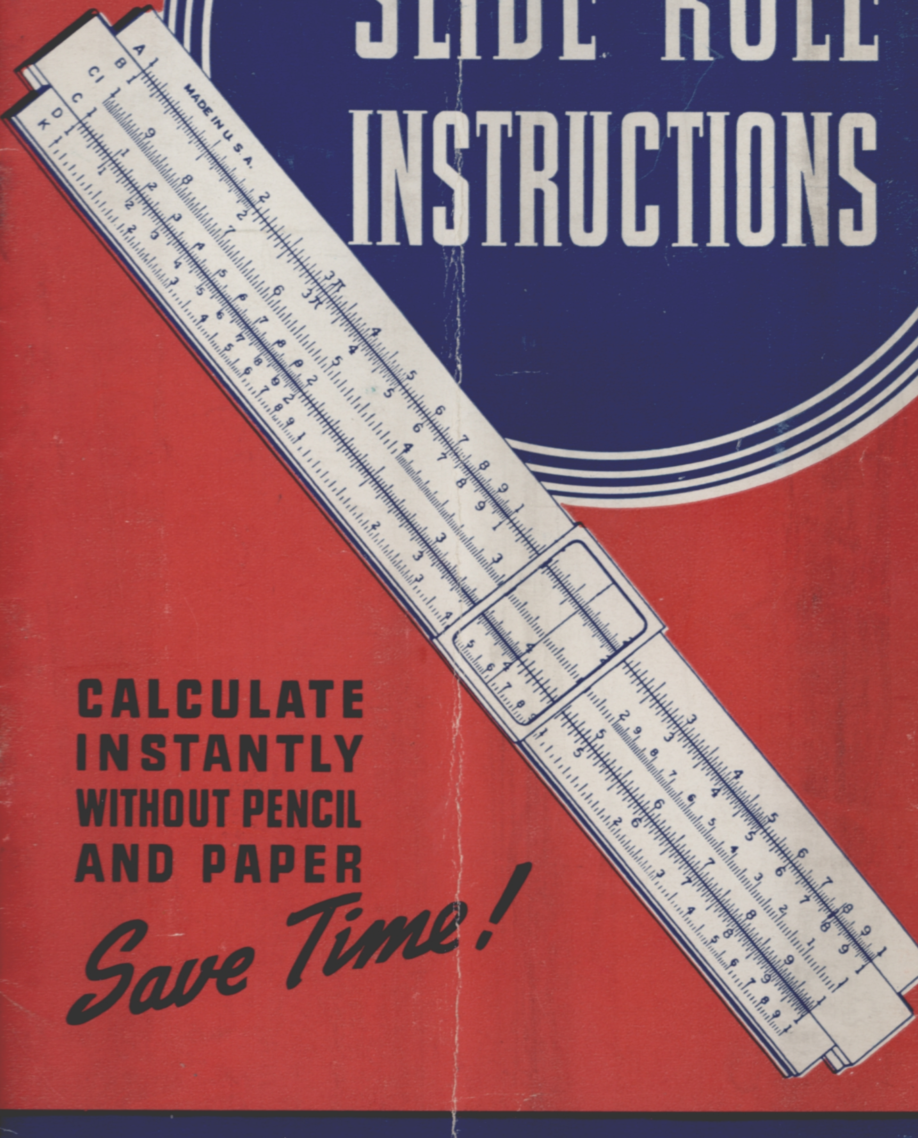
Stanley's
SLIDE RULE INSTRUCTIONS



CALCULATE INSTANTLY WITHOUT PENCIL AND PAPER

Save Time!

W. STANLEY & COMPANY
South Bend, Indiana

Publishers of

"Stanley's Slide Rule Practice"

and

"Stanley's Slide Rule Instructions"

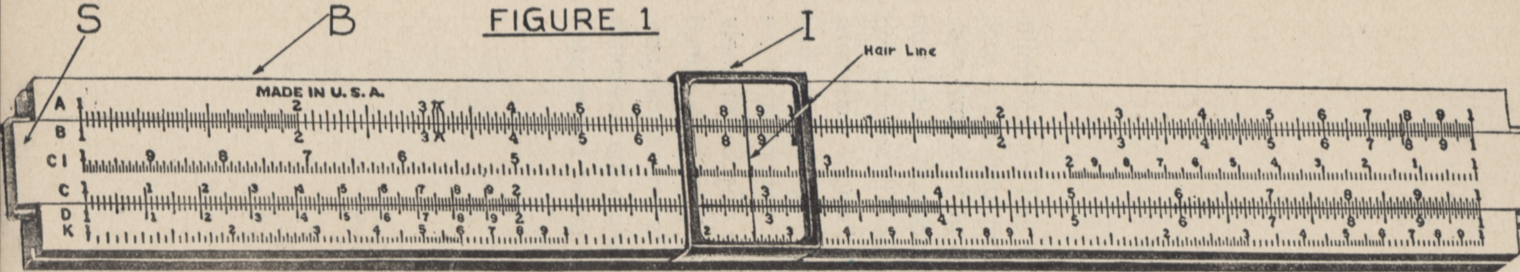
INTRODUCTION

The slide rule is a device for easily and quickly multiplying, dividing, extracting square root and cube root, squaring and cubing, etc. It will also perform any combination of these processes. On this account, it is found extremely useful by students and teachers in schools and colleges, by engineers, architects, draftsmen, surveyors, chemists, and many others. Accountants and clerks find it very helpful when approximate calculations must be made rapidly. The operation of a slide rule is extremely easy, and it is well worth while for anyone who is called upon to do much numerical calculation to learn to use one. It is the purpose of this manual to explain the operation in such a way that a person who has never before used a slide rule may teach himself to do so.

STANLEY'S SLIDE RULE INSTRUCTIONS

W. STANLEY & COMPANY

FIGURE 1



DESCRIPTION OF THE SLIDE RULE

The Slide Rule consists of three parts, (see figure 1), B the "body", S the "slide", and I the "indicator". As seen in figure 1, the "body" of the rule has thereon the three scales lettered A, D and K. On the "slide" are also three scales, known as the B, C1 and C scales. The "indicator" is marked in the center with a hair line, that is used to transfer readings from one scale to another.

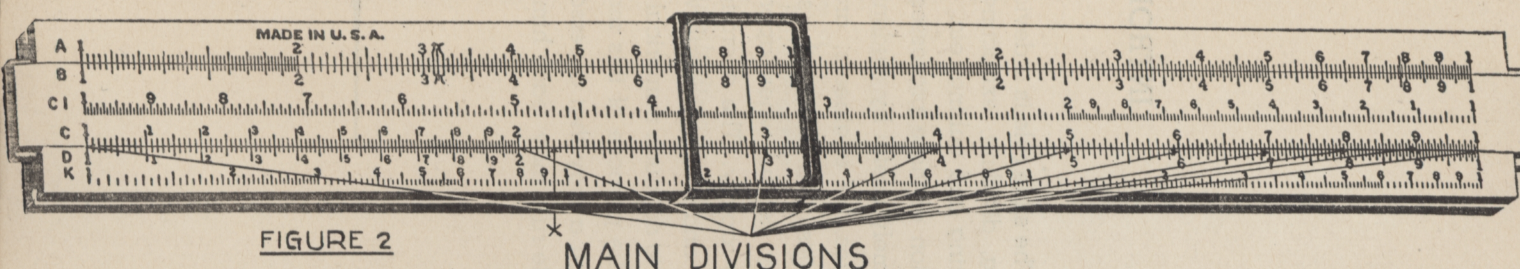


FIGURE 2

READING THE SCALES

Reading the setting from a slide rule is very much like reading measurements from a ruler. Imagine the slide rule is a ten foot rule, and the larger divisions between the large 2 and 3 on the D scale, (figure 2) are those of a ruler divided into tenths of a foot. Each tenth of a foot is divided into 5 parts, each of which would be 0.02 of a foot long. Then the distance from the extreme left hand 1 on the D scale to "X" (figure 2), would be 2.12 feet. Of course, a foot rule is divided into parts of uniform length, while those on a slide rule get smaller toward the right-hand end, but this example helps to give an idea of the method of making and reading settings.

