PATENT SPECIFICATION

582,145

Application Date: Jan. 31, 1944. No. 1777/44.

Complete Specification Accepted: Nov. 6, 1946.

(Under this application, which was originally made under Section 91 of the Patents and Designs Acts, 1907 to 1942, a Specification was laid open to public inspection on Dec. 18, 1944).

CORRECTION OF CLERICAL ERROR

SPECIFICATION NO. 582,145

The following correction is in accordance with the decision of the Superintending Examiner, acting for the Comptroller-General, dated the seventeenth day of March, 1947:

Page 2, line 2, *after* "the" *insert* "opposite".

THE PATENT OFFICE,
17th April, 1947.

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the apparatus one or more times in order to bring the figures into their normal upright reading position. It is well known that this drawback hinders an intensive development of the slide-rule of circular shape, in spite of the superiority which such a slide-rule presents, as compared with a rectilinear slide-rule, by the ...ality inherent to its movable scale of ...ver getting out of the range of the fixed scale. Designs that comprise several scales, which are movable not only in relation to a fixed support but also in relation to one another, impose on the operator even more complicated manipulations. Some designs are also known in which, on account of the absence of a cursor or sliding index, one reading at least must necessarily be effected with great liability to inaccuracy, coupled with great awkwardness.

The purpose of the present invention is to remedy all these drawbacks. The invention relates to a logarithmic calculation device the scales of which are of circular shape. According to the invention any calculation of multiplication or division can be performed by a single to-and-fro displacement of a single control member, the operation being the same for either form of calculation, and the operator is freed from the inconvenience of having to operate members other than the single control member, which carries at least one scale, and he is enabled to read with precision all the terms of the calculation and its result in an upright position, the result, moreover, always appearing at the same spot.

As contrasted with the devices which only resolve special and limited calculations, and to those with complicated only of scientists and engineers, who up to the present have been practically the only ones to use slide-rules.

The accompanying drawing shows by way of example several embodiments of the invention. Figure 1 is a plan view of a wrist-watch combined with the logarithmic calculator. Figure 2 is a vertical axial section thereof. Figure 3 is an enlarged view of the control device of the sliding index enabling it to be brought into coincidence with one of the factors of the calculation. Figure 4 is a plan view of a logarithmic calculator mounted on the outside of an object such as a time-piece, a telephone dial frame or a watch, or more generally of any object suitable for use as a support. The figure shows only a sector of the support, which is assumed to be a watch. Figure 5 is a vertical axial section of Figure 4, and Figure 6 is an enlarged section along the line O^{I}—O^{II} of Figure 5, showing the control device of the sliding index for bringing it into coincidence with one of the factors of the calculation. Figure 7 shows another embodiment of the slide-rule.

Referring to Figures 1, 2 and 3, *a* is the casing of a watch supporting a rotating ring *b* with knurled rim, *c* is the glass of the watch, *e* the clockwork, and *f* the dial, carrying, in addition to the hour scale, a double circle *q*. On the inner circle of *q* is traced a logarithmic scale extending from 1 to 10 on the 360°, the graduation marks 1 and 10 coinciding with one another, and the graduation increasing in the direction of rotation of the hands of the watch. On the outer circle of *q* a similar scale is traced in the opposite direction, extending also from

[*Price* 1/-]

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COMPLETE SPECIFICATION

Improvements in and relating to a Logarithmic Calculator

I, GERARD FRANCIS WITTGENSTEIN, a citizen of Switzerland, of Villa Bellaria, La Tour-de-Peilz, Canton of Vaud, Switzerland, 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:—

It is known that the operator of a circular slide-rule must necessarily rotate the apparatus one or more times in order to bring the figures into their normal upright reading position. It is well known that this drawback hinders an intensive development of the slide-rule of circular shape, in spite of the superiority which such a slide-rule presents, as compared with a rectilinear slide-rule, by the ...ality inherent to its movable scale of ...ver getting out of the range of the fixed scale. Designs that comprise several scales, which are movable not only in relation to a fixed support but also in relation to one another, impose on the operator even more complicated manipulations. Some designs are also known in which, on account of the absence of a cursor or sliding index, one reading at least must necessarily be effected with great liability to inaccuracy, coupled with great awkwardness.

