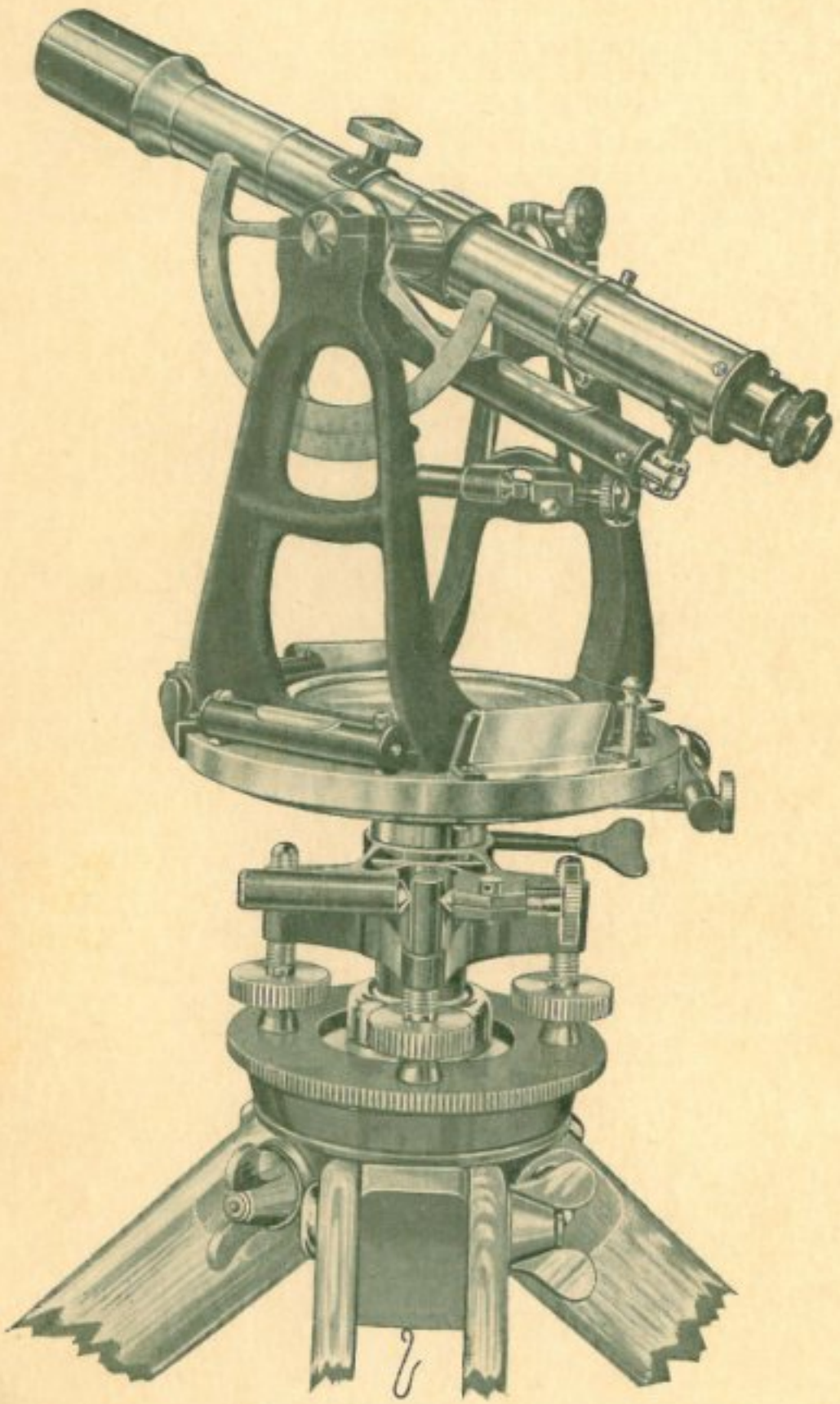


BUFF

This Copy Presented to

_____

Civil Engineer

Prestige
Reputation
Value

"When an Engineer gets all these three in a
Transit, the Buff will have been chosen."

"The priceless ingredient of any product is the honor and integrity of the maker. Consider his name before you buy."

BUFF & BUFF MFG. CO.

MAKERS OF FINE INSTRUMENTS
TRANSITS, LEVELS, PLANE TABLES
CURRENT METERS, THEODOLITES
AEROLOGICAL - BUFF RAILIGN

SURVEYING INSTRUMENTS

For Civil and Mining Engineers

1938

LOUIS F. BUFF, General Manager
HENRY A. BUFF, Research Department
MARY L. McALLISTER, Sales Executive
BOSTON

W. J. BUFF,
New York Manager
69 Dey Street

M. S. JORDAN,
Chicago Manager
325 W. Huron Street

BUFF & BUFF MFG. CO.

JAMAICA PLAIN STATION, BOSTON, U. S. A.

ADJUSTMENTS—PP. 45–57

BUFF MASTER TRANSIT, No. 1 Ec.
With Error-Proof Bearings

THE UNFAILING GUIDE

To the Engineer We Dedicate the BUFF

1. Over swirling waters creep the outstretched arms of a massive bridge. The approaching bolt holes finally match within a tiny fraction of an inch.

2. Down in the mud of a river bed, a creeping tunnel gropes its way from shore to shore, until the two enormous ends meet within one-fiftieth of an inch!

These stupendous achievements are rightfully credited to the exacting engineer with his precision instrument. To him goes the glory of such tremendous projects as the Empire State Building, the Panama Canal, The Washington Memorial Bridge, Radio City, Boulder Dam, the Holland Tunnel, and many others.

With such magnificent structures to erect; with so many lives at stake; and with so much invested money involved, it is necessary to be certain of absolute precision.

To be "dead sure" of perfect construction, the Engineer must have Precision Instruments of the highest reputation. Instruments with a superfine record of achievements that can secure average closure of triangulation angles within half a second.

It is because we know BUFF makes such instruments that we offer them to those Engineers who require the best.

To all engineers thru-out the world, — we dedicate the BUFF that their work may be the acme of precision.

GEORGE LOUIS BUFF
1839–1923
Founder and Manager

Surveying Instrument Works
York, England, 1858
New York, 1864 Boston, 1871

Buff Biography

Our founder, George Louis Buff, began the manufacture of surveying instruments and continued the study of Levels and Theodolites in York, England, in 1858.

Perceiving with prophetic genius that supremacy in instrument making was to start their manufacture in America, he left England in 1864, and came to New York City. There he associated himself with the best instrument makers in the country.

With a wealth of experience and knowledge already acquired, he set up his own business in 1866.

In 1871, George L. Buff moved his well-established shop of precision machinery—tools, dies, fixtures and instruments, from New York to Boston, and with this he formed a partnership, which in 1898 he dissolved. It was Buff's knowledge and marvelous skill and Buff's machinery which secured the recognition of the leading Civil Engineers. Buff's savings and capital paid for everything during the first ten years. Buff was *the instrument maker;* he was the originator of the famous Buff Transit, and the designer of five marvelous graduating machines.

Thus from the best in Europe and America, George Buff selected the finest construction points and added many improvements of his own, all of which have culminated in the supreme result—THE BUFF PRECISE TRANSIT.

Today, these same fundamental features exist in our latest models without a change. No one has ever shown such everlasting originality as the George L. Buff design.

Since 1898, Louis F. Buff, Carl W. Buff, Henry A. Buff, and William J. Buff, have continued in the constant strengthening of the "BUFF" reputation. Quality is alone considered, and constant improvements in precision machinery made by us, and advanced methods of construction, produce the greatest accuracy obtainable.

Mr. Louis Buff, General Manager for the past thirty-seven years, retains personal charge of the final exhaustive testing of the finished instrument. It is virtually a "Buff" instrument from start to finish, requiring approximately two years for each instrument.

The Buff Precise Transit

The "Buff" Precise Transit has behind it an unparalleled history of years of uninterrupted success, demonstrating the correctness of the design and the accuracies of construction. We offer for your consideration the following facts: —

1. Buff holds the record for accuracy on triangulation work for bridges, tunnels and boundary line surveys. (See U. S. Supreme Court records in case of State of Texas, defendant, and State of Oklahoma, complainant.)

2. Buff is 100% non-corrosive; of bronze construction throughout, with graduations on solid silver.

3. Buff spool type axle bearings, technically known as "Double Thrust and Radial Axle Bearings," eliminate side play and loose standards.

4. Buff error-proof bearings, automatic type, hold telescope in any position without clamping and prevent bearing from wearing oval, a patented feature. These bearings will produce lines on the ground with uncanny accuracy of only 3/10,000″ error, on a sight of 11,000 yards.

5. Buff graduations accurately cut diamond rulings, — every line of the same width ensuring extreme accuracy to a fraction of a second.

6. The telescope has 40% oversize field for penetrating haze and permitting longer working days in winter. The latest type of Night Lenses is the BUFF "X" System. (See page 13.) [Internal focusing lenses are available but not recommended as they require a heavier telescope and cause top-heaviness and lack of balance.]

7. The entire instrument is of "stream-line" design preventing vibration on windy days, and the telescope, of small diameter bore design, cuts the wind.

8. The large vernier openings permit brilliant illumination for accurate, speedy readings.

9. The centers are larger and stronger, 100% oversize for accuracy and strength. They are tested to $\frac{1}{50000}$ of an inch.

10. Extra large bubbles permit accurate setting, and avoid shadows. Adjustments hold permanently.

The Buff Finish

There are three different methods in which a BUFF may be finished.

1. BUFF Golden Bronze is unique and characteristic of BUFF instruments. It is not glaring, but is bright enough to throw off all objectionable heat rays. This is important, for by keeping the temperature of the instrument down, the watch oil is kept in prime condition, and the fine fitting graduations preserved. It is recommended for all general engineering.

The workmanship on a bright finished transit requires finer polishing and greater care in squaring corners. This finish is a work of art and a BUFF transit so finished will retain its beautiful appearance for many years. It is the most permanent finish.

BUFF makes his own lacquer, because repeated tests show him that the original gums are twice as strong, having the accumulations of 50 years of wild insect life. The result is a far tougher finish for the engineer's transit.

2. BUFF Dark Metal finish is applied on a finely polished surface and burnt a delicate brown with acid. Clear lacquer is applied to preserve the rich tone of the brown color. This type of finish is suitable for mining work as it throws no reflections.

3. BUFF Black Leather finish is a finely prepared enamel. Three separate coats are applied with japan and give a durable and long-lasting finish.

This is recommended for indoor astronomical instruments and for those Transits used in the far North.

Buff's Newest Graduating Engine Unparalleled

The BUFF fifth and latest graduating engine has been the life work of our management. The accurate work on each theodolite sent out is due to these fine monuments of original accuracy.

These super-machines represent a work of scientific accomplishment which money alone could not duplicate.

SALIENT FEATURES:

1. Isolated location — separate vault structure.
2. 3-point support for main foundations.
3. Water table foundations.
4. Heavy rubber pads — chemically treated — a vibration absorbent.
5. Dust and moisture-proof.
6. Light-proof and vibration-proof.
7. Heat regulated by thermostat to within 1½ degrees Fahrenheit.
8. Circles up to 40-inch diameter can be graduated.
9. BUFF graduations are accurately cut diamond rulings on solid silver — each line of the same width ensuring extreme accuracy.

All BUFF graduations are flat and the limb and vernier are in absolutely the same place.

Some years ago we made bevel graduations with about 21° bevel but many engineers complained of inaccuracy and of a wide gap.

The *Flat Graduation* shows no gap and provides the easiest reading with soft, uniform illumination.

These machines guarantee BUFF circles an accuracy within 1½ seconds of arc. This represents an error of less than 1/50,000 part of an inch.

FOR A SOLID PRODUCT LOOK FOR A SOLID FOUNDATION.

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.

Manganese 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 are 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.

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.

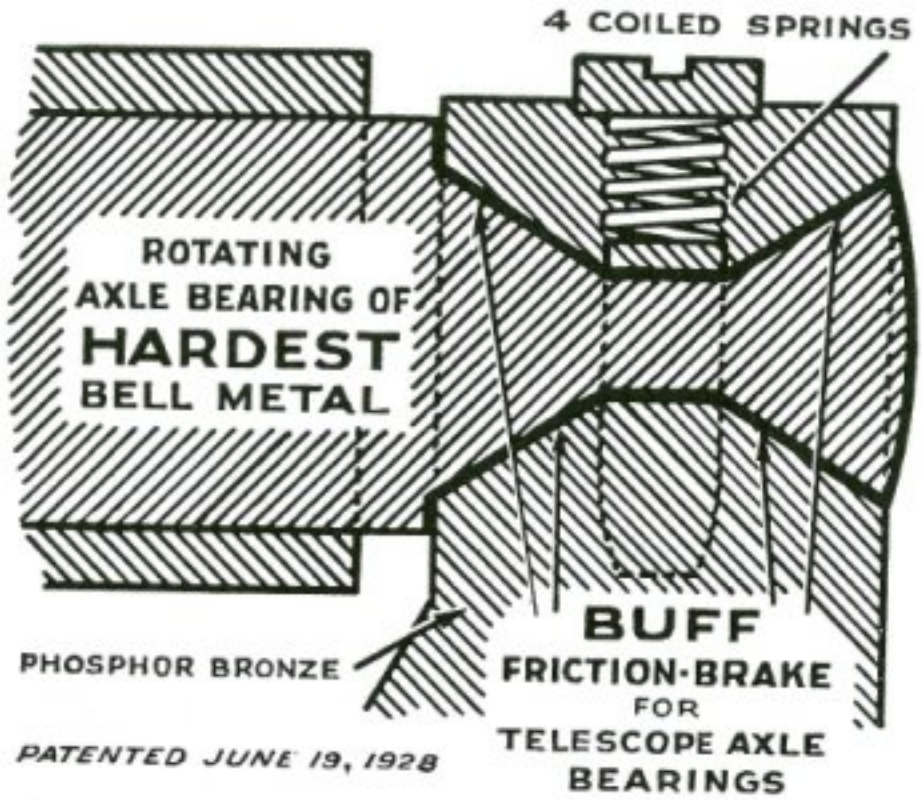
It is unnecessary to say that these metals are the best possible for any center [when their presence is not objectionable] and this combination is universally adopted for all large astronomical instruments, and provides:

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*.

After extensive search throughout the past twenty-five or thirty years the careful investigator would find that no transit in all the world contains such hard and wear-proof bronze as the BUFF.

BUFF — THE SYMBOL OF PRECISION

The *Double-cone Grip* of Buff Self-seating Bearings is *Invincible in Strength*



The BUFF Friction BRAKE on both axle bearings is the most valuable improvement in the past 25 years. The "V" bearing [spool type] has thousands of contacts, ensuring perfect performance for many years. The difficulties of producing such bearings are easily understandable *but* expense shall not bar their use on Buff Transits.

CHIEF ENGINEER TUTTLE SAYS:

New York City, Dec. 11, 1922.

"Our Buff Transit 15,799 used continuously, is an especially accurate investment.

The work involves sights of 13,000 ft. upon a small 3½-inch target, and the definition is excellent even under poor weather condition. The accuracy is phenomenal. In the higher wind the instrument does not show the slightest vibration — attesting to the highest accuracy. We are much pleased with BUFF transits."

ARTHUR S. TUTTLE
Chief Engineer

Buff Telescopes

One of the four important parts of the Engineer's Transit is the telescope. A Transit, no matter how perfect and well-constructed, will give constant annoyance if the telescope is of faulty design.

The telescope must shoot straight and be true for any distance. This requires the inner slide to be more true to line than the finest rifle, eliminating the tiniest errors by repeated tests. Accuracy to 1/50,000 of an inch is demanded.

