PATENT SPECIFICATION

DRAWINGS ATTACHED

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COMPLETE SPECIFICATION

Improvements in or relating to Slide Rules

We, LICENCIA TALALMANYOKAT ERTEKISITO VALLALAT, a body corporate organised under Hungarian Law, of 10 Jozsef Nador ter, Budapest V, Hungary, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention concerns improvements in or relating to slide rules.

The possibility of rapid and easy calculation with the aid of logarithmic slide rules has led to the construction of numerous special slide rules, *inter alia* for the calculation of interest, compound interest and percentages. All the hitherto existing slide rules, however, are based on the known slide rule principle, namely that they consist of a fixed bar, provided with graduations, a slide, movable with respect thereto, likewise provided with graduations, as well as a movable index or cursor directed at right angles to said slide.

These conventional slide rules have the following disadvantages which result from their construction.

a) Due to the fact that they have identical scales both on the fixed bar and on the slide along the lines of contact therebetween, the number of scales which can be accommodated is limited. Furthermore some scales appear on the narrow side of the bar or on the rear face of the slide, and the calculations with these scales are effected by means of lateral index marks or by means of small apertures on the rear face of the bar, which is disadvantageous both for precision of manufacture as well as for convenience of operation.

b) The precise guiding of the slide between the two parts of the bar requires a complex construction, springs, tongues and grooves and the like, the satisfactory operation of which can only be assured by careful and expensive construction.

c) The fixed and movable scales must precisely coincide in every detail and this source of error requires the use of carefully selected materials (for example high-quality wood, fully dried out for several decades etc.). This fact is also the reason for the rather high manufacturing costs and hence price of such slide rules of good quality.

It is an object of the invention to provide an improved slide rule of economic construction which avoids these disadvantages.

According to the invention there is provided a slide rule comprising an elongate transparent cover plate, a transparent cursor having one or more index lines thereon which embraces said cover plate and a non-transparent slide of equal length to that of said cover plate slidably mounted with respect to said cover plate, said slide having thereon a logarithmic and a reciprocal logarithmic scale, and two additional linear scales with identically spaced graduations one or which is graduated in days and months of the calendar whilst the other is continuously graduated from nought to 365, and said transparent cover plate having thereon short fixed index lines at suitable levels thereon which when the ends of the cover plate and slide coincide register with predetermined points on selected scales of the slide.

This construction has several advantages, of which the following may be pointed out:—

a) Due to the fact that they do not have any scales which duplicate each other, such slide rules can carry considerably more scales than conventional slide rules, among them, scales for the above mentioned technical purposes. This advantage can be still further increased if the front face and rear face of the slide are provided with scales, either co-ordinated with or independent of one another, and can be used as complete slide rules without having to pull out the slide and insert it in the reversed position.

b) The slide rules require no resilient or

similarly complex mounting or guiding and their construction is simple and the manufacturing costs are low.

c) They are free of the source of error arising from a need for accurate coincidence of the fixed scales with the movable scales; precise operation can also be assured by simple construction:—

d) The slide rules are flat (2—2½ mm thick), flexible, unbreakable, they can be carried in a book or pocket without damaging them, or they can serve as a book marker.

In order that the invention may be well understood several embodiments by way of example only, will be more fully described with reference to the accompanying drawings in which:—

Figure 1 shows a plan view of a slide rule according to the invention,

Figure 2 shows a cross section thereof,

Figure 3 shows a plan view to a larger scale of the slide of Figure 1,

Figures 4 and 5 show detail views illustrating possible arrangements of scales and graduation marks on the slide.

Figure 6 shows a cross section of a modified slide rule according to the invention.

Referring to Figures 1 and 2 there is a slide 1 which can be made of any nontransparent material (cardboard, synthetic plastic, sheet metal etc), complete with graduations and a transparent cover plate 2 of the same length, which overlaps the slide 1 on the top and bottom surfaces so that the slide can easily and safely slide therein without any special guide grooves if one hand grips the cover plate 2 and the other hand grips the slide 1 by way of a cutout 3. This cover plate is embraced by a cursor 4 which can be displaced with respect to the cover plate 2, and is provided with an index line 5, disposed perpendicularly to the longitudinal direction of the scales of the slide 1.

Figure 3 shows the slide 1 in front elevation to a larger scale.

As has already been mentioned, the cover plate 2 and the slide 1 are preferably of the same length, and when the end of the slide, possibly protruding at one side, is completely pushed in by hand, its ends coincide with the ends of the cover plate. Hereafter this position will be called the original position (o.p.).

