

Oct. 11, 1927.

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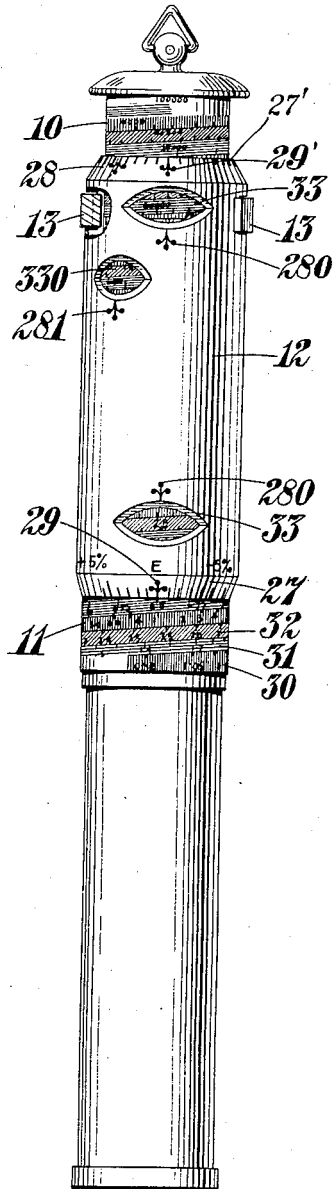
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CALCULATING APPARATUS

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2 Sheets-Sheet 1

Fig. 1



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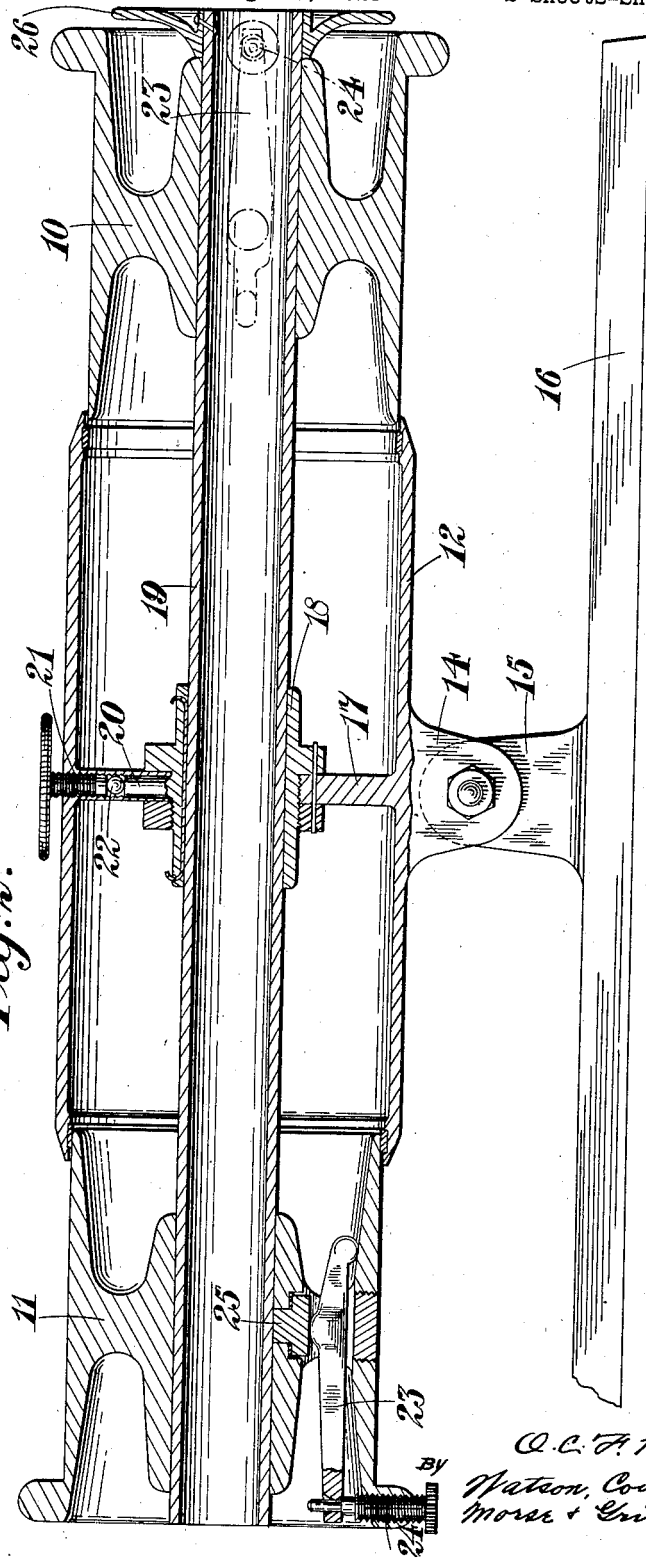
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2 Sheets-Sheet 2

