PATENT SPECIFICATION

719,080

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COMPLETE SPECIFICATION

Logarithmic Calculator with Optically Projected Scales

We, MARIO ABEILLE, of Italian Nationality, and VINCENZO AQUILECCHIA, of Italian Nationality, both of 12, Via Imperia, Rome, Italy, 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:—

It is known that the slide rule is essentially a device for the addition and subtraction of linear and angular logarithmic quantities, in the first case, we have the linear slide rule, and in the second the cylindrical rule or the rule in the form of a circular disc. It is also possible to make the rule of helical form by combining the linear rule and the cylindrical rule.

Generally, the slide rule is composed of two parts, one of which is movable with respect to the other by translation or rotation; in addition there is a cursor movable with respect to one of the two parts.

It is, however, possible to conceive the rule as a single-linear or angular scale, or better a multiplicity of scales traced parallel to each other on a single support, and to dispose of suitable mechanical means for effecting the addition or subtraction of linear or angular quantities represented in some way by the said scales.

The principle object of the present invention is a compact office device, which is simple and convenient in use. According to the present invention there is provided a logarithmic calculator comprising two movable transparent plane circular discs with opposed surfaces almost in contact, there being traced on said opposed surfaces various scales similar to those used in logarithmic slide rules, said scales being distributed on the surfaces in such a manner as to occupy different annular zones, and comprising also a light source and optical elements for obtaining optical projection of the scales on a fixed screen provided with one or more reference points or lines cooperating with the scales for reading results, the said light source and optical elements being arranged in such a manner that the said optical projection is provided along a common light path. The resulting precision of the device in accordance with the invention depends upon that obtained in tracing the scales and upon the quality of the projection optics; it is thus possible to arrange matters such that the absolute precision of the magnified images of the scales corresponds to that of the best ordinary slide rules, and therefore the relative precision will be directly proportional to the equivalent length of the projected rule.

The invention will be described by way of example, to which it is not limited, in an embodiment with reference to the accompanying drawings, in which:—

Figure 1 shows a section in side elevation of an embodiment of the present invention;

Figure 2 shows the calculator of Figure 1 in front elevation, and

Figure 3 is a section on a larger scale on the line A—A of Figure 2.

Referring to the drawings, we shall describe an embodiment serving to provide a concrete idea of the present invention without excluding all other possible embodiments.

The essential members of the calculator in accordance with the present invention in the embodiment shown in Figures 1, 2 and 3 are the following:

(a) a casing in the form of a trapezoidal box 1, on the front face of which is a window 2, closed by a ground glass plate which serves as a screen and on which is engraved a straight line 5 forming a fixed reference mark; operating members outside the casing; these comprise three co-axial knobs 7, 8, 50 and a small lever 12; two circular discs 6, 9, the outer part of which is formed of transparent material (glass), the two internal surfaces 51, 52 carrying the graduated scales engraved or reproduced photographically; the disc 6 is keyed to the shaft 23 rotating inside a hollow shaft

53, to which is fixed the disc 9 and which in its turn is adapted to rotate in a support 54. The small lever 12 may assume two positions (see Figure 2); in the position shown in full lines, the hollow shaft 53 is free to rotate, in the position shown in broken lines, the shaft 53 remains stationary;

(b) the knob 8 fixed directly to the hollow shaft 53 controls the rotation of both shafts 53, 23 and hence of both the discs 6, 9; the knob 7 controls the rotation of the shaft 23 alone and hence of the disc 6 when the shaft 53 is blocked by the lever 12;

(c) the knob 50 is normally maintained released in the manner indicated in Figure 3 by the effect of a cylindrical spring 55. By pressing it inwardly, a conical part 56 of a spindle 57, sliding by its extension along the axis of the shaft 23, engages three rollers 58 pivoted on a flange 59 of the shaft 23 and engaging the inner periphery of the knob 8. If, while maintaining it pressed, the knob 50 is rotated, the result is a micrometric movement of the shaft 23 and hence of the disc 6 with respect to the disc 9;

(d) the luminous projection optical system, comprising the electric bulb 60, fed from the mains through the transformer 17, a condenser 18, a mirror 61, an objective 19, the mirror 20 and the screen 2.

The distance between the two graduated surfaces 51, 52 may be reduced to a minimum so that the images of their scales, projected on to the screen, will be clear and of equal magnification.

It is obvious that the annular zone on which a graduation is traced on one of the discs, should be superposed on a transparent, non-graduated annular zone of the other disc.

This permits the graduations on the two discs to be distributed in a more convenient manner.

