

*Instructions for Using the
Midget Slide Rule.*

CATALOGUE

GILSON SLIDE RULE CO., NILES, MICH.

Richardson Direct Reading Slide Rules

WITH ENGINE DIVIDED SCALES.

DUE TO OUR NEW PATENT PROCESS of making Metal Scales with black lines on a white background, it is possible to make Slide Rules that are accurate, and that will retain their accuracy indefinitely. This is not possible with wooden slide rules, because wood absorbs moisture, the camphor of the celluloid evaporates and the rule soon becomes useless for accurate work. No such trouble is experienced with Richardson Slide Rules, because the scales and the frame of these rules are made of metal. Acids, alkalis, grease or water will not injure the scales and the rule may be cleaned with soap and water, should it become soiled.

All the slides of the Richardson Slide Rules are interchangeable. Thus, No. 812 may be purchased and as many extra slides as desired. The whole rule can then be changed into a Polymetric, Binary, Log-Log, Add and Subtract or Business Man's depending upon which slides are purchased.

An instruction book "The Slide Rule Simplified", has 100 pages, with 135 illustrations and diagrams for solving the simplest as well as the most intricate problems in Civil, Mechanical and Electrical Engineering formulas. It explains a method for extending slide rule readings to seven or eight figures. The book also explains and illustrates the method of using a slide rule for solving problems in Logarithms and Trigonometry. This instruction book is sent with every slide rule.

The following illustrations are about one-half the size of our regular 10-inch slide rules. Each rule is supplied with a frameless runner and a pocket carrying case.



No. 812. - The above is a facsimile of our RICHARDSON 10-INCH MANNHEIM SLIDE RULE, having A, B, C, D, Log., Sine and Tangent Scales.

Price with case and 100-page instruction book.....\$3.00



No. 1812. - THE RICHARDSON ADD AND SUBTRACT SLIDE RULE is identical with No. 812, except that the addition and subtraction feature is included. This is the only straight slide rule that will add and subtract.

Price, with case and instruction book.....\$3.50



No. 1776. - THE RICHARDSON POLYMETRIC SLIDE RULE has all the scales of No. 812, also a cube scale and a CI or C Inverted scale. This rule will handle three factors at one setting, and it will also give cube roots, square and two-third roots and the corresponding powers. Our largest seller and the best general purpose rule. Price, with case and instruction book ----- \$4.00



No. 1860 L-L—THE RICHARDSON LOG-LOG SLIDE RULE will solve the simplest as well as the most difficult formulas which are found in Mechanical, Electrical and Civil Engineering practice. Problems involving fractional powers and roots, natural and hyperbolic logarithms and unknown exponents can be easily solved with this rule. Price, with case and instruction book ----- \$4.00

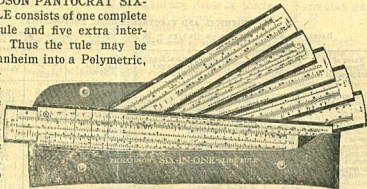


No. 1860—THE RICHARDSON BUSINESS MAN'S SLIDE RULE will give the amount of interest due on any principal, at any rate, for any length of time. It is especially designed for computing commercial problems, cost, estimation and distribution, division of freight rates, wages by the month, day or week for any number of days or hours at any rate per hour, unit cost and selling price, string discounts off of the list price, percentages, proportion, rule of three, etc. A 20 page book especially written and illustrated with 24 cuts shows just how to use this rule for solving commercial problems. Price, with instruction book and case..... \$5.00

No.1901 RICHARDSON POLYMETRIC FIVE-INCH SLIDE RULE takes up no more room than a small pocket comb. It has a CI Scale and the Direct Reading feature. Price with a full leather case and 100 page instruction book, \$3.00



THE RICHARDSON PANTOCRAT SIX-IN-ONE SLIDE RULE consists of one complete Richardson Slide Rule and five extra interchangeable slides. Thus the rule may be changed from a Mannheim into a Polymetric, Business Man's, Binary, Add and Subtract or Log-Log rule as desired. Several rules of other makes would have to be purchased at a cost of from \$25 to \$40 to get the equivalent of the Pantocrat.



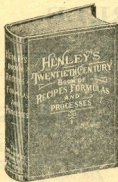
You save from \$15 to \$25 by making this purchase. Each rule with the extra slides come in a genuine leather pocket case, and the complete outfit is about the size of an ordinary 10-inch slide rule and case.

If you want to know all there is to know about slide rules, send for this Six-In-One Rule. Price, with 100 page instruction book and leather case \$10.00

CHEMICAL AND ELECTROCHEMICAL EQUIVALENTS

BASED ON ATOMIC WEIGHT OF OXYGEN = 16 AND ELECTROCHEMICAL EQUIVALENT OF SILVER.
= .001118. THE NAMES OF NON-METALLIC ELEMENTS ARE PRINTED IN ITALICS.