As can be seen in Figure 2, the "C" and "D" scales are identical, both being numbered from 1 to 10, and are mainly used for multiplying and dividing. The spaces (known as the Main Divisions) between these numbers decrease steadily toward the right, which is the way in which a slide rule differs from an ordinary ruler, that is used for measuring inches, or feet, etc.

In making a setting on the slide rule, the decimal point is disregarded. Only the figures themselves are considered. Hence, the hair-line on the indicator is set at the same position for any of the following numbers: .00293, .0293, .293, 2.93, 29.3, 293, 2930, 29300, etc.

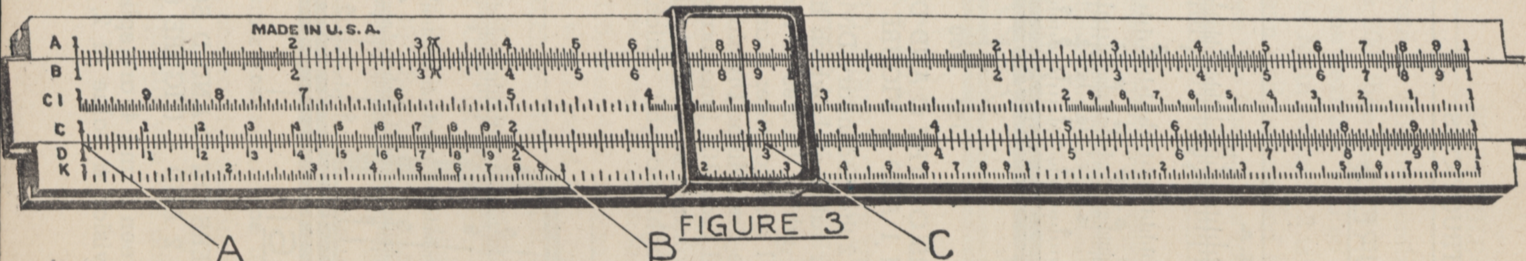


FIGURE 3

TO READ NUMBERS SUCH AS 1, 2, 3, ETC. ON THE C. AND D. SCALES (FIGURE 3)

The one-figure number 1, is located at the point (Main Division) on the scale as shown by arrow A, the number 2, by arrow B, number 3, by arrow C, and so on down the scale for all other one-figure numbers.

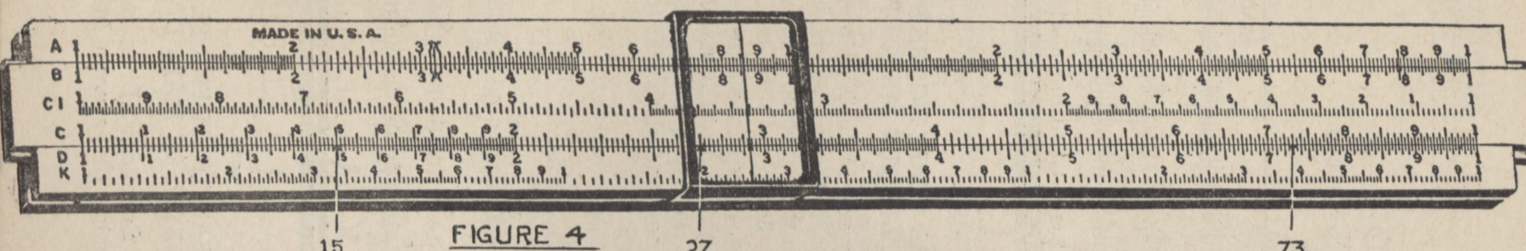
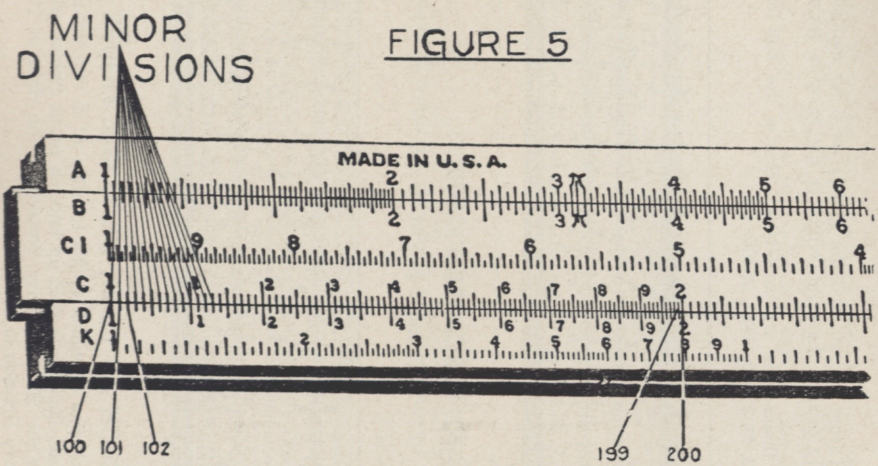


FIGURE 4

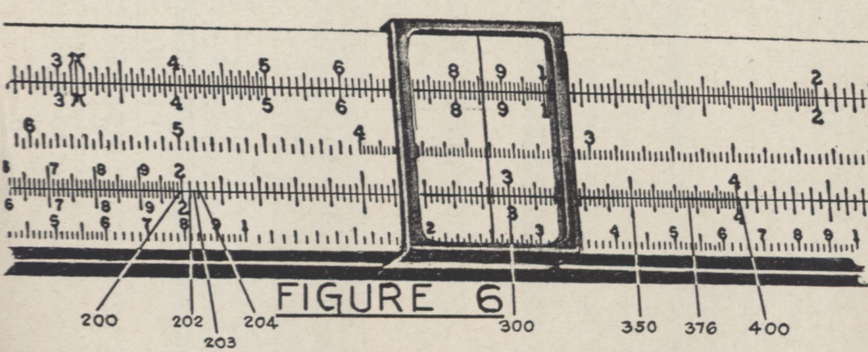
TO READ TWO-FIGURE NUMBERS, ON THE C. AND D. SCALES SUCH AS 15, 27, OR 73 (SEE FIGURE 4)

The Main Divisions are split up into ten parts, which we call Secondary Divisions, each one of which is the location of a two figure number. Consider Main Divisions 1, 2, 3, etc., as representing 10, 20, 30, etc.: therefore, since each Main Division is split up into ten parts, (which we call Secondary Divisions) to locate 15, which is more than 10, but less than 20, it will be located at the 5th Secondary Division to the right of 10; and the two figure number 27, the 7th Secondary Division to the right of 20; and 73, the 3rd Secondary Division to the right of 7.



