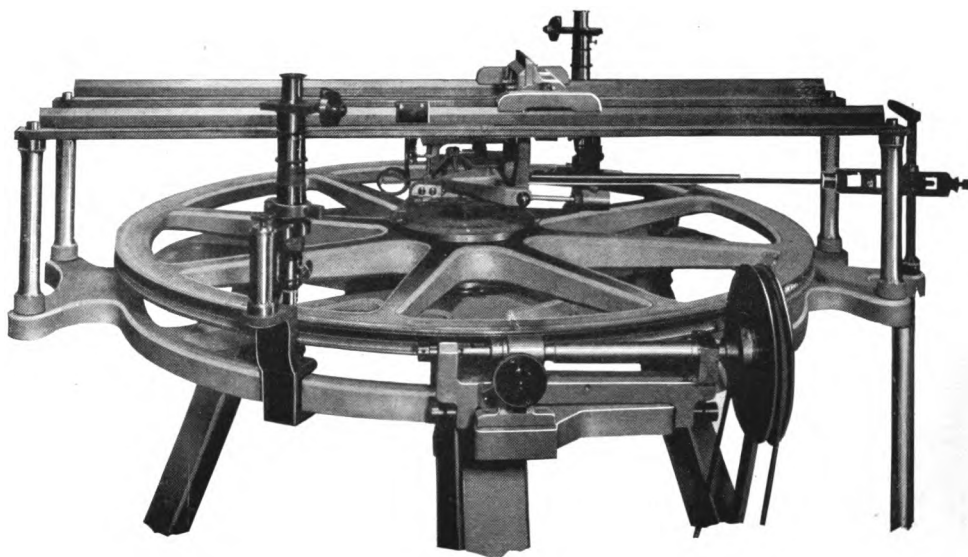
Our latest and fourth addition to our graduating engines is also the largest in our shops, being 39 inches in diameter. This engine has been in process of construction for many years, and was primarily intended for the graduating of meridian circles of larger size. It is, however, in active use now on all our regular graduating work, owing to the large increase in our regular business.

Our graduations on each transit sent out are guaranteed absolutely accurate within $1\frac{1}{2}$ seconds of arc (being the equal of $\frac{1}{34000}$ part of an inch). Graduations which are tested and tried and have withstood repeated examinations by experts of wide recognition are certainly worth having on an engineer's transit.

Our latest graduating engine has been the life work of our Mr. Geo. L. Buff in its design of temperature compensating details. Its accurate work on each transit sent out is due to the finest precise workmanship of the present day.

Capacity, 48 inch meridian circle.

The proof of any instrument is in its record of tasks achieved where others have tried and failed.



1. Isolated location—Separate Structure.
2. 3-Point Support.
3. Water Table Foundations.
4. 1 inch Rubber Pads—chemically treated—as a last vibration absorbent.
5. Dust-proof.
6. Light-proof.
7. Heat regulated by thermo-stat to within $\frac{1}{2}^{\circ}$ Fah.
8. Artificial illumination only.

When the foundation work is right,—then each transit can be built right.

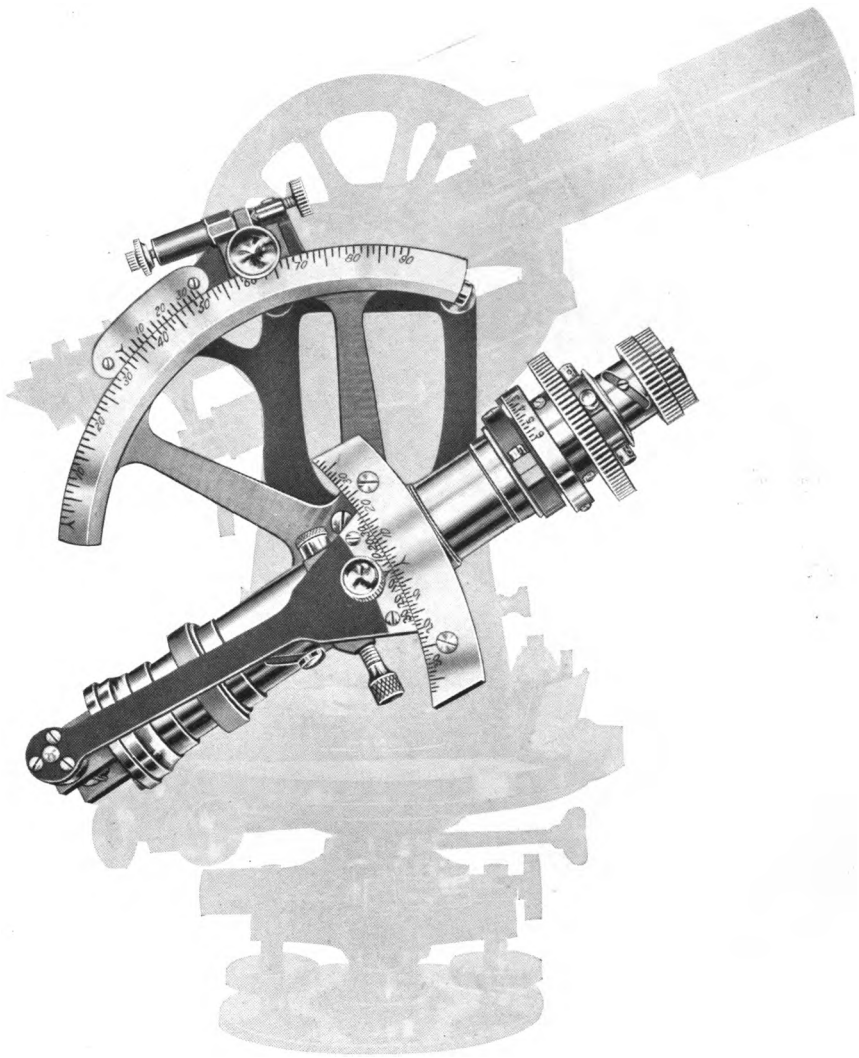


BUFF SOLAR TRANSIT. No. 22.

As made for General Land Office. As made for Forest Service.

Transit No. 35	\$238.00
Solar No. 2	125.00
	<u>\$363.00</u>

Particularly designed for the most accurate and rapid determination of the meridian.

