J. J. WHITE.

COMPUTING INSTRUMENT.

APPLICATION FILED JUNE 28, 1915.

1,176,414.

Patented Mar. 21, 1916.

2 SHEETS—SHEET 1.

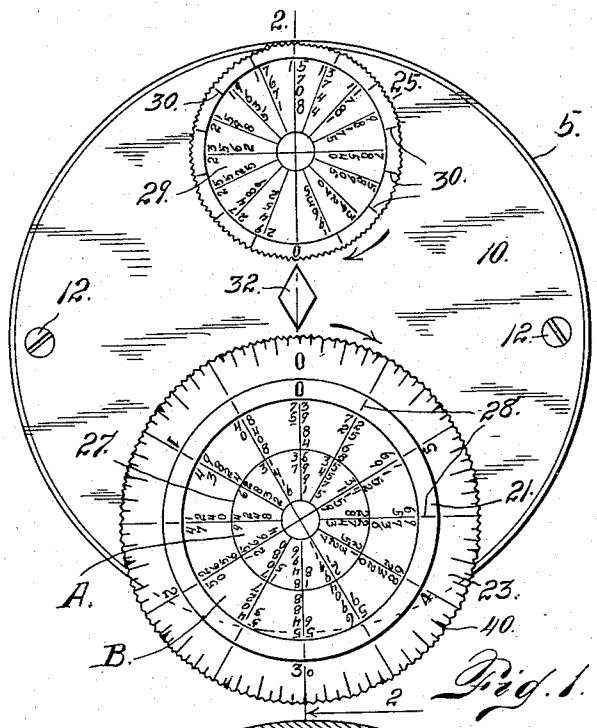


Fig. 1.

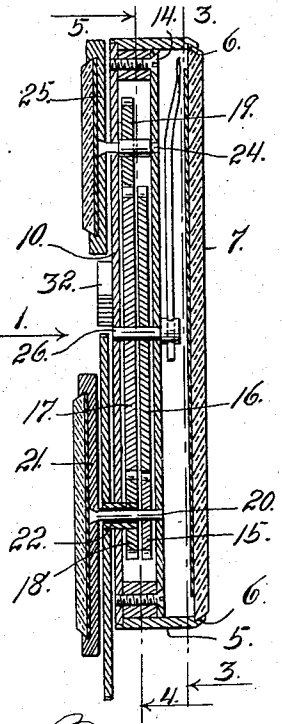


Fig. 2.

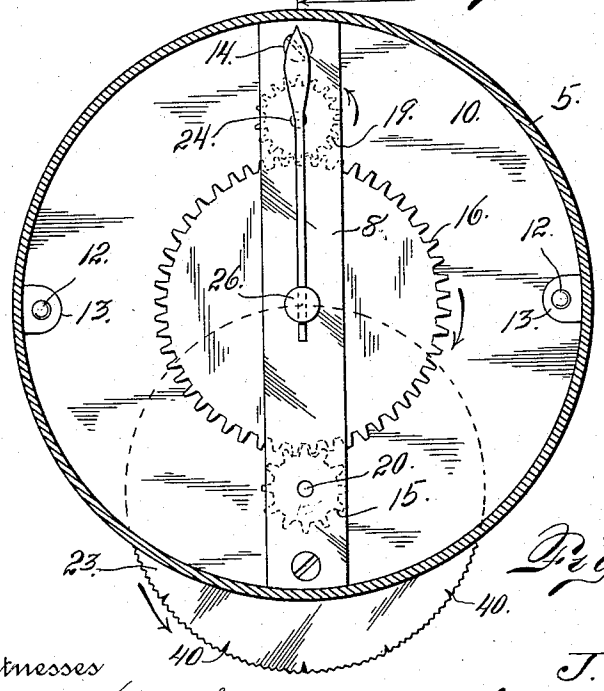


Fig. 3.