TO READ THREE-FIGURE NUMBERS ON THE C AND D SCALES BETWEEN MAIN DIVISION 1 AND 2. (FIGURE 5)

Between Main Divisions 1 and 2 the Secondary Divisions are split into tenths, giving each line a value of 1, which lines we'll call Minor Divisions, each one of which locates a three-figure number. Begin with the left figure 1 and consider it as 100 (read it as one, naught, naught), then the first Minor Division marking to the right of Main Division 1, will read 101 (one, naught, one), and the next 102, (one, naught, two), and so on up to 199, (one, nine, nine), and then 200 (two, naught, naught), which is Main Division 2.



TO READ THREE-FIGURE NUMBERS ON C AND D SCALES BETWEEN MAIN DIVISION 2 AND 4. (FIGURE 6)

The Secondary Divisions, between 2 and 4, are split up into fifths, which gives each Minor Division a value of 2, each of which locates a 3-figure number. Begin at Main Division 2, consider it as 200, then the first marking or line to the right of 2 will read 202, the next 204, and so on up to 400. Since the first line to the right of Main Division 2 is 202, and the second 204, it can be readily seen and understood that at the center of the space between these two lines is the location of 203.

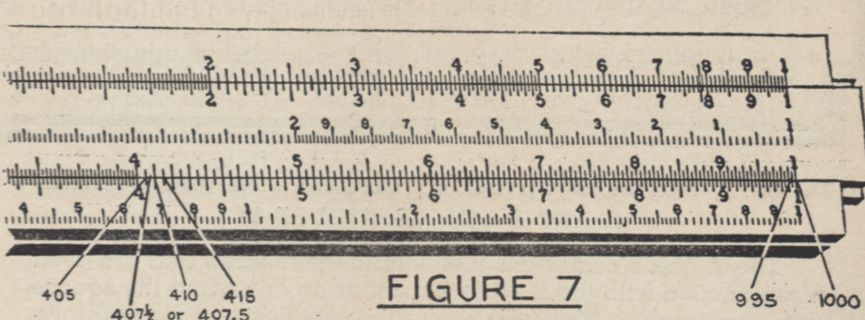


FIGURE 7

TO READ THREE-FIGURE NUMBERS ON C AND D SCALES BETWEEN MAIN DIVISIONS 4 AND RIGHT HAND 1. (FIGURE 7)

From Main Division 4 to the figure 1 at the extreme right hand end of the rule the Secondary Divisions are split up into halves, giving each Minor Division a value of 5. In view of this fact, the first Minor Division to the right of Main Division 4 is 405, the next 410, then 415, and so on through and including the last two lines, which read 995, and 1000 respectively. To locate a number such as 407, or 408, which lies between 405 and 410, it is done by finding the mid-point between 405 and 410, which would be 407½ (407.5). Then just a fraction to the right of this imaginary point would be 408, and the same distance to the left would be 407. Besides locating three-figure numbers such as 407 or 408, it can be seen and understood that four-figure numbers such as 407½ or 407.5, 4075, etc., can easily be located on the rule by estimating.

Extreme care should be used in setting the slide and indicator most accurately and in reading the results carefully. The more practice and care used, the greater your accuracy will be, and consequently you will obtain an additional number of digits in the answer.

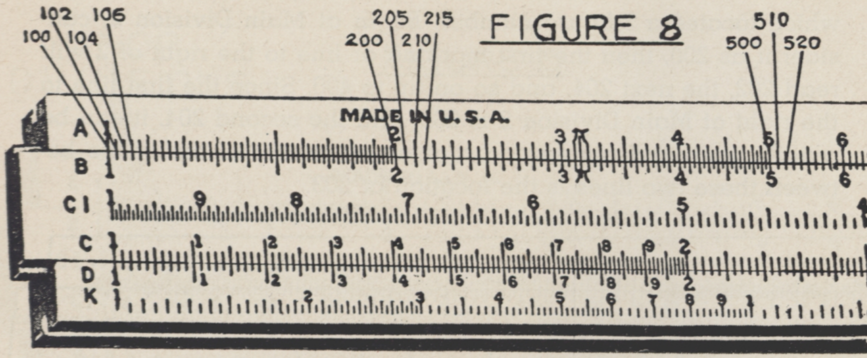


FIGURE 8

TO READ NUMBERS ON BOTH THE LEFT AND RIGHT HAND A AND B SCALES. (FIGURE 8)

The A and B scales are identical to each other, and are used in conjunction with the D scale, for squaring or finding the square root of a number. However, they also can be used for multiplying and dividing, but they are not as accurate at this as the C and D scales, because they are only half as long as the C and D scales.

The A and B scales have ten Main Divisions, as have the C and D scales, and are read in the same way, but the values in the Secondary and Minor Divisions are not the same, which values are explained as follows: From Figure 8, note that in the left hand A and B scales the Secondary Divisions from 1 to 2 are split up into fifths, reading 100, 102, 104, 106, etc. Between 2 and 5, the Secondary Divisions are split into halves, giving the readings of 200, 205, 210, 215, and so on. Then from 5 to the center 1, each Secondary Division has a value of one, reading 500, 510, 520, and so forth. The right hand A and B scales are identical to those of the left hand scales and are read in the same manner.

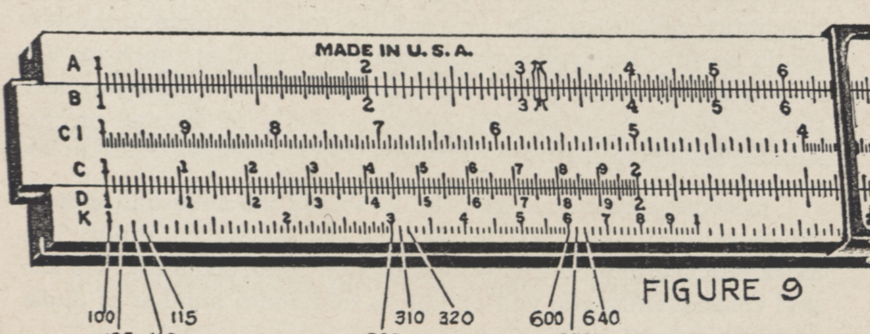


FIGURE 9

TO READ NUMBERS ON THE THREE K SCALES. (FIGURE 9)

The K scales are used in conjunction with the D scale for finding cubes and cube roots. They have ten Main Divisions and are read in the same manner as the C and D scales. The values of their Secondary and Minor Divisions are as follows: As seen in figure 9, on the left-hand K scale, between Main Division 1 and 3, the Secondary Divisions are split up into halves, giving the readings of each Minor Division as 100, 105, 110, 115, and so on. Between 3 and 6 each Secondary Division has a value of one, reading 300, 310, 320, etc. From 6 to the first right hand 1, the Main Divisions are split up into fifths, giving each Secondary Division the value of 2, and reading 600, 620, 640, etc. The middle and right hand K scales are identical to the left hand and are read in the same manner.

