

MANUFACTURERS OF
**ENGINEERING, SURVEYING,
MINING *and* NAUTICAL
INSTRUMENTS**

DRAWING MATERIALS
FIELD EQUIPMENT



THE A. LIETZ COMPANY

Established 1882

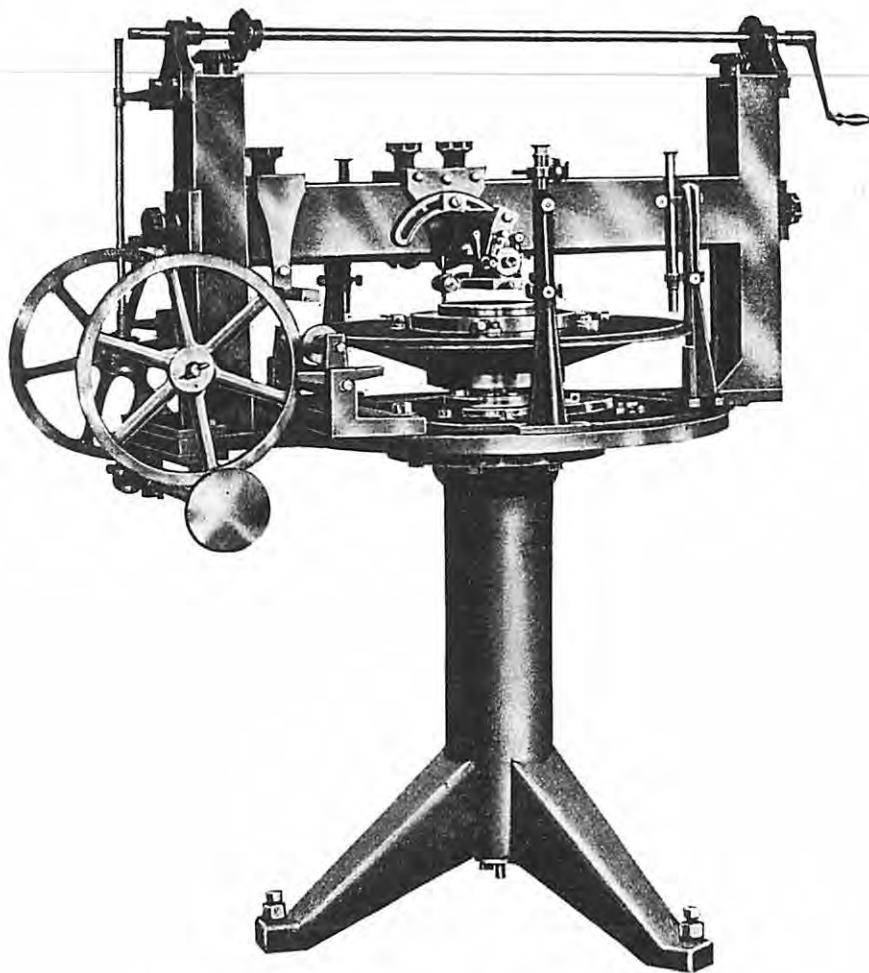
MAIN OFFICE *and* SALESROOMS: 61 POST ST.

FACTORY: 632-634 COMMERCIAL ST.

SAN FRANCISCO, U. S. A.

CIRCULAR DIVIDING ENGINE

Built by A. Lietz Co. for the Graduating Department



We are in position to regraduate the arcs or circles of all makes of surveying instruments; also sextants, octants, protractors, etc. Prices on application.

PREFACE

The articles manufactured by this Company are quoted at prices consistent with their quality of workmanship and material. We endeavor to place before the public the very best that can be produced or obtained, without imitating in shape or design the products of other makers. All our articles are of the most recent standard, with every known improvement.

The manufacture of American engineer's instruments constitutes an industry of National importance, inasmuch as the construction of them is of specific American origin; which has made it possible from the beginning (in about 1832) to accomplish engineering problems with that amount of speed and obtain results within the limitations of accuracy which characterizes many of our American industrial problems.

It is realized that those American manufacturers who have devoted their efforts to the construction of first-class instruments only have been the pioneers in establishing the standardization of the American engineer's instruments of today.

It is also realized and fully established by experience that the first-class instrument is in any and every instance the most advantageous to use.

Economic efficiency can only be obtained with the use of first-class instruments which are kept in good working condition by keeping them out of the hands of the ordinary mechanic, who frequently attempts to make repairs which can only be executed by the manufacturer.

Lietz Transits, Levels and Alidades are precise, sensitive and strong and assure their purchasers a lasting satisfaction in the field and as an investment.

Quality evidenced since 1882.

THE A. LIETZ CO.

NOTA

Este manual reemplaza las ediciones anteriores de nuestro catálogo y está cuidadosamente revisado y corregido a la fecha.

Al formar pedidos guiados por el catálogo, sírvanse mencionar el número, nombre y la medida del artículo. Al telegrafiar pedidos por instrumentos de agrimensura, usen palabras de clave, para comodidad.

Nuestros precios son F. O. B. San Francisco. Transportación de mercancías enviadas a vistas ó para su examen, es a cargo del cliente.

Sírvanse tener cuidado de mencionar el Distrito y Estado al dar su dirección, haciéndola en cada caso tan clara como sea posible.

No cobramos los empaques, con excepción de embarques para el extranjero que requieran cajas especiales y cuidado. Cuando no recibimos instrucciones especiales, usamos nuestro propio criterio acerca de la manera de embarcar y pagaremos anticipados los gastos de transportación si así se desea, agregando esas sumas a la factura.

Garantizamos todas las mercancías manufacturadas por nosotros, y cualesquier artículos que no resulten satisfactorios pueden devolvérsenos y nosotros los cambiaremos gustosos. Si no estuvieren satisfechos, sírvanse escribirnos.

Nuestra política es satisfacer a nuestros clientes, porque creemos que los clientes satisfechos son nuestro más alto caudal.

De acuerdo con las reglas de Express Company, un instrumento de agrimensura, cuidadosamente colocado en su caja y en una caja de empaque, es despachado como mercancía y se cobra "tarifa sencilla." Triple tarifa es aplicada si no se observa esa precaución. Por consiguiente, el cliente no deberá omitir conceder estricta atención a esta regla y evitarse cargos excesivos.

Cajas de empaque para instrumentos de agrimensura, son proporcionadas por nosotros a muy bajo costo.

THIS MANUAL WAS WRITTEN EXPRESSLY FOR THIS COMPANY AND THE MATTER THEREIN CONTAINED IS PROTECTED BY COPYRIGHT. PARTIES INFRINGING WILL BE PROSECUTED

ENTERED ACCORDING TO ACT OF CONGRESS IN THE YEAR 1925

BY

THE A. LIETZ COMPANY

IN THE OFFICE OF THE LIBRARIAN OF CONGRESS AT WASHINGTON

NOTICE

This manual supersedes the former editions of our catalogue and is carefully revised and corrected to date. Kindly destroy old issues.

When ordering from catalogue please give numbers, the name and size of article. When telegraphing orders for surveying instruments use code words for convenience.

Our prices are F. O. B. San Francisco. Transportation on goods sent on memorandum, or for examination, is at the expense of the customer.

Please be careful to add the county and state to your address, making it, always, as clear as possible.

We make no charge for packing, except on foreign shipments requiring special cases and care. Unless otherwise ordered we shall use our best judgment in the way of shipping, and will prepay transportation if desired, adding amounts to your invoices.

We guarantee all goods sold by us, and any articles which do not prove satisfactory should be returned to us, and we will cheerfully rectify or replace.

It is our policy to please our customers, believing that satisfied patrons are our highest asset.

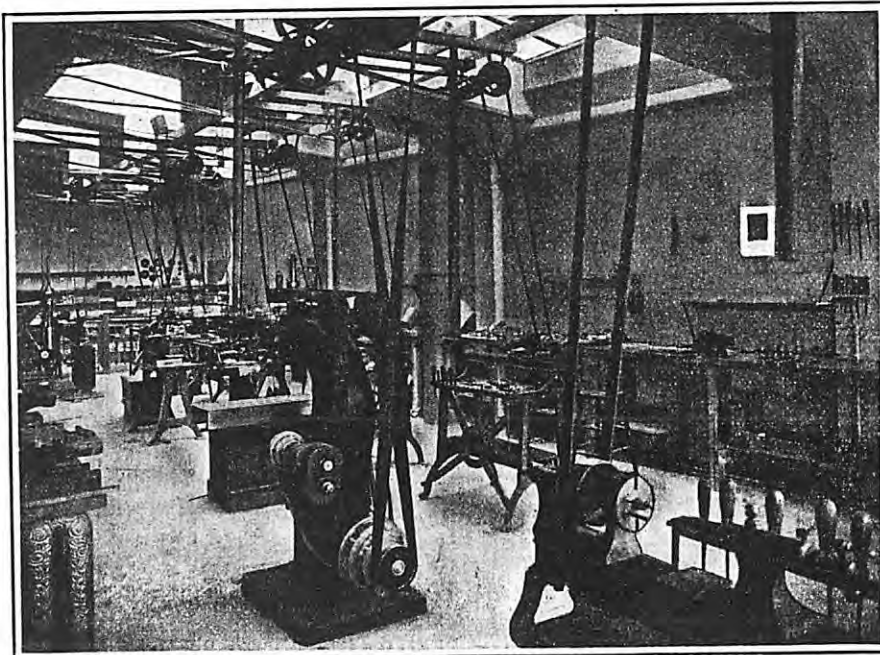
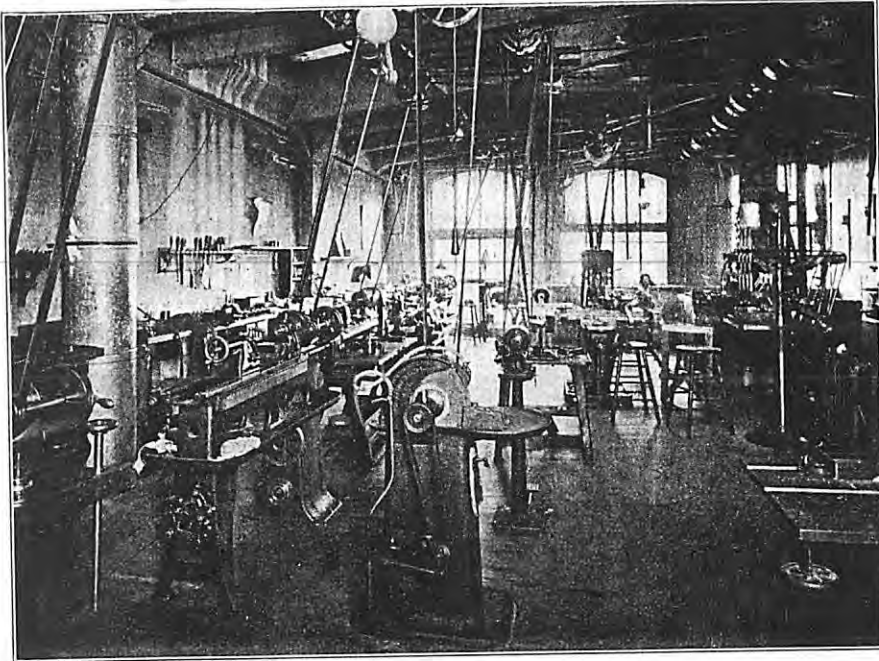
According to the rules of the Express Companies, a surveying instrument, carefully placed in its case and in a packing box, is shipped as merchandise and charged at "single rate." "Three rates" will be charged if this precaution be not taken. The customer should not omit, therefore, to pay strict attention to this rule and avoid unnecessary overcharges.

Packing boxes for surveying instruments are furnished by us at a nominal rate.

DESCRIPTION OF

THE LIETZ INSTRUMENTS

INCLUDING REMARKS ON THEIR USE, HANDLING, CARE,
PRESERVATION AND ADJUSTMENTS



VIEWS OF OUR MANUFACTURING DEPARTMENT

THE ENGINEERS' TRANSIT OR THEODOLITE

In reviewing the different parts of the transit and theodolite, it will answer our purpose to include them, for the present, under one head, using both terms as synonymous—the word theodolite having been defined as an instrument of angular measure, possessing two graduated circles, normal to each other, which during manipulation are set in horizontal and vertical planes respectively. Authorities say that it is generally believed that the word theodolite (theodolith) is a combination of *θεα* sight, *σδος* road, and *λιθος* stone, and that in order to understand this derivation it must be known that formerly all supports upon which theodolites were placed were made of stone. This meaning, however, seems somewhat ambiguous, and other derivations have been sought. The etymology of the word is uncertain.

In classifying there appear two distinct groups of theodolites: the simple theodolite, in which the lower clamp and tangential movement is neglected; and the repeating theodolite, possessing the double horizontal movement on spindle and plate, which is the principal feature of all complete field instruments made for the engineer at the present time.

The various parts of the transit or theodolite may be grouped under the following heads, viz.:

Beginning from the base-plate we have:

- 1—The tripod connection with the leveling, plumbing and centering apparatus (Page 10);
- 2—The centers (Page 11);
- 3—The graduated plate and verniers (Page 11);
- 4—The compass and variation plate (Page 13);
- 5—The standards with the vertical arc and its movements (Page 15);
- 6—The gradienter (Page 16);
- 7—The spirit levels (Page 16);
- 8—The telescope (Page 17).

eye-piece, in order to compare them and to find their proportion. While the former is easily obtained by a direct measurement from the objective lens to the cross-hairs, the latter, usually containing an entire system of lenses, presents numerous difficulties. For this purpose we possess an apparatus especially designed for us.

Dividing the focal length of the objective (when the telescope is focused to mean distance) in millimeters, by the equivalent gives the magnifying power of the telescope under consideration.

If any of our customers want the focal length of an eye-piece determined, we shall cheerfully do so, without charge, upon receipt of it, which should be sent carefully packed.

Adjustments of the Plane-Table Alidade

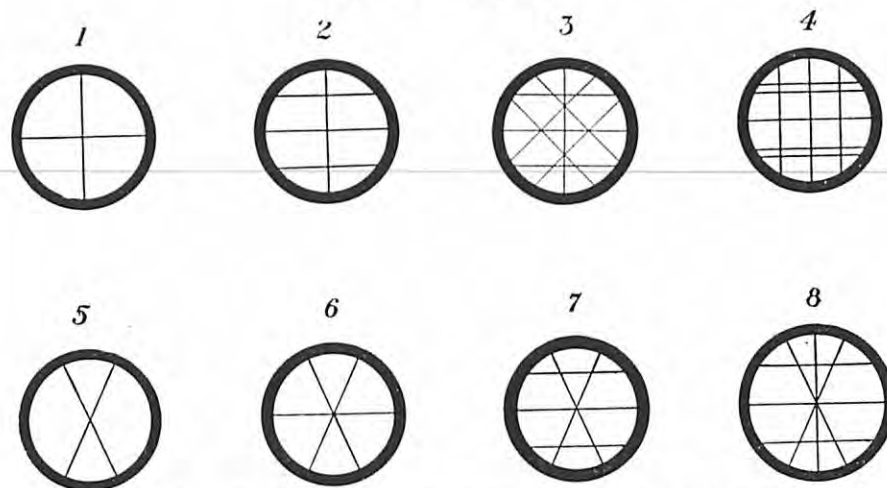
Without going again into all the details of instrumental adjustments, it behooves us to enumerate the points required of this instrument when in proper condition. These are:

- 1st—That the *fiducial edge* of the rule be absolutely straight;
- 2d—That all *parallax* be destroyed, by placing the cross-hairs in proper focus;
- 3d—That the line of collimation move in a vertical plane;
- 4th—That this plane be normal to the plane of the ruler;
- 5th—That the same plane also intersect the fiducial edge of the ruler, or at least be parallel thereto;
- 6th—That during parallelism of the optical axis and the fiducial edge, the zeros of the vertical arc and its vernier correspond.

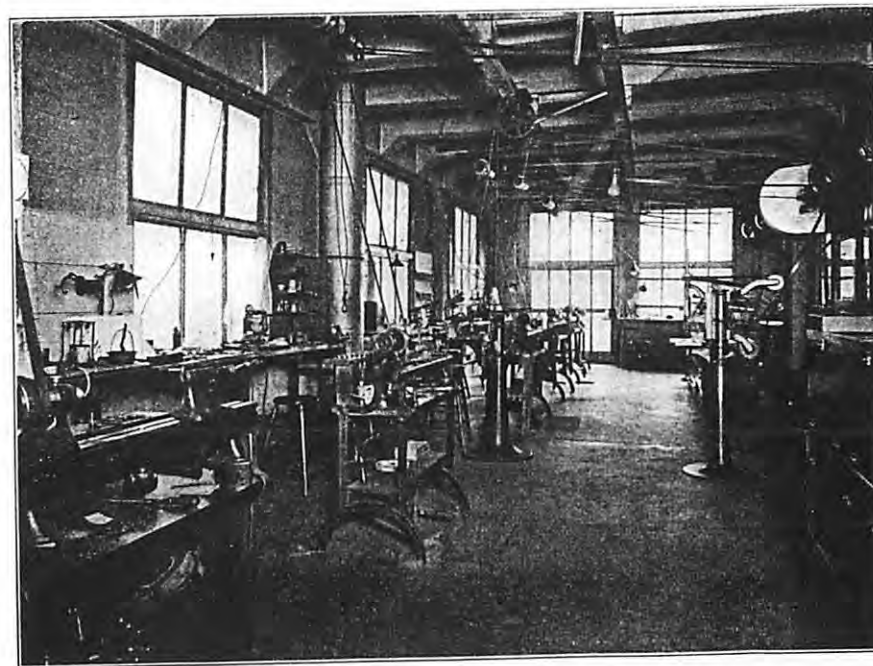
This instrument is used in the topographical departments of the U. S. Coast and Geodetic Survey, and the U. S. Geological Survey, and is exclusively applied in mapping the topographical features of the country in Europe, usually by officers of the army, who control these surveys, after the triangulation points have been established.

This method of surveying has been constantly improved in practice, particularly by the experts of the Geological Survey, and it may be safely said that, with the required accuracy, nothing surpasses it for small-scaled work in speed and application. All the bulky parts of the table have been reduced to a minimum, so that it may be handled with comparative ease in the roughest mountain country.

CROSS HAIRS

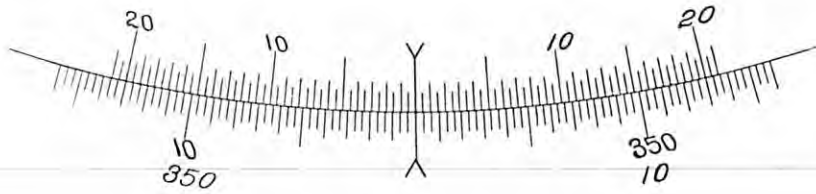


The cuts show the different cross hairs we set in our instruments as ordered. When ordering please indicate by number cross hairs wanted, as shown above. We employ No. 1 cross hairs and No. 2 stadia hairs unless otherwise specified.



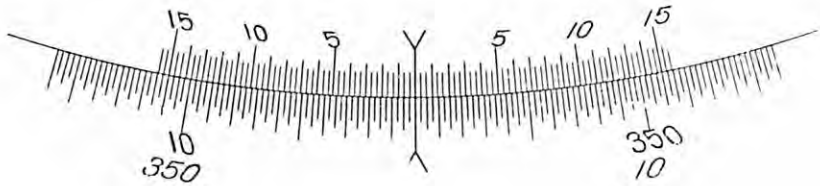
ASSEMBLING DEPARTMENT

METHODS OF GRADUATING LIETZ INSTRUMENTS



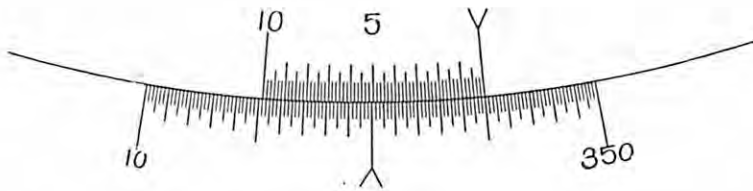
No. 1

Double vernier reading to 30". Circle graduated to 20'.



No. 2

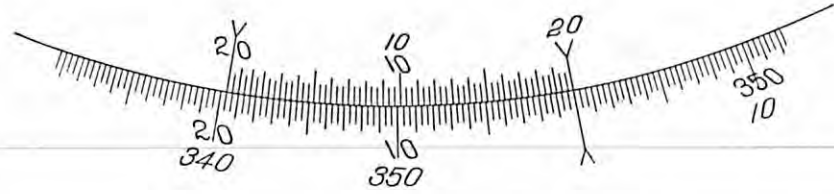
Double vernier reading to 20". Circle graduated to 15'.



No. 3

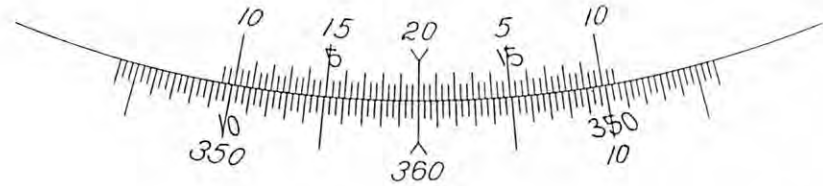
Single vernier reading to 10". Circle graduated to 10' with one row of figures.

AND POPULAR STYLES OF VERNIERS FURNISHED



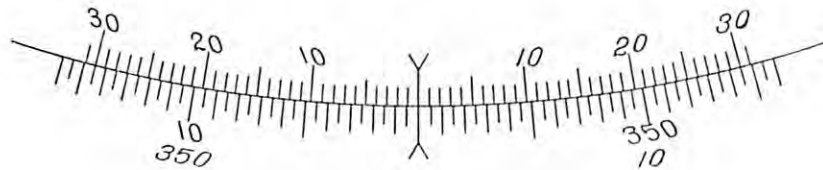
No. 4

Single vernier reading to 20". Circle graduated to 20' with two rows of figures.



No. 5

Folding vernier reading to 20". Circle graduated to 20' with two rows of figures.



No. 6

Double vernier reading to single minutes. Circle graduated to 30'.

PART II

ILLUSTRATED CATALOGUE AND PRICE LIST OF

MODERN ENGINEERS' AND SURVEYORS' INSTRUMENTS

AS MADE BY

THE A. LIETZ COMPANY

INTRODUCTION

The following illustrations show the principal articles we manufacture, being, in the case of this section, almost exclusively confined to instruments required by the civil, mining, irrigation, hydraulic and military engineer, for making accurate measurements and surveys for any purpose whatever.

Of the instruments each illustration, or plate, is complete within itself. Every feature is carefully noted, together with the price and a general description in a condensed form. The additional accessories that may be had in each instance are also enumerated and their prices given. It is well, however, that the engineer should consult the preceding part of this Manual, wherein every detail is carefully described and extensively discussed. If pains are taken to look this over, the reader will obtain such information as would be given him in the salesroom.

Every article has been numbered, and by these numbers our customers may order, without going into a minute description of the articles wanted. For example:

"Send me transit No. 4, with the following extras....." is all that is required to designate to us exactly what is desired.

In ordering please mention the issue of the catalogue, as the numbers of preceding issues necessarily conflict.

Also see Telegraph Code Words.

With the detailed information on its succeeding page, every plate becomes a complete price list of the particular instrument illustrated. Every effort has been made to make this part of the book as intelli-

gible as possible, without the necessity of searching over numerous pages to gather information.

Although we shall make any instrument of precision called for, we desire to state clearly that we have made a particular specialty of engineers' and surveyors' instruments, because there is for them alone a demand at the present time, and for this reason our shop facilities have been especially designed and improved for the manufacture of these articles.

If instruments for a more scientific purpose are wanted, for astronomical or geodetic work, for instance, we can either *make* them on a special order, or we can *import* them for our customer, having made arrangements in Europe which enable us to sell such instruments as cheaply as anyone in the United States.

All our products have been priced commensurate with their quality and deductions are not made from our price list.

We furnish a first-class article at a fair price, and our goods stand upon their individual merit. It has been our object to create the best that the instrument maker's art can make or devise, and with the records of the past decades before us we feel that we have been successful in every way.

THE A. LIETZ COMPANY.

TELEGRAPHIC CODE

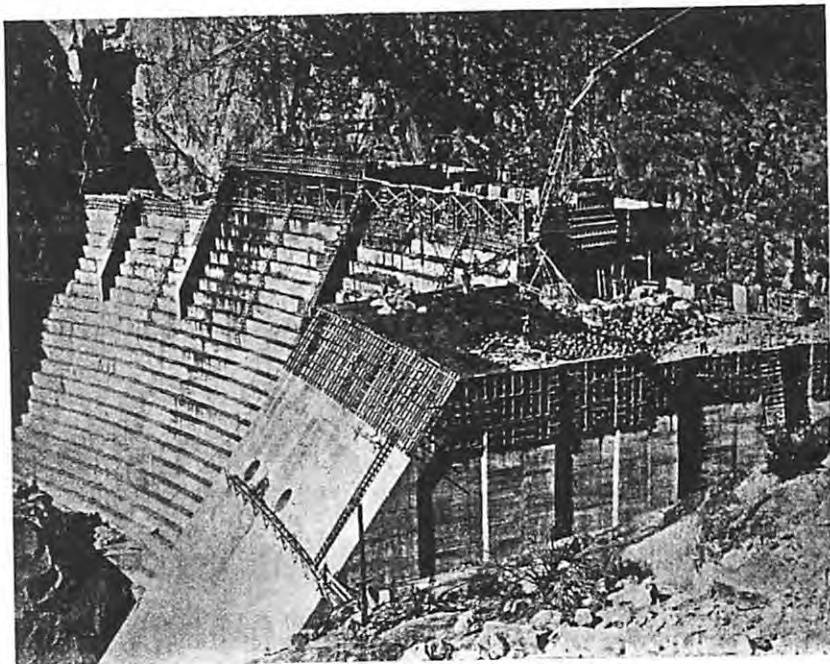
THE A. LIETZ COMPANY

San Francisco, U. S. A.

Cable Address: CYCLOTOMIC, San Francisco, U. S. A.

Use A. B. C., 5th Edition, or A. B. C., 5th Edition, Improved, or Bentley's Codes in connection with our Private Code Words noted in our Catalog.

O'SHAUGHNESSY DAM



The O'Shaughnessy Dam, hitherto known as Hetch Hetchy, now completed, was built to a height of 226½ feet above stream level by the Utah Construction Company at a cost of \$5,500,000. The foundation is designed to support also a future addition to bring the height to 312 feet above stream level, with a length of 900 feet at the crest. The foundation extends 118 feet below stream level and is 298 feet long at the bottom. The dam contains 375,000 cubic yards of concrete and was completed on March 28, 1923, and will store 67,000,000,000 gallons of water. The ultimate storage will be 113,000,000,000 gallons. This dam will be the largest in California. The water of the river was turned through a by-pass tunnel 23 x 25 feet, 900 feet long, to permit construction work.

This is one of the many Great Engineering Projects constructed with Lietz Transits and Levels.

LIETZ ENGINEERS' TRANSITS AND THEODOLITES

Nos. 1 to 5G

With 6¼ and 7-inch horizontal circle.
(Double spindle repeating)

These are elegant instruments, absolutely accurate in all working parts, designed for land surveying and engineering work of the highest character, and are guaranteed in every detail. The general dimensions are given to the right of each illustration, as well as the extras that may be added. The horizontal circle is graduated to read to either 60, 30 or 20 seconds and 10 seconds if ordered with the 7" horizontal circle, two verniers being provided and placed so as to afford a reading without stepping aside. The vertical arc or circle is graduated to read to 60 or 30 seconds. Each instrument has long compound centers, shifting plates on tripod head. The telescope possesses definition, light and power in a high degree. High-grade lenses, achromatic objective and eye-piece, erect vision. The telescope is reversible and evenly balanced, provided with slide protector and screw motion for focusing cross-hairs. Top of telescope provided with fine punch mark for centering instrument from a point above. Instruments are prepared to receive solar attachment or secondary telescope. Finished in torchon finish. The case has leather straps, rubber cushions, and contains all the usual accessories. For minute description of every detail, see first part of the Manual.



No. 1

LIETZ 6 1/4-INCH PLAIN PRECISION TRANSIT

Code Word, **BUGBEAR**

LIETZ ENGINEERS' TRANSIT No. 1

Dimensions and Weights

Horizontal Circle (measured to edge of graduation).....	6 1/4 inches diam.
Compass Needle	4 1/2 " long
Object Glass	1 1/4 " diam.
Telescope	11 " long
Magnifying power.....	24X
Weight.....	Instrument, 14 lbs.; tripod, about 8 lbs.; box, about 10 lbs.

Instrument as Usually Furnished

No. 1. Plain Precision Transit, with 6 1/4" horizontal circle, verniers reading to minutes; graduations on solid silver; cross hairs to telescope. Equipped with split-leg tripod. Instrument complete with plumb bob, reading glass, sunshade, adjusting pins, dust brush, etc., in neat polished mahogany caseCode Word, **BUGBEAR**

Extras for Transit No. 1

For which the additional charge is made. Kindly specify if desired.

	Code Word
Horizontal verniers reading to 30 seconds.....	CULLYISM
Horizontal verniers reading to 20 seconds.....	CULMINATE
Stadia hairs fixed.....	CUPOLA
Variation ring to compass.....	CULPRIT
Arrangement for offsetting right angles.....	CULTIVATE
Gradiometer attachment to vertical motion with movable head.....	CULPABLE
Constructed with three leveling screws instead of four....	CULVERIN
Three leveling screw shifting center.....	CUMBER
One extension leg in lieu of one split leg.....	CURLY
Full extension tripod in lieu of straight legs.....	CUMBRANCE
Silk protection bag or hood (waterproof).....	CURTAIN
Bottle of fine instrument oil.....	CUTEX
Inverting eye-piece (made to order only).....	CUTWATER

For complete list of features applicable to Lietz Transits see pages 88 and 89.

See price list in back of catalog.



No. 2

LIETZ 6 1/4-INCH ENGINEERS' PRECISION TRANSIT

Like No. 1 but fitted with level and tangent to telescope.

Code Word, **BUGGY**

LIETZ ENGINEERS' TRANSIT No. 2

Dimensions and Weights

Horizontal Circle (measured to edge of graduation).....	6 1/4 inches diam.
Compass Needle	4 1/2 " long
Object Glass	1 1/4 " diam.
Telescope	11 " long
Magnifying power	24 X
Weight.....Instrument, 14 1/2 lbs.; tripod, about 8 lbs.; box, about 10 lbs.	

Instruments as Usually Furnished

No. 2. Engineers' Precision Transit, with 6 1/4" horizontal circle; verniers reading to minutes; graduations on solid silver; cross hairs to telescope; level and tangent to telescope. Equipped with split-leg tripod. Instrument complete with plumb bob, reading glass, sunshade, adjusting pins, dust brush, etc., in neat polished mahogany case.

.....Code Word, **BUGGY**

Extras for Transit No. 2

For which the additional charge is made. Kindly specify if desired.

	Code Word
Horizontal verniers reading to 30 seconds.....	CULLYISM
Horizontal verniers reading to 20 seconds.....	CULMINATE
Reversion level vial with protection ring.....	CULTURE
Variation ring to compass.....	CULPRIT
Arrangement for offsetting right angles.....	CULTIVATE
Stadia hairs, fixed, set 1:100	CUPOLA
Gradiometer attachment to vertical motion with movable head.....	CULPABLE
Constructed with three leveling screws instead of four.....	CULVERIN
Three leveling screw shifting center.....	CUMBER
One extension leg in lieu of one split leg.....	CURLY
Full extension tripod in lieu of straight legs.....	CUMBRANCE
Silk protection bag or hood (waterproof).....	CURTAIN
Bottle of fine instrument oil.....	CUTEX
Inverting eye-piece (made to order only).....	CUTWATER

For complete list of features applicable to Lietz Transits see pages 88 and 89.

See price list in back of catalog.



No. 3
LIETZ 6¼-INCH ENGINEERS' PRECISION TRANSIT
With 5-inch Vertical Arc and double vernier reading to minutes.
Code Word, **BUGLEHORN**

No. 3W
Same as No. 3 but without Variation Ring to Compass.
Code Word, **BUGLESONG**

LIETZ ENGINEERS' TRANSITS Nos. 3 to 3W

Dimensions and Weights

Horizontal Circle (measured to edge of graduation).....	6¼ inches diam.
Vertical Arc (measured to edge of graduation).....	5 " "
Compass Needle	4½ " long
Object Glass	1¼ " diam.
Telescope	11 " long
Magnifying power	24 ×
Weight	Instrument, 15 lbs; tripod, about 8 lbs.; box, about 10 lbs.

Instruments as Generally Furnished

- No. 3.** Engineers' Precision Transit with 6¼-inch horizontal circle and 5-inch vertical arc with vernier reading to minutes; graduations on solid silver throughout; level and tangent to telescope with fixed stadia hairs set 1:100; variation to compass ring. Equipped with split-leg tripod. Instrument complete with plumb bob, reading glass, sunshade, adjusting pins, dust brush, etc., in neat polished mahogany case.
.....Code Word, **BUGLEHORN**
- No. 3W.** Same as Transit No. 3 but without variation ring to compass.
.....Code Word, **BUGLESONG**

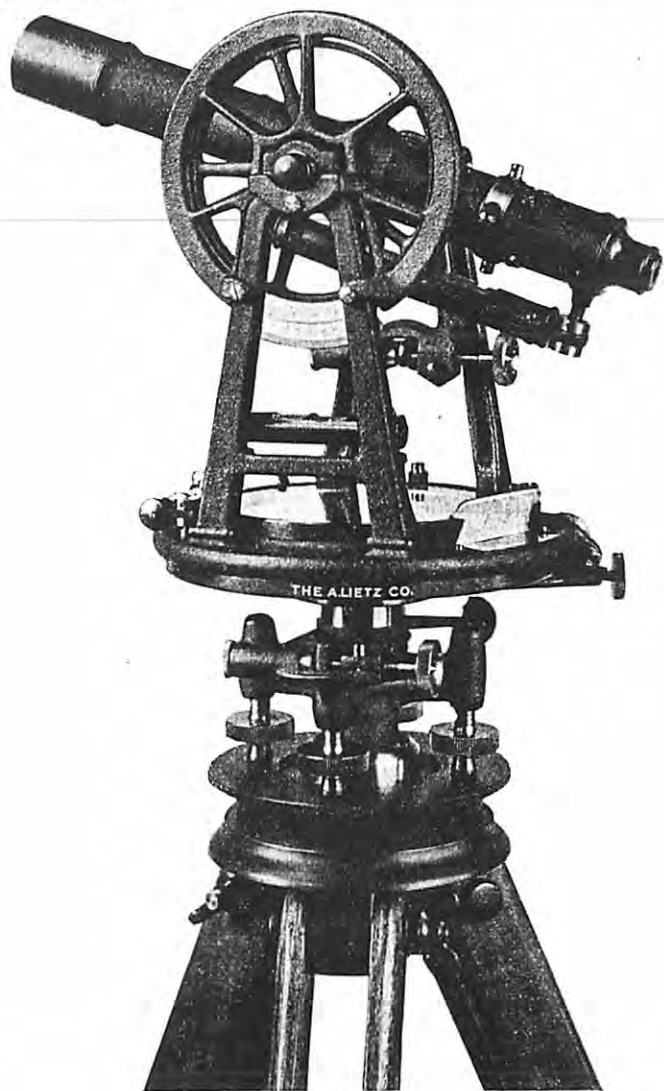
Extras for Transits Nos. 3 and 3W

For which the additional charge is made. Kindly specify if desired.

	Code Word
Horizontal verniers reading to 30 seconds.....	CULLYISM
Horizontal verniers reading to 20 seconds.....	CULMINATE
Reversion level vial with protection ring.....	CULTURE
Arrangement for offsetting right angles.....	CULTIVATE
Gradiometer attachment to vertical motion with movable head..	CULPABLE
Prism to eye-piece, with neutral glass	CUMBERSOME
Colored object glass cap in lieu of ordinary.....	CUTLERY
Constructed with three leveling screws instead of four.....	CULVERIN
Three leveling screw shifting center.....	CUMBER
One extension leg in lieu of one split leg.....	CURLY
Full extension tripod in lieu of straight legs.....	CUMBRANCE
Silk protection bag or hood (waterproof).....	CURTAIN
Bottle of fine instrument oil.....	CUTEX
Inverting eye-piece (made to order only).....	CUTWATER

For complete list of features applicable to Lietz Transits see pages 88 and 89.

See price list in back of catalog.



No. 4

LIETZ 6¼-INCH COMPLETE ENGINEERS' TRANSIT

With 5-inch full Vertical Circle and double vernier reading to minutes.
Code Word, **BUGLER**

No. 4W

Same as No. 4 but without Variation Ring to Compass.
Code Word, **BULLSEYE**

LIETZ ENGINEERS' TRANSITS Nos. 4 to 4W

Dimensions and Weights

Horizontal Circle (measured to edge of graduation).....	6¼ inches diam.
Vertical Circle (measured to edge of graduation).....	5 " "
Compass Needle	4½ " long
Object Glass	1¼ " diam.
Telescope	11 " long
Magnifying power	24 X
Weight.....Instrument, 16½ lbs.; tripod, about 8 lbs.; box, about 10 lbs.	

Instruments as Usually Furnished

- No. 4.** Complete Engineers' Precision Transit with 6¼-inch horizontal circle and 5-inch full vertical circle fitted with aluminum guard; verniers reading to minutes; graduations on solid silver throughout; level and tangent to telescope with fixed stadia hairs set 1:100; variation to compass ring. Equipped with split-leg tripod. Instrument complete with plumb bob, reading glass, sunshade, adjusting pins, dust brush, etc., in neat polished mahogany case.....Code Word, **BUGLER**
- No. 4W.** Same as Transit No. 4 but without variation ring to compass.
.....Code Word, **BULLSEYE**

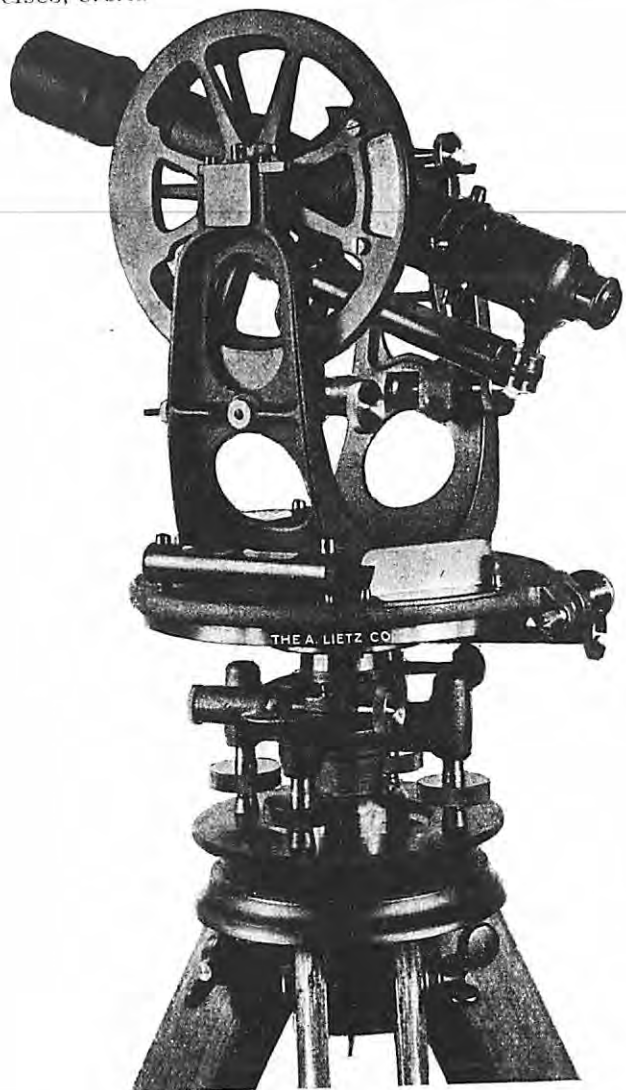
Extras for Transits Nos. 4 and 4W

For which the additional charge is made. Kindly specify if desired.

