PATENT SPECIFICATION

COMPLETE SPECIFICATION.

Improvements in or relating to Calculating Apparatus.

I, LEON ·APPOUILLOT, a citizen of the French Republic, of 358, rue de Vaugirard, Paris, in the Republic of France, 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:—

This invention relates to calculating apparatus, and has for its object to provide an improved apparatus, of the circular slide rule type, which can be cheaply manufactured, readily manipulated and read with comparative ease.

With the above objects in view the invention consists in a calculating apparatus of the circular slide rule type comprising a dial having any desired scales printed or otherwise suitably inscribed thereon, a conical bearing mounted in the centre of the dial, cursors having conical hubs rotatably mounted on said bearing, and means co-operating with said conical hubs for holding one of the cursors stationary on the conical bearing while the other cursor or cursors are rotated or for causing the cursors to move in unison when the first mentioned cursor is rotated.

I am aware that it has been proposed to provide a navigating instrument consisting of a plane scale bearing member having a conical bearing and two indicating members having conical hubs mounted to rotate freely in said bearing, said indicating members being adapted to be clamped together to rotate in unison by a clamping device mounted on the outer end of one of said members.

In order that the said invention may be clearly understood and readily carried into effect the same will now be described more fully with reference to the accompanying drawings, in which:—

Figure 1 is a detail view illustrating the arrangement of the graduations of the scales.

Figure 2 is a vertical sectional view illustrating a conical bearing, with two cursors mounted thereon, and means for controlling the movements of the cursors.

Figure 3 is a detail sectional view of means for controlling the movements of the cursors.

Figure 4 is a plan view of a complete calculating apparatus constructed in accordance with this invention.

The dial may be made of any suitable material upon which the scales can be printed, impressed or otherwise suitably inscribed. It preferably consists of a sheet of stiff paper, cardboard or the like capable of retaining any usual printing ink and, after the scales have been printed thereon, it may be coated with celluloid or other suitable substance or material to impart a greater rigidity and to protect the dial and the scales against external noxious influences. Further, the dial may be mounted on a plate of metal or other suitable material to ensure the desired rigidity. If desired, the machine which prints the scales may simultaneously print suitable register marks to assist in accurately assembling the conical bearing with the dial. The minor graduations of the scales are preferably arranged in staggered order, as indicated in Figure 1, as such an arrangement greatly facilitates accurate reading owing to the fact that each graduation can be readily distinguished even when the scale is very finely graduated. If desired the graduations may be still further distinguished, by printing them in different colours or of different thicknesses or lengths.

The scales are also preferably arranged spirally, this being more particularly advantageous with logarithmic scales as the divisions or graduations of these scales normally decrease progressively in a logarithmic ratio whereas with a spiral arrangement, such as indicated in Figure

4 of the drawings, the increasing distance from the centre provides a progressively greater length to be graduated than would be the case with a true circle.

5 Secured in the centre of the dial is the conical bearing a on which the cursors are rotatably mounted. This conical bearing has many advantages, for instance, the cursors can be quickly and 10 accurately mounted thereon and maintained firmly in their correct central position notwithstanding the wear of the parts; very convenient means are afforded for adjusting the cursors so that 15 they can be moved in unison or independently of one another. Moreover the conical bearing itself can be readily secured in accurate position in the centre of the dial; a simple method of effecting 20 this is illustrated in Figure 2 of the drawings, in which the bearing a is provided with a stem adapted to be passed through a central hole in the dial and receive a screw-threaded clamping nut u. 25 The central position of the bearing can be ensured by the registering marks on the dial, before referred to, such as marks arranged to coincide with the outer circumference of the base of the 30 bearing, or a central circle to indicate the exact location of the hole to receive the stem. A suitable distance washer is preferably interposed between the nut u and the under surface of the dial plate, 35 or the nut provided with a collar, so that said nut constitutes a button or handle for manipulating the apparatus.