TO READ NUMBERS ON THE CI SCALE

The CI is identical to the C and D scales excepting that it is laid off and read from the right to the left, and its divisions, therefore have the same values. It is used mostly in problems involving reciprocals.

MULTIPLICATION

Definition of Arithmetical Terms:

Multiplication: The process by which any given number or quantity is increased a certain number of times.

Multiply: To cause to increase in number.

Product: The result obtained by multiplying two or more numbers together.

Multiplicand: The number or quantity to be increased or multiplied.

Multiplier: That which multiplies or increases a number or quantity.

Digit: A numeral, such as 0, 1, 2, 3, 4, etc.

Factor: One of two or more quantities (Multipliers and multiplicands), which when multiplied together, give a product.

Integer: A whole number.

Multiplication is the easiest operation to do on a slide rule. For instance we will start with a very simple example:

Example 1: 2×3=6

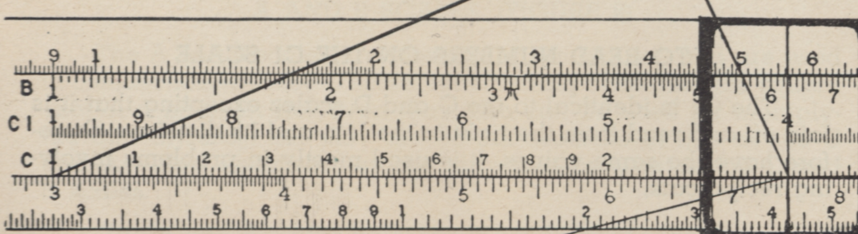
To prove this on the slide rule, move the slider so that the 1 on the left hand end of the C scale is directly over the large 2 on the D scale. Then move the indicator till the hairline is over 3 on the C scale. Read the answer 6 on the D scale under the hairline. Now, let us consider a more complicated example.

Example 2: 3×25=75

FIGURE 10

(1st) Set left-hand index 1 of C scale over 3 on D scale.

(2nd) Set indicator over 25 on C scale.



(3rd) Read answer, 75, on D scale under hair-line

As before, set the 1 of the left-hand end of the C scale, which we will call the left-hand index of the C scale, over 3 on the D scale (Figure 10). Now place the hair-line of the indicator over 25 on the C scale and read the answer 75 on the D scale.

Example 2a: 20×55=1100

After we set the left-hand index of the C scale over 20, on the D scale, we find that 55 on the C scale falls out beyond the body of the rule. In a case like this, we set the right-hand index of the C scale over 20 on the D scale, move the indicator to 55 on the C scale and read the answer (1100) under the hair-line on the D scale.

LOCATING THE DECIMAL POINT

The following example will show the most convenient way to locate a decimal point.

Example 3a: 2.12×7.35=15.6

Set the right-hand index on the C scale over 2.12 on the D scale, and move the indicator to 7.35 on the C scale and read the result, 15.6 on the D scale under the hair-line.

The slide rule takes no account of decimal points. Thus the settings would be identical for all of the following products:

Example	**3a:**	2.12×7.35=15.6
"	**3b:**	21.2×7.35=156.0
"	**3c:**	212×73.5=15600
"	**3d:**	2.12×.0735=.156
"	**3e:**	.00212×735=1.56
"	**3f:**	.00212×.0735=.000156

The most convenient way to locate the decimal point is to make a mental multiplication, using only the first digits, other than zero in the given factors. Then place the decimal point in the result so that its value is nearest that of the mental multiplication. Thus, in example 3a above, we can multiply 2×7 in our heads, getting 14. We see immediately that the decimal point must be placed in the slide rule result 156, to give the true answer 15.6, which has the same number of digits as 14. In example 3b: 20×7=140, so we must place the decimal point to give 156.

Where both factors are decimals, the same mental multiplication method is used. In example 3f of above, multiply 200×700=140,000 and since there are a total of nine decimal points in the two factors we must point off that many in the result, which gives us,

.00212×.0735=.000155820, or .000156

and the other examples can readily be verified in the same way.

Since the product of a number by a second number is the same as the product of the second by the first, it makes no difference which of the two numbers is set first on the slide rule. Thus an alternative way of working example No. 2 would be to set the left-hand index of the C scale over 25 on the D scale and move the runner to 3 on the C scale and read the answer under the hair-line on the D scale.

EXAMPLES FOR PRACTICE

A group of examples follow, which covers all the possible combinations of settings which can arise in the multiplication of two numbers.

Example	**4:**	20×3=60
"	**5:**	85×2=170
"	**6:**	45×35=1575
"	**7:**	151×42=6342
"	**8:**	6.5×15=97.5
"	**9:**	.34×.08=.0272
Example	**10:**	75×26=1950
"	**11:**	.00054×1.4=.000756
"	**12:**	11.1×2.7=29.97
"	**13:**	1.01×54=54.5
"	**14:**	3.14×25=78.5

SUPPLEMENTARY METHODS OF MULTIPLICATION

A—Using the Cl Scale: The Cl scale (in using this scale remember, it should be read from the right to the left), can be used in multiplication. For instance, in the following example:

Example 15: $18 \times 14 = 252$

Set the Indicator to 18 on the D scale, then under the hair-line set 14 on Cl scale, and below the right-hand index of the C scale is the answer, 252 on the D scale. It is suggested that the reader refigure Examples 4 to 14 using the Cl scale.

B—Using the A and B Scales: The A and B scales are made up of two identical halves, each of which is very similar to the C and D scales. Multiplication or division can also be carried out on either half of the A and B scales exactly as it is done on the C and D scales. However, since the A and B scales are only half as long as the C and D scales, the accuracy is not as good.

DIVISION

Definition of Arithmetical Terms:

Division: The process of finding how many times one number or quantity is contained in another.

Dividend: A number or quantity to be divided.

Divisor: The number by which another (the dividend) is divided.

Quotient: The number resulting from the division of one number by another.

Since Multiplication and Division are inverse processes, division on a slide rule is done by making the same settings as for multiplication, but in reverse order. Suppose we have the example,

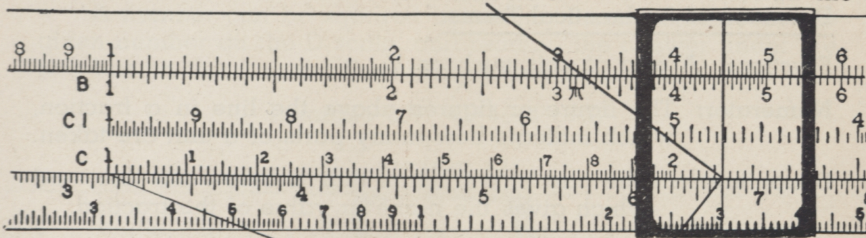
Example 16: $35 \div 7 = 5$

Set indicator over the dividend 35 on the D scale. Move the slider until the divisor 7 on the C scale is under the hair-line. Then read the result on the D scale under the right-hand index of the C scale.