	Code Word
Horizontal verniers reading to 30 seconds.....	CULLYISM
Horizontal verniers reading to 20 seconds.....	CULMINATE
Vertical circle graduated on the periphery.....	CUPBEARER
Reversion level vial with protection ring.....	CULTURE
Striding level to axis of telescope.....	CULTRATED
Arrangement for offsetting right angles.....	CULTIVATE
Gradiometer attachment to vertical motion with movable head.....	CULPABLE
Disappearing stadia hairs.....	CUPRIC
Prism to eye-piece, with neutral glass, see page 88.....	CUMBERSOME
Colored object glass cap in lieu of ordinary.....	CUTLERY
Constructed with three leveling screws instead of four.....	CULVERIN
Three leveling screw shifting center.....	CUMBER
One extension leg in lieu of one split leg.....	CURLY
Full extension tripod in lieu of straight legs.....	CUMBRANCE
Silk protection bag or hood (waterproof).....	CURTAIN
Bottle of fine instrument oil.....	CUTEX
Inverting eye-piece (made to order only).....	CUTWATER

For complete list of features applicable to Lietz Transits see pages 88 and 89.

See price list in back of catalog.



No. 5

LIETZ 6 1/4-INCH TRANSIT THEODOLITE

With U-shaped Standards, Y Bearings, without Compass.
Code Word, **BULLFISH**

No. 5C

Same as No. 5 but with Circular Compass 3 1/2 inches diameter with Variation Ring.
Code Word, **BULLETIN**

LIETZ TRANSIT THEODOLITES Nos. 5 to 5C

With U-shaped Standards and Y Bearings

Lietz Transit Theodolites Nos. 5 and 5C have U-shaped standards of improved design, consisting of a one-piece casting. Transit No. 5 has no compass, but No. 5C is furnished with a compass, with a variation ring and a needle 3 1/2" long. The U-shaped telescope support gives great stability in the upper structure, where lateral rigidity is most essential. The telescope has cylindrical pivots, which rest in wye bearings. This secures a greater refinement of motion in a vertical plane, and without stress. The telescope is reversible in position and exchangeable in its bearings, which are provided with dust caps and screws to give the necessary friction.

Dimensions and Weights

Horizontal Circle (measured to edge of graduation)....	6 1/4 inches diam.
Vertical Arc or Circle (measured to edge of graduation)..	5 " "
Telescope	11 " long
Object Glass	1 1/4 " diam.
Magnifying power	24 X
Weight	Instrument, 16 lbs.; tripod, about 8 lbs.; box, about 10 lbs.

Instruments as Usually Furnished

- No. 5.** Lietz Transit Theodolite with 5-inch full vertical circle and double vernier reading to minutes, fitted with aluminum guard, and 6 1/4-inch horizontal circle with double opposite verniers reading to 30 seconds, graduations on solid silver throughout; level and tangent to telescope, with fixed stadia hairs set 1:100. Equipped with split-leg tripod. Instrument complete with plumb bob, reading glass, sunshade, adjusting pins, dust brush and all usual accessories in polished mahogany boxCode Word, **BULLFISH**
- No. 5C.** Same as No. 5 but with circular compass with variation ring and compass needle 3 1/2 inches long.....Code Word, **BULLETIN**

Extras for Nos. 5 to 5C

For which the additional charge is made. Kindly specify if desired.

Horizontal verniers reading to 20 seconds.....	Code Word CULMINATE
Reversion level vial with protection ring.....	CULTURE
Striding level to axis of telescope.....	CULTRATED
Gradienter attachment to vertical motion with movable head..	CULPABLE
Opposite double verniers to vertical circle reading to minutes (in lieu of single vernier).....	CURATIVE
Two vernier microscopes.....	CURBING
Compass needle in box on plate 4 1/2 inches long.....	CURBLES
Full extension tripod in lieu of straight leg.....	CUMBRANCE
Silk protection bag or hood (waterproof).....	CURTAIN

For complete list of features applicable to Lietz Transits see pages 88 and 89.

See price list in back of catalog.



**No. 5D
LIETZ TRANSIT THEODOLITE**

With 7-inch Horizontal Circle and opposite verniers reading to 10 seconds.
Code Word, **BUNGALOW**

No. 5DC

Same as No. 5D but with Circular Compass 3½ inches diameter
with Variation Ring.
Code Word, **BUNTING**

LIETZ TRANSIT THEODOLITES Nos. 5D to 5DC

The general design and construction of these instruments is the same as that of our Transit Theodolites Nos. 5 and 5C, described and illustrated on pages 62 and 63, but Nos. 5D and 5DC have a 7" Horizontal Circle with opposite verniers reading to 10 seconds. Two vernier microscopes on swinging arm.

Dimensions and Weights

Horizontal Circle (measured to edge of graduation)....	7	inches	diam.
Vertical Arc or Circle (measured to edge of graduation)..	5	"	"
Telescope	11	"	long
Object Glass	1¼	"	diam.
Magnifying power			24 X
Weight.....Instrument, 18 lbs.; tripod, about 8 lbs.; box, about 11 lbs.			

Instruments as Usually Furnished

No. 5D. Lietz Transit Theodolite with 5-inch full vertical circle and double vernier reading to minutes, fitted with aluminum guard; 7-inch Horizontal Circle with opposite verniers reading to 10 seconds; two vernier microscopes on swinging arm; graduations on solid silver throughout; level and tangent to telescope, with fixed stadia hairs set 1:100. Equipped with split-leg tripod. Instrument complete with plumb bob, reading glass, sunshade, adjusting pins, dust brush and all usual accessories, in polished mahogany case

.....Code Word, **BUNGALOW**

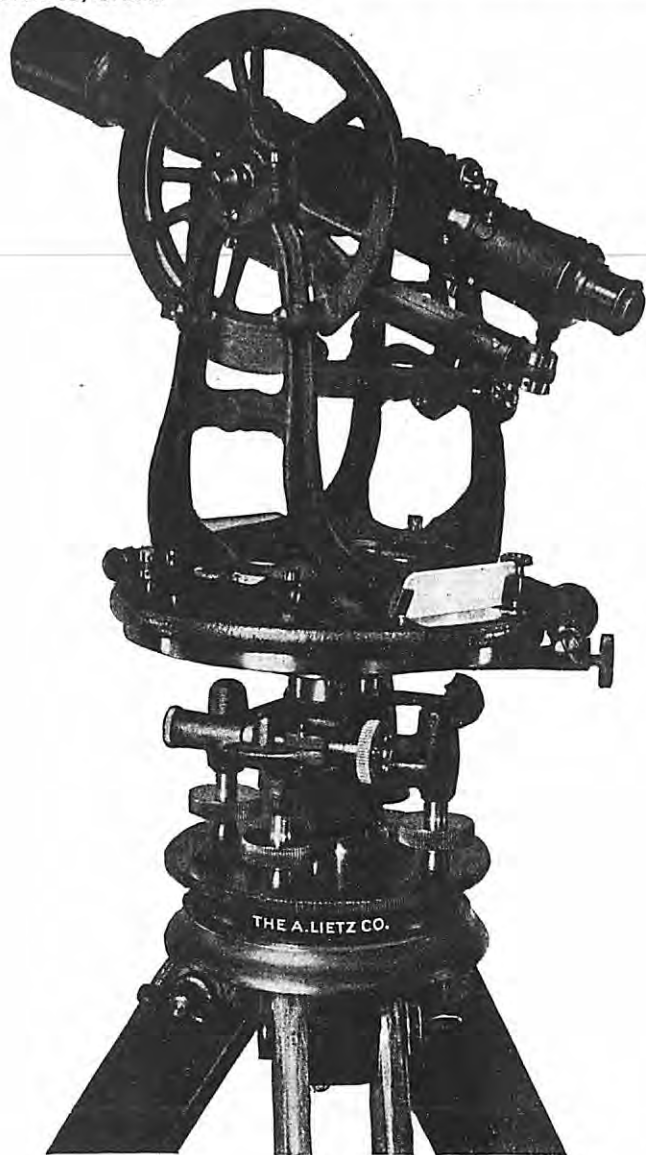
No. 5DC. Same as No. 5D but with Circular Compass with variation ring and compass needle 3½ inches long.....Code Word, **BUNTING**

Extras for Transits Nos. 5D and 5DC

Reversion level vial with protection ring.....	Code Word CULTURE
Striding level to axis of telescope.....	CULTRATED
Gradiometer attachment to vertical motion with movable head.....	CULPABLE
Opposite double verniers to vertical circle reading to minutes (in lieu of single vernier).....	CURATIVE
Two vernier microscopes.....	CURBING
Compass needle in box on plate 4½ inches long.....	CURBLES
Full extension tripod in lieu of straight legs.....	CUMBRANCE
Silk protection bag or hood (waterproof).....	CURTAIN
Bottle of fine instrument oil.....	CUTEX
Inverting eye-piece (made to order).....	CUTWATER

For complete list of features applicable to Lietz Transits see pages 88 and 89.

See price list in back of catalog.



No. 5E

LIETZ TRANSIT THEODOLITE

With 6¼-inch Horizontal Circle and 5-inch full Vertical Circle.
Code Word, **BUNTLINE**

No. 5F

Same as No. 5E but with 7-inch Horizontal Circle and opposite verniers reading to 10 seconds.
Code Word, **BUNTWELL**

LIETZ TRANSIT THEODOLITES Nos. 5E to 5F

Lietz Transit Theodolites Nos. 5E and 5F have been constructed so as to obtain the highest amount of stability in the upper structure where lateral rigidity is most essential. The U-shaped telescope support is of a superior design, consisting of a one-piece casting with large circular base, which makes a more substantial connection to the upper plate and which also permits of a circular compass with variation ring and a compass needle 3½ inches long. The sectional shape of this piece is of the "even cross" design, a characteristic of Lietz Instruments in all parts where the greatest stability is desirable with the least amount of material and weight.

Dimensions and Weights of No. 5E

Horizontal Circle, measuring to edge of graduation.....	6¼ inches diam.
Vertical Circle, measuring to edge of graduation.....	5 " "
Compass Needle	3½ " long
Object Glass	1¾ " diam.
Telescope	11 " long
Magnifying power	24 X
Weight.....	Instrument, 15½ lbs.; tripod, about 8 lbs.; box, about 10 lbs.

Instruments as Usually Furnished

- No. 5E.** Lietz Transit Theodolite with 5-inch full vertical circle and double vernier reading to minutes, fitted with aluminum guard, and 6¼-inch horizontal circle with double opposite verniers reading to minutes; graduations on solid silver throughout; level and tangent to telescope, with fixed stadia hairs, set 1:100; variation ring to compass. Equipped with split-leg tripod. Instrument complete with plumb bob, reading glass, sunshade, adjusting pins, dust brush and all usual accessories, in polished mahogany box.....Code Word, **BUNTLINE**
- No. 5F.** Same as No. 5E but with 7-inch Horizontal Circle with opposite verniers reading to 10 seconds and two vernier microscopes on swinging arm.....Code Word, **BUNTWELL**

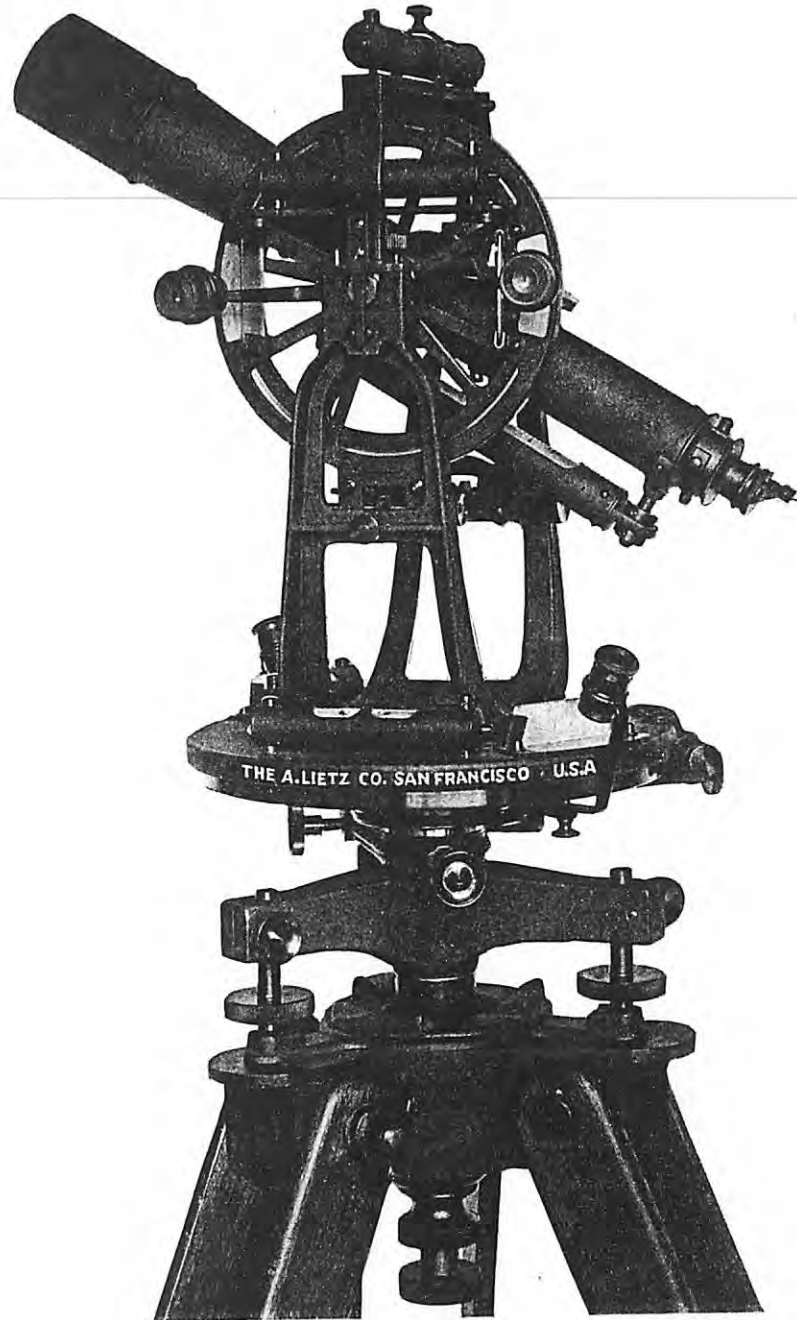
Extras for Transits Nos. 5E and 5F

For which the additional charge is made. Kindly specify if desired.

	Code Word
Horizontal verniers reading to 30 seconds.....	CULLYISM
Horizontal verniers reading to 20 seconds.....	CULMINATE
Vertical circle graduated on the periphery.....	CUPBEARER
Reversion level vial with protection ring.....	CULTURE
Striding level to axis of telescope.....	CULTRATED
Gradienter attachment to vertical motion with movable head.....	CULPABLE
Opposite double verniers to vertical circle reading to minutes (in lieu of single vernier).....	CURATIVE
Two vernier microscopes.....	CURBING
Full extension tripod in lieu of straight legs.....	CUMBRANCE
Silk protection bag or hood (waterproof).....	CURTAIN

For complete list of features applicable to Lietz Transits see pages 88 and 89.

See price list in back of catalog.



No. 5G
LIETZ 7-INCH BOUNDARY THEODOLITE

United States Coast and Geodetic Survey Design.
For Triangulation and Boundary Line Surveys.

LIETZ 7-INCH BOUNDARY THEODOLITE No. 5G

SPECIFICATIONS

HORIZONTAL CIRCLE for repeating angles, 7 inches to edge of graduation with two rows of figures 0-360, graduated on solid silver, with opposite verniers reading to 10 seconds of arc. Two vernier microscopes on swinging arm.

VERTICAL CIRCLE, 5 inches to edge of graduation, graduated on solid silver, with two opposite double verniers reading to 30 seconds. Sensitive level attached to vernier arm. Two vernier microscopes.

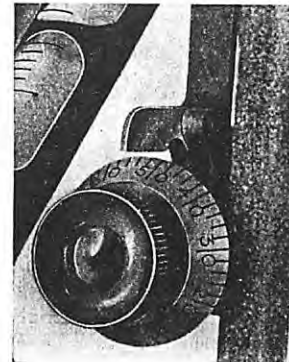
TELESCOPE, 13 inches long, with two interchangeable inverting eye-pieces. Magnification 25 and 35 times respectively. Object Glass, 1 $\frac{3}{8}$ -inch diameter, clear aperture, prism to eye-piece with two dark glasses, long sensitive level to telescope. Releasable clamp and tangent screw. Cylindrical telescope axis and wye bearings. Striding Level resting on points of contact. Cross Hairs electrically illuminated through the axis of telescope, with emergency oil lamp.

CENTER made of steel fitted in cast-iron starpiece, with three leveling screws and shifting center.

STANDARD, U-shaped, cast in one piece with wye bearings. Entire instrument constructed so as to give the greatest amount of rigidity and accuracy.

WEIGHT: Instrument, 26 lbs.; tripod, 17 lbs.; two boxes, 26 lbs. For protection and portability the telescope is packed in separate carrying case from the base and standard of the instrument.

Code Word, **BURDOCK**



Gradienter Attachment to Vertical Motion
supplied with movable head which admits zero setting

Code Word, **CULPABLE**

For complete list of features applicable to Lietz Transits see page 89.

See price list in back of catalog.



PRIMARY TRIANGULATION OF THE PALOS VERDES PROJECT IN SOUTHERN CALIFORNIA

By WILLIAM W. MICHAEL, Assoc. M. Am. Soc. C. E.

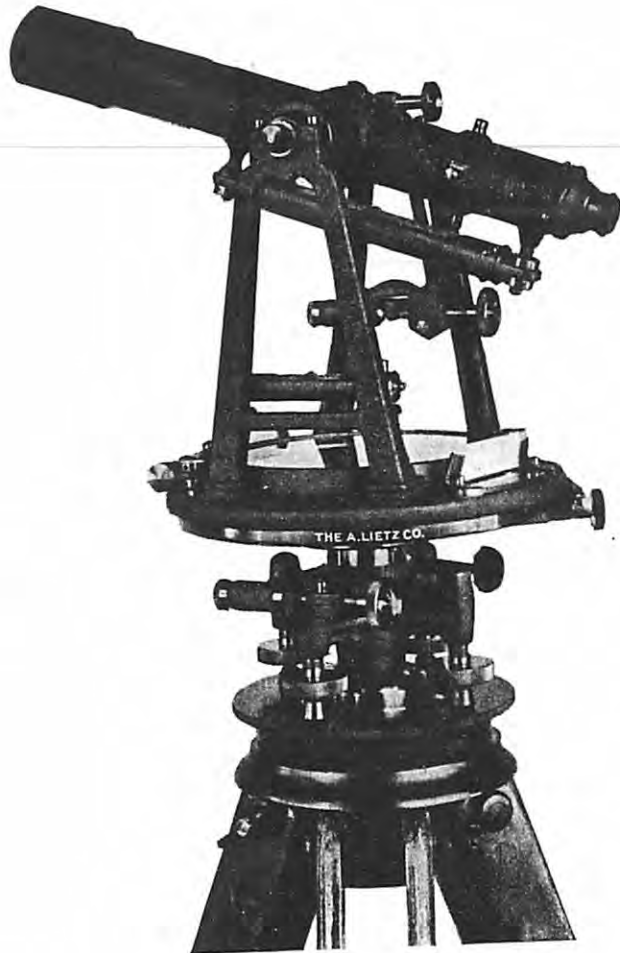
The instrument used was a Lietz 7-inch repeating theodolite reading to 10 seconds of arc by two opposite verniers. Vertical circle of 5-inch diameter reading to 30 seconds with sensitive level vial attached to vernier arm. Telescope 13 inches long, with two inverting eye-pieces of 25 to 35 diameter magnification. Object glass $1\frac{3}{8}$ -inch clear aperture. Cylindrical telescope axis provided with striding level resting on points of contact. The entire instrument was constructed so as to give the greatest rigidity and accuracy. Microscopes were applied to verniers, and cross hairs could be illuminated through the horizontal axis by electric flashlight. Sensitiveness of level vials: telescope 15 to 20 seconds; striding level 10 seconds; plate levels 30 seconds. The instrument was packed in two separate boxes for protection and to facilitate transportation. For further description and illustration see pages 68 and 69.

LIETZ ENGINEERS' TRANSITS AND THEODOLITES Nos. 7 to 11E

With 5" horizontal circle
(Double spindle repeating)

These instruments are in every respect equal to the $6\frac{1}{4}$ " and 7", but are smaller in size and lighter in weight. The horizontal circle is graduated to read to single minutes by two double verniers which are placed so as to afford easy reading without stepping aside. The vertical arc or circle is graduated to read to single minutes. These instruments are recommended where less weight and bulk are desirable. The upper structure is somewhat reduced in proportion as compared with the larger instruments, thereby offering less resistance to the wind and offering greater stability. While these instruments are used to advantage for Mining, Mountain and Road work, their quality is such that they can be used for any kind of engineering work requiring accuracy. They have frequently been used for triangulation, with very satisfactory results.

The top of the telescope is provided with a fine punch mark for centering instrument from a point above, and the instrument is prepared to receive Solar Attachments or Secondary Telescope.



No. 7

LIETZ 5-INCH ENGINEERS' PRECISION TRANSIT

With Level and Tangent to Telescope.

Code Word, **BULBOUS**

LIETZ ENGINEERS' TRANSIT No. 7

Dimensions and Weights

Horizontal Circle (measured to edge of graduation).....	5	inches	diam.
Compass Needle	3½	"	long
Object Glass	1	"	diam.
Telescope	8½	"	long
Magnifying power			18 X
Weight.....	Instrument, 9½ lbs.; tripod, about 9 lbs.; box, about 7 lbs.		

Instruments as Usually Furnished

No. 7. Engineers' Precision Transit with 5-inch horizontal circle, verniers reading to minutes, graduations on solid silver; cross hairs to telescope; level and tangent to telescope. Equipped with split-leg tripod. Instrument complete with plumb bob, reading glass, sunshade, adjusting pins, dust brush, etc., in polished mahogany case.

.....Code Word, **BULBOUS**

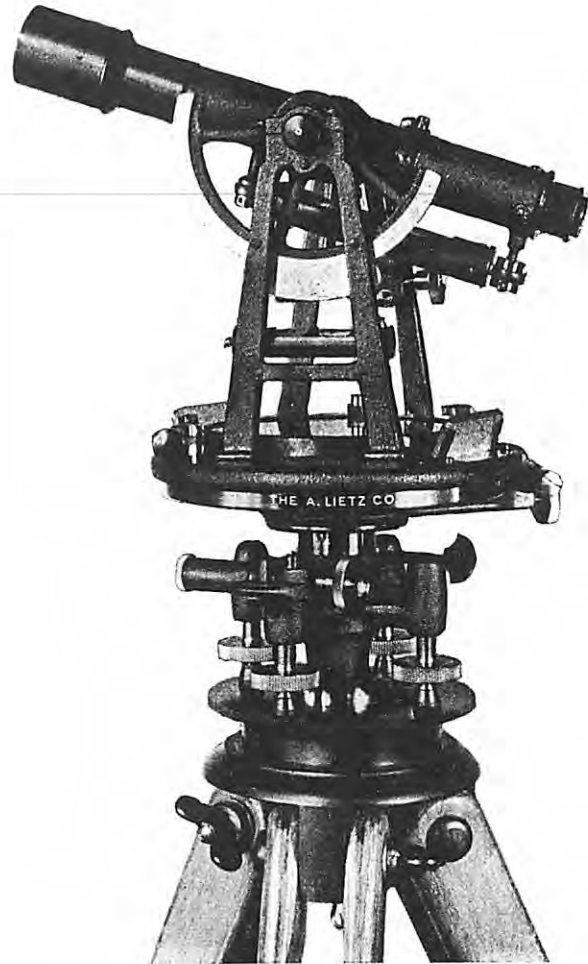
Extras for Transit No. 7

For which the additional charge is made. Kindly specify if desired.

Reversion level vial with protection ring.....	Code Word
Variation ring to compass.....	CULTURE
Arrangement for offsetting right angles.....	CULPRIT
Stadia hairs, fixed, set 1:100.....	CULTIVATE
Gradiometer attachment to vertical motion with movable head.....	CUPOLA
One extension leg in lieu of one split leg.....	CULPABLE
Full extension tripod in lieu of straight legs.....	CURLY
Silk protection bag or hood (waterproof).....	CUMBRANCE
Bottle of fine instrument oil.....	CURTAIN
Inverting eye-piece (made to order only).....	CUTEX
	CUTWATER

For complete list of features applicable to Lietz Transits see pages 88 and 89.

See price list in back of catalog.



No. 8

LIETZ 5-INCH ENGINEERS' PRECISION TRANSIT

With 4-inch Vertical Arc and double vernier reading to minutes.
Code Word, **BULGED**

No. 8W

Same as No. 8 but without Variation Ring to Compass.
Code Word, **BULBERT**

LIETZ ENGINEERS' TRANSITS Nos. 8 and 8W

Dimensions and Weights

Horizontal Circle (measured to edge of graduation).....	5	inches	diam.
Vertical Arc	4	"	"
Compass Needle.....	3½	"	long
Object Glass	1	"	diam.
Telescope	8½	"	long
Magnifying power			18 X
Weight.....Instrument, 10 lbs.; tripod, about 8½ lbs.; box, about 7 lbs.			

Instruments as Usually Furnished

- No. 8.** Engineers' Precision Transit with 5-inch horizontal circle, verniers reading to minutes and 4-inch vertical arc with vernier reading to minutes; graduations on solid silver; level and tangent to telescope, with fixed stadia hairs, set 1:100; variation ring to compass. Equipped with extension tripod. Instrument complete with plumb bob, reading glass, sunshade, adjusting pins, dust brush, etc., in polished mahogany caseCode Word, **BULGED**
- No. 8W.** Same as No. 8 but without variation ring to compass.
.....Code Word, **BULBERT**

Extras for Transits Nos. 8 and 8W

	Code Word
Reversion level vial with protection ring.....	CULTURE
Arrangement for offsetting right angles.....	CULTIVATE
Gradiometer attachment to vertical motion with movable head..	CULPABLE
Prism to eye-piece, with neutral glass, see page 88.....	CUMBERSOME
Colored object glass cap in lieu of ordinary.....	CUTLERY
Constructed with three leveling screws instead of four.....	CULVERIN
Three leveling screw shifting center.....	CUMBER
Silk protection bag or hood (waterproof).....	CURTAIN
Bottle of fine instrument oil.....	CUTEX
Inverting eye-piece (made to order only).....	CUTWATER

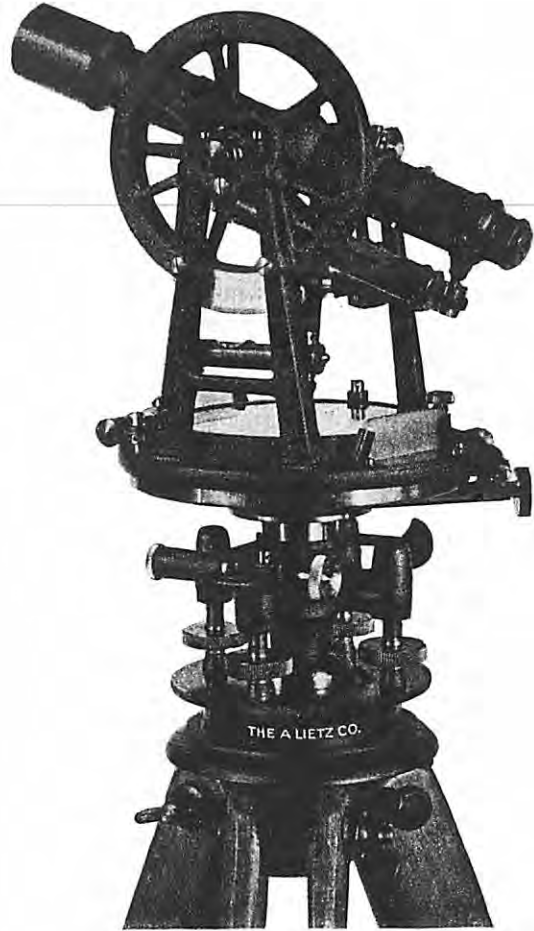
SOLAR ATTACHMENTS AND SECONDARY TELESCOPES

For further description and illustrations see pages 90 to 93.

	Code Word
Saegmuller Solar Attachment with counterpoise.....	CUMBROUS
Smith Solar Attachment with counterpoise.....	CURATOR
Burt Solar Attachment with counterpoise.....	CUTICLE
Attachable secondary telescope (side or top) with counterpoise	CUNEATED
Davis Solar Screen	CUSTARD

For complete list of features applicable to Lietz Transits see pages 88 and 89.

See price list in back of catalog.



No. 9

LIETZ 5-INCH ENGINEERS' PRECISION TRANSIT

With 4-inch full Vertical Circle and double vernier reading to minutes.
Code Word, **BULIMY**

No. 9W

Same as No. 9 but without Variation Ring to Compass.
Code Word, **BULKHEAD**

LIETZ ENGINEERS' TRANSITS Nos. 9 and 9W

Dimensions and Weights

Horizontal Circle (measured to edge of graduation).....	5	inches diam.
Vertical Circle (measured to edge of graduation).....	4	" "
Compass Needle	3½	" long
Object Glass	1	" diam.
Telescope	8½	" long
Magnifying power	18	×
Weight.....Instrument, 10 lbs.; tripod, about 8½ lbs.; box, about 7 lbs.		

Instruments as Usually Furnished

- No. 9.** Engineers' Precision Transit with 5-inch horizontal circle, verniers reading to minutes and 4-inch full vertical circle fitted with aluminum guard and vernier reading to minutes; graduations on solid silver; level and tangent to telescope, with fixed stadia hairs, set 1:100; variation ring to compass. Equipped with extension tripod. Instrument complete with plumb bob, reading glass, sunshade, adjusting pins, dust brush, etc., in polished mahogany case. Code Word, **BULIMY**
- No. 9W.** Same as No. 9 but without variation ring to compass.

.....Code Word, **BULKHEAD**

Extras for Transits Nos. 9 and 9W

Reversion level vial with protection ring.....	Code Word	CULTURE
Arrangement for offsetting right angles.....		CULTIVATE
Gradienter attachment to vertical motion with movable head.....		CULPABLE
Prism to eye-piece with neutral glass, see page 88.....		CUMBERSOME
Colored object glass cap in lieu of ordinary.....		CUTLERY
Constructed with three leveling screws instead of four.....		CULVERIN
Three leveling screw shifting center.....		CUMBER
Silk protection bag or hood (waterproof).....		CURTAIN
Bottle of fine instrument oil.....		CUTEX
Inverting eye-piece (made to order only).....		CUTWATER

SOLAR ATTACHMENTS AND SECONDARY TELESCOPES

For further description and illustrations see pages 90-93.

Saegmuller Solar Attachment with counterpoise.....	Code Word	CUMBROUS
Smith Solar Attachment with counterpoise.....		CURATOR
Burt Solar Attachment with counterpoise.....		CUTICLE
Attachable Secondary Telescope (side and top) with counterpoise		CUNEATED
Davis Solar Screen.....		CUSTARD

For complete list of features applicable to Lietz Transits see pages 88 and 89

See price list in back of catalog.



No. 11

LIETZ 5-INCH TRANSIT THEODOLITE

With U-shaped standards and Y bearings without compass.
Code Word, **BULK TOWN**

No. 11C

Same as No. 11, but with Circular Compass, 2½ inches diameter with variation ring.
Code Word, **BULKVILLE**

LIETZ TRANSIT THEODOLITES Nos. 11 to 11C

With U-shaped Standards and Y Bearings

These Instruments are of the same type and embody the same characteristics as our Nos. 5 and 5C, but they are of a smaller size, therefore lighter and more portable. The telescope has cylindrical pivots which rest in Y Bearings and is reversible in position and exchangeable in its bearings, which are provided with dustcaps and screws to give the necessary friction.

Dimensions and Weights

Horizontal Circle (measured to edge of graduation).....	5	inches diam.
Vertical Circle (measured to edge of graduation).....	4	" "
Object Glass	1	" "
Telescope	8	" long
Magnifying power		18 X
Weight.....Instrument, 10 lbs.; tripod, about 8 lbs.; box, about 6½ lbs.		

Instruments as Usually Furnished

- No. 11.** Lietz Transit Theodolite with 5-inch horizontal circle, verniers reading to minutes and 4-inch full vertical circle fitted with aluminum guard and vernier reading to minutes. Graduations on solid silver; level and tangent to telescope, with fixed stadia hairs set 1:100. Equipped with split-leg tripod. Instrument complete with plumb bob, reading glass, sunshade, adjusting pins, dust brush and all usual accessories in polished mahogany case.....Code Word, **BULK TOWN**
- No. 11C.** Same as No. 11 but with Circular Compass with variation ring and compass needle 2½ inches long.....Code Word, **BULKVILLE**

Extras for Nos. 11 to 11C

Horizontal verniers reading to 30 seconds.....	Code Word CULLYISM
Two vernier microscopes.....	CURBING
Reversion level vial with protection ring.....	CULTURE
Striding level to axis of telescope.....	CULTRATED
Gradiometer attachment to vertical motion with movable head..	CULPABLE
Prism to eye-piece with neutral glass.....	CUMBERSOME
Compass needle in box on plate 4½ inches long.....	CURBLES
Full extension tripod in lieu of straight legs.....	CUMBRANCE
Silk protection bag or hood (waterproof).....	CURTAIN
Bottle of fine instrument oil.....	CUTEX
Inverting eye-piece (made to order only).....	CUTWATER

For complete list of features applicable to Lietz Transits see pages 88 and 89.

See price list in back of catalog.



No. 11E

LIETZ TRANSIT THEODOLITE

With 5-inch Horizontal Circle and 4-inch full Vertical Circle.
Code Word, **BULLFINCH**

LIETZ TRANSIT THEODOLITE No. 11E

This is the same type of instrument as our Nos. 5E and 5F but of a smaller and more portable size. A compact and accurate instrument incorporating the characteristics of construction and stability as obtained in the larger instruments.

Dimensions and Weights

Horizontal Circle, measuring to edge of graduation.....	5	inches	diam.
Vertical Circle, measuring to edge of graduation.....	4	"	"
Compass Needle.....	2½	"	long
Object Glass	1	"	diam.
Telescope	8	"	long
Magnifying power			18 X
Weight.....Instrument, 10 lbs.; tripod, about 8 lbs.; box, about 6½ lbs.			

Instrument as Usually Furnished

No. 11E. Lietz Transit Theodolite with 5-inch horizontal circle, verniers reading to minutes and 4-inch full vertical circle fitted with aluminum guard and vernier reading to minutes. Graduations on solid silver; level and tangent to telescope, with fixed stadia hairs set 1:100. Variation ring to compass. Equipped with split-leg tripod. Instrument complete with plumb bob, reading glass, sunshade, adjusting pins, dust brush and all usual accessories, in polished mahogany box.
.....Code Word, **BULLFINCH**

Extras for No. 11E

	Code Word
Horizontal verniers reading to 30 seconds.....	CULLYISM
Two vernier microscopes.....	CURBING
Reversion level vial with protection ring.....	CULTURE
Striding level to axis of telescope.....	CULTRATED
Gradienter attachment to vertical motion with movable head..	CULPABLE
Prism to eye-piece with neutral glass.....	CUMBERSOME
Full extension tripod in lieu of straight legs.....	CUMBRANCE
Silk protection bag or hood (waterproof).....	CURTAIN
Bottle of fine instrument oil.....	CUTEX
Inverting eye-piece (made to order only).....	CUTWATER

For complete list of features applicable to Lietz Transits see pages 88 and 89.

See price list in back of catalog.

THE CARQUINEZ BRIDGE



Lietz Transit Theodolite Number 5D controls location and elevation of the mammoth Carquinez Straits Bridge. For complete description and illustration of this instrument see pages 64 and 65.

The construction of the Carquinez Bridge will give Central California the unique distinction of having one of the largest structures of its kind in the world.

The length of this majestic masterpiece of engineering will be 3350 feet, or practically two-thirds of a mile. The clearance height for ships will be 135 feet above high water, the same as for the big bridges in New York City.

