Instructions for using the Binary Slide Rule.

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GILSON SLIDE RULE CO., Stuart, Fla.
(Slide Rule Makers since 1915.)

Instructions For Using The Binary Slide Rule.

The Instructions for using the scales of the Midget apply to the corresponding scales of the Binary. Starting at the outside the scales of the Binary are -: C, CI, A, K, Log and four turns of the Log-Log, Binary, Fraction, Thread, Drill and Millimeter. It will be noted that the outer **Scales** of the **Midget** and **Binary** differ in arrangement.

The K or Cube scale is used with the C scale for cubes and cube roots. Set either indicator to a number on C and read the cube on K. To extract the cube root, separate the number into groups of three figures, beginning at the decimal point, as 51'535.32 or 024'8 If the left group contains one, two or three significant figures, use the first, second or last one-third of the K scale.

The Log-Log scale has four turns and may be extended any number of turns below **1.000,15** using the C scale, because this number is under an indicator set at 15 on the C scale. Therefor, to raise 1.000,034,45 to the 4.2ths power, set **L** at 42; **S** at **1** turn **L** until **S** is at 3445, read **1447**, which makes the answer **1.000,144,7** (all solved on C scale). If the exponent, 4.2 or base had been slightly larger, the answer would be greater than 1.000,15 and could be read on the **Log-Log Scale.**

To handle a number smaller than **1**, multiply the number by some convenient factor and follow the Midget Instructions for using the **Log-log Scale.**

INSTRUCTIONS FOR USING THE MIDGET SLIDE RULE.

The Midget Slide Rule is constructed to give years of service if properly used. Some Midgets have been in constant use for over ten years. The scales of the Midget are protected by two coats of transparent lacquer, so that any ordinary wear will not erase the scales. However if the user continually presses down on the indicators when they are moved, the finish of the rule will soon become dull and in time the scales will wear off.

In starting to use the Midget, the correct method of moving the indicators can be easily learned, and if followed there is practically no limit to the length of the service that the rule will give. To move the short indicator the best method is to catch the fingernail under the edge and slightly raise the indicator, say about 1-16 of an inch. In moving the long indicator it also can be slightly raised. When taking a reading under the long indicator it can be pressed lightly against the rule, so that the error due to parallax will be reduced to zero.

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 5x7. Set L at 5 and S at 10. Turn L until S is at 7 and L will indicate the answer, 35.

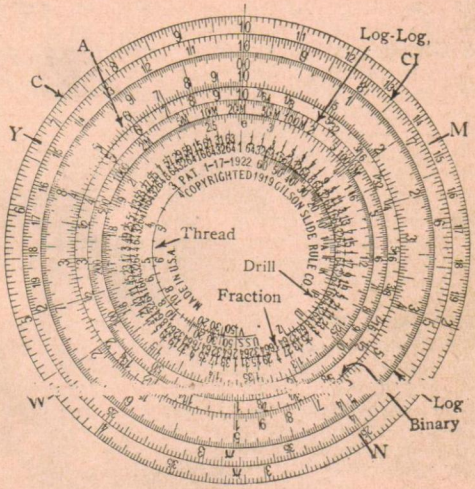
TO DIVIDE 18 by 3. Set L at 18 and S at 3. Turn L until S is at 10 and L will indicate the answer, 6.

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.

The illustration shows the scales of theMidget. Also, the mar.s 'M' on the C Scale indicates ***1463***; 'N' indicates ***2527***; 'W' indicates ***438*** and 'Y' indicates ***668***. with the position of the decimal point determined by the problem that is being solved.

This feature is common to all of the regular slide rules in use. This is sometimes rather difficult for the Beginner to understand. Also, it is due to this feature that the slide rule will handle all numbers, from the smallest to the largest, with a degree of precision depending on the length of scale. The Midget will give the answer to most problems, close enough for all practical purposes.

Learn to use it and it will be the most useful aid and timesaver in your figuring, because the Midget will solve more problems than any other calculator.



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 beginning 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 77x842x128, 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 coils 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 290 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 32000 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 ⅛.

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 decimal 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 ½" 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 ½ 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.

Pi, or 3.1416 is given on the C and CI Scales, also ¼ Pi, or .7854 is given on these scales by the small mark near 8. 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 x N ÷ 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 ÷ (N x 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 ÷ ($N \times C^2$) = 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.

To solve any quadratic equation of the form x^2 plus or minus bx plus or minus c equal 0, set L at 1 and S at c on CI Scale. Turn L until the sum (or difference as the case may be) of the values under L on the C scale and under S on the CI scale equals b. These are the roots. The position of the decimal point may be located by inspection

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 simply 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 past, 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.

TRIGONOMETRIC FUNCTIONS.

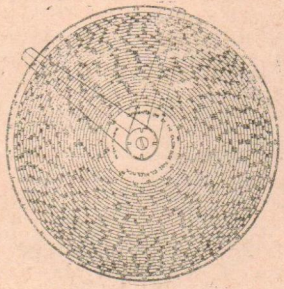
The back side of the Rule has one indicator, which will be referred to as T. It has three separate Sets of scales. The outer scale of each Set is Degrees, the middle scale is Sines and the inner scale is Tangents. Each degree graduation has one or two figures on each side of the line, as 53|37. The figures at the left of each line give the degrees for Sines and Tangents and increase from 0 to 90 degrees in a clockwise direction, while the figures at the right of the line give the degrees for Cosines and Cotangents and increase from 0 to 90 degrees in a counter-clockwise direction. Each of the larger degree divisions is divided into .1 degree or six minute divisions.