Example 17: $6.70 \div 2.12 = \frac{6.70}{2.12} = 3.16$

FIGURE 11

(2nd) Move slide until 2.12 on C scale is under hair-line



(1st) Set indicator over 6.70 on D scale

(3rd) Read answer 3.16 on D scale under index 1 of C scale

Set indicator over the dividend 6.70 on the D scale (see figure 11). Move the slide until the divisor 2.12 on the C scale is under the hair-line. Then read the result, 3.16 on the D scale under the left-hand index of the C scale. As in multiplication, the decimal point must be placed by a separate mental process. Make all the digits, except the first in both dividend and divisor equal zero and mentally divide the resulting numbers. Place the decimal point in the slide rule result, so that it is nearest to the mental result. In example 17, we mentally divide 6 by 2. Then we place the decimal point in the slide rule result, 316, so that it is 3.16, which is nearest to 3.

A group of examples for practice in division follow:

Example 18: 34÷2=17
" **19:** 49÷7=7
" **20:** 132÷12=11
" **21:** 480÷16=30
" **22:** 1.05÷35=.03

Example 23: 4.32÷12=.36
" **24:** 5.23÷6.15=.85
" **25:** 17.1÷4.5=3.8
" **26:** 1895÷6.06=313
" **27:** 45÷.017=2647

SUPPLEMENTARY METHOD OF DIVISION

The Cl scale (in using this scale remember that it should be read from the right to the left) can also be used in division. Take for example:

Example 28: 135÷15=9

Set the left-hand index of the C scale over 135 on the D scale. Move indicator to 15 on the Cl scale and read answer, below, under hair-line on D scale. The reader is advised to refigure examples 16 to 25, using the Cl scale.

CHANGING FRACTIONS TO DECIMALS

Definition of Arithmetical Terms:

Fraction: A part of unit, such as ¼.

Numerator: The figure or figures above the line in a fraction, which indicate how many parts of a unit are taken.

Denominator: The part of a fraction that is below the line, and which gives the name or value of the fraction.

TO CHANGE A FRACTION TO A DECIMAL

Set the indicator over the numerator of the fraction on the D scale, then move the slide so that the denominator on the C scale will be under the hair line. The answer, or decimal will then be found on the D scale under the index 1 of the C scale. For example:

Example 29: Change the fraction ¾ to a decimal.

Set the indicator over 3 on the D scale. Move the slide so that 4 on the C scale will be under the hair-line. Read the answer, .75 on the D scale, under the right hand index 1 of the C scale.

It is evident that this process is simple division, and it is well to recall that fractions indicate division, the numerator being the dividend and the denominator being the divisor.

SQUARE OR SQUARE ROOT OF A NUMBER

Definition of Arithmetical Terms:

Square: The product of a number multiplied by itself, such as 4 is the square of 2. The process is called squaring the number.

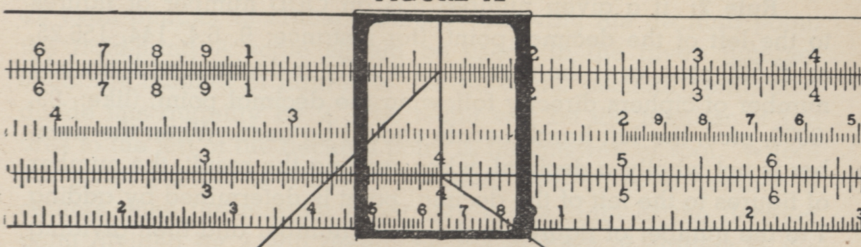
Square Root: The number or quantity which, when multiplied by itself produces the given number or quantity, such as 2 is the square root of 4. The process of finding this quantity is called extracting the square root of the number.

TO SQUARE A NUMBER

A number can be squared by setting the indicator over the given number on the D scale, and reading the answer under the hair-line on the A scale. For example (see figure 12):

Example 30: $4 \times 4 = 4^2 = 16$

FIGURE 12



(1st) Set indicator to 4 on D scale

(2nd) Read answer, 16 on A scale under hair-line

Set indicator over 4 on the D scale. Read 16 on A scale under hair-line.

Example 31: $2.2^2 = 4.84$

Set indicator over 2.2 on the D scale. Read 4.84 on A scale under hair-line. The decimal point can be placed by mental survey. For instance, we know that 2.2^2 must be a little larger than $2^2 = 4$, so the answer must be 4.84. Another way to locate the decimal is by the following rule:

Rule 1: When the square or answer falls to the left of the center 1 on the A scale, the number of figures in the answer is 1 less than double the number of figures in the number that is to be squared. When the answer is read to the right of the center 1, the number of figures in the answer is twice as many as in the number to be squared. In either case, after the decimal point there should be twice as many figures in the answer as in the given number. Therefore, answers to the left of the center 1 will have an odd number of figures, and answer to the right of the center 1 will have an even number of figures.

Example 32: $.3^2 = .09$

As explained above, set indicator over 3 on the D scale and read answer, .09 under hair-line on the A scale. Since there is one decimal in the number to be squared and there should be twice as many in the answer, a naught has been placed before the nine in order to give two decimal places in the answer, .09.

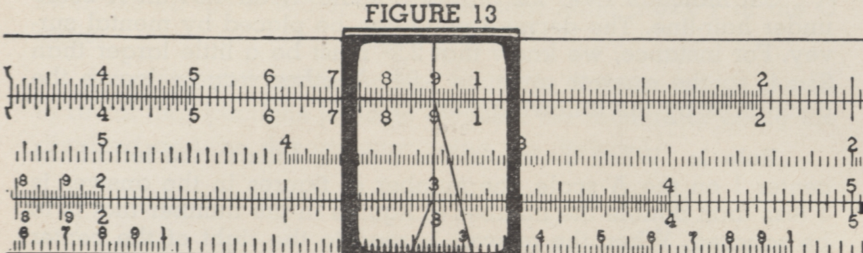
EXTRACTING SQUARE ROOT

To find the square root of a number, set the indicator over the number on the A scale and read the result under the hair-line on the D scale. However, as can be seen, there is both a left-hand and right-hand A scale, and in order to be able to tell which scale is to be used, the following rules must be adhered to.

Rule 2: If a given number has an ODD number of figures to the left of the decimal point, (for instance: 9, 6.4, 144, 156.25, or 22,500 etc.), or if the number is wholly a decimal with an odd number of ciphers directly following the decimal point, (like: .03, .0009, etc.), the left hand a scale should be used. When the number is not wholly a decimal, when reading the result, the number of figures to the left of the decimal point is determined by adding 1 to the number of figures in the given number and then dividing by 2. Where the given number is wholly a decimal, with an odd number of ciphers, subtract 1 from the number of ciphers to the right of the decimal point in the given number, divide by 2, and the result will be the number of ciphers to the right of the decimal point in the answer.

Example 33: Find the Square Root of 9 (Figure 13)

FIGURE 13



(1st) Set indicator to 9 on A scale

(2nd) Read answer, 3, on D scale under hair-line

Set the indicator over 9 on the left-hand A scale, since the number of figures is odd, and read the answer under the hair-line on the D scale.

Example 34: Find the Square Root of 156.25.

Since there are an odd number of figures to the left of the decimal point, the left-hand A scale is used, and the indicator is set at 156.25. The answer under the hair-line, on D scale, reading to three figures is 125. Now, to find the number of figures to the left of the decimal point, add (1) to the number of figures (3) in the given number, and divide by (2) which equals $\frac{1+3}{2}=2$. Therefore, there will be two figures to the left of the decimal and hence, the result is 12.5.

