PATENT SPECIFICATION

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COMPLETE SPECIFICATION.

Improvements in or relating to Logarithmic Calculating Apparatus Combined with Writing Implements.

I, JOACHIM SCHAUER, of 11, Murarska, Lwow, Poland, a Polish citizen, do hereby declare the nature of this invention and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement:—

The present invention relates to an improved logarithmic calculating apparatus combined with a writing implement, such as a pencil or fountain pen, and has for its object the provision of an apparatus of this kind which is convenient in use and overcomes the drawbacks which such apparatus usually possess.

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 been once more pushed back.

This drawback of the slide rules combined with writing implements was avoided by the present applicant in a previous invention 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.

[*Price* 1/-]

According to the present invention this drawback is eliminated by the use of reciprocal logarithmic fixed scales and reciprocal logarithmic slide scale halves, one preferred constructional form of the invention consisting in a writing implement provided with two logarithmic scales the numbers of which run in opposite directions and a slide member sliding on the writing implement and provided with two logarithmic complementary half scales each of half the length of each of said logarithmic scales and the numbers of which run in opposite directions, said logarithmic half scales being adapted to co-operate respectively with said logarithmic scales and having their numbers running in the same directions respectively as those of said logarithmic scales, whereby it is rendered possible to effect the multiplication of two factors and in some cases three factors with a single setting of the slide member.

According to a modified constructional form of the invention the apparatus comprises a writing implement provided with two scales, one of which is a double scale consisting of two successive complete logarithmic scales whilst the other is a single scale consisting of one complete logarithmic scale, the said double and single scales having their numbers running in the same direction and a slide member sliding on the writing implement and provided with two logarithmic scales, each of half the length of the double scale, one of said last-named logarithmic scales being adapted to co-operate with said double scale and having its numbers running in the same direction as those of said double scale, whilst the other one of said last-named logarithmic scales is adapted to co-operate with said single scale and has its numbers

running in the opposite direction to those of said single scale whereby it is rendered possible to effect the multiplication of any three factors with a single setting of the slide member.

The above-mentioned advantages which are unattainable with other types of combined slide rules and writing implements, represent 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 or error and consequently an increase of the accuracy.

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

Two constructional forms of the invention are illustrated by way of example on the accompanying drawing in which:

Fig. 1 is a cross section corresponding to both constructional forms.

Fig. 2 is a plan of the first constructional form,

Fig. 3 is a plan of the second constructional form,

Fig. 4 is a longitudinal section of the second constructional form and

Fig. 5 is a side view of the second constructional form.

In the first constructional form (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 whilst the second opposite half R (namely the lower one) bears the numbers from 316—1 running from right to left. Outside the two scales of the slide cylinder B the two halves of the usual known type scale for calculating squares and square roots (not shown in Fig. 2) may be arranged, the squares from 1 to 10 being arranged outside the upper slide scale and the squares from 10—100 outside 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.

In the second constructional form shown in Figs. 1 and 3 one of the fixed scales (C) is made up of two complete logarithmic scales having their numbers running from left to right. Adjacent to this is a second fixed scale D consisting of one complete logarithmic scale of double the length of the first-named fixed scale and serving for finding square roots. The edges of the slide cylinder B with its two scales S and R are arranged adjacent on both sides to the guide edges *t* and *z* on which these two fixed scales are arranged, the scale S being one complete scale of the fixed scale C, i.e. half the total length of the scale C. The scale R is a similar scale, but its numbers run in the opposite direction.

The following details are common to both constructional forms:

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

The other usual scales, namely, the sine and tangent scales, and also the usual known types of scales for calculating cubes and cube roots and logarithms respectively are 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 scales is effected by means of a cursor or by means of the ends of the slide cylinder.

The cursor consists of a short cylinder L of glass or better still of another 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 4). 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, upon which the latter hand may be used to write down the result.