The inner slide of a Buff telescope is a dense red bronze, and the outer slide, a hard-drawn brass alloy, a combination providing greatest anti-friction qualities for many years.

A Buff telescope gives a more satisfactory optical combination with 10% greater illumination. It has slightly greater power and a sharper defined field.

The most modern astronomical practice is Buff's guide. The Buff X System of lenses was designed to increase illumination — it is the best system of night lenses ever devised. Buff X Telescopes have such exceptional brilliancy that once the engineer has used them, he prefers them above all others.

"The line of collimation shall not change." Buff Transits are equipped with new-style friction bearings on the axle of the telescope. These bearings provide absolute adjustment for the line of collimation. They require no adjustment and are not affected by temperature changes.

Buff has never had a telescope failure!

"IF YOU CAN'T SEE IT THROUGH A BUFF, IT'S NOT WORTH A SECOND LOOK"

Buff Telescope Bearing

Unexpected errors cause *untold expense.*

This fact is proved over and over again every day in the year. To *avoid errors* is a problem of every Civil Engineer.

In 1928, BUFF invented the *error-proof telescope bearing*, especially designed to prevent telescope errors. It is exclusive with BUFF. There are no spring tongues, to prevent wabbling — and no extra lenses as in internal focusing, which cut the light 11%. Every BUFF telescope is absolutely in *perfect balance* and dust-tight. In addition, BUFF supplies a soft friction, so when the telescope is sighted, it remains in that position. This is a great convenience and prevents many errors, but the important error-proof condition is the *uniform* friction on the bearings all around,— at every point. It preserves this bearing beautifully round. It does not wear oval, and it *does prevent errors*. Highest type of precise triangulation is accomplished.

There is NO substitute for *this perfect axle bearing*. It is the *one big improvement* which has been *applied to Transits during the past twenty-five years*. Remember:

1. Buff holds the record for accuracy on triangulation work for bridges, tunnels and boundary line surveys. (See U. S. Supreme Court records.)

2. Buff spool type axle bearings, technically known as "*Double Thrust and Radial Axle Bearings*", eliminate side play and loose standards.

3. BUFF error-proof bearings, automotive type will produce lines on the ground with uncanny accuracy of only 3/10,000" error on a sight of 11,000 yards. "Your organization is deserving of great praise and should be justly proud of its contribution to present day Engineering Science, for beyond a shadow of doubt, the BUFF Transit has done most to advance our profession to its present point." E. S. B. 1932.

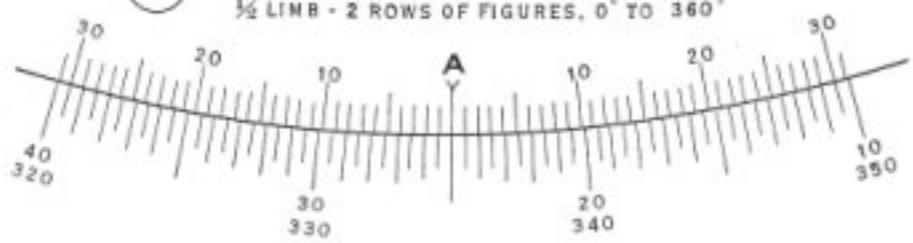
4. BUFF provides double lock nut adjustment for the vertical sighting, ensuring repeated accuracy which is so necessary on modern steel buildings, and shafts and mining work.

SEVENTY-THREE YEARS' EXPERIENCE MEANS MUCH

Graduations

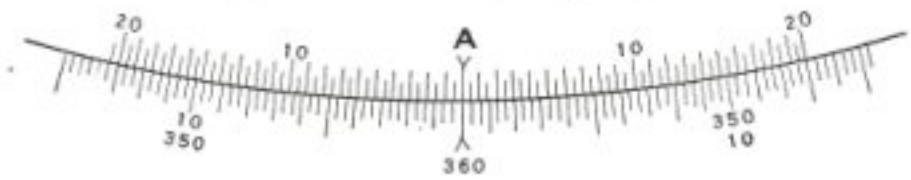
(1) VERNIERS TO SINGLE MINUTES – DOUBLE READING

½° LIMB - 2 ROWS OF FIGURES, 0° TO 360°



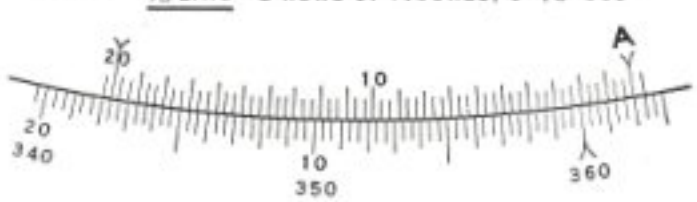
(2) VERNIERS TO 30 SECONDS – DOUBLE READING

½° LIMB - 2 ROWS OF FIGURES, 0° TO 360°



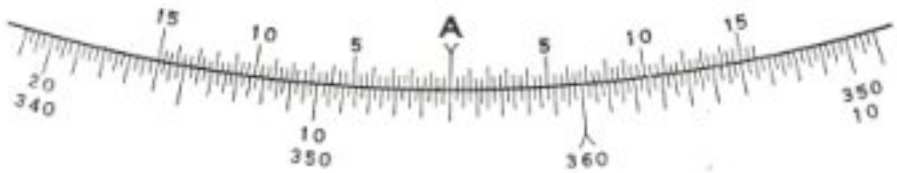
(3) VERNIERS TO 20 SECONDS – EASY READING

½° LIMB - 2 ROWS OF FIGURES, 0° TO 360°



(3A) VERNIERS TO 20 SECONDS – CLOSE SPACING

¼° LIMB - 2 ROWS OF FIGURES, 0° TO 360°



The (3) 20″ vernier is 105% easier to read than the 3-A

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; —

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

All graduations are sterling silver with a dull, frosted finish of harmonious whiteness, facilitating rapid reading in the field. Solid silver graduations are ground and polished dead flat automatically. 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.

The illumination of BUFF verniers is distinctly superior. The lighting is soft and abundant and in comparison, about as 3 to 1. This copious illumination is strikingly unique. The engineer appreciates it constantly, especially in dark set-ups. Keen and intelligent designing is responsible for this improvement as well as other BUFF advantages.

Spirit Levels

BUBBLES.

LIST OF SIZES AND COST.

Length	Diameter	Sensitiveness	Cost
1½ in.	4/10 in.	60″ to 80″	$2.25
2 "	5/10 "	30″ to 60″	2.25
2½ "	5/10 "	20″ to 30″	4.00
3 "	6/10 "	15″ to 20″	4.00
4 "	6/10 "	15″ to 20″	8.00
5 "	7/10 "	15″ to 20″	8.00
6 "	8/10 "	10″ to 15″	8.00

Special sizes and lengths made to order at reasonable cost.

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 the objectionable heat of the hand when grinding with an arbor on the lathe. The 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 ½ second for the finest leveling instrument, and also for all astronomical uses.

8.71 SQUARE INCH plus
6.72 SQUARE INCH=15.43

The above two large areas in square inches are the size of the Bearing Surfaces of "*Buff*" *Transit centers.*

Such a large size is most unusual.

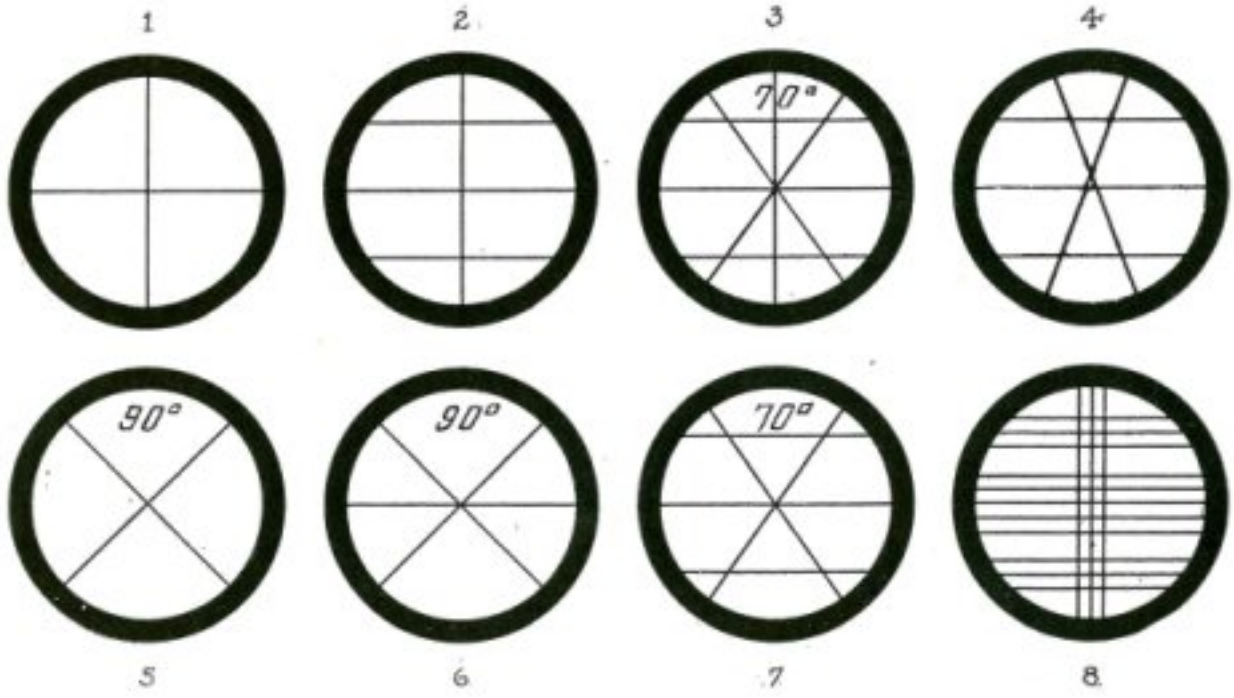
It is one of several reasons why "Buff" leads in *Durability* and *Long Life.*

Consider for a moment!—A total of over *15* square inches for Buff's two center bearings! And this entire surface is fitted to an accuracy of 1/50000 part of an inch;—And of the hardest phosphor bronze and gun-metal.

Stadia Diaphragms

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

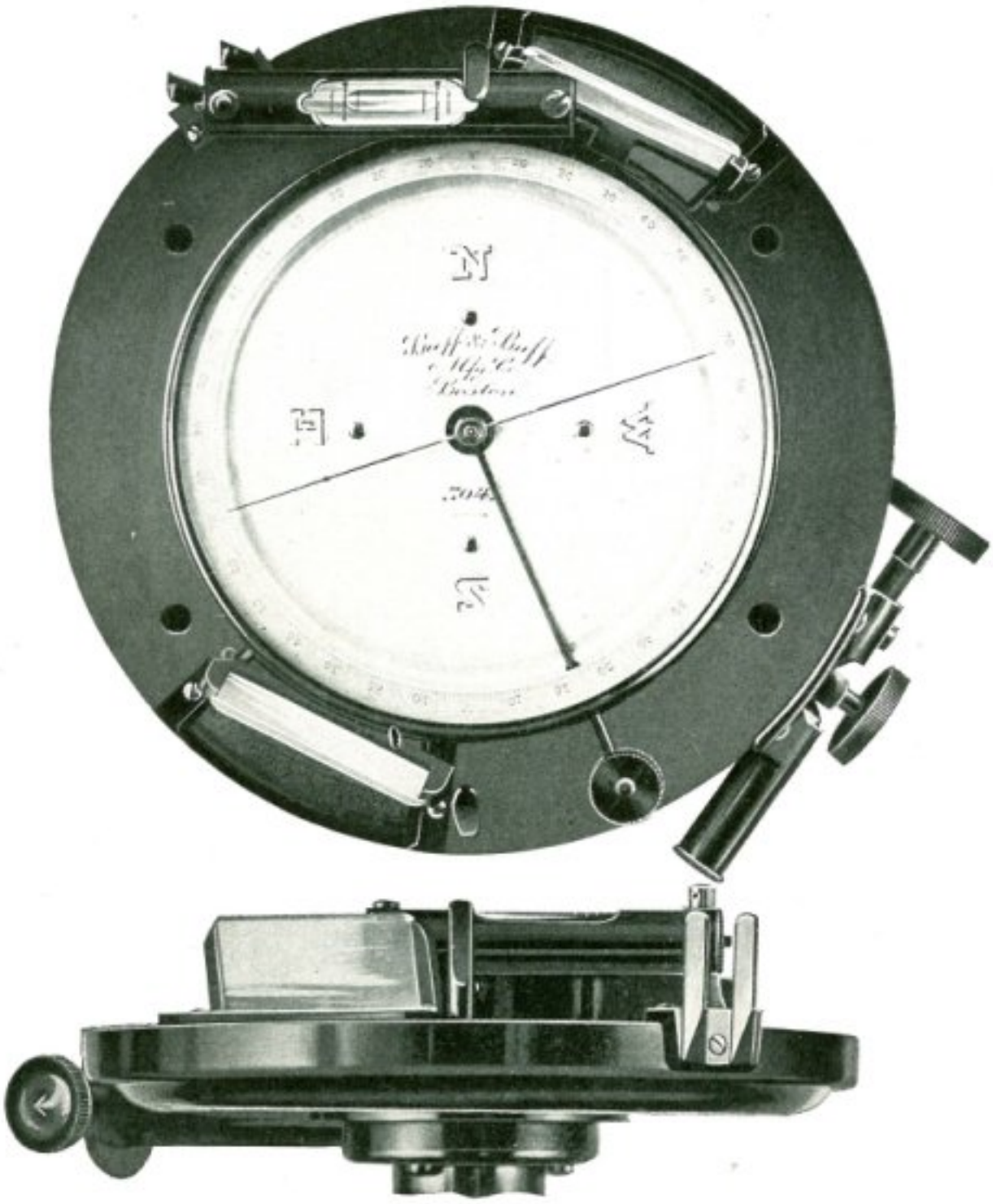
Our custom is to set the Stadia wire at 1 to 100 to read correct from center of Transit without addition of constant F + C.



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

2.	Stadia and cross-wires	$8.00
3.	" " diagonal wires 70°	9.00
4.	" " " $\frac{1}{8}$" above intersection	9.00
7.	Triangulation	8.00
8.	Stellar observation	12.00

BUFF SUPER-PRECISION TRANSITS ARE BUILT TO ENDURE



BUFF SIMPLICITY IS A KEYNOTE

(128 less parts than any other)

Showing new arrangement whereby we use full length of plate bubble and also avoid projection beyond edge of plate. Used on all sizes of Buff transits exclusively. Compass-glass and verniers are waterproofed.

Design pat. November 13, 1900. Pat. February 3, 1903. Pat. July 11, 1916. Pat. June 19, 1928.

We harden and temper our copper bronzes and have succeeded, for many years, in so perfecting Buff alloys that our different bronzes are nearly the equivalent of steel.

Buff Material and Construction

Every single part of a BUFF Transit is made of the best materials obtainable, and of the most approved design known to the Scientific arts.

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

The center bearings are of bronze metals, the finest for the purpose, as the experience of over 73 years indicates. The three widely different compositions of phosphor-bronze, gun-metal bronze, and hard red bronze are the metals chosen, since each has for the next, respectively, the least coefficient of friction, of expansion and contraction. All of these three alloys can be compared in strength and hardness only to tempered steel.

There is no better metal for instrument-making than the hard bronzes; they can be machined only by using powerful and accurate lathes. BUFF uses this remarkable tough metal for its horizontal limb, vernier plates, standards, and outer members.

Telescopes, axles, inner centers are of hard bell metal. Not a soft or yellow brass casting is used on a BUFF.

Slow-motion tangent screws — and levelling screws, throughout BUFF instruments, have 25% greater wearing surface on the thread of the screw.