Witnesses

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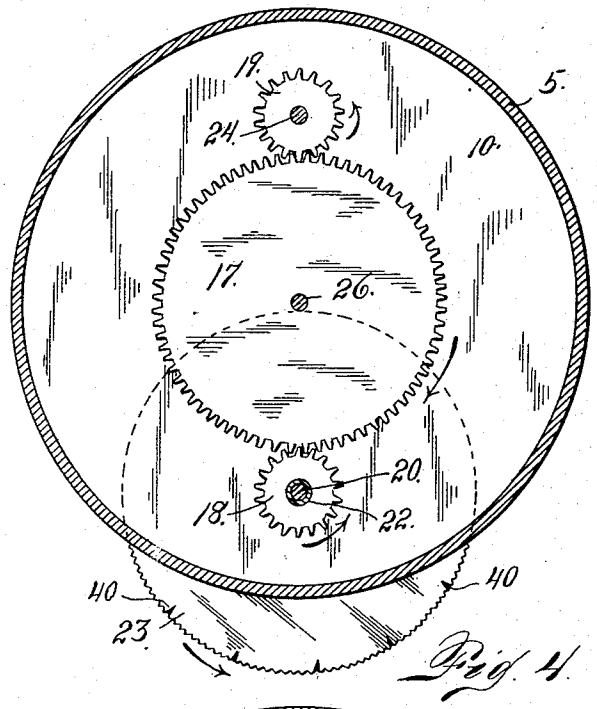


Fig. 4.

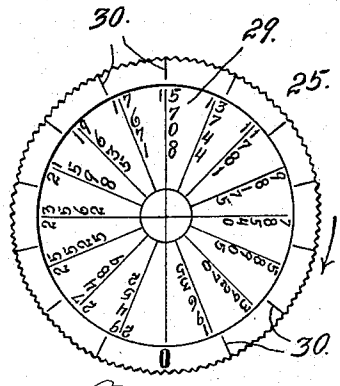


Fig. 6.

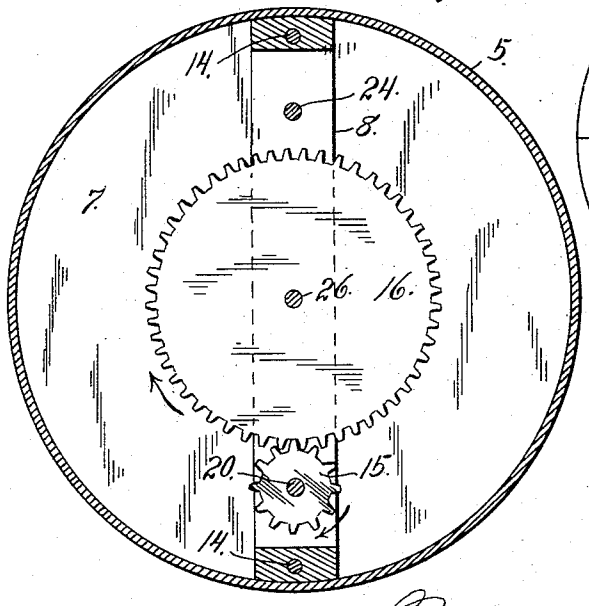


Fig. 5.

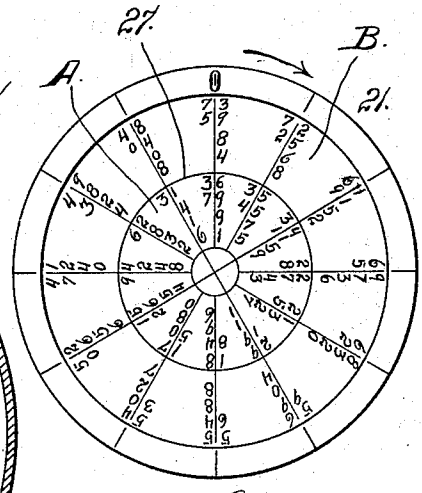


Fig. 7.

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COMPUTING INSTRUMENT.

1,176,414. Specification of Letters Patent. Patented Mar. 21, 1916.

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To all whom it may concern:

Be it known that I, JOHN J. WHITE, citizen of the United States, residing at Arvada, county of Jefferson, and State of Colorado, have invented certain new and useful Improvements in Computing Instruments; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the characters of reference marked thereon, which form a part of this specification.

My invention relates to improvements in computing instruments and more particularly to a device for computing the circumferences of circles when the diameters are known or the diameters when the circumferences are known.

Generally speaking the instrument consists of a combination of indicating disks and charts mounted within or upon a circular casing, and operating in connection with or through the medium of a train of gears arranged in such a manner that the circumference of a circle of any given diameter may be readily and accurately obtained, all of which will be hereinafter more fully described and finally pointed out in the claims.