LEATHER COVERS FOR INSTRUMENT BOXES



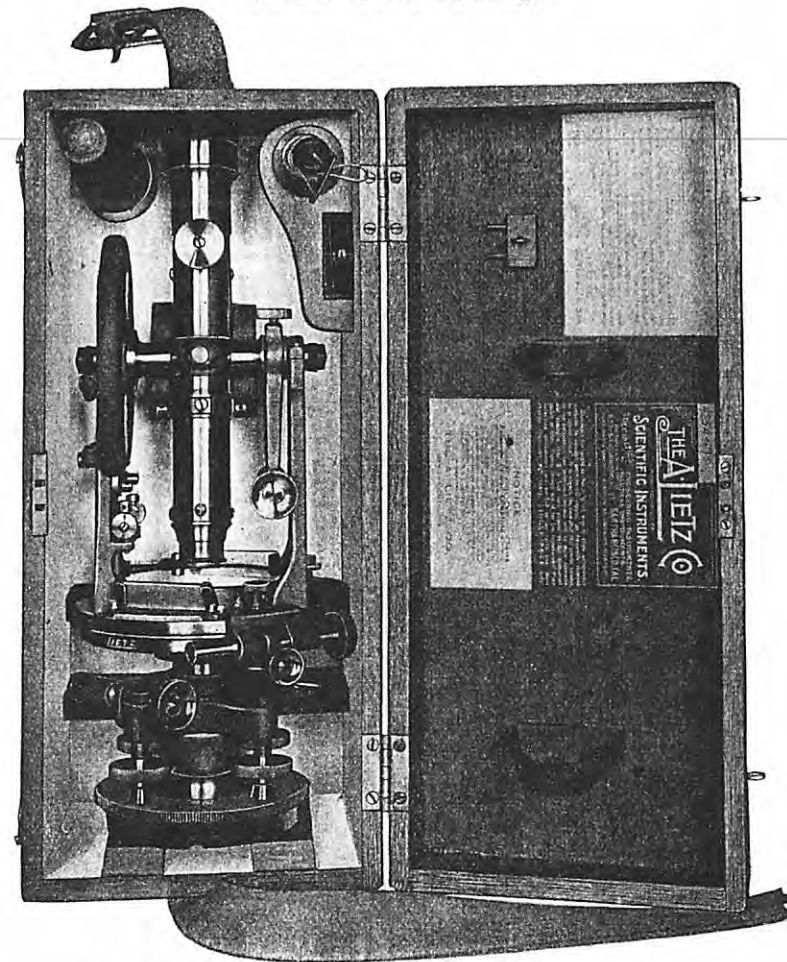
Special Leather Carrying Cases. See page 89. Code Word, CYCLOID

See price list in back of catalog.

LIETZ ENGINEERS' TRANSITS AND THEODOLITES

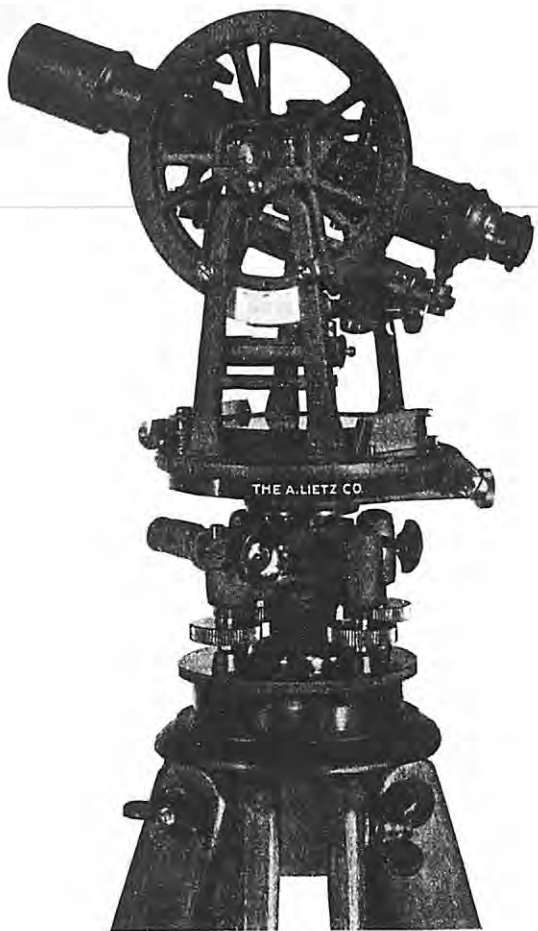
Nos. 12 to 14C

With 4" horizontal circle
(Double spindle repeating)



LIETZ MOUNTAIN AND MINING TRANSIT No. 12
In Case

These instruments have been constructed and are recommended where great portability and lightness are desirable. They are in every respect equal to and have all the features of our larger transits with 6 1/4" and 5" plates. In addition to their portability, this type permits of measuring greater vertical angles, which is often necessary in Mountain and Mining work, where the engineer is confronted with steep vertical angular requirements. These instruments are also prepared to receive the side or top telescope for extreme or prime verticals, and the top of the telescope is provided with a fine punch mark for centering the instrument from a point above. On account of their accuracy and stability, these instruments can be used for any kind of engineering work.



No. 12

LIETZ 4-INCH MOUNTAIN AND RECONNAISSANCE TRANSIT

Code Word, **BULLCALF**

No. 12W

Same as No. 12 but without Variation Ring to Compass.
Code Word, **BULLRUN**

**LIETZ MOUNTAIN AND MINING TRANSITS
Nos. 12 and 12W**

Dimensions and Weights

Horizontal Circle, measuring to edge of graduation.....	4	inches diam.
Vertical Circle, measuring to edge of graduation.....	4	" "
Compass Needle	2½	" long
Object Glass	1	" diam.
Telescope	8	" long
Magnifying power		18 X
Weight.....Instrument, 7½ lbs.; tripod, about 8½ lbs.; box, about 4 lbs.		

Instruments as Usually Furnished

- No. 12.** Lietz Mountain and Mining Transit with 4-inch horizontal circle, verniers reading to minutes and 4-inch full vertical circle fitted with aluminum guard and vernier reading to minutes; graduations on solid silver; level and tangent to telescope, with fixed stadia hairs, set 1:100. Variation ring to compass. Equipped with extension tripod. Instrument complete with plumb bob, sunshade, adjusting pins, dust brush, etc., in polished mahogany case. Code Word, **BULLCALF**
- No. 12W.** Same as No. 12 but without variation ring to compass.
.....Code Word, **BULLRUN**

Extras for Transits Nos. 12 and 12W

Reversion level and protection ring.....	Code Word	CULTURE
Prism to eye-piece with neutral glass.....		CUMBERSOME
Constructed with three leveling screws instead of four.....		CULVERIN
Three leveling screw shifting center.....		CUMBER
Gradiometer attachment with movable head.....		CULPABLE
Silk protection bag or hood (waterproof).....		CURTAIN
Bottle of fine instrument oil.....		CUTEX
Inverting eye-piece (made to order only).....		CUTWATER

SOLAR ATTACHMENTS AND SECONDARY TELESCOPES

For further description and illustration see pages 90-93.

.....	Code Word	CUMBROUS
Saegmuller Solar Attachment with counterpoise.....		CURATOR
Smith Solar Attachment with counterpoise.....		CUTICLE
Burt Solar Attachment with counterpoise.....		CUNEATED
Attachable secondary telescope (side and top) with counterpoise		CUSTARD
Davis Solar Screen		

For complete list of features applicable to Lietz Transits see pages 88 and 89.

See price list in back of catalog.



No. 14C

LIETZ 4-INCH TRANSIT THEODOLITE

With U-shaped standards and Y bearings and with Circular Compass.
 Code Word, **BULWING**

NOTE: Instrument complete with FULL VERTICAL CIRCLE. Illustration shows Vertical Arc only.

LIETZ TRANSIT THEODOLITE No. 14C

With U-shaped Standards and Y Bearings

Similar in design and incorporating the characteristics of our Nos. 5C and 11C Theodolites. The U-shape standard is of superior design and obtains lateral rigidity to the highest degree. Telescope with cylindrical pivots which rest in Y bearings is reversible in position and exchangeable in its bearings. Instrument has compass with variation ring and needle 2½ inches long.

Dimensions and Weights

Horizontal Circle, measuring to edge of graduation.....	4	inches	diam.
Vertical Arc or Circle, measuring to edge of graduation....	4	"	"
Compass Needle	2½	"	long
Object Glass	1	"	diam.
Telescope	8	"	long
Magnifying power			18 X
Weight.....Instrument, 7½ lbs.; tripod, about 8½ lbs.; box, about 4 lbs.			

Instruments as Usually Furnished

No. 14C. Lietz Transit Theodolite with 4-inch horizontal circle, verniers reading to minutes and 4-inch full vertical circle fitted with aluminum guard and vernier reading to minutes; graduations on solid silver; level and tangent to telescope, with fixed stadia hairs, set 1:100. Variation ring to compass. Equipped with extension tripod. Instrument complete with plumb bob, sunshade, adjusting pins, dust brush and all usual accessories, in polished mahogany case.
Code Word, **BULWING**

Extras for Transit Theodolite No. 14C

	Code Word
Reversion level vial with protection ring.....	CULTURE
Striding level to axis of telescope.....	CULTRATED
Constructed with three leveling screws instead of four....	CULVERIN
Three leveling screw shifting center.....	CUMBER
Gradiometer attachment with movable head.....	CULPABLE
Prism to eye-piece with neutral glass.....	CUMBERSOME
Silk protection bag or hood (waterproof).....	CURTAIN
Bottle of fine instrument oil.....	CUTEX
Inverting eye-piece (made to order only).....	CUTWATER

For complete list of features applicable to Lietz Transits see pages 88 and 89.

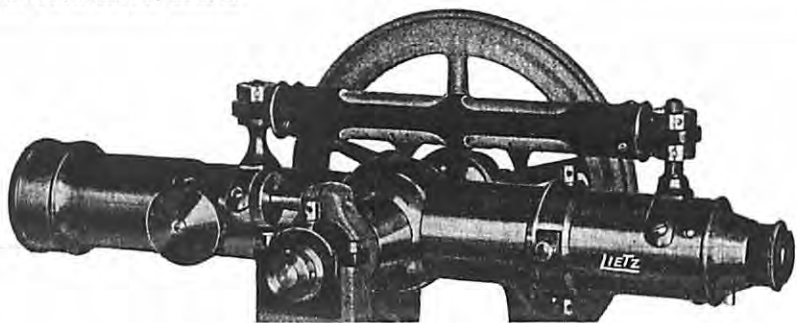
See price list in back of catalog.

COMPLETE LIST OF FEATURES APPLICABLE TO LIETZ INSTRUMENTS

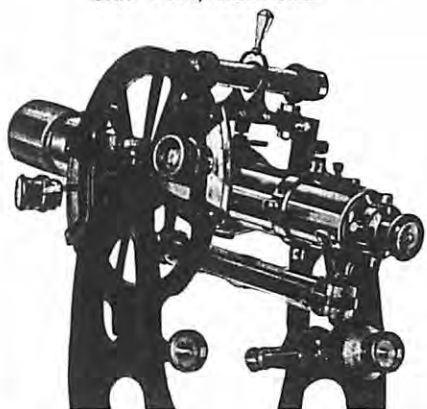
For which additional charge is made when not included in the specifications and prices as quoted in price lists. Please specify if desired.

	Code Word
Horizontal verniers reading to 30 seconds.....	CULLYISM
Horizontal verniers reading to 20 seconds.....	CULMINATE
Horizontal verniers reading to 10 seconds.....	CURABLE
Stadia hairs fixed.....	CUPOLA
Disappearing stadia hairs.....	CUPRIC
Variation ring to compass.....	CULPRIT
Arrangement for offsetting right angles.....	CULTIVATE
Gradiometer attachment to vertical motion with movable head (see page 69).....	CULPABLE
Constructed with three leveling screws instead of four..	CULVERIN
Three leveling screws shifting center.....	CUMBER
Striding level to axis of telescope.....	CULTRATED
Beaman Stadia Arc	DIAMOND
Reversion level with protective housing in lieu of ordinary.	CULTURE
Level for vernier arm for control of zero on vernier.....	DIAGNOSE
Prism to eye-piece with neutral glasses (see page 88).....	CUMBERSOME
Colored glass object cap.....	CUTLERY
Colored glass eye-piece cap.....	CUTLET
Colored glass in shutter of cap.....	CUTAWAY
Elbow zenith eye-piece.....	CUTLASS
Guard to vertical circle.....	CUMSHAW
Vertical circle graduated on the periphery with guard.....	CUPBEARER
Vertical circle with two opposite verniers in lieu of single	CURATIVE
Two vernier microscopes.....	CURBING
Mining bracket for mounting transits in mines.....	CUTWORM
Lateral adjustor for transits with four leveling screws....	CUPLING
One extension leg in lieu of one split leg.....	CURLY
Full extension tripod instead of straight legs.....	CUMBRANCE
Protection bag, silk, waterproof.....	CURTAIN
Inverting eye-piece (made to order only).....	CUTWATER
Reflector for illuminating cross hairs.....	CUNEIFORM
Compass needle in box on plate, 4½" long.....	CURBLES
Mirror to control bubble from the end.....	CUPID
Agate-fitted wyes	CUPIDITY
Trough compass for alidade.....	DROUGHT
Leather cover for transit box with shoulder straps.....	CYCLOID

Note: Solar attachments and secondary telescopes, see pages 90-93.



REVERSION LEVEL
For leveling with telescope on back sight. Applicable to any of our transits.
Code Word, **CULTURE**



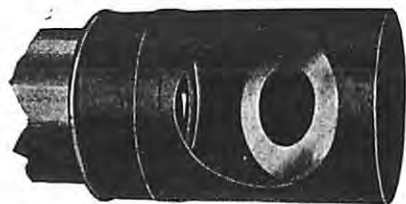
DOUBLE OPPOSITE VERNIER ATTACHMENT
Code Word, **CURATIVE**
Two Vernier Microscopes. Code Word, **CURBING**



VERTICAL CIRCLE
GRADUATED ON
PERIPHERY
Code Word, **CUPBEARER**



ATTACHABLE PRISM
TO EYE-PIECE
Code Word, **CUMBERSOME**

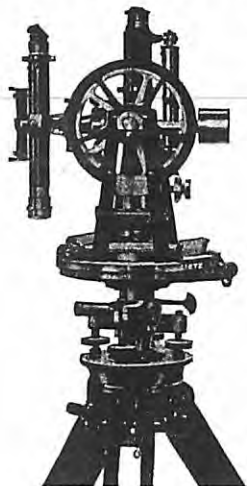


REFLECTOR SHADE FOR ILLUMINATING
CROSS HAIRS
Code Word, **CUNEIFORM**

Gradiometer, see page 69.

See price list in back of catalog.

**SAEGMUELLER
 SOLAR
 ATTACHMENT**



Illustrating use of Saegmueller Solar Attachment as secondary telescope for vertical sighting.

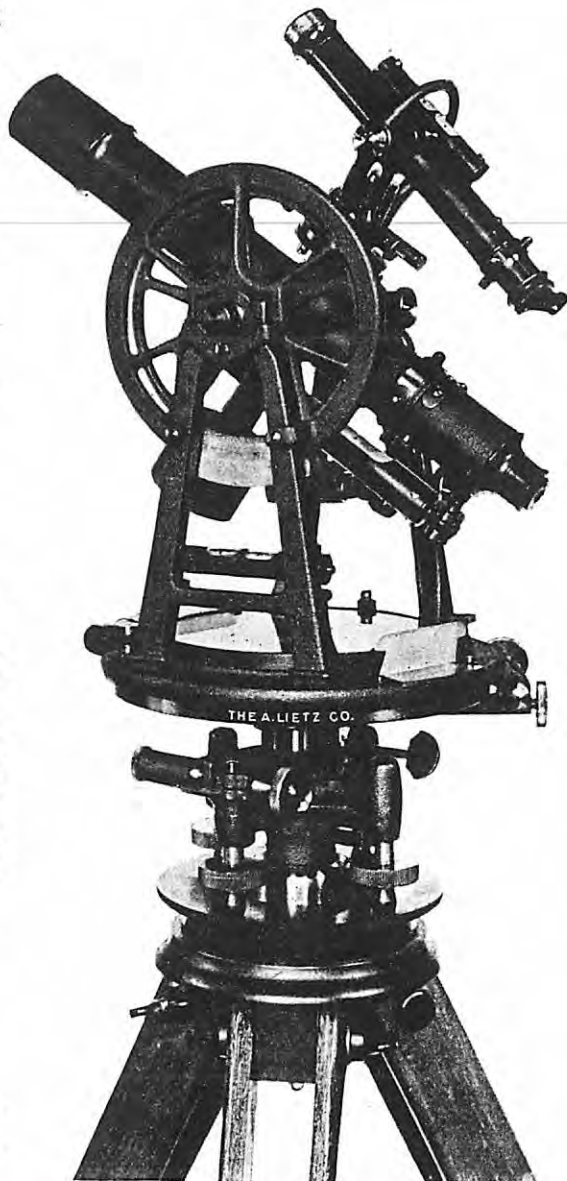
This solar attachment is detachable; it screws into the top of the telescope axis, and becomes a part of the instrument. It answers the purpose of a side telescope, as shown above. Made in two sizes suitable for engineers' instruments and for the mountain and mining instruments.

No. 16. Saegmueller Solar Attachment (either size)

Code Word, **CUMBROUS**

Price includes fitting with new instrument.

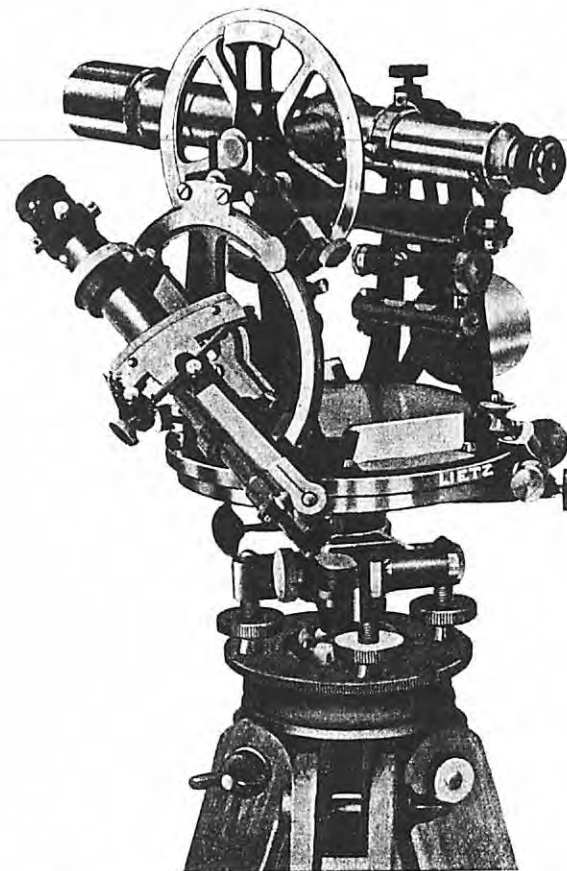
Nominal charge made when fitted to used transit.



Illustrating Lietz Transit No. 4 fitted with Saegmueller Solar Attachment.

See price list in back of catalog.

SMITH SOLAR ATTACHMENT



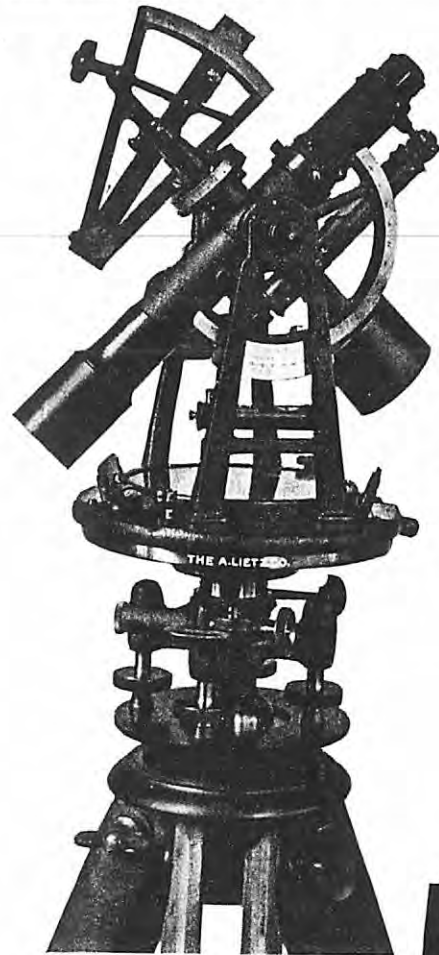
Illustrating Lietz Transit No. 9 fitted with Smith Solar Attachment.

This attachment is fitted permanently to the instrument and therefore becomes part thereof.

No. 16S Smith Solar Attachment.....Code Word, **CURATOR**

Price includes fitting with new transit.

See price list in back of catalog.



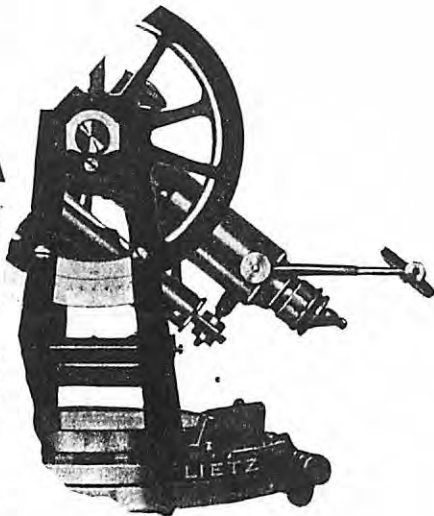
BURT SOLAR ATTACHMENT

No. 16B

Burt Solar Attachment. This Solar Attachment is detachable; it is screwed into the top of the telescope axis and becomes part of the instrument.

Code Word, **CUTICLE.**

Price includes fitting with new instrument.



DAVIS SOLAR SCREEN

No. 17D

Davis Solar Screen with prism for eye-piece of transit.

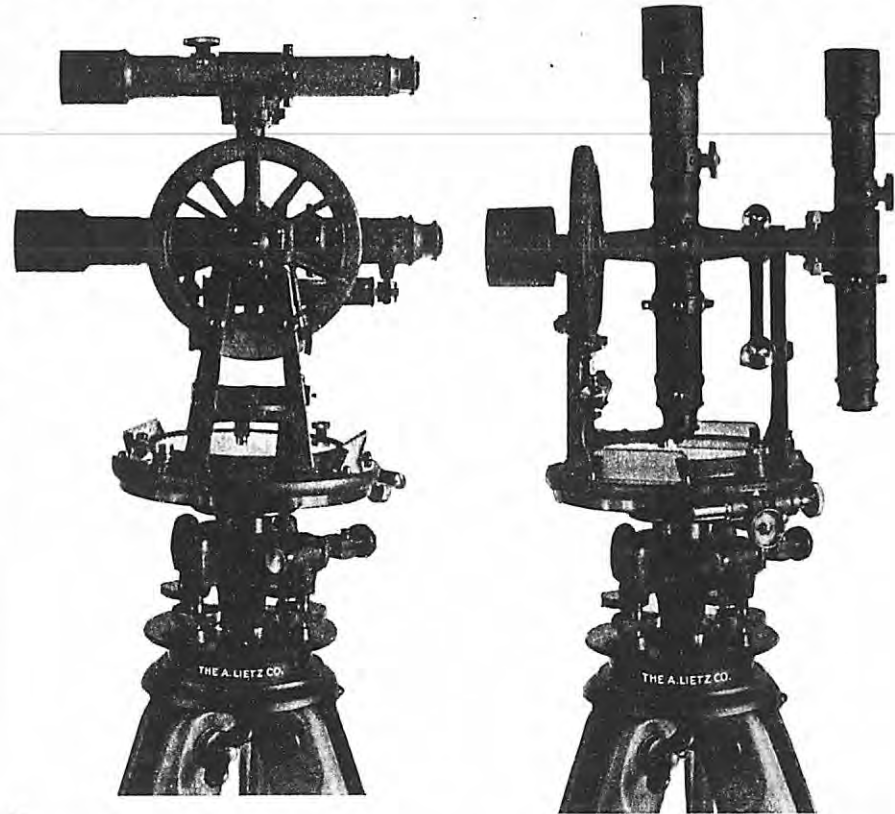
This permits of taking sun observations direct with the instrument telescope. It can be attached to any transit with a vertical circle or vertical arc.

Code Word, **CUSTARD**

Price includes fitting with new instrument.

See price list in back of catalog.

LIETZ ATTACHABLE SECONDARY TELESCOPE



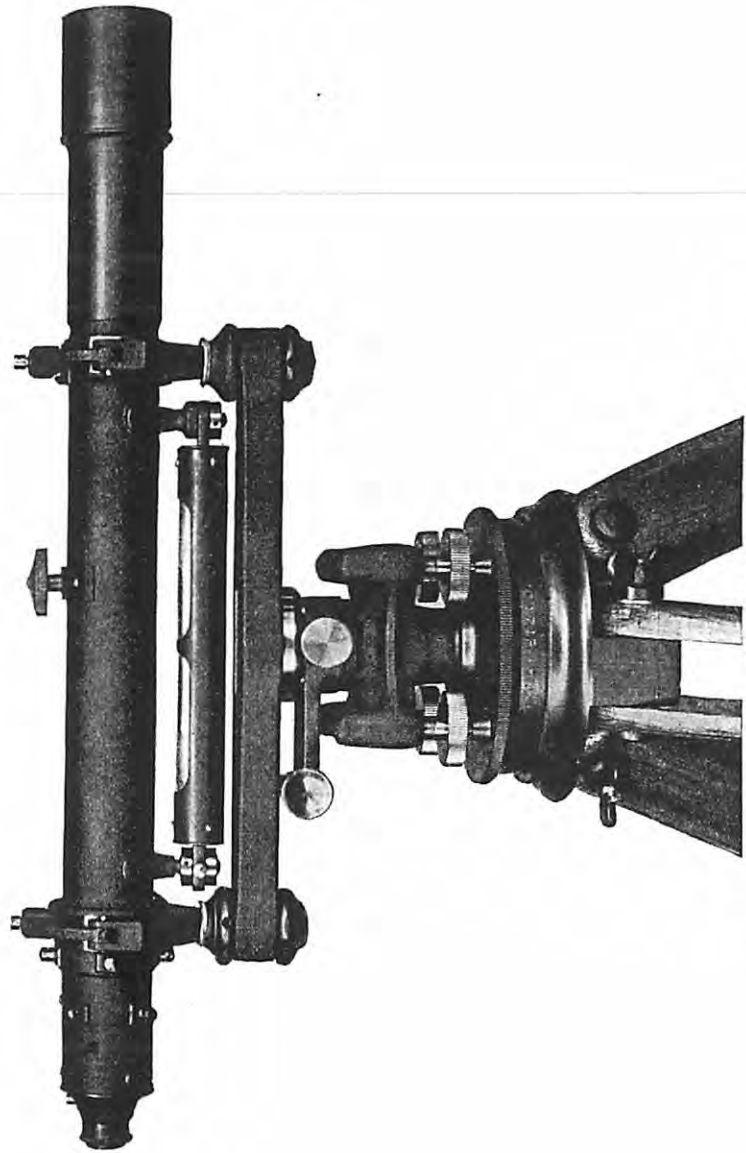
Showing Secondary Telescope in position on top for measuring horizontal angles.

Showing Secondary Telescope in position on the side for measuring vertical angles.

No. 17. Attachable Secondary Telescope with counterpoise.
 Code Word, **CUNEATED**

Lietz Secondary Telescope is detachable and interchangeable. It may be attached to the top or the side of the instrument as conditions require. Price includes fitting with new instrument.

See price list in back of catalog.



No. 19
LIETZ ENGINEERS' PRECISION Y LEVEL
 Code Word, BUMBOAT

LIETZ ENGINEERS' PRECISION Y LEVEL No. 19

This instrument is constructed to secure the greatest amount of stability without adding to its weight. Improved reinforced bar and-ribbed construction of the starpiece. Long center, with clamp and tangent. Sensitive spirit level. Telescope has definition, light and power in a high degree and is provided with slide protector. The collars are made of our special hard metal and equalized with great care.

Dimensions and Weights

Length of telescope.....	18	inches
Diameter of objective.....	1 3/8	"
Magnifying power	33	X
Weight.....	Instrument, 11 lbs.; tripod, about 8 1/2 lbs.; box, about 8 lbs.	

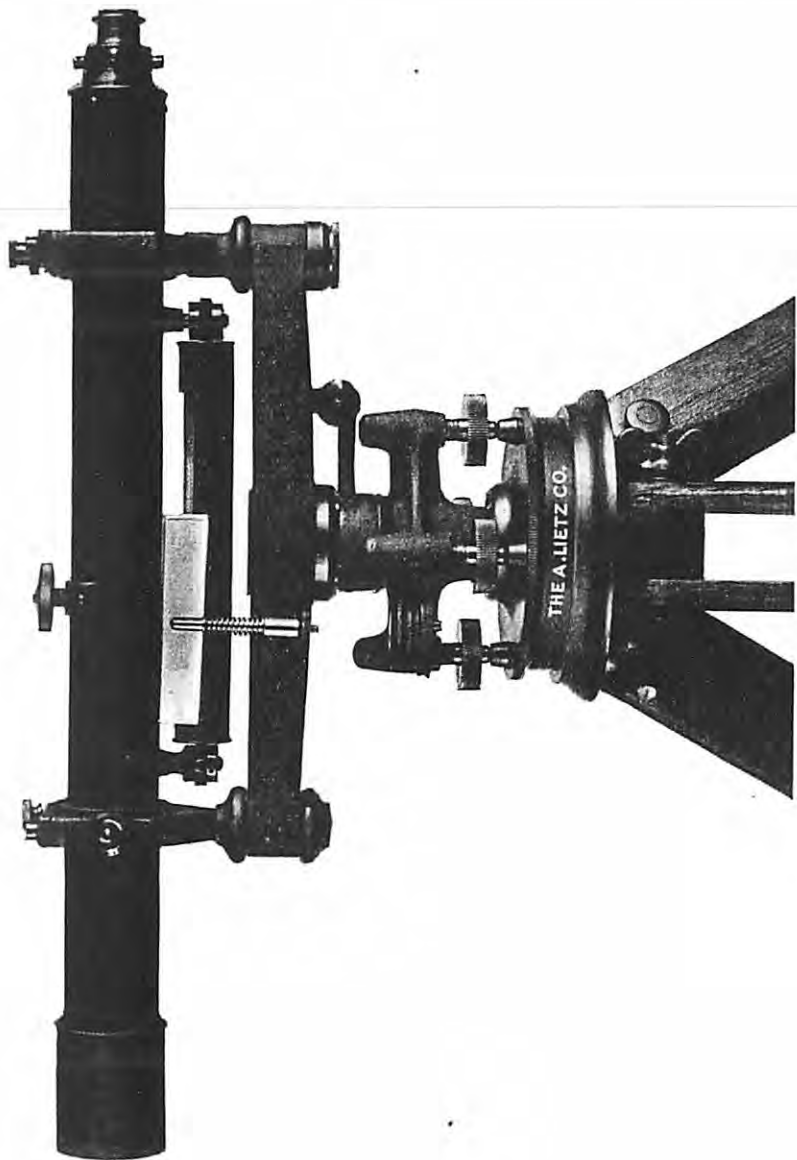
Instrument as Usually Furnished

- No. 19.** Lietz Engineers' Precision Y Level, equipped with split-leg tripod. Instrument complete with sunshade, dust brush, adjusting pins, and all usual accessories, in polished mahogany box.
Code Word, **BUMBOAT**

Extras for Y Level No. 19

Mirror to control bubble from eye end.....	Code Word
Stadia hairs fixed, set 1:100.....	CUPID
Reversion level to telescope with protection ring.....	CUPOLA
Constructed with three leveling screws instead of four.....	CULTURE
Silk protection bag (waterproof).....	CULVERIN
Full extension tripod in lieu of straight legs.....	CURTAIN
Bottle of fine instrument oil.....	CUMBRANCE
Inverting eye-piece (made to order only).....	CUTEX
	CUTWATER

See price list in back of catalog.



No. 19G
LIETZ GEODETIC PRECISE LEVEL
 Code Word, BUMBRAY

LIETZ GEODETIC PRECISE LEVEL No. 19G

With the Lietz Geodetic Precise Level quicker and more accurate results can be obtained than with the ordinary Wye or Dumpy Level.

The feature by which this is accomplished consists principally of a micrometer screw for the vertical control of one of the Ys. With this the telescope can be raised or lowered at the eye end with greater speed and accuracy than can be obtained with the leveling screws.

The Telescope is carefully pivoted, but can easily be relieved for testing of adjustments, which is done in the same manner as with the ordinary Wye Level. The collars are made of our special hard metal and are equalized with great care. A mirror is attached for control of the level bubble from the eye end of the Telescope. A circular level attached to the starpiece is for the purpose of leveling the instrument approximately. The final setting is accomplished with the micrometer screw for each reading.

It has been the custom generally to recommend and supply this type of instrument with three leveling screws and inverting Telescope, but late experience has proven that it is more practical and economical to adhere to the four leveling screws, as it enables the average instrument man to handle the instrument without the necessity of adapting himself to the manipulation of a system which is not of everyday use. With the development of our optics, we can furnish a highly satisfactory Telescope of the erecting type.

The Lietz Geodetic Precise Level will give excellent results and can be manipulated by the average instrument man with greater facility than the ordinary level. It will, therefore, replace the ordinary Wye and Dumpy Level in many instances, where the first cost is made subsidiary to economic efficiency.

Sensitiveness of level vial furnished is from ten to twenty seconds. We recommend fifteen seconds of arc, as this level can be readily set to any reading within two or three seconds of arc. This has been accomplished by careful grinding to the proper curvature, which together with the nature of the filament gives the bubble a free and rapid motion.

Dimensions and Weights

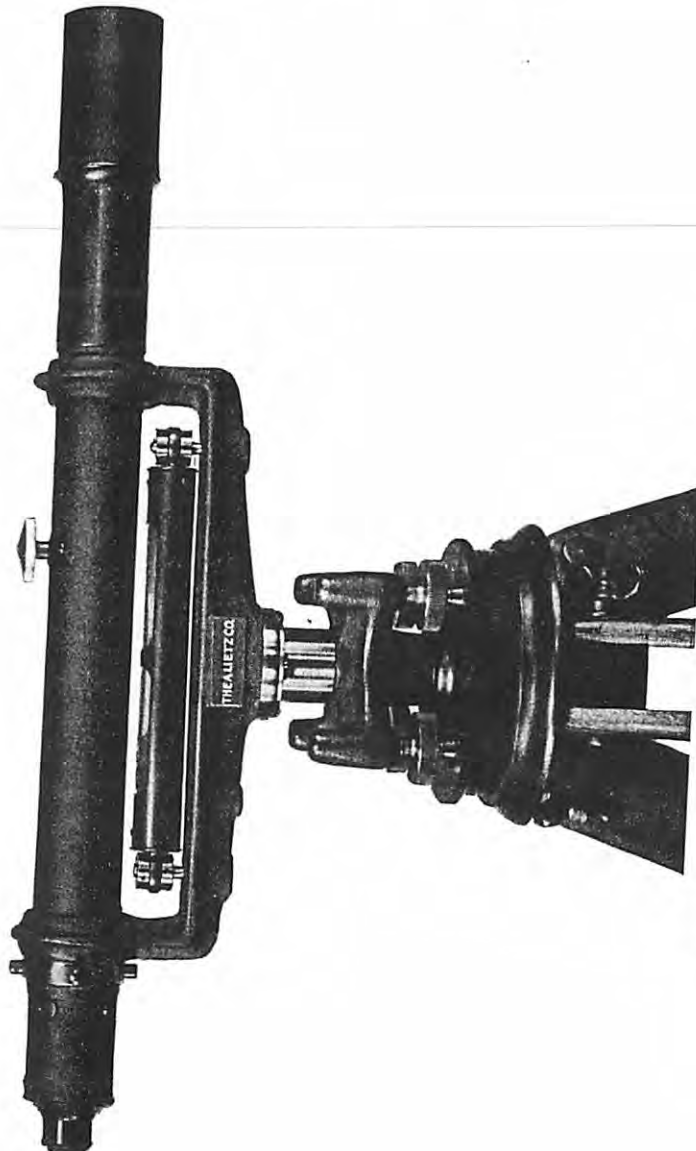
Length of telescope.....	18 inches
Diameter of objective.....	1 3/8 "
Magnifying power	33 X
Weight.....	Instrument, 11 lbs.; tripod, about 8 1/2 lbs.; box, about 8 lbs.

Instrument as Usually Furnished

No. 19G. Lietz Geodetic Precise Level, equipped with split-leg tripod. Instrument complete with sunshade, dust brush, adjusting pins and all usual accessories, in polished mahogany box.
Code Word, BUMBRAY

For extras for Geodetic Precise Level see under No. 19, page 95.

See price list in back of catalog.



No. 20
LIETZ ENGINEERS' DUMPY LEVEL
 Code Word, **BUMPER**
No. 20T. Same as No. 20, but with clamp and tangent movement.
 Code Word, **BURGESS**

LIETZ ENGINEERS' DUMPY LEVELS Nos. 20 to 20T

A rugged and compact instrument of great strength and permanency of adjustments. Greater stability has been secured with a reinforced bar of improved design and ribbed construction of the starpiece, without increasing the weight. Its simplicity and accuracy recommend it for the best class of engineering work and for use in rough country and under most severe conditions. Instrument sets low on the tripod, which is a desirable characteristic. Long center of our special hard alloy; sensitive spirit level. Telescope has definition, light and power in a high degree and is provided with slide protector.

Dimensions and Weights

Length of telescope.....	18	inches
Diameter of objective.....	1 3/8	"
Magnifying power	33	X
Weight.....	Instrument, 10 lbs.; tripod, about 8 1/2 lbs.; box, about 8 lbs.	

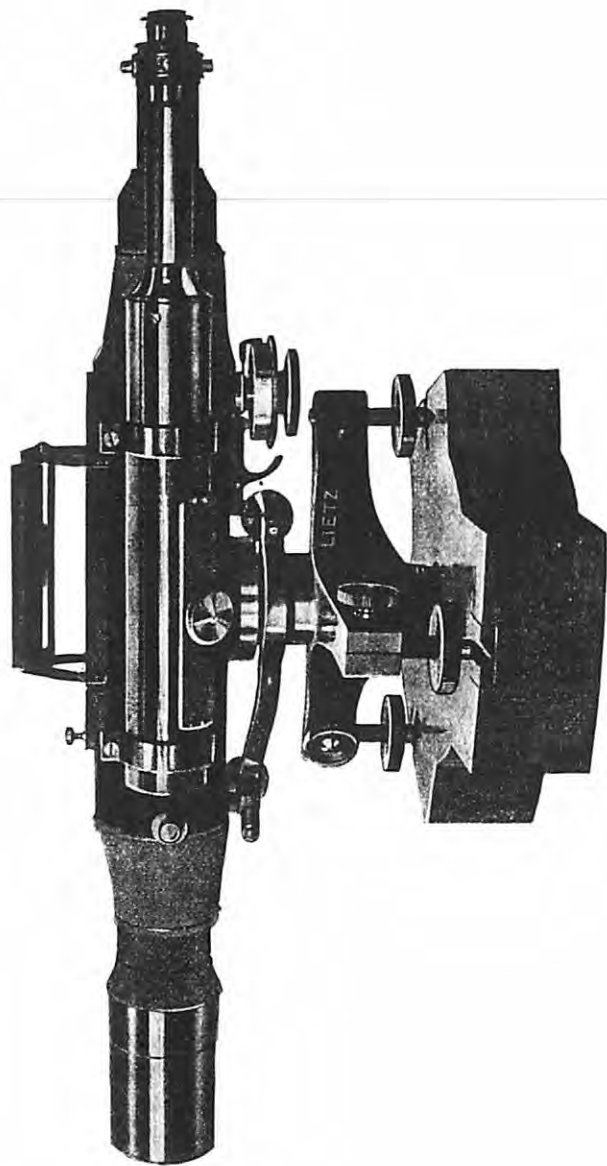
Instruments as Usually Furnished

- No. 20.** Lietz Engineers' Dumpy Level, equipped with split-leg tripod. Instrument complete with sunshade, dust brush, adjusting pins and all usual accessories, in polished mahogany case.
.....Code Word, **BUMPER**
- No. 20T.** Same as No. 20 but fitted with clamp and tangent movement.
.....Code Word, **BURGESS**

Extras for Nos. 20 and 20T

Mirror to control bubble from eye end.....	Code Word	CUPID
Stadia hairs fixed, set 1:100.....		CUPOLA
Constructed with three leveling screws instead of four.....		CULVERIN
Silk protection bag (waterproof).....		CURTAIN
Full extension tripod in lieu of straight legs.....		CUMBRANCE
Bottle of fine instrument oil.....		CUTEX
Inverting eye-piece (made to order only).....		CUTWATER

See price list in back of catalog.