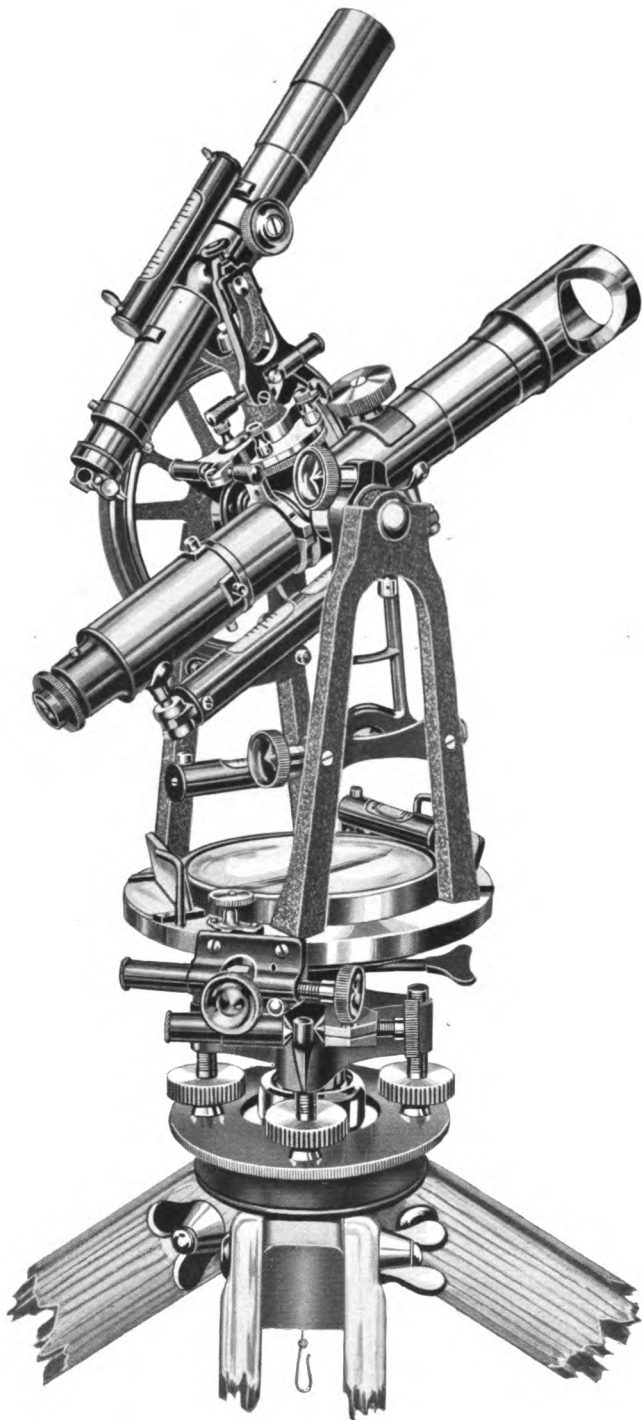


BUFF SOLAR ATTACHMENT. No. 2.

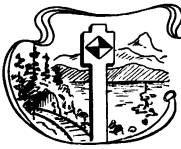
With counterpoise and complete instructions, \$125.00.

This solar attachment performs its work instantly. Including time for setting up, the meridian is determined inside of three minutes actual time and the limit of error may be kept within 1'.

This instrument is developed to the highest possible degree.



THE BUFF MINE TRANSIT. No. 2 M.
With solar No. 1, complete, \$284.00.



BUFF & BUFF MFG Co
BOSTON



THE "BUFF" PRECISE SOLAR ATTACHMENT. No. 1.

Removably attached to top of axle.

(Originally designed by Supt. U. S. Coast and Geodetic Survey.)

Our Solar Attachment is made of aluminum-bronze, with a long inner center of bell metal.

Its advantages are briefly:

1. Greater accuracy than others, due to —
 - (a) More powerful telescope.
 - (b) Direct observation and greater ease in bisecting.
 - (c) Larger base, providing additional stability and practically eliminating any change in adjustment.
2. Simplicity of manipulation.
3. Its use as a vertical sighting telescope.
4. Its light weight of but $9\frac{1}{4}$ oz. requires no counterpoise (thus eliminating about two lbs. extra weight), which is only a drag and wear on the bearings of main transit.

These Solars are used by all the best and most progressive engineers in the United States. Price, complete with prism, \$50.00.



Buff Solar Attachment. No. 1.

The Buff Solar attachment is attached to our instruments at the net price of \$50.00.

This solar attachment is made of aluminum and its advantages are several:—1st. Accuracy greater than that of others; 2d. Simplicity of manipulation.

We can attach this solar to old instruments of our make at slight cost.

It consists essentially of a small telescope and level, the telescope being mounted in standards, in which it can be elevated or depressed. The standard revolves around an axis, called the polar axis, which is fastened to the telescope axis of the transit instrument. The telescope called the "Solar Telescope" can thus be moved in altitude and azimuth. Two pointers attached to the telescope to set the instrument approximately are so adjusted that when the shadow of one is thrown on the other the sun will appear on the field of view.

DIRECTIONS FOR USING THE ATTACHMENT.

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

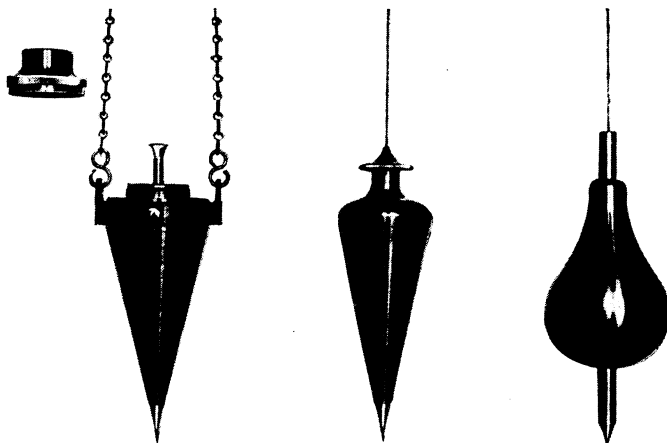
Second. Without disturbing the relative positions of the two telescopes, incline them and set the vernier, to the co-latitude of the place.

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

The vertical axis of the "Solar Attachment" will then point to the pole, the apparatus being, in fact, a small equatorial.

PLUMB-BOBS AND PLUMMET LAMPS.

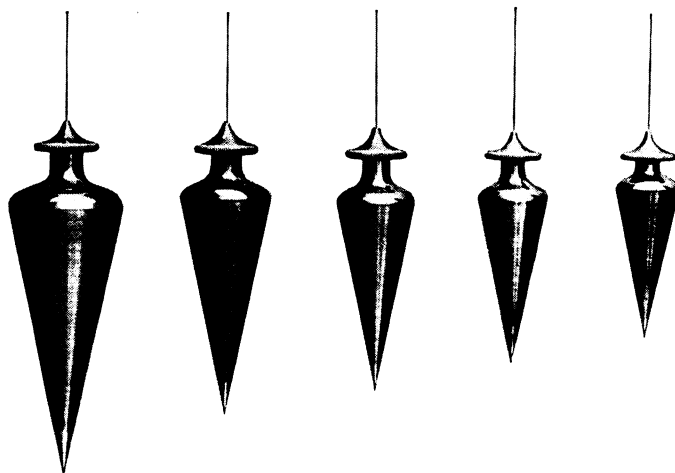
Hardened and Tempered Tool-Steel Points.



PLUMMET LAMP No. 12. Weight 18 oz. Price Complete, \$9.00	TUNNEL-BOB No. 13. Weight 26 oz. Price Complete, \$4.00	SHAFT-BOB No. 14. Weight 44 oz. Price Complete, \$5.00
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In style and construction our plumb-bobs are all of a standard form, one that has been found to taper enough to allow the line of sight to pass easily by, and not be obstructed by rotundity of the bob from easily seeing the point.

Tool-steel points which are hardened and tempered in oil are fixed to all our plumb-bobs and plummet lamps. This feature is one that will be appreciated by the engineer accustomed to soft points, which are easily bent when plunging into wood.



All of our plumb-bobs have the hardened and tempered tool-steel points common only to our make.

SIZE.	WEIGHT.	PRICE.	Generally Furnished with
No. 0	26 oz.	\$4.00	Plane-Table Mining
No. 1	13 oz.	2.50	No. 1 Transit.
No. 2	9 oz.	2.25	No. 2 Transit.
No. 3	6 oz.	2.00	No. 3 Transit.
No. 4	4½ oz.	2.00	No. 4 Transit.



Wood and Iron Range Poles.

Manufactured from well-seasoned ash, of octagon shape, hand-dressed and painted alternate white and red in feet, with tempered steel point shoe, a thoroughly first-class rod, 6 feet long, \$1.90; 7 or 8 feet long, \$2.25.