Mounted on the bearing a is the conical hub of the cursor b, and on this, is 40 mounted the conical hub of the cursor e. With this arrangement the frictional engagement between the cursor b and the bearing a or the cursor e and the cursor b can be readily regulated to permit the 45 cursors to move in unison or independently of one another. A convenient method of effecting this is illustrated in Figures 2 and 3 of the drawings, and consists in securing a washer c on the 50 upper end of the hub of the cursor b. Arranged to bear on the upper face of the washer c is a spring d, and interposed between the washer c and the hub of the cursor e is a spring washer f. The spring 55 d is mounted on a stem projecting from the upper end of the bearing a, and is secured against a shoulder on the stem by a nut h. Mounted on the nut is an adjusting member i which normally rests on the 60 spring d and is adapted to be slid longitudinally on the nut to compress the spring and to be rocked to bring a shoulder thereon into engagement with a shoulder on the nut, as shewn in Figure 65 3, to keep the spring compressed. The

relative pressure of the springs d and f can thus be adjusted so that when the adjusting member i is in the position shewn in Figure 2 the pressure of the spring f is the stronger and the cursors b 70 and e will move in unison when the cursor b is rotated on the bearing a, but when the member i is moved to the position shewn in Figure 3 the spring d will be compressed and exert sufficient pres- 75 sure on the washer c to hold the cursor b stationary on the bearing a while the cursor e is rotated. If desired the adjusting member i can be dispensed with, the spring d being arranged to 80 always exert sufficient pressure to hold the cursor b stationary while the cursor e is being rotated, and the spring f arranged to exert sufficient pressure to ensure that the cursor e will move in 85 unison with the cursor b when the latter is rotated.

To this arrangement may, if desired, be added other cursors such, for instance, as a plurality of cursors independent 90 from each other and adapted to remain, as indicating means, at the various positions occupied by the other cursors. These supplemental cursors may be mounted on the central bearing a or may 95 be in the form of movable pegs or clips adapted to be inserted in perforations in the dial or secured to the edge thereof.

At t, Figure 4, is shewn an abutment which serves for adjusting the cursors at 100 the starting point of the graduated scales. A plurality of these abutments may be provided if desired, and arranged at any desired points on the dial. These abutments may be fixed, if the cursors, or 105 the dial plate, are sufficiently resilient to permit the cursors to pass thereover, or they may be adapted to be depressed flush with the face of the dial or otherwise removed from the path of the cursors 110 when desired.

The dial may be provided with any desired scales and in Figure 4 it is shewn provided with logarithmic and uniformly divided scales. In the logarithmic scale 115 l, each of the main divisions of which is graduated into one hundred sub-divisions by means of alternate short and long marks made at different distances from the base line of the scale, the "$o5$," 120 "$l5$" etc. sub-divisions being at the greatest distance from said base line. The percentage discount scale m, and the percentage increase scale n, correspond with the log. scale l so that the sub-divisions 125 of the latter can be used with either of the scales m and n. The scale o is uniformly divided for additions and subtractions, and the odd sub-divisions have been omitted. The scale p is graduated 130

to indicate the square roots of the numbers on the scale *l*, and comprises two spiral turns, the divisions on the outer turn indicating the roots of numbers having an even number of digits, such as 10 to 99 or 1000 to 9999, and the divisions on the inner turn indicating the roots of numbers having an odd number of digits, such as 1 to 9, or 100 to 999. The scale of tangents also comprises two spiral turns, an outer turn *r* and an inner turn *s*, this scale being thus interrupted to avoid confusion with the scale *p*.

The apparatus is used in a similar manner to the ordinary slide rule or circular calculator; for instance, for a multiplication, the cursor *b* is moved to one of the factors on the scale *l*, the cursor *e* then turned to the commencement of the scale and the cursor *b* finally moved again around the scale until the cursor *e*, which moves in unison with the cursor *b*, is brought to the other factor. The product will then be indicated by the cursor *b*, which can, if desired, be held in this position by depressing the adjusting member *i* in the manner previously described. If it be desired to again multiply the product thus obtained, the cursor *e* is returned to the commencement of the scale, the cursor *b* released and turned until the cursor *e* is brought to the new factor, and the new product will be again indicated by the cursor *b*. The two cursors may be used in a similar manner with the scales *m* and *n* for finding discounts and percentages, and either of the cursors may be used as an index or datum line with the scale *l* and the scale *p* or the scales *r*, *s* for squares, square roots or tangents.

The foregong is given by way of example only and it is obvious that any suitable scales may be inscribed on the dial.

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 calculating apparatus of the circular slide rule type comprising a dial having any desired scales printed or otherwise suitably inscribed thereon, a conical bearing mounted in the centre of the dial, cursors having conical hubs rotatably mounted on said bearing, and means co-operating with said conical hubs for holding one of the cursors stationary on the conical bearing while the other cursor or cursors are rotated or for causing the cursors to move in unison when the first mentioned cursor is rotated.

2. The means claimed in Claim 1 comprising a spring mounted on the conical bearing and adapted to bear on the main cursor, and a spring interposed between the respective cursors.