In Figure 2, the scale on the left belongs to one disc and all the others to the other disc. It is possible however, to imagine having on one disc two series of graduations alternating with three series of graduations traced on the other disc, or any other arrangement which facilitates the use of the apparatus according to the system of scale adopted.

With regard to the operation of the calculator in accordance with the invention in the embodiment just described, it is merely necessary to say that it functions like any of the known disc slide rules, except that the operations of positioning and coincidence and the reading of the results are effected always on the projection screen 2 in correspondence with the fixed mark 5.

In addition to the advantages already indicated for the luminous projection calculator, it should be mentioned that in the embodiment described, the reproducibility of the scales by photography and the facility of replacing the discs by others provided with different graduations appear advantageous.

It is to be understood that the embodiment described may in practice be provided with every modification which the art may suggest without departing from the scope of the present invention as defined by the following claims.

What we claim is:—

1. A logarithmic calculator comprising two movable transparent plane circular discs with opposed surfaces almost in contact, there being traced on said opposed surfaces various scales similar to those used in logarithmic slide rules, said scales being distributed on the surfaces in such a manner as to occupy different annular zones, and comprising also a light source and optical elements for obtaining optical projection of the scales on a fixed screen provided with one or more reference points or lines cooperating with the scales for reading results, the said light source and optical elements being arranged in such a manner that the said optical projection is provided along a common light path.

2. A calculator as claimed in claim 1, characterised in that the two adjacent discs are mounted on two concentric shafts, the outer shaft being provided with a blocking or unblocking system controlled by a lever, and that the inner shaft is rotatable within the outer shaft with smooth friction.

3. A calculator as claimed in claim 2, characterised in that said two shafts are controlled respectively by two co-axial manually operated knobs, and that there is also a knob for the micrometer movement of one disc with respect to the other, which knob is actuated by pressure and simultaneous rotation and controls an epicyclic friction reduction drive.

4. A calculator as claimed in claim 2 or claim 3, characterised in that a common optical projection system is provided for both discs, this system comprising an electric bulb, a condenser, an objective, a mirror and a screen on which are projected partial images of the scales.

5. A calculator as claimed in claims 2 and 3 and 4, characterised in that the optical system as well as the system of the two discs on which are traced the scales are housed in a casing, from which project to the outside only the two manual knobs, the micrometric movement knob and the operating lever, a window closed by the screen being provided in the casing.

6. A calculator as claimed in any of claims 1 to 5, characterised in that the arrangement of the circular scales traced on the two discs is such that the scales of one disc are all arranged radially outward of those on the other disc.

7. A calculator as claimed in any of claims 1 to 5, wherein the circular scales on the two discs are interlaced with one another.

8. A logarithmic calculator constructed and

arranged substantially as described herein and as shown in Figures 1 to 3 of the accompanying drawings.

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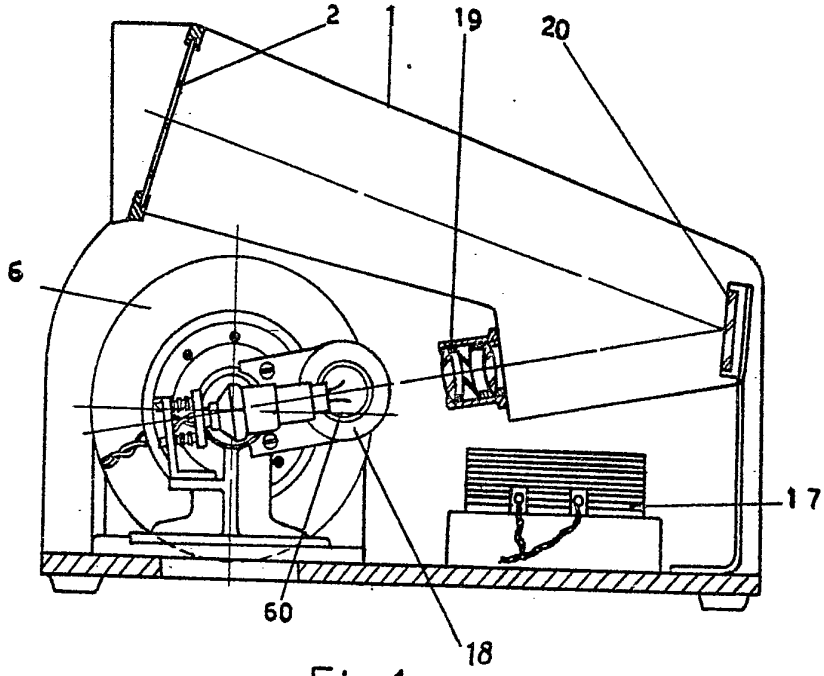

Fig.1.