Iron tubular ranging pole, 6 feet long, painted alternate feet red and white, $\frac{1}{8}$ inch diameter, steel shoe, \$2.75.

Red Eye Marking Pins.



Set of 11 best tool-steel marking pins, hand tapered, 12 inches long (rings closed to hold tags), \$1.50. Will not bend. 17 inch pins, \$1.90 per set.

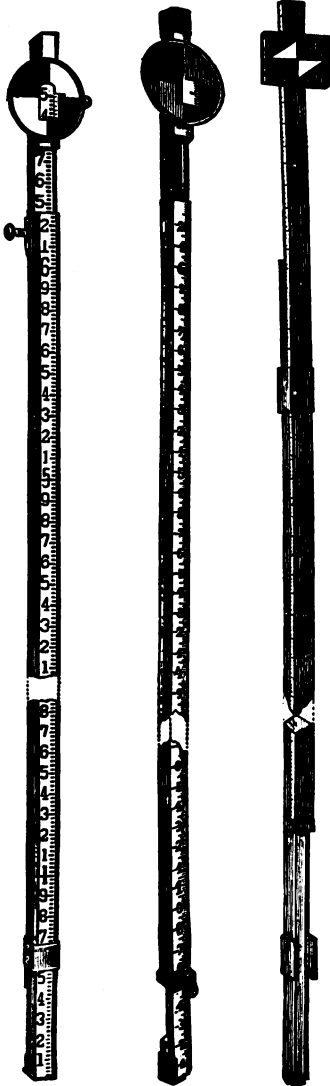
Spring Balance.

Spring balance, extra quality, $\frac{1}{2}$ lb. intervals to 20 lbs.; guaranteed correct, \$2.75.



Levelling Rods.

Warranted Accurate.



Philadelphia. New York. Boston.

PHILADELPHIA ROD.

A perfect self-reading rod, with target, vernier and clamps, 7 feet long, sliding to 12 feet. Scale on tangent, reads to thousandths, \$14.00. Metric System, \$1.00 extra.

NEW YORK ROD.

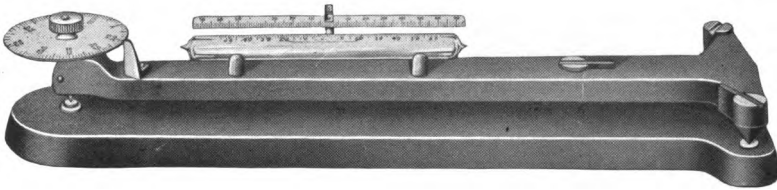
Hardwood, 6½ feet, sliding to 12 feet, verniers to thousandths of a foot, \$14.00.

BOSTON ROD.

Of mahogany, machine divided on satin-wood with target, verniers at both ends read to thousandths of a foot. 6½ feet long, sliding to 11 feet. Convenient on account of its lightness, \$14.00.



The "Buff" Level Trier.



Price of this instrument, complete, \$30.00.

For testing the sensitiveness and regularity of curvature of the spirit vials the "Buff" Level Trier was designed. The commercial and finished trier as listed and described is constructed like our own testing trier and by the same formula. The value of making this test is great, and every college should be provided with a trier. The use of this instrument will at once show why it is that some instruments will not close an angle or a line of levels.

The inconsistency of graduations reading to 30 seconds and of front plate bubbles of four or five minutes' sensitiveness (as is occasionally found in cheaper transits) is forcibly detected and shown. Its application, however, is in testing the curvature and detecting irregularities, if any.

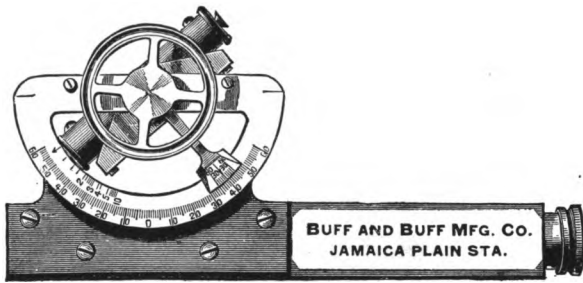
CONSTRUCTION.

The trier is 17 inches long between bearing points and reads with micrometer screw and 4 inch silver disc direct to single seconds of arc. The bearing is hardened and polished steel. Attachments can be provided for examination of a complete transit, to be tested as a whole or the different levels separately.

MATHEMATICAL.

In our trier, the distance, length and pitch of micrometer screw and point are such as to give absolute readings to even single seconds, and it is therefore only necessary to mention the sensitiveness of each tenth of an inch. Travel is read directly from graduated disc in correct value without making any correction whatever. The observed run of bubble is the true run and the correct curvature of same is as read on dial. The vial should always be tested both forward and backward, and in finer levels the test should be repeated several times.

The Abney Level and Clinometer.

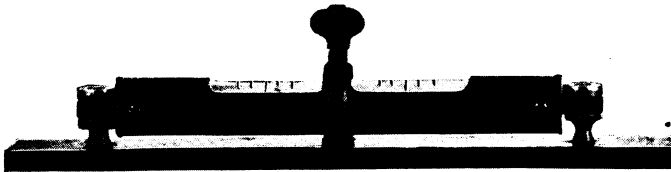


A modification of Locke's Hand Level, with a wider range of usefulness, combining it with an excellent clinometer.

The main tube is square and can be applied to any surface, the inclination is read from the vernier and arc when the bubble is in the middle. The angle of any slope can be obtained in the same way, by sighting along the slope at any point of the same distance above the ground at which the clinometer is held, with the bubble level.

Abney Level, giving angles of elevation, and also degree of slope as, 1 to 1, 2 to 1, etc., \$13.50.

MACHINISTS' LEVELS ON METALLIC BASE.

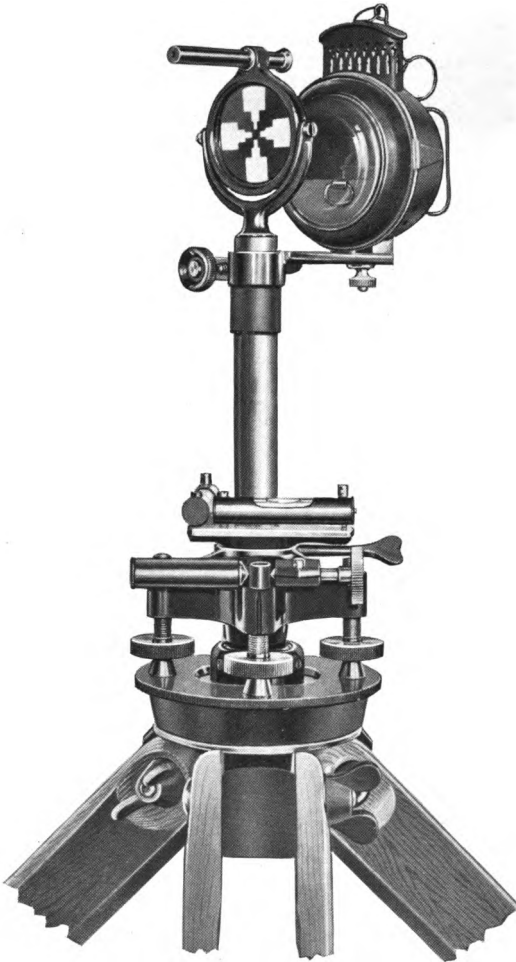


Spirit-level on 8 inch base, with handle, accurately ground so that one division of level is equivalent to a deflection of $30''$ of arc. Bubble is adjustable, and is complete in morocco case, \$12.00.

