DIETZ COMPANY
SAN FRANCISCO U.S.A.

1919

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: 632-648 COMMERCIAL ST.
SAN FRANCISCO, U. S. A.

SLIDE RULES

The Slide Rule is an indispensable aid to anyone who in his business is called upon to make calculations. The principles with which one must be familiar are few and simple and are easily mastered with little practice.

Abstract from Kent's Mechanical Engineers' Pocket Book, 9th Edition, 1916.

The slide rule is based on the principles that the addition of logarithms multiplies the numbers which they represent, and subtracting logarithms divides the numbers. By its use the operations of multiplication, division, the finding of powers and the extraction of roots, may be performed rapidly and with an approximation to accuracy which is sufficient for many purposes. With a good 10-inch Mannheim rule the results obtained are usually accurate to $\frac{1}{4}$ of 1 per cent. Much greater accuracy is obtained with cylindrical rules like the Thacher.

The rule consists of a fixed and a sliding part both of which are ruled with logarithmic scales; that is, with consecutive divisions spaced not equally, as in an ordinary scale, but in proportion to the logarithms of a series of numbers from 1 to 10. By moving the slide to the right or left the logarithms are added or subtracted, and multiplication or division of the numbers thereby effected. The scales on the fixed part of the rule are known as the A and D scales, and those on the slide as the B and C scales. A and B are the upper and C and D are the lower scales. The A and B scales are each divided into two, left hand and right hand, each being a reproduction, one half the size, of the C and D scales. A "runner," which consists of a framed glass plate with a fine vertical line on it, is used to facilitate some of the operations. The numbering on each scale begins with the figure 1, which is called the "index" of the scale. In using the scale the figures 1, 2, 3, etc., are to be taken either as representing these numbers, or as 10, 20, 30, etc., 100, 200, 300, etc., 0.1, 0.2, 0.3, etc., that is, the numbers multiplied or divided by 10, 100, etc., as may be most convenient for the solution of a given problem.

The following examples will give an idea of the method of using the slide rule.

Proportion.—Set the first term of a proportion on the C scale opposite the second term on the D scale, then opposite the third term on the C scale read the fourth term on the D scale.

Example.—Find the fourth term in the proportion 12 : 21 :: 30 : x. Move the slide to the right until 12 on C coincides with 21 on D, then opposite 30 on C read x on $D = 52.5$. The A and B scales may be used instead of C and D.

Multiplication.—Set the index or figure 1 of the C scale to one of the factors on D.

Example.—25×3. Move the slide to the right until the left index of C coincides with 25 on the D scale. Under 3 on the C scale will be found the product on the D scale, $= 75$.

Division.—Place the divisor on C opposite the dividend on D, and the quotient will be found on D under the index of C.

Example.—$750 \div 25$. Move the slide to the right until 25 on C coincides with 750 on D. Under the left index of C is found the quotient on D, $= 30$.

Combined Multiplication and Division.—Arrange the factors to be multiplied and divided in the form of a fraction with one more factor in the numerator than in the denominator, supplying the factor 1 if necessary. Then perform alternate division and multiplication, using the runner to indicate the several partial results.

Example.—$\dfrac{4 \times 5 \times 8}{3 \times 6} = 8.9$ nearly. Set 3 on C over 4 on D, set runner to 5 on C, then set 6 on C under the runner, and read under 8 on C the result 8.9 — on D.

Involution and Evolution.—The numbers on scales A and B are the squares of their coinciding numbers on the scales C and D, and also the numbers on scales C and D are the square roots of their coinciding numbers on scales A and B.

Example.—$4^2 = 16$. Set the runner over 4 on scale D and read 16 on A.

$\sqrt{16} = 4$. Set the runner over 16 on A and read 4 on D.

In extracting square roots, if the number of digits is odd, take the number on the left-hand scale of A; if the number of digits is even, take the number on the right-hand scale of A.

To cube a number, perform the operations of squaring and multiplication.

Example.—$2^3 = 8$. Set the index of C over 2 on D, and above 2 on B read the result 8 on A.

Extraction of the Cube Root.—Set the runner over the number on A, then move the slide until there is found under the runner on B, the same number which is found under the index of C on D; this number is the cube root desired.

Example.—$\sqrt[3]{8} = 2$. Set the runner over 8 on A, move the slide along until the same number appears under the runner on B and under the index of C on D; this will be the number 2.

Trigonometrical Computations.—On the under side of the slide (which is reversible) are placed three scales, a scale of natural sines marked S, a scale of natural tangents marked T, and between these a scale of equal parts. To use these scales, reverse the slide, bringing its under side to the top. Coinciding with an angle on S its sine will be found on A, and coinciding with an angle on T will be found the tangent on D. Sines and tangents can be multiplied or divided like numbers.

