

Feb. 2, 1926.

S. J. MACFARREN

1,571,728

CALCULATOR

Filed Nov. 9, 1922

5 Sheets-Sheet 1

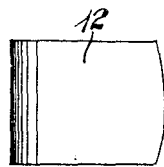
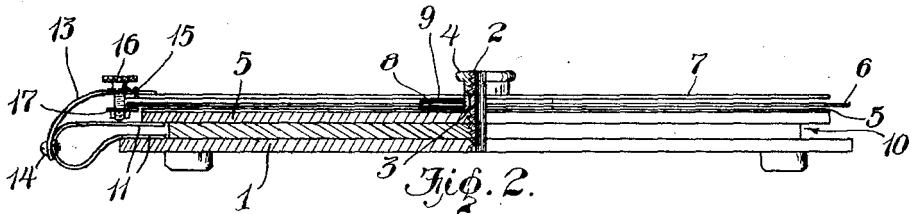
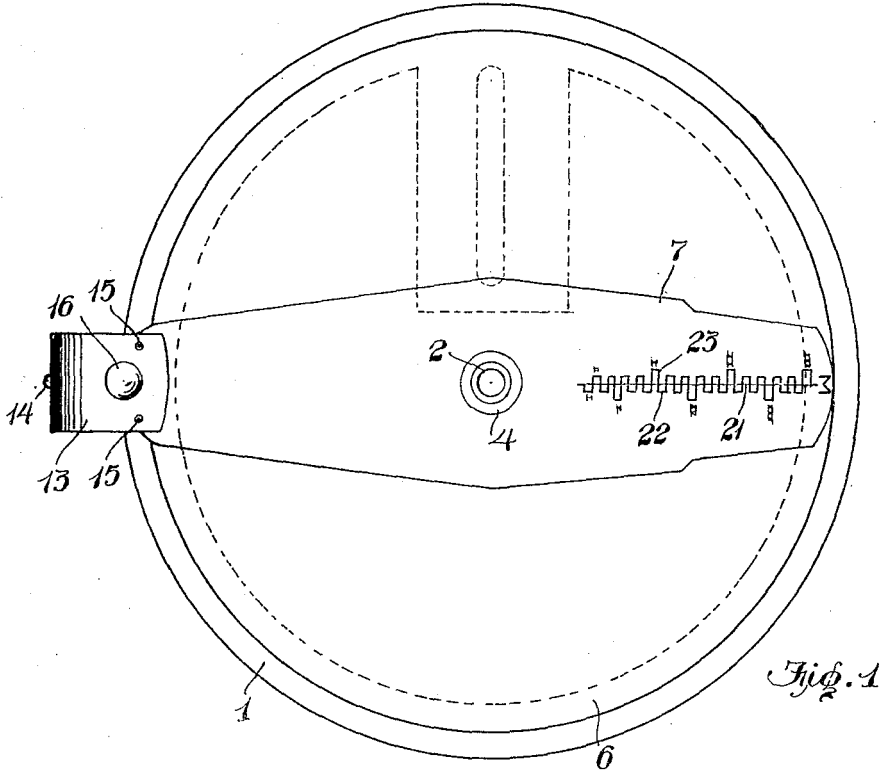


Fig. 5.

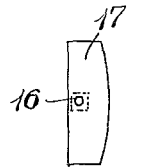


Fig. 5A.

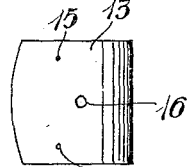


Fig. 6.

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5 Sheets-Sheet 2

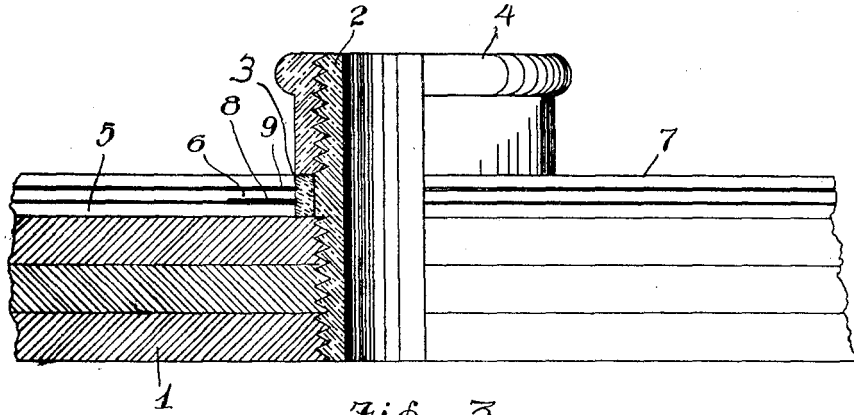


Fig. 3.