The slide 1 is shown separately in plan view in Figure 3. It has the following scales: scale 6, consisting of 365 graduation lines, i.e. of 364 graduation spacings. Each graduation stroke corresponds to one day of the year. Correspondingly, above and below the graduation strokes, the months and, between them, the days (preferably with emphasis on the 1st, 5th, 10th etc. 30th and the last day of the month) are indicated. Below there is a line 7 with the same graduation as the above line, but continuously numbered from left to right, preferably as usual with emphasis and numbering on each 5th and 10th graduation stroke. The scales 6 and 7 have graduation spacing of equal size, but scale 6 has 365 graduation lines (from January 1 to December 31), scale 7 has 366 division lines (from nought to 365). The extreme left hand side graduation lines of the two scales cover each other, whereas the graduation line 365 in the extreme right hand end, extends by one spacing beyond the last graduation line of scale 6, indicated by XII/31.

The cover plate 2 carries the short, fixed index lines 8 placed so that in the o.p. they coincide with the 1st and 366th graduation stroke of the scale 7.

By coordinating the scales 6 and 7 with the fixed index lines 8 and if the cursor is shifted with respect to the o.p. so that the index 5 points to a graduation stroke of the scale 6, corresponding to an initial date (e.g. the 7th March), and the slide 1 is then shifted so that a graduation stroke on the same scale, which corresponds to a date of maturity (e.g. the 14th August), comes beneath the index 5, then in this position one of the fixed index marks 8 (in the present case the left hand one) points to "160" on the scale 7, and indicates that the interval between the 7th March and the 14th August is 160 days (in leap years, when the 29th February has to be included, the interval read has to be increased by 1).

To save space, the bottom part of scale 6 and the top part of scale 7 can abut against one another, as shown in Figure 4.

The basic principle of interest calculation is this: the interest "Z" on a capital "S" in "n" days at a rate of interest "p%" is calculated according to the equation:—

$$Z=\frac{S.p.n.}{100\ .\ 360} \quad \text{or} \quad =\frac{S.p.n.}{100.365}$$

dependent upon whether the year is calculated with 360 or 365 days. In the majority of the known commercial slide rules, the interest calculation is effected by means of fixed and movable logarithmic scales, further by similar scales which, however, are displaced by a length corresponding to log 360 so as to save the separate division by 360. This solution, however, has the following disadvantages:—

a) the two additional scales, displaced by log 360, occupy the space of other useful scales;

b) it is only usable for interest calculations on a basis of 360 days per year.

Both these disadvantages are avoided in slide rules according to the present invention in the following manner: The slide 1 carries, besides the abovementioned scales, also the usual normal scale [X]9 and the reciprocal scale [I/X]10, to the same base. At the level of scale 10, the cover plate 2 also carries the following short fixed indices: close to the ends of the cover plate 10, the fixed indices 11

which in the o.p. indicate the first and last graduation strokes (denoted by "10" and "1") of the scale 10, as well as the fixed index 12 which in the o.p. indicates the value "360" and the fixed index 13 which in the o.p. indicates the value "365" of the scale 10.

For calculating the interest "Z", the value "p" on the scale 10 is shifted beneath the fixed index 12 or 13, index 5 is set to the value of "n" on the scale 9, the value of "S" on the scale 10 is shifted beneath the index 5, and the interest "Z" is read below the fixed index 11.

The basic equation for all compound interest- and annuity and amortisation calculations is as follows:—

$$S_N = S(1+0.01\ p)^N$$

Three scales serve for these calculations, namely the scale [N] which contains the reciprocal values of log N, the scale [p], containing the values of (1+0.01p), and finally the scale [S_N] which contains the values of S_N, the two latter to the base e. At the level of the scale S_N, the cover plate 1 has two fixed indices which in the o.p. indicate the values of x=0.1 (i.e. e^x=1.105) and X=1 (i.e. e^x=2.718). If, after the o.p., the index 5 on N is shifted below "p", then the value of "S_N" can be read beneath a fixed index.

In commercial practice it often occurs that the net price of a product is to be increased by a certain percentage, which increase corresponds to a given percentage of the increased (gross) value. The scales 14 and 15 serve for the calculation of the net (n) and the gross (b) percentages, corresponding to one another. The scale 14 contains the net percentages from 1—100% to a linear scale, preferably (but not necessarily) with scale divisions of 0.1% between 1—10%, and with scale divisions of 1% between 10 and 100%. The scale 15 contains the gross percentages in such a manner that the n and b percentages corresponding to one another always lie on a vertical line. This is achieved by the graduation strokes "b" of the scale 15 being so coordinated with the "n" strokes of the scale 14 that always correspond to the equation

$$b = \frac{n}{1+0.01\ n}$$

It has been mentioned in the introduction that, due to the absence of the fixed scales, more space is available for the normal and reciprocal logarithmic scales, serving for multiplication, division, squaring etc., than in the hitherto known slide rules. Only two of the practically useful possibilities will be referred to here.

One resides in the fact that all the graduation strokes of the normal and reciprocal scales of the usual graduation density are numbered, that is they are provided with the corresponding numbers, on an extension of the vertical line of the corresponding graduation stroke, but in rows horizontally offset with respect to each other, as is shown to a larger scale on the partial scale in Figure 5. If, for example, the index is set to the graduation stroke corresponding to the value 4.6, this number can be read above the graduation stroke below the index. This solution facilitates to an extraordinary degree the setting and reading, and thus calculating with the slide rule for those, who are technically not highly skilled, for example the majority of business men and merchants. A further advantage conssists in that one or more scales subdivided into several rows, can be applied to a scale which corresponds to a multiple of the slide rule. The accuracy of the slide rule is thus increased, which is of particular significance for financial calculations.