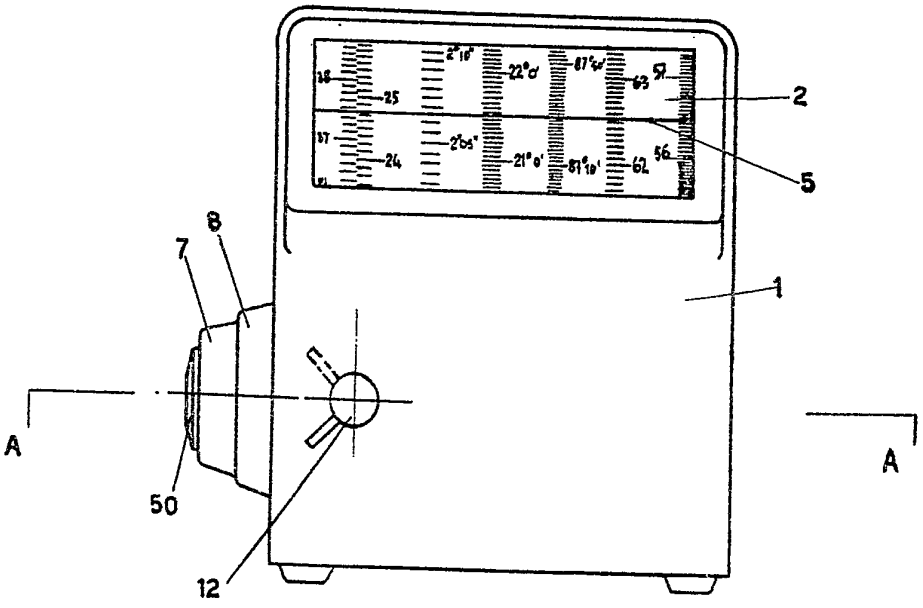

Fig.2.

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2 SHEETS

This drawing is a reproduction of the Original on a reduced scale.