MANNHEIM SLIDE RULES

Best Quality   **Adjustable**
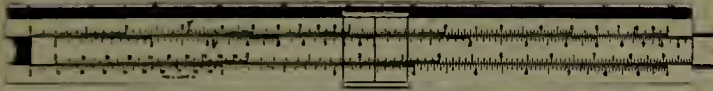
These Rules are engine divided on white celluloid facings. The divisions are clear, distinct, permanent and accurate.

No. 2960—5-inch Mannheim Rule in sewed leather case, with instructions. Each $4.50
> This Rule is subdivided as closely as the 10-inch Rule No. 2964.

No. 2962—8-inch Mannheim Rule in sewed leather case with instructions. Each 4.50
> This Rule is subdivided as closely as the 10-inch Rule No. 2964.

No. 2964—10-inch Mannheim Rule in morocco case, with instructions. Each 4.50

No. 2965—10-inch Mannheim Rule, like No. 2964 but subdivided as closely as the 20-inch Rule, in morocco case, with instructions. Each 8.00

No. 2967—16-inch Mannheim Rule in morocco case, with instructions. Each 10.00
> This rule is subdivided as closely as the 20-inch Rule No. 2969.

No. 2969—20-inch Mannheim Rule in morocco case, with instructions. Each 12.50
> Rules Nos. 2965, 2967 and 2969 have from 200 to 20 subdivisions between the prime numbers, while the shorter rules have from 100 to 10, therefore the reading is closer by at least one figure.

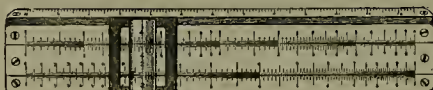No. 3060H Glass Indicator with two hairlines instead of one, add.... .20

For complete line of Indicators, Instruction Books, and Slide Rule Accessories
see pages 432 and 433.

For prevailing prices see latest supplementary price list.

MANNHEIM SLIDE RULES
Best Quality.

THE JUNIOR SLIDE RULE

No. 2970

No. 2970 Junior Mannheim Slide Rule, 5 in. long, mahogany stock with white celluloid facings. Graduations engine divided, with magnifier. In sewed leather case with instructions $4.50

The Junior Mannheim Slide Rule No. 2970 combines the accuracy of a regular 10-inch slide rule with the convenience afforded by its compactness. The subdivisions are as fine as those on a regular 10-inch rule, and by means of a neat but powerful magnifying glass attached to the indicator their value is easily ascertained with the same degree of accuracy as can be obtained on the larger rule.
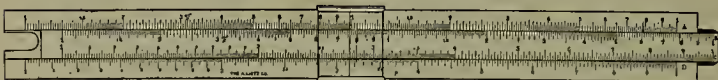
THE VEST POCKET SLIDE RULE

No. 2973

No. 2973 Vest Pocket Slide Rule, 5 in. long, thin mahogany stock with white celluloid facings. Narrow for pocket use. Complete with indicator, case and instructions $2.50

ECONOMY SLIDE RULES

No. 2974

No. 2974 Economy (Mannheim) Slide Rule, 10 inches long, divisions on white celluloid facings. Complete with indicator, case and instructions................... $3.50

The Economy Slide Rule is of the same pattern as Mannheim Slide Rule No. 2964 but is not adjustable. The A and D scales are attached to a flexible back made of a similar material as the face of the slide and scales. This construction insures a uniform expansion and contraction under all atmospheric conditions.
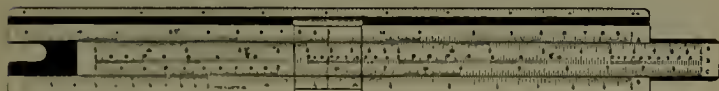
For Slide Rule Accessories see pages 432 and 433.

For prevailing prices see latest supplementary price list.

THE POLYPHASE SLIDE RULE

Best Quality   Adjustable

The Polyphase Slide Rule has in addition to the regular scales of the Mannheim Rule a scale of cubes on the edge of the rule and an inverted scale through the center of the slide. These scales may be used in connection with the others, by means of the indicator. The inverted scale enables taking three factors at one setting of the slide, and reading reciprocals by means of the indicator. Almost any combination of three factors involving square, square root, cube and cube root may be solved at one setting of the slide.

Rules are engine divided on white celluloid facings. The divisions are clear, distinct, permanent and accurate.

