May 29, 1928.

1,671,616

E. A. SPERRY

LOGARITHMIC CALCULATOR

Filed Jan. 23, 1922

Fig. 1.

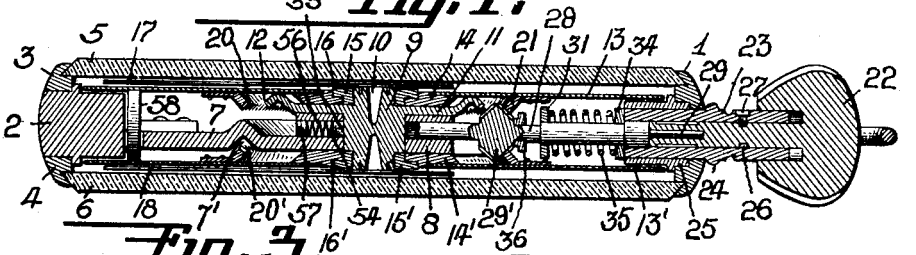


Fig. 3.

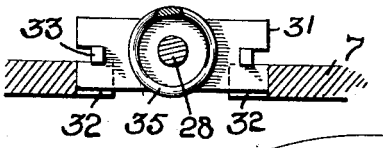
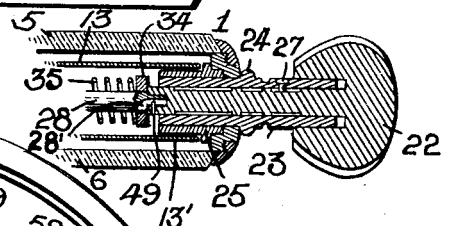


Fig. 5.



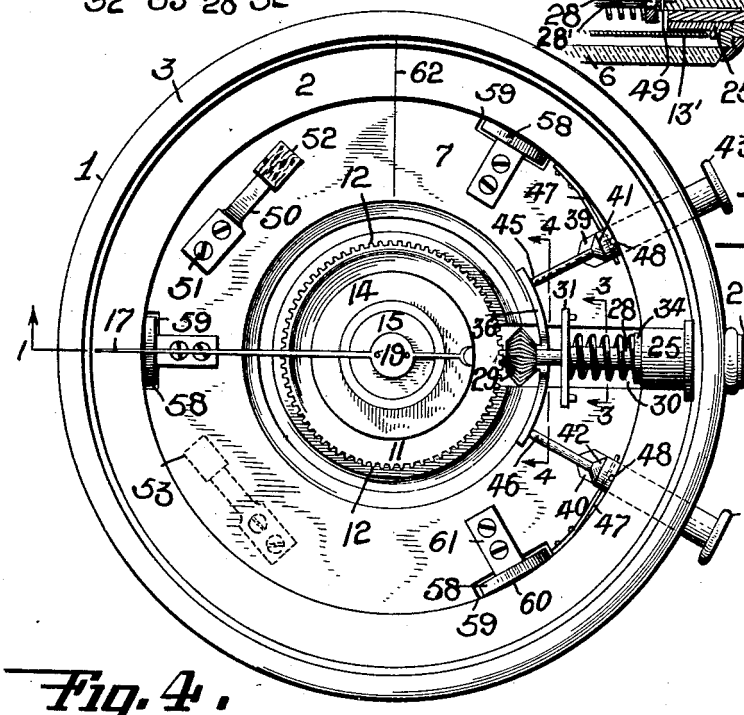


Fig. 2.

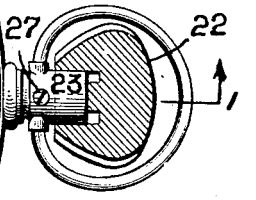
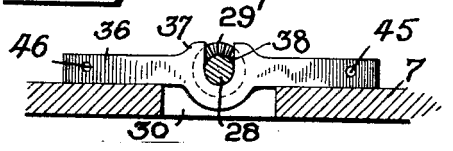


Fig. 4.



Inventor

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By his Attorney

Hubert K. Thompson

Patented May 29, 1928. 1,671,616

UNITED STATES PATENT OFFICE.