This again is one of those details that cost more through the shop production, but which is worth the extra cost.

Mathematical analysis has consistently strengthened BUFF accuracy and smooth operation. External finish is a factor in sales argument, but when the finish is worn the important characteristics built into each BUFF assert themselves; — BUFF supremacy is constantly revealed.

SPECIFY BUFF FOR ENDURANCE

$6\frac{1}{4}$-In. BUFF PRECISE TRANSIT, No. 1 B — THEODAS

COMMERCIAL SIZES OF TRANSITS

	Wt.	Dia.	Needle	Telescope
No. 1	15 lbs.	$6\frac{1}{4}$ in.	$4\frac{1}{2}$ in.	12 in.
" 2	12 "	$5\frac{1}{2}$ "	$3\frac{3}{4}$ "	$10\frac{3}{4}$ "
" 3	7 "	$4\frac{1}{2}$ "	$3\frac{1}{4}$ "	8 "
" 4	5 "	4 "	$2\frac{3}{4}$ "	8 "

TRIANGULATION SIZES — 7 in. — 8 in. — 10 in.

MADE OF HARDEST BRONZE THRU-OUT

$6\frac{1}{4}$-In. BUFF PRECISE TRANSIT, No. 1 C

Code-Name — THEODUSE

Weight, $14\frac{1}{2}$ lbs.

If equipped with radial reading glasses and 20 second graduation the finest closures can be secured.

The sensitiveness of the spirit level to telescope is more than many wye levels.

Reads face of watch at 1141 feet.

6¼-In. PENNSYLVANIA PRECISE, No. 1 D

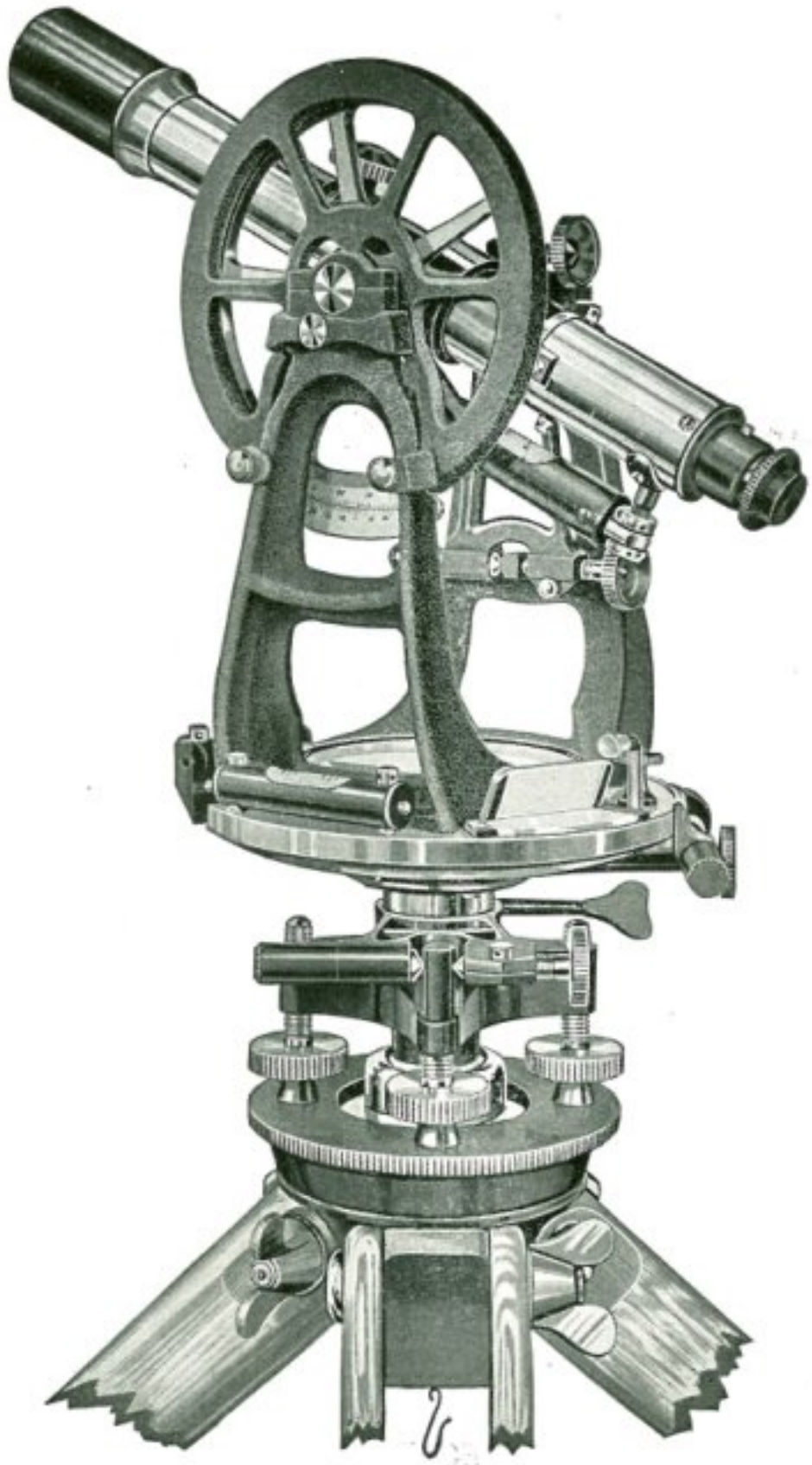
For Tunnel Alignment Work.

Code-Name — THEOPENN [Has no compass.]

Weight, 14 lbs. Black Leather Finish

"Quality means leadership."

Keen thinking engineers of discrimination who have visited our shop invariably speak words to this effect: — "Mr. Buff, I fail to understand how you can make a complete engineer's Transit with the large amount of labor necessary — at such a comparatively low price."



5½-In. LIGHT MOUNTAIN UNIVERSITY, No. 2 Ec

Code-Name — TRANDO

Can be equipped Top and Side Telescope. This style combines the *extra strong U standards* and a 3¼ compass needle.

BUFF Transits combine light weight, great strength and superior accuracy. BUFF design is severe and rigid, and secures ability to withstand adverse conditions of weather.

5½-In. BUFF PRECISE TRANSIT, No. 2 B

Light Mountain Size

Code-Name — TRANDATE

This size of Engineers' Transit in design is identical with the regular No. 1, larger size, and with decreased size and weight is admirably adapted for work of a reliable nature where a lighter-weight instrument is desirable.

Weight, 12 lbs. *"BUFF QUALITY IS ECONOMY."*

BUY A BUFF AND BE PROUD OF IT FOR 50 YEARS

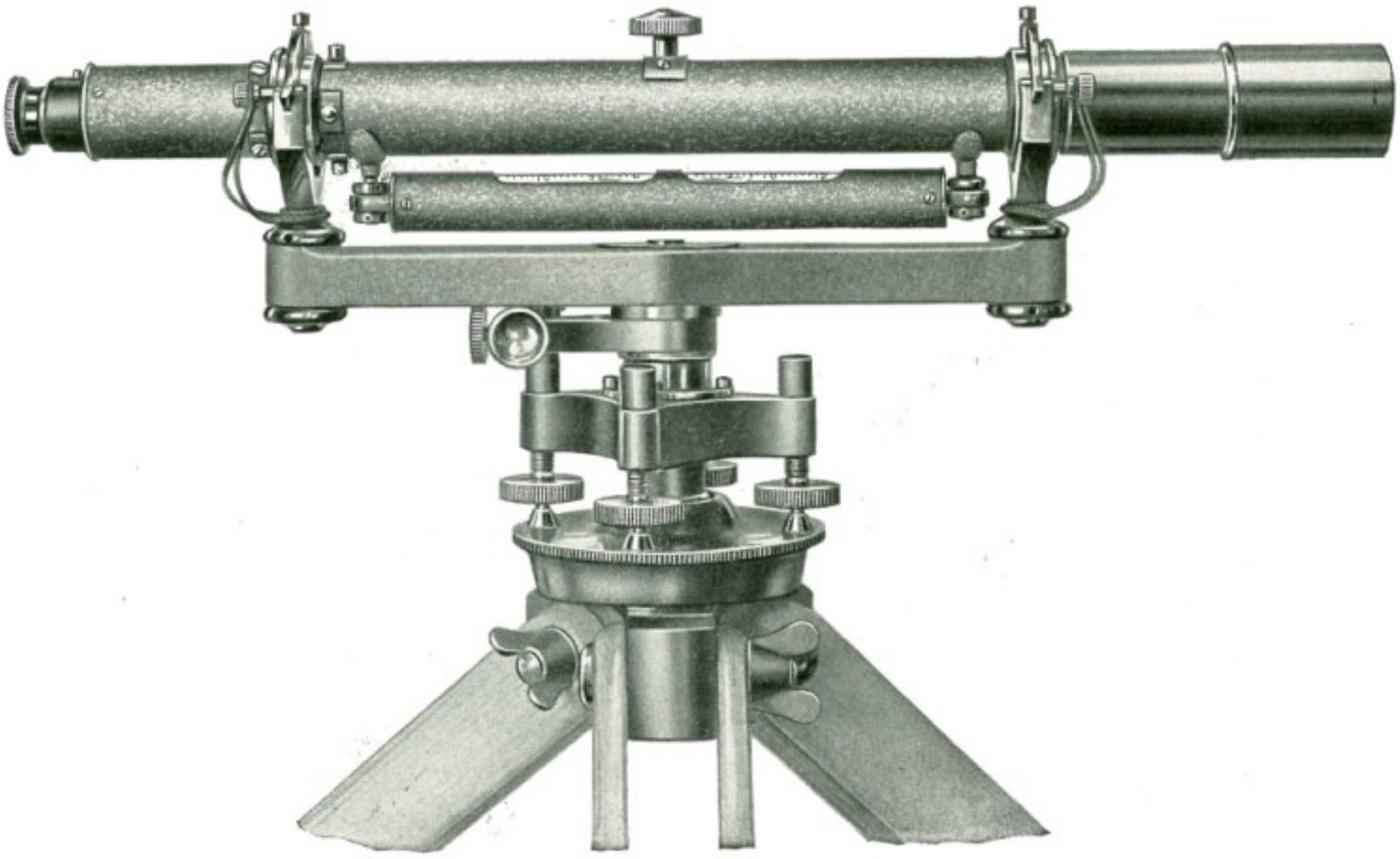
$5\frac{1}{2}$-In. BUFF PRECISE TRANSIT No. 2 C

(Design patented)

Weight, 13 lbs.

Code-Name — TRANDUSE.

The sweetness of low price is *always overshadowed* by the bitterness of low quality.



ENGINEERS' 18-In. WYE LEVEL No. 18

Power, with erecting eye-piece, 36 diameters. Weight, 10 lbs.
Can be supplied with 20-inch or 22-inch Telescope. Extra, $10.00. Power 42 Dia.
With Hexagon Telescope of about twice the weight. $10.00 Extra

Code-Name — WYES.

A longer Telescope increases the power but somewhat disturbs the perfect balance of an accurate level for bench work. Only in special cases would we suggest the 22″ Telescope.
Internal Focussing Telescope is offered as an option.

4½-In. BUFF WET MINE TRANSIT, No. 3 F W

Code-Name — TRIOWATE

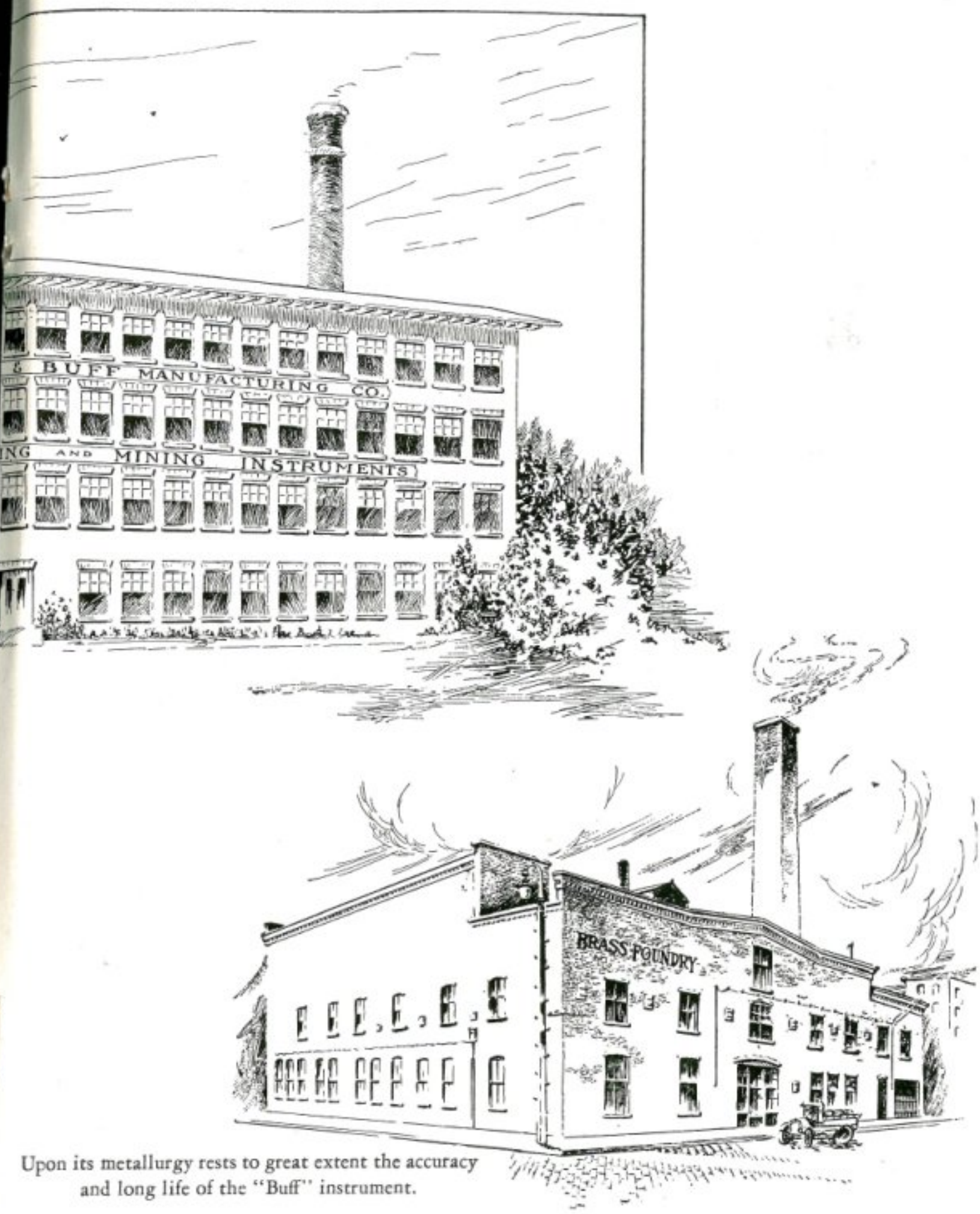
Edge graduation provides ease in reading from front. Top and side telescopes. Can be supplied on all sizes of transits. Completely protected for wet mine use. Jointed reading glass. (With or without compass needle.)

Note the efficient design and stability, and light weight of 8 lbs.

THE MOST PRECISE INSTRUMENT SHOP IN THE WORLD.

VIEW LOOKING WEST. JAMAICA PLAIN WORKS.

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, as well as city dirt and noise. Sunlight and pure air predominate.