No. 2982—8-inch Polyphase Rule in sewed leather case, with instruc-
       tions.   Each $5.00

No. 2984—10-inch Polyphase Rule in morocco case, with instructions.
       Each 5.00

No. 2985—10-inch Polyphase Rule like No. 2984, but subdivided as
       closely as the 20-inch Rule, in morocco case, with instruc-
       tions.   Each 8.50

No. 2989—20-inch Polyphase Rule in morocco case, with instructions.
       Each 14.00

THE PRECISION SLIDE RULE
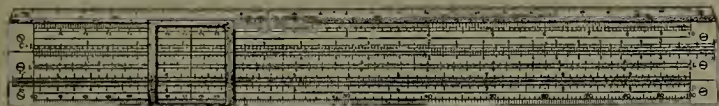
The Precision Slide Rules are similar to other Mannheim Slide Rules, but the results obtained are of a considerably greater accuracy. The increase in accuracy is obtained by making the scale length of the logarithmic unit equal to 50 cm. instead of 12.5 cm or 25 cm. The scale is not, however, made in one length of 50 cm. but in two lengths of 25 cm. each. All the other scales, including those on the back of the slide, are based on the scale length of 50 cm.; so that all calculations with this slide rule have a uniform and considerably greater degree of accuracy than those made with the ordinary slide rule.

Rules are engine divided on white celluloid facings. The divisions are clear, distinct, permanent and accurate.

No. 2994—10-inch Precision Slide Rule in morocco case, with instruc-
       tions.   Each $6.50

No. 2999—20-inch Precision Slide Rule in morocco case, with instruc-
       tions.   Each 20.00

For Slide Rule Accessories see pages 432 and 433.

For prevailing prices see latest supplementary price list.

THE ALCO SLIDE RULE

This Slide Rule differs from those hitherto ordinarily employed in that it has on its front face not only the four middle scales (two on the rule A and D; and two on the slide B and C), but also two other scales, viz., an evenly divided scale E, on the lower margin, and a logarithmic scale F, at the top, the latter consisting of three similar scales, placed consecutively.

By this arrangement, logarithms, cubes and cube roots can be directly and easily determined. With the ordinary slide rules these calculations, especially the extraction of cube roots, are somewhat complicated, and necessitate the use of the slide.

All calculations such as multiplication, division, involution, evolution, etc., are carried out with the first mentioned scales, A, B, C, D.

Engine divided on white celluloid facings. The divisions are clear, distinct, permanent and accurate.

No. 3024—10-inch Alco Slide Rule, in morocco case with instruc-
tions. Each $5.00

No. 3026—15-inch Alco Slide Rule, in morocco case with instruc-
tions. Each 12.00

No. 3029—20-inch Alco Slide Rule, in morocco case with instruc-
tions. Each 15.00

THE ELECTRIC SLIDE RULE
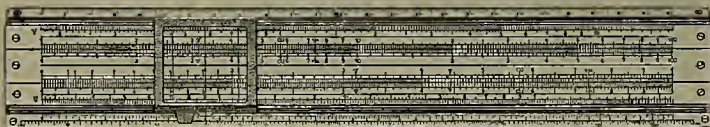
Especially evolved in response to a demand for a suitable Slide Rule for Electrical Engineers and for students in Electro-Technology.

Serves in an excellent manner the facility of calculation of all electro-technological problems. The table of constants, on the reverse of the rule, makes the reference to hand-books almost superfluous.

Engine divided on white celluloid facings. The divisions are clear, distinct, permanent and accurate.

No. 3034—10-inch Electric Slide Rule, in morocco case with direc-
tions. Each $5.50

For Slide Rule Accessories see pages 432 and 433.

For prevailing prices see latest supplementary price list.

HAZEN-WILLIAMS HYDRAULIC SLIDE RULE

No. 3044

The Hazen-Williams Hydraulic Slide Rule is used principally for determining the velocity and quantity of the flow of water in pipes and channels, but is also adapted for ordinary slide rule calculations. Special computations may also be solved by its use, as, for instance, to determine the corresponding flow at any other slope or head, when the flow of water through a pipe or system of pipes produced by a given slope or head is known; to find what size of pipe must be used to produce the same discharge for any other slope, when the discharge in a given size of pipe at a given slope is known; to compute the discharge through a compound pipe, that is, a pipe of larger diameter connecting with a pipe of smaller diameter, or a series of such pipes; to compute the friction of a given amount of water flowing through two pipes of different diameters and different lengths, freely connected at each end; to get with one setting of the slide the quantity of water corresponding to any slope; to get with one setting of the slide the quantities of water discharged by pipes of different sizes for a given slope and coefficient. In size and general appearance the rule is like an ordinary Mannheim 10-inch slide rule. On the back of the rule are several tables to aid in the convenience of computations to which the rule is applicable. Engine divided on white celluloid facings. The divisions are clear, distinct, permanent and accurate.