Spirit-level on $3\frac{1}{2}$ inch base, with handle, one division of level is equivalent to one minute of arc. Bubble is adjustable and is complete in morocco case. Net, \$6.50.



Lamp Targets for Mine Use.



Our Lamp Targets as illustrated are made precisely of the same height as transit, so that they can be interchanged without disturbing tripod. The target is made with a clamp and tangent movement for horizontal movement and can also be revolved in vertical plane. The lamp is complete with a tubular sight on top of target, as shown, so that target and lamp can be lined up more accurately. The lamp itself is also adjustable and can be quickly detached. It burns lard oil. To give better diffusion of light the light is sent through a disc of milk glass, thus defining the intersection very sharply.

Total weight of lamp, $6\frac{1}{2}$ lbs.

Weight of extension tripod for lamp, $9\frac{1}{2}$ lbs.

Price of lamp target and tripod complete, with spirit levels, in mahogany case, \$90.00.

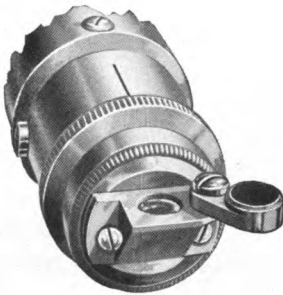
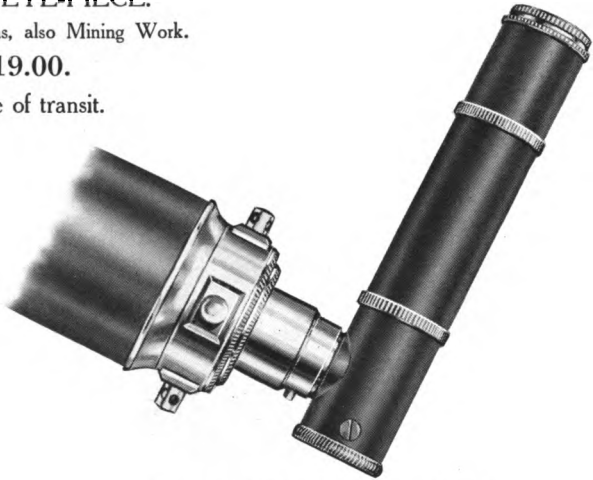
NOTE.— We make this Lamp Target regularly for the No. 2 size transit, but will furnish it to order for other sizes as well.

DIAGONAL EYE-PIECE.

For Zenith Observations, also Mining Work.

Price, \$19.00.

For any size of transit.



PLAIN DIAGONAL PRISM.

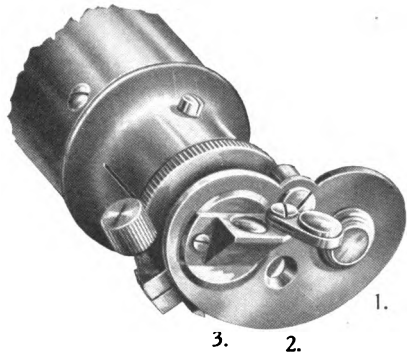
with hinged smoke glass, to be screwed on to eye-piece of any regular transit.

Price, \$8.00.

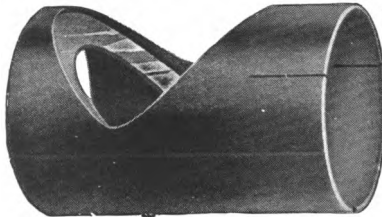
Combination Prism and 2 colored glasses, pivoted, and a very convenient arrangement, \$12.00.

(Completely detachable.)

1. Direct sight through colored glass.
2. Direct sight.
3. Prism with pivoted colored glass.



REFLECTOR SHADE.



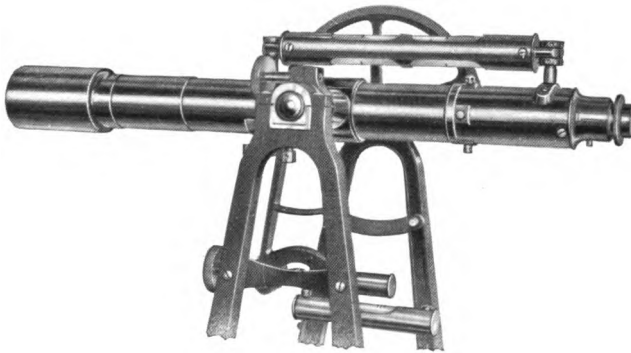
To illuminate the cross wires in mining work. Made in all sizes for our different instruments. Price, each, \$4.00.



DOUBLE OPPOSITE VERNIER ATTACHMENT.

This arrangement is provided with adjusting screws to set zero of vernier.

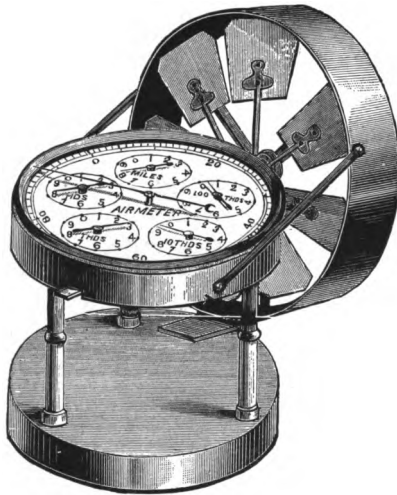
Price of extra vernier with guard and slow motion screw . . .	\$20.00
Reading-glasses for both verniers. Style page 61 . . .	10.00
Graduation reading to 30". A and B verniers . . .	10.00



REVERSION LEVEL.

For Levelling with Telescope Reversed.

A guard is provided with this level to protect the under side of the vial when not in use. Price, **\$12.50.**



Portable Anemometer.

Portable air meter for the measurement of air currents in shaft mines, sewers, and ventilating ducts in buildings. The velocity is obtained by the revolution of a very light aluminum fan, on a steel shaft, in jewel bearings.

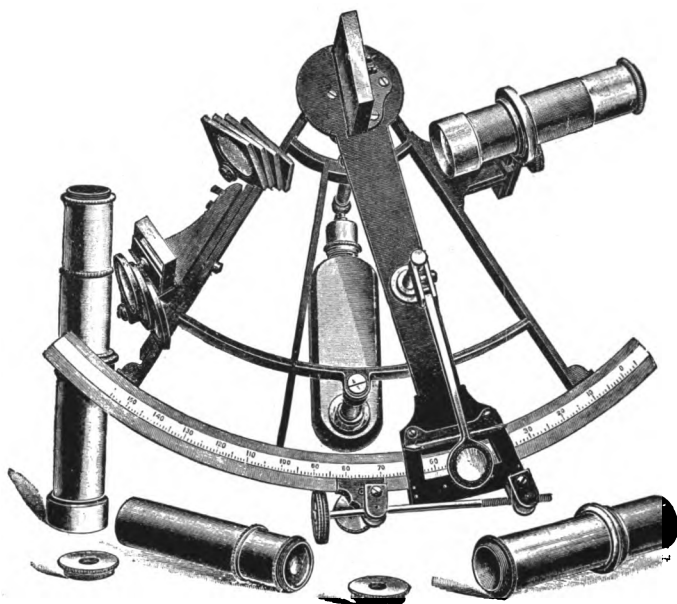
The enumeration is commenced by the long hand, shown in the illustration, continued on the smaller dials, and is continuous up to 10,000,000 feet; a projecting lever on the instrument serves to disconnect fan and stop recording.

