Improved Slide Rule, with Special Scale and Pointed Cursor.

Mean Heights of Indicator Diagrams by use of Slide Rule.

The quickest and most accurate method of obtaining the mean pressure of an Indicator Diagram is by means of a planimeter; unfortunately this entails the possession of a costly instrument, which may only occasionally be called into requisition.

The more ordinary way is to divide the diagram into ten equal divisions; and, with a scale corresponding to strength of indicator spring, to measure separately the mean heights of these divisions, add them together, then divide the result by 10 to obtain the mean.

This entails many processes, and becomes a somewhat tedious operation. In the first place, if some handy means of dividing up the diagram is not at hand, recourse is had to the dividers; then there are the chances of the correct scale not being found; next we have ten separate measurements to make, and these to be added together (the division by 10 of course only entails the moving of a decimal place).

Now with the **improved divisions on the bevelled edge** of Slide Rule, the latter lends itself admirably to the **easy** and **expeditious** division of diagram; any even length on the rule can be used, according to length of diagram. Fig. 6 shows 4in. being used.

With the **improved cursor** the heights of successive ordinates are added **continuously,** as shown in Fig. 7 and Fig. 8, by starting from zero on the first ordinate and sliding the pointer along the length of each ordinate in succession. This is quite independent of any special scales, and only the final reading need be noted. This figure multiplied by strength of spring, and divided by 10 gives the mean pressure.

NOTE.—In the continuous addition there are **fewer processes**, and therefore **less chances of error**, a great **saving of time**, and, having slide rule in one's hand, **the whole process can be gone through without writing down a single figure.**

In the diagram the final reading of 10 ordinates was 7·1 inches; then 7·1 × 6 spring = 42·6 lbs. **mean pressure.**

The same diagram by planimeter was **42·2 lbs.**

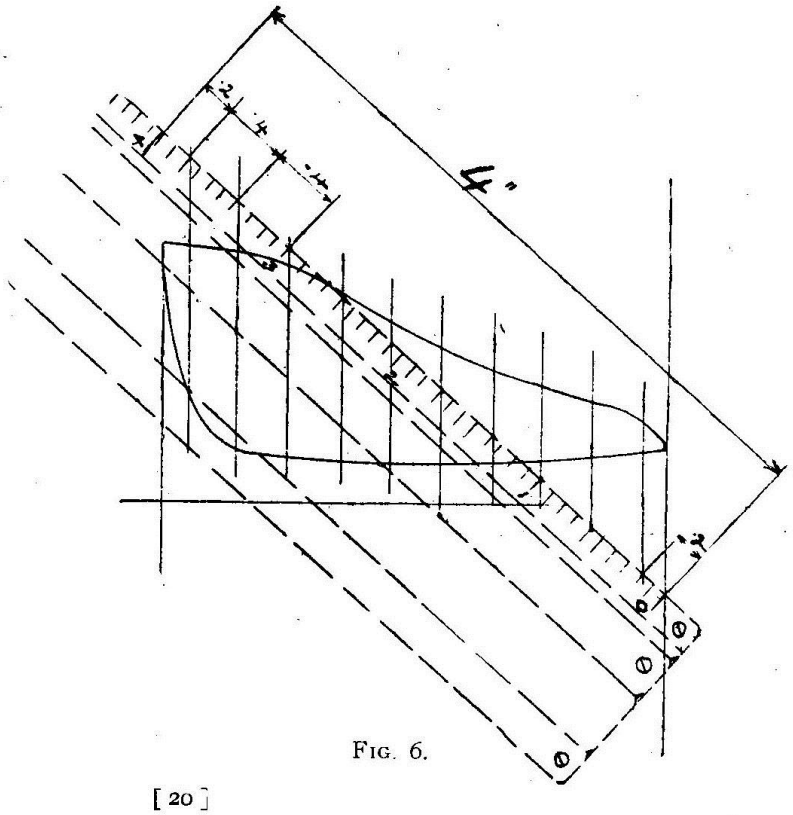

FIG. 6.

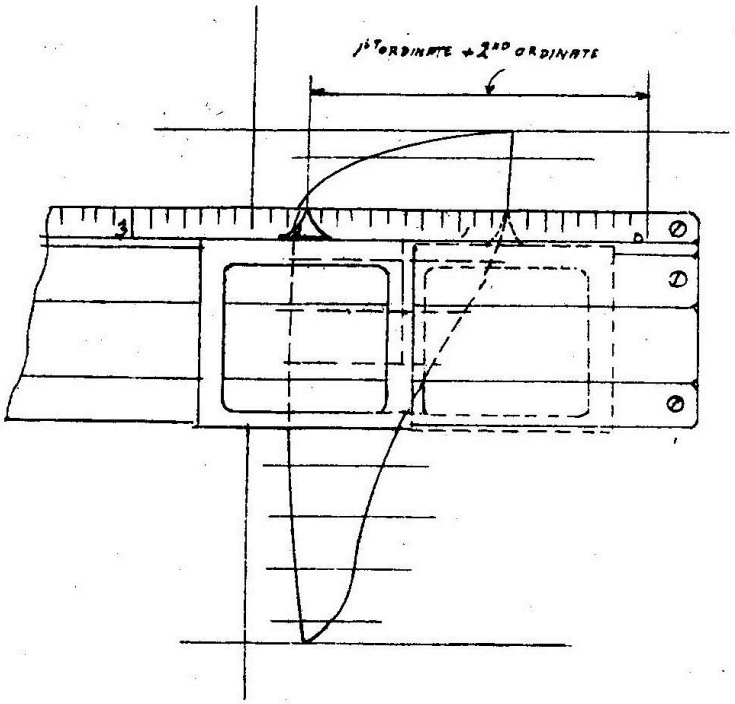

FIG. 7.