No. 20G

LIETZ PRECISE LEVEL

Design of the U. S. Coast and Geodetic Survey.
Code Word, **BURGUNDY**

LIETZ PRECISE LEVEL No. 20G

U. S. Coast and Geodetic Survey Design

The United States Coast and Geodetic Survey Precise Level is of the Dumpy Type, and is designed to meet the demand for an instrument whereby the greatest precision possible in leveling can be obtained. In the construction of this instrument we follow in every respect the specifications of the United States Coast and Geodetic Survey. The use of nickel iron, with coefficient of expansion of 0.000004 per degree Centigrade, in connection with nickel steel with coefficient of expansion of 0.000001 per degree Centigrade, assures of a permanency of adjustment of this instrument under decided changes of temperature. The instrument has a fixed adjustment between the line of collimation and the level. The level is set partially within the telescope and as near as possible to the line of collimation.

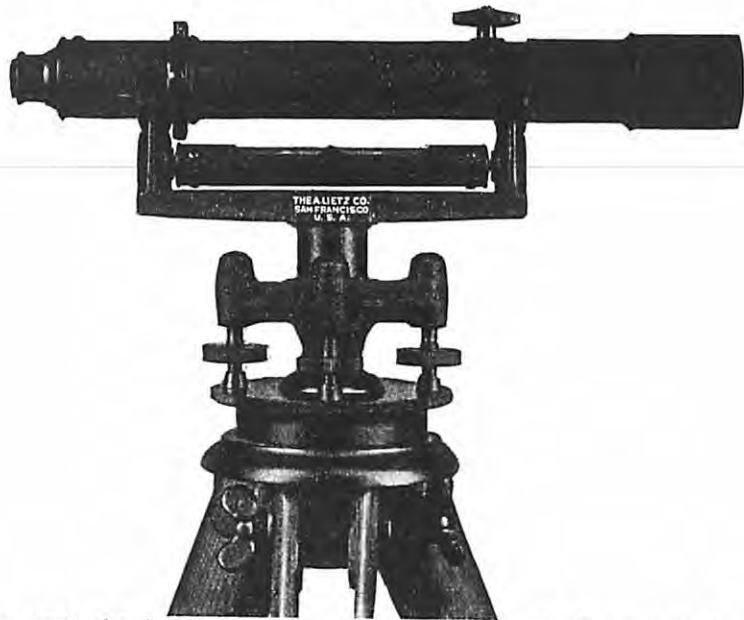
Specifications

- TELESCOPE**—17 inches long, inverting, magnifying power about 40 X, object glass, 1 $\frac{3}{4}$ inches diameter.
- LEVEL TO TELESCOPE**—5 $\frac{3}{4}$ inches long, chambered, graduated 2-mm. divisions; sensitiveness to 2" of arc.
- STADIA HAIRS**—Set 30 cm. to 100 meters.
- MICROMETER SCREW**—Has head divided into 100 parts, 100 revolutions to one inch, provided with cam for lifting telescope from micrometer screw when not in use.
- WEIGHT**—Instrument, about 14 lbs.; tripod, about 19 lbs.; box, about 16 lbs.

Code Word, **BURGUNDY**

See price list in back of catalog.

LIETZ IMPROVED BUILDERS' DUMPY LEVEL
 No. 21



To meet the increasing demand for a high-grade instrument for the road builder, drainage engineer and building contractor we have constructed our improved Builders' Dumpy Level. It is similar in design and construction to our Engineers' Dumpy Level No. 20 but smaller in size, therefore lighter and more portable. Built along simple lines of our hard metal alloys, assuring of long wear and greatest efficiency in the field. Long center, sensitive spirit level, and a telescope possessing definition, light and power in a high degree, provided with slide protector.

Dimensions and Weights

Length of telescope.....	11 inches
Diameter of objective.....	1 1/8 "
Magnifying power	24 X
Weight.....Instrument, 5 3/4 lbs.; tripod, about 7 1/2 lbs.; box, about 5 lbs.	

Instruments as Usually Furnished

No. 21. Lietz Improved Builders' Dumpy Level, equipped with split-leg tripod. Instrument complete with sunshade, dust brush, adjusting pins, etc., in neat polished mahogany case.....Code Word, **BURROW**

EXTRAS

For which the additional charge is made. Kindly specify if desired.

Fixed stadia hairs set 1:100.....	Code Word CUPOLA
One extension tripod leg in lieu of straight leg.....	CURLY
Full extension tripod in lieu of straight leg.....	CUMBRANCE
Silk protection bag or hood (waterproof).....	CURTAIN
Bottle of fine instrument oil.....	CUTEX

See price list in back of catalog.

LIETZ IMPROVED BUILDERS' DUMPY LEVEL
 No. 21C



This is the same Instrument as our No. 21 but equipped with horizontal circle and vernier reading to 5 minutes.

Instrument as Usually Furnished

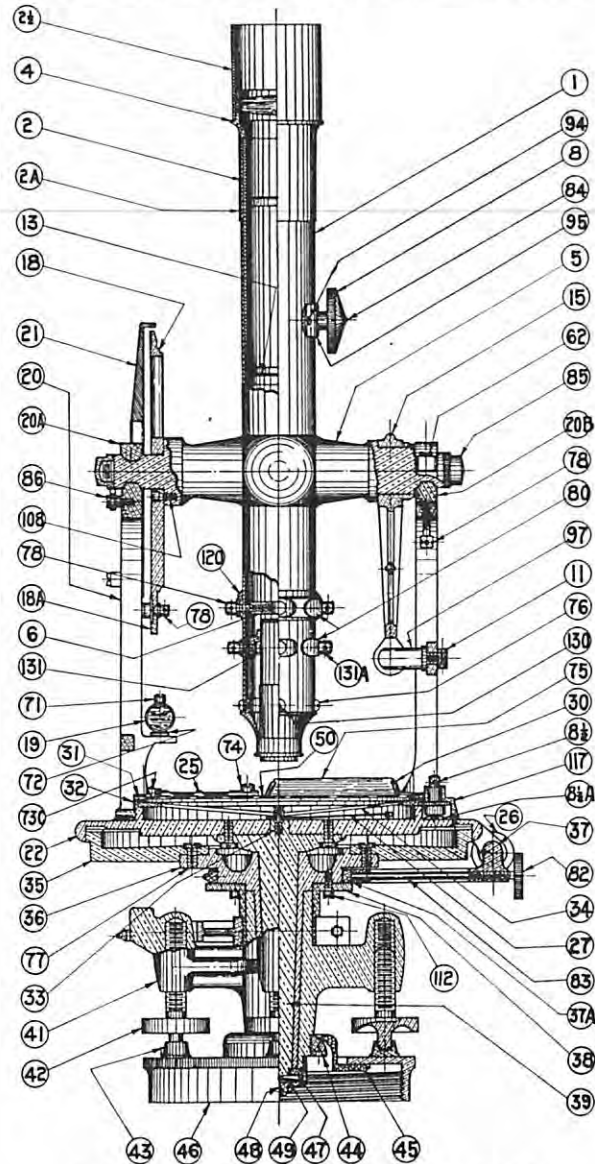
No. 21C. Lietz Improved Builders' Dumpy Level, equipped with horizontal circle with vernier reading to 5 minutes, and split-leg tripod. Instrument complete with sunshade, dust brush, adjusting pins, etc., in neat polished mahogany case.....Code Word, **BURSAR**

For extras, see opposite page

A good instrument assures its owner of a lasting satisfaction, both in results obtained and as an investment.

See price list in back of catalog.

CROSS SECTION OF LIETZ TRANSIT

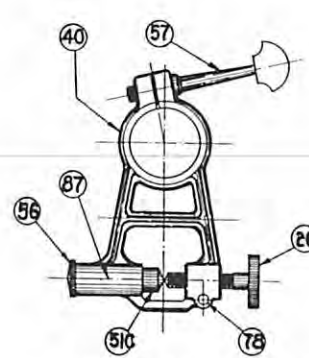


SUNDRIES FOR TRANSITS AND LEVELS

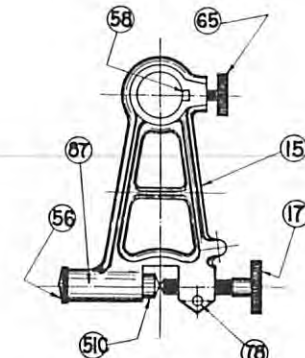
- Tempered Steel Adjusting Pins for instrument adjustments.....
- Tempered Steel Adjusting Pins, large size for Y levels.....
- Phosphor Bronze Adjusting Pins for setting off variation.....
- Screw Driver for instrument box.....
- Camel Hair Dust Brush for instruments.....

Each

PARTS SUSCEPTIBLE TO LOSS OR INJURY



Piece 40 Lower Clamp complete



Piece 15, Axis Clamp complete

Please order part by piece number, giving serial number of instrument. It must be borne in mind that vital parts of Precision Instruments cannot be made interchangeable. It is therefore advisable to forward broken parts.

- | Piece No. | Description |
|-----------|-------------------------------|
| 2 1/2 | Sunshade. |
| 6. | Cross Hair Frame. |
| 8. | Pinion Head. |
| 15. | Axis Clamp complete. |
| 17. | Tangent Screw. |
| 18. | Vertical Circle. |
| 19. | Standard Level Housing. |
| 21. | Vertical Circle Guard. |
| 25. | Plate Level Housing. |
| 26. | Plate Tangent Screw. |
| 30. | Vernier Shade Bracket. |
| 30A. | Vernier Shade Bracket Screws. |
| 31. | Shell for Compass Glass. |
| 34. | Compass Needle. |
| 37. | Plate Clamp complete. |
| 38. | Collar. |
| 40. | Lower Clamp complete. |
| 42. | Leveling Screws. |
| 43. | Leveling Screw Cups. |
| 46. | Base Plate. |
| 47. | Spindle Nut. |

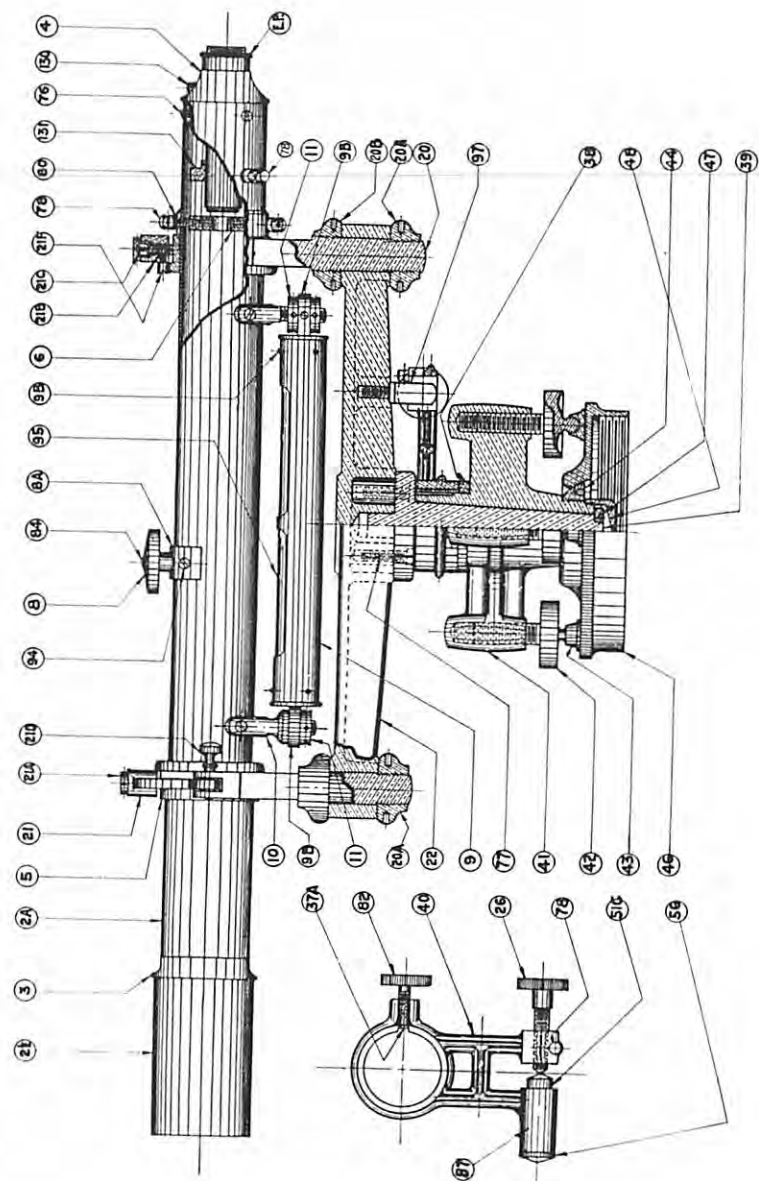
- | Piece No. | Description |
|-----------|----------------------------|
| 48. | Plumbbob Cap. |
| 49. | Spindle Release Spring. |
| 50. | Compass Glass. |
| 51B. | Plunger for Plate Tangent. |
| 51C. | Plunger for Clamps. |
| 56. | Cap for Clamps. |
| 57. | Clamp Screw. |
| 62. | Standard Cap Screw. |
| 65. | Axis Clamp Screw. |
| 75. | Shade Glasses. |
| 82. | Plate Clamp Screw. |
| 85. | Acorns for Axis. |
| 86. | Guard Screws. |
| 87. | Tangent Spring. |
| 88. | Chain for Plumbbob. |
| 89. | Vernier Cover Glasses. |
| 90. | Dust Cap for Telescope. |
| 94. | Collet Fastening Screws. |
| 95. | Collet. |
| 112. | Collar Fastening Screws. |
| 152. | Spanner Wrench. |

INSTRUMENT BOXES AND ACCESSORIES

- New mahogany box with wooden fittings and strap complete for Transits Type 4 and 9
- New mahogany box with wooden fittings and strap complete for Levels Type 19 and 20
- New mahogany box with wooden fittings and strap complete for Transits Type 12
- New mahogany box with wooden fittings and strap complete for Levels Type 21
- Extra key for boxes
- New strap for boxes
- New bumpers for boxes
- New shipping boxes with carrying rope for transits and levels.....

Each

CROSS SECTION OF LIETZ LEVEL

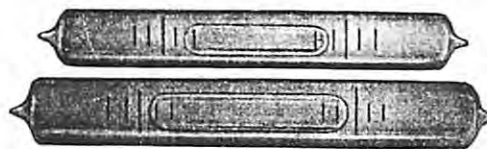


PARTS OF LEVEL SUSCEPTIBLE TO LOSS OR INJURY

Kindly order by piece number, giving serial number of instrument. It must be borne in mind that vital parts of precision instruments cannot be made interchangeable. Needed screws are best ordered by sending broken portions.

- | | | | |
|------------|----------------------------|----------|-----------------------------|
| Piece | | Piece | |
| No. 1. | Telescope. | No. 26. | Tangent screw. |
| No. 2. | Slide. | No. 37A. | Clamp block. |
| No. 2A. | Slide protector. | No. 38. | Collar. |
| No. 2 1/2. | Sun shade. | No. 39. | Spindle. |
| No. 3. | Objective head. | No. 40. | Lower clamp. |
| No. 4. | Eye-piece collar. | No. 41. | Starpiece. |
| No. 5. | Telescope axis. | No. 42. | Leveling screw. |
| No. 6. | Cross Hair frame. | No. 43. | Leveling screw cups. |
| No. 8. | Pinion Head complete. | No. 44. | Ball. |
| No. 8A. | Saddle. | No. 46. | Baseplate. |
| No. 9. | Tel. level housing. | No. 47. | Spindle nut. |
| No. 9A. | Tel. level housing ends. | No. 48. | Bottom cap. |
| No. 9B. | Tel. level end fast screw. | No. 51C. | Plunger. |
| No. 19. | Tel. level brackets. | No. 56. | Plunger cap. |
| No. 11. | Tel. level adjusting nuts. | No. 76. | Eye-piece collar screw. |
| No. 13. | Diaphragm (not shown). | No. 77. | Bar fastening screw. |
| No. 20. | Standards. | No. 78. | Cross Hair frame screw. |
| No. 20A. | Lower nuts to standard. | No. 80. | Cross Hair frame washer. |
| No. 20B. | Upper nuts to standard. | No. 82. | Plate clamp screw. |
| No. 21. | Clasp. | No. 84. | Pinion Head screw. |
| No. 21A. | Cap. | No. 87. | Spring not shown. |
| No. 21B. | Plunger. | No. 90. | Dust cap. |
| No. 21C. | Plunger spring. | No. 94. | Collet screw. |
| No. 21D. | Lock pins. | No. 95. | 6" level vial. |
| No. 21E. | Hinge pins (not shown). | No. 97. | Abutting piece. |
| No. 21F. | Stop pin to Telescope. | No. 130. | Eye-piece focusing screw. |
| No. 22. | Bar. | No. 131. | Eye-piece reinforcing ring. |

LIETZ GRADUATED AND GROUND LEVEL VIALS



Prices of Level Vials Only, Without Housing

Level Vials for Telescopes of Transits and Levels. Per inch of length (unmounted)
 Level Vials for Plate and Standard of Transits (unmounted).....
 Circular Level Vial (as furnished with our Hydrographic Y Level and Alidades)

PLAIN LEVEL VIALS, NOT GRADUATED OR GROUND

Plain Level Vials, not graduated, 1 to 4 inches long, each.....
 Plain Level Vials, not graduated, 4 1/2 to 6 inches long, each.....

Housing for Lietz Level Vials

(Not including posts or nuts, etc.)

Housing for Telescope Levels for Mountain Transits.....
 Housing for Telescope Levels for large Engineers' Transits.....
 Housing for Telescope Levels for Dumpy and Y levels.....
 Housing for Plate and Standard Levels for Transits.....

For replacing broken level vials we suggest the sending of the housing for which the level vial is intended to insure proper size.
 Extra for mounting any size.....

See price list in back of catalog.

LIETZ PLANE TABLE OUTFITS

The advantages of the Plane Table for topographic surveying and mapping are being more and more appreciated. The engineer, topographer and geologist can obtain maps more quickly and accurately than by the usual method of transit survey, for the reason that the essential locations and sketches are made directly in the field, eliminating the necessity of extensive field notes.

A drawing board, especially constructed for field use, and fitted with countersunk holding-down screws for drawing paper, is mounted on a tripod with a specially constructed head.

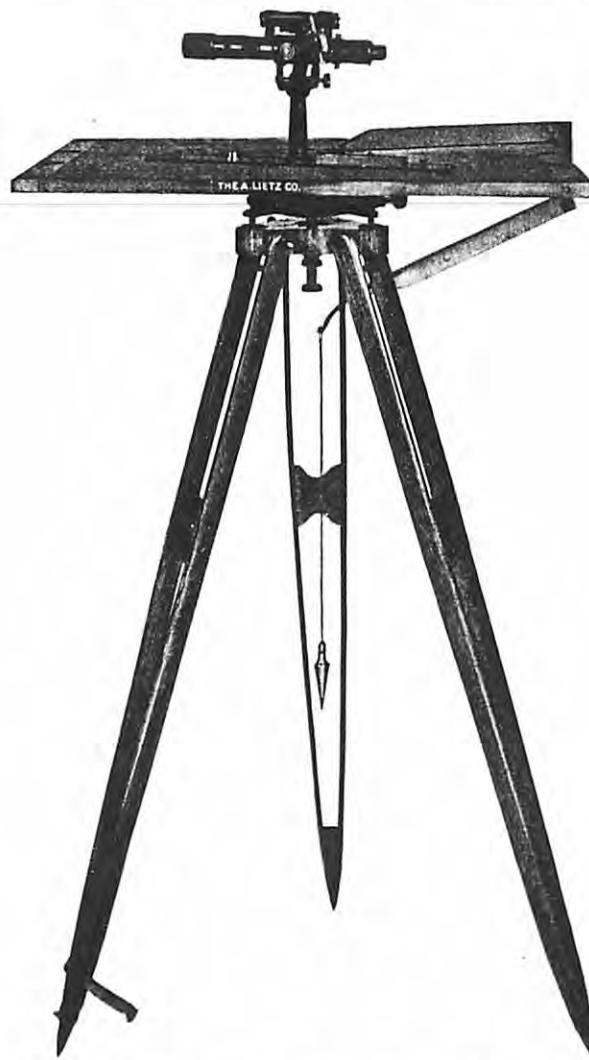
The Johnson Head consists of a ball and socket movement which permits of the orientation and quick leveling of the drawing board, and two wing nuts by means of which the board is securely clamped in position.

The Lietz Tangent Head is an improved form, and while it entails a somewhat greater investment, it is self-evident that its nicety of adjustment and control of the drawing board is a labor-saving feature. It is constructed with three leveling screws and a clamp and tangent movement.

Lietz Alidades are now made in several forms or modifications to meet the various requirements of the profession. They fill a long-felt want for a high-grade instrument of this kind. The telescope has definition, light and power in a high degree and revolves 180 degrees on its longitudinal axis for adjustment and control of the line of collimation. The vertical arc is graduated on the periphery and set at an angle for convenient reading of the vernier. The index of the vernier is at 30 instead of 0; therefore all angles as read are positive, eliminating the possibility of error in the notes. A recent improvement consists of a tangent movement to the vernier arm, which permits setting the vernier exactly at index when the telescope level is centered, irrespective of a possible slight tilt of the drawing board, and the subsequent reading of the vertical angle can be recorded directly by one reading of the arc.

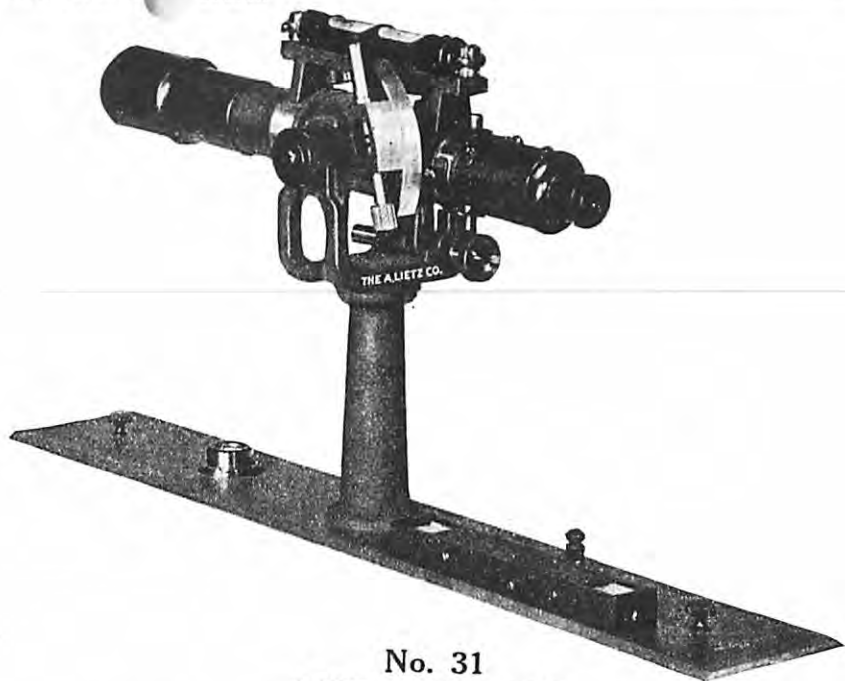
The Striding Level is long and sensitive and has a neat snap arrangement for quickly attaching to the telescope. The collars on which it rests are made of our special hard alloy to insure of long wear. When not in use, the striding level is detached from the telescope and placed on the blade for safe and compact packing.

An improved form of trough compass may be mounted on the blade of the instrument or countersunk into the edge of the drawing board.



Lietz Plane Table Outfit consisting of No. 31 Alidade with trough compass No. 34A, No. 34B Lietz Tangent Head Tripod, No. 34F Drawing Board size 24x31 with holding-down thumbscrews, and No. 34L Plumbing Arm and Plummet.

For further description see pages 110 to 113.



**No. 31
 LIETZ ALIDADE**

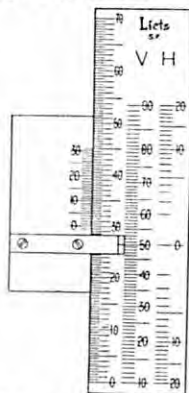
Standard type. 11-inch telescope, 18-inch blade. Fitted with trough compass.

Alidade Code Word **CORDATE**
 Trough Compass **DROUGHT**

GRADUATIONS OF ARC AND VERNIER



Illustrating graduation of vertical arc, vernier reading to minutes.



Illustrating graduation of Beaman stadia arc, vernier reading to minutes.

LIETZ PRECISION ALIDADE No. 31

Dimensions and Weights

Length of telescope..... 11 inches
 Diameter of objective..... 1 1/4 "
 Magnifying power 24 X
 Size of blade 18 inches long, 3 inches wide
 Weight About 7 lbs.

Specifications

No. 31. Lietz Precision Alidade with revolving telescope, 11 inches long, with clamp and tangent, Cross Hairs and Stadia Hairs fixed, set 1:100. Striding Level with snap arrangement for attaching to telescope. Vertical arc graduated on the periphery on solid silver with vernier reading to minutes, tangent movement to vernier arm; blade 18 inches long and 3 inches wide, finished on under side with white celluloid paint to prevent soiling of drawing paper and with circular spirit level. Instrument complete with sunshade, dust brush, adjusting pins and all usual accessories in polished mahogany box.
 Code Word, **CORDATE**

Extras for Alidade No. 31

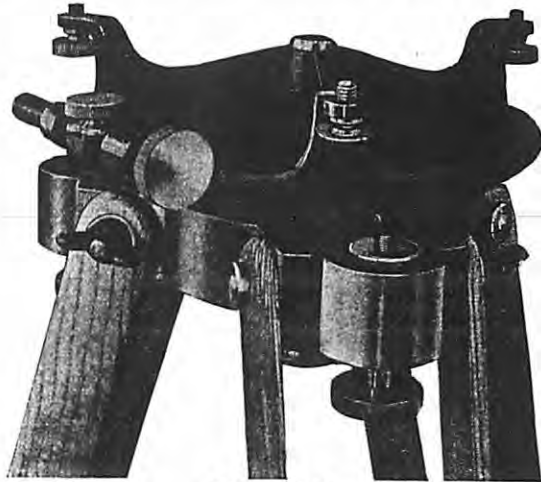
Prism to eye-piece with neutral glass, see page 69..... Code Word **CUMBERSOME**
 Gradiometer attachment to vertical motion with movable head... **CULPABLE**
 Level attached to vernier arm for control of zero on vernier... **DIAGNOSE**
 Trough compass mounted on blade..... **DROUGHT**
 Quarter hair in upper field..... **DIALECT**
 Parallel straightedge attachment to blade..... **DIALOGUE**
 Beaman stadia arc..... **DIAMOND**
 Inverting eye-piece (made to order only)..... **CUTWATER**

Parts susceptible to loss or breakage

Extra striding level complete..... **DIBBER**
 For level vial only see page 107.
 Extra circular spirit level for blade..... **DICKY**

See price list in back of catalog.

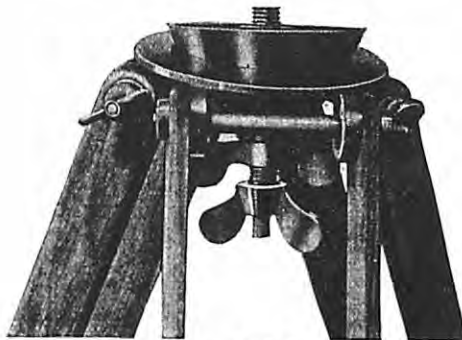
LIETZ PLANE TABLE OUTFITS



No. 34B

LIETZ TANGENT HEAD TRIPOD WITH STRAIGHT LEGS AND HOOD

Weight with hood about 19 lbs.
Code Word, **DEMOLISH**



No. 34C

LIETZ JOHNSON HEAD TRIPOD WITH STRAIGHT LEGS AND HOOD

Weight with hood about 11 lbs.
Code Word, **DEMON**

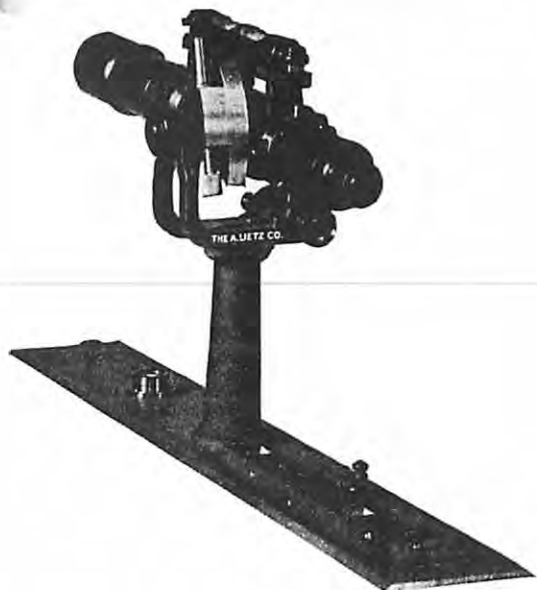
LIETZ PLANE TABLE OUTFITS

- | | |
|--|-----------------|
| | Code Word |
| No. 34B. Lietz tangent head tripod with straight legs..... | DEMOLISH |
| No. 34BE. Lietz tangent head tripod with extension legs... | DENDRITE |
| No. 34C. Johnson head tripod with straight legs..... | DEMON |
| No. 34CE. Johnson head tripod with extension legs..... | DENDROID |
| No. 34F. Drawing board with holding-down screws for paper and flange for mounting on tripod, size 24x31 inches | DRAFTING |
| No. 34FF. Same as No. 34F but size 18x24 inches..... | DRAGON |
| No. 34H. Same as No. 34F but size 15x15 inches..... | DRAWN |
| No. 34J. Canvas carrying case with leather corners for drawing board 24x31..... | DREDGE |
| No. 34JJ. Canvas carrying case with leather corners for drawing board 18x24..... | DRIBLET |
| No. 34K. Canvas carrying case with leather corners for drawing board 15x15..... | DRIFTAGE |
| No. 34L. Plumbing arm and plummet..... | DROPPED |
| No. 34M. Fine quality drawing paper, white*, cream or green (specify color); size 24x31 inches, single mounted | DRYAD |
| No. 34N. Fine quality drawing paper, white*, cream or green (specify color); size 24x31 inches, double mounted, muslin between, can be used on both sides | DRYDOCK |
| No. 34MM. Single mounted drawing paper like No. 34M but size 18x24 or 15x15 (specify color)..... | DRYING |
| No. 34NN. Double mounted drawing paper like No. 34N but size 18x24 or 15x15 (specify color)..... | DRYSALT |
| On special order we will supply drawing board size 22x22 and paper to fit at the same prices as size 18x24 (made to order only)..... | DRYWARD |
| *White paper can be furnished with Eggshell surface. If desired, specify "EGGSHELL" | EGGSHELL |

Parts Susceptible to Loss or Injury

- | | |
|--|----------------|
| Extra leather hood for tripod heads..... | DUALIST |
| Wing nuts for Johnson head..... | DUBLING |
| Leveling screws for tangent head..... | DUCAL |
| Screws for attaching board to tangent head..... | DUCKING |
| Holding-down screw and socket for drawing board..... | DUCTILE |
| Holding-down screw only..... | DUDEEN |
| Extra straight leg for tripod (Johnson or tangent head).... | DUENA |
| Extra extension leg for tripod (Johnson or tangent head).... | DUFFER |

See price list in back of catalog.



No. 32

LIETZ ALIDADE

Stanford Geological type, 8½-inch telescope, 14-inch blade. Fitted with trough compass.

Alidade	Code Word
Trough Compass	CORDWAIN
	DROUGHT



No. 32LC

Same as No. 32, but in leather carrying case instead of mahogany box.

Code word, **CORDWEIGHT**

LIETZ PRECISION ALIDADES Nos. 32 to 32LC

Stanford Geological Type

These instruments are of the same type and embody the same characteristics as our No. 31, but they are somewhat smaller in size. They are recommended for the best class of work, where a light, compact and portable instrument is desirable. The leather case, furnished with No. 32LC, is velvet lined and has shoulder strap, making an especially light and convenient means of carrying.

Dimensions and Weights

Length of telescope.....	8½ inches
Diameter of objective.....	1 inch
Magnifying power	18 X
Size of blade	14 inches long, 3 inches wide
Weight	About 6 lbs.

Specifications

No. 32. Lietz Precision Alidade with revolving telescope, 8½ inches long, with clamp and tangent; cross hairs and stadia hairs fixed, set 1:100; striding level with snap arrangement for attaching to telescope; vertical arc graduated on the periphery on solid silver with vernier reading to minutes, tangent movement to vernier arm; blade 14 inches long and 3 inches wide, finished on under side with white celluloid paint to prevent soiling of drawing paper and with circular spirit level. Instrument complete with sunshade, dust brush, adjusting pins and all usual accessories in polished mahogany box.

.....Code Word, **CORDWAIN**

No. 32LC. Same as No. 32, but in strong compact leather carrying case with shoulder strap instead of mahogany case, with all accessories neatly fitted

Code Word, **CORDWEIGHT**

Extras for Nos. 32 to 32LC

Prism to eye-piece with neutral glass, see page 69.....	Code Word
Gradienter attachment to vertical motion with movable head.....	CUMBERSOME
Level attached to vernier arm for control of zero on vernier.....	CULPABLE
Trough compass mounted on blade.....	DIAGNOSE
Quarter hair in upper field.....	DROUGHT
Parallel straight edge attachment to blade.....	DIALECT
Beaman stadia arc.....	DIALOGUE
Inverting eye-piece (made to order only).....	DIAMOND
	CUTWATER

For parts susceptible to loss or breakage see page 111.

For tripods, boards and other accessories see page 113.

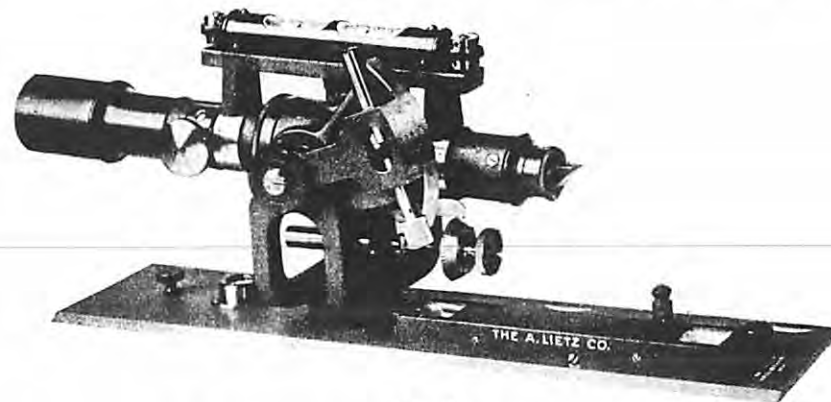
See price list in back of catalog.

LIETZ GEOLOGISTS' PLANE TABLE OUTFITS



The Lietz Geologists' Alidade No. 33 was developed by us several years ago to meet the demand for an extra light and compact instrument. It met with instant favor, for its portability was obtained without sacrificing any of the desirable features found in our larger Alidades, and which are so necessary for quick and accurate results. The telescope is the same as that in our high-form Alidade No. 32, and possesses definition, light and power in a high degree. Fitted with prismatic eye-piece. The Striding Level has a snap arrangement for quickly attaching to the telescope and the spirit level is long and sensitive. The gradienter screw with movable head and our improved trough compass are standard equipment with this instrument; the blade is beveled on both sides and the right edge is graduated to inches, 10ths and 50ths. Today this instrument is the standard of equipment with many of our largest users, and especially in our Mid-Continent oilfields and in California.

The Lietz Special Light-Weight Johnson Head Tripod used in connection with this instrument has extension legs and weighs only six pounds.



No. 33

LIETZ GEOLOGISTS' ALIDADE

Code Word, **CORIANDER**

Dimensions and Weights

Length of telescope.....	8½ inches
Diameter of objective.....	1 inch
Magnifying power.....	18 X
Size of blade.....	12 inches long, 3 inches wide
Weight.....	About 5 lbs.

Specifications

No. 33. Lietz Geologists' Alidade with revolving telescope 8½ inches long with clamp and tangent and gradienter screw to vertical movement; cross hairs and stadia hairs fixed, set 1:100; prism to eye-piece; striding level with snap arrangement for attaching to telescope; vertical arc graduated on the periphery on solid silver with vernier reading to minutes, tangent movement to vernier arm; blade 12 inches long and 3 inches wide, finished on under side with celluloid paint, beveled on both sides, the right edge graduated to inches, 10ths and 50ths, fitted with circular spirit level and trough compass and finger buttons for conveniently orienting alidade. Instrument complete with sunshade, dust brush, adjusting pins and all usual accessories in neat leather carrying case with shoulder sling.

.....Code Word, **CORIANDER**

Extras for No. 33

Level attached to vernier arm for control of zero on vernier.....	Code Word DIAGNOSE
Quarter hair in upper field.....	DIALECT
Parallel straight edge attachment to blade.....	DIALOGUE
Beaman stadia arc.....	DIAMOND
Inverting eye-piece (made to order only).....	CUTWATER
For parts susceptible to loss or breakage see page 111.	
For tripod, boards and other accessories see page 118.	

See price list in back of catalog.

LIETZ SPECIAL LIGHT-WEIGHT JOHNSON PLANE TABLE MOVEMENT AND EXTRAS FOR PLANE TABLE OUTFITS



- | | | |
|-----------------|--|-----------------------------|
| No. 34 1/2 CE. | Lietz Special Light-Weight Johnson Head Tripod with extension legs..... | Code Word
DENTARY |
| No. 34 1/2 CEC. | Canvas carrying case with leather ends for tripod No. 34 1/2 CE..... | DERBY |
| No. 34 1/2 CEH. | Leather protection hood for No. 34 1/2 CE..... | DERMIC |
| No. 34FF. | Drawing board with holding-down screws for paper and flange for mounting on tripod. Size 18x24 inches..... | DRAGON |
| No. 34H. | Same as No. 34FF but size 15x15 inches..... | DRAWN |
| No. 34JJ. | Canvas carrying case with leather corners for drawing board 18x24..... | DRIBLET |
| No. 34K. | Canvas carrying case with leather corners for drawing board 15x15..... | DRIFTAGE |

For Drawing Paper see page 113.