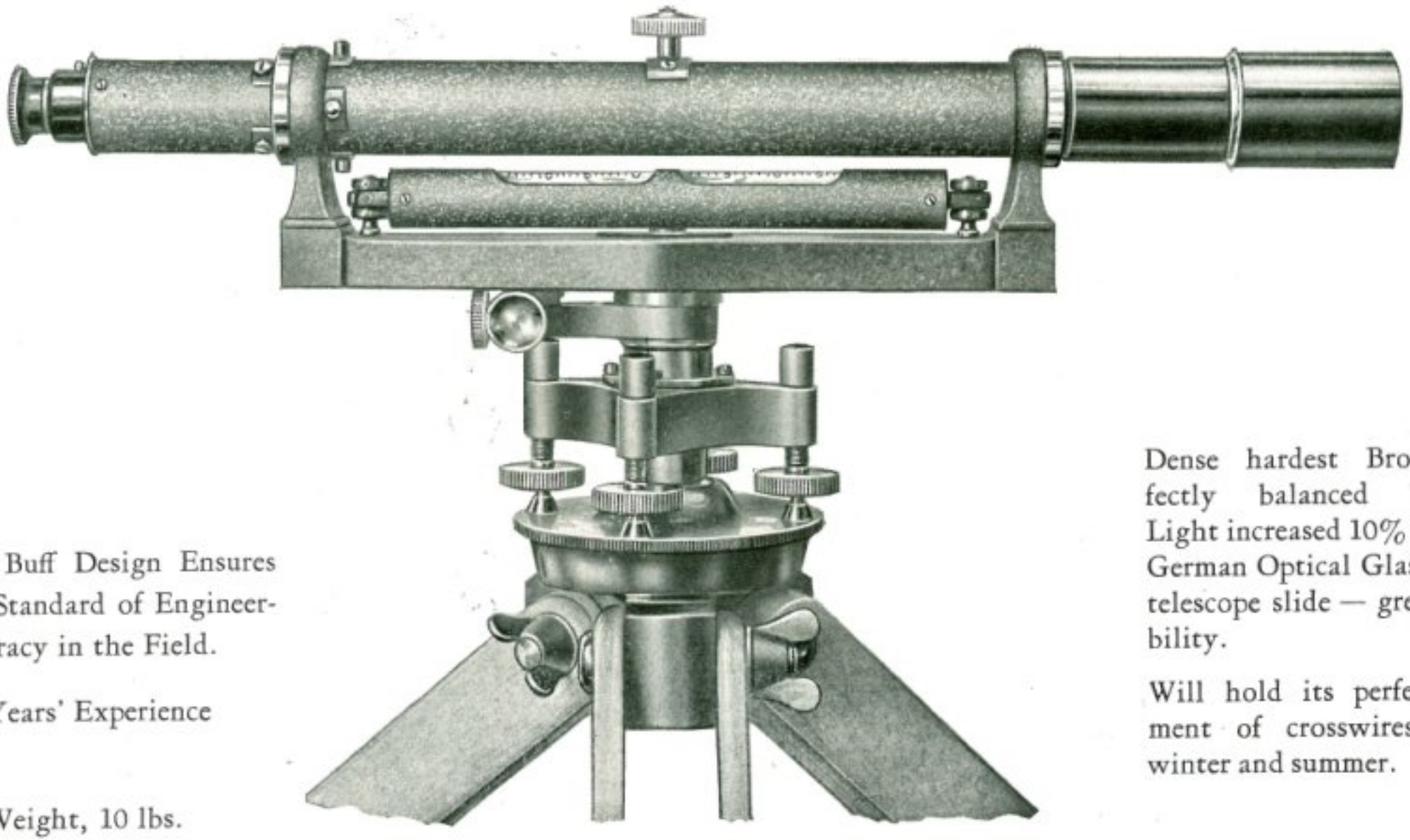


Upon its metallurgy rests to great extent the accuracy and long life of the "Buff" instrument.

Genuine Buff Design Ensures Highest Standard of Engineering Accuracy in the Field.

73 Years' Experience

Weight, 10 lbs.



ENGINEER'S 18-IN. DUMPY LEVEL, MODEL 19
POWER OF TELESCOPE — 32 MAGNIFICATION
Code-Name — DUMPAT
MASTER LEVEL OF RUGGED STRENGTH

Dense hardest Bronze. Perfectly balanced Telescope. Light increased 10% with New German Optical Glass. Larger telescope slide — greater durability.

Will hold its perfect adjustment of crosswires through winter and summer.

The "Buff" Plane Tables

		Code	Price
Made in three sizes	No. 1, 16-inch Telescope Alidade only	Alidadi	$257.00
	No. 2, 12 " " " "	Alide	190.00
	No. 3, 8 " " " "	Alam	150.00

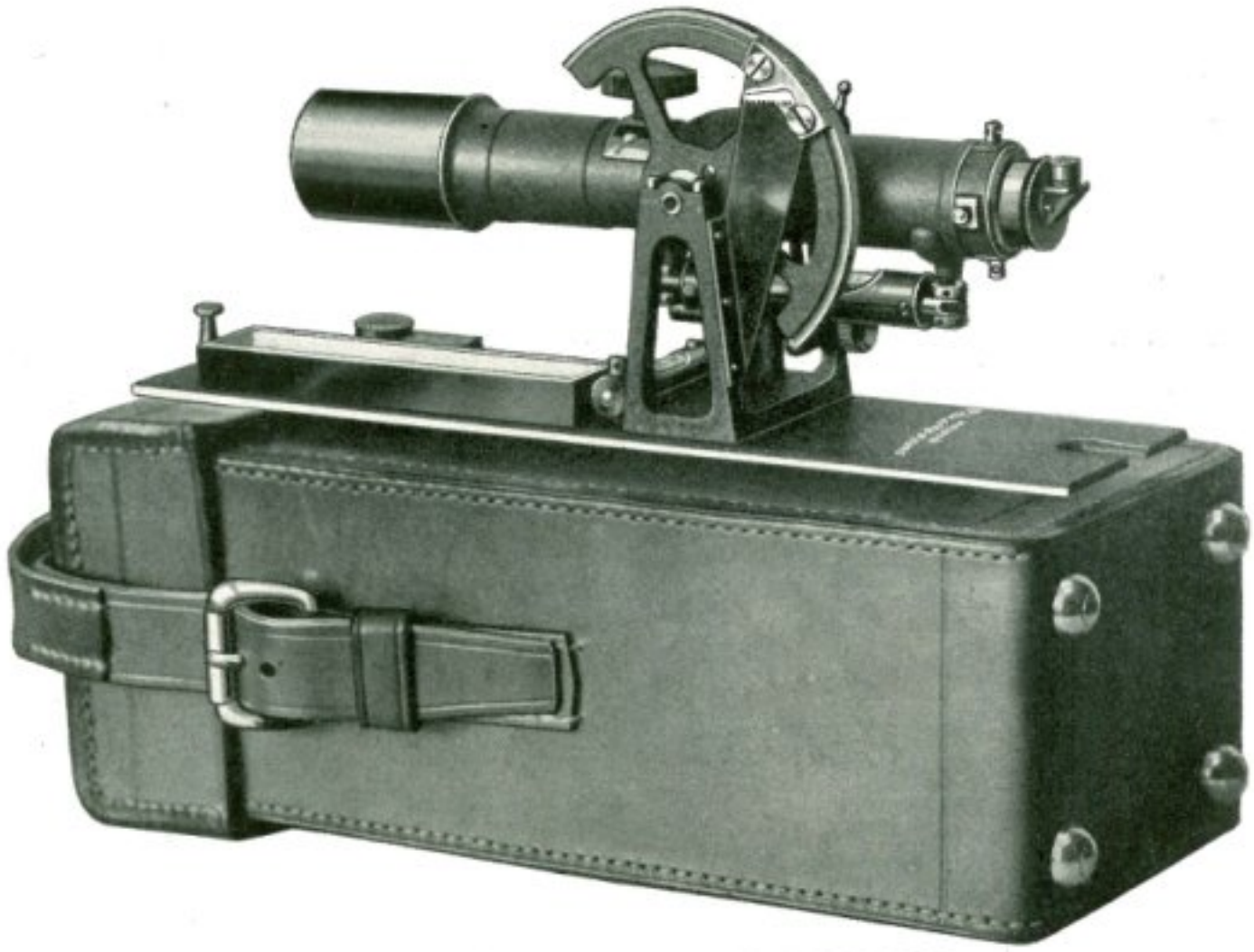
(No. 37, Explorers Type)

Vertical arcs read to 54° to enable observation on Polaris.

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 waterworks 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 a superior instrument.



BUFF No. 37 EXPLORERS' ALIDADE

FOR OIL-FIELD DEVELOPMENT

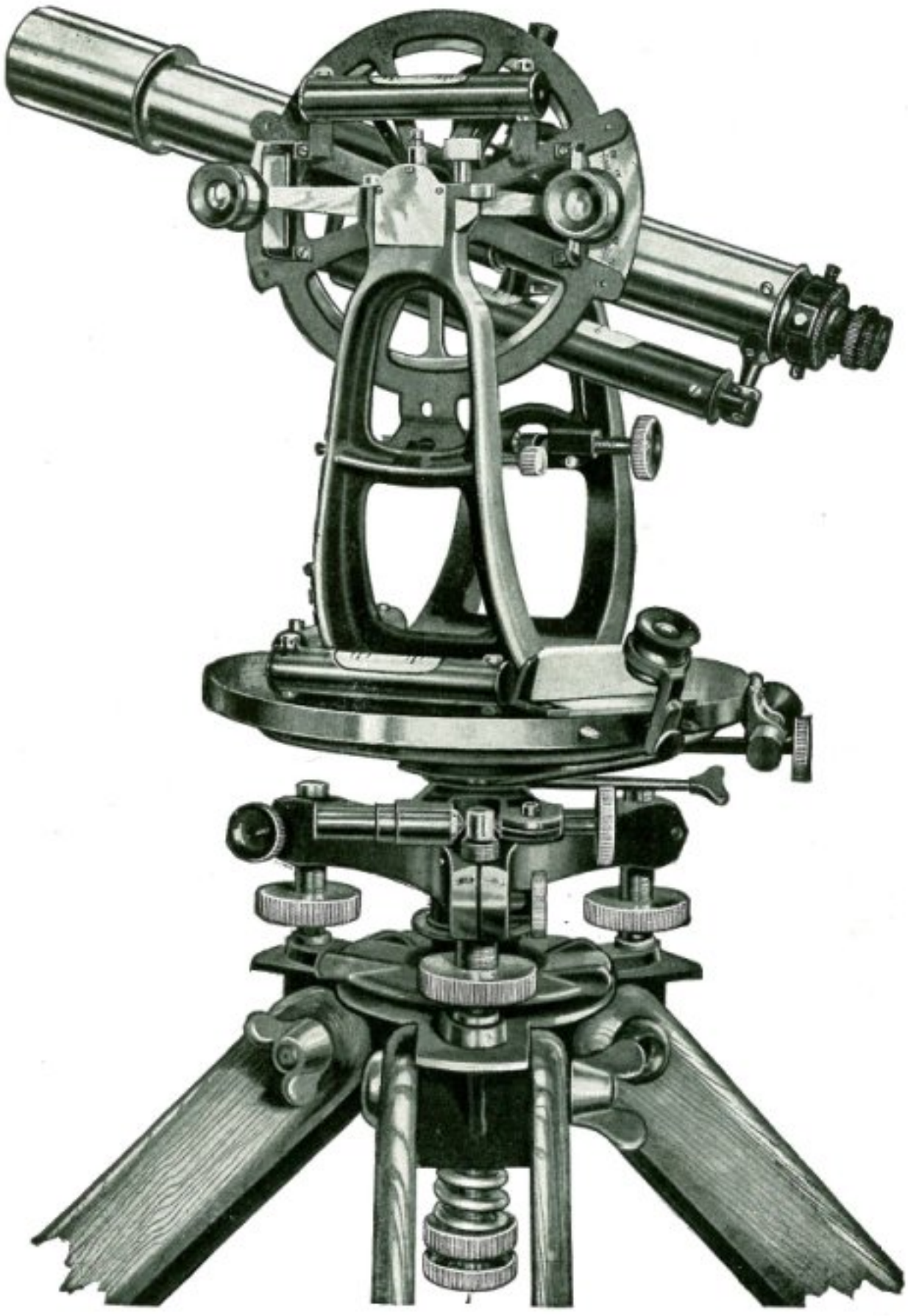
With revolving prismatic eye-piece, fixed stadia wires, 3″ x 12″ base, large telescope with 40% larger field, extra large screw heads for operating clamp screws, circular bubble, both sides of base beveled, leather-finished telescope, vertical arc reading to single minutes, vertical frame equipped with bubble to control zero level line; fixed level, adjusting screws at both ends and easily adjustable; all complete *with mahogany case and straps* $217.00

EXTRAS

5-inch box compass with extra light-weight and accurate needle	$20.00
Johnson Plane Table movement complete and three-leg regular tripod	55.00
Drawing Board, 15 x 15 with 4 improved flush fittings . .	6.00
No. 3 Gradienter Attachment	7.50
Beaman Stadia Arc, complete	18.00
Leather case and straps	10.50

CHARACTERISTICS

1. Extra powerful telescope. Shows objects erect.
2. Increase of 180% in size of image and field of view, due to a re-designed prismatic eyepiece.
3. Compact and strong design and no delicate parts exposed.
4. Vertical arc and clamp and tangent motions are placed inside of the standards, thus giving extra protection against any possible injury.
5. The instrument is equipped in every detail to guard against any projections, and all adjustment screws kept low and countersunk.



BUFF 8-In. TRIANGULATION THEODOLITE, No. 81

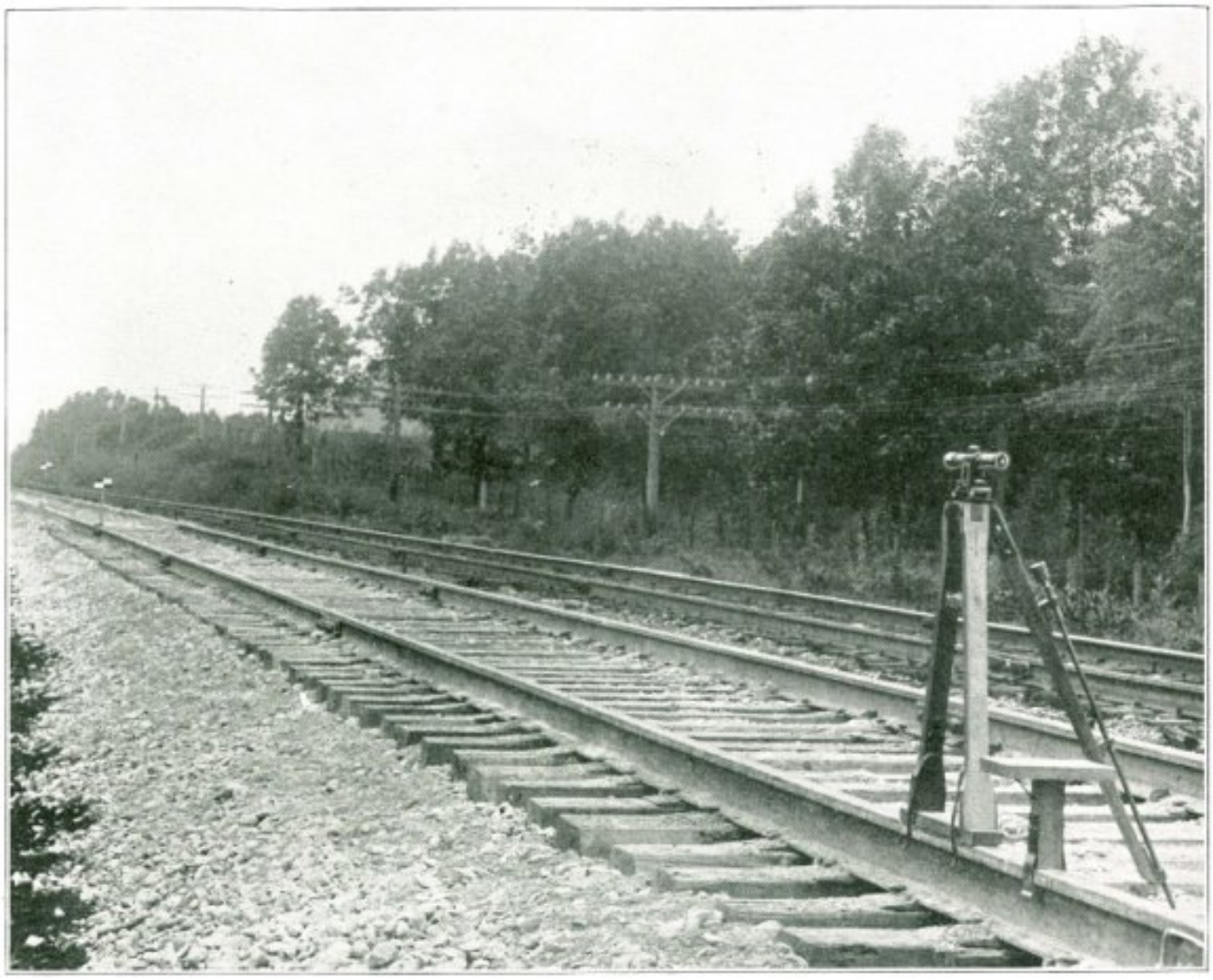
Code-Name — TRIANGLES

We recommend 8-inch Theodolite for 10″ vernier reading. Specifications on request.