The purpose of the present invention is to remedy all these drawbacks. The invention relates to a logarithmic calculation device the scales of which are of circular shape. According to the invention any calculation of multiplication or division can be performed by a single to-and-fro displacement of a single control member, the operation being the same for either form of calculation, and the operator is freed from the inconvenience of having to operate members other than the single control member, which carries at least one scale, and he is enabled to read with precision all the terms of the calculation and its result in an upright position, the result, moreover, always appearing at the same spot.

As contrasted with the devices which only resolve special and limited calculations, and to those with complicated manipulation, and to those of difficult or approximate reading, the device according to the present invention is universal in the sense that it solves very simply, and with the precision of reading insured by a sliding index or point equivalent to a cursor with a hair line, all arithmetical problems of multiplication and of division, and that it is also within the reach of the universality of the public, and not only of scientists and engineers, who up to the present have been practically the only ones to use slide-rules.

The accompanying drawing shows by way of example several embodiments of the invention. Figure 1 is a plan view of a wrist-watch combined with the logarithmic calculator. Figure 2 is a vertical axial section thereof. Figure 3 is an enlarged view of the control device of the sliding index enabling it to be brought into coincidence with one of the factors of the calculation. Figure 4 is a plan view of a logarithmic calculator mounted on the outside of an object such as a time-piece, a telephone dial frame or a watch, or more generally of any object suitable for use as a support. The figure shows only a sector of the support, which is assumed to be a watch. Figure 5 is a vertical axial section of Figure 4, and Figure 6 is an enlarged section along the line O^{I}—O^{II} of Figure 5, showing the control device of the sliding index for bringing it into coincidence with one of the factors of the calculation. Figure 7 shows another embodiment of the slide-rule.

Referring to Figures 1, 2 and 3, *a* is the casing of a watch supporting a rotating ring *b* with knurled rim, *c* is the glass of the watch, *e* the clockwork, and *f* the dial, carrying, in addition to the hour scale, a double circle *q*. On the inner circle of *q* is traced a logarithmic scale extending from 1 to 10 on the 360°, the graduation marks 1 and 10 coinciding with one another, and the graduation increasing in the direction of rotation of the hands of the watch. On the outer circle of *q* a similar scale is traced in the opposite direction, extending also from

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0 to 360°, or in other words a second logarithmic scale increasing in the direction of rotation of the hands of the watch. Finally, a third scale similar to the first one is traced on the ring *b*. When the ring *b* is rotated, this scale moves under a fixed mark *p*.

In the example described, the fixed mark *p* is purposely chosen in alignment with the radius passing through the twelve o'clock point on the watch. This radius determines also the common origin of the two fixed scales of the dial, and the vertical plane passing through this radius will be the main reading plane.

The knurled rim of the ring *b* enables it to be rotated with the fingers. This motion may alternatively be carried out by other means, and in particular by means of a winding knob similar to that of the watch.

A groove *d* is cut in the ring *b*, and a slider *g* fitted in this groove moves with the ring when the latter revolves in one direction or in the other. This motion of the slider *g*, however, only lasts until its finger *h* causes a lever *l*, which pivots around an axis *i*, to abut against a stop *m* or m^1 according to the direction of rotation. The arrangement of these members is such that a sliding index or cursor *k* carried by the finger *h* always falls with the radial line of its pointer or the hair line of the cursor in the main reading plane at the moment of such abutment, whatever the direction of rotation of the ring *b*. After the abutment, the slider cannot move any further, and when the operator continues the rotation of the ring *b* the latter slips over the slider *g*.

The operation of the calculator is as follows:

One rotates the ring *b* so as to bring the sliding index *k* into the main reading plane, where it stops automatically, and one then rotates the ring *b* further so as to bring the first factor of the operation into the main reading plane, i.e. under the fixed mark *p*. The ring *b* is then rotated in the opposite direction so as to bring the sliding index *k* on to the second factor of the calculation read on the dial *f*. The first factor is a multiplier or a divisor, whilst the second factor is a multiplicand read on the second logarithmic scale or a dividend read on the first logarithmic scale. One reads the result on the scale of the ring in the main reading plane, i.e. under the fixed mark *p*.

The scale of the movable ring is always used in the vicinity of the main reading plane, so that it is sufficient that this scale, which may be simple or multiple, be visible in this sector only. This property enables the scale to be disposed under a fixed protection, which may be the dial of a time-piece, provided with the necessary apertures in the vicinity of the main reading plane.

It is of course possible to dispense with the automatic stopping of the movable index in the main reading plane and to stop same by hand.