Name of Element and Symbol	Atomic Weight	Common Valence	Electrochemical Equivalent Grams per Coulomb	Name of Element and Symbol	atomic weight	Common Valence	Electrochemical Equivalent Grams per Coulomb
Aluminum, <i>Al</i> ...	27.1	III	.00009354	Mercury, <i>Hg</i> ...	200.0	I-II	.00207172— .00103586
Antimony, <i>Sb</i> ...	120.2	III-V	.00041504— .00024902	Nickel, <i>Ni</i>	58.7	II-III	.00030402— .00020272
Arsenic, <i>As</i>	75.0	III-V	.00025997— .00015538	Nitrogen, <i>N</i>	14.04	III-V	.00004848— .00002911
Barium, <i>Ba</i>	137.4	II	.00071164	Oxygen, <i>O</i>	16.0	II	.00008287
Bismuth, <i>Bi</i>	208.5	III-V	.00071992— .00043195	Palladium, <i>Pd</i> ...	106.5	IV	.00027585
Boron, <i>B</i>	11.0	III	.00003802	Phosphorus, <i>P</i> ...	31.0	III-V	.00010700— .00006422
Bromine, <i>Br</i>	79.96	I	.00082827	Platinum, <i>Pt</i> ...	194.8	IV	.00050446
Cadmium, <i>Cd</i> ...	112.4	II	.00058216	Potassium, <i>K</i> ...	39.15	I	.00040554
Calcium, <i>Ca</i>	40.1	II	.00020758	Selenium, <i>Se</i> ...	79.2	II	.00041020
Carbon, <i>C</i>	12.0	IV	.00003108	Silicon, <i>Si</i>	28.4	IV	.00075346
Chlorine, <i>Cl</i>	35.45	I	.00036721	Silver, <i>Ag</i>	107.93	I	.00111800
Chromium, <i>Cr</i> ...	52.1	II-VI	.00026984— .00008991	Sodium, <i>Na</i>	23.05	I	.00023877
Cobalt, <i>Co</i>	59.0	II-III	.00030558— .00020375	Strontium, <i>Sr</i> ...	87.6	II	.00045371
Copper, <i>Cu</i>	63.6	I-II	.00065881— .00032940	Sulphur, <i>S</i>	32.06	II	.00016006
Fluorine, <i>F</i>	19.0	I	.00019681	Tellurium, <i>Te</i> ...	127.6	II	.00060088
Gold, <i>Au</i>	197.2	III	.00069087	Thallium, <i>Tl</i> ...	204.1	I-III	.00211419— .00070470
Hydrogen, <i>H</i>	1.008	I	.00001044	Thorium, <i>Th</i> ...	232.5	IV	.00060215
Iodine, <i>I</i>	126.85	I	.00131399	Tin, <i>Sn</i>	119.0	II-IV	.00064634— .00030817
Iron, <i>Fe</i>	55.9	II-III	.00028952— .00019298	Tungsten, <i>W</i> ...	184.0	IV-VI	.00047680— .00031769
Lead, <i>Pb</i>	206.9	II-IV	.00107160— .00063585	Uranium, <i>U</i> ...	239.5	IV-VI	.00062027— .00041352
Lithium, <i>Li</i> ...	7.03	I	.00007282	Vanadium, <i>V</i> ...	51.2	III-V	.00017682— .00010607
Magnesium, <i>Mg</i>	24.36	II	.00012617	Zinc, <i>Zn</i>	65.4	II	.00033873
Manganese, <i>Mn</i>	55.0	II-VII	.00028486— .00008142				



HENLEY'S Twentieth Century Book of Recipes, Formulas and Processes. Edited by Gardner D. Hiscox, M. E.

800 large octavo 6x9 1/2 pages

Contains over 10,000 selected and tested scientific chemical, technological and practical Recipes and Processes, including hundreds of so-called trade secrets for every business.

A book to which you may refer with confidence that you will find what you are looking for. A mine of information, up-to-date in every respect; contains an immense number of formulas that are not found in any other book.

To present here even a limited number of the subjects which find a place in this valuable work would be difficult. Suffice to say that in its pages will be found matter of intense interest and immeasurable practical value to the scientific amateur and to him who wishes to obtain a knowledge of the many processes used in the arts, trades and manufactures, a knowledge which will render his pursuits more instructive and remunerative.

PRICE: 1920 Edition. Cloth binding, \$4.00.

MODEL MAKING, Including Workshop Practice, Design and Construction of Models. Edited by Raymond F. Yates, Editor of Everyday Engineering.

400 pages. 303 illustrations. A book for the amateur and professional mechanic. Practical; complete, easily understood. This book does not describe the construction of toys. Its pages are devoted to model engineering and the mechanical sciences associated with it. It contains descriptions with illustrations of the complete models made by some of the leading model engineers in this country. It is the only book published on this important subject

Price \$3.00.

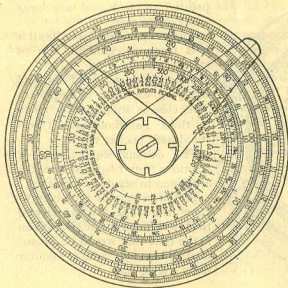
THE MIDGET SLIDE RULE

PATENTED JAN. 17, 1922.

A TIME SAVER FOR THE
ENGINEER, DRAFTSMAN, STUDENT, ACCOUNTANT,
CONTRACTOR, ESTIMATOR, CARPENTER,
CLERK, MACHINIST, ETC.

The Midget Slide Rule will solve any problem in multiplication, division, addition, subtraction and proportion. A Log-Log Scale gives any root (excepting an even root of negative 1) or power of any number. It gives the Logarithms of Numbers and the Sines, Tangents, Cosines and Cotangents of Angles. Fractions and mixed numbers can be added, subtracted, multiplied and divided, without changing them to decimals.

The front side of the Midget has eight scales as follows:- a regular C Scale, a CI [C Inverted] Scale, an Addition and Subtraction Scale, an A or Square Root Scale, a Binary Scale, a Log-Log Scale, a Fraction Scale and a Thread Scale. It is apparent that the Midget is a combination Mannheim, Polymetric, Log-Log, Binary, Addition and Subtraction Slide Rule. It has many other advantages because the eight scales of the Midget will solve many complicated problems with one setting, whereas any other slide rule would require two or more settings.