See price list in back of catalog.

LIETZ SIGHT ALIDADES



No. 35 1/2

- No. 35 1/2. Lietz Pocket Sight Alidade, straight edge 10 inches long, one edge beveled graduated 40 parts to the inch. Folding fore and back sights, 3 1/2 inches high. In sewed leather pocket case.....
Code Word, **CORMORANT**

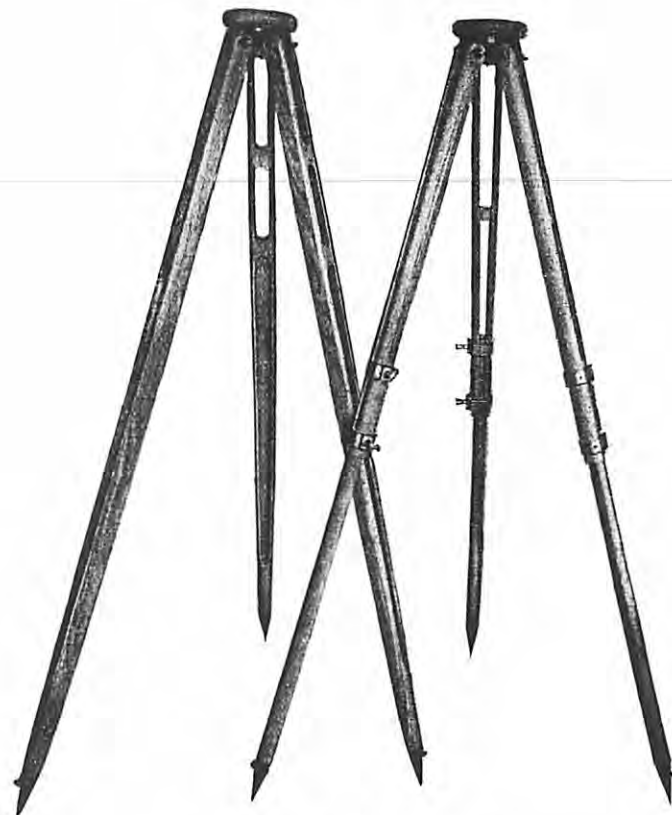
LIETZ TRAVERSE TABLES

The Lietz Traverse Tables are light and portable and very simple in construction. The tripod is similar to our light-weight Johnson Head Outfit, but instead of the Johnson Head, the drawing board is mounted on a simple metal swiveling arrangement, which permits of orientation and clamping. The extension legs permit of a quick set-up in the field and make the tripod light and compact for transportation. The drawing boards are similar to those furnished with our Plane Table Outfits and can be furnished with trough compass inserted in one edge.

- | | | |
|--|--|-----------------------------|
| No. 36A. | Traverse table tripod with metal clamping and swiveling arrangement for attaching drawing board, fitted with light extension legs..... | Code Word
CORONAL |
| No. 36C. | Canvas carrying case with leather ends for tripod No. 36A..... | CORRIDOR |
| No. 34H. | Drawing board with flange for mounting on tripod, and holding-down screws for paper, size 15x15..... | DRAWN |
| No. 34K. | Canvas carrying case with leather corners for drawing board 15x15..... | DRIFTAGE |
| No. 34A. | Trough compass fitted in one edge of drawing board..... | DROUGHT |
| No. 34MM. | Single mounted drawing paper, white*, cream or green (specify color); size 15x15..... | DRYING |
| No. 34NN. | Double mounted drawing paper, white*, cream or green (specify color); size 15x15..... | DRYSALT |
| *White paper can be furnished with eggshell surface. If desired, specify "EGGSHELL"..... | | EGGSHELL |

See price list in back of catalog.

TRIPODS FOR LIETZ INSTRUMENTS



Made of selected straight-grained hardwood, well seasoned. Tripod heads are cast of our bell metal and fitted with aluminum protection caps. Shoes fitted with offset for pressing same more securely into the ground.

Our split-leg tripods are so designed and constructed as to secure the greatest amount of steadiness and strength with the least amount of weight. We can furnish these tripods with one extension leg. This admits of all the advantages of the extension tripod as regards set-ups, with, of course, the disadvantage of being less portable.

Our Extension Tripods are very rigid and strong. The double clamps employed act quickly and firmly. They are made of special drawn hard metal and will not break or bend under ordinary use.

TRIPODS FOR TRANSITS AND LEVELS

- | | |
|---|----------------|
| | Code Word |
| No. 38S. Standard Split-Leg Tripod for Transits Nos. 1 to 5F | EAGLET |
| No. 38L. Lightweight Split-Leg Tripod for Transits Nos. 7 to 14C | EARING |
| No. 39S. Standard Extension Tripod for Transits Nos. 1 to 5F | EARLDOM |
| No. 39L. Lightweight Extension Tripod for Transits Nos. 7 to 14C | EARTHY |

TRIPODS FOR LEVELS

Our Engineers' Y Levels Nos. 19 to 19G and Dumpy Levels Nos. 20 to 20T will fit and interchange with tripods used for our Transits Nos. 1 to 5F.

Our Improved Builders' Dumpy Levels Nos. 21 to 21C will fit and interchange with tripods used for our Transits Nos. 7 to 14C.

Separate Legs for Tripods

- | | | |
|---|----------|------|
| | Set of 3 | Each |
| No. 038S. Separate Standard Split-Leg for Tripod No. 38S.. | | |
| No. 038L. Separate Lightweight Split-Leg for Tripod No. 38L | | |
| No. 039S. Separate Standard Extension Leg for Tripod No. 39S | | |
| No. 039L. Separate Lightweight Extension Leg for Tripod No. 39L | | |
| No. 041CE. Separate Special Lightweight Extension Leg for Special Johnson Head Tripod No. 34½CE..... | | |
- Plane Table Tripods and Extra Legs for same are listed on page 113.

Extras for Tripod Legs

- | | |
|---|------|
| | Each |
| No. 042A. Round or Lower Portion of Extension Leg with shoe.... | |
| No. 042B. Complete Upper Half of Extension Leg, consisting of two shells and clamps..... | |
| No. 042C. One Side or Shell of Upper Half of Extension Leg only.. | |
| No. 042D. Extra Clamp complete with wing bolt..... | |
| No. 042E. Inner Ring of Extension Tripod Leg..... | |
| No. 042F. Extra Wing Bolt only for Clamp..... | |
| No. 042G. Extra Shoe with screws to attach..... | |

Tripod Head

- | | |
|--|------|
| | Each |
| No. 43. Tripod Head complete with bolts, nuts and washers (Tripod cap not included) | |
| No. 043A. Cast Aluminum Cap for Tripod..... | |
| No. 043B. Extra Bolt with wing nut and washer..... | |
| No. 043C. Extra Wing Nut and Washer for bolt only..... | |

CARRYING CASES FOR TRIPODS

Made of Heavy Canvas with Leather Ends and Shoulder Strap.

- | | |
|--|------|
| | Each |
| No. 44A. Carrying Case for Split-Leg Tripods..... | |
| No. 44B. Carrying Case for Extension Tripods..... | |

See price list in back of catalog.

AGRICULTURAL LEVELS Nos. 46 and 46½

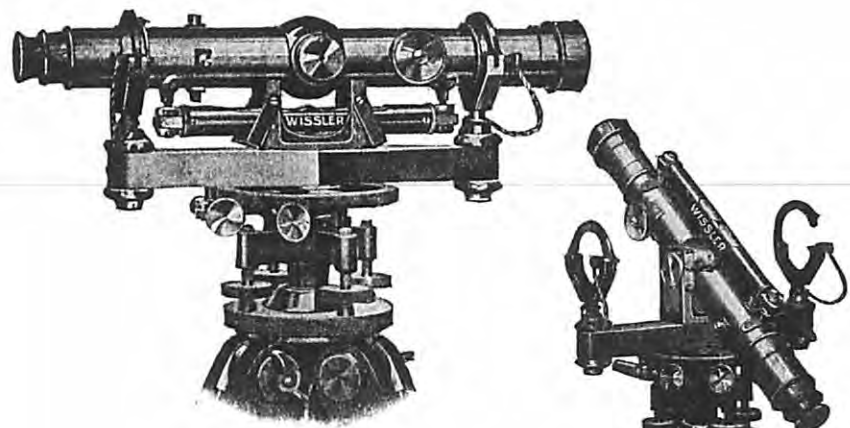


No. 46½

- No. 46. Agricultural Level, Dumpy Type, with 12-inch telescope, magnifying power 24 diameters with cross hairs, 3½-inch horizontal circle with vernier reading to 5 minutes. Instrument equipped with split-leg tripod. Complete in neat mahogany finished case with all usual accessoriesCode Word, **EBONITE**
- No. 46½. Agricultural Level, similar to No. 46 but of lighter construction, with 10-inch telescope, magnifying power 15 diameters with cross hairs; 4-inch horizontal circle with vernier reading to 5 minutes. Shifting center. Instrument equipped with split-leg tripod. Complete with all usual accessories, in neat mahogany finished case.Code Word, **EBURINE**

See price list in back of catalog.

CONVERTIBLE BUILDERS' LEVEL



No. 48

For vertical sighting the telescope is simply lifted out of the wyes, placed into the standards on cross bar and two clips pressed over the axis.

- No. 48. Convertible Builders' Level with 12-inch telescope, magnifying power 24 diameters with cross hairs; 3½-inch horizontal circle with vernier reading to 5 minutes. Instrument equipped with split-leg tripod. Complete with metal trivet plate, plumb bob, sunshade, adjusting pins and all usual accessories, in neat mahogany finished case.Code Word, **EBYING**

SURVEYORS' UMBRELLAS



These Umbrellas are rattan ribbed so as not to deflect the compass needle. They are light and strong.

- No. 58. Surveyors' Umbrella, heavy brown duck, rattan ribbed, about 6-foot spread, with tilting device; jointed handle 7 feet long with metal spear point.Code Word, **ECHELON**
- No. 59. Same as No. 58 but without tilting device.Code Word, **ECHINATE**

See price list in back of catalog.

SEXTANTS



No. 65

No. 65. High-grade Sextant, 6½-inch radius, one-piece frame, gun-metal finish. Graduated on solid silver with vernier reading to 10 seconds. Telescopes (outside cell type) consist of high and low power inverting, achromatic star, blank, 2 dark heads, cone fitting. All telescopes have interrupted threads. Shades and neutral tint. Instrument complete with usual accessories in polished hardwood case.

.....Code Word, **EDGETOOL**

No. 66. High-grade Sextant like No. 65, but 8-inch radius. Instrument complete with usual accessories in polished hardwood case.

.....Code Word, **EDICTOR**

See price list in back of catalog.

POCKET MAGNIFYING GLASSES

Suitable for Reading Verniers, etc.



No. 70A



No. 71



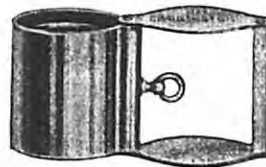
No. 74

- No. 70.** 1-inch Single Lens, hard rubber, oval, magnification 4.0×
- No. 70A.** 1¼-inch Single Lens, hard rubber, oval, magnification 3.5×
- No. 70B.** 1½-inch Single Lens, hard rubber, oval, magnification 3.0×
- No. 71.** 1¼-inch Double Lens, hard rubber, oval, magnification 3.5-7×
- No. 74.** 1-inch Single Lens, hard rubber, bellows shape, magnification 4.0×

Each

Metal Mounting

- No. 75.** 1¼-inch Single Lens, metal mounting, bellows shape, magnification 3.5×
- No. 76.** 1¼-inch Double Lens, metal mounting, bellows shape, magnification 3-6×



No. 80



No. 81



No. 84

Each

- No. 77.** Lietz Special Mining Loupe, 1⅜-inch diameter, nickel plated folding frame, magnification 4.5×
- No. 78.** Coddington Lens, ½-inch diameter, nickel plated folding frame, magnification 20×
- No. 79.** Coddington Lens, ¾-inch diameter, nickel plated folding frame, magnification 10×
- No. 80.** Coddington Lens, 1-inch diameter, nickel plated folding frame, magnification 7×
- No. 79H.** Hastings Aplanatic Triplet, ½-inch diameter, nickel plated folding frame, magnification 10×
- No. 81.** Thread Counter, brass frame, ½-inch field.
- No. 83.** Thread Counter, brass frame, nickel plated, 1-inch field.
- No. 84.** Magnifier on three legs, brass, screw adjustment, 1-inch diameter, magnification 7.5×

See price list in back of catalog.

MAGNIFYING OR READING GLASSES

Reading Glasses Nos. 85 to 91 are of the best quality material and workmanship. The lenses are double convex, accurately ground from clear white glass and highly polished, mounted in German silver rim, with ebonized handle.



Nos. 85-91

- | | | | |
|------------------------------------|------|------------------------------------|------|
| No. 85. 2 inches diameter. | Each | No. 89. 4 inches diameter. | Each |
| No. 86. 2½ inches diameter. | | No. 90. 4½ inches diameter. | |
| No. 87. 3 inches diameter. | | No. 91. 5 inches diameter. | |
| No. 88. 3½ inches diameter. | | | |

MAGNIFYING AMOPTOSCOPES

In Leather Cases

Amoptoscopes are a new style of reading glass of the finest finish, workmanship and design. The lenses are of fine quality white glass fitted in narrow nickeled frames.



Nos. 95-96

- | | |
|---|------|
| No. 95. 2 inches diameter, in seal grain leather case. | Each |
| No. 96. 3 inches diameter, in seal grain leather case. | |

See price list in back of catalog.

DIMINISHING OR REDUCING GLASSES

Reducing Glasses consist of double concaved lenses. Used by artists, engravers, etc., to reduce, optically, drawings, photographs and other illustrations.



Nos. 104-106

- | | |
|--|------|
| No. 100. Reducing Glasses, round, rough edges, unmounted, 1½ inches in diameter | Each |
| No. 101. Reducing Glasses, round, ground edges, unmounted, 2 inches in diameter | |
| No. 103. Reducing Glasses, in hard rubber case like Nos. 70-71 Magnifying Glasses, 1½ inches in diameter. | |
| No. 104. Reducing Glasses, in German silver rim with ebonized handle, 2 inches in diameter. | |
| No. 105. Reducing Glasses, like No. 104, but 3 inches in diameter. | |
| No. 106. Reducing Glasses, like No. 104, but 4 inches in diameter. | |

READING GLASS HOLDERS



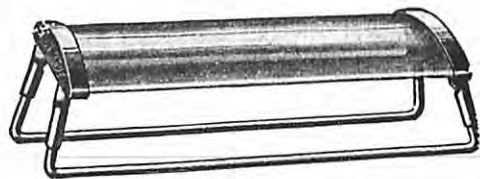
No. 107

No. 108

- | | |
|--|------|
| No. 107. Reading Glass Holder, metal base 3¾ inches in diameter, 6¾ inches high. The lens arm is of one piece with spring clamp end, which will hold any lens not over 1½ inches in diameter. Vertical and lateral adjustments. | Each |
| No. 107A. Same as No. 107, but with socket end in place of the spring clamp end, to accommodate Reading Glasses Nos. 85-92 or Reducing Glasses Nos. 104-105, after removing the ebonized handle. | |
| No. 108. Reading Glass Holder, metal base 4¾ inches in diameter, round metal pillar measuring 3¾ inches to the top. The lens arm is in three parts, with three joints, attached to a triangular post by a strong joint with broad bearing surface. The spring clamp will hold lenses not exceeding 1½ inches in diameter. Adjustment is by rack and pinion. | |
| No. 108A. Same as No. 108, but with socket end in place of the spring clamp end, to accommodate Reading Glasses Nos. 85-92 or Reducing Glasses Nos. 104-105, after removing the ebonized handle. | |

See price list in back of catalog.

EASYREAD MAGNIFYING GLASSES



No. 109

A new line of Reading Glasses. Nickel mountings. Always in focus.

- No. 109.** Reading Glass, 4x1½ inches, folding, in leather case. Each
No. 110A. Reading Glass, 5x2¼ inches, not folding.
No. 110B. Reading Glass, 7x2¼ inches, not folding.



No. 112

PRISMATIC RANGE FINDER

No. 112. Prismatic Range Finder. After sighting an object, the distance to which is to be measured, the shutter is shifted, either left or right (depending on the convenience of pacing distance). The distance walked along the base line until the same object is again brought into view multiplied by a constant of 50 will determine the distance sought. In leather case with directions.

.....Code Word, **EDUCATING**



No. 117

ANGLE PRISM

No. 117. Rectangular Prism, for angles of 90 degrees. Size of instrument 2½x1¼x5⁄8 inches, in morocco case, eachCode Word, **EDUCATION**

See price list in back of catalog.

TALLY REGISTERS



No. 126A



No. 127A



No. 129

Hand Tally Registers Nos. 126-128, for keeping count by pressing on a knob, are of first-class workmanship and will not get out of order. The cases are nickel-plated and they are arranged with a zero-setting device. Each

- No. 126A.** Hand Tally Register, capacity 1 to 1,000.
No. 126B. Hand Tally Register, capacity 1 to 10,000.
No. 127A. Hand Tally Register with Safety Pin, capacity 1 to 1,000.
No. 127B. Hand Tally Register with Safety Pin, capacity 1 to 10,000.

DOUBLE TALLY REGISTER

No. 128. Lietz Special Combined Tally Register, consisting of two No. 126A Registers joined as one, for tallying various timbers, etc., at one time Each

CELLULOID FIELD BOOKS OR CRUISERS' PADS

As used by woodsmen for tallying timber.

Cruisers' Pads contain six sheets of heavy white, opaque celluloid, dull finish, with strong leather covers. Will take pencil and erasures instantly. Not affected by rain. Each

- No. 129A.** Cruisers' Pad, 4x6 inches, each.
No. 129B. Cruisers' Pad, 5x6 inches, each.

TIMBER SCRIBES



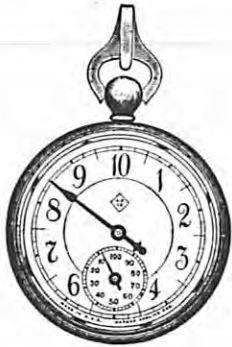
No. 130

No. 130. Timber Scribe, wooden handle (size 6½ inches), each. Each

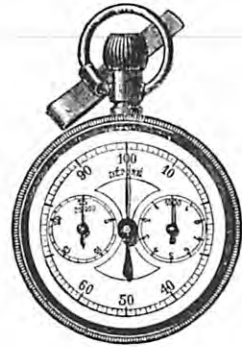
NOTE—For special Circumference Tapes see page 191.
 For Township Plats see page 215.
 For Topographical Paper see page 216.

See price list in back of catalog.

PEDOMETERS AND PASSOMETERS



No. 132A



No. 138

PEDOMETERS

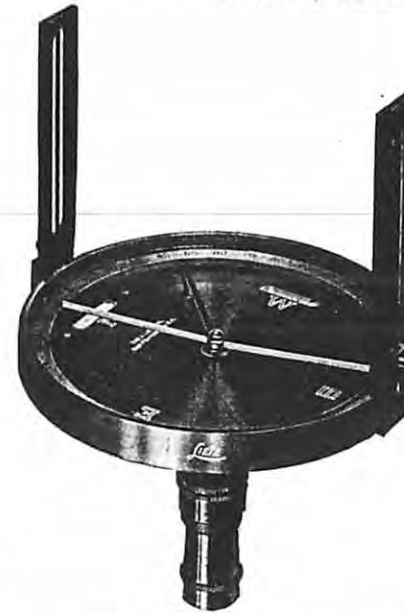
- No. 132A.** Pedometer, registers distance walked up to 100 miles by each one-quarter mile. Each
 The hands on above can be set backward or forward as desired by removing back of case and turning set screw.
- No. 135.** Pedometer, registers distance walked up to 100 miles by each one-quarter mile, with resetting device.
- No. 136.** Pedometer, small size for ladies, 1 1/4 inches, registers 100 miles by single miles, gunmetal case.

PASSOMETERS

- No. 138.** Passometer, or step-counter, registers to 100,000 steps with stem resetting device. Each

See price list in back of catalog.

SURVEYING COMPASSES



No. 140



No. 144A

- No. 140.** Surveying Compass, with folding sights, graduated to 1/2 degrees on raised ring, variation plate, two level bubbles, ball joint and socket for Jacob's staff mountings, needle 3 1/2 inches long. Each Code Word **EFFECTOR**
- No. 141.** Same as No. 140, but with 4 1/2-inch needle. Each. **EFFECTUAL**
- No. 140LC.** Same as No. 140 in leather case with shoulder strap. **EFFICO**
- No. 141LC.** Same as No. 141 in leather case with shoulder strap **EFFIGY**
- Extra Parts for Surveying Compasses** Each
- No. 144A.** Leather Case for surveying compass, with shoulder strap.
- No. 144C.** Ball and Socket for surveying compass.
- No. 144D.** Needle for surveying compass.

Jacob's Sticks and Tripods for Compasses

- No. 146.** Jacob's Staff, 5 feet, iron shoe. Code Word **EFFERENT**
- No. 147.** Tripod with Jacob's staff top for compasses. **EFFERVO**
- No. 148.** Tripod with brass staff top for compasses. **EFFETE**

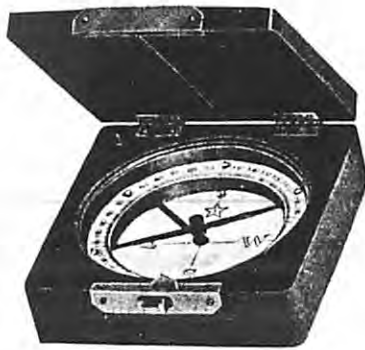
BILTMORE STICK



- No. 149.** Biltmore Stick used in reconnaissance estimates of timber tracts. Each

See price list in back of catalog.

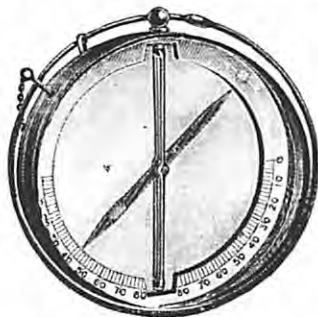
CRUISERS' BOX COMPASSES



Nos. 150-150A

- No. 150.** Box Compass, 3x3 inches, with hinged cover with sight line, 2-inch needle, graduated on raised metal ring from 0-360.... Each
- No. 150A.** Same as No. 150, but graduated in quadrants.....

MINERS' COMPASS OR DIPPING NEEDLE



No. 154

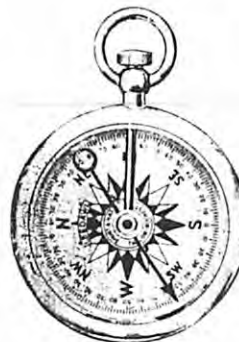
- No. 154.** Dipping Needle, Norwegian pattern, needle gimballed, in velvet-lined case Each

This instrument is a serviceable guide to the discovery and location of magnetic iron ore. The magnetic needle is carefully balanced in a gimbal frame. It must be held so suspended that the needle is in the plane of the magnetic meridian. After releasing the stop the needle will swing freely. This instrument can be used for locating pipe lines and iron inspection covers which may be covered out of sight. It will not, however, indicate the presence of gold or silver.

See price list in back of catalog.

POCKET COMPASSES

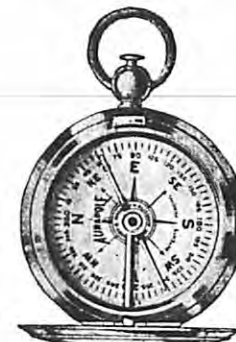
WATCH PATTERN COMPASSES



No. 156



No. 158



No. 159

- No. 156.** Pocket Compass, white metal, open-face case, flat, jeweled needle 1 1/4 in. long, silvered metal dial. Needle stop in crown.. Each
- No. 158.** Pocket Compass, white metal, open-face case, jeweled bar needle 1 1/4 in. long, white enameled dial. Needle stop in crown
- No. 159.** Same as No. 158, but Hunting case. Self-acting needle stop..
- No. 160.** Pocket Compass, white metal, open-face case. Dial 1 1/4 in., is of aluminum and floats instead of being fixed, enabling one to note all magnetic bearings at once, jeweled center. Stop in crown
- No. 161.** Same as No. 160, but Hunting case. Self-acting stop.....

COMPASSES WITH ILLUMINATED DIAL FOR NIGHT READING

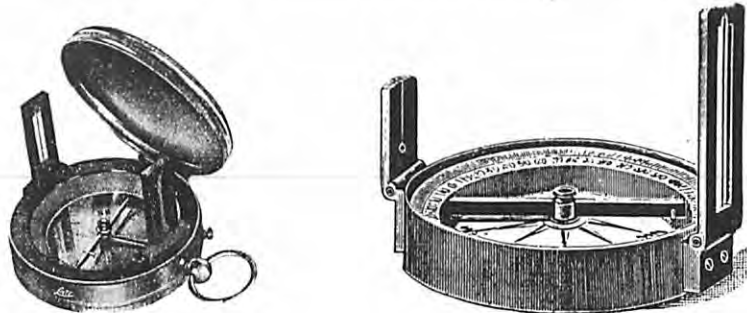


No. 165

- No. 164.** Pocket Compass, white metal open-face case, floating aluminum dial 1 1/4 in., similar to our No. 160 Compass, but the "N" and "S" points of the dial are treated with a permanently luminous compound which enables one to read direction at night. Jeweled center, stop in crown..... Each
- No. 165.** Same as No. 164, but Hunting case. Self-acting needle stop.....
- No. 165G.** Same as No. 165, but in gold-filled Hunting case.....

See price list in back of catalog.

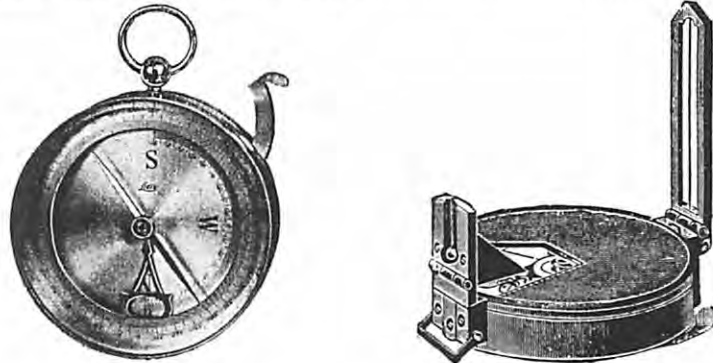
SIGHT AND CLINOMETER COMPASSES



No. 167A

No. 169

- Each
- No. 167A. Pocket Sight Compass, watch pattern, with folding sights. Jeweled needle, self-acting stop, 2 in.....
 - No. 167B. Same as No. 167, but needle 2 3/8 in.....
 - No. 168. Pocket Sight Compass, same as No. 167B with clinometer
 - No. 169. Bronzed Pocket Compass, pull-off cover, folding sights, edge bar, jeweled needle, with stop. Graduations on raised ring; 2-in.
 - No. 169A. Same as No. 169, but 2 1/4-in.....



No. 170

No. 175

- Each
- No. 170. Clinometer Compass, nickel case, flat jeweled needle; 2 in. long, with stop. Graduated on raised ring to single degrees. Pull-out lever which serves to rest the instrument on base when used as a clinometer.....

PRISMATIC COMPASSES

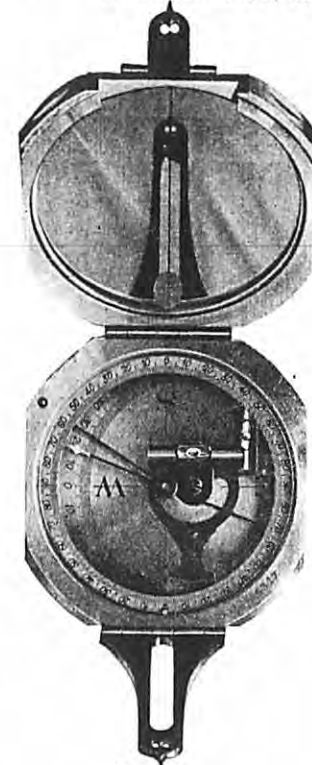
- Each
- No. 175. Improved Prismatic Surveying Compass, bronze finish brass case 3" in diameter, folding prism in slide for focusing, floating dial, jeweled center, folding sight with automatic stop, in leather sling case
 - No. 175A. Same as No. 175, but fitted with engine divided aluminum ring

See price list in back of catalog.

BRUNTON POCKET TRANSIT



Showing Brunton Transit on Ball and Socket Tripod Head No. 185C.



No. 183

- No. 183. Brunton Pocket Transit, graduated 0-360..... Code Word EGLANTO
- No. 183A. Brunton Pocket Transit, graduated in quadrants. EGLOMBO

BRUNTON TRANSITS WITH ILLUMINATED DIAL

Especially adapted for night or underground work.

These instruments are similar to Nos. 183-183A, but are furnished with a graduated cover glass treated with a permanent luminous compound. The ends of the needle and the sights are likewise illuminated. The illuminated features do not interfere with the use of the instrument for accurate work in the daylight.

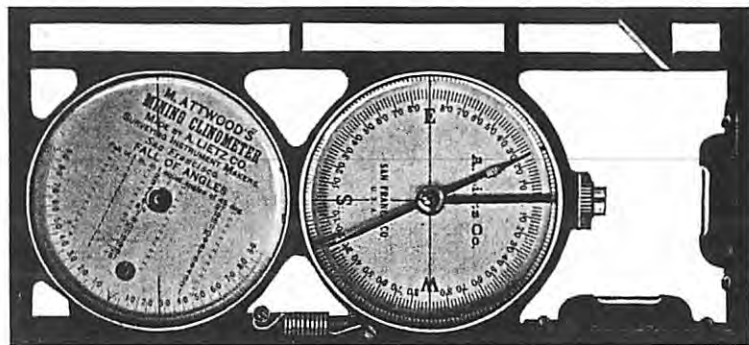
- No. 184. Brunton Pocket Transit with illuminated dial on cover glass, illuminated needle and sights. Graduated 0-360.... Code Word, EGOTIC
- NOTE—Illuminated dials on cover glass are graduated to 10 degrees only, as the luminous compound cannot practically be used for finer graduations.

ACCESSORIES FOR BRUNTON POCKET TRANSITS

- No. 185A. Leather case for Brunton Transit, with belt strap only.... Code Word ELAND
- No. 185B. Leather case for Brunton Transit, with sling strap..... ELAPSE
- No. 185C. Ball and Socket Tripod Head for Brunton Transit..... ELASTIC
- No. 185D. Collapsible Metal Tripod for Brunton Transit..... ELATE
- No. 185E. Level Bubble for Brunton Transit, loose..... Each
- No. 185F. New Mirror for Brunton Transit.....
- No. 185G. New Cover Glass for Brunton Transit.....
- No. 185H. New wire ring to hold glass cover.....
- No. 185I. New Needle for Brunton Transit.....
- No. 185J. New Double Bubble Set.....
- No. 185K. New Graduated Compass Ring.....

See price list in back of catalog.

ATTWOOD'S MINING CLINOMETER AND COMPASS



No. 186

No. 186. Atwood's Mining Clinometer in leather case.

A universal measuring tool, combining a most sensitive clinometer, a compass, a hand level, and a horizontal and vertical contact level. Weight of instrument in genuine leather case eight ounces.

- No. 187. Same as No. 186, but with graduations to the edges, which serve as a protractor; graduations to single degrees, also a scale 20 to 25 parts to the inch. In leather case.....Code Word, **ELECTIVE**

LIETZ HAND LEVELS



No. 190

- No. 189. Lietz Special Hand Level, 5-inch, in sewed leather case. Finely finished and constructed, nickel-plated, with prism and magnifying lens to bubble, and drawout eye-piece.....Code Word, **ELECTRON**
- No. 190. Lock's Hand Level, 5-inch, bronze finish, in leather case.....Code Word, **ELEGANT**
- No. 191. Extra Leather Case for Nos. 189 and 190.

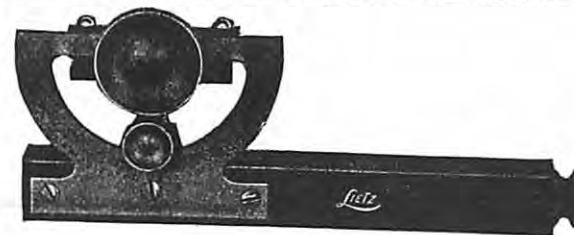


No. 192

- No. 192. Square type combination hand and bench Level, 5-inch, in leather case.....Code Word, **ELEVATOR**
- No. 193. Extra Leather Case for No. 192.....Code Word, **ELEVATOR**

See price list in back of catalog.

LIETZ HAND LEVELS AND CLINOMETERS

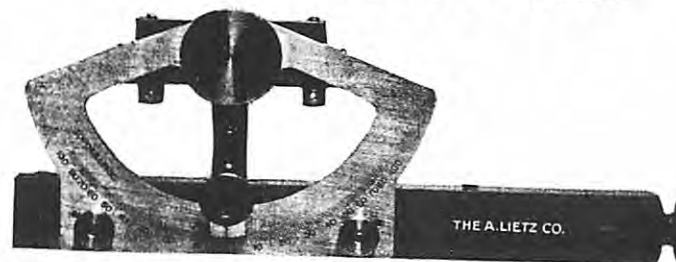


No. 195

- No. 195. Abney's model Combined Hand Level, Clinometer and Slope Measurer, 5-inch, arc graduated to degrees 0-90 in both directions with vernier reading to 10 minutes. Also a slope scale 1:1 to 1:10 reading each way. In leather case.....Code Word, **ELFFIRE**
- No. 195A. Same as No. 195, but with arc graduated to degrees and with a per cent scale from 1 to 100%. U. S. Forest Service pattern. In leather case.....Code Word, **ELFLOCK**
- No. 196. Extra Leather Case for Nos. 195 and 195A.....Code Word, **ELFLOCK**

Each

TOPOGRAPHIC ABNEY LEVEL



The Topographic Abney Level, as made by us for the U. S. Forest Service, is 6 inches long with 4-inch arc. Arcs can be obtained with various graduations and are interchangeable. Each instrument contained in leather case with belt strap.

- No. 198. Topographic Abney Level, arc in degrees.....Code Word, **ELKBORN**
- No. 198A. Topographic Abney Level, arc in per cent.....Code Word, **ELKHEAD**
- No. 198B. Topographic Abney Level, with topographic arc.....Code Word, **ELKFORK**
- No. 199. Extra arcs with any single graduation.....Code Word, **ELKTON**
- No. 199A. Extra arcs with any two graduations.....Code Word, **ELKWOOD**

EXTRA PARTS FOR HAND LEVELS

- No. 197A. Object Glass.....Code Word, **ELKWOOD**
- No. 197B. Eye-piece Glass.....Code Word, **ELKWOOD**
- No. 197C. Prism.....Code Word, **ELKWOOD**
- No. 197D. Half-lens.....Code Word, **ELKWOOD**
- No. 197E. Level Bubble, unmounted.....Code Word, **ELKWOOD**

Each

See price list in back of catalog.

ANEROID BAROMETERS

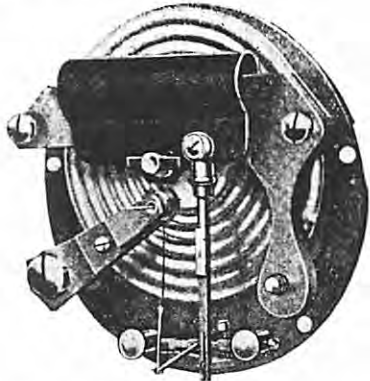
In connection with our line of Barometers, Barographs, Thermographs, etc., we desire to call attention to the importance of selecting such articles. We aim to carry only the most reputable makes of these instruments.

With our factory facilities and years of experience we are in a position to offer our patrons the accommodation of testing each individual instrument under pressure and in connection with a standard mercurial barometer, thus assuring our friends of that satisfaction seldom enjoyed when purchasing through other sources.

DESCRIPTION

The Aneroid, owing to its portable form and great sensitiveness in responding to changes in pressure of the atmosphere (it will denote a change much quicker than the Mercurial Barometer), is today in more general use by observers of meteorological changes than any other form of Barometer.

In measuring altitudes, owing to its portability, sensitiveness and the ease with which approximate results may be obtained, it is highly valuable to the Engineer and Surveyor, while the Tourist, with the Aneroid, notes his gain in elevation foot by foot, as well as plans his excursions in accordance with prognostications from its readings.



The illustration shows the general construction of the movement with its elastic metallic box, called the vacuum chamber.

This chamber is constructed with two circular discs of thin corrugated German silver, firmly soldered together at the edges, forming a close box. The air is exhausted from this box, which causes the top and bottom discs to close together.

The vacuum chamber is firmly fixed to the circular metal base by a post upon its centre, projecting through the base plate.

An iron bridge spans the chamber, resting upon the base plate by means of the two pointed screws. (These screws are used to finely regulate the tension upon the chamber.)

To the bridge is fixed the mainspring, which is forced down by mechanical means sufficient to insert a knife edge piece.

As this knife edge is fastened (by means of a central pillar) to the top disc of the chamber the mainspring, when released, lifts the upper part of the chamber, drawing the two discs apart.

As this forms a perfect balance (the power of the mainspring opposing the atmospheric pressure upon the vacuum chamber), any variation in air pressure will now be shown by a movement up or down of the elastic chamber. A decrease in pressure will allow the mainspring to overcome the power of the vacuum, the action then being upwards, and an increase of air pressure will produce the contrary result.

BOOKS ON THE BAROMETER

- "The Aneroid Barometer—Its Construction and Use," by George W. Plympton, A. M., C. E.
"The Barometer as the Foot Rule of the Air," by P. R. Jameson, F. R. Met. Soc.

See price list in back of catalog.