ELMER A. SPERRY, OF BROOKLYN, NEW YORK.

LOGARITHMIC CALCULATOR.

Application filed January 23, 1922. Serial No. 531,297.

This invention relates to logarithmic calculators, and more specifically to that type of calculating instruments in which a circular or spiral logarithmic scale is carried by a dial arranged beneath a radial pointer; the apparatus being mounted in a case similar to a watch case and being actuated by the usual watch winding stem.

Such a calculator is shown in my U. S. Patent No. 773, 235, dated October 25, 1904. Instruments of this nature heretofore manufactured, while extremely more handy and more convenient to carry than ordinary slide rules, have been comparatively large and heavy, as well as costly to manufacture. The object of the present invention is to improve upon the mechanism contained in the calculator, so that the device may be made very much thinner and lighter than is now the practice and regarded as necessary to obtain the desired results, and also to reduce the cost of manufacture.

Referring to the drawings wherein I have shown what I now consider to be the preferred form of my invention:

Fig. 1 is a sectional side elevation taken substantially on line 1—1 of Fig. 2.

Fig. 2 is a plan view, partly in section and with the top dial removed.

Fig. 3 is a sectional detail taken on line 3—3 of Fig. 2 of a stop member against which the spring which holds the actuating parts in normal position rests.

Fig. 4 is a sectional detail taken on line 4—4 of Fig. 2, showing means for shifting the position of the actuating mechanism.

Fig. 5 is a fragmentary sectional view showing a modified form of connection between the operating stem and gearing.

In the drawings the case 1 is shown as comprising a circumferential member 2 to which are attached the bezel rings 3, 4, carrying the crystals 5, 6. Integral with member 2 is shown a plate 7. This plate and member may be machined from a single disc or they may be cast as one piece. In short, the structure comprises a disc 7 having a rim 2 extended or offset on one side. The central portion of plate 7 may be thicker than the other portions or offset on the same side as rim 2, to form the bearing for a central rotatable shaft or spindle 9. The core of this spindle may be bored out as indicated at 10 so as to reduce its weight.

Integral with spindle 9 I have shown a wide circumferential flange 11 which serves to bear against the central portion 8 and at the same time carries at its periphery, bevel gear teeth 12.

A thin indicating dial 13 may be carried by a reinforcing or hub-like member 14 which may in turn rest upon the flange 11, being held in position by a member 15 screwed upon the spindle 9 and reaching over the said member 14 at 16. The dial 13 is, of course, adapted to rotate independently of spindle 9. The opposite dial 13′ is shown as mounted on a similar reinforcing hub member 14′ which bears on one side against the central portion 8 of plate 7, and is held in position by a member 15′ screwed upon the spindle 9 and reaching over the member 14′ at 16′. The member 15′ thus serves also to hold the spindle 9 in place.

Pointers 17, 18 may be secured to the opposite ends of spindle 9 by pins or screws 19 and are adapted to cooperate with the dials 13 and 13′, respectively.

The back or inner surfaces of the dials 13, 13′ may be provided with circumferential bevel gearing 20, 20′. As shown, this gearing may be cut in a separate annular member 21 secured to the dial. As shown at 7′, the plate 7 may be grooved or arched to provide space for the gearing 20′.

The usual watch winding stem 22 is shown as reaching into the case through a sleeve 23 fixed in the case and held against longitudinal movement by a flange 24 and a collar 25. An annular groove 26 may be provided in the stem to receive the end of a screw 27 in sleeve 23 to prevent endwise movement of the stem. A shaft 28 bearing at one end in the thick portion 8 of plate 7 and at the other in the sleeve 23 may be provided with a square shank 29 reaching into a square hole in the stem 22 so that rotation of the stem will cause rotation of said shaft. As more clearly shown in Fig. 2, an opening 30 is cut in the member 2 including plate 7 for the insertion of sleeve 23 and the shaft 28 and the other elements associated therewith. The shaft is also adapted to endwise movement and has thereon a double-faced bevel gear or pinion 29′, one side of which, when in the position shown, meshes with gearing 20, 20′, so that rotation of the stem 22 will cause the dials 13, 13′ to rotate. When the