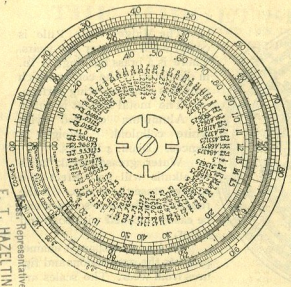


The Midget Slide Rule is constructed to wear for years. There is a brass bushing, $\frac{1}{4}$ In. in diameter, at the center which provides ample wearing surface.

The metal Midget is made of Aluminum covered with white celluloid. Weight 2 ounces. Diam. 4 Inches.

Water, grease, weak acids or alkalis will not affect the rule or erase the scales. If the rule should become soiled it can be easily cleaned with soap and water.

A clear transparent enamel protects the graduations and figures from wear. The scales are



printed in black and are large and easy to read.

The celluloid model is flexible. It is made of celluloid .032 of an inch thick.

When desired, a Fabrikoid Carrying Case can be supplied. This case is substantially made of thick Fabrikoid and it will stand hard pocket wear.

The decimal equivalents of fractions from 1-64th to 63-64ths are given to six decimal places.

A few examples are given to show the scope and capacity of the instrument. The time given is the time that would be consumed by a person who is familiar with a slide rule.

338 Harvard St., (Univ. 2330)
 CAMBRIDGE, MASS.
F. T. HAZELTINE
 Sales Representative

EXAMPLES

Find the width of a single leather belt, which will transmit 10 H. P. between two pulleys, each 30 inches in diameter and running 250 R. P.M.

Answer, $4\frac{5}{8}$ " , use a 5" belt. Time, 5 seconds. Solved in one setting.

What is the total stress on 8 Eye Bars, each $6'' \times \frac{7}{8}''$, at 12,000 Lbs. per Sq. In?

Answer, 504,000 lbs. Time, 5 seconds. One setting.

What is the cube root of 709.73? Answer, 8.92 Time 5 seconds, one setting.

Find the value of \$100 placed at 5% for nine years. Interest compounded annually. Value \$163.00 Time ten seconds.

A merchant, whose overhead is 17%, wishes to make 10% net profit. What should be the selling price of an article that cost \$1.75? Ans. \$2.40 One setting.

If a doz. articles cost him \$43.50 what should be the unit selling price? Ans. \$4.97

A 16 page, illustrated, instruction book, "The Slide Rule Manual." is sent with each rule. Simple and complete directions are given for operating a slide rule and instructions in Logarithms and Trigonometry are also included. A knowledge of these subjects may be obtained from these instructions and the usefulness of the slide rule will be greatly increased.

Price of the Midget Slide Rule (white enameled aluminum) **\$1.50**

Celluloid Midget Slide Rule, **\$1.75** Fabrikoid Case **\$.50** Extra.

Diameter of a circle $\times 3.1416$ = circumference.
 Diameter of a circle $\times .5852$ = side of an equal square.
 Diameter of a circle $\times .7071$ = side of an inscribed square.
 Square of a diameter $\times .7854$ = area of circle.
 Circumference of a circle $\times .31831$ = diameter.
 Side of a square $\times 1.128$ = diameter of equal circle.
 Square root of an area $\times 1.12837$ = diameter of equal circle.
 Square of the diameter of a sphere $\times 3.1416$ = convex surface.
 Cube of the diameter of a sphere $\times .5236$ = solidity.
 Diameter of a sphere $\times .505$ = dimensions of equal cube.
 Diameter of a sphere $\times .6067$ = length of equal cylinder.
 Square inches $\times .00095$ = square feet.
 Cubic inches $\times .0058$ = cubic feet.
 Cubic feet $\times .03704$ = cubic yards.
 Cylindrical inches $\times .0004546$ = cubic feet.
 Cylindrical feet $\times .02009$ = cubic yards.
 Cubic inches $\times .003607$ = imperial gallons.
 Cubic feet $\times .6232$ = imperial gallons.
 Millimetres $\times .03937$ = inches.
 Millimetres $\div 25.4$ = inches.
 Centimetres $\times .3937$ = inches.
 Centimetres $\div 2.54$ = inches.
 Metres $\times 39.37$ = inches.
 Metres $\times 3.281$ = feet.
 Metres $\times 1.094$ = yards.
 Kilometres $\times .621$ = miles.
 Kilometres $\div 1.6093$ = miles.
 Kilometres $\times 3280.8693$ = feet.
 Sq. Millimetres $\times .00155$ = sq. in.
 Sq. Millimetres $\div 645.1$ = sq. in.
 Sq. Centimetres $\times .155$ = sq. in.
 Sq. Centimetres $\div 6.451$ = sq. in.
 Sq. Metres $\times 10.764$ = sq. ft.
 Sq. Kilometres $\times 247.1$ = acres.
 Hectare $\times 2.471$ = acres.
 Cu. Centimetres $\div 16.383$ = cu. in.