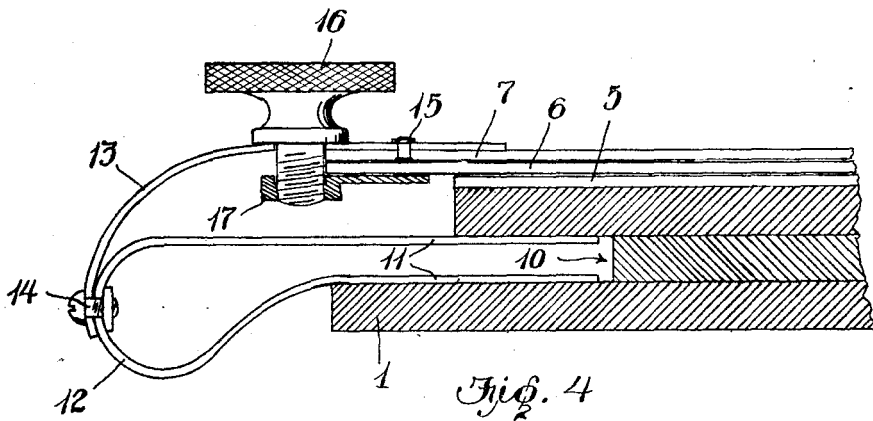


Fig. 4.

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5 Sheets-Sheet 3

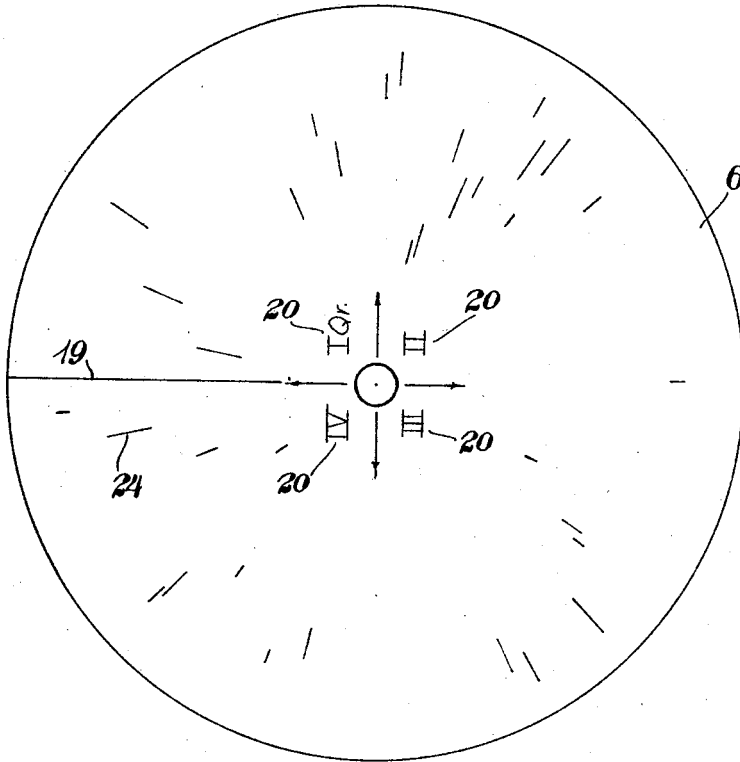


Fig. 7.

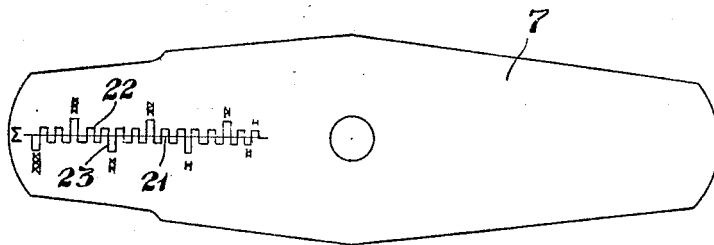


Fig. 8.