No. 3044—10-inch Hazen-Williams Hydraulic Slide Rule, in morocco
 case with directions $6.00

THE SPITZGLASS SLIDE RULE AND FLOW COMPUTER

The Spitzglass Slide Rule will solve quickly and simply all problems involving the flow of fluids in pipes with a greater amount of accuracy than results obtained by other formulas, as the rule is based on new experimental data. It will also accomplish all ordinary slide rule calculations. The rule is made of solid seasoned white celluloid, fastened to a durable leather folding case, convenient for the pocket. The graduations are engine divided and are clear, distinct, permanent and accurate.

No. 3047 Spitzglass Slide Rule and Flow Computer, 11 inches long,
 2½ inches wide, in leather folding case with directions.... $12.50

For Slide Rule Accessories see pages 432 and 433.

For prevailing prices see latest supplementary price list.

SLIDE RULE INDICATORS

Frameless
Indicator

Indicator with
Aluminum Frame

Indicator with
Decimal Pointer
No. 3061

When ordering specify style wanted.

No. 3060A For Mannheim Rules Nos. 2960-2965 and 2970 and 2975, each	$0.60
No. 3060B For Mannheim Rules Nos. 2967-2969, each	.80
No. 3060C For Polyphase Rules Nos. 2982-2989, each.............	1.00
No. 3060D For Precision Rules Nos. 2994-2999, each	1.00
No. 3060E For Alco Slide Rules Nos. 3024-3029, each.............	1.00
No. 3060F For Electric Slide Rule No. 3044, each	1.00
No. 3060G For Hazen-Williams Slide Rule No. 3048, each.........	.80
No. 3060H Glass Indicator with two hairlines instead of one, add....	.20
No. 3061 Indicator with Decimal Pointer, for any rule, each........	1.00

GLASSES ONLY FOR FRAMELESS INDICATORS

No. 3062A For Slide Rules up to and including 10 in. long, each....	$0.40
No. 3062B For Slide Rules over 10 in. long, each	.50

Above prices include fitting.

BOOKS ON THE SLIDE RULE

No. 3064 The Mannheim Slide Rule, Complete Manual (furnished with Mannheim Rules), each	$0.50
No. 3065 Instructions for the use of the Slide Rules, published by A. W. Faber, each	.75
No. 3066 "The Use of the Slide Rule," by F. A. Halsey, Fourth Ed., 18 Ill., 7 folding plates, each	.50
No. 3067 "The Slide Rule," by Chas. N. Pickworth. A Practical Manual of Instruction, Fifth Ed. Illustrated, each........	1.00
No. 3068 "Solution of Railroad Problems by the Slide Rule," by E. R. Carey, 43 illustrations, each	1.00
No. 3069 "The Slide Rule," by R. G. Blaine. A simple explanation of the theory and use. Illustrated, each	1.00

For prevailing prices see latest supplementary price list.

MAGNIFIERS FOR SLIDE RULES

No. 3071

No. 3072

No. 3070 Detachable Magnifier for Slide Rule Indicator. Each...... $2.00
  When ordering please specify for which Slide Rule the Magnifier is wanted.

No. 3071A Indicator with full-size Magnifier for 5-inch Slide Rules.
  Each 2.50

No. 3071B Indicator with full-size Magnifier for 8, 10, 16 and 20 inch
  Slide Rules.   Each 2.75

No. 3072A Indicator with half-size Magnifier for 5-inch Slide Rules.
  Each 2.00

No. 3072B Indicator with half-size Magnifier for 8, 10, 16 and 20 inch
  Slide Rules. Each 2.25

  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	8	10	16	20
Each	$0.30	$0.35	$0.40	$0.60	$0.80

No. 3074A Sewed Leather Case for Slide Rules.

Inches long—	5	8	10	16	20
Each	$1.00	$1.15	$1.25	$1.50	$2.00

No. 3074B Sewed Leather Case with space for Magnifier.

Inches long—	5	8	10	16	20
Each	$1.70	$1.80	$2.00	$2.50	$3.00

  For prevailing prices see latest supplementary price list.

NOTICE

  Owing to the large variety of Slide Rules now being offered for varied or special purposes, we have listed only such types as are widely used. We are in position to furnish any type of Slide Rule which may better suit the requirements of our trade.

THE IMPROVED HALDEN CALCULEX

2⅜ inches diameter by ¼ 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 $5.00

FOWLER'S POCKET CALCULATOR

About 2¾ inches diameter by ¼ inch thick.