The embodiment illustrated in Figures 4, 5 and 6, again comprises the casing *a*, the glass *c*, the clock-work *e*, the dial *f*, the groove *d*, the slider *g*, the finger *h*, the lever *l*, the shaft *i*, the stops *m* and m^1, the double circle *q*. The movable logarithmic scale is traced on a ring *t*, which is knurled on its periphery, and which can rotate around a crown or annulus *s* mounted on the casing *a*, by means of a thread for instance. The fixed mark *p* and the two scales of *q* are traced on this crown *s*, provided with a groove *r* permitting the circular displacement of the finger *h*. A transparent celluloid sheet k^1 covers the three scales and carries the index *k*. The slider *g* and the finger *h* are rigidly linked with the sheet k^1. The fixed mark *p* and the origin of the two scales of *q* are in the main reading plane, and the operation of this embodiment is similar to that already described.

It is of course possible to dispense with the automatic marking of the factor of the movable scale in the main reading plane and to mark the same by hand, wherever it may be, for instance by temporarily preventing the rotation of the sheet k^1 whilst the ring *t* is being turned in such a way as to make the said factor coincide with the index *k*.

It is of course also possible, if the convenience of certain supports require such a disposition, to trace only a single scale on the fixed member, and to place the double scale of the circle *q* on the movable member.

Figure 7 shows another embodiment. The movable scale is traced on a disk *t* knurled on its periphery and fixed on a shaft T. *p* is as before the fixed mark, and *q* the immovable double circle traced on the face of the cover *s*. The shaft T revolves with light friction in the axis of the cover *s*, and drives, also with light friction, the slider *g* carrying the index *k*. The front face of the cover presents an arcuate slot *r* along which can move the broach *i* fitted with a washer *l*. During its rotation, the finger *h* of the slider comes to strike the washer *l*, which is somewhere in the slot *r*, and drives it until the broach *i* comes to abut against the end of the slot. The finger is dimensioned in such a way that, at this moment,

the index finds itself in the main reading plane. On the face and at the back of the disk, one disposes with advantage various tables of the usual functions, such as X^2 and X^3, log X etc. To facilitate carrying the device in the pocket, it is advisable to provide the calculator with a clip.

In the examples described, the mechanism linking the sliding element with the movable member has been shown as a simple friction coupling. It may be of advantage, in particular for the solution of calculations involving several consecutive operations, to bring the index back into the main reading plane after each operation. To that effect, one can for instance provide the element k, g with a light spring in such a way that the said element comes under the action of the spring to abut against a stop m as soon as the coupling linking the slider to the movable member is released. The first operation of the calculation being effected, it will thus suffice to release this coupling in order to let the index come automatically to place itself in the main reading plane and point out the result of this first operation which is already there. The second operation is then effected by driving the index (by rotating the movable member) until this index shows on the convenient fixed scale the factor involved in the second operation of the calculation; and so on.

If the automatic return of the index by means of a spring or any other mechanism is dispensed with, one can displace it by hand as far as the position of the main reading plane, taking care that during this displacement the movable member is maintained immovable, for instance by blocking it by means of a brake-shoe or a push-button.

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 calculation device, comprising three or more scales of circular shape, one of which is graduated in the inverse sense with respect to an adjacent scale, characterised by the feature that the scales are distributed on a movable member and on a fixed support in such a manner that two scales provided on one of these two elements have an origin on the same radius but with the graduations thereon increasing in opposite directions with respect to one another, that the numbers of the scale or scales of the fixed support are readable in an upright position, that a fixed mark is located on the radius passing through the origin of the fixed scale or scales, and that the adjustment of the movable member not only produces the displacement of at least one scale but also that of a cursor which may immobilised, either by coming into contact with a stop or by being arrested by hand, without preventing continued rotation of the movable member.

2. A logarithmic calculation device as claimed in claim 1, characterised by the feature that during the immobilisation of the cursor, an index of the cursor is located on the radius of the fixed mark.

3. A logarithmic calculation device as claimed in claim 1, characterised by the feature that when the cursor is immobilised, this immobilisation ceases as soon as the operator reverses his action on the movable member and that the said index of the sliding cursor, during this reverse rotation, continues to point to the position of that one of the divisions of the movable scale or scales which was marked by the said index at the moment of such reversal.

4. A logarithmic calculation device as claimed in claim 1, characterised by the feature that the stop is designed in such a way that the radial centre line of the sliding index can nevertheless sweep through an angle of 360°.

5. A logarithmic calculation device as claimed in claim 1, characterised by the feature that the sliding index is also movable by hand.