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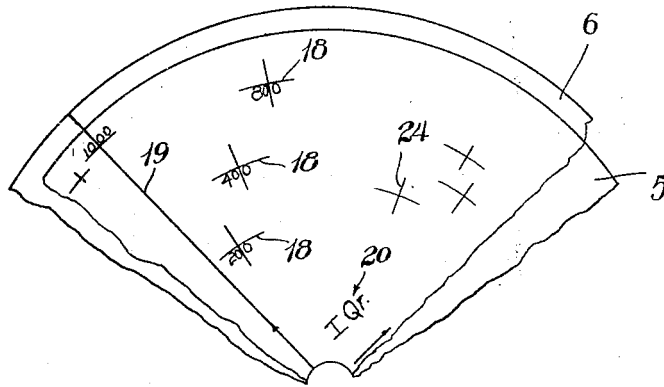


Fig. 9.

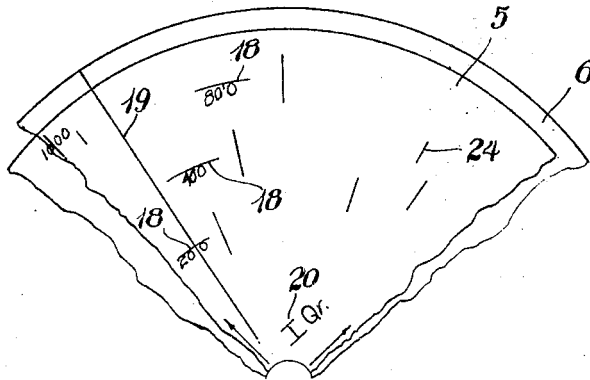


Fig. 10.