"With a Buff Theodolite, triangulation is a pleasure, even under trying conditions. Such an instrument constitutes a '*Portable Observatory*' with the aid of a Chronometer, Thermometer and Barometer."

The Buff Railign System

Includes a telescope and tripod: — Vertically aligned with the gauge of rail. It avoids all errors of transfer and supplies a 20-Power Telescope as compared to the eye of the foreman with zero magnification.



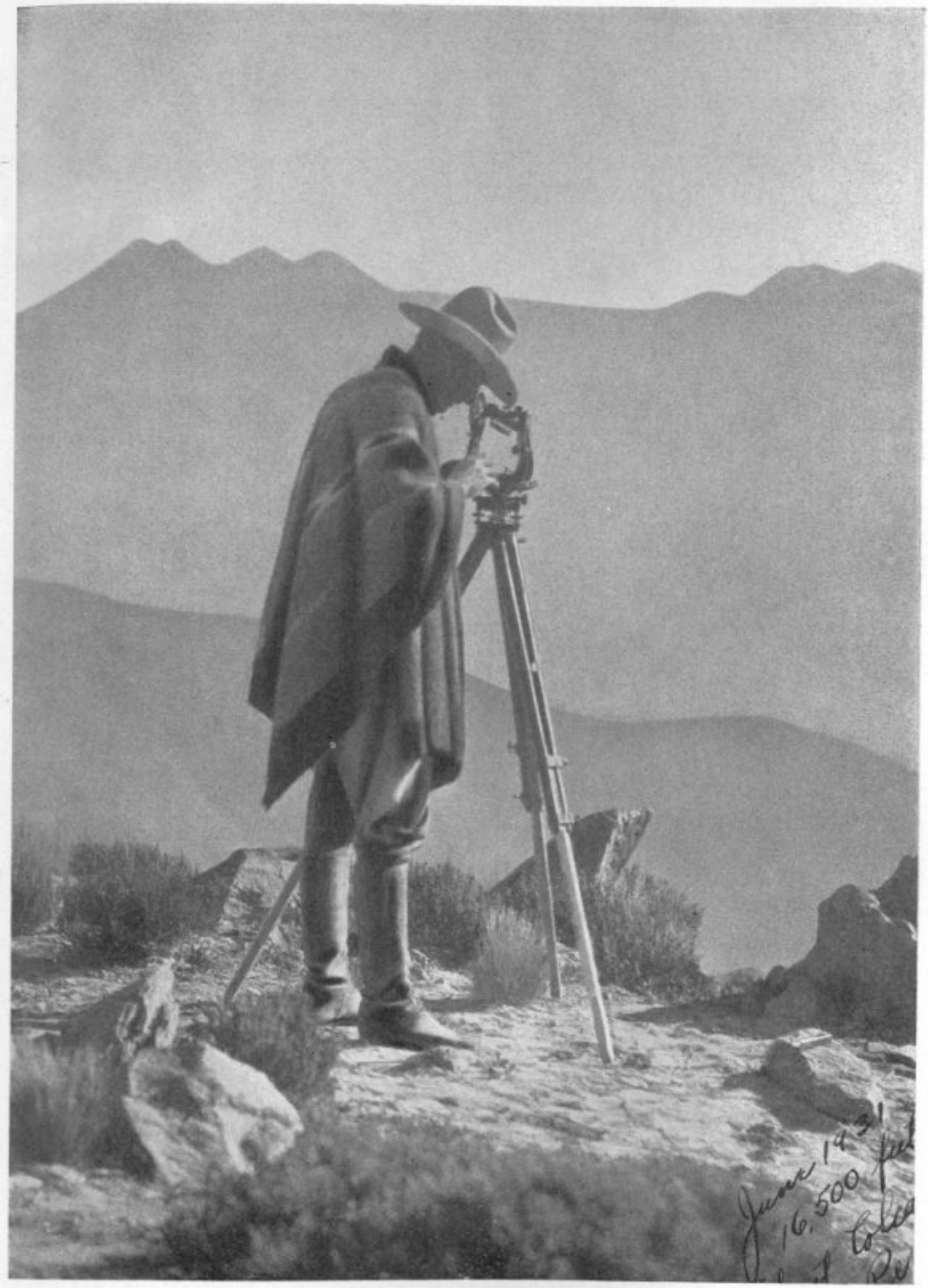
The "BUFF" Railign — Type 88

A master-instrument to secure wonderfully straight alignment

1. For 100% Accuracy, in Lining Track.
2. For Perfect Surfacing.
3. For Rapid Accurate Raising of Track.
4. For Eliminating Vibration at higher speeds.
5. One Second to Snap onto Rail: ½ Second to remove.

IT HELPS TO TAKE OUT ALL THE LITTLE KINKS

Send for Circular No. 88



ON TOP OF THE WORLD

Buff Theodolite, No. 2 E, Lost Colca Valley, Peru, S. A. 1931 Expedition

There are thousands of features on each Buff transit that are superior, and which make the completed instrument the undisputed master. In this or any other piece of printing, it would be impossible to itemize these improvements. Suffice it to say — *specifications also could not* list them and that is why the only completely satisfactory way is —

"Order a Genuine Buff" — and secure the best transit made.

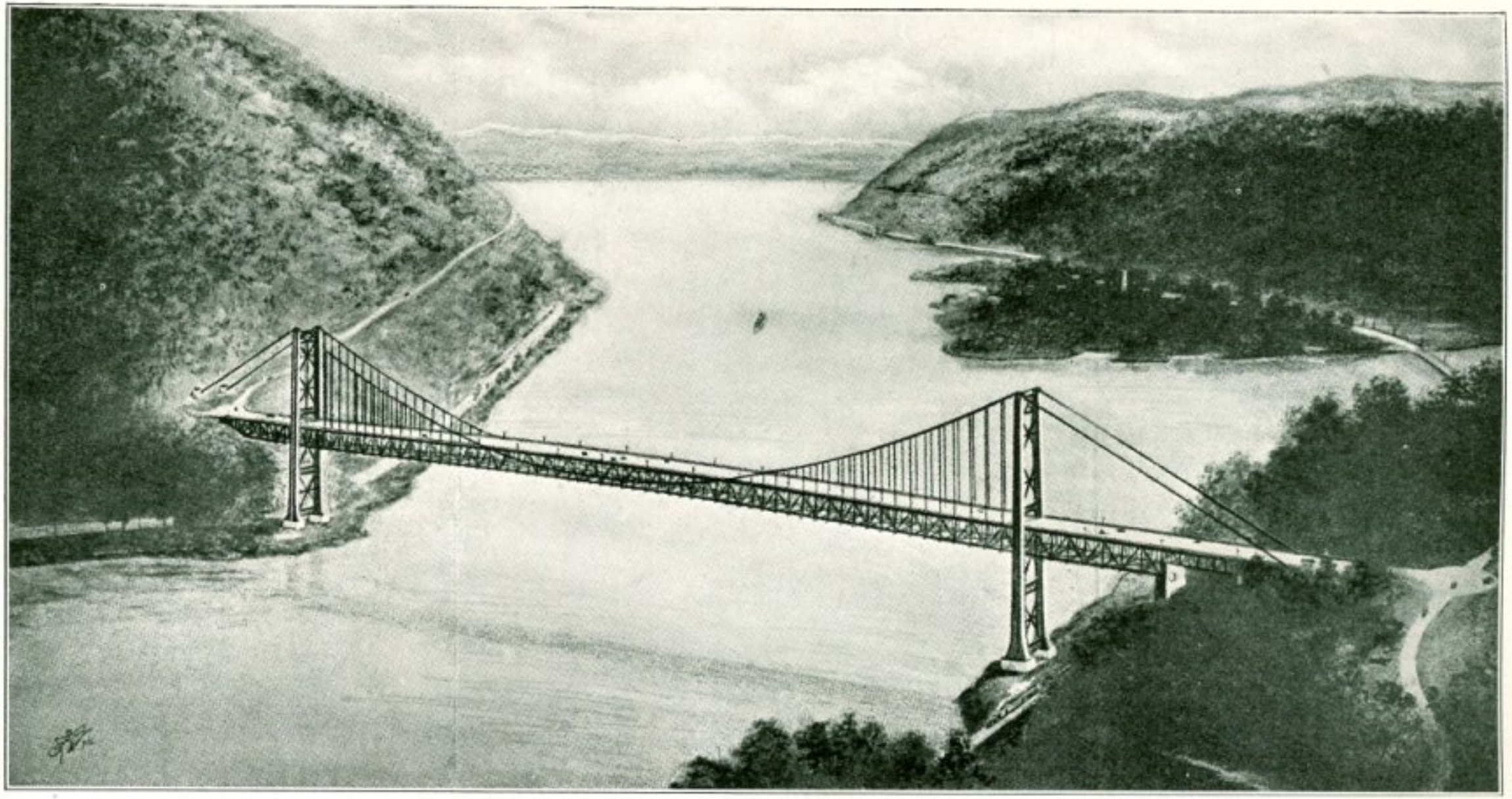
The Buff Transit is the natural result of a firm vision and a plan of many years' standing which recognized over three generations ago the wisdom of supplying nothing but *time-seasoned bronze* in its construction.

Such Bronzes, before they are fully machined and fitted into a Buff Precise Transit may have been two or three years in their original form as castings, slowly seasoning. Every Engineer knows that when a thin "skin" is machined from a piece of metal, that metal itself undergoes a momentary molecular change, therefore it may be subjected to several periods of rest before it is ready for the final fitting with other component parts. By this method, that of giving the metal a chance to cure after each operation, *it remains as in its original state.*

Bronze Is Eternal. Age, and age alone, can produce its equal as of the hard steels, *never brittle, always strong and tough*, yet never subject to demolition through atmospheric nitration.

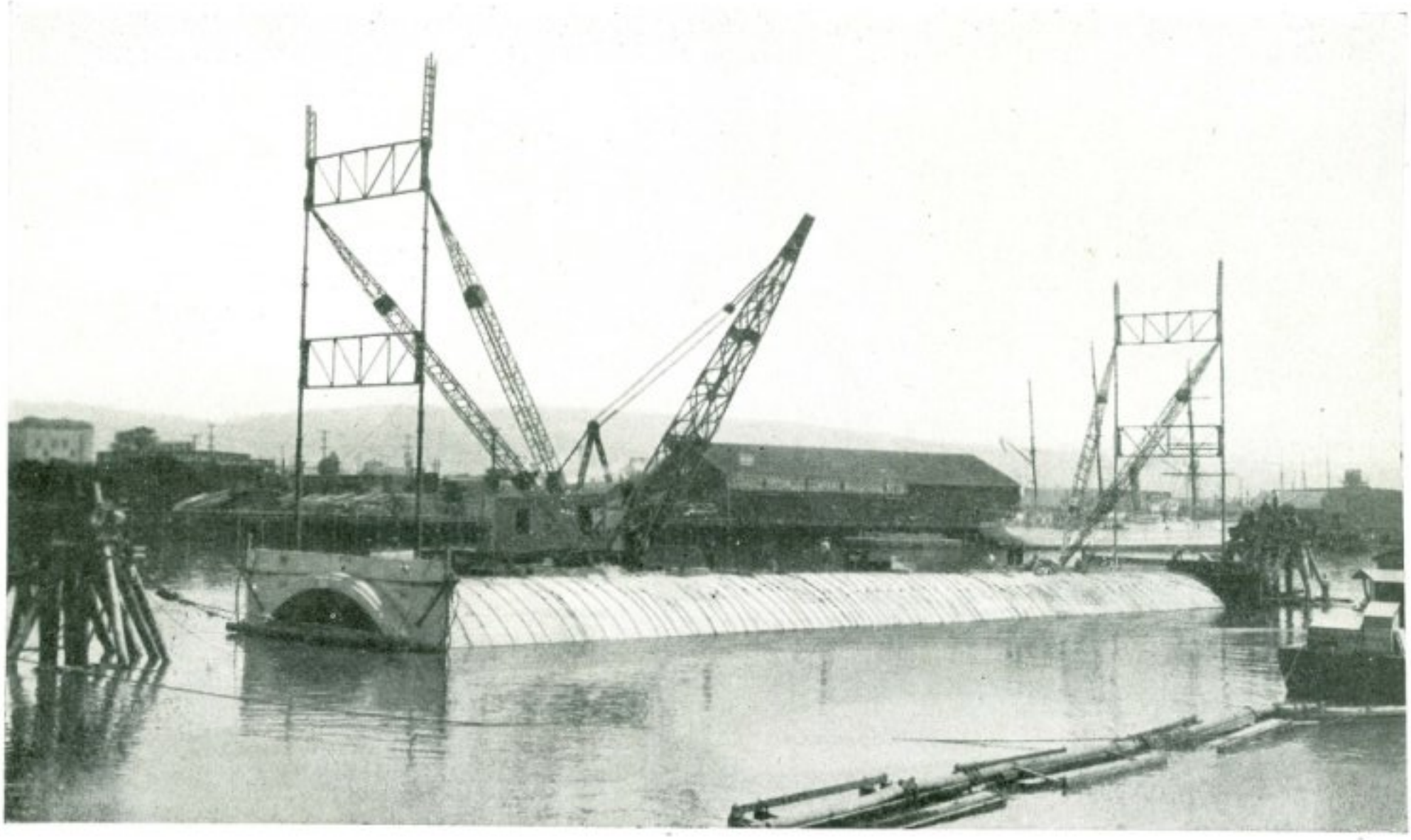
Bronze statues and tablets all over the world and under all climatic conditions remain true to form and design; always being weather proof. As in a bronze statue of tradition whose value increases yearly, so too, does the intrinsic value of a *Buff Bronze Transit* increase as time rolls on. *Seventy-three years past record has proven this to Buff owners.*

Age of Bronze (for out-door use) — 4000 yrs. plus.
Age of Iron (for out-door use) — 150 yrs. or less.
Age of Aluminum (for out-door use) — 10 yrs. or less.



