

"ACU-RULE"

A Mannheim type slide rule with A, B, C, D, CI and K Scale

A simple accurate device for easily and quickly solving mathematical problems involving multiplication, division and the combination of each or both, percentage and proportion, squares and square root, cubes and cube roots, diameters and areas, reciprocals, and combinations of these processes.

The operation of a slide rule is extremely easy. It is well worth while for anyone called upon to do much numerical calculation. to learn to use one. By means of a slide rule hours of work are saved without mental strain in the calculation of everyday problems of all forms of business.

Used by: Students, Teachers, Architects, Engineers, Merchants, Salesmen, Purchasing Agents, Manufacturers, Accountants, Estimators and Chemists.

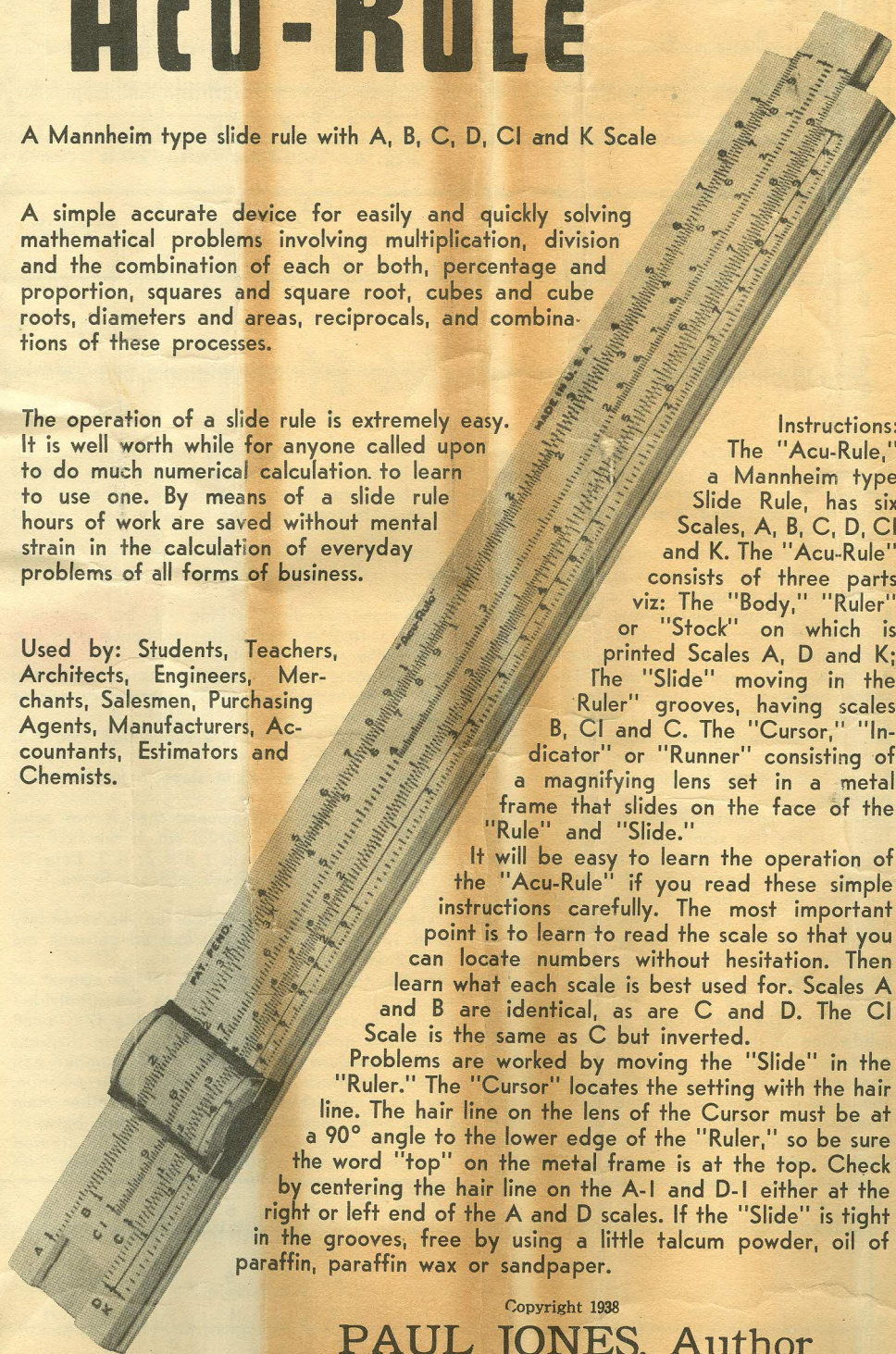
Instructions:
The "Acu-Rule," a Mannheim type Slide Rule, has six Scales, A, B, C, D, CI and K. The "Acu-Rule" consists of three parts viz: The "Body," "Ruler" or "Stock" on which is printed Scales A, D and K; The "Slide" moving in the "Ruler" grooves, having scales B, CI and C. The "Cursor," "Indicator" or "Runner" consisting of a magnifying lens set in a metal frame that slides on the face of the "Rule" and "Slide."