Front   Back
No. 3077
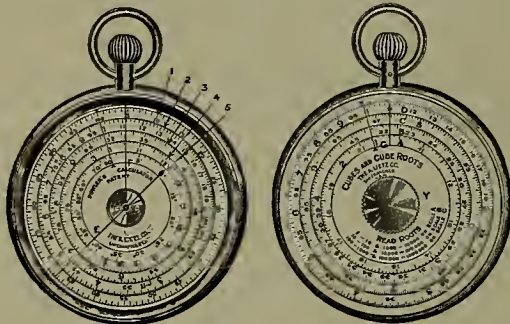
With the aid of Fowler's Pocket Calculator any problems of multiplication and division, fractions, squares and square roots, cube and cube roots, logarithms, areas of circles, sines, cosines and tangents of angles, etc., are easily solved. The dials are engine divided, and the instrument is strong, compact and of convenient size for carrying. Full directions accompany each instrument.

No. 3077 Fowler's Pocket Calculator with directions................................ $6.50

For prevailing prices see latest supplementary price list.

THE BOUCHER CALCULATOR
About 2 inches diameter by 9/16 inch thick.

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........... $14.00
No. 3081, same as No. 3080 but enameled
    dial 8.50

Nos. 3080-81

SEXTON'S OMNIMETRE

Functions: Logarithms, Numbers, Squares, Square Roots, Cubes, Cube Roots, Sines, Tangents, Versed Sines, Secants.

No. 3084-1 Sexton's Omnimetre No. 1, diam. 7¼ in., Bristol Board Discs, readings from edge of runner. Each.............. $1.00

No. 3084-2 Sexton's Omnimetre No. 2, diam. 7¼ in., non-absorbent Card Discs, reading from hair-lined runner. Lower disc perforated to facilitate manipulation. Each ... $2.00

No. 3084-3 Sexton's Omnimetre No. 3, diam. 7 in., non-absorbent Bristol Board Discs, readings from hair-lined runner. Lower disc perforated to facilitate manipulation. Milled nut to clamp disc in position when required. Character of graduations gives increased ease of reading.

No. 3084-1

Additional functions, fifth powers and fifth roots. Each... $3.00

No. 3085 Companion Instrument No. 6, diam. 6⅛ in. This instrument consists of a cardboard disc, a transparent disc and a transparent runner. Printed upon the card disc is a logarithmic scale about 13½ feet long, arranged in circles. The instrument is intended as a companion to the Omnimetre (although it will answer as a companion to the straight slide rule as well) for those who wish to read accurately at least four figures in the answers to problems of multiplication and division. Each $2.00

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 $\dfrac{a \times b \times c \times d}{e \times f \times g \times h}$

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-divider 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 Precision Computer is made of metal and will last indefinitely. The graduated dial is also mounted on metal. Instrument is nine inches in diameter and weighs one pound.

The Precision Computer is thin, portable, normally held by hand, but for greater convenience the tilted duplex clamp shown in illustration is provided to attach the computer to any desk edge. Instantly attached or detached it greatly enhances operation of the computer. Clamp is finely japanned with polished nickel trimmings.

No. 3090 Ross Precision Computer, complete with leather case and full directions $20.00

No. 3091 Tilted Duplex Clamp for the Ross Precision Computer, extra 2.50

For prevailing prices see latest supplementary price list.

THE ROSS RAPID COMPUTER

Solves expressions like: abc; a/bc; ab tan x; a cos x;
a sin x cos y; ab $\frac{3}{c}$; II/180 log a/bc, etc., etc.

The Ross Rapid Computer solves all numerical, trigonometric and logarithmic problems. Its numerical scales correspond to upper scales of a 40-inch slide rule; trigonometric scales correspond to those of 30-inch rule; actually practical for trigonometric work, traverses, stadia, artillery and other engineering problems. Figures quantities, capacity, unit cost, earthwork, payroll, etc., etc.; no blank movements; answer does not run off scale, each movement effective. Has 360° protractor for measuring vertical and horizontal angles. Reads as simply as an ordinary foot rule. Clamped metal arm, especially convenient to lock constants, prevents accidental shifting of scales. Proves its answers by double vernier principle. Not subject to breakage or unequal shrinkage. Eight inches diameter, made of weather and wear-proof celluloid, precise metal centering.

No. 3094 Ross Rapid Computer with sewed leather case and full
directions, complete $7.50

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, 8 inches diameter, construction like No. 3094.

No. 3095 Commercial Computer with sewed leather case and full
directions, complete $7.50

No. 3096

THE MINIATURE RAPID COMPUTER

This instrument is graduated like No. 3094 but is only 3½ inches in diameter. Numbers and scales correspondingly reduced. Made of celluloid, the scales durably protected by a transparent coating. Fits the vest pocket.