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5 Sheets-Sheet 5

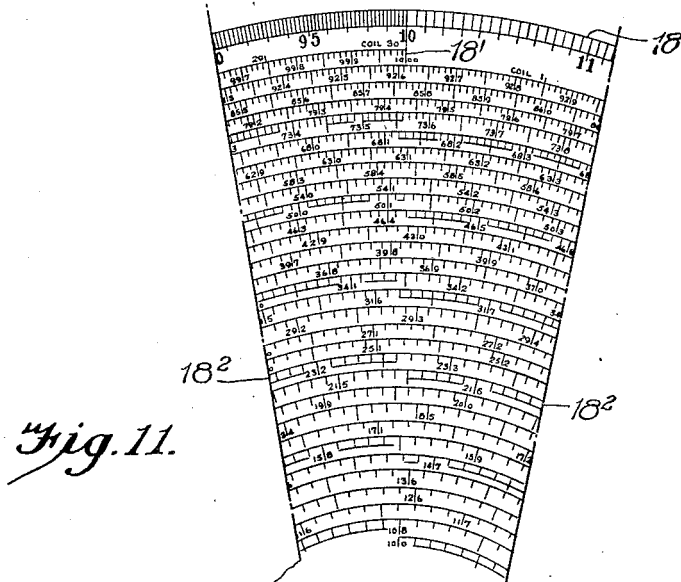


Fig. 12

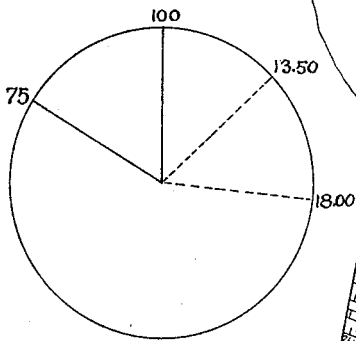
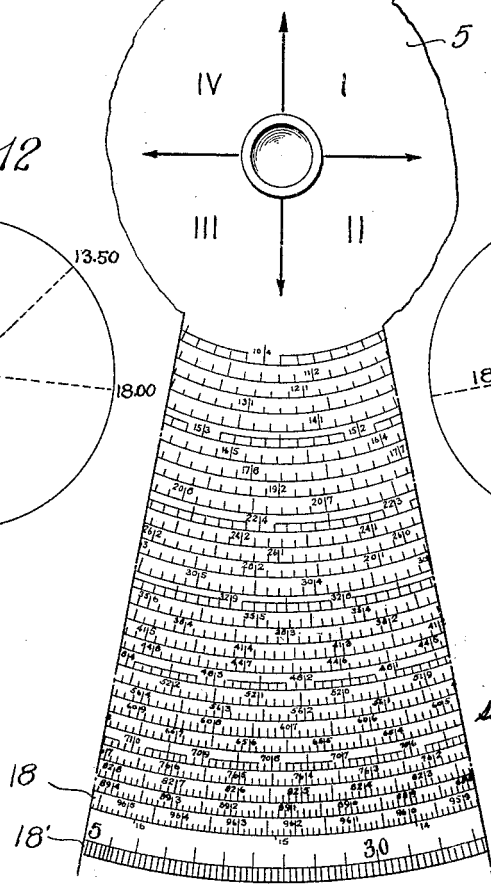
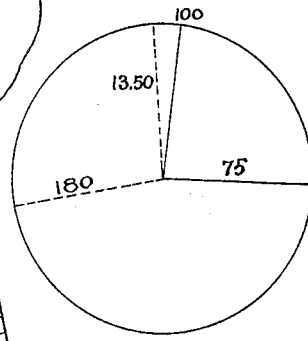


Fig. 13



Inventor
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UNITED STATES PATENT OFFICE.

SAMUEL J. MACFARREN, OF WASHINGTON, DISTRICT OF COLUMBIA.

CALCULATOR.

Application filed November 9, 1922. Serial No. 599,826.

To all whom it may concern:

Be it known that I, SAMUEL J. MACFARREN, a citizen of the United States, residing at Washington, in the District of Columbia, have invented certain new and useful Improvements in Calculators, of which the following is a specification.

My invention relates to that simple class of calculators which treats all numbers as integral and singular, measuring values in terms of length,—thus differing widely both in principle and operation from the ordinary repetitive devices which work separately on each item or unit of a total.

My device requires less than one per cent of the parts and about five per cent of the movements necessary for the repetitive devices, and is faster and quieter than the repetitive counting machines and probably more accurate for the highest figures of any result. Devices of the type of the present invention are ordinarily less easily read, especially the lower denominations to the right than those of the repetitive type, and while standard for engineering service, estimating, etc., they have not met commercial requirements, despite their simplicity.

The object of my invention is to provide a calculator simple in construction, easily read, and having an extended range of accuracy sufficient for all practical requirements for commercial work, and with this and other objects in view my invention consists in the parts and combination of parts as will be hereinafter more fully set forth.

In the drawings:

Figure 1 is a top plan view of my calculator,

Fig. 2 is an edge view, partly in section,

Fig. 3 is an enlarged detail view, partly in section,

Fig. 4 is an enlarged detail view at the perimeter of the calculator, parts being in elevation,

Figs. 5, 5^a and 6 are detail views of the brake mechanism,

Fig. 7 is a top plan view of the disk,

Fig. 8 is a similar view of the arm,

Figs. 9 and 10 are detail views of the disk and dial superposed.

Figure 11 is an enlarged view of the dial showing the scale, a portion of the dial being omitted.

Figures 12 and 13 are illustrations of a setting of a problem.

The reference number 1 designates a suitable laminated base preferably composed of three laminae to prevent warping, said base being provided with a central screw threaded opening in which the pivot 2 is adapted to be seated. A spacing ring 3 is screw threaded on said pivot and rests on the base. A cap 4 is screw threaded on the plug 2 and is limited in its downward movement by means of the spacing ring 3.

A dial 5 is placed on the base and is provided with a central opening whereby it may fit over the pivot 2 and immediately above the dial is a disk 6 having a central opening to receive the ring 3 whereon it is revoluble, and immediately above the disk 6 is an arm 7 likewise having a central opening to receive the ring 3 as a pivot. The disk is spaced from the dial near the ring 3 by means of washer 8 and the arm is spaced from disk near the ring 3 by means of the washer 9, the objects of which will be hereinafter pointed out.