It will be easy to learn the operation of the "Acu-Rule" if you read these simple instructions carefully. The most important point is to learn to read the scale so that you can locate numbers without hesitation. Then learn what each scale is best used for. Scales A and B are identical, as are C and D. The CI Scale is the same as C but inverted.

Problems are worked by moving the "Slide" in the "Ruler." The "Cursor" locates the setting with the hair line. The hair line on the lens of the Cursor must be at a 90° angle to the lower edge of the "Ruler," so be sure the word "top" on the metal frame is at the top. Check by centering the hair line on the A-1 and D-1 either at the right or left end of the A and D scales. If the "Slide" is tight in the grooves, free by using a little talcum powder, oil of paraffin, paraffin wax or sandpaper.

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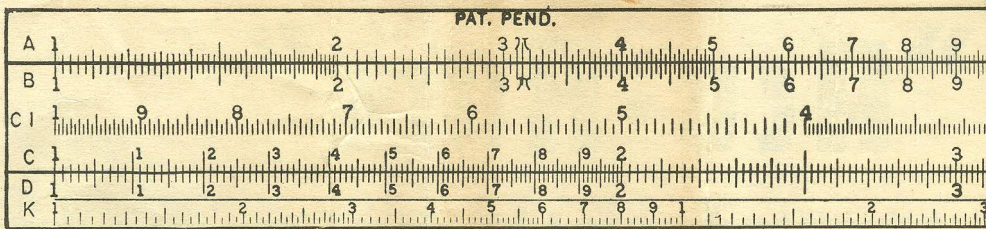


Fig. A. "Acu-Rule" with "Slide" closed showing scales A, B, C, D, and K.

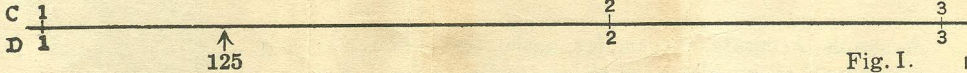


Fig. I.

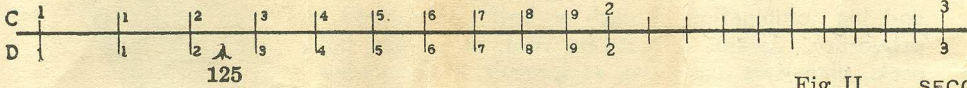


Fig. II.

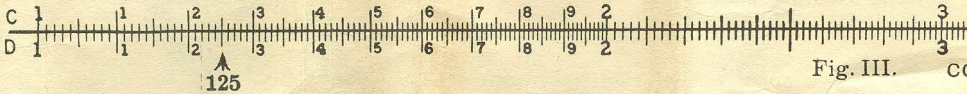


Fig. III.

1. Experience proves that the beginner's greatest difficulty lies in correctly locating numbers on the scales. We cannot recommend too strongly this all important point to the beginner. The graduations on the scales are not measures of length, but represent figures. The reading of all of the scales is accomplished in the same manner. We will illustrate scale readings by using the C and D scale as an example.

2. The C and D scales consist of nine main divisions (Fig. I) of unequal length; the first line of each of these divisions is numbered, respectively, 1 (called left index), 2, 3, 4, 5, 6, 7, 8, 9; the last line is numbered 1, and is called the right index.

3. Each of these main divisions is divided into ten (secondary) divisions (Fig. II). The secondary divisions between main division 1 and 2 are numbered 1 to 9 in smaller figures. Space does not permit the numbering of other secondary lines between other main divisions.

4. Each of the spaces between the secondary lines is again sub-divided. Thus, each secondary space between main 1 and main 2 is divided into 10 (unequal) parts. The secondary spaces between main 2 and 3 and 3 and 4 are divided into 5 (unequal) spaces (Fig. III).

5. The secondary spaces from main 4 to the right index of the scale are subdivided into two (unequal) parts by one line between the two secondary lines (Fig. III).

6. To locate three figure numbers on the C and D scales, there are three steps in the following sequence:

Step 1. The first significant figure of a number is the first left hand numeral that is not zero. Thus, 1 is the first significant figure of the numbers, 125, 12.5, .125, .0125, etc. If the first significant figure is 1, the location of the number is between the main divisions 1 and 2; if 2, between 2 and 3; if 3, between 3 and 4, etc. For example, we will locate 125. The significant figure is 1, therefore the number is between main 1 and 2 (Fig. I).