6. A logarithmic calculation device as claimed in claim 1, characterised by the feature that the fixed support is the dial of a watch, while the movable member is a ring mounted rotatably on that watch.

7. A logarithmic calculation device as claimed in claim 1, characterised by the feature that the fixed support is a time piece, a telephone dial frame or a watch.

Dated this 31st day of January, 1944.
MARKS & CLERK.

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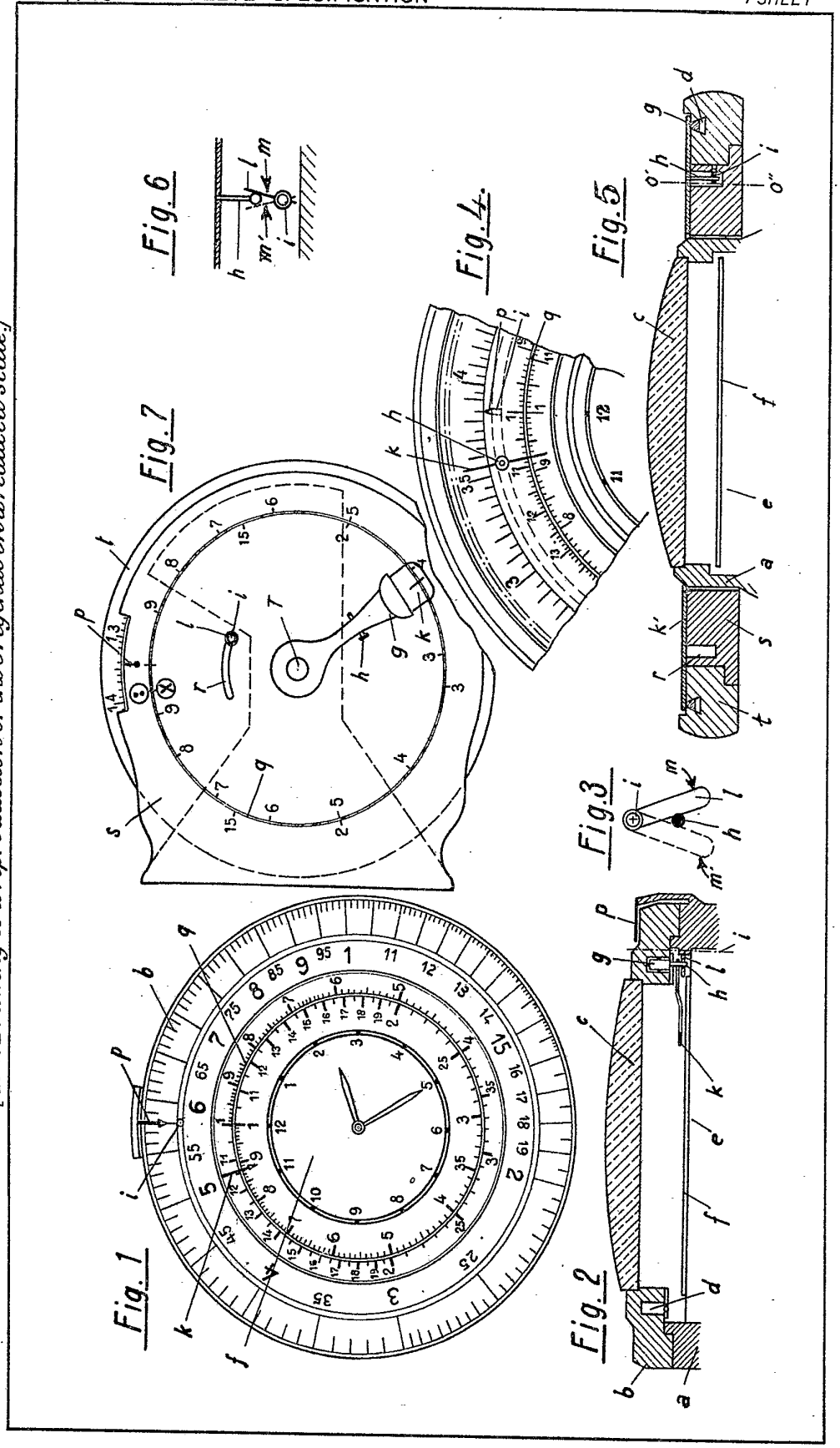
[This Drawing is a reproduction of the Original on a reduced scale.]



H.M.S.O. (Ty.P.)