BEAR MOUNTAIN — HUDSON RIVER BRIDGE — 1924

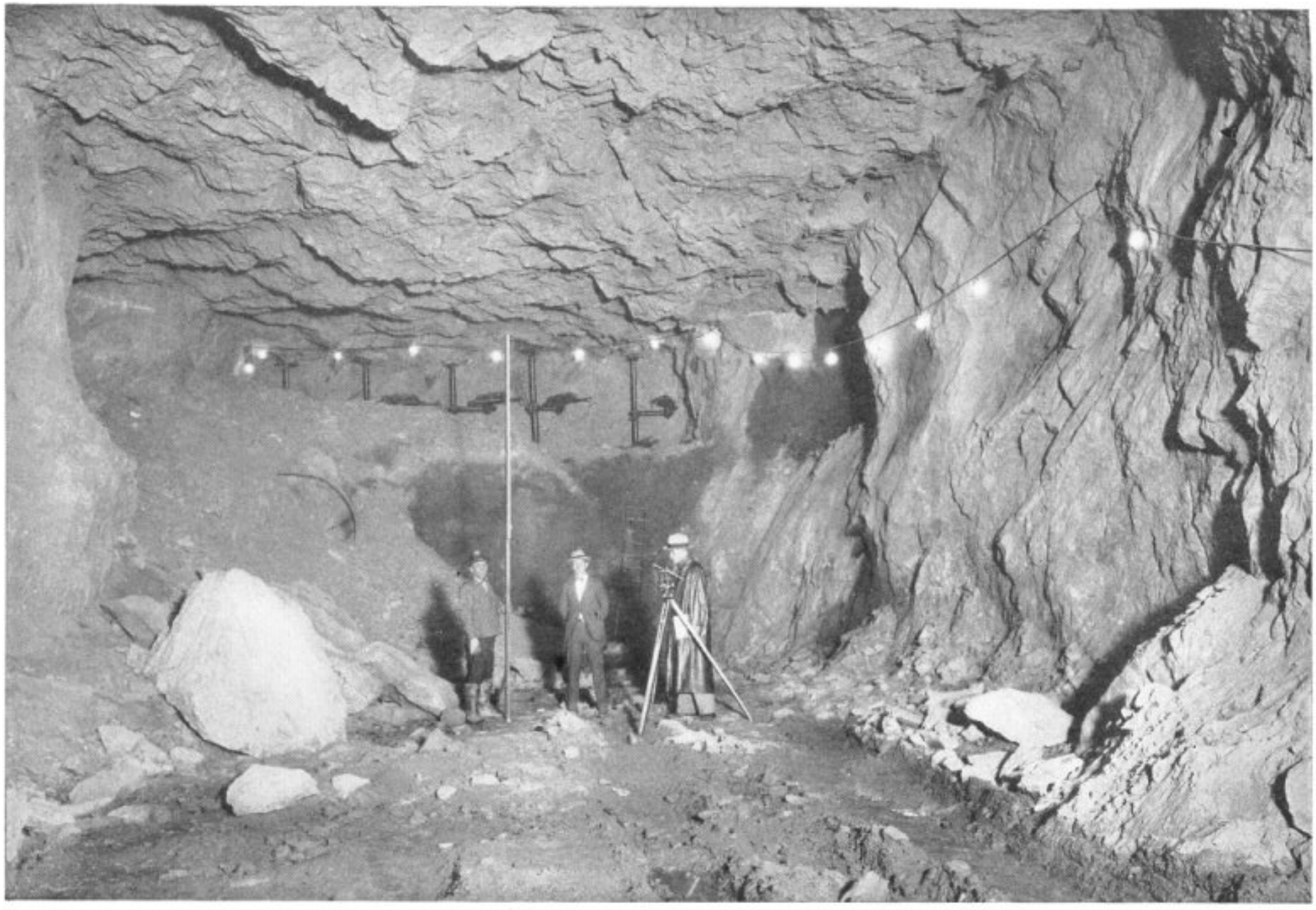
Main Span, 1,632 feet. Clearance, 153 feet. Towers, 350 feet. Width, 48 feet.



THE OAKLAND–ALAMEDA SUBWAY, 1927

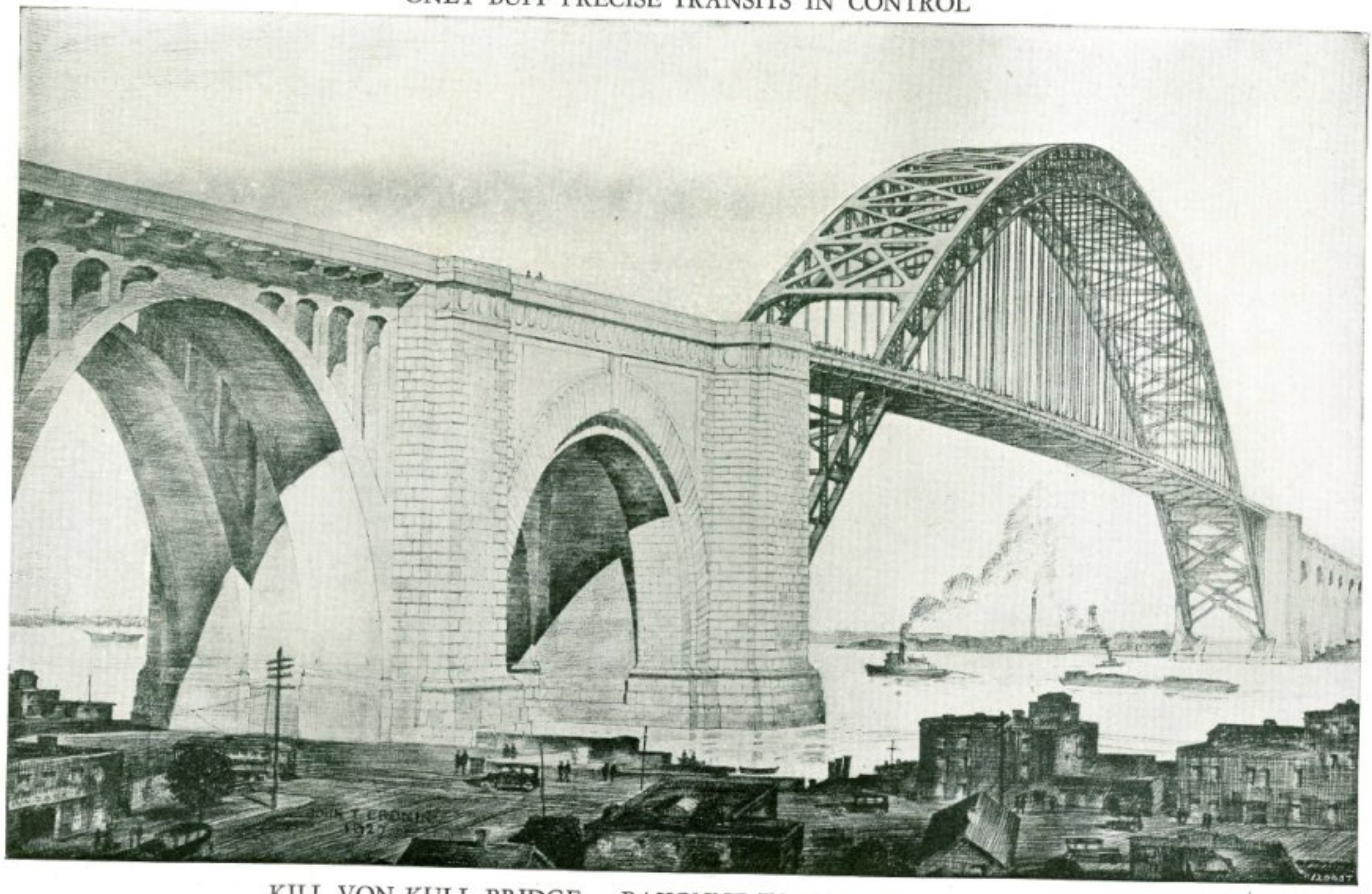
The largest under-water subway ever built. BUFF Transits in exclusive control. Sinking the tubes proved to be the easiest major operation, because the alignment was so perfect between the steel masts at each end.