Instrument complete, with mahogany case, universal pointed socket, holder and disconnecter, each, \$25.00.



Sextant.

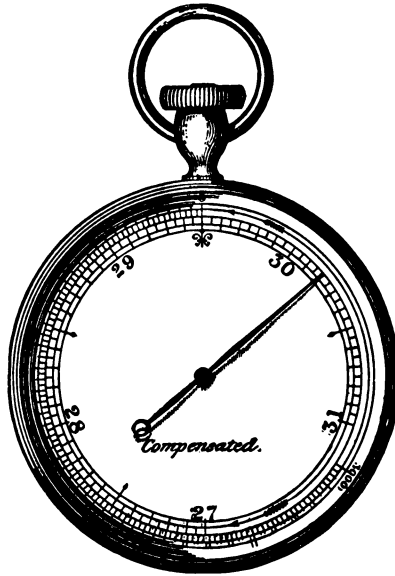
U.S. NAVY, APPROVED TYPE.



Radius 7 inches, for measuring angles up to 130° ; four sun glasses between the large and small reflecting mirror, and three sun glasses behind the small mirror, all of which can be turned on their axis 180° . Graduations on inlaid solid silver, reading to 10 minutes, vernier reading to 10 seconds, one reading glass, clamp and tangent screw to vernier.

One inverting telescope with two eye-pieces of magnifying powers of 6 and 12 diameters, one sighting tube and one star telescope. Two neutral glasses for telescopes, one spare index and one spare horizon mirror.

Instrument complete, as approved by the U. S. Navy, in polished mahogany lock case with two screw drivers, each \$120.00.



Aneroid Barometers.

SPECIFICATION.

2½ inches diameter, in morocco case, polished brass case, silvered dial, revolving altitude scale, compensation for temperature.

ALTITUDE SCALE.

3,000 by 10 feet	\$21.00
6,000 " 20 "	20.00
12,000 " 50 "	21.00
18,000 " 100 "	22.00

Send for lists of other finer Barometers.

Mining Barometer.

2,000 feet below } by 20 feet.
6,000 feet below }

2¾ inch diameter, in bronze-finished case, silvered dial, rack and pinion to operate scale, compensation for temperature. Each, \$34.50.

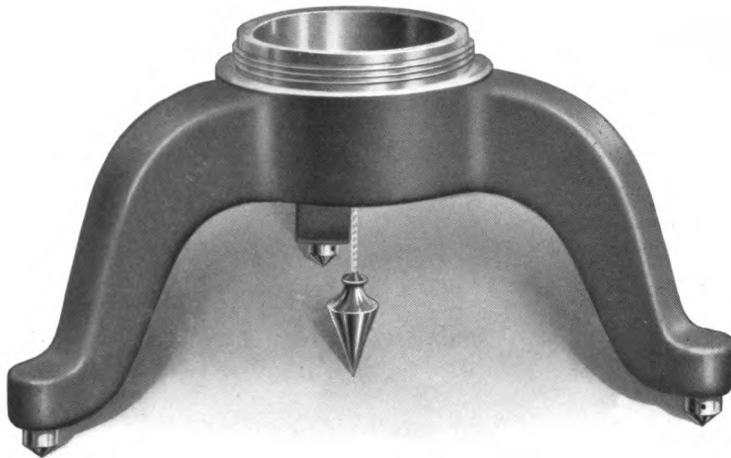
A Good Aneroid Barometer.

1¾ inch diameter, watch pattern, silvered dial, revolving altitude scale, 8,000 feet by 50 feet (estimates to 25 feet), each, \$13.50.



Tunnel Trivit.

(Of Bronze.)



STEEL POINTS ACCURATELY FITTED.

Penn., N. Y. & L. I. Tunnel Trivit.

Designed for the Buff No. 1 and No. 2 Size Transits.

Weight, 8 pounds. Spread of Base, 9 inches.

Price	\$7.00
Small Bob . . . . .	.90
Plain Trivit as shown on page 59 — 3 inch or 6 inch legs	3.50



SHIPPING WEIGHTS OF TRANSITS AND LEVELS IN LBS.

	No. 1 Transit 14 lbs.	No. 2 Transit 10½ lbs.	No. 3 Transit 6¾ lbs.	18" Wye Level 11 lbs.	Dumpy Level 10 lbs.
MAHOAGANY CASE	10 lbs.	9½ lbs.	5¼ lbs.	8 lbs.	6½ lbs.
TRIPOD	9 lbs.	9 lbs.	5 lbs.	9 lbs.	9 lbs.
TRIPOD PACKING CASE	7½ lbs.	7½ lbs.	7½ lbs.	7½ lbs.	7½ lbs.
TRANSIT PACKING CASE	16 lbs.	16 lbs.	6 lbs.	8 lbs.	7 lbs.
NET On 2 Boxes	23 lbs.	19½ lbs.	12 lbs.	20 lbs.	19 lbs.
GROSS On 2 Boxes	56½ lbs. = 26 kilos	51½ lbs.	30½ lbs.	43½ lbs.	40 lbs.



Entirely Unsolicited Opinions.

Rapid Transit R. R. Com., New York.

It gives me pleasure to state that we have in use on the present work here in New York one hundred and three instruments of your "Buff" make.

Yours very sincerely,

WM. BARCLAY PARSONS, Chief Engineer.

Spokane, Wash.

We judge, therefore, that errors below 2" of arc have been entirely eliminated in your graduations. . . . We would state further that it is the first and only transit we have used in which the graduations could be proved accurate to 2" second of an arc and less.

Austin, Tex.

After six months' constant field use of my transit I have found no occasion to adjust the same at all. The gradienter attachment works accurately. The line of collimation is still perfect and the telescope focusing slide works very perfect with no back lash.

Atlanta, Ga.

I am pleased, in fact very pleased, with your "Buff" Transit lately sent me. After a month's steady use I do not hesitate in stating my convictions that, in your own words, "Quality in Engineering Instruments holds first place in every part." The glasses in the telescope please me greatly and are the best I own in any of my six instruments.

Sault Ste. Marie, Ontario, Canada.

In concluding would say, we are especially pleased with the four transits furnished us recently and will assure you we certainly consider your make the best, and what we shall choose when again in the market.

Denver, Colo.

The No. 4 Transit is a beauty in looks and more than that in action, for there is not one feature that I should even suggest as having been overlooked to make it the eminent success it is.

Eldora, Colo.

The telescope in definition far excels my old transit, and certainly makes your transit a superior, but above all a "consistent transit of the highest quality."



St. Marys, Pa.

The transit which you built for me two years ago has been most satisfactory. I have used many transits, of all the American and some European makes, and, while not detracting from the many excellencies of the best American instruments which are very finely made, I am more confident, and derive more satisfaction from the use of your transit than from that of any other I have used. This instrument has been used very constantly, and has never yet needed the slightest adjustment. I believe that such a transit, after coming from your hands with all the bearings tightened **just right**, will need no adjustment whatever, through the course of many years, except as the result of an actual blow or accident.

Aiken, S. C.

It has had a very full year of very hard service in the roughest kind of work and there was no opportunity to give it the necessary or proper attention, but in spite of all this it showed not the slightest lack of smoothness in action. I can speak in only the highest terms of its accuracy, stability and beauty, and it has **compelled praise** from a number of engineers in high standing who have worked with me.