No. 3096 Miniature Rapid Computer in soft leather case and full directions ... $2.00
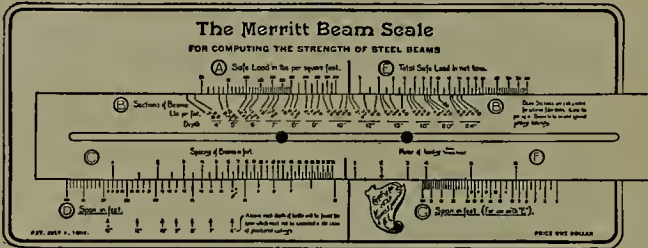
THE MERRITT BEAM SCALE

For computing the strength of steel beams.
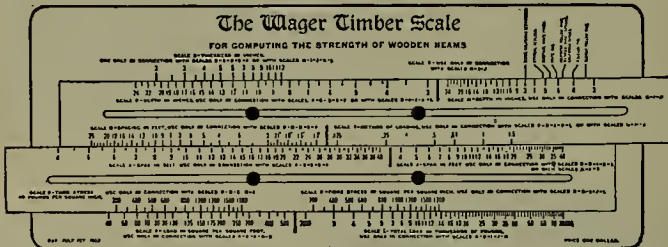

No. 3097

Absolute 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........ $1.00

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...... $1.00

For prevailing prices see latest supplementary price list.

THACHER'S CALCULATING INSTRUMENT


No. 3100A

No. 3100 Thacher's Calculating Instrument, cylinder 18 in., in polished mahogany box with full directions. Each $35.00

No. 3100A Thacher's Calculating Instrument with 3 in. reading glass sliding on brass bar, adjustable to any part of the instrument and for focus. Each 45.00

Thacher's Calculating Instrument is a device for performing a great variety of useful arithmetical calculations with rapidity and accuracy. Its operation is simple and readily learned. By its use the tedious drudgery of calculation is avoided and the chance of error eliminated.

As is shown in the illustration, the instrument consists of a cylinder 4 inches in diameter and 18 inches long, which revolves in an open framework composed of 20 angular bars held between two metal rings. The cylinder bears a scale corrsponding to the scale of the Slide Rule, which is duplicated on the exposed sides of the bars. Results can be obtained to the fourth and usually to the fifth place of figures with a surprising degree of accuracy, sufficient for nearly every requirement of the professional or business man. Examples in multiplication, division, proportion, powers or roots involving not more than three quantities, are solved by one operation, and any number of values of an algebraic function composed of two constants and a single variable may generally be found by one setting.

The useful applications of the instrument are almost unlimited; among them may be mentioned finding the stresses and sections in trusses and girders, mensuration, estimates of work and material, solving trigonometrical formulas, making and applying tables, problems in mechanical powers, machinery and hydraulics, problems in simple and compound interest, discount, prorating, the conversion of weights and measures, cost of merchandise with per cent of duty or profit added.

FULLER'S SLIDE RULE
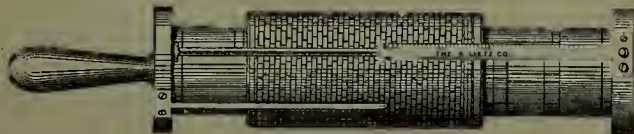
No. 3103

No. 3103 Fuller's Spiral Slide Rule, in mahogany box with directions $30.00

Fuller's Spiral Slide Rule consists of a cylinder which can be moved up or down and turned round a sleeve which is attached to the handle. A single logarithmic scale, 42 feet long, is wound round the cylinder spirally, and ratios are established by means of two pointers or indices, one attached to the handle and the other to an axis which slides in the sleeve.
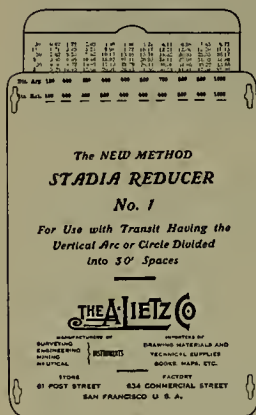
For prevailing prices see latest supplementary price list.

STADIA COMPUTORS

No. 3104 Cox Stadia Computor $0.75

The Cox Stadia Computor is a circular slide rule of about 15 inches effective length for the reduction of stadia readings. Printed on heavy cardboard, cloth bound, size 6¼x6¼, suitable for carrying in coat pocket.