shaft 28 is moved to the left, as viewed in the drawing, the other side of the double bevel pinion will engage gearing 12 for actuation of the pointers 17, 18. The ratios between the driving pinion 29′ and the driven gearing 20, 20′ and 12, are preferably low. Also the pinion is adapted to occupy substantially all of the distance between the dials. In other words, the dials are placed as close together as the pinion and the gearing on the dials will permit. With this construction, the instrument may be made comparatively thin. Also with the arrangement shown, i. e., with the pinion actuating the oppositely disposed dials, the dials will be driven in opposite directions. On the other hand, it will be seen that the pointers 17, 18 will be driven in the same direction. Said pinion may be normally held in one of its positions and adapted to be shifted to the other position. To this end I have shown a stop 31 (see also Fig. 3) inserted in slots 32 in the plate 7. This stop may fit tightly in the slots and may have bent over portions 33 resting against plate 7 to aid in fixing it in position. A hole may be provided in the stop 31 for the shaft 28 to pass through as shown, and to move freely therein. Fixed on the shaft is shown a collar 34. A spring 35 may be provided on the shaft, pressing against stop 31 and collar 34. This will hold the bevel pinion 29 normally in mesh with gearing 20 and 20′.

For moving the pinion into engagement with gearing 12, I may employ a lever 36, (see also Fig. 4) provided with an enlarged section 37 having a slot 38 adapted to fit over shaft 28 and bear against the bevel pinion as a shoulder. The central or enlarged portion of lever 36 may project into the opening 30, while the arms of the lever rest upon the plate 7. Said lever may be curved as shown in Fig. 2 to conform to the curvature of the case 1. Reaching into the case in openings 39, 40 cut in member 2 and plate 7 are shown rods 41, 42 provided on their outer ends with buttons 43, 44 and resting at their inner ends 45, 46 against lever 36. Springs 47 secured to member 2 and passing through rods 41 may be provided to press the rods outwardly in the position shown, pins 48 being provided in the rods to engage member 2 to limit the outward movement of the rods. It will be seen that if one of the rods 41, 42 is pressed inwardly against lever 36, the other rod will act as a fulcrum and the bevel pinion will be moved by the lever into mesh with gearing 12.

Instead of shifting the gears by means of rods 41, 42, I may do this by means of the stem 22. For this purpose I have shown the stem as connected by a pin 49 (Fig. 5) to the shaft 28; the pin engaging the shaft loosely in a slot 28′ to permit lost motion axially (longitudinally of shaft 28) between the stem and the shaft, or any suitable resilient connection may be employed which will yield to axial strain so that shaft 28 may be moved inwardly by stems 43—44 without moving stem 22. In the position shown in Fig. 5 the stem and shaft are pushed in, in which case the pinion 29′ will engage gearing 12. The spring 35 acting against collar 34 will as heretofore stated, return the parts to normal position when the stem 22 is released. In this form the screw 27 is shown as projecting into a groove 26′ adapted to permit the necessary end play of the stem 22 but rotates therewith.

In order that the dials may not be moved when the pointers are being actuated and vice versa, and to prevent movement of these parts in general, I may employ braking means therefor. Such means may comprise a resilient arm 50 secured at one end by screws 51 to plate 7 and carrying at its other end a friction shoe 52 adapted to press against the rear surface of dial 13. Similar means 53 may be provided for braking dial 13′. In connection with the pointers, I may provide a hole 54 in the portion 8 of plate 7 reaching in adjacent to the spindle 9. A cork or other friction member 55 may be inserted in said hole and pressed by a spring 56 against the spindle; the spring in turn resting against a screw plug 57 secured in the hole 54.

If desired, one or more rollers 58 may be employed to aid in steadying the dials and to prevent any tendency to warp. Openings 59 may be provided in the plate 7 so that the rollers may reach through and engage both dials. The rollers may rotate on an axle 60 carried by a member 61 secured to plate 7.