Step 2. The next figure to the right of the significant figure locates the number on the secondary divisions in a similar manner. As the second number of 125 is 2, our number is located between the secondary division 2 and 3 of the main division 1 to 2 (Fig. II).

Step 3. The third figure 5 locates the number on the third set of divisions, which appear in Fig. III—(The slide rule, C and D scale, in its final form). The secondary divisions are subdivided into tenths. The third figure of 125 is 5. Therefore, we locate the number 125 on the fifth small subdivision to the right of the 2 of the secondary divisions between 1 and 2 of the main divisions as shown by the 125 in Fig. I, II and III. This same procedure would apply if the number had been any of the following 12.5, 1.25, .125, .0125 or with the decimal point in some other position. The same procedure would also be followed for any other number between any of the other main divisions, excepting it will have to be noted that the small secondary subdivisions vary between the main divisions (note par. 4 and 5 and Fig. III). Between main 2 and 4 all three figured numbers ending in an even number will fall on a secondary small subdivision line, as these lines

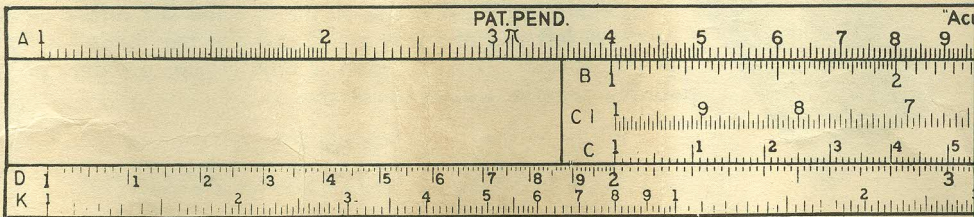
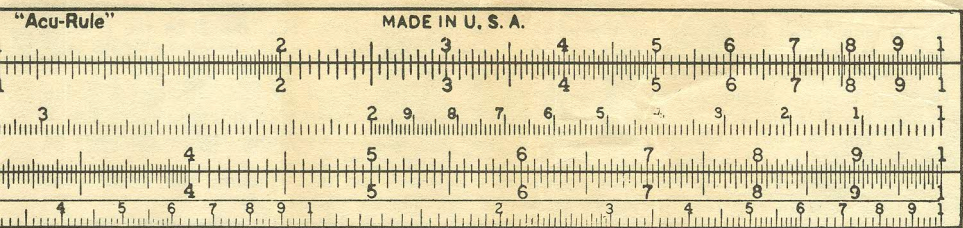
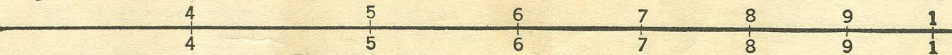


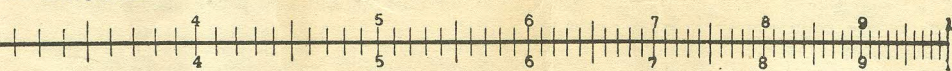
Fig. B. "Acu-Rule" with "Slide" set to right with



Following the C scales, A, B, C, D, CI and IC.



MAIN DIVISIONS



SECONDARY DIVISIONS



COMPLETE SCALE

have a value of 2, 4, 6, 8, while between main 4 and the right hand index 1, numbers only ending in 5 will fall on the secondary small subdivision line. Where they do not fall on the line you must estimate the distance between the small secondary subdivision lines for the number. Where the number has but two figures, you use first the main and then the secondary divisions and when there is only one number, use just the main. Where there are four or more numbers, the numbers past the third number are estimated between the small secondary subdivisions.

7. The decimal point is not considered in operating the slide rule, but is placed through a mental survey of the influence of the involved factors upon the result as it is estimated by arithmetic. Where numbers are multiplied or divided ending in zero, the zeros in the result must be computed in a like manner.

8. The CI scale (C inverted) is like scale C, except that the numbers are placed on the rule in inverted order reading from right to left. This scale enables you to read reciprocals of all numbers at once without setting the slide. It enables three factors to be taken at a single setting.

9. Scales A and B; if 1 at the extreme left is taken as unity then 1 in the middle of the scale is 10 and 1 at the extreme right is 100. The main, secondary and small subdivisions are computed the same as on scales C and D.

10. Scale K is graduated from 1 to 1,000, while scale D runs from 1 to 10. The space given to each number on scale D is three times that given to the same number on scale K. If one at the extreme left is taken as unity, then the first 1 to the right is 10 (1 to 10), the next 1 is 100 (10 to 100) and to the third at the right is 1000 (100 to 1000).