In the first constructional form 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 of 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 other 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, 4×0, $5 = 0$, 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. In this case a method is used which consists in multiplying the first two factors by adjusting the cursor to that one of the two said factors which lies on the right hand side and sliding the scale division corresponding to the second of the said factors 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 and the final product of multiplication with the third factor is read off on the last named scale below the scale division on the slide corresponding to the said third factor.

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 used also if necessary.

In Fig. 2 of the drawing the position for the product 0, 35 . 4, 0 . 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 under division 27 of the scale S.

With this first constructional form the division of two numbers can always be converted into a multiplication with the reciprocal of the denominator. This is effected by adjusting the cursor line or the end of the slide to the division corresponding to the denominator so that on the opposite scale the reciprocal of the denominator 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 is adjusted on the slide 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 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 0, 71 appears on the scale D above the unit division of the slide scale R as the numerator was adjusted above the denominator.

The second constructional form is used for multiplication and division in accordance with the known rules for slide rules. It may be mentioned, however, that products of three factors can in this case without exception be solved by one movement of the slide. The cursor is placed over one factor on the fixed scale C. The division corresponding to the second factor on the scale R is then pushed underneath the cursor line and the result is read off under the division on S corresponding to the third factor on the fixed scale C.

In Fig. 3 the adjustment of the slide for the numerical example 2, 8×0, 5×6, $5 = 9$, 1 is shown. The cursor is adjusted to the division 5 of

the scale C, the division 2, 8 of the scale R is pushed under the cursor line as indicated by the line J—K and under the division 65 of the scale S the result is read off on the fixed scale C.

I am aware that it has already been proposed to construct a logarithmic slide rule provided with the ordinary known type and arrangement of scales and combined with a writing implement by adapting a split cylinder slide member to fit over and slide on the surface of a barrel having a longitudinal raised guiding portion and I therefore do not claim this constructional feature broadly, but only when applied to logarithmic slide rules having the new types and arrangements of scales hereinbefore described.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is :—

1. A logarithmic calculating apparatus combined with a writing implement comprising a writing implement provided with two logarithmic scales the numbers of which run in opposite directions and a slide member sliding on the writing implement and provided with two logarithmic half scales each of half the length of each of said logarithmic scales and the numbers of which run in opposite directions, said logarithmic half scales being adapted to co-operate respectively with said logarithmic scales and having their numbers running in the same directions respectively as those of said logarithmic scales, whereby it is rendered possible to effect the multiplication of two factors and in some cases three factors with a single setting of the slide member, substantially as described.

2. A logarithmic calculating apparatus combined with a writing implement comprising a writing implement provided with two scales, one of which is a double scale consisting of two successive complete logarithmic scales whilst the other is a single scale consisting of one complete lorgarithmic scale, the said double and single scales having their numbers running in the same direction and a slide member sliding on the writing implement and provided with two logarithmic scales, each of half the length of the double scale, one of said last-named logarithmic scales being adapted to co-operate with said double scale and having its numbers running in the same direction as those of said double scale, whilst the other one of said last-named logarithmic scales is adapted to co-operate with said single scale and has its numbers running in the opposite direction to those of said single scale whereby it is rendered possible to effect the multiplication of any three factors with a single setting of the slide member, substantially as described.

3. A logarithmic calculating apparatus combined with a writing implement according to Claim 1 or Claim 2, characterised by the feature that the writing implement is of cylindrical form and is provided with a longitudinal raised portion upon which the fixed logarithmic scales are arranged and the longitudinal edges of which serve as guides for the slide member which is in the form of a split cylinder and is arranged concentrically around the writing implement, substantially as described.

4. The logarithmic calculating apparatus combined with a writing implement, substantially as described with reference to the accompanying drawings.

Dated the 6th day of March, 1926.

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1, Great James Street, Bedford Row, London, W.C.,
Chartered Patent Agent.

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[This Drawing is a reproduction of the Original on a reduced scale.]

Fig. 1.

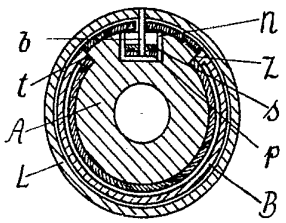


Fig. 2.