OVER SIX HUNDRED BUFF PRECISE TRANSITS AND LEVELS IN CONTROL



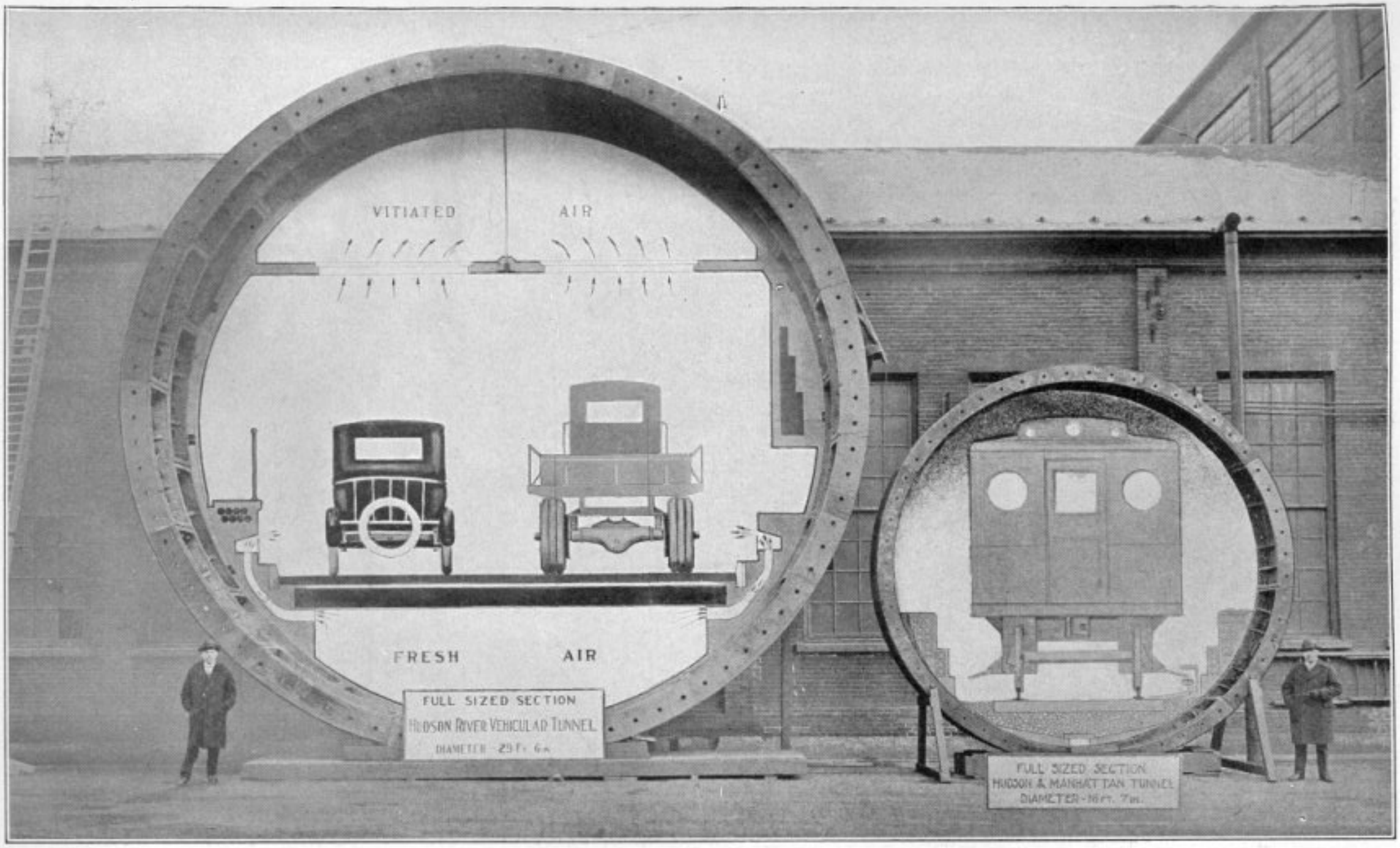
THE NEW YORK SUBWAY TUNNEL

ONLY BUFF PRECISE TRANSITS IN CONTROL

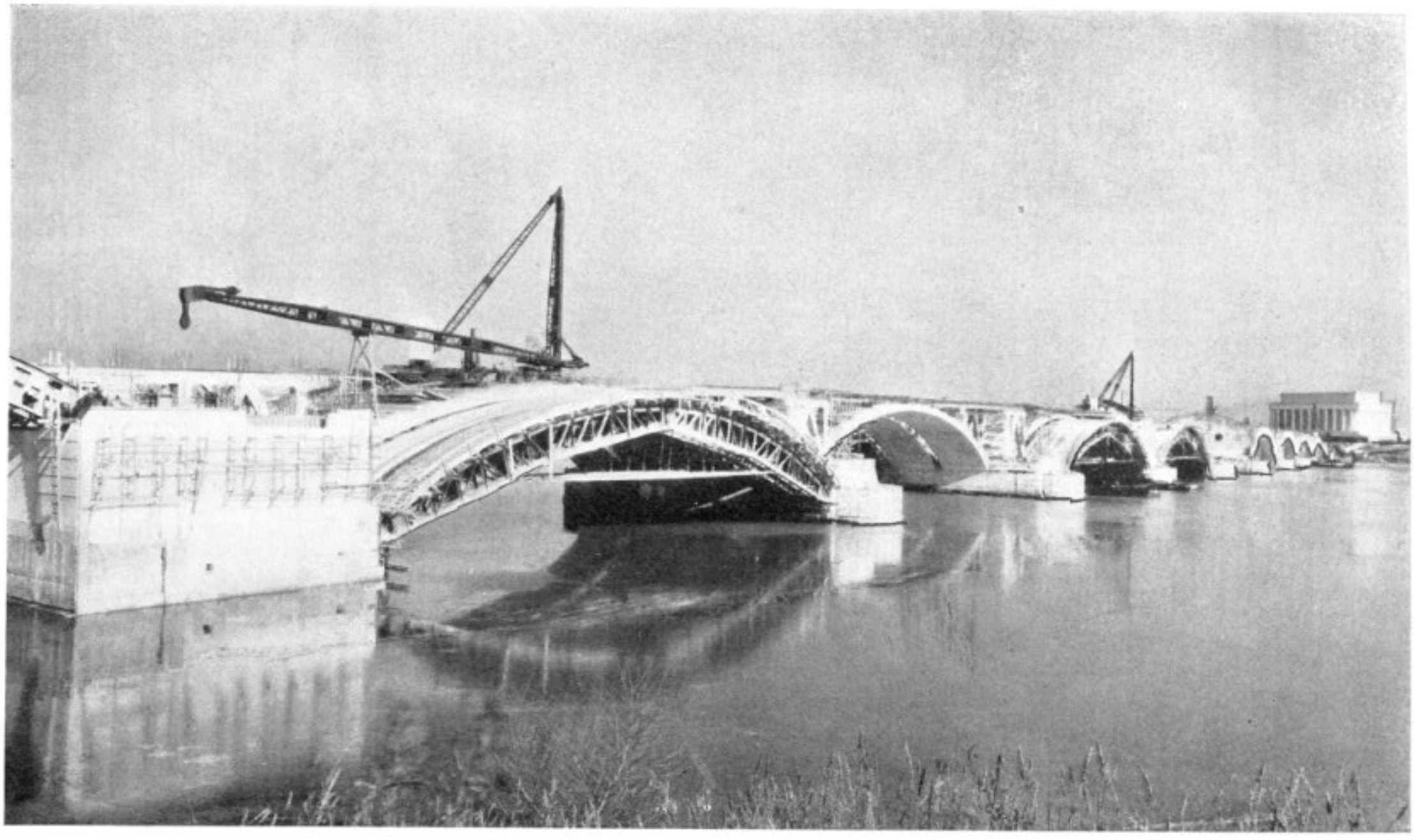


KILL VON KULL BRIDGE — BAYONNE TO STATEN ISLAND — 1931

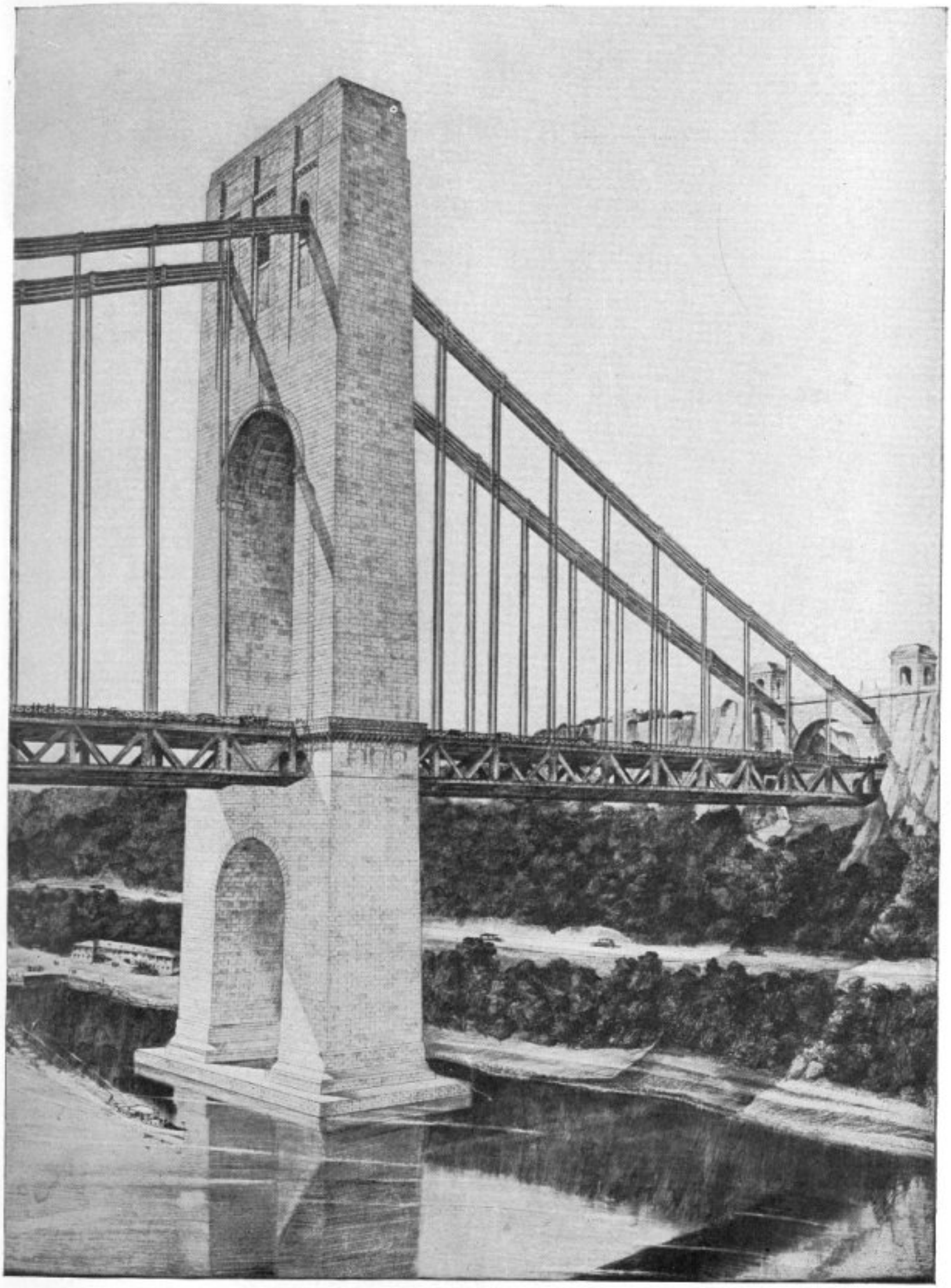
BUFF TUNNEL THEODOLITES IN CONTROL



THE HOLLAND TUNNEL



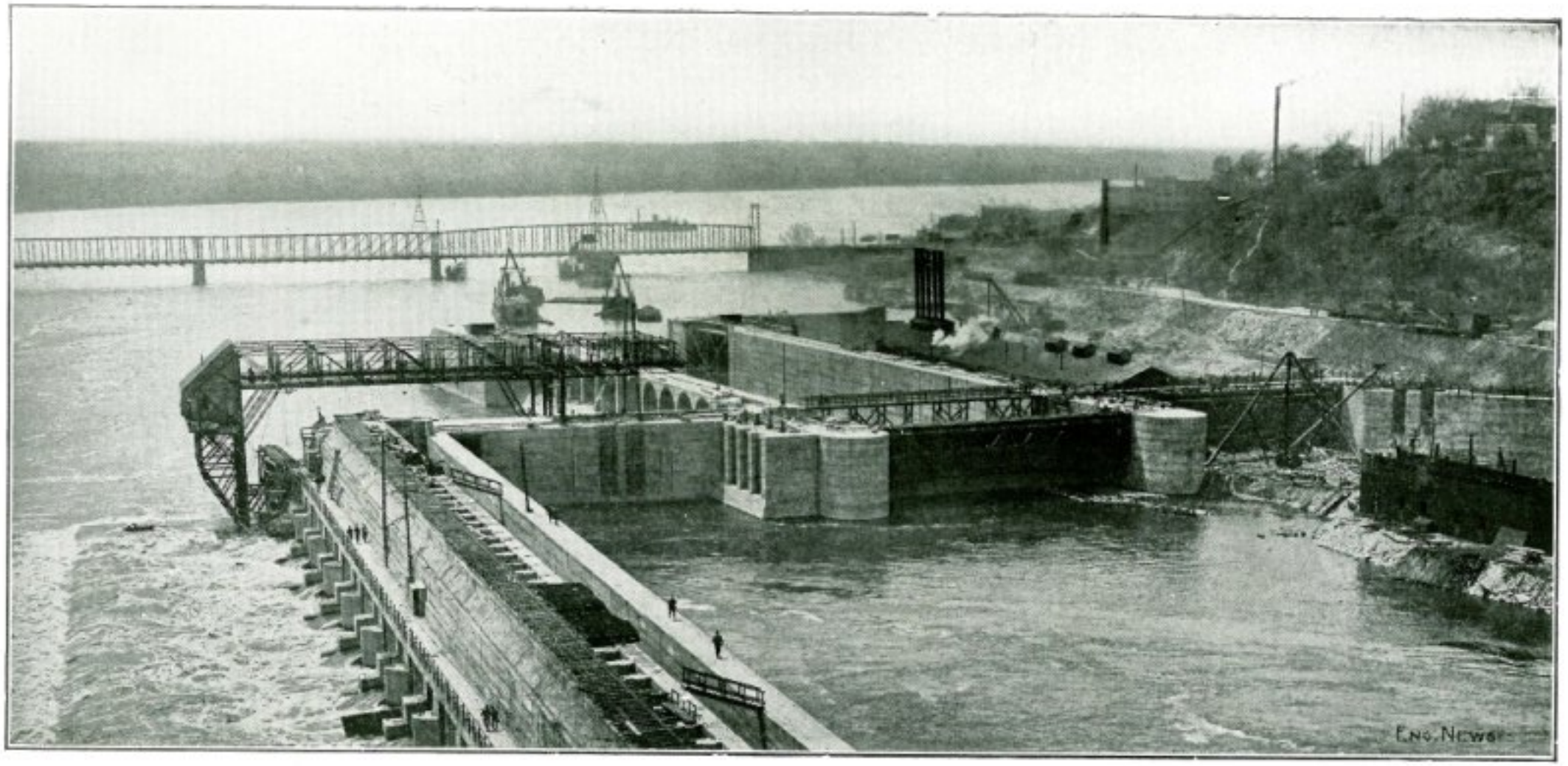
ARLINGTON MEMORIAL BRIDGE — 1929-1932 — WASHINGTON, D. C. — BUFF THEODOLITES



GEORGE WASHINGTON MEMORIAL BRIDGE

Perspective view of the bridge spanning the Hudson River between Fort Washington (179th Street), on the New York City side, and Fort Lee, on the New Jersey side. Excavation started September, 1927. The two massive towers are 650 feet high.

BUFF PRECISION THEODOLITES IN EXCLUSIVE CONTROL — 1927–1932



THE GREAT KEOKUK DAM, 1913

This largest of water-power dams represents one of the greatest engineering feats of the day. Its huge locks — the dam, 4,278 feet long, holding back 687,500 tons of water — first and last this 300,000 h.p. plant was laid out with BUFF TRANSITS AND LEVELS.

What more need be said when the greatest engineering works in the country are laid out, checked at every turn, with Buff Transits and Levels!

The reason is obvious. Engineers of experience know the cost of inaccurate work. Realize that the trifling difference in cost between the Buff and the next best is made up many times over during the transit's life.

Complete Adjustments of Buff Transit

ADJUSTMENTS BY THE MAKER WHICH CANNOT BE MADE IN THE FIELD

1. The optical axis is made to coincide with the line of collimation, *i. e.*, it is made perpendicular to the horizontal axis of the instrument.

2. The pivots of the horizontal axis are made truly circular.

3. The upper and lower plates are made perpendicular to their axes.

4. The axes of the two plates are made to coincide and form the vertical axis of the instrument.

5. The axis of the plumb-bob is made to coincide with the vertical axis of the instrument.

6. The intersection of the horizontal axis and the line of collimation is made to lie in the vertical axis produced.

7. The graduations are made truly radial and equally spaced at equal distances from the center.

8. The vertical arc is made perpendicular to the horizontal axis.

9. The center of the vertical arc is made to lie in the horizontal axis.

SIDE TELESCOPE

10. The optical axis is made perpendicular to the horizontal axis.

SOLAR ATTACHMENT

11. The optical axis is made perpendicular to the horizontal axis.

ADJUSTMENTS WHICH CAN BE MADE IN THE FIELD

1. The axes of the plate levels should be in planes perpendicular to the vertical axis.

2. The vertical wire should be in a plane perpendicular to the horizontal axis.

3. The line of sight should be perpendicular to the horizontal axis, *i. e.*, should coincide with the line of collimation.

4. The horizontal axis should be perpendicular to the vertical axis.

5. The axis of the telescope-level should be parallel to the line of collimation.

6. The vertical arc should read zero when the line of collimation is perpendicular to the vertical axis.

DO IT RIGHT OR NOT AT ALL

ADJUSTMENTS OF THE ATTACHMENTS TO THE TRANSIT

SIDE TELESCOPE

7. The line of sight must coinside with the optical axis.

8. The line of sight of the auxiliary telescope must be parallel to the line of sight of the main telescope.

SOLAR ATTACHMENT

9. The polar axis of the solar attachment must be perpendicular to the line of collimation of the main telescope and to the horizontal axis of the instrument.

10. The level must be in the center of the tube when the line of sight of the telescope is horizontal.

METHODS USED IN MAKING THE FIELD ADJUSTMENTS

1. To bring the axes of the plate bubbles into planes perpendicular to the vertical axis: bring both bubbles to the center of their tubes by means of the leveling screws and turn the plates 180°. If the bubbles are not now in the center of their tubes move them *halfway* toward the centers by means of the adjusting screws. Level up the instrument and test it again, repeating until no change occurs upon reversing.

2. To bring the vertical wire into a plane perpendicular to the horizontal axis: sight on some well-defined point and move the telescope slightly up and down. The wire should remain on the point throughout its entire length. If it does not, loosen slightly the capstan-headed screws holding the diaphragm and rotate the latter until the wire will remain on the point, then tighten the screws.

3. To make the line of sight perpendicular to the horizontal axis: level the instrument, sight on some point A, at nearly the same elevation as the instrument and preferably a long distance from it, clamp both plates, turn the telescope over and mark a point B, which should be on the same level and at the same distance as A. Now turn the instrument in azimuth until A is again sighted (notice that the horizontal axis is now turned end for end); clamp both plates, turn the telescope over, and see if it again strikes B. If it does not the difference is *four times* the error, since in this case we have made a *double reversal*. Consequently the cross-hair should be moved by the capstan-headed screw until it appears to have moved *one-quarter* of the way towards B. Test it again and repeat until it reverses perfectly. If this test is made for *different distances* the accuracy of shop adjustment No. 1 may be tested.

SEND TO MAKER'S SHOP FOR REPAIRS

The accuracy of this adjustment depends upon the fixed position of object glass, therefore do not unscrew it. When the cross-hairs are adjusted, it may be that the intersection is not in the center of field. This in no way can impair the accuracy.

4. To make the horizontal axis perpendicular to the vertical axis: sight on some high point (such as a church spire) which is not very far from the instrument. Lower the telescope and set a point on the same level as the transit. Now turn the telescope about its vertical axis and about its horizontal axis and again sight the lower point. Raise the telescope and see if it again sights the original point. If it does not the difference is *twice* the error. Correct it by moving the adjustable end of the axis so that the cross-hair moves toward the point. Test it again and repeat the operation until the adjustment is perfect.

5. To make the axis of the telescope-level parallel to the line of collimation: set two stakes 200 feet apart or more; set the transit over one of them and measure the distance from its center to the top of the stake. Place a leveling-rod on the other stake and with the bubble in the center of the tube, read where the horizontal wire strikes the rod. From these two measurements find the difference in elevation of the two stakes, assuming that the line of sight is level. Now set up over the second stake and repeat the operation, getting another value for the difference in elevation. Half the sum of these two values is the true difference in elevation of the top of the stakes. With the instrument over the second stake, find what rod reading will be needed to give a true level line. Set the target at this point and place the rod on the first stake. Then set the horizontal wire on the target by means of the tangent screw and bring the bubble to the center of its tube by means of its adjustment screw.

EXAMPLE. Suppose that the transit is set 2 feet above A, and that the line of sight strikes the rod at the 2-foot mark, where it is at B. Then assuming the instrument to be right, we would say that A and B were at the same level. Suppose that with transit 3 feet above B the line strikes 1 foot above A. Then A would appear to be 2 feet higher than B. One-half the sum gives A actually 1 foot higher than B. Consequently, with the instrument 3 feet above B, the target ought to be 2 feet above A for a level line. This shows that the instrument was 1 foot in error at this distance.

NOTE — Instead of measuring the height of the center above the stake by a tape, a good way is to set the rod on the stake and then place the eye end of the transit close to it so that the observer can look through the objective. The target will then appear very small and can be placed in the center of the field and the height of the center then read off directly.

6. To make the arc read zero when the line of collimation is perpendicular to the vertical axis: level the plates and the telescope-level.

Loosen the screws holding the vernier-plate and move it till it reads zero, then turn the screws carefully to a firm bearing.

The transit proper is now in complete adjustment. The adjustments of the auxiliary parts are as follows:

SIDE TELESCOPE

7. To make the line of sight coincide with the optical axis (which is made coincident with telescope tube by the maker): rotate the telescope in wyes, as will be described under the adjustments of the wye level, and see if the intersection of the cross-hairs remains fixed on a given point. If it does not, adjust by the capstan-headed screws holding the cross-hair diaphragm.

8. To make the line of sight of the auxiliary telescope parallel to the line of sight of the main telescope: when used as a side telescope the adjustment is the same except that it is made for the horizontal wire.