FIRST QUALITY WATCH FORM ANEROID BAROMETERS



- No. 200 Gilt Case, open face, 1 3/4-in., silvered metal dial with altitude scale 3000 feet in 10-ft. divisions. Compensated for temperature. In velvet-lined morocco case.....Code Word, **EPACT**
- No. 200C. Same as No. 200, but 8000 feet. Altitude scale in 50-foot divisions. In velvet-lined morocco case.....Code Word, **EPAULET**
- No. 200D. Same as No. 200, but 10,000 feet. Altitude scale in 100-foot divisions. In velvet-lined morocco case..Code Word, **EPHOD**
- No. 200E. Same as No. 200, but 12,000 feet. Altitude scale in 100-foot divisions. In velvet-lined morocco case.....Code Word, **EPICURE**

SECOND QUALITY WATCH FORM ANEROID BAROMETERS

- No. 202C. Same pattern as No. 200, compensated for temperature, silvered metal dial, with altitude scale to 8000 feet in 100-foot divisions.Code Word, **EPIDILE**
- No. 202E. Same as No. 202C, but 12,000 feet. Altitude scale in 100-foot divisionsCode Word, **EPIGRAM**

ANEROID BAROMETERS IN METRIC DIVISIONS

For our export trade we carry the above Aneroid Barometers registering in the metric system at corresponding prices.

See price list in back of catalog.

POCKET SIZE ANEROIDS

Best Quality



Showing Pocket Aneroid No. 205A in Lietz Special Leather Case No. 206D, as adopted by timber cruisers.

This is a most suitable instrument for the engineer and timber cruiser and for all reconnaissance purposes.

- | | | | |
|------------------|---|-----------------|-----------|
| No. 205. | Pocket Size Aneroid, 2½ inches, gilt case. Compensated for temperature, silvered metal dial with altitude scale 3000 ft. in 10-ft. divisions, in velvet-lined morocco case..... | EPILOGUE | Code Word |
| No. 205A. | Same as No. 205, but 5000-ft. altitude scale in 20-ft. divisions, in velvet-lined morocco case.... | EPIMORE | |
| No. 205C. | Same as No. 205, but 8000-ft. altitude scale in 50-ft. divisions, in velvet-lined morocco case.... | EPISODE | |
| No. 205D. | Same as No. 205, but 10,000-ft. altitude scale in 50-ft. divisions, in velvet-lined morocco case.... | EPISTEM | |
| No. 205E. | Same as No. 205, but 12,000-ft. altitude scale in 50-ft. divisions | EPITAPH | |
| No. 205F. | Same as No. 205, but 16,000 ft. altitude scale in 100-ft. divisions | EPITHET | Each |
| No. 206. | Leather Sling Case for Nos. 205-205F, in lieu of morocco.. | | |
| No. 206A. | Extra Leather Sling Case for Nos. 205-205F..... | | |
| No. 206B. | Extra Morocco Case for Nos. 205-205F..... | | |
| No. 206D. | Lietz Special Leather Case for Nos. 205-205F, as adopted by timber cruisers. If in lieu of the morocco.....
If extra | | |

POCKET THERMOMETERS

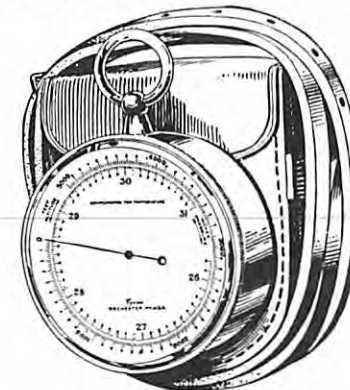


No. 207

- No. 207.** Pocket Thermometer, 5-inch glass cylinder, porcelain scale, hard rubber or nickel screw case, mercury tube approximate scale range 20 to 130 degrees F.Code Word, **EPITOME**
 For other Pocket Thermometers see page 152.

See price list in back of catalog.

ALTITUDE BAROMETERS

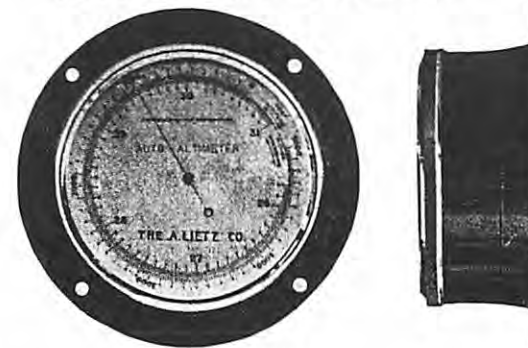


No. 205½D

These Barometers are "Direct Reading." The scales have been redesigned so that the altitude scale is in equal divisions, overcoming the difficulty met in the past in that the altitude scales were unequally divided, and as a consequence they had to be used with the zero of the scale at a fixed point and a sum worked out for correct readings, or the scales were made to revolve so the zero could be set at 0 feet. If used in the latter manner the readings were only approximate and grew in error the higher the altitude. With the "direct reading" scale all chances of error are eliminated.

- No. 205 ½ D.** Altitude barometer 2¾-inch silvered metal dial, aluminum case, altitude scale 10,000 ft. in 50-foot divisions, in velvet-lined leather sling case.....Code Word, **EQUATOR**

AUTO ALTITUDE BAROMETERS



No. 208D

- No. 208D.** Auto Altimeter, 2¾-inch dial, with flange at back for screwing to dashboard. Altitude scale 10,000 ft. in 50-foot divisions,Code Word, **EQUERRY**

See price list in back of catalog.

SPECIAL SURVEYING ANEROID BAROMETERS



Nos. 208-211ALF

These instruments are specially designed for use of the engineer and geologist for ascertaining and checking slight differences in elevation. Made in two sizes, 3 and 5 inches in diameter, and in aluminum or stout bronze cases. Silvered metal dial with vernier on rack movement, reading lens arranged to traverse entire circle. Carefully selected movement, compensated for temperature, each instrument in leather sling case.

FACE 5-INCH DIAMETER

No.	Case	Altitude Scale	Code Word
No. 208.	Bronze Case,	3,000 feet.....	ERBIUM
No. 208B.	" " "	" 6,000 "	ERECTOR
No. 208D.	" " "	" 10,000 "	EREMITE
No. 208F.	" " "	" 16,000 "	ERGMETER
No. 208AL.	Aluminum Case "	" 3,000 "	ERGOT
No. 208ALB.	" " "	" 6,000 "	ERMIN
No. 208ALD.	" " "	" 10,000 "	EROTIC
No. 208ALF.	" " "	" 16,000 "	ERUDITE

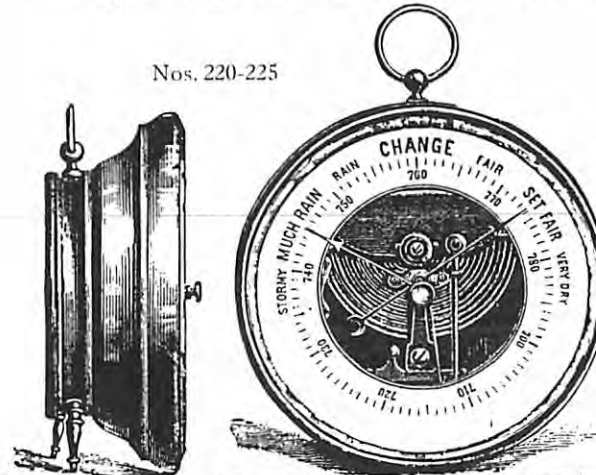
FACE 3-INCH DIAMETER

No.	Case	Scale	Code Word
No. 210.	Bronze Case,	Scale 4,000 feet ascent, 2,000 feet descent	ESCALADE
No. 210A.	Aluminum Case,	Scale 4,000 feet ascent, 2,000 feet descent	ESCARP
No. 211.	Bronze Case,	Altitude Scale 3,000 feet.....	EXCELSIOR
No. 211B.	" " "	" 6,000 "	EXCHEQUER
No. 211D.	" " "	" 10,000 "	EXCLAVE
No. 211F.	" " "	" 16,000 "	EXCRETA
No. 211AL.	Aluminum Case "	" 3,000 "	EXCURSION
No. 211ALB.	" " "	" 6,000 "	EXEMPLAR
No. 211ALD.	" " "	" 10,000 "	EXOGEN
No. 211ALF.	" " "	" 16,000 "	EXPLORER

See price list in back of catalog.

BRASS CASE BAROMETERS

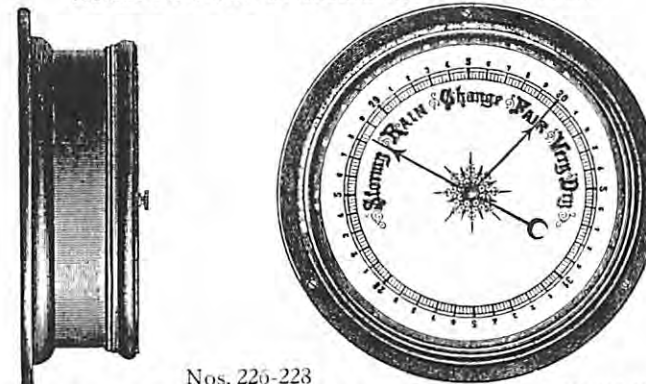
Nos. 220-225



We offer the highest grade of Compensated Barometers. Guaranteed dependable, each instrument being tested before delivery under our Standard Vacuum Air Pump, with the mercurial standard. Made with open-face dial and brass case, highly polished and lacquered.

- No. 220. 3 -inch face, each
- No. 221. 4 -inch face, each
- No. 222. 5 -inch face, each
- No. 223. 6½-inch face, each
- No. 224. 8 -inch face, each
- No. 225. 10 -inch face, each
- No. 223G. 6½-inch face, with graduations on glass, exposing full works, brass case, each

WALL FLANGE BAROMETERS (Brass Case)



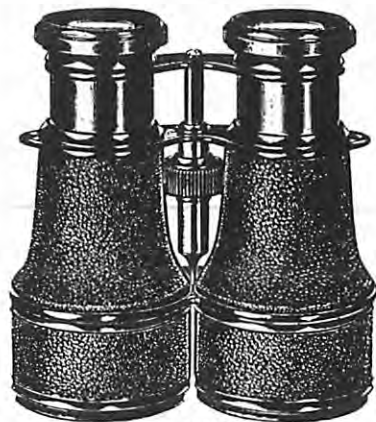
Nos. 226-228

These Barometers are of the same high grade as our Nos. 220-225 line, but differ from them in that they are screwed to the wall through a flange.

- No. 226. 5 -inch face, each
- No. 227. 6½-inch face, each
- No. 228. 8 -inch face, each
- No. 230. Direction Charts for reading Barometers.....

See price list in back of catalog.

FIELD GLASSES



Nos. 392-394

Lietz Superior Quality Field Glasses, black leather covered, fine japanned finish, in leather case with strap.

- Each
- No. 390. Lietz Field Glass, 6 lenses, 2-inch objectives, short body, in leather case with strap; magnification, $2\frac{3}{4}$ times; field at 1000 yards, 200 yards
 - No. 392. Lietz Field Glass, 6 lenses, 2-inch objectives, long body with sunshades, in leather case with strap; magnification, $3\frac{1}{2}$ times; field at 1000 yards, 120 yards.
 - No. 393. Same as No. 392, but $2\frac{1}{4}$ -inch objectives, in leather case, with strap; magnification, 5 times; field at 1000 yards, 80 yards.
 - No. 394. Same as No. 392, but $2\frac{1}{2}$ -inch objectives, in leather case with strap; magnification, $3\frac{3}{4}$ times; field at 1000 yards, 110 yards.

In addition to the above glasses we carry a complete line of Marine Glasses and Telescopes, etc. If interested send for our Nautical Catalog.

LIETZ LEVELING RODS

The Leveling Rods, Nos. 410-425, are of our own manufacture, graduated to hundredths, by uniform, clean divisions. The black numerals, corresponding to the tenths, have an exact height of 0.06 foot and the red or foot numerals are 0.08 foot high. This affords a rod reading at distances where graduation lines disappear. The wood is the best, thoroughly seasoned. The target and all connecting metal parts are cast in one piece; the vernier reads to thousandths; the scale is brass, face of target japanned. We recommend these rods to be the best in the market. Made in two self-reading designs, known as the block and line graduations, similar to the Philadelphia pattern.

We also manufacture a complete line of Flexible Leveling Rods and Stadia Rods as listed on the following pages.

See price list in back of catalog.

FLEXIBLE LEVEL RODS

The Lietz Flexible Rods are 12 feet long and 3 inches wide.

Code Word

- No. 400. Lietz Flexible Level Rod, diamond design, alternating, painted on especially prepared oil canvas. May be rolled up in a package 3 inches long and less than $1\frac{1}{2}$ inches in diameter. Weight 3 ounces. Punched with eyelets for attachment to board....**FLORIST**
- No. 401. Lietz Flexible Level Rod, same as No. 400 but Philadelphia design.....**FLORY**
- No. 402. Lietz Flexible Level Rod, same as No. 400 but in the metric system.....**FLOSH**
- No. 406. Chicago Flexible Level Rod, $1\frac{1}{2}$ inches wide, $12\frac{1}{2}$ feet long, graduated to 100ths of feet....**FLOUNDER**
- No. 406A. Same as No. 406 but $16\frac{1}{2}$ feet long.....**FLOURY**
- No. 406B. Same as No. 406 but $20\frac{1}{2}$ feet long.....**FLOWBIT**
- No. 408. Chicago Flexible Level Rod, $1\frac{1}{2}$ inches wide, $12\frac{1}{2}$ feet long, graduated in feet, inches and eighths.**FLOWERET**

See price list in back of catalog.



410-415



421-425



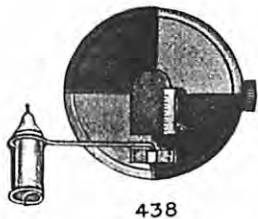
430-431



446



447



438

LEVELING RODS
Complete With Targets

Nos. 410-415—LINE GRADUATION

No.	410	411	412	413	414	415
Length in feet.....	8 to 15	7 to 13	6½ to 12	5 to 9	4 to 7	3 to 5
Code Word	FLUFF	FLUID	FLUKE	FLUNK	FLUSH	FLURRY

Nos. 421-425—BLOCK GRADUATION

No.	421	422	423	425
Length in feet	7 to 13	6½ to 12	5 to 9	3 to 5
Code Word	FLUTIST	FLUWAL	FLUX	FLUXION

No. 428. Metric Leveling Rod, 2.2 meters, extending to 4 meters.....
.....Code Word, FLYBLOW

ARCHITECTS' RODS

- No. 430. Architects' Leveling Rod, 5½ to 10 feet, brass mounted, with clamp and target, divided in feet, inches and 8ths, vernier reading to 64ths of inch.Code Word, **FLYKITE**
- No. 431. Same as No. 430, but divided in feet, 10ths and 100ths, vernier reading to 1000ths of foot.....Code Word, **FLYWHEEL**

Extra Targets and Canvas Bags for Leveling Rods

- No. 437. Extra Target for Philadelphia leveling rod.....Code Word **FOAM**
- No. 438. Target with swinging candle bracket for illuminating vernier, for use in mines, tunnels, etc.....Code Word **FOCAL**
If ordered with a new rod in lieu of the ordinary, extra.....
- No. 439. Extra Target for architects' rods, Nos. 430-431.....Code Word **FOAM**
- No. 440. Extra Target or Clamp Screw for leveling rods.....Code Word **FOCAL**
- No. 441. Sewed Canvas Bag for Philadelphia leveling rods to 12 feet.....Code Word **FOAM**
- No. 442. Sewed Canvas Bag for Philadelphia leveling rods to 15 feet.....Code Word **FOCAL**

LIETZ CROSS SECTION RODS

- No. 446. Lietz Cross Section Rod, one-piece, 10 feet long; graduated in feet and 10ths, with level vial at each end.....Code Word, **FOEMAN**



No. 449

- No. 447. Lietz Vertical Cross Section Rod, hardwood, 7 feet long, 1 inch square with iron shoes. Graduated on four sides in feet and 10ths reading both ways, for use in conjunction with horizontal cross section rod No. 446.....Code Word, **FOGBANK**

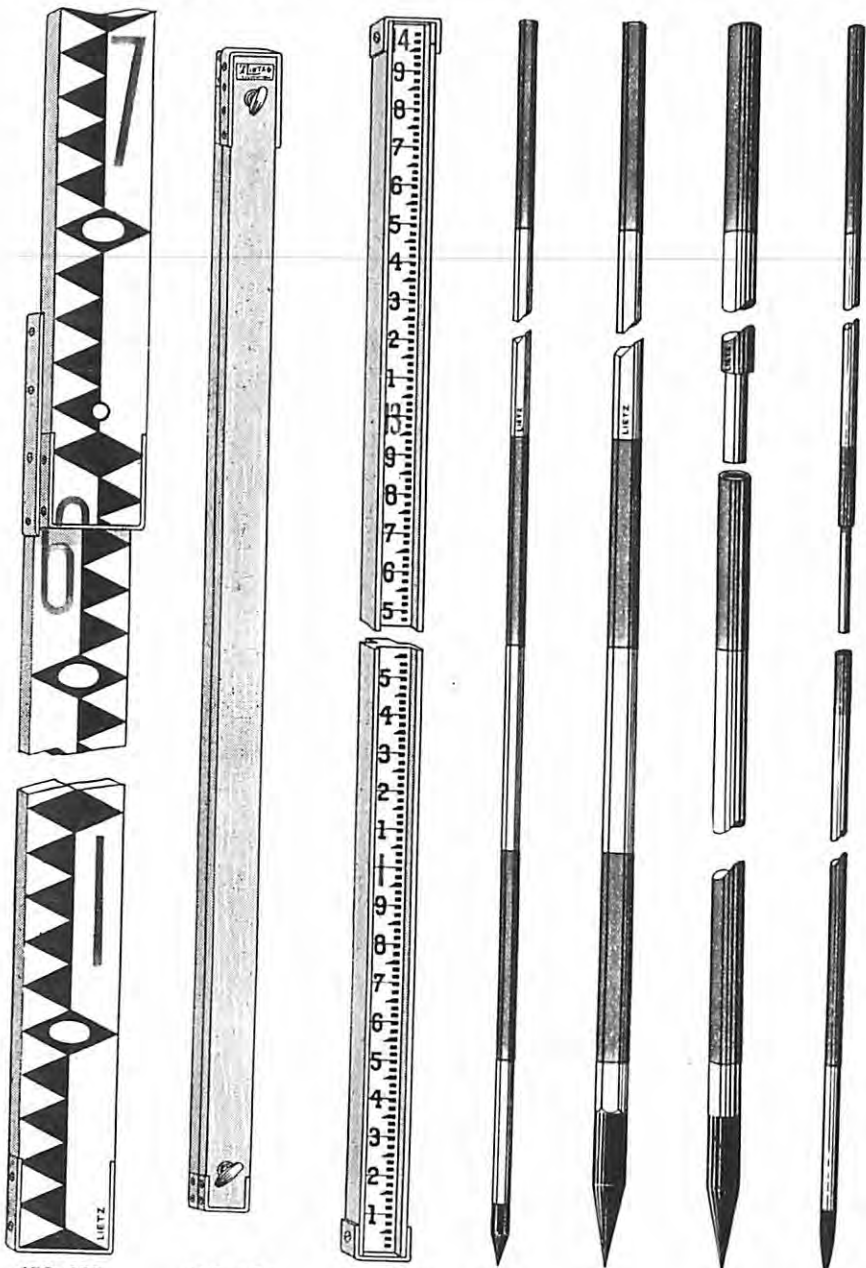
ROD LEVEL

- No. 449. Lietz Improved Rod Level.....Code Word, **FOGBELL**

This Rod Level is an improved type, used to hold rod or pole of any shape perpendicular. The level bubbles are sunk in the casting at right angles to each other, thereby lessening the possibility of breakage, as well as making it easier for the rodman to hold the bubbles in the center than the old form of circular spirit levels. The latter are continually leaking and it is impossible to keep them in order.

The Improved Rod Level can either be fastened to the rod by means of a flat-head screw, for which there is a key slot provided, or pressed against the rod or pole while holding. Indispensable for stadia work.

See price list in back of catalog.



450-455
DIAMOND DESIGN

450-455
FOLDED

460-462

465

466

468

469

LIETZ STADIA RODS

For designs of Flexible Level Rods, see page 167.

- | | | |
|-----------------|---|----------------------------|
| No. 450. | Lietz Stadia Rod, 2¾ in. wide, diamond design (alternating), 12 feet long, 2-fold. Same design as Flexible Rod No. 400..... | Code Word
FOILER |
| No. 451. | Lietz Stadia Rod, 2¾ in. wide, diamond design (alternating), 15 feet long, 3-fold. Same design as Flexible Rod No. 400..... | FOISTER |
| No. 454. | Lietz Stadia Rod, 2¾ in. wide, graduated in the metric system, 3 meters long, 2-fold. Same design as Flexible Rod No. 402..... | FOLDEROL |
| No. 455. | Lietz Stadia Rod, 2¾ in. wide, graduated in the metric system, 4½ meters long, 3-fold. Same design as Flexible Rod No. 402..... | FOLIOLE |
| No. 460. | Lietz Plain Stadia Rod, Philadelphia block design, in one piece with tapering rib, 10 feet long. | FOLLICLE |
| No. 461. | Same as No. 460, but 12 feet long..... | FOLLOWER |
| No. 462. | Same as No. 460, but 14 feet long..... | FOLLY |

RANGING POLES

Steel Ranging Poles, ½-inch in diameter, octagonal, solid with pointed end, divided in feet, alternately red and white.

- | | | |
|------------------|---------------|---------------------------|
| No. 465A. | 6 feet | Code Word
FOMER |
| No. 465B. | 8 feet | FONDU |
| No. 465C. | 10 feet | FONTAL |

Wooden Ranging Poles, ¾ to 1¾ inches in diameter, tapered, octagonal with steel-pointed shoe, divided in feet, alternately red and white.

- | | | |
|------------------|---------------|------------------------------|
| No. 466A. | 6 feet | Code Word
FOOTBALL |
| No. 466B. | 8 feet | FOOTMAN |
| No. 466C. | 10 feet | FOOTPAD |

Wooden Ranging Poles, like No. 466, but divided in meters.

- | | | |
|------------------|-----------------|----------------------------|
| No. 467A. | 2 meters | Code Word
FORAGE |
| No. 467B. | 2½ meters | FORAMEN |
| No. 467C. | 3 meters | FORAY |

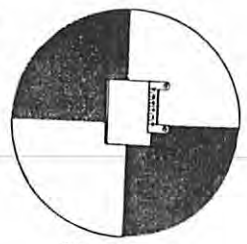
- | | | |
|-----------------|--|-----------------|
| No. 468. | Sectional Ranging Poles, 1 1/16-in. in diameter, round, steel. In two sections, each 4½ feet long, jointed with metal telescope tubing, making an absolutely rigid pole 8½ feet long with steel-pointed shoe. In two-pocket canvas bag.. | FOREBOW |
| No. 469. | Sectional Mining Pole, as No. 468, but 5/8-in. in diameter and in three sections, each 33 in. long, lengthening out to 7¼ feet. In three-pocket canvas bag..... | FORECAST |

See price list in back of catalog.

CHICAGO JOINTED LEVELING AND STADIA RODS

CHICAGO JOINTED LEVELING RODS

These Rods are made of 3 or 4 pieces of selected hardwood, 2 inches wide, 1 inch thick and 4½ feet long. They are joined by telescope socket joints, making when put together a very rigid rod 12½ or 16½ feet long. The face is on one plane and the entire rod from top to bottom when extended is the same size, making it possible to use two targets for stadia work. The graduations are similar to our Philadelphia leveling rods Nos. 421-425 (BLOCK GRADUATION). The feet are marked in red figures and the 10ths in black figures. Each rod contained in a canvas carrying bag.



No. 472-2S

- No. 470A. Chicago Jointed Leveling Rod, in 3 sections, each 4½ feet long, making a rigid rod 12½ feet long. Without target, in canvas carrying bag.....Code Word, **FORELAND**
- No. 470B. Chicago Jointed Leveling Rod, in 4 sections, each 4½ feet long, making a rigid rod 16½ feet long. Without target, in canvas carrying bag.....Code Word, **FORELOCK**

CHICAGO JOINTED STADIA RODS

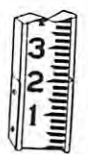
The Chicago Jointed Leveling Rod can be used for stadia work, but the Chicago Jointed Stadia Rod is designed for that purpose only. It is similar to the leveling rod, excepting that it is numbered from the top downward. By setting the upper stadia hair at "O", near the top of the rod, it saves calculation in estimating the distance. By the use of a pair of targets, readings to 1/1000 of a foot can be made a half mile away. An equivalent to 1/10 foot horizontally.

- No. 471A. Chicago Jointed Stadia Rod, in 3 sections, each 4½ feet long, making a rigid rod 12½ feet long, without target, in canvas carrying bag.....Code Word, **FORERUN**
- No. 471B. Chicago Jointed Stadia Rod, in 4 sections, each 4½ feet long, making a rigid rod 16½ feet long, without target, in canvas carrying bag.....Code Word, **FORESAIL**

TARGETS FOR CHICAGO JOINTED RODS

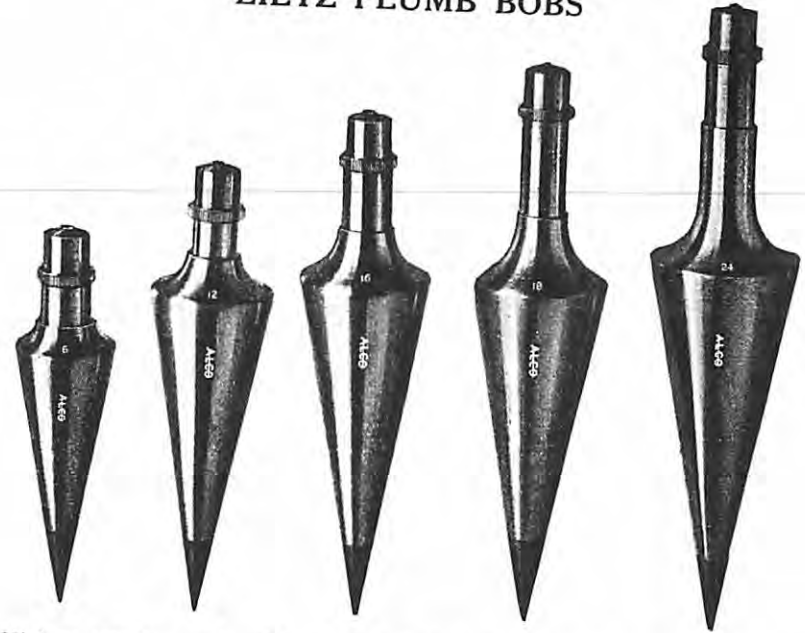
- No. 472A. Fiber Target, round, with vernier for Chicago jointed leveling rods Nos. 470A and 470B, each.....Code Word, **FORESTAY**
- No. 472B. Fiber Target, oval, constructed with open back so it may be slipped onto the rod at any point, with vernier for Chicago jointed leveling rods Nos. 470A and 470B, each.....Code Word, **FORETOP**
- No. 472-2S. Fiber Targets, round, for Chicago jointed stadia rods Nos. 471A and 471B, furnished in pairs, one without vernier to clamp at top of rod and one with vernier. Per pair.....Code Word, **FOREWIND**

See price list in back of catalog.



470A-470B

LIETZ PLUMB BOBS



Highest quality, made of brass, nicely finished, with screw caps and hardened steel points. THE CAPS AND POINTS ARE OF UNIFORM SIZE FOR ALL SIZES OF BOBS AND CAN READILY BE INTERCHANGED OR NEW ONES INSERTED.

Number	474	475	476	477	478	479	480	481	482
Weight	6-oz.	8-oz.	10-oz.	12-oz.	14-oz.	16-oz.	18-oz.	24-oz.	32-oz.
Each									

Extras for Plumb Bobs

- No. 484A. Extra Points Each
- No. 484C. Extra Caps Each

PLUMB-BOB CORD

- No. 484A. Best Braided Linen Cord, thick..... Per yd.
- No. 485B. Best Braided Linen Cord, medium.....
- No. 485C. Best Braided Linen Cord., thin.....
- No. 486. Best Braided Silk Cord, oiled, medium



No. 485B

Plumb-bob Cord is put up in 25- and 100-yard hanks.

See price list in back of catalog.

PLUMB BOBS AND ACCESSORIES



No. 490



No. 515



No. 516

BOB LINE TARGETS

No. 490. Wuth's Bob Line Target, made of pressed metal, for attaching to plumb-bob line. Painted red and white. Each

IRON BOBS

No. 515. Iron Plumb Bob, 7-oz., black enameled finish. Each

LEATHER SCABBARDS FOR PLUMB BOBS

Our Scabbards are made with a leather strip which fits over the top of the bob, insuring it against loss. The back is a heavy piece of flat leather and the point of the bob cannot wear through and injure the user; with belt loop.

- No. 516A. Scabbard for plumb bob, 8 to 12-oz. Each
- No. 516B. Scabbard for plumb bob, 14 to 16-oz.
- No. 516C. Scabbard for plumb bob, 18 to 24-oz.
- No. 516D. Scabbard for plumb bob, 40 to 48-oz.

When ordering please state weight of bob for which scabbard is intended.



No. 520

No. 520. Plummet Adjuster. By pressing sides of adjuster and moving it up or down the proper length of string the plummet height is quickly secured with one hand, leaving the other hand free to shift the transit head to position over tack or center. The adjuster grips instantly on releasing pressure. No tying or untying of knotted strings. Saves time, trouble and tire some stooping. Price, each

See price list in back of catalog.

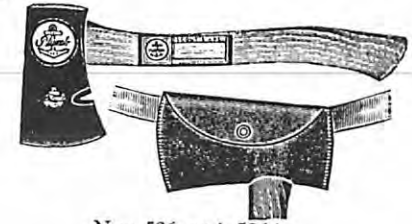
ENGINEERS' BUSH KNIVES, HOOKS AND AXES



No. 521



No. 523



Nos. 526 and 526A.

Each

- No. 521. Engineers' Bush Knives for cutting shrubs, brush, and for sharpening stakes. 24-inch blade
- No. 521A. Same as No. 521, in fancy leather sheath.
- No. 522. Same as No. 521, but 17-inch blade.
- No. 522A. Same as No. 522, in fancy leather sheath.
- No. 523. Engineers' Bush Hooks, fitted with long ax handle; weight 3 lbs.
- No. 523 1/2. Short Engineers' Bush Hook.
- No. 524. Engineers' Axes, with broad head. For pointing and driving stakes, cutting trees, etc. Long handle. Weight 5 pounds.
- No. 525. Same as No. 524, but weight 3 1/2 pounds.
- No. 526. Select Quality Hand Ax. Weight 2 pounds.
- No. 526A. Select Quality Hand Ax, in leather sheath.

STAKE TACKS AND SURVEYING SPADS



No. 528



No. 531



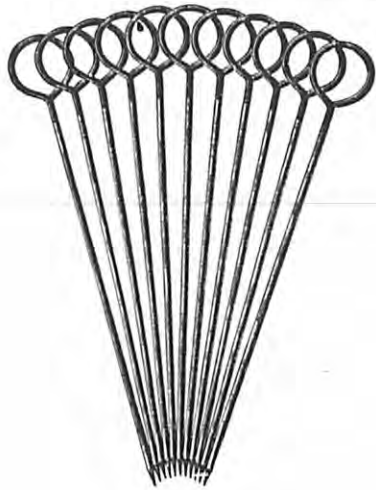
No. 532

- No. 528B. Stake Tacks, galvanized, tin box of 100.
- No. 528C. Stake Tacks, galvanized, in one-pound packages.
- Above Tacks have an indentation in the surface of the head, to guide plumb bob point.
- Surveying Spads, non-corrosive steel, 1 3/8 inches long, for suspending plumb bob from timbers in mines:
- No. 531A. Tin box of 50
- No. 531B. In bulk, per 1000
- Surveying Spads, hook-shape, steel, 2 inches long:
- No. 532A. Tin box of 50.
- No. 532B. In bulk, per 1000

See price list in back of catalog.

SURVEYORS' ARROWS

The rings are enameled in bright vermillion.



Nos. 534-537



No. 549

- No. 534. Steel Arrows, extra heavy, nickel plated, 10 inches long. Per set of 11
- No. 535. Steel Arrows, extra heavy, nickel plated, 14 inches long. Per set of 11
- No. 536. Steel Arrows, not nickel plated, 10 inches long. Per set of 11
- No. 537. Steel Arrows, not nickel plated, 14 inches long. Per set of 11
- No. 539. Steel Arrows, painted red and white alternately every inch, 6 inches long. Per set of 11

CARRYING RINGS AND SCABBARDS FOR ARROWS

- No. 545. Steel Carrying Ring for arrows
- No. 547. Cloth-Covered Scabbard with carrying strap
- No. 548. Leather Scabbard with carrying strap
- No. 549. Leather Scabbard with belt strap

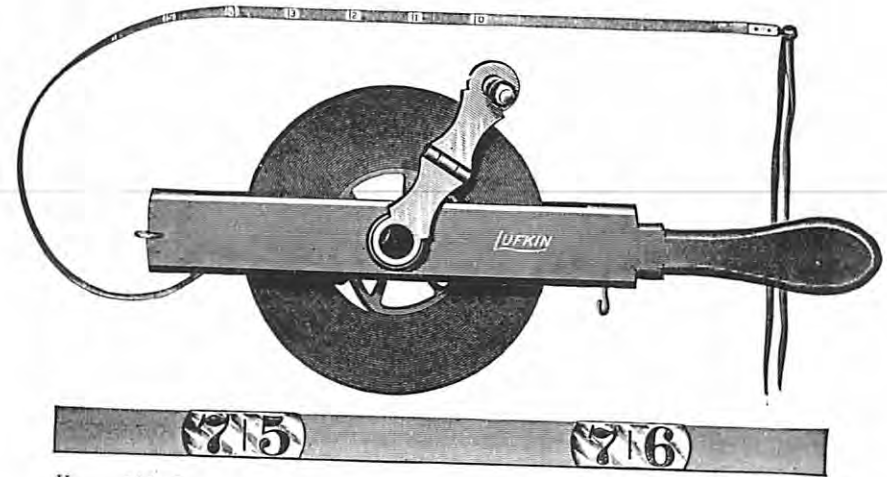
CLOTH FOR SURVEYORS' FLAGS

- No. 550. Red Cloth. Per yard
- No. 551. White Cloth. Per yard

See price list in back of catalog.

SURVEYORS' CHAIN TAPES

Etched Graduations



Heavy 1/4-inch steel tape. Nicely finished hardwood reel, with large metal folding handle, and two large detachable rings. Trimmings nicely nickel plated. The graduations on these tapes are etched, and wherever graduated the steel has a bright, raised surface, with the figures etched in. The steel being tempered and of the finest quality the graduations and figures will never be effaced, but will always show up clear and distinct. As a convenient, strong, durable chain tape for heavy field work ours excels all others, and we guarantee it in every way.

Graduations

All chain tapes shown on this page are graduated one side only in feet, every foot, or 100ths of a foot. Tapes graduated in feet have end feet graduated in 100ths of a foot. Tapes graduated in links have end links graduated in tenths of links. Tapes with metric measure are graduated the first decimeter in millimeters, balance of first meter in centimeters, balance of tape in decimeters.

Tapes Complete, with Reel

	Wt. Each	Each
No. 5100.	100 ft.,	2 1/2 lbs.
No. 5150.	150 ft.,	3 3/4 "
No. 5200.	200 ft.,	4 1/2 "
No. 5300.	300 ft.,	5 1/2 "
No. 5066.	100 links,	2 "
No. 5132.	200 "	3 1/2 "
No. 5082M.	25 meter,	2 1/4 "
No. 5100M.	30 "	2 1/2 "
No. 5164M.	50 "	3 3/4 "
No. 5328M.	100 "	5 3/4 "
Reel only		

Tapes Only, with Thongs

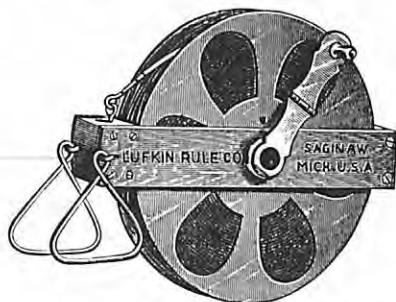
	Wt. Each	Each
No. 05100.	100 ft.,	2 1/4 lbs.
No. 05150.	150 ft.,	3 "
No. 05200.	200 ft.,	3 3/4 "
No. 05300.	300 ft.,	5 "
No. 05066.	100 links,	1 3/4 "
No. 05132.	200 "	2 3/4 "
No. 05082M.	25 meter,	2 "
No. 05100M.	30 "	2 1/4 "
No. 05164M.	50 "	3 1/4 "
No. 05328M.	100 "	5 1/4 "
Thongs only		per pair

CITY ENGINEERS' CHAIN TAPES

- No. 5050S. Graduated to 100ths throughout their entire length. 50 feet in leather case like No. 233.
- No. 5100S. 100 feet, with reel, as shown above.
- No. 05100S. 100 feet, without reel.
- No. 05100SC. Same as No. 05100S, but fully certified.

See price list in back of catalog.

MINING ENGINEERS' CHAIN TAPES
ETCHED GRADUATIONS



Tape complete with Reel



Heavy 1/8-inch steel tapes, hardwood frame with substantial sheet steel open reel. Large metal folding handle and two detachable rings. One side of frame is provided with a large and convenient leather loop for holding. The graduations on these tapes are etched, and wherever graduated, the steel has a bright, raised surface, with the figures etched in. The steel being tempered and of the finest quality, the graduations and figures will never be effaced, but will always show up clear and distinct.

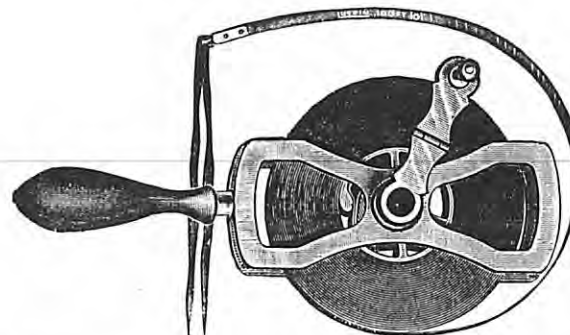
GRADUATIONS

All chain tapes shown on this page are graduated one side only in feet, every foot, or links and poles every link, as ordered. Tapes graduated in feet have end feet graduated to tenths, and, unless otherwise specified, will be sent end feet in hundredths. Tapes graduated in links have end links graduated in tenths of links. Tapes with metric measure are graduated the first decimeter in millimeters, balance of first meter in centimeters, balance of tape in decimeters.