Fig. 2.



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CALCULATING APPARATUS.

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This invention consists in improvements in or relating to calculating apparatus of the type comprising two co-axial cylinders relatively movable axially and angularly, and each carrying a spirally arranged logarithmic scale to be set and read by means of a tubular cursor having an index mark or marks for use in conjunction with both scales.

According to one feature of the present invention, calculating apparatus of the type above described is characterized by means to hold the cursor in fixed relation to one of the scale-cylinders at will. If desired, such means may be provided to hold the cursor in fixed relation to either one or the other of the scale-cylinders.

According to another feature of the present invention the cursor is provided, in addition to the usual setting mark, with another setting mark displaced circumferentially and/or axially from the first setting mark at an unalterable distance therefrom. The additional mark may be provided in co-operation with an aperture in the cursor, in which aperture are exposed scale-figures to be read in conjunction with the additional mark. The latter may thus be used to read or set on to the same scale as the companion setting mark, or on to another scale in conjunction with which the cursor operates. The object of this additional mark is to solve conversions where the factor is constant, or to obtain readings in any two or more predetermined terms.

Other features of the invention comprise scales around one or both end margins of the cursor; a plurality of different and interposed helical scales on one or both of the scale-cylinders; particular spacing of the scale divisions.

The foregoing and other features of the invention will be more clearly understood from the following description read in conjunction with the accompanying drawings, which illustrate examples of the various novel features, and in which—

Figure 1 shows in elevation a hand or pocket type of apparatus having certain of the improvements applied to it;

Figure 2 is a central longitudinal-section through a desk type of instrument;

Like reference numerals, where they apply in the several figures of the drawings, denote like parts.

Referring first of all to Figure 1, the apparatus comprises two scale-cylinders 10 and 11 which are axially and angularly movable in relation one to the other. A tubular cursor 12, slidingly mounted upon the scale-cylinders, is also relatively movable both axially and angularly.

It will be appreciated from the construction of the instrument that the cursor 12 is frictionally mounted on the larger cylinder 11 so that it may be set to the scale on the larger cylinder, and if the latter is then held in the hand the smaller cylinder 10—which slides within the larger cylinder 11—may then be set to the setting mark of the cursor. For some purposes it is desirable to be able to maintain the cursor in fixed relation to the smaller cylinder 10, while the cylinder 11 is adjusted relatively to the setting mark 29 on the cursor. For this purpose, and according to the first feature of the invention, the cursor is slotted to receive two finger-grips 13, each of which comprises a small block flanged as to its inner end so that it may project through the slots in the cursor without falling out therefrom. These blocks may be made of wood, and are made a good sliding fit in the orifices in the cursor. Thus, when it is desired to hold the cursor in fixed relation to the cylinder 10, it is only necessary to apply a pressure on the blocks by means of the fingers so that the cylinder 10 is gripped, whereupon the lower cylinder may be moved to any desired position of adjustment.

It may be desirable, although it is not essential to the invention, that the finger-grips or blocks 13 are normally resiliently held away from the scale-cylinder 10. For this purpose they may be secured to a deformable resilient ring situated between and clear of both the cursor and the scale-cylinder. This deformable ring affords the resilient means against the resistance of which the blocks can be pressed into engagement with the scale-cylinder.