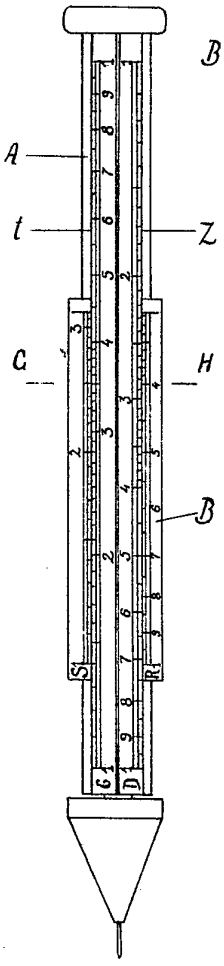


Fig. 3.

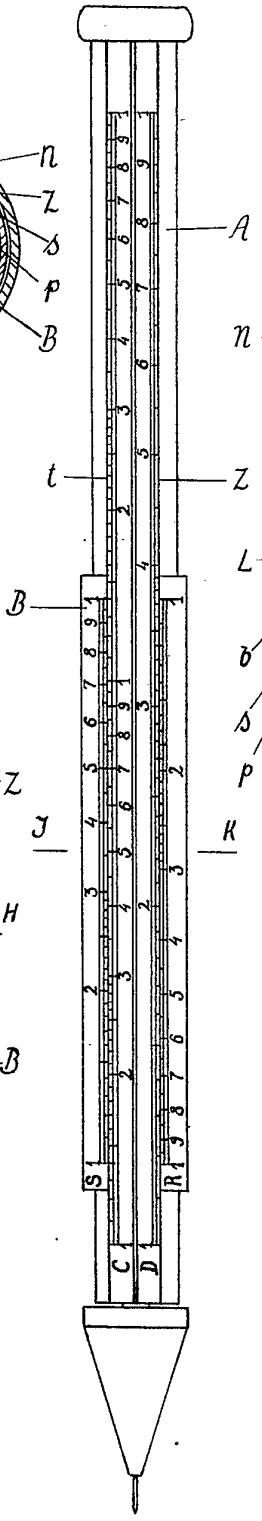


Fig. 4.

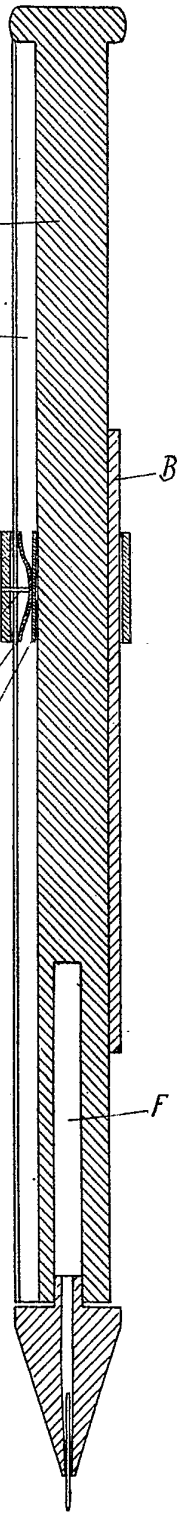
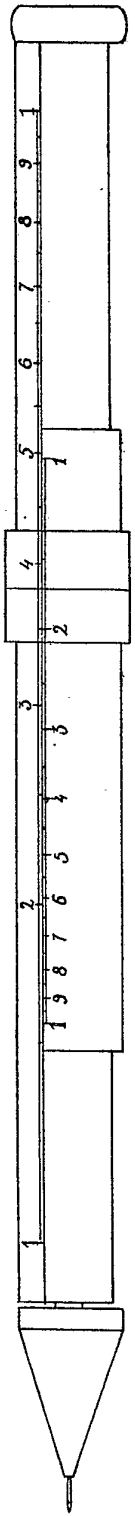


Fig. 5.



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