Tapes Complete, with Reel			Tapes Only, with Thongs		
No.	Length	Wt. Each	No.	Length	Wt. Each
No. 4100.	100 ft.	3 1/4 lbs.	No. 04100.	100 ft.	1 3/4 lbs.
No. 4150.	150 ft.	3 3/4 "	No. 04150.	150 ft.	2 "
No. 4200.	200 ft.	4 1/4 "	No. 04200.	200 ft.	2 1/4 "
No. 4300.	300 ft.	5 1/2 "	No. 04300.	300 ft.	3 1/4 "
No. 4500.	500 ft.	7 "	No. 04500.	500 ft.	5 "
No. 4066.	100 links,	3 "	No. 04066.	100 links,	1 1/2 "
No. 4132.	200 "	3 1/2 "	No. 04132.	200 "	2 "
No. 4082M.	25 meter,	3 "	No. 04082M.	25 meter,	1 1/2 "
No. 4100M.	30 "	3 1/4 "	No. 04100M.	30 "	1 3/4 "
No. 4164M.	50 "	3 3/4 "	No. 04164M.	50 "	2 "
No. 4328M.	100 "	5 3/4 "	No. 04328M.	100 "	3 1/2 "
Reel only			Thongs only		per pair

See price list in back of catalog.

CONSTRUCTION ENGINEERS' CHAIN TAPES
Graduated on Babbitt Metal



This tape is designed to answer the requirements of the most severe usage, and to take the place of the old-time, yet indestructible, steel chain. It is made of practically unbreakable steel, somewhat heavier than the ordinary chain tape.

Graduations are stamped into Babbitt Metal at each foot, end feet in tenths; or at each link, end links in 10ths of links. Each tape is provided with a pair of detachable handles, or rawhide thongs, as desired.

Special attention is called to this reel, which is built especially for Babbitt Metal tapes. Nickel-plated metal frame, with folding winding handle. A very serviceable reel easily wound and of beautiful finish.

Tapes Complete, with Reel

Tapes Only, with Thongs

No.	Length	Wt. Each	No.	Length	Wt. Each
No. 2100.	100 feet	3/16 inch wide.	No. 02100.	100 feet	3/16 inch wide.
No. 2150.	150 feet	Each	No. 02150.	150 feet	Each
No. 2200.	200 feet		No. 02200.	200 feet	
No. 2300.	300 feet		No. 02300.	300 feet	
No. 2500.	500 feet		No. 02500.	500 feet	
No. 2066.	100 links		No. 02066.	100 links	
No. 2132.	200 links		No. 02132.	200 links	
No. 3100.	100 feet	5/16 inch wide.	No. 03100.	100 feet	5/16 inch wide.
No. 3066.	100 links	Each	No. 03066.	100 links	Each

We can furnish other lengths of 5/16-inch tapes to order.

SHOULDERS FOR CHAIN TAPES

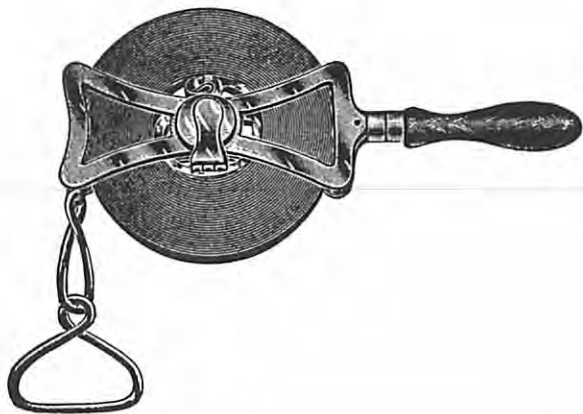


Some surveyors use in chaining a tape equipped with shoulders. These shoulders assist in locating the zero and the last graduation. They are carefully soldered to the tape and when so ordered will be supplied on any of our chain tapes.

Order by "W. S." Extra, per pair.....

See price list in back of catalog.

CHICAGO STEEL TAPES



Chicago Steel Tapes are made of the best quality flexible steel ribbons carefully tempered to prevent kinking. Made in two widths, 3/16 and 5/16 inch. Plainly divided at every foot, link or meter, end divisions in 10ths. The divisions are deeply stamped on solder and are clear and legible and begin 6 inches from the end. These tapes are made under a ten-pound strain at a temperature of 70° Fahrenheit.

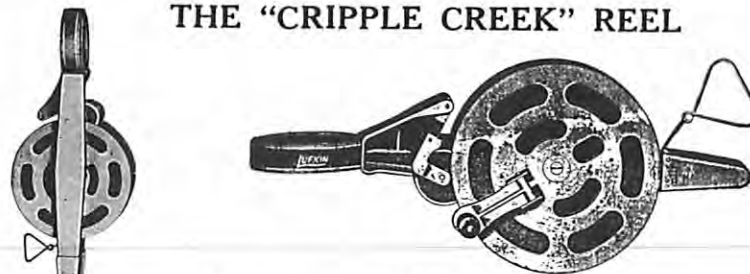
With or without nickel-plated metal frame with folding handle. Each tape supplied with two detachable handles or rawhide thongs, as desired.

Tapes Complete, with Reel		Tapes Only, with Thongs	
3/16 inch wide		3/16 inch wide	
No. 8100.	100 feet	No. 08100.	100 feet
No. 8200.	200 feet	No. 08200.	200 feet
No. 8300.	300 feet	No. 08300.	300 feet
No. 8500.	500 feet	No. 08500.	500 feet
No. 8066.	100 links	No. 08066.	100 links
No. 8132.	200 links	No. 08132.	200 links
5/16 inch wide		5/16 inch wide	
No. 9050.	50 feet	No. 09050.	50 feet
No. 9100.	100 feet	No. 09100.	100 feet
No. 9200.	200 feet	No. 09200.	200 feet
No. 9300.	300 feet	No. 09300.	300 feet
No. 9066.	100 links	No. 09066.	100 links
No. 9132.	200 links	No. 09132.	200 links
No. 9020M.	20 meters	No. 09020M.	20 meters
No. 9040M.	40 meters	No. 09040M.	40 meters

We can furnish other lengths of 5/16-inch tapes to order. Chicago Steel Tapes can be furnished with shoulders, see page 179.

See price list in back of catalog.

THE "CRIPPLE CREEK" REEL



Aluminum frame 14 inches long; nickel-plated steel reel 8 inches in diameter. A hardwood roller or spool is fitted between the sides or discs of reel which by means of a spring presses toward the axis of reel, causing the tape to wind up evenly and tightly and keeping it in place. Long, neat and strong aluminum winding handle with large metal finger hold, giving a winding leverage of nearly five inches, and enabling the winding of a long tape with exceptional ease and rapidity. A leather strap for carrying is attached to one end of the frame.

The Cripple Creek Reel is the neatest, lightest, most convenient, easiest working, most durable reel for long steel tapes made. Weight, 4½ lbs.
 Price of Cripple Creek Reel.....Each.....

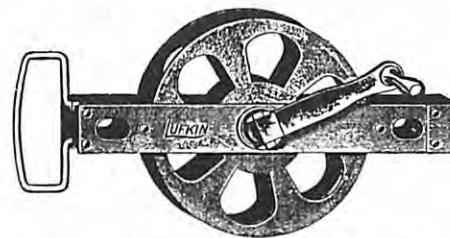
STAFF FOR CRIPPLE CREEK REEL

Forty inches long, of hard maple wood; aluminum socket with heavy set screw at one end into which the reel fits and is securely fastened. Other end of staff is tapered by means of a heavy brass ferrule and steel point which can be firmly set into the ground. The great advantage of this staff is that it serves as a complete support in winding or unwinding the tape, and when the reel is not in use, the outfit can be conveniently carried over the shoulder. Weight, 2¼ lbs.

This staff is very strong, but light and very convenient.
 Price of Staff onlyEach.....

THE 1914 REEL

An All-Steel Lock Handle Reel for Chain Tapes



The winding reel is of 7 inch diameter and frame in which it is mounted is 14 inches long over all. The winding handle gives 5 inches leverage, and locks into either end of the frame, thus holding the tape at any point. Hardwood spring tension roller engages the tape, causing it to wind evenly and tightly. This reel is in dull nickel plated finish. It is of medium weight and will withstand severe use.

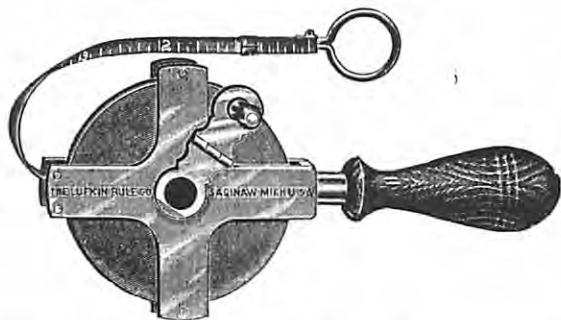
No. 1914 reel can be used with any of our chains, and is especially recommended for the longer lengths and the habbit tapes. Made in three capacities, varying only in width.

In Ordering Always State Length, Width and Style of the Tape to be Used
 No. 1914. Reel, for 100 foot tapes. Weight each, 3¾ lbs. Each.....
 No. 1914. Reel, for 200 to 300 foot tapes. Weight each, 4 lbs. Each.....
 No. 1914. Reel, for 500 foot tapes. Weight each, 4½ lbs. Each.....

See price list in back of catalog.

ENGINEERS' PATTERN FRAME STEEL TAPES

Instantaneous Readings



Metal frames and trimmings, polished hardwood handles, two detachable rings. The tape can be readily detached from frame, and when so detached, the frame can be conveniently carried in pocket.

Tapes less than 100 feet are put up on two-arm frames; tapes 100 feet and longer are put up on four-arm frames.

With One-quarter-Inch Heavy Tapes

Marked Feet and 12ths (Inches and Eighths)	Marked Feet, 10ths and 100ths of feet, for Surveyor's Use	Length	Each
No. 273	No. 273D	50 ft.	
No. 275	No. 275D	75 ft.	
No. 276	No. 276D	100 ft.	

Tapes marked links on back add 1c per foot.
Tapes marked metric on back add 2c per foot.

CLAMP HANDLES



No. 584

For attaching to any part of a long steel tape, thus enabling one to adapt it to any desired length. Brass, nicely nickel plated.

No. 584. Wt. 4 oz. Each

EXTRA SWIVEL HOOKS AND LEATHER THONGS

- No. 585. Extra Swivel Hooks for chain tapes.....Each,
- No. 586. Extra Rawhide Thongs for chain tapes.....Pair,
For Tape Repair Outfits see pages 194 and 195.

See price list in back of catalog.

ATTACHMENTS FOR ENGINEERS' TAPES

EXTRA DETACHABLE RINGS OR HANDLES

No. 650. 1-in. round Per pair

TAPE HOOKS

For attaching to steel tapes. Measures from inside of hook.

No. 654. For 1/4-inch tapes..... Each

No. 655. For 3/8-inch tapes.....



Nos. 654-655



No. 650

This hook when attached to the first end of a steel tape enables one steadily to take long as well as short measurements readily.

TENSION HANDLES

For applying exact tension at which a steel tape is standard. Brass, nickel plated.



Nos. 625-629

Capacity.	Diam. and Length.	Each
No. 625. 20 lbs. by 1/2 lbs.	5/8 in. by 4 3/4 in...	
No. 626. 30 lbs. by 1/2 lbs.	5/8 in. by 4 3/8 in...	
No. 627. 40 lbs. by 1/2 lbs.	3/4 in. by 8 in...	
No. 628. 50 lbs. by 1/2 lbs.	7/8 in. by 9 in...	
No. 629. 60 lbs. by 1/2 lbs.	7/8 in. by 9 1/2 in...	

McCULLOUGH TAPE LEVEL



No. 635

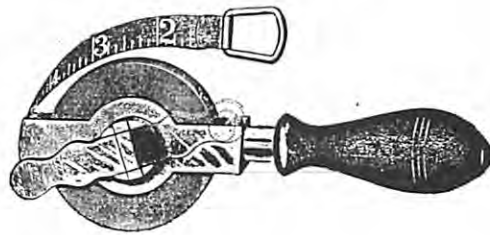
No. 635. McCullough Tape Level insures accuracy in measurements with steel tapes. Above cut full size. Weight, one ounce. It is used by clamping to the tape, about one foot from the handle, by means of the two springs shown, and can be attached and detached instantly. Price

No. 636. Thermometer and Level in nickel-plated case to attach to tape at any point.....
For Pocket Thermometers see pages 140 and 152.

See price list in back of catalog.

LOCK HANDLE FRAME STEEL TAPES

Instantaneous Readings



The frames of these tapes are fitted with a folding lock handle, which folds over the tape, enabling one to stop it at any desired length. This handle, on account of its length, also affords increased winding leverage, which, together with the large knob, makes it especially convenient and easy winding.

With 1/4-Inch Engineer's Pattern Tapes, Detachable Rings

Marked Feet and 12ths (Inches and Eighths)	Marked Feet, 10ths and 100ths of feet, for Surveyor's Use	Length	Each
No. 1273	No. 1273D	50 ft.	
No. 1275	No. 1275D	75 ft.	
No. 1276	No. 1276D	100 ft.	

No. 1276, 100-foot Tape listed above, is supplied with 4-arm frame.

With 3/8-Inch Tapes, Rings Attached

No. 1280	No. 1280D	25 ft.
No. 1281	No. 1281D	33 ft.
No. 1283	No. 1283D	50 ft.
No. 1284	No. 1284D	66 ft.
No. 1285	No. 1285D	75 ft.
No. 1286	No. 1286D	100 ft.

With 1/2-Inch Tapes, Rings Attached

No. 1293	No. 1293D	50 ft.
No. 1296	No. 1296D	100 ft.

Tapes marked metric measure one side only, same price as corresponding length in feet.

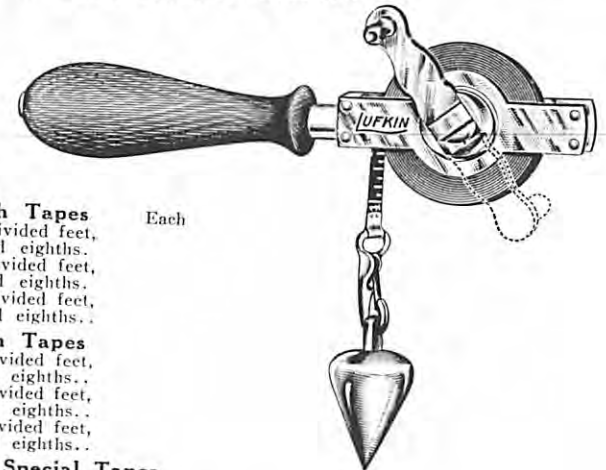
Tapes marked feet one side, metric measure on the other, add 2 cents per foot to list price.

See price list in back of catalog.

OIL MEASUREMENT TAPES

With plumb bob attachment for gauging oil in tanks. This attachment is included in the measurement of the tape supplied. The tapes are provided with a snap for detaching from bob when not in use.

IN LOCK HANDLE FRAMES



- With 1/4-Inch Tapes
- No. 1270WB. 25 feet, divided feet, inches and eighths. Each
 - No. 1271WB. 33 feet, divided feet, inches and eighths.
 - No. 1273WB. 50 feet, divided feet, inches and eighths.
- With 3/8-Inch Tapes
- No. 1280WB. 25 feet, divided feet, inches and eighths.
 - No. 1281WB. 33 feet, divided feet, inches and eighths.
 - No. 1283WB. 50 feet, divided feet, inches and eighths.

With 3/8-Inch Lietz Special Tapes

These tapes are made of Phosphor Bronze. Guaranteed not to rust or be affected by acids, etc.

- No. 1280XWB. 25 ft., divided feet, inches and eighths. Each
- No. 1281XWB. 33 ft., divided feet, inches and eighths.
- No. 1283XWB. 50 ft., divided feet, inches and eighths.

PLUMB BOBS FOR STEEL TAPES



No. 588



No. 589



No. 590

These plumb bobs attached to steel tapes are used in tank gauging throughout the oil industry. No. 588 is of weight suitable for gauging the lighter crude oils, gasoline, etc. No. 590 will penetrate the heavier oils. These two bobs are nickel plated and polished. No. 589 is enameled, and being same length as No. 588, is interchangeable with it.

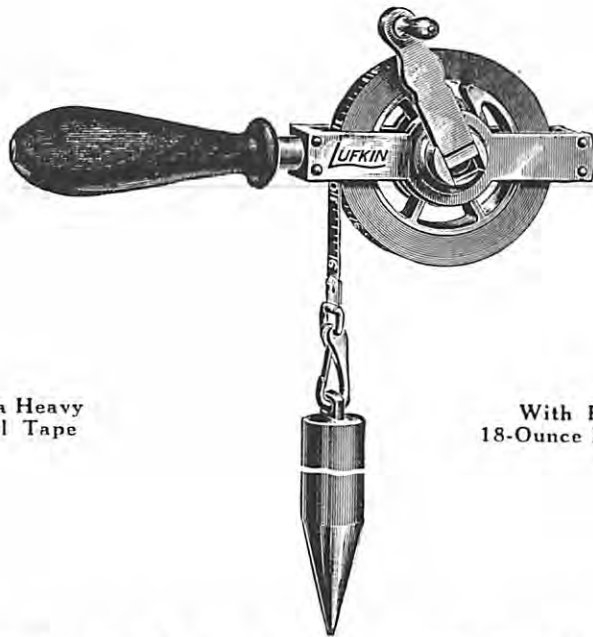
No. 588. Weight each, 6 ozs. Length, 2 3/8 inch. Diameter, 1 1/4 inch. Each..

No. 589. Weight each, 14 ozs. Length, 2 3/8 inch. Diameter, 2 3/8 inch. Each..

No. 590. Weight each, 18 ozs. Length, 6 3/4 inch. Diameter, 1 inch. Each..

See price list in back of catalog.

OIL GAUGERS' STEEL TAPES WITH PLUMB BOB



Extra Heavy
Steel Tape

With Pointed
18-Ounce Plumb Bob

The tapes shown on this page have been especially designed to meet the demand for a practical oil gaugers' steel tape, and one that will withstand a great deal of hard usage. The steel line, which is considerably heavier than used in our regular tapes, is mounted on a strong metal frame of special design and is fitted with a round plumb bob $6\frac{3}{4}$ inches long with tapering point and weighing 18 ounces, which is a weight sufficient to penetrate the heaviest of oils such as those that accumulate an asphalt deposit, etc.

Fitted with a lock handle which folds over the tape, enabling one to stop and hold it at any desired length, and as this handle is extra long and winding drum extra large, it affords increased winding leverage, which, together with the large knob, makes it especially convenient and easy winding. The length of the bob is included in the markings on the tape and the bob is so attached that it can be quickly removed when not in use. Handle of frame is made of hardwood and is nicely polished.

With One-Half Inch Heavy Steel Tape

Marked feet, inches and 8ths one side only.

- No. 1291S. With pointed Plumb Bob No. 590. Length 33 feet, weight each $2\frac{3}{4}$ lbs. Each
- No. 1293S. With pointed Plumb Bob No. 590. Length 50 feet, weight each 3 lbs. Each

See price list in back of catalog.

POCKET MEASURING TAPES

LUFKIN STEEL TAPES Standard of Measurements

Lufkin Steel Tapes are so carefully graduated by standards supplied by the United States Government that they can be used for testing the accuracy of other tapes.

Tension:

Lufkin Steel Tapes are made under a tension of 10 pounds for tapes up to 100 feet in length and 20 pounds if longer. They are accurate when supported full length at this tension.

Temperature:

Steel tapes graduated in customary English units (feet, inches, etc.) are standard at a temperature of 62° Fahrenheit. The National Bureau of Standards recommend tapes graduated in the metric system be made standard at 20° Centigrade, this being the normal temperature under which they are used. We are prepared to make them at 20° Centigrade if so desired, but unless otherwise specified, we will make them accurate at 0° Centigrade, which is the customary standard for countries that have adopted the metric system.

CERTIFICATE OF COMPARISON OF THE NATIONAL BUREAU OF STANDARDS AT WASHINGTON, D. C.

We can furnish a certificate of comparison of the National Bureau of Standards for any Lufkin Steel Tape the graduations of which are marked directly on the steel and the zero of the graduations is represented by a line marked on the tape. The fees of the Bureau of Standards for comparisons are given below, to this must be added the transportation charges to and from Washington, D. C.

- (A) For total length, not greater than 100 feet or 50 meters, either supported throughout or at intervals.....
For each additional 100-foot or 50-meter interval.....
- (D) For comparing total length both supported throughout and at intervals for length of 100 feet or 50 meters.....
For each additional 100 feet or 50 meters.....
- (F) For each sub-division compared.....
- (G) For determination of length at an additional tension, for each 100-foot or 50-meter interval
- (H) For determining the tension to the nearest 0.5 pound or 0.25 kilogram at which the tape is most nearly correct at the standard temperature, for each 100-foot or 50-meter interval.....

For tapes not sent on a reel there will be an additional charge for each 100-foot or 50-meter length or fraction thereof of....

The Bureau of Standards certificate states the temperature at which the comparison was made, the method of support, the tension used in making comparison, and the length corrected for the standard temperature. The number of each certificate is also etched on the tape.

INSTANTANEOUS READINGS

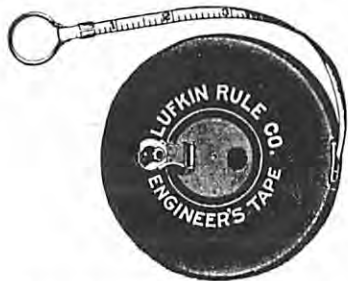


Instantaneous Readings, a patented system of marking steel and metallic tapes, consists of repeating the foot marks at every inch in small, yet easily distinguishable figures. Thus the total reading is brought directly before the eye, eliminating all chance of possible error, and saving valuable time.

See price list in back of catalog.

ENGINEERS' PATTERN STEEL TAPES

Leather Cases
Instantaneous Readings



A sturdy Tape and Case designed for engineering, surveying and other heavy work.

A quarter-inch tape, 50 per cent heavier than standard 3/8-inch lines, and put up in steel-lined leather case. It is the width and weight best for heavy work. For carrying, a case tape is by many preferred to a frame tape.

The line, of highest grade tape steel, is distinctly marked, with measurements beginning at end. It is readily removed from case and is supplied with a pair of detachable rings. The case is narrow, of selected genuine russet leather, hand-stitched, with

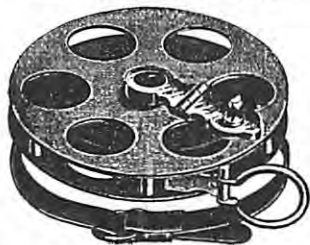
substantial plated steel liner. Folding flush handle is opened by pressing pin on opposite side. Measurements guaranteed accurate.

Marked Feet and 12ths (Inches and Eighths)	Marked Feet, 10ths and 100ths of feet, for Surveyor's Use	Length	Weight Ounces	Each
No. 231	No. 231D	33 ft.	13	
No. 233	No. 233D	50 ft.	17	
No. 234	No. 234D	66 ft.	21	
No. 235	No. 235D	75 ft.	22	
No. 236	No. 236D	100 ft.	27	

Tapes divided metric system on back add 2c per foot.

"WOLVERINE" STEEL TAPES

Instantaneous Readings



Open metal reel, with nickel-plated brass folding handle. Leather strap on the reverse side, by which the tape can be firmly held when winding. This reel is very strong, and is built to withstand the most severe usage. The metal is given a satin finish, which presents a beautiful appearance. With 1/4-inch engineers' pattern steel tapes.

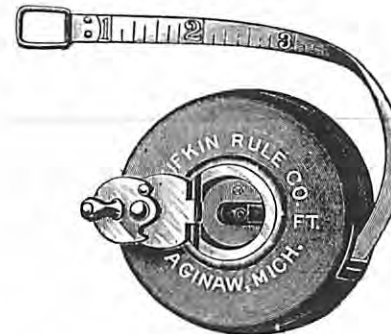
Marked Feet and 12ths (Inches and Eighths)	Marked Feet, 10ths and 100ths of feet, for Surveyor's Use	Length	Each
No. 1373	No. 1373D	50 ft.	
No. 1376	No. 1376D	100 ft.	
No. 1377	No. 1377D	150 ft.	

For prices of Lines only, see page 193.

See price list in back of catalog.

"RELIABLE" STEEL MEASURING TAPES

Instantaneous Readings
3/8-Inch Tapes



Marked Feet and 12ths (Inches and Eighths)	Marked Feet, 10ths and 100ths of feet, for Surveyor's Use	Length	Each
No. 200	No. 200D	25 ft.	
No. 203	No. 203D	50 ft.	
No. 205	No. 205D	75 ft.	
No. 206	No. 206D	100 ft.	

RELIABLE JUNIOR TAPES

Instantaneous Readings
1/4-Inch Tapes



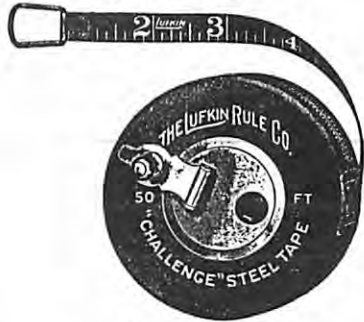
Marked Feet and 12ths	Marked Feet, 10ths and 100ths	Length	Each
No. 100	No. 100D	25 ft.	
No. 103*	No. 103D*	50 ft.	
No. 105	No. 105D	75 ft.	
No. 106	No. 106D	100 ft.	

*No. 103 can be furnished marked feet and 12ths on one side and feet and 100ths on the back. Order by No. 103DOB.....

See price list in back of catalog.

CHALLENGE STEEL MEASURING TAPES

Instantaneous Readings
3/8-Inch Tapes



Marked Feet and 12ths (Inches and Eighths)	Marked Feet, 10ths and 100ths of feet, for Surveyor's Use	Length	Diameter of Case	Each
No. 260	No. 260D	25 ft.	2 3/4 in.	
No. 263*	No. 263D*	50 ft.	3 1/4 in.	
No. 265	No. 265D	75 ft.	4 1/4 in.	
No. 266*	No. 266D*	100 ft.	4 1/2 in.	

*Nos. 263 and 266 can be furnished marked feet and 12ths on one side and feet and 100ths on the back or with metric measure on back.

- No. 263DOB. 50 feet (decimals)
- No. 263MOB. 50 feet (metric)
- No. 266DOB. 100 feet (decimals)
- No. 266MOB. 100 feet (metric)

CHALLENGE JUNIOR STEEL MEASURING TAPES

Instantaneous Readings
1/4-Inch Tapes



Marked Feet and 12ths (Inches and 16ths)	Marked Feet, 10ths and 100ths of feet, for Surveyor's Use	Length	Diameter of Case	Each
No. 1260	No. 1260D	25 ft.	2 3/4 in.	
No. 1263*	No. 1263D*	50 ft.	2 7/8 in.	
No. 1265	No. 1265D	75 ft.	3 3/8 in.	
No. 1266	No. 1266D	100 ft.	3 3/4 in.	

*No. 1263 can be furnished marked feet and 12ths on one side and feet and 100ths on the back or with metric measure on back.

- No. 1263DOB. 50 feet (decimals)
- No. 1263MOB. 50 feet (metric)

See price list in back of catalog.

"RIVAL" STEEL MEASURING TAPES

Instantaneous Readings
3/8-Inch Tapes



Nickel-plated steel cases, folding flush handle, opened by pressing pin on opposite side. Cases have knurled edges, which afford a firm hold when winding in tape. Measurements guaranteed accurate.

Marked Feet and 12ths (Inches and Eighths)	Marked Feet, 10ths and 100ths of feet, for Surveyor's Use	Length	Each
No. 240	No. 240D	25 ft.	
No. 243	No. 243D	50 ft.	
No. 246	No. 246D	100 ft.	

"RIVAL JUNIOR" STEEL MEASURING TAPES

Instantaneous Readings
1/4-Inch Tapes



Marked Feet and 12ths (Inches and Eighths)	Marked Feet, 10ths and 100ths of feet, for Surveyor's Use	Length	Each
No. 1240	No. 1240D	25 ft.	
No. 1243	No. 1243D	50 ft.	
No. 1246	No. 1246D	100 ft.	

RIVAL TAPES WITH DIAMETER MEASUREMENTS

These tapes are marked on one side in feet, inches and 8ths, other side with diameter measurements in feet, enabling one, by measuring the circumference, to arrive at the exact diameter as fine as 64ths of inches.

- No. 241P. "Rival," 33 feet with diameter measurement.....
- No. 243P. "Rival," 50 feet with diameter measurement.....
- No. 1243P. "Rival Junior," 50 feet with diameter measurement.....
- No. 241XP. Lietz Special Non-Rust, Non-Breakable Tape, in "Rival" case, 33 feet, with diameter measurement.....
- No. 243XP. Like No. 241XP, but 50 feet.....

See price list in back of catalog.

"BANNER" STEEL MEASURING TAPES

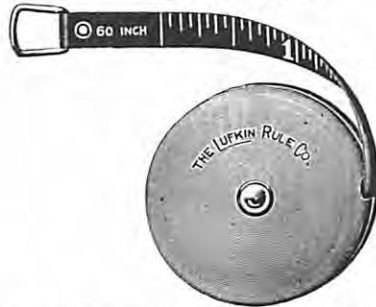
Instantaneous Readings
3/8-Inch Tapes

Cases made of steel, covered with handsome mottled black "Autoleather," extremely durable. Fitted with folding flush handle, opened by pressing button on opposite side. Trimmings nickel plated.



- Graduated in Feet, Inches and Eighths only**
 No. 550. 25 feet Each
 No. 556. 100 feet
 No. 553. 50 feet

POCKET SPRING STEEL TAPES
1/4-Inch Tapes



Round Edge Nickel-Plated Brass Cases, Spring Wind, Center Stop

- | | | | | |
|------------|------------|----------|--|------|
| | | | Marked One Side Only; Inches and 16ths | |
| No. 143. | 36 inches, | 1/4-inch | Tape..... | Each |
| No. 145. | 60 " | 1/4 " | " | " |
| No. 146. | 72 " | 1/4 " | " | " |
| No. 148. | 96 " | 1/4 " | " | " |
| | | | Marked Inches and 16ths One Side; Feet, 10ths and 100ths Other Side. | |
| No. 143D. | 36 inches, | 1/4-inch | Tape..... | Each |
| No. 145D. | 60 " | 1/4 " | " | " |
| No. 146D. | 72 " | 1/4 " | " | " |
| No. 148D. | 96 " | 1/4 " | " | " |
| | | | Marked Inches and 16ths One Side; Millimeters Other Side. | |
| No. 143EM. | 36 inches, | 1 meter, | 1/4-inch | Each |
| No. 145EM. | 60 " | 1 1/2 " | 1/4 " | " |
| No. 146EM. | 72 " | 2 " | 1/4 " | " |
| No. 148EM. | 96 " | 2 1/2 " | 1/4 " | " |

POCKET STEEL TAPES WITH ARCHITECTS' SCALES

For quickly measuring scale-drawings or blue prints of buildings, plans, etc.

- Tapes of best quality steel, 1/4 inch wide, in "Nubian" Finish. The cases are nickel plated and polished. They are round-edge pattern, spring-wind with center stop.
- | | | |
|----------|--|------|
| No. 391. | 60-inch, marked in 1/8 inch architect's scale, 1 to 480, one side; inches to 16ths other side. | Each |
| No. 392. | 60-inch, marked in 1/4 inch architect's scale, 1 to 240, one side; inches to 16ths other side. | |
| No. 393. | 60-inch, marked in 3/8 inch architect's scale one side; 1/4 inch architect's scale other side. | |

See price list in back of catalog.



TEMPERATURE SCALE

For the most exact results the temperature in which a measuring tape is actually used must be taken into account.

Temperature scale on a steel tape is a series of graduations at the last end corresponding to the expansion and contraction of the tape over a range of temperatures which are indicated opposite the various lines. (Above illustration shows such scale (half size) on a 100-foot tape graduated to feet, 10ths and 100ths.) This scale takes the place of the terminal mark, that point falling on the line in the scale representing the temperature prevailing.

We are prepared to put this scale on all steel tapes 1/4-inch and over in width, on the basis of the Fahrenheit thermometer for tapes in English markings, and the Centigrade thermometer for those in metric.

Extra for Temperature Scale..... per tape.

STEEL TAPE LINES WITHOUT CASES OR FRAMES

With Regular Graduations

Specify as "Tapes only" and by prefixing zero to stock number of complete tape, as "No. 0263 Challenge tape only."

Three-Eighths Inch Wide

For No. 200 Series "Reliable," No. 260 Series "Challenge," "Rival," and No. 280 and No. 1281 Series Frame Tapes.

Length, feet	25	33	50	66	75	100	150	200
" meters	5	10	15	20	25	30	50	60
Marked, one side, each	..	..	..	..	..	..	..	..
Marked, both sides, each	..	..	..	..	..	..	..	..

Light Weight, One-Quarter Inch Wide

For "Reliable Jr.," "Challenge Jr.," and "Rival Jr." Tapes.

Length, feet	25	33	50	66	75	100
Length, meters	5	10	15	20	25	30
Marked, one side, each	..	..	..	..	..	..
Marked, both sides, each	..	..	..	..	..	..

Heavy, One-Quarter Inch Wide (with Detachable Rings)

For "Wolverine," and Nos. 231, 273 and 1273 Series Engineers' Pattern Tapes.

Length, feet	33	50	66	75	100	150	200
Length, meters	10	15	20	25	30	50	60
Marked, one side, each	..	..	..	..	..	..	..
Marked, both sides, each	..	..	..	..	..	..	..

Oil Gauge One-Half Inch Wide

Standard Pattern with Snap.

Length, feet	33	50
Length, meters	10	15
Marked, one side, each	..	..
Marked, both sides, each	..	..

NOTE—For Chain Tapes only, see Chain Tape pages.

REPAIRS TO STEEL TAPES

We are prepared to give prompt and satisfactory service.

- A—Repairing Pocket Tapes—per break.....
- B—New End Ring, ordinary type.....
- C—New End Ring, engineers' pattern.....
- D—Extra Tape furnished, per foot.....
- E—Repairing Band Chains, per break.....
- F—New End Ring for band chains.....
- G—Extra Tape furnished, per foot.....

*Pocket Spring Steel Tapes cannot be mended except at ends.

See price list in back of catalog.

SLIDE RULE ACCESSORIES



Frameless Indicator Indicator with Aluminum Frame No. 3071 No. 3072

INDICATORS

- No. 3060A.** For all 5 in. and vest pocket rules. Each.....
No. 3060B. For all 10 and 20-in. rules. Each.....
 Be sure to specify the number of the rule for which indicator is desired and whether frameless type or indicator with frame is wanted.

GLASSES ONLY FOR FRAMELESS INDICATORS

- No. 3062A.** For Slide Rules up to and including 10 in. long, each....
No. 3062B. For Slide Rules over 10 in. long, each.....

MAGNIFIERS

- No. 3070.** Detachable Magnifier for Slide Rule Indicator. Each....
 When ordering please specify for which Slide Rule the Magnifier is wanted.
No. 3071. Indicator with full-size Magnifier for slide rules. Each..
No. 3072. Indicator with half-size Magnifier for slide rules. Each..
 When ordering please specify for which Slide Rule the Indicator is wanted.

CASES FOR SLIDE RULES

- | | | | | |
|--|---|----|----|----|
| No. 3073. Morocco Case for Slide Rules. | | | | |
| Inches long— | 5 | 10 | 16 | 20 |
| Each | | | | |
| No. 3074A. Sewed Leather Case for Slide Rules. | | | | |
| Inches long— | 5 | 10 | 16 | 20 |
| Each | | | | |
| No. 3074B. Sewed Leather Case with space for Magnifier. | | | | |
| Inches long— | 5 | 10 | 16 | 20 |
| Each | | | | |

BOOKS ON THE SLIDE RULE

- BK1.** Instructions in the use of Slide Rules. 55 pages with illustrations and complete instruction for all our slide rules. Each.....
BK2. Instructions for the use of the Slide Rules, published by A. W. Faber. Each

- BK3.** "The Use of the Slide Rule," by F. A. Halsey, Fourth Ed., 18 Ill., 7 folding plates. Each

- BK4.** "The Slide Rule," by Chas. N. Pickworth. A practical manual of instruction, 17th Ed., illustrated. Each

See price list in back of catalog.

THE IMPROVED HALDEN CALCULEX

2 3/8 inches diameter by 1/4 inch thick.



No. 3075

This is a very compact, convenient and accurate instrument and very simple to operate. It is made entirely of metal and its construction is extremely simple, so that it is impossible for the instrument to get out of order.

The book of rules accompanying each instrument is most extensive and complete, yet very clear and easy to understand. It has been arranged so as to fit in a separate compartment of the leather case containing the instrument, so that both together can be conveniently carried in the vest pocket.

The Calculex, briefly described, consists of a disc within a fixed ring, which together form a dial with logarithmic scales on both sides, surrounded by a metal ring and protected on both sides by a glass rim with an indicator hair line marked thereon.

The instrument is operated by turning the disc, holding the nut on either side between finger and thumb. The outside ring is fastened to the rim.

Logs of numbers, squares, square roots, cubes, cube roots, angles, can be read direct from the indicator line, without turning the disc.

The front face contains five circles of scales. The outer scale No. 1 is a scale of Logs; Nos. 2 and 3 are the calculating scales A and B, Nos. 4 and 5 are the square roots of B scale.

The reverse contains six circles of scales. The outer scale, No. 6, is a scale of angles, Nos. 7 and 8 are calculating scales for reverse proportions, Nos. 9, 10 and 11 are cube roots of scale B.

- No. 3075.** Halden Calculex Slide Rule, in leather case, with book of instructions. Each

- No. 3075G.** New Glass for Halden Calculex. Each.....

THE BOUCHER CALCULATOR

About 2 inches diameter by 9/16 inch thick.



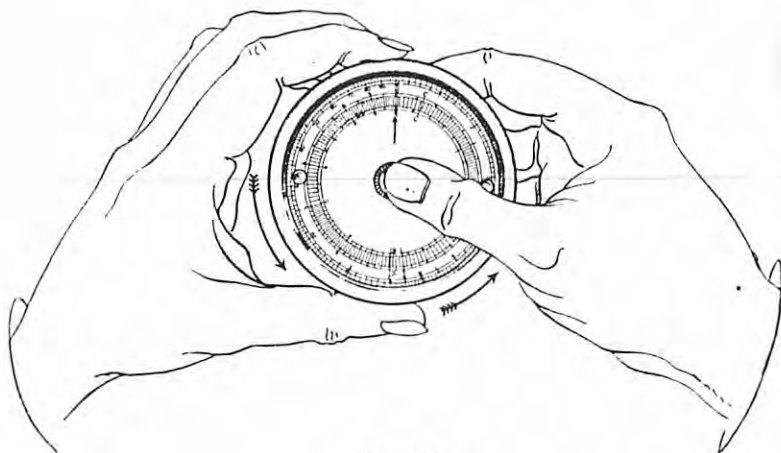
No. 3080

This instrument resembles an ordinary stem-winding watch, with glass-covered dials back and front. Ratios are set off by means of pointers, which, as well as the movable dial, are moved by means of the stem-winder key. Instrument of convenient size to carry in pocket.