Rule 3: Where the given number has an EVEN number of figures to the left of the decimal, or if it is wholly a decimal with an even number of ciphers directly following the decimal point, the right-hand A scale should be used. In the given number, count the number of figures to the left of the decimal point, then divide this quantity by 2. The result will be the number of figures to the left of the decimal point in the answer, or root. Where the given number is wholly a decimal, with an even number of ciphers, then the number of ciphers to the right of the decimal point divided by 2 will determine the number of ciphers to the right of the decimal point in your answer or root.

Example 35: Find the Square Root of .0016

Set the indicator at 16 on the *right-hand* A scale. (Use the right-hand A scale, because there are an even number of ciphers to the right of the decimal point.) Read the answer, 4 on the D scale. To determine the decimal point or number of ciphers in the answer, divide 2 into the number that represents the number of ciphers in the given number, (.0016), which is 2, and the result, 1 is the number of ciphers to the right of the right of the decimal point in the answer or root. Therefore, the answer is .04.

Example 36: $\sqrt{157}=12.5$

Since we have an odd number of figures, set the indicator over 157 on left-hand half of A scale. Read 12.5 on the D scale under hair-line. To locate the decimal point, add (1) to the number of figures (3) in 157, which gives you 4. Divide this by 2, which is the number of figures to the left of the decimal, giving 12.5.

A number of examples follow for squaring and extraction of square root.

Example 37: $2^2=4$
" **38:** $15^2=225$
" **39:** $26^2=676$
" **40:** $19.65^2=386$
" **41:** $\sqrt[2]{64}=8$

Example 42: $\sqrt[2]{6.4}=2.53$
" **43:** $\sqrt[2]{498}=22.3$
" **44:** $\sqrt[2]{2500}=50$
" **45:** $\sqrt[2]{.16}=.04$
" **46:** $\sqrt[2]{.03}=.173$

RECIPROCALS

Reciprocals of numbers are found instantaneously on the Slide Rule by use of the Cl scale. (In using this scale remember that it should be read from the right to the left).

The reciprocal of a number is the answer secured after dividing that number into 1. For instance, the reciprocal of 2 is ½ $=2\overline{)1}=.5$. the reciprocal of 4 is ¼$=4\overline{)1}=.25$. The reciprocal of any number on the C scale is found directly above it on the Cl scale. For example, above 2 on the C scale is its reciprocal .5 on the Cl scale, or above 4 on the C scale is its reciprocal .25 on the Cl scale.

Examples for Practice

Find the reciprocals of the following numbers:

Example 47: Reciprocal of $3=\frac{1}{3}=.333$

" **48:** Reciprocal of $7.2=\frac{1}{7.2}=.139$

" **49:** Reciprocal of $6=\frac{1}{6}=.166$

" **50:** Reciprocal of $.41=\frac{1}{.41}=2.44$

" **51:** Reciprocal of $9=\frac{1}{9}=.111$

" **52:** Reciprocal of $.0063=\frac{1}{.0063}=159$

CUBE AND CUBE ROOT

Definition of Arithmetical Terms:

Cube: The product obtained by multiplying the square of a quantity by the quantity itself. Thus, $2^3=2\times2\times2=4\times2=8$.

Cube Root: A number or quantity, the cube of which is the given number or quantity is called the cube root of the number. Thus, $\sqrt[3]{8}=2$.

CUBE

The cube of a number is found by setting the indicator over the given number on the D scale and reading the answer under the hair-line on the K scale. For example:

Example 53: $2^3=8$

Set the indicator on 2 of the D scale, and the answer will be found under the hair-line on the K scale. This scale is divided into 3 parts which we shall call the left-hand, the middle and the right-hand K scales.

The number of figures in the answer, depends upon whether the answer falls on the left-hand, middle or right-hand K scale, which is explained by the following rules.

Rule 4: When the answer or cube is found on the left-hand K scale, the number of figures it will contain will be 2 less than 3 times the number of figures in the given number that is to be cubed.

If on the middle K scale, 1 less than 3 times the number of figures in the given number; and if found on the right-hand K scale, the answer will contain 3 times the number of figures in the given number.

Example 54: $3^3=27$

In this case the answer is found on the middle K scale, and the number of figures in the answer is 1 less than three times as many as are in the given figure.

The number of decimal places in the cube or answer is equal to three times the number of decimal places in the given number. For example, $.3^3=.027$, $1.5^3=3.375$, $.02^3=.000008$. As can be seen in these cases, as is true in all others, the number of decimal places in the answer is equal to three times the quantity in the given number.

CUBE ROOT

The cube root of a number is found by setting the indicator over the number on the K scale and reading the answer on the D scale under the hair-line. For example:

Example 55: $\sqrt[3]{27}=3$

Set the indicator at 27 on the middle K scale and read the result, 3 under the hair-line on the D scale.

The method of finding the number of figures to the left of the decimal in the root or answer, is to point off the given number into periods of 3 figures each, starting at the decimal point and counting in each direction. The root or answer, will contain 1 figure to the left of the decimal for each period of 3 digets or fraction of a period in the given number.

For example; in the problem $\sqrt[3]{1728}=12$, the root or answer, 12, contains 2 figures to the left of the decimal because the given number has one period of 3 figures and a fraction of a figure period.

If the number is wholly a decimal or mixed number, additional ciphers must be annexed to the right to make up periods of 3 figures.

Now, to locate the decimal point where the given number is wholly a decimal. In this case, the decimal point, in the root or answer will have as many naughts after it as the given number has sequent periods of 3 naughts, after the decimal. For example:

Example 56: $\sqrt[3]{.000343}=.07$

In this case the decimal in the given number has after it, one period of 3 naughts, which indicates that there will be one naught after the decimal in the answer.

In cases where the given number has 2, 1, or no naughts directly following the decimal such as, (.00343, .0343, or .343) the answer will have no naughts after the decimal.

To ascertain as to which of the three K scales should be used: If the first period from the left contains but one figure, the left-hand K scale is used, if it contains two figures the middle K scale is used; and if it has three figures the right-hand K scale is used.

For example.

Example 57: $\sqrt[3]{8}=2$ use left-hand K scale.
" **58:** $\sqrt[3]{27}=3$ use middle K scale.
" **59:** $\sqrt[3]{125}=5$ use right-hand K scale.

A group of examples for practice in extraction of cube-root follow:

Example 60: $\sqrt[3]{64}=4$
" **61:** $\sqrt[3]{8}=2$
" **62:** $\sqrt[3]{343}=7$
" **63:** $\sqrt[3]{.000715}=.0894$
" **64:** $\sqrt[3]{.00715}=.193$

Example 65: $\sqrt[3]{.0715}=.415$
" **66:** $\sqrt[3]{.516}=.803$
" **67:** $\sqrt[3]{27.8}=3.03$
" **68:** $\sqrt[3]{5.49}=1.76$
" **69:** $\sqrt[3]{87.1}=4.43$

FOURTH POWER AND FOURTH ROOT

The Fourth Power of a given number is equal to the square of the square of the given number. For example:

Example 70: $5^4=625$

Set indicator over 5 on the D scale and read its square, 25, under hair-line on A scale. Next, set indicator over 25 on the D scale and read its square, 625, on A scale, which is the fourth power of 5, ie. 5^4.