If desired the cursor may be so made that it is not frictionally engaged normally to move with the scale-cylinder 11, in which

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case similar gripping devices may be provided at the lower end of the cursor so as to be able to hold it in fixed relation to the cylinder. This, however, will not generally
 5 be adopted, as normally the cursor would be too easily accidentally removed from its set position unless it is frictionally gripped normally to one of the cylinders.

Dealing with this part of the invention,
 10 Figure 2 shows table or desk model in which it is desirable that both scale-cylinders should be capable at will of being held in fixed relation to the cursor. In the example illustrated, the cursor 12 is mounted by
 15 means of a lug 14 to a standard 15 on a base-plate 16. The cursor is formed with an internal central diaphragm 17 which affords a bearing 18 for a central spindle 19. At one side the diaphragm 17 is apertured to admit
 20 a sliding plug 20, the inner end of which can be pressed into engagement with the spindle 19 by means of a screw 21, between which and the other end of the plug is a ball 22. Thus, when the screw 21 is moved
 25 inwardly, the plug is forced into engagement with the spindle 19 and so locks it in relation to the cursor.

Opposite ends of the spindle 19 carry respectively scale-cylinders 10 and 11 corresponding to the scale-cylinders 10 and 11
 30 of Figure 1. Each cylinder is slidingly mounted on the end of the spindle and has located within it a floating lever 23 operated by means of a screw 24 to press inwardly
 35 a plug 25 sliding through an orifice in the boss of the cylinder to engage the spindle 19. By means of the screw 24, therefore, either cylinder may be locked at will to the spindle, and when desired may be
 40 retained fixed in any set position in relation to the cursor by means of the screw 21.

At one end of the spindle 19 is a handle or knob 26 by which the spindle may be manually adjusted.

45 The cylinders 10 and 11 and the cursor 12 are of such relative dimensions that the two scale-cylinders can be pushed inwardly so as to be totally enclosed by the cursor and protected by it when the apparatus is
 50 not required for use.

Each such apparatus may be provided with several sets of cylinders carrying several scales to suit different types of calculation, such cylinders being interchangeable on the
 55 central spindle 19. All such cylinders may be of the same diameter, or those for one end of the spindle may be of smaller diameter than those for the other end, so as to avoid inaccuracy in assembling.

60 In Figure 1 a further feature of the invention is illustrated, which consists in the provision of a scale, such as 27, around the rim of the cursor. This scale is shown at one end only to co-operate with the cylinder
 65 11, although it may be equally well pro-

vided in addition at the other end as shown at 27', and such scales may also be applied to the cursor shown in Figure 2. Similarly, the setting mark need not be applied along the whole length of the cursor, but the ends
 70 only may be marked as at 29 and 29'.

The purpose of such a scale is to determine ratio variations from true answers, as for example to denote variations required to allow for waste, shrinkages, percentages,
 75 and the like. The scale-divisions in the scale 27 are so spaced in relation to those of the scale on the co-operating cylinder that if the true answer is indicated at the arrow or setting mark, the amended answer due to the
 80 waste, shrinkage, or the like, as represented by the scale 27, can be read beneath the particular value on that scale.

Obviously, the scale may be used for setting when the figure to be set has to be
 85 modified by a variation of the class above referred to.

Another feature of the invention consists in the provision on the rim of the cursor of an auxiliary setting mark, such as 28, in addition to the main setting mark 29. The auxiliary setting mark 28 is at an unalterable distance from the main mark and may be used to read or set on to the same scale as the companion mark so as to solve conversions where the conversion factor is constant.
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Another feature of the invention consists in the provision on one or both scale-cylinders of two or more logarithmic spiral scales, such as are indicated in Figure 1 at 30, 31 and 32. The convolutions of one scale are interposed with those of the other or others in a manner similar to the interposition of the threads of a multi-thread screw. The
 100 105 marking on one scale will be in different terms or values to those of the other or others. Thus the auxiliary setting mark 28 may be employed not only to solve conversions but to obtain readings in any two or more predetermined terms as represented by the different scales employed. The case with which such additional setting marks may be employed is increased in some cases by providing an aperture, such as 33, in the wall
 110 115 of the cursor with an auxiliary setting mark 280 reading on to the same or another one of the scales. The aperture 33 and the setting mark 280 are illustrated as being axially displaced from the main setting mark 29'.
 120 Alternatively or additionally, the aperture may be displaced both axially and angularly as at 330 and is also provided with an additional setting mark such as 281.