While the dial faces and the graduations thereon are not shown here, it will be understood that any suitable scale may be employed. Thus, the scales shown in my aforesaid Patent, No. 773,235 may be employed if desired, or the usual slide rule scales may be used.

For the fixed reference, I have shown a hair line 62 which may be cut into the crystals 5 and 6. Or, obviously, if desired, a pointer may be employed instead. Such a pointer while not shown here could, of course, be secured to member 2 and project inwardly therefrom.

In accordance with the provisions of the patent statutes, I have herein described the principle of operation of my invention, together with the apparatus, which I now consider to represent the best embodiment thereof, but I desire to have it understood that the apparatus shown is only illustrative and that the invention can be carried out by other means. Also, while it is designed to use the various features and elements in the combination and relations described, some of these may be altered and others

omitted without interfering with the more general results outlined, and the invention extends to such use.

Having herein described my invention, what I claim and desire to secure by Letters Patent is:

1. In a calculating device, a double faced casing, a supporting element carried by said casing, a member rotatably carried by said element, said member being centrally disposed with respect to the casing, an index carried by said member adjacent each of said faces, a movable dial also disposed adjacent each of said faces, and a single means for actuating said dials and said member.

2. In a calculator, a double faced casing, a supporting member in said casing, a spindle rotatably carried by said member, gearing associated with said spindle, a pointer adjacent each of said faces, carried by said spindle, a dial rotatably mounted adjacent each of said faces back of said pointers, gearing on the inner side of each of said dials, a single pinion movable into engagement with said first named gearing and said second named gearing and means for actuating said pinion.

3. In combination with a double faced watch casing having the usual winding stem, a reference dial rotatably mounted adjacent each of said faces, an index pointer mounted over each of said dials, bevel gearing on the inner surface of each of said dials, an additional bevel gear between said dials connected with said pointers, a bevel pinion positioned between said dials and rotatably connected to said stem and means for moving said pinion into engagement with said first mentioned gearing in one position and said second mentioned gearing in another position.

4. In combination with a double faced watch casing having the usual winding stem, a reference dial rotatably mounted adjacent each of said faces, a spindle passing through both of said dials, a pointer positioned over each of said dials and carried by said spindle, bevel gearing on the inner surface of each of said dials, bevel gearing on said spindle, a bevel pinion between said dials and connected to said stem, said pinion being adapted to engage said first mentioned gearing in one position and said second mentioned gearing in another position, means resiliently pressing said pinion toward one of said positions and manually operable means for moving the same into the other position.

5. In a calculator, a pair of oppositely disposed indicator dials, means projected between said dials and adapted to operatively connect therewith and rollers engaging the inner surfaces of said dials.

6. In a double faced calculator, a rotating dial on each face, a pointer cooperating with each dial, gearing between said dials connected with the dials and pointers, a bevel pinion between said dials, a radial slidable shaft carrying said gear adapted to actuate said gear and to shift its relationship with said gearing.

7. In a calculator, a disc having a rim and a hub offset on one side thereof, a bezel ring carried by said rim, a spindle operating in said hub, a pointer carried by said spindle, a dial rotatably mounted with respect to said spindle and hub, and means for actuating said pointer and dial.

8. In a calculator, a disc having a rim and a hub offset on one side thereof, a bezel ring carried by said rim, a spindle operating in said hub, a pointer carried by said spindle, a dial rotatably mounted with respect to said spindle and hub, gearing connected with said dial, gearing connected with said pointer, a radially extending shaft, a bevel pinion carried thereby, a bracket supported by said disc, a spring connected with said shaft and engaging said bracket and adapted to hold said pinion in mesh with one of said gearings and manual means for shifting said pinion into mesh with said other gearing.

9. In a calculator, a double faced casing, a dial adjacent each face, gearing on the inner face of each dial, a pinion between said dials adapted to engage said gearing, means without said casing having a lost motion connection with said pinion for operating the same.

10. In a calculator, a pair of oppositely disposed indicator dials, a spindle reaching through said dials, a pointer positioned over each dial and secured to said spindle, and an actuating element for selectively operating said dials and pointers.

In testimony whereof I have affixed my signature.

ELMER A. SPERRY.