The Fourth Root of a given number is obtained by extracting the square-root of the given number, and then extracting the square-root of that result. For example:

Example 71: $\sqrt[4]{81}=3$

Set the indicator over 81 on the right-hand A scale and read its square root, 9, on the D scale. Next, set this result 9 on the right-hand A scale and read its square-root, 3, on the D scale, which result is the fourth-root of 81, ie. $\sqrt[4]{81}$.

COMBINATIONS OF PROCESSES

A Slide rule is especially useful where some combination of porcess is necessary, like multiplying 3 numbers together and dividing by a third. Operation of this sort may be performed in such a way that the final answer is obtained immediately without finding intermediate results.

1. Multiplying several numbers together. For example, suppose it is desired to multiply $4\times8\times6$. Place the right-hand index of the C scale over 4 on the D scale and set the indicator over 8 on the C scale. Now, leaving the indicator where it is, move the slider till the right-hand index is under the hair-line. Now, leaving the slider where it is, move the indicator until it is over 6 on the C scale, and read the result, 192, on the D scale. This may be continued indefinitely, and so as many numbers as desired may be multiplied together.

Example 72: $2.32\times154\times.0375\times.56=7.54$

2. Multiplication and division. Suppose we wish to do the following example:

Example 73: $\frac{4\times15}{2.5}=24$

First divide 4 by 2.5. Set indicator over 4 on the D scale and move the slider until 2.5 is under the hair-line. The result of this division, 1.6, appears under the left-hand index of the C scale. We do not need to write it down, however, but we can immediately move the indicator to 15 on the C scale and read the final result 24 on the D scale under the hair-line. Let us consider a more complicated problem of the same type:

Example 74: $\frac{30}{7.5} \times \frac{2}{4} \times \frac{4.5}{5} \times \frac{1.5}{3} = .9$

First set indicator over 30 on the D scale and move slider until 7.5 on the C scale comes under the hair-line. The intermediate result, 4, appears under the right-hand index of the C scale. We do not need to write it down but merely note it by moving the indicator until the hair-line is over the right-hand index of the C scale. Now we we want to multiply this result by 2, the next factor in the numerator. Since two is out beyond the body of the rule, transfer the slider till the other (left-hand) index of the C scale is under the hair-line, and then move the indicator to 2 on the C scale. Thus, successive division and multiplication is continued until all the factors have been used. The order in which the factors are taken does not affect the result. With a little practice you will learn to take them in the order which will require the fewest settings. The following examples are for practice:

Example 75: $\frac{6}{3.5} \times \frac{4}{5} \times \frac{3.5}{2.4} \times \frac{7}{2.8} = 0.8$

Example 76: $352 \times \frac{273}{254} \times \frac{760}{768} = 374$

An alternative method of doing these examples is to proceed exactly as though you were multiplying all the factors together, except that whenever you come to a number in the denominator you use the C I scale instead of the C scale. The reader is advised to practice both methods and use whichever one he likes best.

3. The area of a circle. The area of a circle is found by multiplying $3.1416 = \pi$ by the square of the radius or by one-quarter the square of the diameter.

(Formula: $A = \pi R^2$ or $A = \pi \frac{D_2}{4}$).

Example 77: The radius of a circle is 0.25 inches; find its area.

Area $= \pi \times (0.25)^2 = 0.196$ square inches.

Set left-hand index of C scale over 0.25 on D scale. $(0.25)^2$ now appears above the left-hand index of the B scale. This can be multiplied by π by moving the indicator to π on the B scale and reading the answer .196 on the A scale. This is an example where it is convenient to multiply with the A and B scales.

Example 78: The diameter of a circle is 8.1 feet. What is its area?

$$\text{Area} = \frac{\pi}{4} \times (8.1)^2 = .7854 \times (8.1)^2 = 51.7 \text{ square inches.}$$

Set right-hand index of the C scale over 8.1 on the D scale. Move the indicator till hair-line is over .7854 (the special long mark near 8) at the right-hand of the B scale. Read the answer under the hair-line on the A scale. Another way of finding the area of a circle is to set 7854 on the B scale to one of the indices of the A scale, and read the area from the B scale directly above the given diameter on the D scale.

4. The circumference of a circle. Set the index of the B scale to the diameter and read the answer on the A scale opposite π on the B scale (Formula: $C = \pi D$ or $C = 2\pi R$).

Example 79: The diameter of a circle is 1.54 inches, what is its circumference?

Set the left-hand index of the B scale to 1.54 on the A scale. Read the circumference 4.85 inches above π on the B scale.

EXAMPLES FOR PRACTICE

80: What is the area of a circle 32½ inches in diameter? Answer 830 square inches.

81: What is the area of a circle 24 inches in diameter? Answer 452 square inches.

82: What is the circumference of a circle whose diameter is 95 feet? Answer 298 feet.

83: What is the circumference of a circle whose diameter is 3.65 inches? Answer 11.5 inches.

5. Ratio and Proportion.

Example 84: $3 : 7 :: 4 : X$ or $\frac{3}{7} = \frac{4}{X}$

Find X

Set 3 on C scale over 7 on D scale. Read X on D scale under 4 on C scale. In fact, any number on the C scale is to the number directly under it on the D scale as 3 is to 7.

PRACTICAL PROBLEMS SOLVED BY SLIDE RULE

85: Discount.

A firm buys a typewriter with a list price of $150, subject to a discount of 20% which means 0.8 of the list price, and 10% more means $0.8 \times 0.9 \times 150 = 108$.

To do this on the slide rule, put the index of the C scale opposite 8 on the D scale and move the indicator to 9 on the C scale. Then move the slider till the right-hand index of the C scale is under the hair-line. Now, move the indicator to 150 on the C scale and read the answer $108 on the D scale. Notice that in this, as in many practical problems, there is no question about where the decimal point should go.

86: Sales Tax.

A man buys an article worth $12 and he must pay a sales tax of 1.5%. How much does he pay? A tax of 1.5% means he must pay 1.015×12.00.

Set index of C scale at 1.015 on D scale. Move indicator to 12 on C scale and read the answer $12.18 on the D scale. A longer but more accurate way is to multiply $12 \times .015$ and add the result to $12.

87: Unit Price.

A motorist buys 17 gallons of gas at 19.5 cents per gallon. How much does he pay?

Set index of C scale at 17 on D scale and move indicator to 19.5 on C scale and read the answer $3.32 on the D scale.

88: Gasoline Mileage.

An automobile goes 175 miles on 12 gallons of gas. What is the average gasoline consumption?

Set indicator over 175 on D scale and move slider till 12 is under hair-line. Read the answer 14.6 miles per gallon on the D scale under the left-hand index of the C scale.

89: Average Speed.

A motorist makes a trip of 256 miles in 7.5 hours. What is his average speed?

Set indicator over 256 on D scale. Move slider till 7.5 on the C scale is under the hair-line. Read the answer 34.2 miles per hour under the right-hand index of the C scale.

90: Decimal Parts of an Inch.

What is 5/16 of an inch expressed as decimal fraction?

Set 16 on C scale over 5 on D scale and read the result .3125 inches on the D scale under the left-hand index of the C scale.