WHAT EACH SCALE IS USED FOR

11. The C and D scales are used for multiplication, division, multiplication combined with division, and proportions.

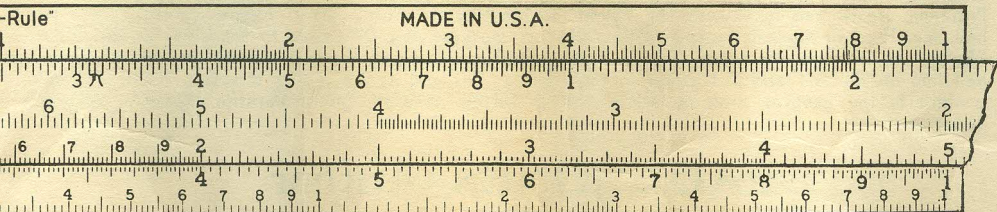
12. The A and D scales are used to find squares and square roots.

13. The D and K scales are used to find cubes and cube roots.

14. The CI scale is used for multiplication of three or more factors, multiplication and division, successive division and reciprocals. There are other uses of the scales but those listed are used most frequently.

15. Multiplication. (C and D scales) To multiply two factors, set the index of the C scale (either right or left end figure 1) on one factor on the D scale. Find the other factor on the C scale, and you will read the answer under it on the D scale.

The "Acu-Rule" in Fig. B is set to multiply so that one factor is 2 (or 20, 200 or .2, .02, etc.). This is done by moving the "Slide" to the right so that the left index 1 of the C scale is over the main 2 of the D scale. Notice that under 2 on the C scale is 4, under 2.5 is 5, under 3 is 6, under 3.5 is 7, under 4 is 8, and under 5 is 10, and that all factors on the C scale times 2 have the correct answer under them on the D scale. If you wanted to multiply 2 by a number greater



left index of C scale set over 2 on D scale.

than 5, you would pull the "Slide" to the left and set the right index over the 2 on the D scale and read in the same manner. All numbers are multiplied in the same manner. Properly locate your factors on each scale and proceed in the same manner.

16. Division. Division is the reverse of multiplication. Set the divisor on the C scale over the dividend on the D scale and read the answer on the D scale under the C index. Look at Fig. B again. Note that the left index of the C scale is on 2 of the D scale. Note that all numbers on the D scale divided by all numbers over them on the C scale equal 2.

17. Squares, Square Roots. To find the square of a number, set the indicator hair line to the number on the D scale and read its square under the hair line on the A scale. To find the square root of a number, the reverse process is used. Set the hair line at the number on the A scale and read the square root on D.

18. Cubes and Cube Roots. To find the cube of a number, set the indicator hair line to the number on the D scale and read the answer under the hair line on the K scale.

To find the cube root of a number, reverse this and set the indicator hair line to the number on the K scale and read the cube root on the D scale. In both cases be sure you understand the divisions of the calibrations of the K scale (Par. 10).

19. Proportions. Problems in proportions are encountered every day. Among problems of this type are the conversion of yards to meters, dollars to pounds, knots to miles, meters to centimeters, etc., the determination of weight of one quantity when the weight of another quantity is known. It will be found that when the slide is set so that 2 on the C scale coincides with 4 on the D scale, that all readings on C bear to the coinciding reading on D a ratio of 2:4 or 1:2. With any setting of the slide, all coinciding readings are in the same ratio to each other.

20. The Reciprocal Scale—CI Scale. The reciprocal CI scale is of the same length as C, but runs from right to left. When multiplying with the scale of reciprocals, the two factors are placed one above the other, and the product read off on D at the left or right index of the reciprocal scale. Since one of these two indexes is always in coincidence with D, the product resulting from every setting can be immediately read off. Moreover, by the aid of CI, we can in most cases multiply by an additional factor, without moving the slide, so that calculations of more than two factors can be made with one setting of the slide.

Example: A wall is 15.5 ft. long, 0.8 ft. high and 0.55 ft. thick. What is its volume?

$$V=15.5 \times 0.8 \times 0.55=6.82 \text{ Cu. Ft.}$$

Solution: Set the cursor at 155 on D; draw 8 on the reciprocal scale under cursor line; read the result on D at 55 or C. The advantage of the reciprocal scale is that it permits two operations with one setting of the slide, such as double multiplication, or combined multiplication and division, and eliminates, in most cases, the necessity of reversing the slide which so frequently occurs with slide rules not having the CI scale.

21. Accuracy is developed by practice. First learn to accurately locate the numbers on the scales. This will avoid errors in results. Then learn to accurately read the answers. All answers will not fall exactly on a calibration (division mark). You must estimate the distance between the small divisions. When studying the different operations, develop your own problems, and see that you obtain the correct answers on the rule.

This "Acu-Rule" has been carefully made and should be correct to one tenth of one percent.

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