Sept. 7, 1926. 1,599,102

J. SCHAUER

COMBINED LOGARITHMIC CALCULATING DEVICE AND WRITING IMPLEMENT

Filed March 23, 1926

Fig. 1.

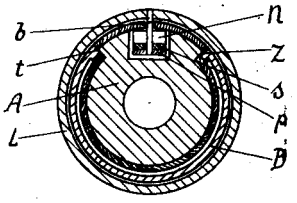


Fig. 2.

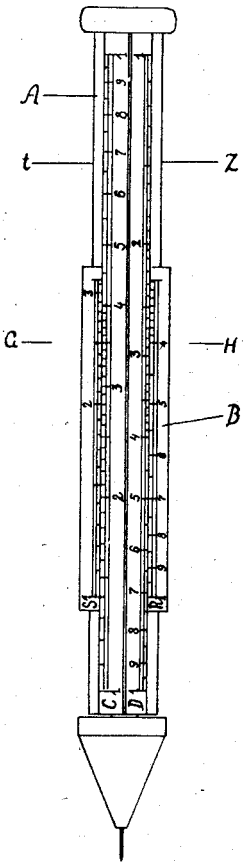
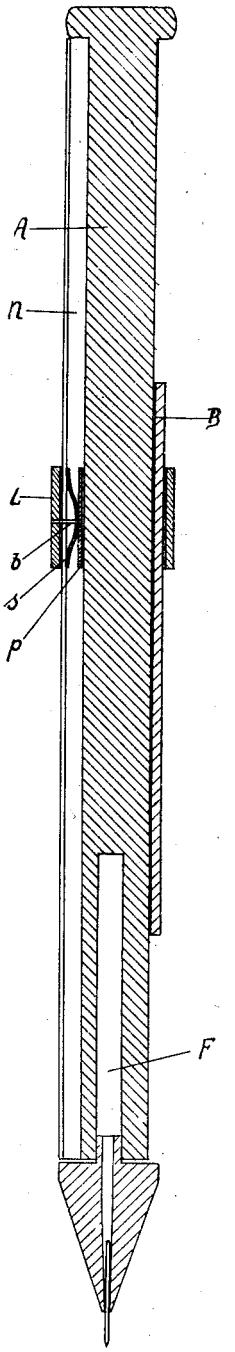


Fig. 3.



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Patented Sept. 7, 1926. 1,599,102

UNITED STATES PATENT OFFICE.

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COMBINED LOGARITHMIC CALCULATING DEVICE AND WRITING IMPLEMENT.

Application filed March 23, 1926, Serial No. 96,833, and in Germany December 31, 1924.

Attempts have already been made repeatedly to combine the logarithmic slide rule which is so frequently used with a writing implement. The inventions of this kind however proved cumbersome and unsuitable for use since they retained in the main the principle of the flat slide rule and merely consisted of adaptations of these in a cylindrical shape. The principal drawback which resulted from this was the covering up of the nib or pencil point on each movement of the slide in the direction of the said point so that the writing down of the result of the calculation was only possible after the slide part had once more been pushed back.

This drawback of the slide rules combined with writing implements was avoided by the present applicant in a previous invention forming the subject matter of German Patent No. 423,733 according to which a slide cylinder of half the length of the fixed scales was used. With this arrangement, however, the disadvantage arose that in many cases the length of the missing half of the scale on the slide had to be made up for by corresponding movement of the slide which led to inaccuracies and loss of time.

According to the present invention this drawback is eliminated by the use of reciprocal logarithmic fixed scales and reciprocal logarithmic slide scale halves. By these means it is rendered possible to execute every operation of multiplication and division of two numbers by a single movement of the slide. In the constructional form according to the invention hereinafter described, three factors may even in many cases be multiplied with one movement of the slide.

This result which is unattainable with other types of combined slide rules and writing implements, represents not only a saving of time but also when the device is made up in pocket form with correspondingly shorter and therefore more inaccurate scales, a diminution of the sources of error and consequently an increase of the accuracy.

This property of the new invention is therefore to be regarded as an important technical result.

A preferred constructional form of the invention is illustrated by way of example on the accompanying drawing in which:

Fig. 1 is a cross section,

Fig. 2 a plan, and Fig. 3 a longitudinal section of the combined slide rule and writing implement.

Referring to Fig. 2 two complete logarithmic scales C and D are arranged parallel to one another on the outer surface of a pencil or fountain pen A. The scale C runs from left to right, the scale D from right to left and these two scales are arranged on the raised portion of the surface provided with two guide edges t and z (Fig. 1). Adjoining these guiding edges and running concentrically round the outer surface of the writing implement is a slidable split cylinder B of half the length of the fixed scale. This split cylinder has on each of its two longitudinal edges one half of a complete logarithmic scale; the first of these half scales S (namely the upper one) carries the numbers 1–316 running from left to right while the second opposite half R (namely the lower one) bears the numbers from 316 to 100 running from right to left. Above the two scales of the slide cylinder B the two halves of the scale for squares (not shown in Fig. 2) may be arranged, the squares from 1 to 10 being arranged above the upper slide scale and the squares from 10–100 above the lower slide scale. These two scales have their numbers running in the same direction as those of the slide scales on the edges of the cylinder.

The device for pushing forward the lead holder is arranged at F. The slide cylinder is of elastic resilient material and can therefore be adjusted to any position.