I ran a line of levels with my 18" "Buff" level 10,000 feet long which was **checked later** by an older man, who holds the reputation of being a **very accurate** instrument man, with my transit using the telescope level, and the elevation of the last (100) station with the two instruments varied by .02 foot only.

Amarillo, Tex.

I have been working under Mr. Twitchell, the state surveyor, for several years and have been using your instrument. It is the best machine in Texas and has been highly recommended by us both. I have taken observations with it on Polaris as early as 3.30 P. M. and never lose any time.

Brownsville, Tex.

The transit is by far the best one that I have ever used. The level, purchased at the same time, is a superior instrument in every detail. I wish particularly to say that the bubbles on both instruments are, without doubt, the most sensitive bubbles that I have ever used. They are perfect.

Aldridge, Ill.

The transit arrived in fine adjustment, and I have had great satisfaction in using it. It is up to date in all respects, and the graduation is the finest I have ever seen.

Spokane, Wash.

This new transit is a beauty. Its action is free, positive and perfect as far as I can determine, and the telescope very satisfactory. In my opinion "3292" is the best all-round mining and mountain transit in the Northwest today.

New Rochelle, N. Y.

The No. 3307 instrument arrived yesterday afternoon, and today have been testing same. The plate divisions are very fine, as is also the centering. The dividing, as far as I have found, is all that I could expect and very satisfactory. The setting of A & B verniers as far as zero and 180 deg. apart and their ends are concerned is practically perfect, and shows great care on your part, and all the above shows you have taken extreme care to meet my specifications.

L. E. Van Etten.

Uniontown, Pa.

Received the instrument you sent me, No. 3371, and have given the instrument some very severe tests as to accuracy, and find it in fine adjustment in every way. Am very much pleased with it. . . . Will you kindly send me another plumb-bob, just like one sent with instrument, as I thought it the finest I ever owned, and had the hardest steel point of any bob I ever saw.

Fossil Creek, Ariz.

Received transit yesterday, and I must say I am more than pleased with the appearance of it. I took it out this morning and tested the adjustments and they are perfect. I am surprised after taking into consideration the kind of a trip it had.



Merritton, Ont.

The instrument, though not examined thoroughly, is certainly a dandy. It is a better looking instrument than I thought it could possibly be. I have been showing it to several engineers and they say they never saw a better glass. . . . Am stuck on the tripod. It is exceedingly light and portable.

Syracuse, N.Y.

Have found time to test the Dumpy level lately bought of you and assure you that I am delighted with it, on account of the very clear field and high power, and also its accuracy in running benches.

Seattle, Wash.

After using the transit nearly a year in Washington and Alaska, can say that I am much pleased with it. It has not been necessary yet to adjust line of collimation. It is much the best instrument I have ever used.

Motzorongo, V.C., Mex.

Both your transit and level have given the very highest degree of satisfaction. I often go on long journeys taking them on pack-mules and have as yet never had to readjust either of them. The transit, in particular, seems to be an exceptional instrument, as I have closed surveys of from fifty to one hundred kilometers with a surprisingly small degree of error.

Nome, Alaska.

I hope the new transit will prove as satisfactory as the last one you sent me in 1899, which, by the way, I sold in Salt Lake City for a little more than I paid for it, and this after making more than 500 official surveys with it. And it looked as well and did its work as good as if it had just stepped out of your shops. I shall take pride in showing my engineering friends the "Buff."

United States Land Office, Gunnison, Colo.

I wish to say that the instrument you sent him is the finest I have ever seen, and I doubt if there is a better one made.

Mr. Dofflemyer seemed greatly pleased with it, and after he has tested it I think he will send you such a letter as you will appreciate.

Surveyor's Office, City of Boston.

It is with pleasure I write you a line with reference to the micrometer Wye Level No. 3781. The results I have obtained in using it have been something remarkable in my experience of twenty-five years as an engineer. In running these levels, I started from the Mitre Still of the Dry Dock at Charlestown Navy Yard. The scheme was that of a circuit closure. The extreme error of the closure has been less than the minimum error given by the United States Government formula.

RECORD OF CLOSURES.

- 12,800 ft. Run 2 1/2 miles. Closed by 4/1000ths, or less than 1/16 inch.
- 10,400 ft. Run 2 miles. Closed by 1/1000th, or less than 1/64 inch.
- 11,400 ft. Run 2 1/3 miles. Closed by 2/1000ths, or less than 1/32 inch.
- 45,500 ft. Run 8 6/10 miles. Closed by 3/1000ths, or less than 3/8 inch.

St. Joseph, Mo.

While I was county surveyor my public duties prevented me from making much use of the instrument. . . . I had occasion to run a set of bench levels for the City of St. Joseph, Mo., and in a circuit of 4 1/2 miles I closed with an error of 7/1000ths of a foot. I ascribe this result to the excellence of the instrument, rather than to my skill.

Tamaqua, Pa.

The transit No. 4625 arrived safely on the 18th, and I must say that it is all that you claim for it and more. The telescope is simply magnificent and by far the best that I have ever seen, as are the graduations. . . . During the coming week I expect to show my new transit to my friends and compare it with their best. The result is a foregone conclusion, as I know every transit the company has. The "other fellow" is simply not in it. I believe he is talking of purchasing a transit shortly and have no doubt that you will get the order.



Honolulu, H.I.

I must say it exceeded my most sanguine expectations. It is the most cute looking instrument I have ever seen. The first preliminary test of the transit fully confirmed your assertions that "it leaves our shops in elegant adjustment." Since my last letter I have put the transit to some thorough tests in the field, and it worked splendid. The line of collimation is absolutely perfect for all distances, stadia works beautiful, and the excellence of the graduations was even more demonstrated in triangulation work.

Granite, Colo.

A transit that is altogether satisfactory in every respect, with particularly clear lenses. Once again complimenting you on the beauty of form and general appearance of the instrument.

Tucson, Ariz.

The finish is really the best I have ever seen, and together with the proportion of the longer telescope, etc., makes a handsomely finished and graceful transit.

Mexico City, Mex.

It pleases me in the graduations and the clear light in the verniers with your admirable arrangement of the verniers at 30° to telescope. The especial feature that catches my attention is the position of the plate bubble, inasmuch as it does not stick out on the edge of the plate, thereby being free from knocks.

Mobile, Ala.

The summary, then, of this extended triangulation survey with your transit No. 3026 gives the corrected angle with an error of 0.26 second of arc, a result that we have no hesitation in saying is better than the best result ever attained in our office with any of the older transits.

Sydney, N.S., Canada.

Respecting the accuracy of my new "Buff" transit when put to the test, and of its extreme rigidity and satisfactory working capacity, I am more than pleased. Without question the transit is the most gracefully proportioned I have ever seen, etc., etc.

Seattle, Wash.

The particular feature that delights my men is the very excellent telescope that you have furnished in the transit. To use their own words, "the glasses in the Buff & Buff transit are clear and sharp, and better than our old transit."

We are prepared to say that there are no surveying instruments on the market to-day equal to those manufactured by Buff & Buff of Boston. The instruments are made of the best materials, are durable in use, perfect in construction, of superior workmanship, and have given us absolute satisfaction under all climatic conditions. They are thoroughly reliable in every respect and can be depended upon.

We will also mention that promptitude is a special feature of your business methods, and was one reason why you received duplicate orders.



Come and See Us.

Take any train for Jamaica Plain, from South Station, Boston, or any car for either Jamaica Plain or Forest Hills. Whichever way you come get off at Green Street and walk to Lamartine Street. At this junction are our shops.