Cu. Centimetres $\div 3.69$ = fluid drams.
 Cu. Centimetres $\div 29.57$ = fluid ounces.
 Cu. Metres $\times 35.315$ = cu. ft.
 Cu. Metres $\times 1.308$ = cu. yds.
 Cu. Metres $\times 264.2$ = gals. (231 cu. in.)
 Litres $\times 61.022$ = cu. in.
 Litres $\times 33.84$ = fluid ounces.
 Litres $\times .2642$ = gals. (231 cu. in.)
 Litres $\div 3.78$ = gals. (231 cu. in.)
 Litres $\div 28.316$ = cu. ft.
 Hectolitres $\times 2.531$ = cu. ft.
 Hectolitres $\times 2.84$ = Bu. (2150.42 cu. in.)
 Hectolitres $\times .131$ = cu. yds.
 Hectolitres $\div 26.42$ = gals. (231 cu. in.)
 Grammes $\times 15.432$ = grains.
 Grammes $\div 981$ = dynes.
 Grammes (water) $\div 29.57$ = fluid oz.
 Grammes $\div 28.35$ = oz. avoirdupois

Cylindrical inches $\times .002833$ = imperial gallons.
 Cylindrical feet $\times 4.805$ = imperial gallons.
 183.346 circular inches = 1 square foot.
 2,200 cylindrical inches = 1 cubic foot.
 Avoirdupois pounds $\times 909$ = cwts.
 Avoirdupois pounds $\times .00045$ = tons.
 Linear feet $\times .00010$ = statute miles.
 Linear yards $\times .000568$ = statute miles.
 To find the pressure in pounds per square inch of a column of water, multiply height of column in ft. by .434.
 Doubling the diameter of a circle increases its area four times.
 Area of a triangle = base multiplied by half the altitude.
 Area of a sector of a circle = one-half the length of the arc multiplied by the radius of the circle.
 To find the capacity (U. S. gallons) of cylindrical tanks, square the diameter expressed in inches, multiply by the length and by .0034.
 Grammes per cu. cent. $\div 2.77$ = lbs. p. cu. in.
 Joule $\times 7373$ = ft. lbs.
 Kilo-grammes $\times 2.2046$ = pounds.
 Kilo-grammes $\times 35.3$ = oz. avoirdupois.
 Kilo-grammes $\times 997.2$ = tons (2000 lbs.)
 Kilo-gr. p. sq. cent. $\times 14.223$ = lbs. p. sq. in.
 Kilo-gram.-metres $\times 7.233$ = ft. lbs.
 Kilo-gr. p. Metre $\times .672$ = lbs. per ft.
 Kilo-gr. p. cu. Metre $\times .662$ = lbs. p. cu. ft.
 Kilo-gr. p. Cheval $\times 2.235$ = lbs. p. H. P.
 Kilo-Watts $\times 1.34$ = Horse-power.
 Watts $\div 746$ = Horse-power.
 Watts $\times 7373$ = ft. pounds p. second.
 Caloric $\times 3.768$ = B. T. U.
 Cheval vapeur $\times .9843$ = Horse-power.
 (Centigrade $\times 1.8$) $\div 32$ = degrees Fahr.
 Franc $\times 100$ = Dollars.
 Gravity Pass = 980.94 centimetres per sec.

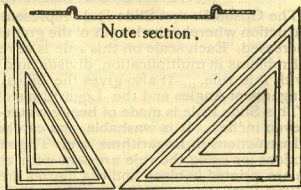
TRIANGLES.

Enameled or Nickel Plated

All Edges Ground Smooth and True. Note Section Showing Form. The advantages are many: first, edge being slightly raised from the drawing, prevents ink from running under and smearing drawing; second: easy to pick up; third: small surface in contact with drawing; fourth: accurate; fifth: moderate price.

Made in 8-in. 45 deg. and 10-in. 30 deg. by 60 deg.

Price-Each, enameled	\$.30
Nickel plated	.60
Per pair, enameled	.50
" Nickel plated	1.00



Your money back if you are not satisfied.

THE GILSON POCKET SLIDE RULE.

PATENTED OCTOBER 15, 1915

The Gilson Pocket Slide Rule represents a new departure in its construction whereby the length of the graduated scale can be greatly increased. Each scale on this rule is seventy inches long.

Problems in multiplication, division and proportion can be solved with this rule. It also gives the Sines, Tangents, Cosines and Cotangents of Angles and the Logarithms of Numbers.

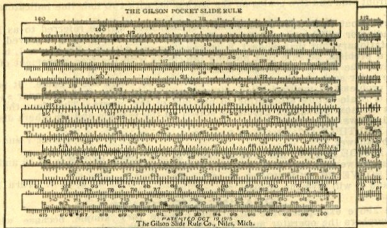
This Slide Rule is made of heavy water-proof Bristol, size four by seven inches. It is washable, and can be easily cleaned.

Instructions in Logarithms and Trigonometry, together with directions for using the rule are sent with each order. The graduations are printed in black and the figures are large and easily read.

This instrument fills the need for a low-priced dependable slide rule. Price with complete Instructions, 50 Cents Each.

THE GILSON POCKET SLIDE RULE.

Size 4x7 inches.



INSTRUCTIONS FOR USING THE MIDGET SLIDE RULE. DESCRIPTION.

The Midget Slide Rule consists of a circular disc having nine, engine-divided scales on the front side and five scales on the back side, with two hair line indicators for close reading.

Throughout these instructions the long indicator will be referred to as L and the short indicator will be termed S. It will be noted that whenever S is moved that L remains stationary, but that when L is moved S moves with it. Whenever L is moved in solving a problem, be sure that nothing interferes with the free movement of S. L always gives the answer to the problem.

The outer scale on the front side of the rule is called the C Scale. It is used for solving problems in multiplication, division and proportion. The beginner should master the C Scale before attempting to use any of the others. Therefore the problems given in the next paragraph should be solved on the C Scale and all others disregarded. Figure 1 shows the scales.