The described construction of slide rule according to the invention renders possible an easy and full utlisation of both sides thereof, if scales are applied to both faces of the slide, and if the cover plate fully surrounds the slide, and the cursor fully surrounds the cover plate, as is shown in Figure 6 in cross section.

A complete slide rule for financial purposes should also contain the possibility of carrying out currency conversions. In the present slide rule this is made easily possible by the application of short so-called currency indices 16 (Figure 1) which are applied to the cover plate at the level of the scale [X] of the slide.

For example there is one such index for British Sterling which points in the o.p. to the first and last graduation strokes of the scale [X], and indices for Dollars, Deutsche Marks, Swiss Francs etc. which are so offset that in the o.p. they point to that number of the scale [X], which corresponds to the equivalent of £1 in the currency concerned. It is thus achieved that, if for example the value "3" of the scale [X] is set underneath the currency index for Swiss Francs, the equivalent of Sw. fr. 3.00 can be read for all currencies below the currency index concerned.

It can furthermore be mentioned, without going into detail and without reference to drawings, that, without departing from the principles and scope of the invention, the slide, cover plate and cursor can be constructed, not as plane surfaces, but also as cylindrical or polygonal prism surfaces, the scales being applied along the generatrix of the cylindrical or prismatic slide, and the indices being full circles, circular arcs or polygonal figures.

WHAT WE CLAIM IS:—

1. A slide rule comprising an elongate transparent cover plate, a transparent cursor having one or more index lines thereon which embraces said cover plate and a non-transparent slide of equal length to that of said cover plate slidably mounted with respect to said cover plate, said slide having thereon a logarithmic and a reciprocal logarithmic scale, and two additional linear scales with identically spaced graduations one of which is graduated in days

and months of the calendar whilst the other is continuously graduated from nought to 365 and said transparent cover plate having thereon short fixed index lines at suitable levels thereon which when the ends of the cover plate and slide coincide register with predetermined points on selected scales of the slide.

2. A slide rule as claimed in Claim 1 in which for calculations according to the equation $S_N=S(1+0.01p)^N$ three scales are provided beneath one another on the slide one of which carries reciprocal values of log N, the second of which has values of $(1+0.01p)$ whilst the third has values of S, the second and third scales being to base e^x, said cover plate having two fixed indices which when the ends of the slide and cover plate coincide indicate X=0.1 and X=1 on such scale.

3. A modification of the slide rule claimed in Claim 1 or 2 in which said slide has two additional associated scales one below the other whose coincident values satisfy the equation $b=\frac{n}{(1+0.01n)}$.

4. A slide rule as claimed in any of the preceding claims in which in addition to the normal known principal graduation marks on one or more scales of the slide, such scale or scales are marked with the numerical values of the intervening graduations vertically below said graduations but at horizontal levels which are offset with respect to one another.

5. A slide rule as claimed in any of the preceding claims in which said slide has one or more scales of a length corresponding to a multiple of the length of the slide rule divided into several rows.

6. A slide rule as claimed in any of the preceding claims in which the cover plate has, at the level of the logarithmic scale of the slide fixed index lines which when the ends of the slide and cover plate coincide indicate equivalent values of currencies of selected countries.

7. A slide rule as claimed in any of the preceding claims in which said slide has scales on both sides, and said cover plate completely surrounds the slide, whilst the cursor completely surrounds the cover plate.

8. Slide rules substantially as described with reference to the accompanying drawings.

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914617 COMPLETE SPECIFICATION

1 SHEET *This drawing is a reproduction of the Original on a reduced scale*

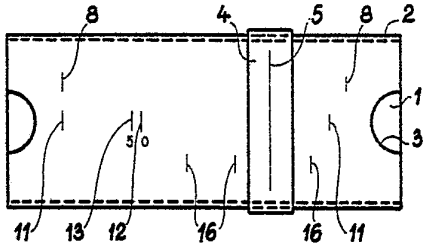

Fig.1

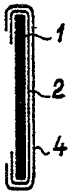

Fig.2

Fig.6

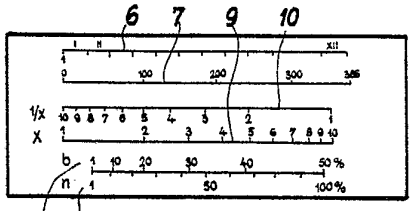

Fig.3

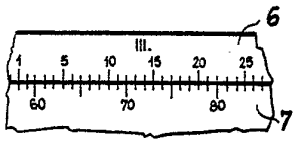

Fig.4

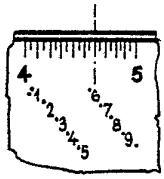

Fig.5