Other Applications of the Slide Rule with Pointed Cursor.

If the cursor be set to a series of numbers on one of the scales, the lengths marked off by the pointer will be proportional to the *logarithms of the numbers.*

Example.—The expansion curve of a gas engine diagram is given. It is required to find whether the expansion follows the law pv^n = const.; and, if so, to determine the index n.

By taking logarithms we find that—

Log p + n log v = log const = constant.

Therefore, plot log v and log p as co-ordinates. If the law be true the curve will be transformed into a straight line, the slope of which gives n.

In order to test this we have marked five points on the expansion curve. The p's and v's for these are

measured in inches and inserted in the drawing. The right hand figure shows the result of plotting the logs of these numbers, using the A scale and the pointed cursor. The points are seen to lie fairly well on a straight line. The slope of the line measures 1·26 to 1, as shown. The law of the expansion is therefore very approximately—

$$pv^{1\cdot26} = \text{const.}$$

NOTE.—If the C or D scale had been used instead of the A scale, the diagram showing log p and log v would have been twice the size. If the numbers had been first cubed by using scales A and C, the figure would have been three times as large. Or, the numbers could have been raised to the fourth power, using scales C and D, with the result that the diagram would have been magnified four times (linear), the line from 1 to 5 being thus nearly 10 inches long.

Starting with a straight line, slope n, and working the reverse way, any

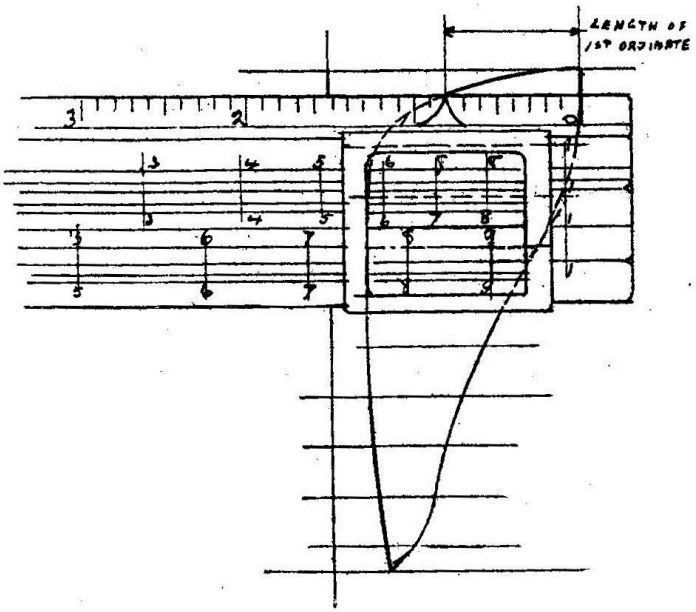

FIG. 8.

curve pv^n = const. is very readily plotted by this method. There are other cases in which the logarithms of numbers have to be plotted, especially in the reduction of experimental observations made in the laboratories of technical schools and colleges, in which this pointed cursor should prove very generally useful.

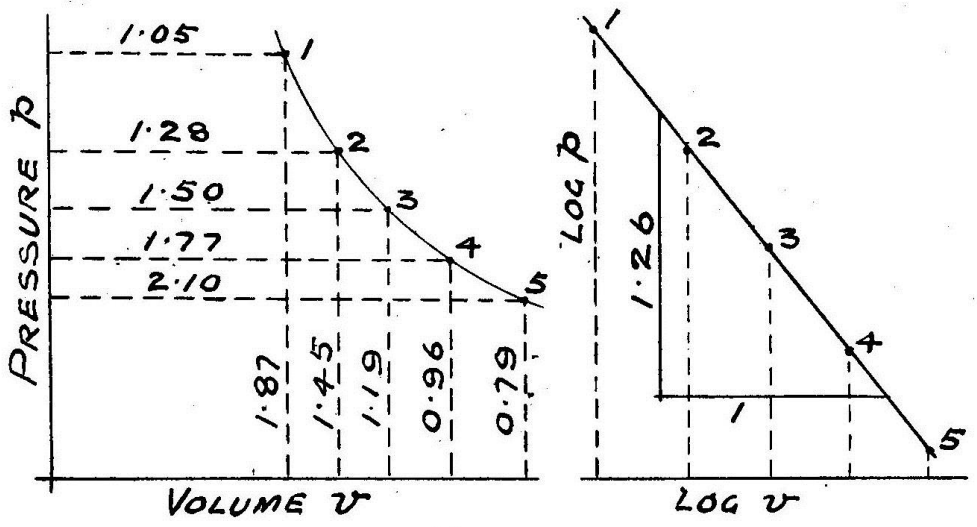

FIG. 9.