SOLAR ATTACHMENT

9. *To make the polar axis perpendicular to the plane of the line of collimation and horizontal axis of the main telescope:* level the plates and the telescope-level; bring the bubble of the solar telescope-level to the center of the tube and revolve 180° about the polar axis. If the bubble moves from the center bring it halfway back by the adjusting screws of the polar axis; then re-level the telescope. Turn the solar telescope through 90°, and if the bubble is out bring it to the center by the other set of adjusting screws belonging to the polar axis. Repeat until perfect.

10. *To place the bubble in the center of its tube when the line of sight is horizontal:* point the main telescope at some distant object, and turn the solar telescope so that it points at the same object. If the object used is not very distant an allowance for the distance between the two telescopes should be made. Level the solar telescope, and, by means of the adjusting screws, bring the wires to the distant object. These adjustments should be freely verified.

The *Buff Solar Attachment* will give the meridian without error to single minutes. If the transit is graduated to read to 10″, the meridian can be determined to 10″.

This Buff Solar therefore is the equivalent of the best triangulation transit. The best surveyors use it exclusively.

BUFF REPAIRS GIVE SERVICE VALUE

Adjustments of the Wye Level

ADJUSTMENTS BY THE MAKER WHICH CANNOT BE MADE IN THE FIELD

1. The optical axis is made to coincide with the axis of rotation in the wye, *i. e.*, the axis of the collars.

2. The collars are made theoretically perfect circles of equal diameters.

3. The level is ground to a uniform curve, and is made to expand or contract equally at the two ends under a change of temperature.

ADJUSTMENTS WHICH CAN BE MADE IN THE FIELD

1. The pin fitting in the stop should be so adjusted that the horizontal wire is perpendicular to the rotation axis when the stop is in contact.

2. The eyepiece should be centered.

3. The line of sight should be made to coincide with the axis of rotation in the wye.

4. The axis of the level tube should be made parallel to the line of sight.

5. The axis of the level tube should (for convenience only) be made perpendicular to the rotation axis.

METHODS OF MAKING THE FIELD ADJUSTMENTS

1. To adjust the stop and horizontal wire: level the instrument over both sets of screws. Place the level tube exactly beneath the telescope. Move the telescope about the vertical axis and see if the horizontal wire follows some point. If it does not, loosen the diaphragm and rotate until a position is found where the wire will follow. Then set the stop against and into its slot.

2. To center the eyepiece: rotate the telescope in the wyes and see if a distant object appears to have any motion across the field. If it does adjust by the capstan-headed screws until there is no such motion.

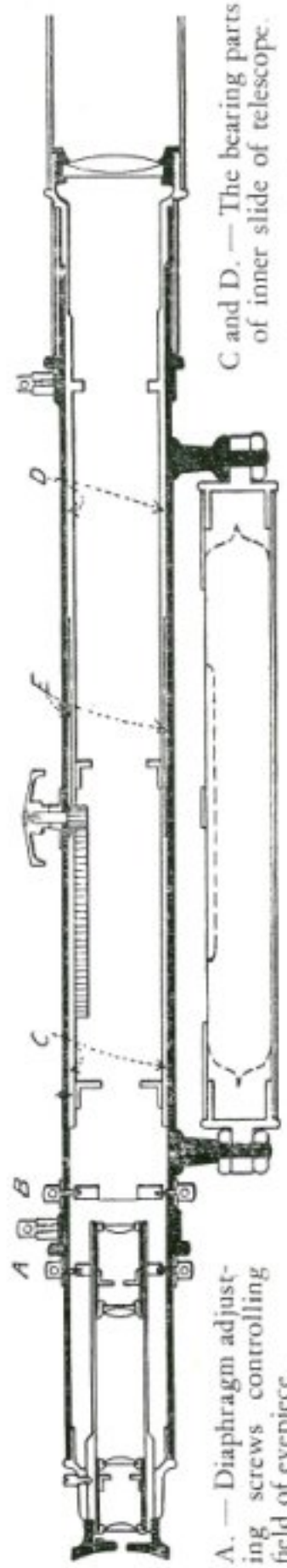
3. To place the line of sight in the axis of rotation in the wyes, *i. e.*, coincident with the optical axis: point the intersection of the cross-hairs at some well-defined point and clamp. Rotate the telescope 180° in the wyes, and see if the intersection moves from the point. If it does, bring each wire halfway back to its original position by the capstan-headed screws holding the cross-hair ring. Repeat the process until the cross-hairs remain on the point.

4. To make the axis of the level tube parallel to line of sight, we must make two adjustments: (*a*) bring them into the same plane, (*b*) make them parallel. These two parts are complicated so that they must be made alternately until both are perfect.

(*a*) To bring them into the same plane: move the level tube a little to one side (by rotating the telescope in the wyes) and see if the bubble moves toward one end. Move the adjustment screw, which gives a lateral motion to the tube, until the bubble remains at the same point.

(*b*) To make the axis of level tube parallel to the line of sight: bring the bubble to the center of the tube; take the telescope out of the wyes, reverse it (end for end) and replace it; if the bubble is no longer in the center it

ENGINEERS' 18" WYE LEVEL.—Section View



C and D. — The bearing parts of inner slide of telescope.

E. — Clearance space of inner slide of telescope.

A. — Diaphragm adjusting screws controlling field of eyepiece.

B. — Diaphragm adjusting screws controlling cross-wires.

should be moved halfway back by the vertical adjusting screw on the level tube.

5. To make the axis of the level tube perpendicular to the vertical axis: bring the bubble to the center, turn 180° in azimuth, and see if the bubble remains in the center. If it does not, correct one-half the displacement by the adjustment screws on the wyes. Level up and test again.

NOTE. — A second method of adjusting the wye level and one which has the advantage of being independent of any inperfection of the collars, is to regard it as a dumpy level and adjust it for the level tube as explained under number 5 of the transit. The other adjustments are the same as in the first method.

Adjustments of the Dumpy Level

The principles involved are the same as in the wye level, but since the construction is somewhat different the field adjustments will not be quite the same.

1. To make the axis of the level tube perpendicular to the vertical axis, proceed as in No. 5, for the wye level.

2. To make the line of sight parallel to the axis of the level tube, proceed as in No. 5 for the transit except that the cross-hairs are moved instead of the level tube.

The dumpy level will now be in adjustment, since the adjustment of the vertical wire is not important.

NOTE. — Since the telescope and uprights comprise a single casting, the line of collimation can be fixed permanently parallel to the level bar.

The geometrical design of BUFF parts is completely balanced. The tendency to pull from side to side, is conspicuous by its absence. A Transit is as steady as its weakest part, and so BUFF design has always developed extraordinary rigidity.

Adjustments for the Plane-Table

Careful examination of the following adjustments for the plane table should be often made, in order to ensure their accuracy. The plane-table more than any other instrument is subject to most severe and rough usage and it is impossible to expect bubbles and alidade to remain indefinitely in perfect adjustment. The three adjustments liable to derangement are:

1. The fiducial edge of the rule.
2. The telescopic parallax.
3. The level bubbles upon the alidade.

The first of these is readily tested by drawing a line along the edge. On reversing the rule, draw another line between the same points. If the two lines coincide, the fiducial edge is straight and in adjustment; if not, the edge must be made true.

The second adjustment of correct, embraces a perfect contact of image and cross-wires — when the position of eye is changed in any way. The cross-hairs, therefore, are in the common focus of object glass and eyepiece. If the contact varies, the object glass focus must be varied until no displacement of the cross-hairs occurs. If the true focus of the cross-hairs is not obtained at first, a re-adjustment is necessary, in order to see them and the object with equal clearness and without parallax.

The third adjustment — the adjustment of the level bubbles — is made as follows: bring the bubbles to the centers of their tubes by means of the leveling screws beneath the table; then draw lines around the rule to locate it exactly, then reverse 180°. If the bubbles remain central they are in adjustment. If not, correct one-half the error by means of the adjusting screw of the bubbles and the remaining half by the leveling screws of the board. This should be repeated until bubbles remain in a central position, on any part of the board (assuming the plane of the board to be true).

A Few Buff Users

GOVERNMENT DEPARTMENTS

U. S. Naval Observatory
U. S. Coast and Goedetic Survey
Engineering Department, U. S. Army
General Land Office
Forest Service, U. S.
Bureau of Reclamation
Government of Porto Rico
Government of the Republic of Peru
Etc.

MINING COMPANIES

Britain Mining & Smelting Co.
Guggenheim Exploration Company
Phelps-Dodge Co.
Topia Mining Company
Hecla Mining Company
American Smelting & Refining Company
Cinco Minas Company
Breitung & Co., Ltd.
Calumet & Arizona Mining Company
Etc.

ENGINEERING AND CONSTRUCTION

Ulen & Company
United Engineers & Construction Co.
Phoenix Utility Co.
U. S. Steel Products Company
Chiriqui Land Co.
Stone & Webster Co.
James Stewart & Co.
Bell Telephone Laboratories
Newfoundland Light & Power Co.
The Republic Construction Co.
Pearson Engineering Company
Ebro Power & Irrigation Company
Westinghouse, Church, Kerr Company
Robinson & Steinemann Company
Merritt, Chapman & Scott Corporation
Thompson-Starrett Co.
Etc.

RAILROADS

Atkinson, Topeka & Santa Fé
Norfolk & Western Railway Company
Boston & Maine R.R.
Pennsylvania R.R.
N. Y. Central R.R.
Lehigh Valley R.R.
Erie Railroad
Brooklyn Rapid Transit Company
Long Island Railroads
Bermuda Railways Co.
Etc.

AERONAUTICS

New York Air Terminals
Western Air Express
Roosevelt Field
Newark Airport
Boston Airport
National Advisory Commission for Aeronautics
Etc.

MUNICIPAL WORK

City of Boston
Passaic Valley Sewerage Commission
Highway and Sewer Depts., New York
Park Departments of New York City
California Highway Commission
Michigan State Highway Commission
N. Y. & Queens Elec. Light & Power Co.
City of Rio de Janeiro
City of Schenectady
Etc.

UNIVERSITIES

Harvard University
Massachusetts Institute of Technology
Northeastern University
Purdue University
University of Notre Dame
Worcester Polytechnic
College of the City of New York
New York University
Lehigh University
Ohio State University
Stevens Institute, N. J.
University of California
Sheffield Scientific University
Etc.

MISCELLANEOUS

Gulf Refining Company
United Fruit Company
W. P. Severin Company
New England Power Construction Co.
Harbison-Walker Refractories Co.
Porcupine Paymaster Ltd.
Texas Oil Company
Utah Power & Water Company
Rockefeller Foundation
Honolulu Iron Works
General Electric Company
Standard Oil Company
Western Electric Company
Union Sulphur Company
U. S. Coal & Coke Company
Newport News Shipbuilding Co.
Mill-Power Supply Co.
Wheeling Traction Company
Nova Scotia Power Commission
Etc.

Repairs

That our instruments may be protected and kept in constant service, 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 Buff 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.

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 so as to keep it on the job."

We always guarantee to place the injured instrument in good working order and adjustment and warrant the accuracy for two years. Engineers sending instruments should point out 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 especially be sent to us to insure fullest satisfaction. Time and money are saved, as new parts from stock are supplied.

All Makes are Carefully Repaired

As the accuracy of the instrument depends upon how it is cared for and adjusted, be sure that it never reaches incompetent hands. *Have it repaired right or not at all.*

TEN YEAR GUARANTY

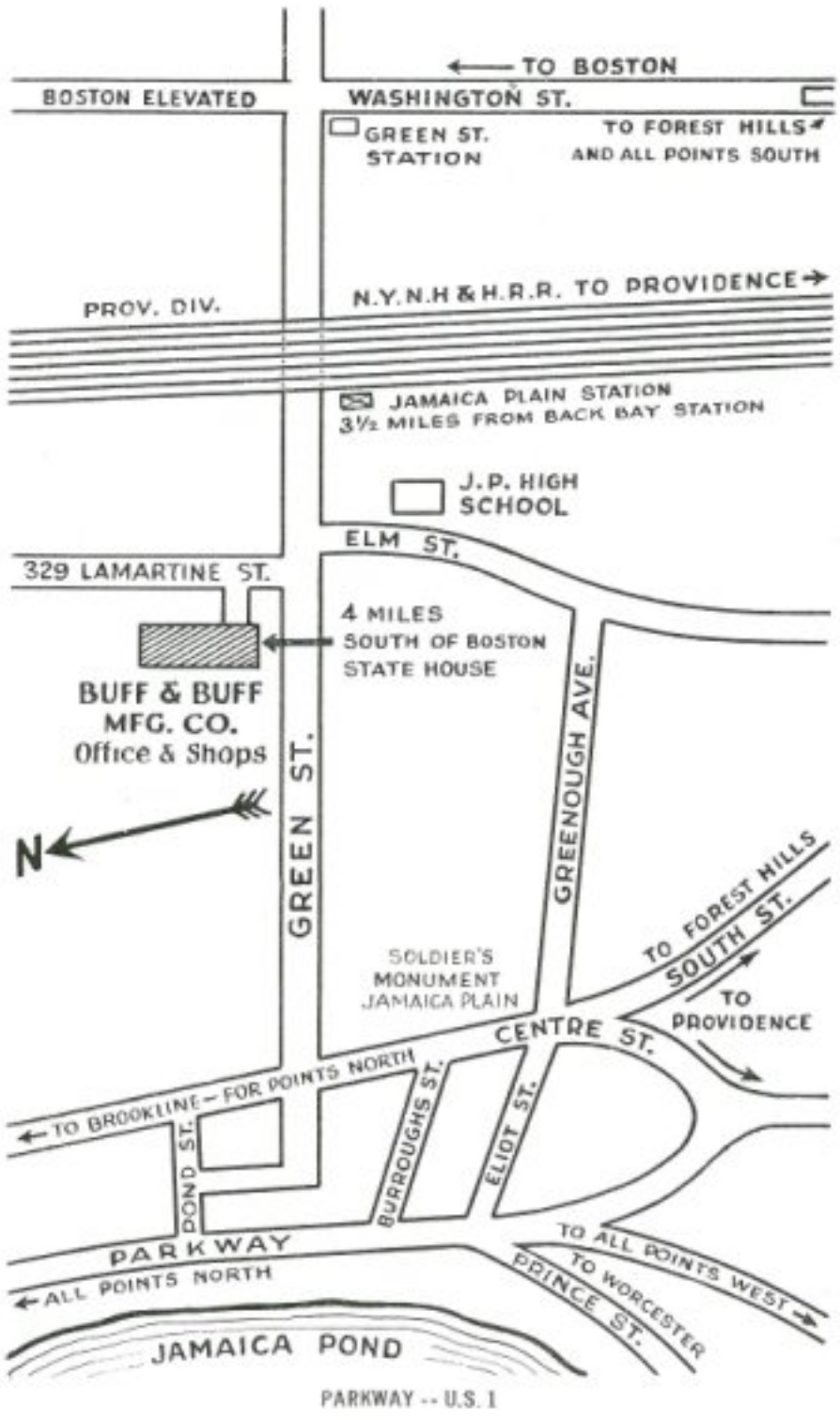
We hereby warrant our BUFF Transits and Levels, free from defects in material and workmanship for a period of TEN YEARS, and we will furnish free, f. o. b. Boston, Massachusetts, any and all parts necessary to replace such defects within that time.

BUFF & BUFF MANUFACTURING COMPANY
By Louis F. Buff
President

BOSTON, MASSACHUSETTS, U. S. A.

A REPAIR BY BUFF SAVES EXPENSE IN THE LONG RUN
[ALL MAKES REPAIRED AT LOWEST POSSIBLE COST]

Civil Engineers truly represent the *Back-bone of Integrity* thru-out the *Entire World.*



4 miles southwest of State House, on U. S. No. 1 highway. At Jamaica Pond, turn left at Pond St. and Green St., Jamaica Plain