SHEETS 1 & 2

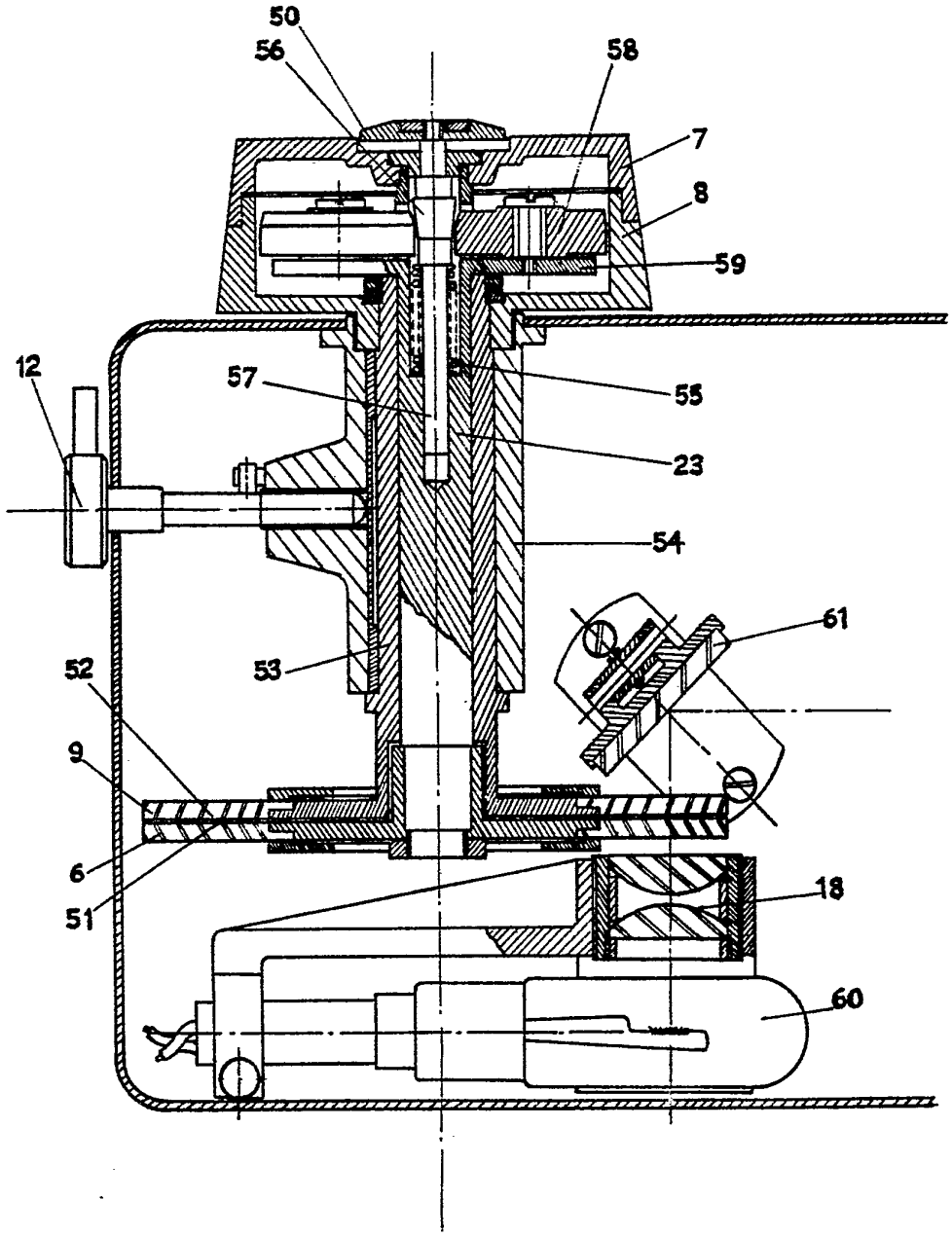

Fig. 3.

719,080 COMPLETE SPECIFICATION
2 SHEETS

This drawing is a reproduction of the Original on a reduced scale.

SHEETS 1 & 2

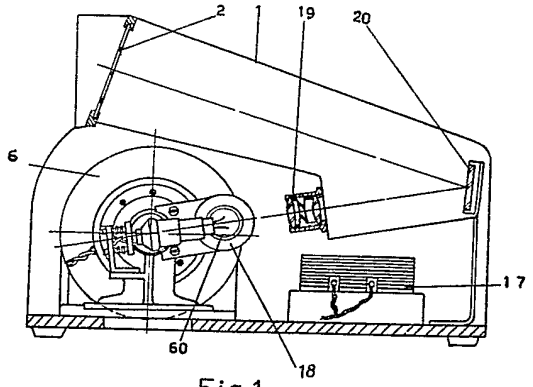

Fig.1.

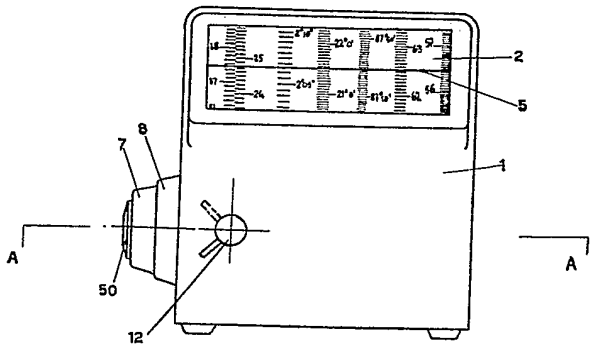

Fig.2.

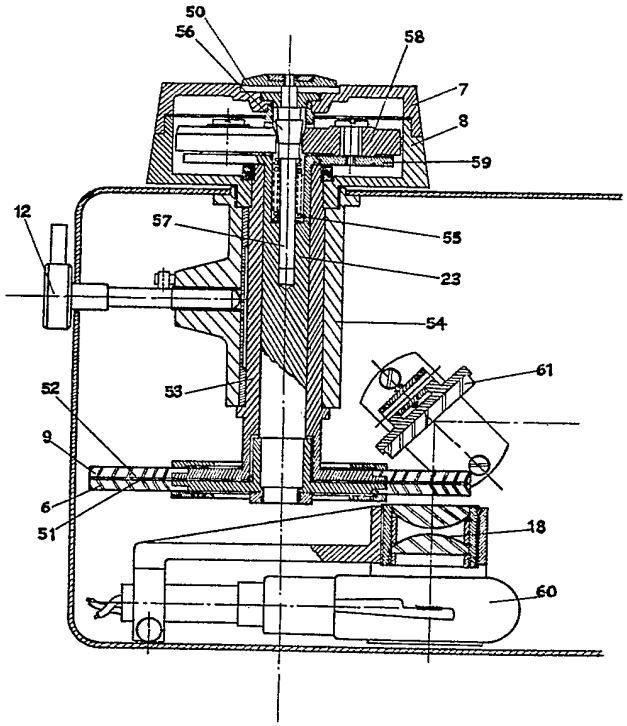

Fig. 3.