The other usual scales, namely, the sine and tangent scales, also the cube scale and scale of logarithms may be arranged on the remaining outer surface of the writing implement. Instead of these scales this space may also be used for special scales for various industrial purposes. In order that these scales should not be worn out by the slide cylinder the latter is folded over at its two longitudinal edges (Fig. 1).

The correlation of the extra scales with the fixed scale is effected by means of the cursor or by means of the ends of the slide cylinder.

The cursor consists of a short cylinder of glass or better still of any transparent unbreakable material fixed in a metal frame and is provided with a cursor line and with a spring s and a small metal plate p (Figs. 1 and 3). This upwardly pressing spring which is movable in a slot between the scales

which is covered up except for a small medial slit by the outer covering of the fixed cylinder enables the cursor to be adjusted to any position and to remain always in a plane perpendicular to the axis of the cylinder owing to the action of the plate *p*. A cursor ring with a slightly curved surface of transparent material may also be used, said ring acting simultaneously as a lens. Finally the cursor ring may be constructed of transparent celluloid with a sharp edge for use as a cursor line.

In use the device is held between the thumb and forefinger of the left hand above the nib or pencil point. The slide cylinder and the cursor are moved with the right hand, after which the latter hand may be used to write down the result.

The multiplication of two numbers of which each has a smaller numerical value than 316 and of two numbers each of which has a greater numerical value than 316 is effected by moving the slide divisions comprising these numbers along the corresponding adjacent fixed scales C and D as on ordinary slide rules. These movements of the slide are only carried out from left to right since on account of the reciprocal scale the initial and final markings of the scale are opposite to one another.

In the case of two factors on which the one is smaller in numerical value than 316 and the other larger than 316, the method of scale extension is employed. One of the unit divisions of the slide is adjusted to the factor which lies nearer to the nib or pencil point i. e. to that one of the two factors which lies to the left; the division corresponding to the second factor on the opposite left half of the fixed scale shows the result on the adjacent slide scale.

In Fig. 2 of the drawing in the position of the slide shown for example the product $1.4 \times .5 = .7$ will be found on the slide scale R under the division 5 of the scale D. In the case of the multiplication of more than two factors this method is not advantageous as the result is not shown on the slide scale. In this case a method is used which consists in adjusting the cursor to that one of two given factors which lies on the right hand side and to slide the scale division corresponding to the second factor on the slide cylinder under the cursor line. The product is shown below the unit division of the slide on the same scale to which the cursor was adjusted.

This reciprocal method completely replaces the scale extension and gives the product on the fixed scale where it may be multiplied with a third factor. In this way it is generally possible to find the product of three factors with one adjustment, the scale extension method being also used if necessary.

In Fig. 2 of the drawing the position for the product $35 \times .4 \times 2.7 = 3.78$ is shown. The division 4 of the scale R is set to the division 35 of the scale C by means of the cursor corresponding to G—H; the product 14 on the left hand side under S^1 is not read off but instead of this the final product is found on scale C under division 27 of the scale S.

The division of two numbers can always be converted into a multiplication with the reciprocal of the divisor or denominator. This is effected by adjusting the cursor line or the end of the slide to the division corresponding to the divisor or denominator so that on the opposite scale the dividend or numerator of the factor appears and is dealt with as above described.

It is, however, generally more advantageous especially in three-fold calculations to effect operations of divisions by placing the denominator above the numerator or vice-versa on each of the two fixed scales:

If the scale division corresponding to the denominator on the slide is adjusted above that of the numerator, on the fixed scale, then the result is read as in the old slide rule under the unit division of the slide on the adjacent fixed scale.

If, however, the division corresponding to the denominator is taken on the fixed scale which is often necessary on account of the limited distance over which the slide is able to move then the quotient is read off under the opposite unit division on the opposite fixed scale.

In the position of the slide shown in Fig. 2 for example the division 15 of the scale S has been adjusted above the division 21 of the scale C to give the quotient of $\frac{2.1}{1.5}$; the quotient 1.4 appears under the unit division of the scale S on the scale C. For $\frac{1.5}{2.1}$ the same adjustment of the slide will serve; the result .71 appears on the scale D above the unit division of the slide scale R as the numerator was adjusted above the denominator.

I claim:

1. A logarithmic calculating apparatus comprising in combination: a fixed scale member, a single logarithmic scale longitudinally arranged on said fixed scale member, a slide member sliding on said fixed scale member, a logarithmic half scale on said slide member adjacent to and co-operating with said single logarithmic scale and having its numbers running in the same direction as those of said single logarithmic scale, a second single logarithmic scale longitudinally arranged on said fixed scale member, and a second logarithmic half scale on said slide member, said second single logarithmic scale and said second logarithmic

half scale being adapted to co-operate with one another and having their numbers running in the opposite direction to those of said first-named single logarithmic scale and said first-named logarithmic half scale, substantially as described.

2. A logarithmic calculating apparatus comprising in combination: a cylindrical fixed scale member, a longitudinal raised portion on said fixed scale member, a split cylindrical slide member on said fixed scale member guided longitudinally by the edges of said raised portion, a logarithmic scale on said raised portion, a logarithmic half scale on said slide member co-operating with said logarithmic scale and having its numbers running in the same direction as those of said logarithmic scale, a second logarithmic scale on said raised portion, a second half logarithmic scale on said slide member co-operating with said second logarithmic scale, the numbers of said second logarithmic scale and said second logarithmic half scale running in the opposite direction to those of the first named logarithmic scale and logarithmic half scale, and a cursor, substantially as described.

In testimony whereof I have hereunto set my hand.

JOACHIM SCHAUER.