TO MULTIPLY 5×7 . Set L at 5 and S at 10. Turn L until S is at 7 and L will indicate the answer, 35.

TO DIVIDE 18 by 3. Set L at 18 and S at 3. Turn L until S is at 10 and L will indicate the answer, 6.

TO SOLVE PROPORTION $7:35::5:x$. Set L at 35 and S at 7. Turn L until S is at 5 and L will give the answer, 25.

READING THE SCALES.

The above examples were intentionally made very simple, because when using larger numbers the operator must be able to read the scale. This can be learned by studying their construction. Taking the first, or C Scale, it will be noted that begin-

ning at 10 and reading clockwise the long lines are numbered 11, 12, 13, etc., to 2. The space from 10 to 2 is divided into 10 parts. Then each of these parts is further divided into 10 smaller parts. To locate any number beginning with 1 as 1365 move L to 13, then move it clockwise six more small spaces which gives 136, now move L five-tenths of the next small division which gives 1365.

THE CI OR C INVERTED SCALE.

The second scale of the Midget Slide Rule is a CI or C Inverted Scale, which is graduated and read in counter-clockwise direction. It is used in connection with the C Scale for multiplying three numbers together at one setting as follows: To multiply $77 \times 842 \times 128$, Set L at 842 on C and S at 77 on CI. Turn L until S is at 128 on C and L will give the product as 8,300,000 on C.

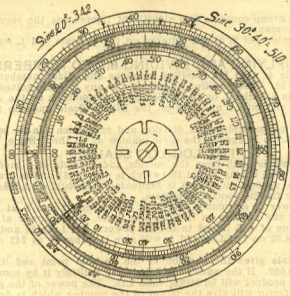
LOGARITHMS.

The third scale from the outside is the Log. Scale. This scale gives the Logarithms of all numbers (Base 10). To find the Logarithm of any number set L at the number on the C Scale and read the Logarithm of the number under L on the Log. Scale. Thus Log. 2 is .301; Log 7.5 is .875; Log. 845 is 2.927. The Log. Scale can be used for addition and subtraction. To add set L at one number and S at 00. Turn L until S is at the second number and L will give the sum. To Subtract, set L at the minuend and S at the subtrahend. Turn L until S is at 00 and L will indicate the remainder.

SQUARE ROOTS AND POWERS.

The fourth scale is called the A Scale. It can be used for multiplication, division and proportion in exactly the same manner as the C Scale.

To Extract the Square Root, first separate the number into groups of two figures each, beginning at the decimal point and going either to the right or left, as required, as 2'34'27 or .06'35'. If the left hand group contains one significant figure set L at the number on the first half of the A Scale and read the square root on the C Scale; under



L. If the left hand group contains two significant figures use the second half of the A Scale in the same manner.

To square a number set L at the number on the C Scale and L will indicate the square on A Scale.

MULTIPLYING AND DIVIDING MIXED NUMBERS.

The Binary Scale is used for handling fractions and mixed numbers between the limits of 7-64ths and 10. When desired, the answer to any problem solved on the Binary Scale can be read, as a decimal, on the A Scale. Also decimals on the A Scale can be used with fractions and mixed numbers on the Binary Scale and the result read on either scale.

Problems involving multiplication, division and proportion can be solved on either the CI, A or Binary Scale in exactly the same manner as on the C Scale.

THE LOG-LOG SCALE.

The Log-Log Scale is sixth from the outside and consists of a modified spiral of two coils. The first coil begins with 1.15 (which is near 1.16) and is graduated around to 4, changing to the second coil which is graduated to 1,000M or 1,000,000. The Log-Log Scale is used for finding roots and powers.

To Find the Power of a Number, Set L at the exponent and S at 10 on C Scale. Turn L until S is at the number on the Log-Log Scale. Read power at L on Log-Log Scale. Find the value of 4.65 raised to the 3.7 power. Set L at 37 and S at 10 on C. Turn L until S is at 4.65 on Log-Log and L will give the answer as 242 on the Log-Log Scale.

The Log-Log Scale gives the position of the decimal point and its range is between 1.15 and 1,000,000. If the number is below 1.15 multiply it by some factor larger than 1.15 so that the product will be larger than 1.15. The power of the product divided by the power of the factor will give the power of the number which is desired.

if the number or its desired power is greater than 1,000,000 resolve the number into two or more convenient factors that can be handled by the scale. The product of the powers of the factors will give the power of the number.

To Extract the Root of a Number, Set L at 10 and S at the Index of the Root, on C turn L until S is at the number on the Log-Log and L will give the root on the Log-Log Scale. Find the 7.3 root of 5,000. Set L at 10 and S at 7.3 on C Scale. Turn L until S is at 5,000 on Log-Log Scale and read 3.2 at L. For numbers which fall off the end of the scale, use same method as for "Powers."

To Find Natural Logarithms. (Base e) Set L at the number on the Log-Log Scale and read Logarithm on C Scale. Thus the Natural Log. of 1.68 is .518; of 675 is 6.52; of 3200 is 10.37;

ADDING AND SUBTRACTING FRACTIONS.

The Fraction Scale. The seventh scale from the outside is used for adding and subtracting fractions and for finding the decimal equivalents of fractions. The complete scale is from 1-64th to 1 or 64-64ths. The third or Log Scale is divided into 500 divisions so if the Fraction Scale represents one inch, divided into 64ths, the Log Scale may represent one inch, divided into 500 parts. Therefore 1-1000 of an inch can be estimated by dividing these small divisions into two parts.