91: Physics.

A certain quantity of gas occupies 1200 cubic centimeters at a temperature of 15° C and 740 millimeters pressure. What volume does it occupy at 0°C and 760 millimeters pressure?

$$\text{Volume} = 1200 \times \frac{740}{760} \times \frac{273}{288} = 1110 \text{ cubic cm.}$$

Set 760 on scale over 12 on D scale. Move indicator to 740 on C scale. Move slider till 288 on C scale is under hair-line. Move indicator to 273 on C scale. Read answer, 1110, under hair-line on D scale.

92: Chemistry.

How many grams of hydrogen are formed when 80 grams of zinc react with sufficient hydrochloric acid to dissolve the metal?

$$\frac{80}{X} = \frac{65.4}{2.01}$$

Set 65.4 on C scale over 2.01 on D scale. Read $X = 2.46$ grams under 80 on C scale.

In conclusion, we want to impress upon those to whom the slide rule is a new method of doing their mathematical calculations, and also the experienced operator of a slide rule, that if they will form a habit of, and apply themselves to using a slide rule at work, study or during recreations, they will be well rewarded in the saving of time and energy. ALWAYS HAVE YOUR SLIDE RULE AND INSTRUCTION BOOK WITH YOU, the same as you would a fountain pen or pencil.

The present day wonders of the twentieth century prove that there is no end to what an individual can accomplish—the same applies to the slide rule.

You will find after practice that you will be able to do many specialized problems that are not outlined in this instruction book. It depends entirely upon your ability to do what we advocate and to be slide rule conscious in all your mathematical problems.

CONVERSION FACTORS

1. *Length:*

   1 mile=5280 feet=1760 yards.

   1 inch=2.54 centimeters.

   1 meter=39.37 inches.

2. *Weight (or Mass):*

   1 pound=16 ounces=0.4536 kilograms.

   1 kilogram=2.2 pounds.

   1 long ton=2240 pounds.

   1 short ton=2000 pounds.

3. *Volume:*

   1 liquid quart=0.945 litres.

   1 litre=1.06 liquid quarts.

   1 U. S. gallon=4 quarts=231 cubic inches.

4. *Angular Measure:*

   3.14 radians=π radians=180 degrees.

   1 radian=57.30 degrees.

5. *Pressure:*

   750 millimeters of mercury=14.7 pounds per square inch.

6. *Power:*

   1 horse power=550 foot pounds per second=746 watts.

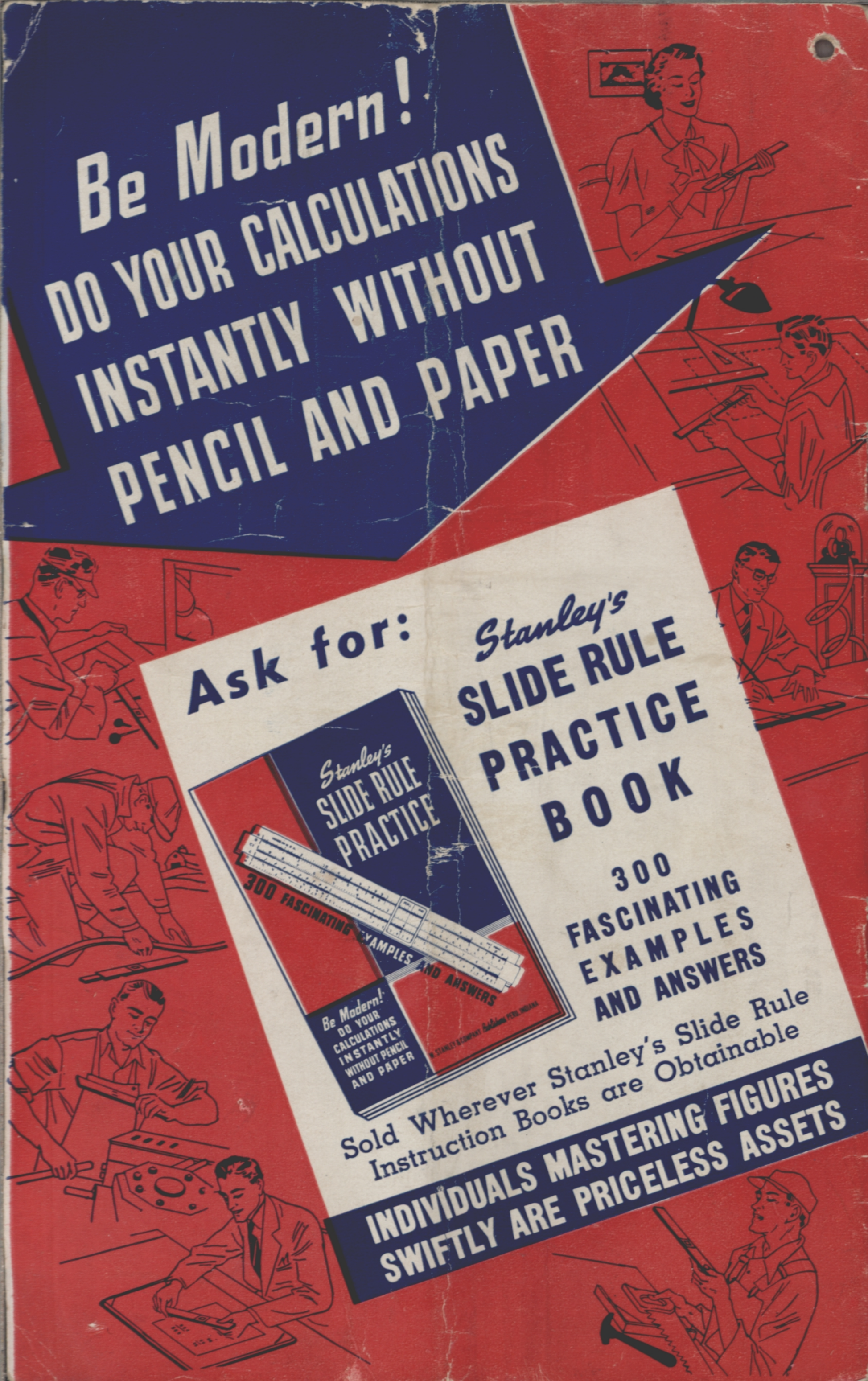
7. *Miscellaneous:*

   60 miles per hour=88 feet per second.

   980 centimeters per second=32.2 feet per second= acceleration of gravity.

   1 cubic foot of water weighs 62.4 pounds.

   1 gallon of water weighs 8.34 pounds.


Be Modern!
DO YOUR CALCULATIONS
INSTANTLY WITHOUT
PENCIL AND PAPER
Ask for:
Stanley's
SLIDE RULE
PRACTICE
BOOK
300
FASCINATING
EXAMPLES
AND ANSWERS
Stanley's
SLIDE RULE
PRACTICE
300 FASCINATING EXAMPLES AND ANSWERS
Be Modern!
DO YOUR
CALCULATIONS
INSTANTLY
WITHOUT PENCIL
AND PAPER
Sold Wherever Stanley's Slide Rule
Instruction Books are Obtainable
INDIVIDUALS MASTERING FIGURES
SWIFTLY ARE PRICELESS ASSETS