Having briefly outlined my improved construction as well as the object it is intended to accomplish I will proceed to describe the same in detail reference being made to the accompanying drawings in which is illustrated an embodiment thereof.

In the drawings, Figure 1 is a face view of my improved computing instrument looking in the direction of the arrow 1, Fig. 2. Fig. 2 is a central section of the same taken on the line 2—2, of Fig. 1. Fig. 3 is a sectional view taken on the line 3—3, of Fig. 2. Fig. 4 is a section taken on the line 4—5, Fig. 2, looking in the direction of the arrow 4. Fig. 5 is a section taken on the line 4—5, Fig. 2, looking in the direction of arrow 5. Fig. 6 is an enlarged detail face view of the smaller charted disk of the instrument. Fig. 7 is an enlarged detail face view of the larger charted disk.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate a metal ring provided with an annular flange 6 formed on one edge for retaining a transparent plate 12 preferably composed of glass. To the opposite edge of this ring 5 is secured a cover composed of a metal disk 10 which is held in place by screws 12 engaging lugs 13 formed on the inner face of the ring 5. The ring 5 and the disks 7 and 10 form a casing in which is mounted a train of gears. These gears are respectively mounted on spindles having bearings in the disk 10 and a cross piece 8 secured within the casing by suitable fastening devices 14. The train of gears consists of toothed wheels 15, 16, 17, 18 and 19. The gear 15 which meshes with the gear 16, is mounted on the spindle 20 which protrudes through the disk 10 and has secured to its protruding end a disk 21. The gear 18 which meshes with the gear 17, is mounted upon a hollow spindle 22 which protrudes through the disk 10 and has secured to its protruding end, a disk 23. The gear 19 which meshes with the gear 17 diametrically opposite the gear 18, is mounted upon a spindle 24 which protrudes through the disk 10 and has secured to its protruding end a disk 25.

The gears 16 and 17 are mounted on the spindle 26 and turn in unison. The gear 15 has 12 teeth, the gear 16, 52 teeth, the gear 17, 72 teeth, and the gears 18 and 19, 18 teeth each.

The disk 21 has mounted upon its face a chart 27 provided with two zones A and B each divided into 12 equal parts or spaces by radial lines, these subdivisions indicating successively and respectively the circumferences of units from 1 to 24, the circumferences of the first 12 units being indicated in zone A of the chart 27, while the circumferences of units from 13 to 24 inclusive are indicated in the zone B of said chart. The annular space on the disk 21 beyond the said chart 27, is also divided into 12 equal parts by short radial lines 28.

The disk 23 which will hereafter be termed the traveler, has upon its exposed face (see Fig. 1), 96 subdivisions formed by radial lines arranged by varying the length of the lines in a manner similar to the linear subdivisions of an ordinary scale, into six spaces each of which is further subdivided into halves, quarters, eighths and sixteenths of the said space. The instru-

ment is herein shown on a slightly larger scale so that the numerals and divisions may be more easily read. In practice the parts are reduced so that the periphery of the traveler 23 is just 6 inches and is subdivided as above described. The periphery of this disk 23 is divided by milling into 140 equal parts, each 10 parts being designated by a deeper cut or groove, this cut or groove being designated by the numeral 40, than employed in the regular milling operation. The disk 25 has mounted or formed upon its face a chart 29 which is subdivided into 16 equal parts, the various subdivisions indicating respectively and successively, in sixteenths, the circumferences of circles from 1/16 to 15/16 of a unit, the circumference of the complete unit being indicated by 0 and read in zone A of the chart 27.

The annular space beyond the chart 29 is subdivided by short radial lines 30 into 14 equal parts. The disk 25 is further divided into 100 equal parts by milling cut into its periphery, each milling representing 1/100 revolution of traveler 23. A diamond shaped pointer 32 (see Fig. 1) is secured to the plate 10 of the casing and has its indicating points adjacent the peripheries of the traveler 23 and the disk 25. The traveler and each disk are marked with the character 0 and in setting the device to its primary position the traveler is turned until its character 0 and the characters 0 on the disks 21 and 25 are on a line with and adjacent to the pointer 32 as shown in Fig. 1.