Any or all of the additional setting marks and/or apertures may be equally well applied to the desk or table model illustrated in Figure 2, as may be also the plurality of interposed scales on the scale-cylinders.
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Where a single scale is employed or where
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a plurality of interposed scales are employed, it is sometimes found preferable so to arrange the spacing of the scale-markings that geometrical progression in scale values occurs along lines parallel to the axis of the cursor and logarithmic sequence occurs in the circumferential or spiral direction. Consequently, if a setting mark be located at one point on the scale, a purely axial movement of that scale will bring to the setting mark, for example, another point of exactly double or half the value.

What I claim as my invention and desire to secure by Letters Patent is:—

1. Calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, a tubular cursor having relative sliding movement over the cylinders and bearing an index-mark for use in conjunction with the scales, and means to hold the cursor in fixed relation to one of the scale-cylinders at will.

2. Calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, a tubular cursor having relative sliding movement over the cylinders and bearing an index-mark for use in conjunction with the scales, and means to hold the cursor in fixed relation to either scale-cylinder at will.

3. Calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, a tubular cursor having relative sliding movement over the cylinders and bearing an index-mark for use in conjunction with the scales, and means to hold the cursor in fixed relation to one of the scale-cylinders at will, said means comprising a gripping-member so mounted in the cursor as to be capable of radial movement therein and to present a portion at the outer surface of the cursor, substantially as described.

4. Calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, a tubular cursor having relative sliding movement over the cylinders and bearing an index-mark for use in conjunction with the scales, and means to hold the cursor in fixed relation to either scale-cylinder at will, said means comprising a gripping-member so mounted in the cursor as to be capable of radial movement therein and to present a portion at the outer surface of the cursor, substantially as described.

5. Calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, a tubular cursor having relative sliding movement

over the cylinders and an index-mark for use in conjunction with the scales, and a scale marked circumferentially around one end margin of the cursor, each said cursor scale being so arranged that one of its markings constitutes the index-mark at that end of the cursor and so proportioned as to the spacing of its marking in relation to those of the co-operating scale-cylinder that ratio-variations from the value read at the setting mark can be determined.

6. A calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, a tubular cursor having relative sliding engagement with the cylinders and an index-mark presented on each end of the cursor for use in conjunction with the scales, a supporting base, means for fixedly securing the cursor thereto, a central spindle passing through the scale-cylinders and the cursor, a central web in the cursor providing a sliding bearing for the spindle with means to lock said spindle to the bearing at will, and means also to lock one of the scale-cylinders to the spindle at will, substantially as described.

7. Calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, a tubular cursor having relative sliding engagement with the cylinders and an index-mark presented on each end of the cursor for use in conjunction with the scales, a supporting base, means for fixedly securing the cursor thereto, a central spindle passing through the scale-cylinders and the cursor, a central web in the cursor providing a sliding bearing for the spindle with means to lock said spindle to the bearing at will, and means also to lock both of the scale-cylinders to the spindle at will, substantially as described.

8. Calculating apparatus of the type described characterized by means to hold the cursor in fixed relation to one of the scale-cylinders at will.

9. Calculating apparatus according to claim 8 further characterized in that means are additionally provided to hold the cursor in fixed relation to the other scale-cylinder at will.

10. The subject-matter of claim 8 wherein the cursor is fixedly supported on a base or carrier and has an internal transverse web providing a sliding bearing for a central spindle with means to lock said spindle to the bearing at will, and two scale-cylinders, slidable within opposite ends of the cursor, are carried on said spindle with means to lock one or both of them at will thereto, for the purpose described.