In ninety-nine cases out of one hundred, we can show exactly what is wanted in a wholly or very nearly wholly finished instrument. Most engineers can decide better after five minutes' inspection than by a whole day's study of a catalogue.

We have agents in a few large cities, who carry our instruments in stock, thus permitting engineers' personal examination, and providing for rush orders.

If you cannot call at our factory, we should be pleased to have you call on our nearest agent, who will welcome you, and take pleasure in showing you our instruments, whether you purchase or not.

Remember that a personal examination will do more to convince you that our instrument is the best for you than anything that can be said, and whether you intend to buy, in five minutes or in ten years, or not at all, come and see the Buff Instrument the next time that you are in Boston.

The one best Transit of them all is the Buff — and the price, as things go, is fair and equitable. This is perfectly known in Boston, New York and Chicago, and in all other cities, as well as on most of the large railroads in the United States.

We want *you* to know it as well, so let us help you to think about it. We shall do all we can to make your thinking agreeable.

Judge the Transit by itself — judge us by our dealing. Before ordering, judge our Transit by looking at it, if you can, and us by what we say and how we say it.

An inaccuracy is most likely an untruth. If this happens only once, no matter how, wipe us out of your mind.

THAT'S ALL.

BUFF & BUFF MFG. CO.

Jamaica Plain Station, Boston.



Repairs.

That our instruments may be protected and kept out of the small repairer's shop, they are designed to secure best possible distribution of metal. Long experience has revealed the general direction and force of blows and falls, and it is protection against them which so strongly marks the difference between our transits and others. Given equally severe falls, the "Buff" withstands them remarkably. The cost is generally less than one-half that of repairing a cheaper instrument. Our low charge to the engineer, which is the actual shop cost to us, has been such an inducement to send injured instruments to our shops for repairs that our splendid facilities for repair work are continually in pressing demand.

We have found this low charge policy to be a promoter of closer relations with our customers, which is to mutual benefit.

It is well to bear in mind that one of our particular shop mottoes is, "To make the 'Buff' transit of such thorough and lasting construction as to keep it out of any repair shops indefinitely."

We always guarantee to put the instrument in as good order and adjustment as the extent of damage and the general wear will permit. Engineers sending instruments should point out in detail, parts to be repaired; but the best course is to "*have the instrument put in thorough order and adjustment,*" allowing us to execute whatever repairs are needed to make it as serviceable as possible. This course is more satisfactory, and in the end cheapest. Our own instruments should be sent to us to insure fullest satisfaction. Time and money is saved, as we duplicate parts from stock on hand.



General Directions.

ORDERING.

In ordering please avoid any possible error by stating plainly style, size and kind of finish, also price. Be particular to give plain shipping directions, the name of Express Co., etc. Transportation charges are always to be borne by purchaser.

Order as long beforehand as you can, for we have never yet been able to keep ahead of the demand, and, in spite of our steady increase of plant and skilled labor, have but a small stock on hand.

We will not send you a half-finished instrument, and as all of our manufacture requires time and care, we ask you to give us as much of this time as possible. Aid us to please you and we will most carefully endeavor to do so.

With triangulation transits we can use only general terms in promising completion, for the task is so delicate that "nearly done" may mean anywhere from a day to two weeks.

TERMS.

Our terms are net cash in every case.

The catalogue price is the cash price, and from this we can not make discounts, except to regular agents.

C.O.D. orders, with privilege of examination, must be accompanied by money enough to pay charges one way.

Instruments are kept in stock in all the large cities.

SHIP REPAIRS TO

BUFF & BUFF MFG. CO.
JAMAICA PLAIN STATION, BOSTON, MASS.



Real or False Economy.

The big modern manufacturer is truly as much interested in *helping the engineer sell his services* as he is in securing an order for a transit.

He knows that his product must be a part of the definite equipment of brains and instrument, and that the better instrument will always secure *more and better business for the engineer*.

The modern manufacturer, knowing this, does not lay emphasis so much on the price or the beauty of his manufacture, but he does emphasize the *fitness* of his instrument for *selling civil engineering services*. He knows that it is necessary to provide the best instrument possible for the most economical services.

An incident illustrating this was most forcibly told by the Chief Engineer of a prominent railroad. He said: "I send out an engineering party of three men, at an expense of \$3,000 a year salary. I give them an equipment of a good transit, levelling rod and supplies, costing about \$250. This equipment, providing it is a good transit, has a life of at least 25 years. Six per cent on the money and four per cent depreciation make a total of \$25 actual expense yearly, to be charged off for equipment. This is an absurdly low amount.

"If I purchase a cheaper make of instrument, whose first cost is \$30 less, then I am obliged at once to mark up depreciation from four per cent to at least twenty per cent. The yearly charge will thus be \$62 instead of \$25, which *immediately points out the wisdom* of choosing the best instrument.

"However, the chief point which I wish to make is this: I spend \$3,000 on salary and am put to an expense (as above noted) of \$25 *only for equipment*. Is it not by far the wisest plan to purchase the very best instrument I can find? Why should I spend *two minutes* of my valuable time attempting to save a few dollars which I will so quickly lose a hundredfold? Besides this, I gain a considerable prestige by using the best make of instrument, and my people—from the President of the railroad down to the Directors—always realize that my work is done on a more economical basis *because I use the best instrument*. Of course this question applies to the engineering ability of my assistants just as much. By paying a slightly higher scale of wages I get superior help, and actually get the work done more rapidly and in a more thorough and workmanlike manner. I insist on *quality of instruments*, for I find it spells 'greater output.'

"I realize furthermore that there is a great deal in personally getting down close to the actual work which my assistants are doing. In many ways I can show them short methods, and from this experience I know that the best transit made is able to deliver at least twice the amount of work of a poor transit, because it is built right, and *brains and experience* have dictated a consistent design. Design and attention to details are very important factors in getting out work rapidly and accurately. A poor transit will easily cost the railroad company \$2,000 a year *unnecessary labor* on the part of the assistant engineers.

"You can readily understand my motives and desire *to get out the best work at the least expense*."

The above was quoted to us first-hand and is the actual expression of a very prominent engineer who has risen from the ranks because he has realized the importance of the *right kind of brains* and the *right kind of equipment*.

Respectfully submitted,

BUFF & BUFF MFG. CO.

INSTRUMENT MAKERS TO

U. S. Government—many departments.
New York Central R.R.
N. Y., N. H. & H. R.R.
New York Water Board.
Public Service Commission, New York City.
Board of Public Works, New York City.
And countless others.



(Youth's Companion, Oct. 26, 1907.)

AN ENGINEERING FEAT. — The building of tunnels under the Hudson River, undertaken by the Pennsylvania Railroad Company five years ago, for the purpose of landing passengers directly in New York City, instead of on the New Jersey shore of the river, is completed. The work involved the driving of two enormous steel tubes, 23 feet in diameter, 6,000 feet under water. When the shields were 125 feet apart the work was stopped, in order that a test might be made of the accuracy with which the work had been done; and it was found that the tubes were only one-eighth of an inch out of alignment and three-quarters of an inch out of grade—a deviation so slight as to admit of a perfect meeting of the bores.

Both the North River Division and the East River Division used Buff instruments in large numbers.

"Use A BUFF For Accuracy"



Homily on First Cost.

During the many years that we have been in business we have made many loyal friends.

The steady growth of our business is definitely due to these friends. They believe in our instruments because past experience has shown their superlative workmanship.