Referring to the base 1 and particularly to Fig. 4, it will be seen that at the perimeter the lowermost lamina is of greater diameter than the other laminae, the uppermost lamina is of the same diameter as the dial, while the intermediate lamina is of less diameter than either of the other two whereby an annular groove 10 is formed into which the free ends of a rebent spring brake 11 project and may slide circumferentially, the outer end of the brake being bowed to form a handle 12. This handle is provided with a plate 13 secured at one end thereto by means of the bolt 14, while its other end overlaps the end of the arm 7 to which it is secured by means of the bolts 15. Through the plate 13 also passes a thumb screw 16 on the lower end of which is mounted a locking nut 17, an extension of which projects beneath the edge of the disk 6, whereby the arm 7 and disk 6 may be locked together and moved as a unit with the ring 3 as a pivot. It will be noted that the function of the locking device 17 is to lock any setting of the disk and arm against relative movement between the two members, whereas the function of the spring brake 11 is to hold or anchor the pointer arm 7 to the base 1 while the disk is being revolved for resetting, as, for example, in continuous multiplication or division.

The dial 5 is oriented as indicated by IQ—II—III—IV and the associated arrows and

has printed on it circular and spiral angular scales 18, the spiral scale reading clock wise and from one direction as a map reads, and is keyed for number finding by the centrally marked quadrants above referred to. The disk 6 is of transparent material, therefore the numbers in the spirals show through it as indicated in Figs. 9 and 10. I have, for the sake of clearness, shown but one figure in each of these spirals—to show all would tend to confuse the patent drawing as the scale would have to be very small. The scale numbers are protected from abrasion by the disk 5 by means of the spacing washer 8.

The disk 6 is provided with a "hair" line 19 and with keyed reference marks 20 which are read by their relative position on the dial.

The arm 7 or diametrical pointer has a "hair" line 21, and keyed reference marks 22, 23, corresponding with the spirals 24 on the dial and at its opposite end carries the brake 12 as described.

The step like marks 22, 23 on the arm are in the form of squares 22 and double squares 23, and each square or box represents its particular coil on the dial. The long line or double squares 23 indicating the odd fives on the right of the "hair" line and the even tens on the left.

As the disk and arm are preferably graduated on the inner side they are spaced apart for protection of their markings and all friction may be taken at the centre by washers or hubs or both as desired, the latter serving to give increased bearing thickness also. These members being concentrically and revolubly mounted on the pivot and being independent except for the clamp, allow ready movement of either hair line in any direction, or of both lines at once in the same or opposite directions, or of both together when so held by clamp.

This construction facilitates operation with either or both hands for greater speed and convenience, since the disk is of greater diameter than the dial, so that it is operable by either hand at any point on the circumference, while the other hand manipulates the arm from the clamp end, all readings being left open to the eye.

All number values are expressed in logarithmic distances so that addition of any two produces their product and subtraction of one from another give the quotient of their division.

Any distance may be set up instantly between the disk hair line at Unity and the arm hair line at any figure on the dial when, if clamped by turning the knurled screw 16, it may be correctly compared with, added to, or subtracted from any other distance-number marked on the dial, in less time than necessary for reading this paragraph. If

one distance number is added to another the result is the product of the two numbers and is read under the arm only. If one distance number is subtracted from another the result is a quotient of division and is read under the disk hair line. In the first mentioned case where two distances are compared the result is a simple ratio or fraction, of which the numerator would be under the arm and the denominator under the disk hair lines respectively. This case covers all problems of proportion; likewise any calculation capable of formulation may be carried out by means of this device.

Figure 12 illustrates the solving of a problem with the aid of the outer circular scale which I have marked 18', say an article costs \$13.50 and the overhead expense is 16 per cent and the seller desires to net 9 per cent profit. 100 less the sum of 16 and 9 is 75. So to get the selling price, set the hair line of the pointer 7 on the number 75 on scale 18' and place the hair line 19 of the disc 6 at 100 on scale 18'. Then swing them as clamped together until the hair line 19 is at the point 13.50 on scale 18' which gives the selling price at 18.00 under the hair line 19.