THE LAMBERT STADIA REDUCER

The use of this Stadia Reducer involves the using of only such vertical angles as may be read without the use of the vernier, and taking the vertical difference and horizontal distance directly from the Reducer slide. Results are given for these angles up to 30 degrees. The height cut on the rod by the middle wire is noted for a correction.

The setting of the telescope to an angle marked by an even division on the arc can be quickly and accurately made with small chance of error, but if desired the observer may mark one side of the arc and let the distinguishing sign appear in the notes. For example, he may mark the minus side red and then an angle of —10° could read red 10°.

The results given by the Reducer are those obtained by the well-known stadia formulæ where S = the stadia distance, V = the measured vertical angle, D = the horizontal distance and H = the distance of elevation to the point sighted on the rod. Then $D = (S + f + c) \cos^2 V$ and $H = (S + f + c) \frac{1}{2} \sin 2 V$. These formulæ are practically correct for vertical heights up to 15° and give results too small from 15° up to 30° by the amounts given in the following table. Horizontal distances are given practically correct up to 30°:

Angle of inclination 15° 20° 23° 25° 27° 29° 30°
Error in vertical
  heights 0.01 0.02 0.03 0.04 0.05 0.06 0.07

These small quantities may be neglected in practice.

Stadia Reductions

After obtaining the stadia distance either by carefully adjusted wires or by a ratio table previously prepared, add the f + c for obtaining the distance argument to be noted on the top of the Reducer case. Incline the telescope to the nearest division on the vertical arc that will keep the middle wire on the rod, and note the rod reading that the middle wire cuts for a final correction. Pull out the Reducer slide until the angle of arc setting shows just above the case. On this same line on the slide and just above the distance argument on the case find the difference of elevation to the noted rod reading cut by the middle wire. Correct this by the rod reading to obtain the difference of elevation to the station occupied by the rod. Without moving the slide find the horizontal distance on the reverse side.

These tables are also to be used after the manner of using a traverse table. For example: Suppose the distance argument is 962 and the telescope is afterward inclined to an arc reading of —11° at which angle the middle wire cuts the rod at 7.21. A foresight computation would then be as follows:

ON THE FRONT SIDE		ON THE REVERSE SIDE	
For 900	—168.57	For 900	867.2
For 60	—11.24	For 60	57.8
For 2	—0.37	For 2	1.9
Rod reading	—7.21		
Difference in elev. to station.....	—187.39	Horizontal distance	926.0

The Reducer admits of being used to carry out the decimals further than is shown in the examples if greater accuracy is desired.

No. 3105 Lambert Stadia Reducer No. 1, for use with transit having the vertical circle or arc divided into 30' spaces, with instructions $2.00

No. 3107 Lambert Stadia Reducer No. 2, for use with transit having vertical circle or arc divided into 20' spaces, with instructions 2.00

No. 3105

STADIA SLIDE RULES

No. 3110 Stadia Slide Rule, engine divided, 10 in., white facing, glass indicator, in morocco case $4.50

No. 3111 Stadia Slide Rule, like No. 3110 but 20 in., in morocco case 12.50

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.

No. 3112 Grunsky Stadia Reduction Diagram, paper, horizontal distances to 1000, differences of elevation 100, vertical angles to 30° .... .50

THE CALCULATOR ADDING MACHINE
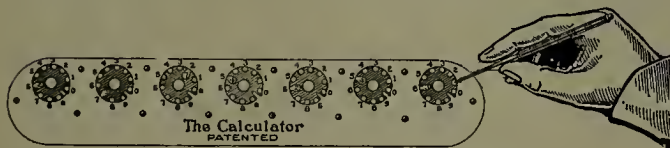
No. 3110

No. 3115 Calculator Adding Machine, complete in heavy pebbleboard carton, and book of instructions................... $7.50

This Adding Machine has a capacity of 9,999,999 or $99,999.99 and it will give the correct result of any problem in addition, subtraction, multiplication or division which falls within this limit. It is constructed of brass and steel throughout. Polished gunmetal finish. There is nothing to get out of order or require adjustment and it will last a lifetime.

A written five-year guarantee is furnished with every Calculator. If the machine does not remain in perfect running order, or if it proves to be defective in material, quality or workmanship, it will be replaced, without charge, by a new machine any time within five years from the date of purchase.

Every Calculator is accompanied by a nickel-steel stylus for operating and a complete book of instructions and suggestions. It is securely packed in a heavy pebble-board carton that will stand "pocket wear" and hard usage almost indefinitely.