Their advice to the young engineer to "*buy the best*" is sound. *It cannot be disputed.*

Not a single reason exists why they should recommend a cheaper instrument which happens to cost \$25 less.

These older engineers say, "A good transit is indispensable if an engineer wishes to get on. It at once gives him prestige and standing."

Geo. L. Buff has had no desire to become rich. He has made beautiful instruments for the love of them and created designs with his own hands to meet the different requirements.

Buff style is synonymous with real beauty and the highest accuracy.



Special Notice.

The increasing demand for Buff Instruments has induced unprincipled makers and dealers to have them imitated, the chief consideration being to secure an instrument similar in appearance, without regard to quality. Several such imitations are offered, in which the general form of Buff Instruments is copied, but the workmanship is inferior, and **the lack of knowledge so evident** in the construction that in a short time the instrument becomes unfit for use and practically worthless. Money spent on such tools is literally thrown away.

Instruments of a notoriously low grade are listed at the same prices as Buff Instruments and **the most extravagant and ridiculous claims** are made concerning their quality.

One of this country's foremost engineers says:

"A good transit is worth much more than the market price asked for it. A poor transit is worthless, no matter how low the price."

Sincerity.

Buff instruments are safe to buy because the Buff character is built into each instrument. In the Buff shop every detail of manufacture is personally studied each day — so that for generations to come each finished instrument may satisfy all requirements. The leading dealer in each city is pleased to sell Buff made on account of reputation and prestige accruing to him.



“Horizontal Packing” for a Transit.

All BUFF Transits are regularly packed and shipped in a vertical position. For extreme compactness and ease in transportation on horseback, a transit which is packed in a horizontal position is preferred by many engineers.

We will pack any BUFF Transit in a horizontal mahogany box at an expense for the extra labor involved of \$5.00. This involves the time of a cabinet maker for 2 days, and thus requires that extra time before shipment can be made.

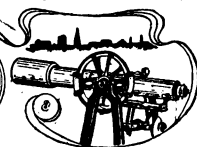
Individual Jacket Box for Constant Shipping.

(Useful and safe and time-saving when shipping constantly by express.)

With each transit sold there is included a mahogany instrument case, and in shipping an outer *box 2 inches larger* all around. This space is filled with excelsior; this outer box has a rope handle. This provides an absolutely safe box.

But in case an engineer desires an especially strong outer jacket box, we can provide the following:

1 Jacket Box of $\frac{7}{8}$ " clear pine, with heavy trunk corners, hinged with regular piano style of continuous hinge, and provided internally with COILED SPRINGS of piano wire for absorbing all shocks; made to order for any size of instrument **\$9.50**



Telegraphic Code.

ENGINEERS' TRANSITS.

Important.—Transits will include the following (unless contrary options are specified).

If solid silver graduations are desired add the word "silver" to code-word.

Ground Glass Shades	\$3.00	Complete in case with accessories.
Verniers 30° to line in sight, no charge	" "	Regular tripod for No. 1 and No. 2 transit.
Erecting Telescope,	" "	Extension tripod for No. 3 and 4 transit.

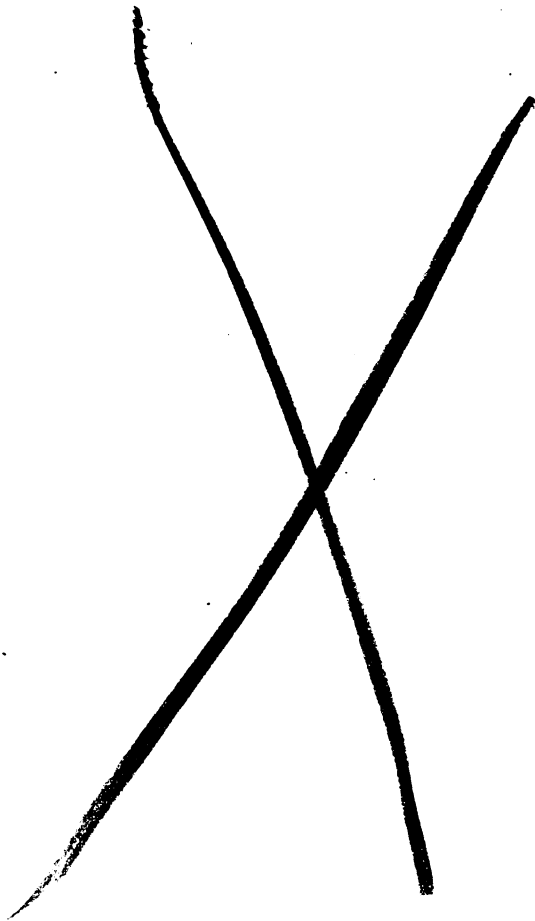
	No. 1 Transit	No. 2 Transit	No. 3 Transit	No. 4 Transit
	Dia. 6½"	Dia. 5½"	Dia. 4½"	
	Wt. 14 lbs.	Wt. 10 lbs.	Wt. 6½ lbs.	
Plain Transit	Theocat	Trandus	Trius	
Bubble Transit	Theodite	Trandist	Tribat	
Bubble and Arc Transit	Theodas	Trandate	Trio	Recon
Bubble Circle and Guard Transit	Theoduse	Trandolite	Trigon	
Triangulation Transit	Triangulate	Trimont		
Tunnel Transit	Tunnel			
Penn. Precise	Theopenn			
University Precise	Theopennsy			

ENGINEERS' LEVELS.

	Dumpy Level	14½" Wye Level	18" Wye Level
Erect	Dumpat	Wyeing	Wyes
Invert	Dumpus	Wyeate	Wyat
Erect, Fixed Stadia	Dumpfixt	Wyefix	Wyfixt
Invert, Fixed Stadia	Dumpinfix	Wycatfix	Wyatfix
Hydrographer's Level	Hydrograph		
Sighting Level	Sigvel		

MISCELLANEOUS.

	Code		Code
Send particulars by mail	Ongo	What is the price of, and how soon can you ship	Scandia
Answer by wire, night message	Oakley	We are awaiting your remittance	Schalls
Has letter been received of —inst.	Onyu	Shall we ship C.O.D. or await remittance by mail	Salvi
Your letter has not been received	Ongie	Delivery F.O.B. Boston	Scahy
Answer by cable or telegram, our expense	Onvil	What will extra expense be of	Scandall
We do not know what you mean	Onus	By what line have you shipped	Tabu
Send latest catalogue to	Oble	Ship by express	Talmo
According to instructions	Oiley	We are shipping to-day	Tortig
Please reply to our letter of ——— concerning	Otter	How shall we ship	Telling
Please refer to letter of	Omblo	Shall we ship	Tomos
Do nothing until you receive our letter of	Owner	We can ship	Tottles
What will be weight of	Ogly	We will ship immediately	Tostis
Answer by wire at once	Ockle	Send tracer for	Tastin
Enter our order for	Raker	Will ship by steamer leaving N.Y.	Tisty
Add to our order	Runkle	How many shall we ship	Tatlas
We are doing all we can to hurry your order, hope to send it shortly	Ramble	Have you shipped	Tarant
When can you fill an order of	Ratn	We can ship immediately	Tabal
		We can ship after receipt of order in ——— days	Tasox



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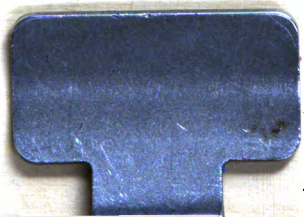
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WILL BE MAILED GRATIS ON APPLICATION.

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