To Add 7-64 and 19-32. Set L at 7-64 and S at 1, Turn L until S is at 19-32 and L will give 45-64.

To subtract 3-8 from 31-64. Set L at 31-64 and S at 3-8. Turn L until S is at 1 L will read 7-64.

Solve 9-64 plus 13-32 minus 27-64. Set L at 9-64 and S at 27-64. Turn L until S is at 13-32 and L will give $\frac{1}{8}$.

If desired decimals on the Log. Scale, may be substituted for any of the fractions in the above three types of problems. Then the answer can be read, exactly, as a deci-

mal on the Log. Scale or to the nearest fraction on the Fraction Scale.

THE DRILL SCALE AND THREAD SCALE.

The eighth and ninth scales are the Drill Scale and Thread Scale. The Drill Scale uses the first half of the circle and the Thread Scale uses the second half. To find the size of a numbered or lettered drill place L at the number or letter on the Drill Scale and read the size as a decimal on the Log. Scale or as a fraction on the fraction scale. Thus, an I drill is .273". I is the third division clockwise from F.

To find the size of drill to use for tapping a perfectly full thread use the Thread Scale. Set L at 5 on the Log. Scale and S at the number of threads on the Thread Scale (either U. S. S. or V Form). Turn L until S is at the bolt size on the Fraction Scale and L will give the drill size on the Log., Fraction, or Drill Scale, as desired.

EXAMPLE: What drill should be used for a hole to tap a $\frac{1}{2}$ " 13 U. S. S. Thread? Set L at 5 on the Log. Scale and S at 13 on U. S. S. Thread Scale. Turn L until S is at $\frac{1}{2}$ on Fraction Scale and L reads .406" on Log. Scale, 13-32 on Fraction Scale and Y on Drill Scale.

Tap breakage is often caused by using a drill too small for the tap. Therefore if the hole will give a thread that is longer than twice the diameter of the bolt, use a drill that is one or two sizes larger than given by the rule. A larger hole may be drilled in steel or wrought iron, as the metal flows into the thread while tapping.

TYPE PROBLEMS AND SHORT CUTS.

On the reverse side the middle graduations give degrees and read clockwise for Sines and Tangents and counter-clockwise for Cosines and Cotangents. An indicator is not used to read these functions. Thus Sine 20 degree is .342 Cotangent 72 degrees is .325

Pi, or 3.1416 is given on the C and CI Scales, also $\frac{1}{4}$ Pi, or .7854 is given on these scales by the small mark near S. The small mark at c on the Log. Scale is at .3937", which is equal to one centimeter. Further calculation gives 39.37" (1000 Cm) as the

Meter.

The operator must be able to solve a problem by ordinary methods before attempting to use the Midget, which is an aid and a time saver. The following type problems show how to handle the usual combination of factors which are met with in practice. The operator should choose the type which is required by his problem and solve it accordingly. Only a few of the many possible combination of the nine scale are given as others will suggest themselves to the operator as he becomes more familiar with the instrument. In the following problems, M, N, O, P and Q will represent known quantities and R the result. When any result is given by L, this result may be used as a factor in further calculations. It is not necessary to read the number under L until the final answer is obtained.

Solve $M \times N \div O = R$. Use C Scale. Set L at M and S at O. Turn L until S is at N and read R under L.

Solve $M \div (N \times O) = R$. Set L at M and S at N on C Scale. Turn L until S is at O on CI Scale and read R at L on C Scale.

Solve $M \div (N \times O \frac{1}{2}) = R$. Set L at M and S at N on A Scale. Turn L until S is at O on CI Scale and L will give R on A Scale.

To Find Reciprocals, Set L at the number on the C or CI Scale and read the reciprocal on the other scale.

THE DECIMAL POINT.

If the C Scale of the Midget is used for multiplication and division and L turned clockwise to set S then the following rules will give the number of figures in the result. To simplify the rules the following terms are used. "Sum" is the number of figures in the multiplier plus the number of figures in the multiplicand. "Difference" is the number of figures in the dividend minus the number of figures in the divisor.

Rule 1. In multiplication, if L is moved to, or apast, 10 to set S, the number of

figures in the product equals the sum. Otherwise the number of figures in the product equals the sum minus 1. (Always turn L clockwise to set S).

In division, if S is set counterclockwise between L and 10 the number of figures in the quotient equals the difference plus 1. If S is set clockwise between L and 10 the number of figures in the quotient will be the difference.

The C Scale is used for solving most commercial problems so if no scale is mentioned the C Scale should be used.

COMMERCIAL PROBLEMS.

OVERHEAD A merchant has \$15,200 sales for a year with a \$3,800 overhead. What is his percent overhead? Set L at \$15,200 (or 152) and S at \$3,800. Turn L until S is at 10 and read 25 or 25% at L.

If an article costs the above merchant \$2.50 and he wishes to make a 10% net profit, with a 25% overhead, What should be the selling price of the article? Add 10% and 25% and subtract them from 100% which gives 65%. Set L at 10 and S at 65. Turn L until S is at \$2.50 (or 25) and L will give \$3.85 as the correct selling price. If the selling price of other articles is desired (25% overhead and 10% profit) turn L until S is at the invoiced cost and L will give the selling price.