Now illustrating the same problem on the spiral scale, Figure 13, set the hair line on pointer 7 on 75 of spiral scale, place the hair line 19 of the disc 6 on 100 of spiral scale 18. Swing them as clamped until the hair line of the pointer 7 is at 13.50 on spiral scale 18, which gives the selling price of 18.00 under hair line 19 of disc 6. For convenience in finding, the turns of the spirals are indexed at each fifth place, by blocking the graduations in blocks or squares as shown in Figure 11. The spiral scale graduations are numbered consecutively and clockwise throughout the 30 turns of the continuous spiral, beginning inside, they are figured from 100 to 1000 consecutively.

The circular and spiral scales may be so used with equal facility separately, but not in cooperation. The spiral however, is the most accurate, say 20 fold, in correspondence with its multiplied length of graduation, or say one hundred times as accurate as the standard slide rule.

The angular or equal parts scale between the circular and the spiral scales on the dial is divided with reference to the number of turns in the spiral, for finding reference.

A reciprocal scale on the disk may be employed which will give all reciprocals of that on the dial, or used in any other position which shortens the work,—as for calculating pulley diameters by peripheral speeds, etc.

The division of dial and disk into quadrants as centrally marked, in connection with the keyed but unfigured marks on the

disk together with the multiple positional index are convenient for working reference.

The number-distance or measuring type of calculators drops any excess of decimals, upon which much time is often wasted, just as it fails in the full completion of results sometimes necessary.

Comultiplication lifts the latter limit and furnishes, practically instantly, precise extensions of readings when desired, since its results, completed from right to left, meet and unite with those of the instrument, completed in the opposite direction, with the greatest convenience and efficiency.

What I claim is:

1. In a calculator, a dial adapted to be read from one direction only and having thereon a spiral scale oriented.

2. In a calculator, a dial adapted to be read from one direction only and having thereon a numbered spiral scale oriented, and means for locating numbers according to spiral positions consisting of an index of the spirals on the dial.

3. In a calculator, a dial having thereon a spiral scale oriented whereby the instrument may be read from one side only when in a fixed position, in combination with a pointer having hair line and key reference marks thereon corresponding to the several spirals of the scale on the dial.

4. In a calculator, a dial adapted to be read from one direction only and having thereon a numbered spiral scale oriented, and means for locating numbers according to spiral positions consisting of an exponential index of the spirals on the dial.

5. A calculator comprising a base, a dial mounted on said base to be read from one direction only and having thereon a spiral scale oriented, a transparent disk pivotally mounted over said dial, a hair line on said disk, and a pointer pivotally mounted over said dial and having a hair line.

6. A calculator comprising a base, a dial mounted thereon to be read from a fixed position and having a spiral scale oriented, and a pointer pivotally mounted over said

dial and having thereon a hair line and keyed reference marks corresponding to the several spirals of the scale on the dial.

7. A calculator comprising a base, a dial mounted thereon to be read from one fixed position and having a spiral scale oriented, and a pointer pivotally mounted over said dial and having thereon a hair line and keyed reference marks on each side of said line corresponding to the several spirals of the scale on the dial.

8. A calculator comprising a base, a dial adapted to be read from one direction only on said base oriented and having a spiral scale, a transparent disk revolubly mounted over said dial and having a hair line on its face, a pointer pivotally mounted over said disk and having a hair line and keyed reference marks thereon cooperating with the scale of the dial and the hair line of the disk.

9. A calculator comprising a base, a dial adapted to be read from one direction only on said base oriented and having a spirally disposed scale on its face a transparent disk revolubly mounted over said base and having keyed reference marks thereon cooperating with the scale on the dial, and a pointer revolubly mounted above the disk and having a hair line and keyed reference marks thereon cooperating with the hair line and scale of the dial.

10. A calculator comprising a base having an annular groove at its periphery, a dial on said base having thereon a spirally disposed scale adapted to be read from one direction only, a transparent disk revolubly mounted over said dial and having keyed reference marks, a pointer revolubly mounted over the disk and having a hair line and reference marks, cooperating with the indications on the dial, and a brake carried by the pointer and extending into and engaging the walls of the groove at the periphery of the base.

In testimony whereof I affix my signature.

SAMUEL J. MACFARREN.