To read the function of any angle, set the hair-line, T, to degrees and read the function on its scale. The co-functions are read on their corresponding scales but the degrees must be read in a clock-wise direction. Thus;- Sine 65°42′ is .9114 Tangent 18°30′ is .3346 Cos. 51°54′ is .6170.

To read to one Minute.

It will be noticed that the divisions on the three Degree scales are not on radial lines but differ by 2 degrees. To increase 2 degrees, move the hair-line to the next outer degree scale, moving to the center if necessary. By going halfway between the degree divisions of any two adjacent (or the outer and inner) graduations, the hair-line can be set to one minute.

THE ATLAS SLIDE RULE.



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 25 inches long and the other, a spiral, 50 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 50 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.

Diameter 8 5-16 In. Price, with Case and Instructions, $7.50, postpaid,

Diameter of a circle × 3.1416 = circumference.
Diameter of a circle × .8862 = side of an equal square.
Diameter of a circle × .7071 = side of an inscribed square.
Square of a diameter × .7854 = area of circle.
Circumference of a circle × .31831 = diameter.
Side of a square × 1.128 = diameter of equal circle.
Square root of an area × 1.12837 = diameter of equal circle.
Square of the diameter of a sphere × 3.1416 = convex surface.
Cube of the diameter of a sphere × .5236 = solidity.
Diameter of a sphere × .806 = dimensions of equal cube.
Diameter of a sphere × .6667 = length of equal cylinder.
Square inches × .00695 = square feet.
Cubic inches × .0058 = cubic feet.
Cubic feet × .03704 = cubic yards.
Cylindrical inches × .0004546 = cubic feet.
Cylindrical feet × .02909 = cubic yards.
Cubic inches × .003607 = imperial gallons.
Cubic feet × 6232 = imperial gallons.

Millimetres × .03937 = inches.
Millimetres ÷ 25.4 =inches.
Centimetres × .3937 = inches.
Centimetres ÷ 2.54 =inches.
Metres × 39.37 = inches.
Metres × 3.281 = feet.
Metres × 1.094 = yards.
Kilometres × .621 = miles.
Kilometres ÷ 1.6093 = miles.
Kilometres × 3280.8693 = feet.
Sq. Milimetres × .00155 = sq. in.
Sq. Milimetres ÷ 645.1 = sq. in.
Sq. Centimetres × .155 = sq. in.
Sq. Centimetres ÷ 6.451 = sq. in.
Sq. Metres × 10.764 = sq. ft.
Sq. Kilometres × 247.1 = acres.
Hectare × 2.471 = acres.
Cu. Centimetres ÷ 16.383 = cu. in.

Cu. Centimetres ÷ 3.69 = fluid drams.
Cu. Centimetres ÷ 29.57 = fluid ounces.
Cu. Metres × 35.315 = cu. ft.
Cu. Metres × 1.308 = cu. yds.
Cu. Metres × 264.2 = gals. (231 cu. in.)
Litres × 61.022 = cu. in.
Litres × 33.84 = fluid ounces.
Litres × .2642 = gals. (231 cu. in.)
Litres ÷ 3.78 = gals. (231 cu. in.)
Litres ÷ 28.316 = cu. ft.
Hectolitres × 3.531 = cu. ft.
Hectolitres × 2.84 = Bu. (2150.42 cu. in.)
Hectolitres × .131 = cu. yds.
Hectolitres ÷ 26.42 = gals. (231 cu. in.)
Grammes × 15.432 = grains.
Grammes ÷ 981. = dynes.
Grammes (water) ÷ 29.57 = fluid oz.
Grammes ÷ 28.35 = oz. avoirdupois.

Cylindrical inches × .002832 = imperial gallons.
Cylindrical feet × 4.895 = imperial gallons.
183.346 circular inches = 1 square foot.
2,200 cyindrical inches = 1 cubic foot.
Avoirdupois pounds × 009 = cwts.
Avoirdupois pounds × .00045 = tons.
Lineal feet × .00019 = statute miles.
Lineal yards × .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.

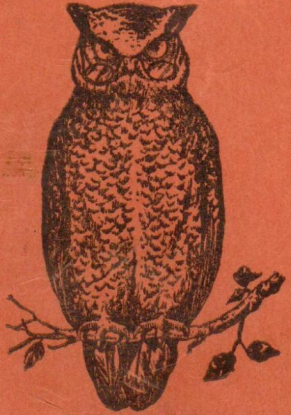
Doubling the diameter of a circle increases its area four times.

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. ÷2.77 = lbs. p.cu.in.
Joule × .7373 = ft. lbs.
Kilo-grammes × 2.2046 =pounds.
Kilo-grammes × 35.3 = oz. avoirdupois.
Kilo-grammes ÷ 907.2 = tons (2000 lbs.)
Kilo-gr. p. sq. cent. × 14.223 = lbs. p. sq. in.
Kilo-gram.-metres × 7.233 = ft. lbs.
Kilo-gr. p. Metre × .672 = lbs. per ft.
Kilo-gr. p. cu. Metre × .062 = lbs. p. cu. ft.
Kilo-gr. p. Cheval × 2.235 = lbs. p. H. P.
Kilo-Watts × 1.34 = Horse-power.
Watts ÷ 746. = Horse-power.
Watts × .7373 = ft. pounds p. second.
Caloric × 3.968 = B. T. U.
Cheval vapeur × .9863 = Horse-power.
(Centigrade × 1.8) + 32 = degrees Fahr.
Franc × .193 = Dollars.
Gravity Paris = 980.94 centimetres per sec.



BE WISE.