If a case of 48 articles cost the above merchant \$145, what should be the selling price of one article so that he will make a 10% net profit with an overhead of 25%. Set L at 48 on CI Scale and S at 65 on C Scale. Turn L until S is at 145 on C Scale and L will indicate 465 on C Scale. Therefore the correct selling price for each article would be \$4.65. The above method may be used for finding the selling price of articles bought by quantities, including dozen and gross lots. When finding the selling price of an article when the unit cost is known, set L at 10. If the cost of the lot is known, set L at the quantity, on the CI Scale and proceed in the same manner.

Mechanic's Guide-Hand Book

This Hand Book contains valuable data for Automobile Owners, Chauffeurs, Mechanics, Engineers, Draftsmen, Teachers, Students, Machinists, Patternmakers, Carpenters, Toolmakers, etc. It gives much valuable data on gears, taps and dies, weight and specific gravity of metal, drills, pipe fittings, decimals, different standards for wire and for case hardening. This book contains seventy-two tables. Thirty of these tables are copyrighted and are not found in any other hand book. It also gives instructions in reading a micrometer, figuring circular and diametral pitch gears, tapers, and how to gear an engine lathe to cut a thread of any pitch.

Price of the Mechanic's Guide Hand Book is 25 cents, stamps or coin.



Here's the Best Low Priced Adding Machine on the Market
THE BASSETT AUTOMATIC ADDER No. 3

MAKES ADDING EASY FOR ANYONE

Eliminates Errors, Reduces Costs

Saves Time and Brain Work

INDISPENSABLE FOR ANYONE HAVING ADDING OF ANY KIND TO DO

What this machine will actually do for you, what it will really save, in time, money and mental effort, considering its very low cost, makes it the biggest value dollar for dollar ever offered in any adding machine.

This Automatic Adding Machine will give absolutely accurate, dependable addition of figures, quickly, easily and without mental computation. Gives you the correct total every time—that's all any machine can do, regardless of price.

Saves Time — Saves Money — Eliminates Mistakes

ADDS — SUBTRACTS — MULTIPLIES — Whole Numbers — Fractions — Decimals

Capacity 8 columns \$999,999.99. Weight 7½ ounces. Totals always visible. Large figures easily read. Every mechanical part subjected to operating wear is made of metal.

PRICE with stylus and complete instructions, \$3.50

This is an exact photograph actual size.

Weight
four ounces.

Capacity
eight columns
2000,000.00

Resets to zero
quickly.

Simplest
in principle.

Over 45,000
in use throughout
the world.

Metal casing.

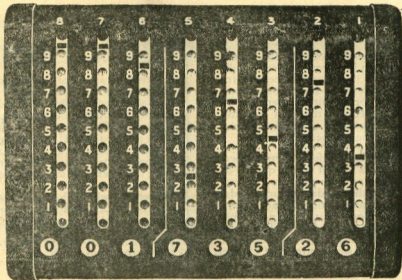
Brace band ten-
sioning springs.

Guaranteed
for one year.

No levers to pull.
No keys to punch.

Total always
visible.

So simple a child
can operate it.



THE BERGGREN UNIVERSAL DRAFTING PEN. PATENTED.

IF you won't accept the typewriter as an improvement over longhand, and if you don't believe in the practicability of the linotype machine, you probably won't want the Berggren Drafting Pen, because this pen is doing for draftsmen exactly what the others are doing for their respective users.

The Berggren Drafting Pen draws unbroken lines as well and as quickly as the best single purpose pens on the market, and, in addition, draws broken, dotted, wavy and combination dot and dash lines without blots, blurs or inconvenience. The fact that lines of these characters may be drawn to any length the supply of ink permits at a single stroke of the pen at once suggests what appreciable savings in

time can be effected.

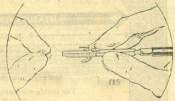
Another advantage of this pen is that even when used for the drawing of unbroken lines accuracy as to the width and absolute uniformity throughout are foregone conclusions. The drawing is made by a little grooved wheel, which is held between two nibs similar to those on an ordinary ruling pen. These grooves become ink reservoirs, and are supplied from the main reservoir between the nibs. Wheels, of which there are thirty styles, may be quickly and easily changed as is illustrated on the opposite page.

The Berggren Drafting Pen is patented, and is in actual use to-day by many discriminating draftsmen.

The Interlox Slide Rule is Only For Measuring



1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30

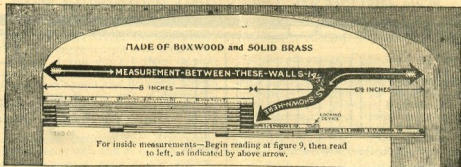


A labor saving device which accomplishes with a few strokes what it takes many hours to do otherwise. With this pen a Draftsman can do more and better work. Result- a better job and a bigger pay envelope.

Price, with three wheels, Nos. 5, 17 and 23, \$3.50

Extra Wheels 35c Each. Order by Numbers.

The Interlox Slide Rule Is Only For Measuring.



When the "Interlox" MASTER SLIDE RULE is closed, all the slides are locked together with the interlocking device except the first slide, which, when pulled out, releases the second slide, the second releases the third, and so on. This new locking device makes the rule absolutely **FOOL-PROOF**, as it prevents any possible error in taking measurements. The



The illustration shows a mechanic taking the inside measurement of a window with the "Interlox" MASTER SLIDE RULE.

Instantaneous Reading.

No Guess Work

slides cannot be extended or closed except in consecutive order. When the rule is fully extended it is held perfectly rigid in every joint by a dead lock.