11. Calculating apparatus of the type described wherein the cursor is provided, in addition to the usual setting mark, with another

setting mark displaced circumferentially from the first said mark at an unalterable distance therefrom for the purpose described.

12. The subject-matter of claim 11 wherein the additional setting mark co-operates with an aperture in the cursor in which aperture are exposed scale-figures to be read in conjunction with the additional setting mark.

13. Calculating apparatus of the type described wherein the cursor is provided, in addition to the usual setting mark, with another setting mark displaced circumferentially and axially from the first setting mark at an unalterable distance therefrom for the purpose described.

14. Calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, and a tubular cursor having relative sliding movement over the cylinders and bearing an index mark at each end thereof displaced circumferentially in respect to one another, one of said marks cooperating with one scale and the other mark cooperating with the other scale.

15. Calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, and a tubular cursor having relative sliding movement over the cylinders and an index-mark presented on each end of the cursor and a second index mark at one end of said cursor circumferentially displaced from the said first setting mark at an unalterable distance therefrom, substantially as described.

16. Calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, and a tubular cursor having relative sliding movement over the cylinders and an index-mark presented on each end of the cursor, said cursor being provided also with a second setting mark displaced circumferentially and axially from the first said mark at an unalterable distance therefrom, substantially as described.

17. Calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, and a tubular cursor having relative sliding movement over the cylinders and an index-mark presented on each end of the cursor, the cursor being formed with an aperture through which is exposed a portion of the scale which would otherwise be hidden beneath the cursor and at the margin of said aperture a second index mark displaced circumferentially from the first said index mark at an unalterable distance therefrom, substantially as described.

18. Calculating apparatus comprising in combination two co-axial cylinders relatively

movable axially and angularly and each carrying a spirally arranged scale, and a tubular cursor having relative sliding movement over the cylinders and an index-mark presented on each end of the cursor, the cursor being formed with an aperture through which is exposed a portion of the scale which would otherwise be hidden beneath the cursor and at the margin of said aperture a second index-mark displaced axially from the first said index mark at an unalterable distance therefrom, substantially as described.

19. Calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, and a tubular cursor having relative sliding movement over the cylinders and an index-mark presented on each end of the cursor, the cursor being formed with an aperture through which is exposed a portion of the scale which would otherwise be hidden beneath the cursor and at the margin of said aperture a second index-mark displaced circumferentially and axially from the first said index-mark at an unalterable distance therefrom, substantially as described.

20. Calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, a tubular cursor having relative sliding movement over the cylinders and an index-mark presented on each end of the cursor for use in conjunction with the scales, and a scale marked circumferentially around both end margins of the cursor, each said cursor scale being so arranged that one of its markings constitutes the index-mark at that end of the cursor and so proportioned as to the spacing of its marking in relation to those of the cooperating scale-cylinder that ratio-variations from the value read at the setting mark can be determined.

21. Calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, and a tubular cursor having relative sliding movement over the cylinders and an index-mark presented on each end of the cursor, one of the scale-cylinders bearing a plurality of different and interposed helical scales arranged thereon similarly to the threads of a multi-thread screw.

22. Calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, and a tubular cursor having relative sliding movement over the cylinders and an index-mark presented on each end of the cursor, both of said scale-cylinders bearing a plurality of different and interposed helical scales

arranged thereon similarly to the threads of a multi-thread screw.

23. Calculating apparatus comprising in combination two co-axial cylinders relatively movable axially and angularly and each carrying a spirally arranged scale, a tubular cursor having relative sliding engagement with the cylinders and an index-mark pre-

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sented on each end of the cursor, the scale-markings on the scale-cylinders being so arranged that the values of the scale markings are in a geometrical progression having a ratio of 2 in a direction parallel with the axis of the cylinders.

In testimony whereof I affix my signature.
OTIS CARTER FORMBY KING.