- No. 3080.** Boucher Calculator, silvered metal dials. Each

See price list in back of catalog.

THE MIDGET CIRCULAR CALCULATOR



No. 3082

This compact little instrument is 2½ inches in diameter and only ¼ inch in thickness, contained in imitation leather case and will fit the vest pocket. The divisions are clear and accurate and finely cut on two white dials. The covers are made of non-breakable glass, provided with indicator lines and two transparent buttons for turning to desired position.

To operate take hold of instrument by the two center knobs with the thumb and forefinger of the right hand and turn the case with the left hand. Turn glass dial with indicator by means of the buttons provided.

Instrument is fitted with square, cubic, logarithmic, sine and tangent scales and by means of the fore and back non-breakable glass slides it is possible to solve immediately the following calculations:

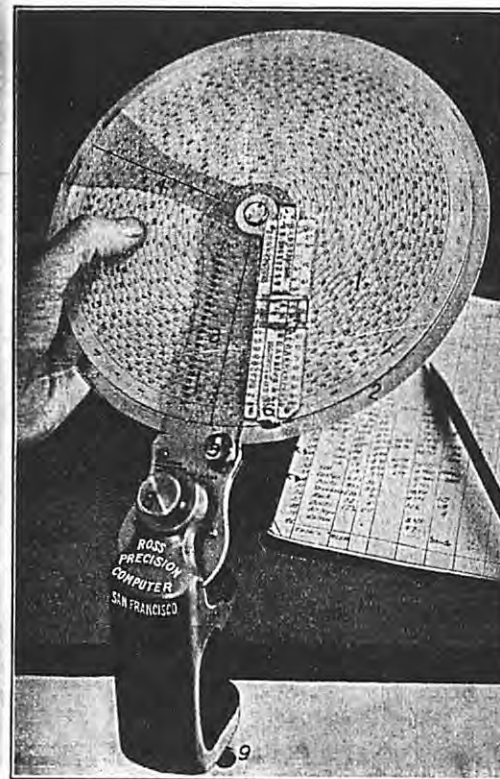
- | | |
|---------------------------------------|---------------------------|
| 1. Watt reduced to H. P. | 7. To cubic. |
| 2. H. P. reduced to Watt. | 8. Cubic extrication. |
| 3. Circle surface by circle diameter. | 9. Logarithmic numerus. |
| 4. Circle diameter by circle surface. | 10. Logarithmic mantissa. |
| 5. To square. | 11. Sine. |
| 6. Square extrication. | 12. Tangent. |

This instrument is operated in the same manner as the ordinary slide rule. It is not influenced by heat or cold and its compactness and durability and nominal cost have established its popularity.

No. 3082. Midget Circular Calculator in imitation leather case, with instructions. Each

See price list in back of catalog.

THE ROSS PRECISION COMPUTER



Multiplies—Divides.
 Gives Reciprocals.
 Solves Proportions.
 Handles constant multipliers.
 Handles constant divisors.
 Handles constant ratios.
 Reads 5-place logs and anti-logs.
 Solves exponential problems.
 Gives 3-place answers instantly.
 Solves expressions like $a \times b \times c \times d$
 $e \times f \times g \times h$

With its trigonometric functions many engineers use it for traverses, obtaining 5-place accuracy, about 1 inch per mile.

Operation: $879.65 \times 7.2638 = ?$
 Set 87965 under arm 3, clamp;
 Set 72638 under arm 4.

Answer 6389.6 is under arm 3.
 Slide checks answer—locates decimal.

The Ross Precision Computer is a new multiplier-and-divisor of unusual precision. It solves problems like $879.65 \times 72.638 \div 74.769 = 854.58$, with an accuracy of 5 figures, i. e. to an ultimate accuracy of 1/1000 of 1%, or 1 in 100,000.

On the back of the Precision Computer are scales of natural sines, cosines, tangents and cotangents. They read minutes exact, interpolable to fractions of a minute. The Precision Computer is used for figuring earthwork, monthly and final estimates, unit cost and payroll, traverses for final design and reports. It is intended primarily for precise calculations where an accuracy of four to five significant figures is indispensable.

The Ross Precision Computer is particularly effective in heavy tabular work, with Constants. After setting Constants, each succeeding item requires only one turn of dial. Constants remain locked, and cannot shift accidentally, however numerous the items. This feature is valuable in figuring payroll, unit-cost, pro-rating, etc., etc. It permits three to five 5-place calculations per minute, 200 to 300 per hour,—as fast as an assistant can call off the data and write down the results.

MECHANICAL DETAILS

The Ross Precision Computer is graduated directly on heavy metal plate, easy to read and thoroughly durable; aluminum frame, trimmed in nickel; precisely machined, of fine workmanship and construction.

Nine inches in diameter; weighs net 1½ lbs.; packed in fabrikoid case. Clamp is finely polished; trimmed in nickel; solid, durable.

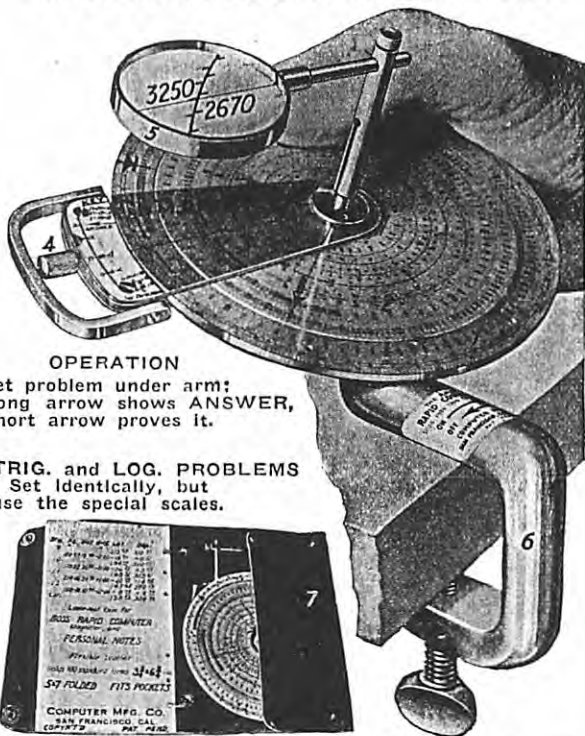
For convenience, accuracy and rigidity the Computer may be attached instantly and firmly to any desk-edge, by the Tilted Duplex Clamp. It permits fine settings to be made with great precision—with either the right, left, or both hands. Can be faced about in any convenient direction. A turn of Thumbnut 8 releases the Computer, ready to put in your desk or valise, among your papers.

Clamp is finely japanned, has polished nickel trimmings; solid, durable.

No. 3090. Ross Precision Computer, complete with tilted duplex clamp, case and full directions. Each

See price list in back of catalog.

THE ROSS RAPID COMPUTER



OPERATION

Set problem under arm;
Long arrow shows ANSWER,
Short arrow proves it.

TRIG. and LOG. PROBLEMS

Set identically, but
use the special scales.

The new Ross Rapid Computer solves all numeric, logarithmic and trigonometric problems. Polyphase duplex in principle, but with simpler, longer, and more complete scales. Solves in one setting problems like abc , a/bc , $a \sin x / \cos y$, $ab \tan x$, $\log (a/bc)$, etc. 5-inch diam., $12\frac{1}{2}''$ contact scales, like upper scales of 25" rule.

Has 360° protractor and all 6 functions; actually practical for trigonometric work, traverses, stadia, etc. Figures quantities, capacity, unit cost, earthwork, etc. Shows answer and proof. Answer never runs off scale, no blank movements, each movement is effective. Unwarpable, unshrinkable; instantly convertible for desk or pocket.

Computer consists of scaled metal dials 1 and 2, set flush, and mounted on aluminum back. The graduations are sharply and deeply engraved into the basic metal; they will never wear out; but if accidentally marred or disfigured, dials may be renovated repeatedly, like new.

Aluminum arm 3 carries Thumbnut 4 for locking constants, and key to operation in plain sight of user.

No. 3092. Ross Rapid Computer, with full directions. Each.....

No. 3092A. Fine sewed leather pouch for No. 3092. Each.....

Magnifier, $1\frac{1}{4}$ -inch diam., adjustable in focus, radius and direction. Makes interpolations more accurate, readings appear larger than ordinary typewriting. A touch of finger turns it aside; instantly detachable for separate use.

No. 3092B. Magnifier complete, with post and thumb-lock. As illustrated. Each.....

Desk Clamp, increases accuracy and convenience, relieves strain from hand and eye, like tripod for compass; permits writing with one hand while figuring with other. Instantly detachable. Made of aluminum, trimmed in nickel, finely machined, weight $\frac{1}{2}$ pound.

No. 3092C. Desk Clamp for No. 3092. Each.....

Loose Leaf, sewed leather case for Computer and Magnifier; directions bound in, supplied with standard $3\frac{1}{4} \times 6\frac{3}{4}$ sheets in variety of rulings, for personal notes; folds to 5×7 ; fits coat, breast or back pockets.

No. 3092D. Loose Leaf Case, with fillers and rings. Each.....

No. 3092X. Complete Set as illustrated and described. Each.....

For highest efficiency the Ross Rapid Computer was designed to be used as a Complete Set; this increases accuracy and comfort to the eye, is more convenient to use, permits one-hand operation, and is instantly convertible for desk or pocket, field or office. Purchasers are urged to avail themselves of these advantages.

See price list in back of catalog.

THE ROSS RAPID COMPUTER



8-INCH RAPID COMPUTER; graduated like No. 3092, but made of heavy celluloid, in 2 colors, with solid, handy metal arm that can be locked on any setting. The scales are open and easy to read. Durable, metal center; protective transparent cover. Packed in 8×9 loose-leaf fabrikoid book, with rings, fillers, and full directions.

No. 3094. 8-inch Celluloid Rapid Computer, complete. Each.....

ROSS COMMERCIAL COMPUTER

Commercial Rapid Computer—The Rapid Computer is also made for commercial use, without technical scales, for figuring payroll, simple and compound interest, discount, freight, profit and loss, prorating, unit costs, foreign exchange, mensuration, weight, in fact any and every calculation involving multiplication and division in any form. Very simple to operate; construction like No. 3094. Packed in 8×9 loose-leaf fabrikoid book, with rings, fillers and full directions.

No. 3095. 8-inch Commercial Computer, complete. Each.....

STUDENTS' RAPID COMPUTER

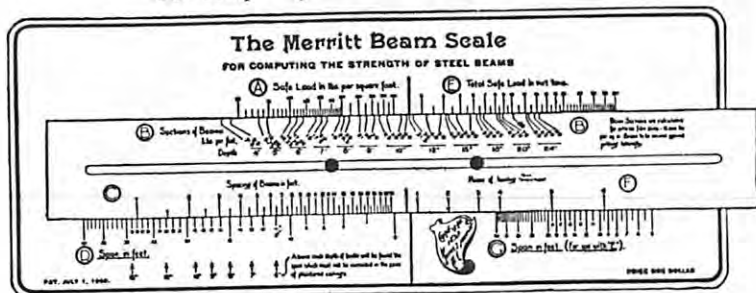
STUDENTS' RAPID COMPUTER; 5-inch diameter, scales like No. 3094, but made of heavy celluloid in 2 colors, with self-locking friction arm. Fits pocket without bulge, very light and handy. Packed in fabrikoid pouch, with full directions.

No. 3096. Students' Rapid Computer, complete. Each.....

See price list in back of catalog.

THE MERRITT BEAM SCALE

For computing the strength of steel beams.



No. 3097

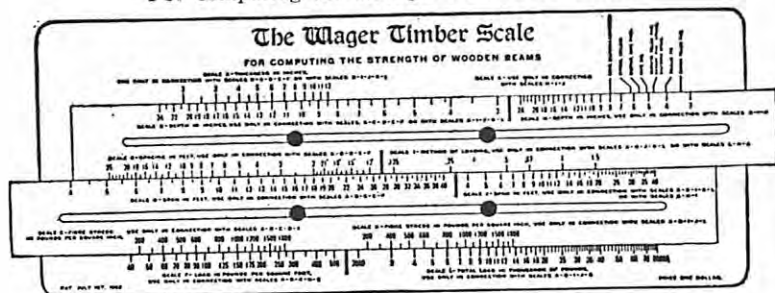
Absolutely accurate. Adapted to all conditions. Load, spacing, span, etc., found instantly. Mistakes absolutely eliminated.

The Merritt Beam Scale for computing the strength of steel beams is based on the principle of the Engineer's Slide Rule and was designed to simplify computations of this kind, and to eliminate all chance of errors. Tables and formulæ are absolutely unnecessary when the Merritt Beam Scale is used, and the speed with which answers to widely varying problems may be solved can hardly be appreciated by anyone who has not had the pleasure of using it.

No. 3097. Merritt Beam Scale, on heavy bristol board. Each.....

THE WAGER TIMBER SCALE

For computing the strength of wooden beams.



No. 3098

For computing the strength of wooden beams. Absolutely accurate. Adapted to all conditions. Load, spacing, span, etc., found instantly. Mistakes absolutely eliminated.

To illustrate the simplicity of the Scale the following is given:

How far apart shall 6 in. x 12 in. timbers of white oak be placed to safely support a load of 150 pounds per square foot, the span being 18 feet, and New York law governing the design?

Select the fibre stress for white oak allowed in New York City (given on back of scale: 1000 pounds). Place 12 in scale B below 6 in scale A. Place 1000 in scale E over 150 in scale F. Above 18 in scale D read 2 ft. 0 in. in scale C.

The Wager Timber Scale, for computing the strength of wooden beams, contains more information than could be given in 500 pages of tables. It is based on the principle of the Engineer's Slide Rule, and five minutes' inspection will convince anyone that it is simplicity itself.

No. 3098. Wager Timber Scale, on heavy bristol board. Each.....

See price list in back of catalog.

STADIA COMPUTORS

COX STADIA COMPUTER

The Cox Stadia Computer is a circular slide rule of about fifteen inches effective length. The fixed outer scale, or base, is graduated to the logarithms of numbers from 1 to 1000. The movable inner disc, concentric with it, is graduated on a portion of its circumference to the logarithms of one-half the sine of twice the angles from 3 min. to 45 deg., and inscribed "Difference in Elevation." Another portion of its circumference is graduated to the logarithms of the cosine squared of the angles from 0 to 45 deg., and inscribed "Hor. Distance."

Printed on heavy celluloid, size 5 7/8 x 5 7/8 inches, suitable for carrying in coat pocket.

No. 3104. Cox Stadia Computer. Each.....

STADIA SLIDE RULES



No. 3110. Stadia Slide Rule, engine divided, 10 in., white facing, glass indicator, in morocco case.....

No. 3111. Stadia Slide Rule, like No. 3110, but 20 in., in morocco case.

This is a very simple form of Stadia Slide Rule. When the stadia rod reading and elevation of the telescope are known the horizontal distance and vertical height can in every case be obtained at once by one setting (always to the left) of the slide. The rule can also be used for ordinary computations as the under side of the slide has a scale corresponding to the lower scale of the rule and resembling the A and B scale of the ordinary Mannheim rule. Directions are printed on the rule.

GRUNSKY STADIA REDUCTION DIAGRAM

No. 3112. Grunsky Stadia Reduction Diagram, paper, horizontal distances to 1000, differences of elevation 100, vertical angles to 30°

See price list in back of catalog.



PRICE LIST

Applying to our

GENERAL CATALOG FIFTEENTH EDITION

Revised to

1929

This Price List is published in the interest of our patrons to serve as a guide to present-day prices.

PRICES ARE SUBJECT TO CHANGE WITHOUT NOTICE.

Our sincere assurance is given that all orders will be invoiced at the lowest prices prevailing at time of purchase.



THE A. LIETZ COMPANY

Established 1882

Main Office and Factory

OAKLAND

336 Twelfth Street

SAN FRANCISCO

Store: 61 Post Street

LOS ANGELES

913 South Grand Avenue



RHODES REDUCING ARC

Patent Pending

The Rhodes Reducing Arc consists of a simple arrangement of scales on a staff or rod, combined in such a manner that distances, vertically and horizontally, to a point are readily obtained graphically when the slope distance is found by measurement.

Horizontal and vertical distances, representing the base and altitude of a right-angled triangle, are read from scales founded on a movable arc revolving about a center of definite height. The slope distance, which is the hypotenuse, is found on the fixed vertical scale. Revolving the arc and sighting the point on which the elevation is desired determines the vertical angle.

The device can be used equally well for original or final cross-sections, setting slope stakes, reference points from center line, or re-establishing the center line from reference points. A three-man party can efficiently handle the work in mountainous and rugged country.

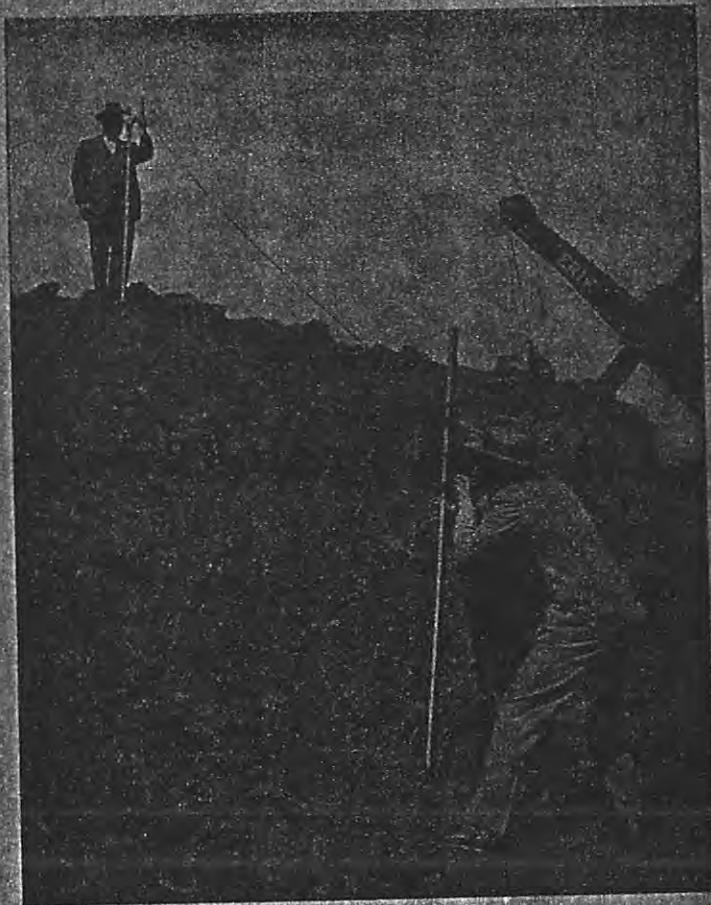
The instrument replaces the transit in the method of taking cross-sections by slope angles and slope measurements. Weighing less than seven pounds, it has the advantage of being lighter and more portable; it can be instantly set up. The device eliminates troublesome manipulations and determines elevation and horizontal distances without mathematical calculations, thus reducing possibilities of error.

No. 50. Rhodes Reducing Arc complete in box with rod and book of instructions.

Code Word, ECARO

\$125.00

A special booklet fully describing the Rhodes Reducing Arc will be sent on application.



TRANSITS—THEODOLITES

1	BUGBEAR	Page 55	\$310.00
2	BUGGY	Page 57	\$355.00
3	BUGLEHORN	Page 59	\$404.50
3W	BUGLESONG		389.50
4	BUGLER	Page 61	\$420.70
4W	BULLSEYE		405.70
5	BULLFISH	Page 63	\$509.00
5C	BULLETIN		539.00
5D	BUNGALOW	Page 65	\$547.00
5DC	BUNTING		577.00
5E	BUNTLINE	Page 67	\$450.00
5F	BUNTWELL		560.00

5G	BURDOCK (with steel center)	Page 69	\$750.00
	CULPABLE		7.50
7	BULBOUS	Page 73	\$355.00
8	BULGED	Page 75	\$415.00
8W	BULBERT		400.00
9	BULIMY	Page 77	\$426.70
9W	BULKHEAD		411.70
11	BULK TOWN	Page 79	\$490.00
11C	BULKVILLE		520.00
11E	BULLFINCH	Page 81	\$439.50
12	BULLCALF	Page 85	\$410.50
12W	BULLRUN		395.50
14C	BULWING	Page 87	\$470.00

Page 89

COMPLETE LIST OF FEATURES APPLICABLE TO LIETZ INSTRUMENTS

Code Word		
CULLYISM	Horizontal verniers reading to 30 seconds	\$15.00
CULMINATE	Horizontal verniers reading to 20 seconds	30.00
CURABLE	Horizontal verniers reading to 10 seconds on 10" plate	45.00
CUPOLA	Stadia hairs fixed	4.50
CUPRIC	Disappearing stadia hairs	9.00
CULPRIT	Variation ring to compass	15.00
CULTIVATE	Arrangement for offsetting right angles	7.50
CULPABLE	Gradienter attachment to vertical motion with movable head (see page 69)	20.00
CULVERIN	Constructed with three leveling screws instead of four	10.00
CUMBER	Three leveling screws shifting center	30.00
CULTRATED	Striding level to axis of telescope	25.00
DIAMOND	Beaman Stadia Arc	18.00
CULTURE	Reversion level with protective housing in lieu of ordinary	25.00
DIAGNOSE	Level for vernier arm for control of zero on vernier	14.25
CUMBERSOME	Prism to eye-piece with neutral glasses (see page 88)	3.50
CUTLERY	Colored glass object cap	3.50
CUTLET	Colored glass eye-piece cap	4.00
CUTAWAY	Colored glass in shutter of cap	30.00
CUTLASS	Elbow zenith eye-piece	7.50
CUMSHAW	Guard to vertical circle	40.00
CUPBEARER	Vertical circle graduated on the periphery with guard	30.00
CURATIVE	Vertical circle with two opposite verniers in lieu of single	30.00
CURBING	Two vernier microscopes	22.50
CUTWORM	Mining bracket for mounting transits in mines	37.50
CUPLING	Lateral adjustor for transits with four leveling screws	3.50
CURLY	One extension leg in lieu of one split leg	10.50
CUMBRANCE	Full extension tripod instead of straight legs	2.00
CURTAIN	Protection bag, silk, waterproof	No charge
CUTWATER	Inverting eye-piece (made to order only)	6.00
CUNEIFORM	Reflector for illuminating cross hairs	30.00
CURBLES	Compass needle in box on plate, 4 1/2" long	22.50
CYCLOID	Leather cover for transit box with shoulder strap	.75
CUTEX	Bottle of fine instrument oil	

SOLAR ATTACHMENTS

Page 90	
16 CUMBROUS	\$ 90.00
Page 91	
16S CURATOR	\$162.50
Page 92	
16B CUTICLE	\$ 78.00
17D CUSTARD	9.00
Page 93	
17 CUNEATED	\$ 60.00
Page 95	
19 BUMBOAT	\$225.00
Page 97	
19G BUMBRAY	\$350.00
Page 99	
20 BUMPER	\$195.00
20T BURGESS	210.00
Page 101	
20G BURGUNDY	\$900.00
Page 102	
21 BURROW	\$135.00
Page 103	
21C BURSAR	\$150.00

PARTS OF TRANSIT SUSCEPTIBLE TO LOSS

(Prices on Application)

Page 107

PARTS OF LEVELS SUSCEPTIBLE TO LOSS

(Prices on Application)

LEVEL VIALS

Level vials for telescopes of Transits and Levels, per inch of length	\$1.50
Level vials for Plate and Standard of Transits (unmounted)	2.25
Circular Level vial (as furnished with our Hydrographic Y Level and Alidade)	6.00
Plain Level vials, not graduated, 1 to 4 inches long	.60
Plain Level vials, not graduated, 4 1/2 to 6 inches long	1.25

COMPLETE LIST OF FEATURES APPLICABLE TO LIETZ LEVELS

Code Word		
CUPID	Mirror to control bubble from eye end	\$15.00
CUPOLA	Stadia hairs fixed, set 1:100	4.50
CULTURE	Reversion level to telescope	18.00
CULVERIN	Constructed with 3 leveling screws instead of four	20.00
CURTAIN	Silk protection bag (waterproof)	2.00
CUMBRANCE	Full extension tripod in lieu of straight leg	10.50
CUTEX	Bottle of fine instrument oil	.75
CUTWATER	Inverting eye-piece (made to order)	No charge
CURLY	One extension leg in lieu of straight leg	3.50

Page 104

Tempered Steel Adjusting Pins for instrument adjustments	Each	\$.10
Tempered Steel Adjusting Pins, large size for Y levels		.10
Phosphor Bronze Adjusting Pins for setting off variation		.10
Screwdriver and Wrench combined		1.00
Camel Hair Brush for instruments		.75

ALIDADES AND PLANE TABLE OUTFITS

Page 111

31	CORDATE	\$200.00
	CUMBERSOME	14.25
	CULPABLE	7.50
	DIAGNOSE	25.00
	DROUGHT	15.00
	DIALECT	No charge
	DIALOGUE	25.00
	DIAMOND	15.00
	CUTWATER	No charge
	DIBBER	22.50
	DICKY	4.50

Page 113

34B	DEMOLISH	\$ 75.00
34BE	DENDRITE	92.00
34C	DEMON	40.00
34CE	DENDROID	57.00
34F	DRAFTING	9.00
34FF	DRAGON	7.50
34H	DRAWN	6.00
34J	DREDGE	7.50
34JJ	DRIBLET	6.75
34K	DRIFTAGE	6.50
34L	DROPPED	8.00
34M	DRYAD	1.25
34N	DRYDOCK	2.50
34MM	DRYING	1.00
34NN	DRYSALT	2.00

DUALIST	3.00
DUBLING	1.60
DUCAL	1.60
DUCKING	1.00
DUCTILE	1.40
DUDEEN	.25
DUENA	6.00
DUFFER	8.00

Page 115

32	CORDWAIN	\$200.00
32LC	CORDWEIGHT	212.00
	CUMBERSOME	14.25
	CULPABLE	7.50
	DIAGNOSE	25.00
	DROUGHT	15.00
	DIALECT	No charge
	DIALOGUE	25.00
	DIAMOND	15.00
	CUTWATER	No charge

Page 117

33	CORIANDER with Bea-	
	man Arc	\$215.00
	DIAGNOSE	25.00
	DIALECT	No charge
	DIALOGUE	25.00
	CUTWATER	No charge

Page 118

34 1/2 CE	DENTARY	\$ 47.00
34 1/2 CEC	DERBY	14.00
34 1/2 CEH	DERMIC	3.00
34FF	DRAGON	7.50
34H	DRAWN	6.00
34JJ	DRIBLET	6.75
34K	DRIFTAGE	6.50

Page 119

35 1/2	CORMORANT	\$ 16.00
36A	CORONAL	22.50
36C	CORRIDOR	10.00
34H	DRAWN	6.00
34K	DRIFTAGE	6.50
34A	DROUGHT	15.00
34MM	DRYING	1.00
34NN	DRYSALT	2.00

Page 121

38S	EAGLET	\$ 26.00
38L	EARING	26.00
39S	EARLDOM	35.25
39L	EARTHY	35.25
038S		5.60
038L		5.60
039S		7.20
039L		7.20
041CE		5.40
042A		1.95
042B		5.50
042C		1.90
042D		1.65
042E		.60
042F		.45
042G		.55
43		8.25
043A		2.25
043B		1.40
043C		.50
44A		18.50
44B		15.00

Page 122

46	EBONITE	\$ 80.00
46 1/2	EBURINE	Discontinued

Page 123

48	EBYING	\$95.00
58	ECHELON	16.50
59	ECHINATE	Discontinued

Page 124

65	EDGETOOL	On application
66	EDICTOR	On application

Page 125

		Each
70		\$ 1.20
70A		1.40
70B		1.75
71		2.00
74		Discontinued
75		1.25
76		2.00
77		2.50
78		3.00
79		3.00
80		3.00
79H		7.50
81		.70
83		5.00
84		1.00

Page 126

		Each
85		\$ 1.50
86		1.65
87		1.80
88		2.20
89		2.75
90		4.00
91		5.00
95		Discontinued
96		Discontinued

Page 127

		Each
100		Discontinued
101		.90
103		Discontinued
104		2.50
105		2.75
106		4.20
107		Discontinued
107A		Discontinued
108		Discontinued
108A		Discontinued

Page 128

		Each
109		\$ 5.25
110A		7.50
110B		8.75
112	EDUCATING	15.00
117	EDUCATION	5.00

Page 129

		Each
126A		\$ 4.00
126B		5.00
127A		Discontinued
127B		Discontinued
128		Discontinued
129A		2.70
129B		Discontinued
130		1.50

Page 130

		Each
132A		\$ 2.70
135		6.75
136		Discontinued
138		7.00

Page 154		Each
332		\$ 60.00
332A		60.00
334		54.00
334A		45.00
334B		80.00
335		4.50
335A		7.00
338		Discontinued

Page 156		Each
345	FIREBALL	\$100.00
Rating Table	FIRKIN	17.50
347	FISHMAW	110.00
Rating Table	FIRKIN	17.50

Page 157		Each
348	FISSURE	\$ 90.00
Rating Table	FIRKIN	17.50
346A		.10
346B		6.00
346C		\$ 7.50
346D	FIRSTLING	20.00
346E		.75
346F		.50
346G		.40
346H		.35
346I		.75
346J		5.50
346K		5.00
346KK		.40
346M	Wrench & Screwdriver	1.50
346N		.35

Page 164

PRICE LIST HENSOLDT PRISM BINOCULARS

Model	Magnification	Dia. of Objective	Each	
375A	Dialyt 5 X	5 times	18 Millimeters	\$ 54.00
B	Dialyt 6 X	6 times	30 Millimeters	59.00
C	Dialyt 6 X	6 times	36 Millimeters	66.00
D	Dialyt 6 X	6 times	42 Millimeters	72.00
E	Dialyt 8 X	8 times	36 Millimeters	68.00
F	Dialyt 8 X	8 times	42 Millimeters	75.00
G	Dialyt 10 X	10 times	50 Millimeters	95.00

376—Monoculars half price of Binoculars.

Page 165

Model	Magnification	Dia. of Objective	Each	
380A	Teljadg	6 times	30 Millimeters	44.00
B	Telachtar	8 times	30 Millimeters	55.00

Note: 25 Millimeters are equal to one inch.

385			11.50
Tripod extra			6.00

Page 158		Per C
349		\$ 4.00
349A		Each
350	FIXITY	3.00
351	FLAGMAN	35.00
351A	FLAMBAGE	19.50
353	FLAMINGO	21.50
355	FLIRTING	25.00
		40.00

Page 160		Each
360	FLANKER	\$ 65.00
360A	FLASHING	75.00
360B	FLEXOR	75.00
360C	FLINCH	75.00

Page 161		Each
362	FLINDER	\$ 95.00
362A	FLIPPER	105.00
362B	FLOCKER	105.00
362C	FLOORER	105.00

Page 162		Each
365A		Per C
365C		5.00
		5.00
365E		Each
365F		3.20
365G		1.10
365H		.60
365J		.35
365K		.60
		1.75

Page 162		Each
367	FLORAN	\$325.00
368	FLORATO	1.25

Page 166		Each
390		\$ 15.00
392		18.75
393		20.00
394		24.50

Page 167		Each
400	FLORIST	\$ 6.00
401	FLORY	6.00
402	FLOSH	6.00
406	FLOUNDER	6.00
406A	FLOURY	1.65
406B	FLOWBIT	2.20
408	FLOWERET	2.75
		1.65

Page 169		Each
410	FLUFF	\$ 22.50
411	FLUID	20.00
412	FLUKE	18.00
413	FLUNK	Discontinued
414	FLUSH	Discontinued
415	FLURRY	Discontinued
421	FLUTIST	Discontinued
422	FLUWAL	18.50
423	FLUX	17.00
425	FLUXION	17.00
428	FLYBLOW	15.00
430	FLYKITE	19.50
431	FLYWHEEL	11.50
437		11.50
438		5.00
438	in lieu of ordinary	Discontinued
439		Discontinued
440		3.00
441	FOAM	.50
442	FOCAL	3.50
446	FOEMAN	4.00
447	FOGBANK	21.50
449	FOGBELL	19.50
		5.00

Page 171		Each
450	FOILER	\$ 17.50
451	FOISTER	21.00
454	FOLDEROL	21.00
455	FOLIOLE	17.50
460	FOLLICLE	21.00
461	FOLLOWER	11.50
462	FOLLY	13.50
465A	FOMER	16.00
465B	FONDU	3.75
465C	FONTAL	4.65
466A	FOOTBALL	5.25
466B	FOOTMAN	4.00
466C	FOOTPAD	4.60
467A	FORAGE	5.65
467B	FORAMEN	4.40
467C	FORAY	5.20
468	FOREBOW	6.10
469	FORECEST	6.60
		5.50

Page 172		Each
470A	FORELAND	\$16.50
470B	FORELOCK	22.00
471A	FORERUN	16.50
471B	FORESAIL	22.00
472A	FORESTAY	3.25
472B	FORETOP	3.25
472-2S	FOREWIND (pair)	7.50

Page 173		Each
474		\$ 1.35
475		1.75
476		2.25
477		2.65
478		3.30
479		3.75
480		4.30
481		5.50
482		7.00
484A		.30
484C		.30
485A		(per yard) .04
485B		(per yard) .04
485C		(per yard) .04
486		(per yard) .06

Page 174		Each
490		\$.75
515		.60
516A		.75
516B		.90
516C		1.10
516D		1.75
520		.60

Page 175		Each
521		\$ 3.00
521A		5.00
522		Discontinued
522A		Discontinued
523		Discontinued
523 1/2		3.75
524		Discontinued
525		Discontinued
526		Discontinued
526A		1.75
528B		2.50
528C		.15
531A		.40
531B		1.00
532A		(1000) 18.00
532B		(1000) 18.00

Page 176		Per Set
534		\$ 2.25
535		2.60
536		1.40
537		1.50
539		2.10
545		Each
547		.35
548		Discontinued
549		3.75
550		3.20
551		(per yard) .30
		(per yard) .20

Page 177		Each
5100		\$ 10.50
5150		14.00
5200		16.50
5300		25.00
5066		9.10
5132		14.00
5082M		10.20
5100M		11.60

Page 377		Each
2975 New No. 2976		\$ 1.60
2980		6.25
2980M		6.25
2984		6.25
2985		13.50
2989		17.50

Page 378		Each
2994		\$10.00
3024	Discontinued	
3029	Discontinued	

Page 379		Each
3034		\$ 8.50
3044		10.00

Page 380		Each
3060A		\$.75
3060B		1.00
3062A		.35
3062B		.50
3070		2.50
3071		3.00
3072		2.50
3073	5 in.	.45
	10 in.	.65
	16 in.	1.00
	20 in.	1.25
3074A	5 in.	1.15
	10 in.	1.50
	16 in.	2.50
	20 in.	2.75
3074B	5 in.	2.50
	10 in.	3.00
	16 in.	4.00
	20 in.	4.25

BK. 1 New No. 3070		.50
BK. 2	Discontinued	
BK. 3	Discontinued	
BK. 4	Discontinued	

Page 381		Each
3075		\$ 9.00
3075G		2.00
3080		8.25

Page 382		Each
3082	Discontinued	

Page 383		Each
3090	Discontinued	

Page 384		Each
3092	Discontinued	
3092A	Discontinued	
3092B	Discontinued	
3092C	Discontinued	
3092D	Discontinued	
3092X	Discontinued	

Page 385		Each
3094	Discontinued	
3095	Discontinued	
3096	Discontinued	

Page 386		Each
3097		\$ 1.40
3098		1.40

Page 387		Each
3104		\$ 1.50
3110		6.50
3111		16.00
3112		.65

Page 388		Each
3155	8 in.	\$.25
	10 in.	.35
	12 in.	.40
3156	6 in.	.25
	8 in.	.35
	10 in.	.40
3175	8 in.	7.75
	10 1/2 in.	9.00
	15 in.	13.75
3176	8 in.	9.00
	10 in.	11.50
	12 in.	13.75

Page 389		Each
3180	4	\$.30
	6	.40
	7	.45
	8	.50
	9	.65
	10	.75
	12	1.05
	14	1.70
	16	2.40
	18	3.40
3181	4	.35
	5	.40
	6	.45
	7	.55
	8	.70
	9	.80
	10	.95
	12	1.55
	14	2.40
	16	3.40
	18	4.90
3182	4	.45
	6	.55
	8	.70
	10	1.00
3185	8	1.40
	9	1.50
	10	1.55
3186	6	1.40
	7	.50
	8	.55

3192	7	\$ 5.00
	10	7.50
3193	8	1.25
	11	1.75

Page 390		Each
3192	7	\$ 5.00
	10	7.50
3193	8	1.25
	11	1.75

Page 391		Each
3194		\$ 1.00

Page 392		Each
3200	Per set	\$ 3.50
3201	" "	3.00
3205	" "	4.00
	Each	.85
3208	Per set	6.00
	Each	1.25

Page 393		Each
3320	Full sheets, 20x50	\$12.00
	Running inch	.30
	Square inch	.02 1/2
3221	Full sheets, 20x50	9.00
	Running inch	.20
	Square inch	.01 1/2
3222	Full sheets, 20x50	6.00
	Running inch	.15
	Square inch	.01
3223 and 3224		
	Full sheets, 20x50	3.00
	Running inch	.10
	Square inch	.00 1/2

3230	Amber	4.30
3232		5.50
3233		4.30
3234		9.20

Page 394		Each
3240		\$ 2.40
3242		1.60
3244		2.25
3246	Discontinued	

Page 395		Each
3250	1	\$.35
	2	.40
	3	.45
	4	.45
3251	1	.55
	2	.60
	3	.70
	4	.70
	5	.70
	6	.65
	7	.70
	8	.55
	9	.70
	10	.85
	11	.55
	12	1.30
	13	2.00

Page 396		Each
3255-36		\$.90
42		.95
48		1.15
60		1.60
3256-24		.75
30		.85
36		.90
42		.95
48		1.15
60		1.60
3260		3.00
3265		32.00

Page 397		Each
3270	Discontinued	
3271		\$ 1.00
3272		1.95
3275	Discontinued	
3276	Discontinued	
3278		2.35
3279		3.95

Pattern No.	Page 399	Each
3290	-1	\$ 1.50
	2	1.50
	3	1.50
	4	1.50
	5	1.50
	6	1.50
	7	1.50
	8	1.50
	9	1.50
	10	1.50
	11	1.50
	12	1.50
	13	1.50
	14	1.50
	15	1.50
	16	1.50
	17	1.50
	18	1.20
	19	.90
	20	.90
	21	.90
	22	.80
	23	.80
	24	1.20
	25	.80
	26	1.50
	27	.90
	28	.90
	29	.90
	30	.80
	31	.90
	32	.90
	33	.90
	34	.90
	35	.90
	36	.65
	37	.65
	38	.65
	39	.65
	40	.65
	41	.65