THE MARCHANT CALCULATOR
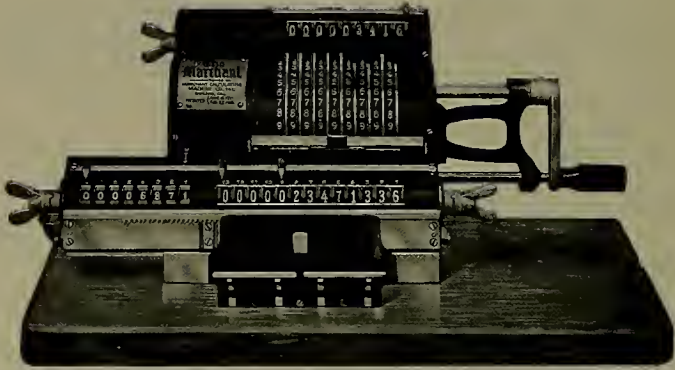
T HE value and importance of a first-class and trustworthy calculating machine to the civil engineer, construction engineer, statistician and others who have considerable figure work to handle has long been conceded.

Such a machine is a great labor and time saver, while the relief it affords from wearying brain work is incalculable.

The Marchant Calculator (illustrated above) has met this long-felt want and has filled the requirements and demands of engineers and statisticians the world over.

Pencil and slide-rule methods of figuring problems are fast becoming obsolete. The up-to-date mining or construction company can no longer afford to have its employees spending time in unnecessary hand figuring when machine calculation has been perfected to such a degree as in the Marchant Calculator.

The Marchant is built on the rotary or drum principle. This principle can be appreciated by technical men as the best for direct action functioning.

By using the drum principle all unnecessary action is eliminated, thus insuring a minimum of expense in upkeep—springs, cams and other parts used in machines of the flat-bed principle being entirely done away with.

Operation

Unlike many of the machines on the market at the present time, the operation of the Marchant can be explained and taught to the novice in a very short time, it being unnecessary to engage a special operator to perform even the most intricate problems—the Marchant motto being "Do it yourself on a Marchant."

Proof

Every calculation performed on a Marchant is instantly proved, no hidden complements to memorize, each factor and result is at all times visible to the operator. It has been found that the proof feature saves 100 per cent of the time spent on rechecking, as is often the case when using the old method of logarithms. Time and absolute accuracy are big features and important ones when engineers are crowded with work.

THE MARCHANT CALCULATOR

Models

The latest model Marchant, namely the Pony, was built with the idea of producing a light, compact calculator of such convenient size that it could be taken to the job or moved about as a piece of hand baggage, and yet having all the well-known features of the standard model.

The Pony Model is built in two styles—with and without the top register dial. The top register dial gives a complete check on all figures operating on levers, a feature not to be overlooked by the engineer who is constantly using constant multipliers and divisors.

Application

The Marchant will handle, in a fraction of the time ordinarily spent, all kinds of engineering calculations. Traverses, averages, square root, cube root, assays, assessments, formulae and tonnages can all be handled with rapidity. A typical problem of the mining industry with which the average engineer comes in contact can be explained thus:

DISTRIBUTION OF METALS

6948.82 tons ore assays as follows:

0.129 oz. gold per ton.
5.72 oz. silver per ton.
3.225% copper.

Weights

$6948.82 \times 0.129 = 896.398$ oz. gold.
$6948.82 \times 5.72 = 39747.25$ oz. silver.
3.225% of 2000 lb. $= 64.5$ lb. per ton.
6948.82×64.5 lb. $= 448198.89$ lb. copper.

Value

$896.398 \times 20.6718 = \$18530.16$.
$39747.25 \times 689 = \$27385.86$.
$448198.89 \times 0.155 = \$69470.83$.

SURVEYING CALCULATION

Bearing 34° 36′ E. distance 295.76.
Nat. cosine 0.82314; sine 0.56784.
$0.82314 \times 295.76 = 243.452$ northing.
$0.56784 \times 295.76 = 167.944$ easting.

This traverse can be figured easily on a Marchant in forty seconds.

Operation: Place distance or 295.76 on machine as constant and multiply by .82314. Leave figures on machine and interchange multiplier to .56784, getting second result. Point off seven decimal places (5+2).

A fine testimonial from one of our largest users has this to say:

"The machine proved itself so valuable in making up our cost statements and in verifying ore statements that we purchased five more Marchants. These are used by our engineers in all calculations pertaining to tonnages, averages, assays and percentages.

(Signed) "UTAH COPPER CO."

Some of the largest mining and engineering firms in this country and foreign lands are using the Marchant every day on their problems.

Among prominent users the Marchant numbers as its endorsers: Utah Iron and Steel Co., American Smelting and Refining Co., International Smelting Co., Ray Consolidated Copper, Chino Copper.

Our representative will deem it a pleasure to demonstrate the wide scope of flexibility of the Marchant. Descriptive literature and prices on request.