NOTE—In closing the "Interlox" MASTER SLIDE RULE be sure to press the key spring, indicated by the hand on the first slide, which releases the second slide and the second, the third, etc., until closed.

The "Interlox" MASTER SLIDE RULE is so far superior to any other rule in real merits, and specifically for taking inside measurements of doors, windows, boilers, furnaces, etc., that the mechanic, architect, contractor or inspector, once using it, will never be without it. It is the only rule in the world that takes inside measurements rapidly and accurately. It reads direct, as indicated by arrow in fig. 1. It provides accurate adjustment, insures correct measuring. Handy to carry around. Opens and closes instantly.

NOTE—The side of the "Interlox" MASTER SLIDE RULE, used for taking inside measurements, is marked "INSIDE" caliper, direct reading. The reverse side of the "Interlox" MASTER SLIDE RULE, used like any other ordinary rule for outside measurement, is marked "OUT-SIDE" on each slide. Made in lengths from 2 to 8 feet.

PRICES {	Two Ft. 40 Cents.	Three Ft. 60 Cents.
	Four Ft. 80 Cents.	Five Ft. \$1.00
	Six Ft. \$1.20	Eight Ft. \$1.60

The Multiple Drafting Instrument.

(PATENTED JANURARY 14, 1919.)

A COMBINATION PLANIMETER, PROTRACTOR, CURVE RADIATOR, 45 AND 30-60 DEGREE TRIANGLE.

The Multiple Drafting Instrument combines in one tool the functions of five different instruments which are used by Engineers, Architects, Draftsmen and Students. It is accurately made of transparent celluloid (Xylonite) and makes a valuable addition to any drafting outfit.

As a Planimeter, the Multiple Drafting Instrument will give the area, in square inches, of any plain figure as an indicator diagram, plan, cross-section, pattern, map, profile, etc. With this instrument, the area of any irregular figure can be measured in one operation. It will reduce the most complex problem in Mensuration to a simple mechanical operation. This one feature of the Multiple Drafting Instrument is worth many times its cost as it will satisfy every requirement, which is met with in practice.

The Protractor is graduated from 0 to 180 degrees in both directions and to insure ease and accuracy in using the instrument the graduations are placed so they will be next to the paper when the instrument is in use.

As a Curve Radiator, this instrument can be used to erect perpendiculars and construct tangents from either the convex or concave side of the curve.

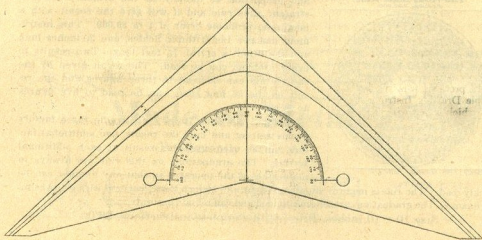
The Multiple Drafting Instrument can be used as a substitute for an ordinary 45 degree and 30-60 degree triangle and when used as a Protractor any other angle can be constructed.

This instrument equals an ordinary Eight Inch 45 degree triangle in size.

Price, with complete instructions,

\$1.00

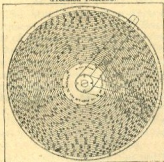
THE MULTIPLE DRAFTING INSTRUMENT.



THE ATLAS SLIDE RULE.

The Atlas Slide Rule

(Precision 1 in 30,000)



Will solve any problem in multiplication, division and proportion as quickly as the ordinary ten-inch straight slide rule and it will give the result with a maximum probable error of 1 in 30,000. This instrument has two Logarithmic Scales, one 30 inches long and the other, a spiral, 75 feet long. Two results to every problem can be read. The result given by the short scale can be read to three figures and the result on the 56 foot scale can be read to five figures as 98,687.

The "Atlas Slide Rule" will handle three factors at one setting and hold the result, two additional factors can be used with this result at each additional setting. The graduations on this rule are always in plain view of the operator so that any number can be

quickly read. The rule is made of aluminum 1-16th of an inch thick, covered with white celluloid enamel. The graduations are engine divided and will remain accurate.

Size 10 x 10 inches. Price, with complete instructions, \$6.00

12-Inch Architect's Triangular Scale.

Divided: 3-32, 3-16, 1-8, 1-4, 3-8, 3-4, 1-2, 1 1-2, 3 in. to the foot, 1-16 in.

WHITE FACE, BLACK LINES

GUARANTEED ACCURATE--OPEN DIVIDED



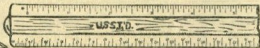
FLAT SCALES, BOTH SIDES DIVIDED LIKE THIS CUT.

Can be Rolled Backward slightly, the edge away from drawing.

Prevents ink from pen flowing under edge.

Made of Metal

(Permanently Accurate)



Price, Each 60 Cents.
EITHER STYLE.

"VULCAN" STYLOGRAPHIC PENS.

TRADE MARK REGISTERED.

These Stylographic Pens or "Ink Pencils" are made by one of the largest manufacturers of fountain pens in United States. The service rendered by the Vulcan Ink Pencil has been consistently perfect and it writes as smoothly as a pencil.



The "BABY VULCAN", Black Rubber Cap and Barrel. Length, four and one-quarter inches. Barrel holds ink sufficient to write about 7,000 words. Packed in a Paste-board Box with filler, cleaner and instructions. PRICE EACH, \$1.25



The "VULCAN", Black Rubber Barrel, Length, five and one-half inches. Holds ink sufficient to write about 10,000 words. Nickel-plated Pocket Clips, 5 Cents Each. Packed in a Paste-board Box with filler, cleaner and instructions. PRICE EACH, \$1.25



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