3. In a calculating apparatus as claimed in Claim 1, the scales arranged spirally on the dial one or more of said scales being graduated into sub-divisions by means of marks made at different distances from the base line of the scale.

4. A calculating apparatus constructed and adapted to be operated substantially as described with reference to the accompanying drawings.

Dated this 26th day of May, 1922.

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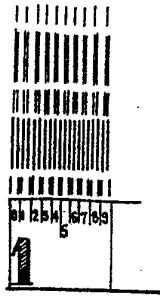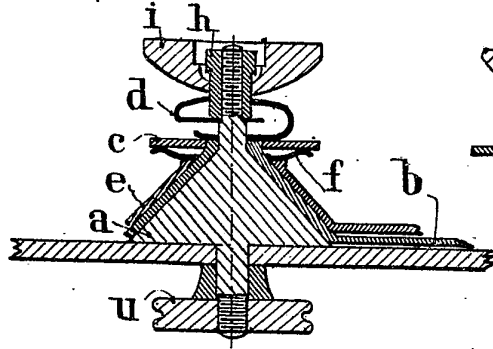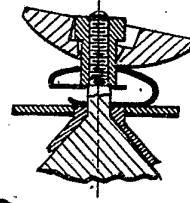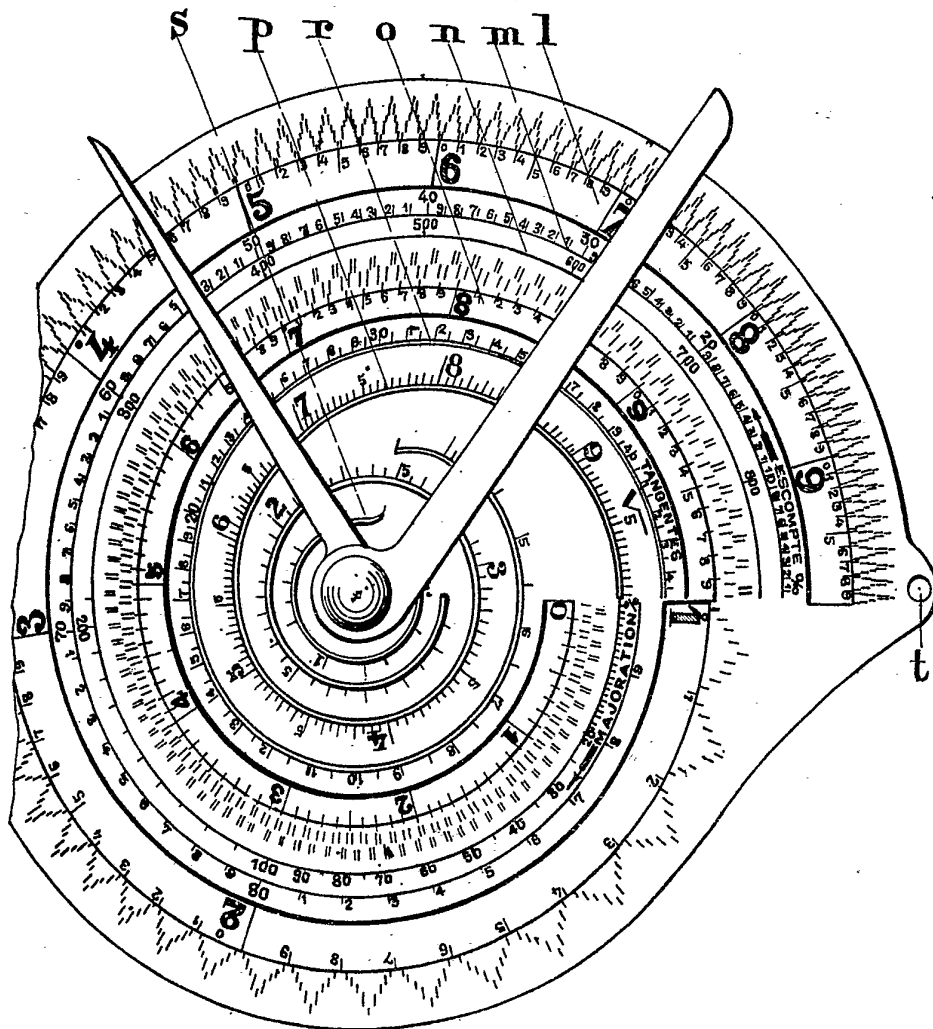Agents for the Applicant.

Fig.1

Fig.2

Fig.3

Fig.4