In operation for example to find the circumference of a circle 3 units in diameter, (the device being set as shown in Fig. 1) the traveler 23 is turned three revolutions, when it will be found that the disk 25 will have assumed its initial position with relation to the pointer 32, and the disk 21 will rest with its 0 mark three radial lines to the right of the pointer 32, indicating that the traveler has made three revolutions, and the third radial line to the left of 0 will be on a line with the pointer 32, where in zone A of the disk 21 may be read the circumference of a circle having a diameter of 3 units which is 9.4248. If the circumference of a circle having a diameter of 31/16 units is desired the traveler 23, after being given three revolutions as above described, is advanced 1/16 of a revolution farther, which will bring the radial line on chart 29 to the right of 0 on the disk 25, on a line with the pointer 32, from which can be read on said radial line a circumference of 1/16 of a unit which is .19635 which added to the circumference of 3 units, namely, 9.4248, equals 9.62115. In this manner the circumferences of circles having diameters which can be expressed in even units, may be read from the chart 27 by turning the traveler as many revolutions as there are units in the diameter given, and the circumference of any such circle may be read on the radial line indicated by the pointer, the figures indicating such circumference being adjacent said line; the circumferences of units from 1 to 12 are read in zone A of chart 27, and the circumferences of units from 13 to 24 inclusive, in zone B; while the circumference of a circle having a diameter of any fraction expressed in sixteenths of a unit, may be read on the chart 29.

Milling on the edge of the traveler and disk 25 together with marks on the margin and radial lines of disk 25, are for the purpose of finding circumferences not given on the charts 27 and 29. It will be noted that the traveler 23 is divided by milling into 140 equal parts which area is subdivided into 14 sections of 10 millings each. The space of one section on the periphery of the traveler 23 is equal to the space between one line on the margin of the disk 25 and the next line whose 14 spaces represent hundredths (.14).

The 16 radial divisions on the chart 29 are ten thousandths (.0016). It will thus be seen that the circumference determined by one revolution of the traveler, multiplied by 3, will give three units and one thousand four hundred sixteen ten thousandths or 3.1416. For example if the circumference of a circle having a diameter of .25 is desired, it may be found by operating the instrument as follows: Turn the traveler 23 one quarter of a revolution to the right. This is .25. It will then be seen that 3 spaces (or .03) and a fraction of a space on the margin of the disk 25; and 4 radial lines (.0004) on the chart 29, also 5 millings (.005) on the edge of the traveler 23 have passed the pointer 32: thus showing that the fraction of space on the margin of the disk 25 is equal to 5 millings (or .005) on the edge of the traveler 23. The .25 revolution of said traveler 23 multiplied by 3 is .75. Adding to this the 3 spaces (.03) on the margin of the disk 25 gives .78; with the 5 millings (.005) on the edge of the disk 23 added to the 4 radial lines (.0004) on the chart 29 makes the result .7854. This example may be used as a key.

Should the circumference of a circle having a diameter of .20 be desired, turn the traveler 23 to the right 28 millings on its periphery (one-fifth or .20 of 140 millings is 28 millings). It will then be seen that 2 spaces (.02) and a fraction of a space on the margin of the disk 25 and three lines (.0003) on chart 29 also 8 millings (.008) have passed the pointer 32. .20 multiplied by 3 is .60; adding to this the .02 shown on the margin of the disk 25 makes .62; with the .008 or 8 millings on edge of the traveler 23 and the three radial lines or

.0003 on chart 29 gives the complete result .6283.

Third example. The diameter of an 18 unit circumference is desired. An easy way to find this is to turn the traveler 23 six revolutions to the right, and the number 18.8496 will appear in first zone of chart 27 on disk 21 opposite pointer 32. Turn the traveler 23 to the left until 27 millings on periphery of the disk 25 have passed the pointer 32. It will then be seen that 3 spaces (.03) and a fraction of a space on the margin of the disk 25 and 4 radial lines (.0004) on the chart 29, also 8 millings (.008) on periphery of the traveler 23 have passed pointer 32. Three times .27 are .81 plus .03 on the margin of the disk 25 and 8 millings, *i. e.* .008 on the periphery of the traveler 23 and 4 radial lines, *i. e.* .0004 on the chart 29 equals .8484, which is .0012 less than .8496. One-third of this amount or .0004 added to reverse of .27 makes the necessary reverse .2704, which, taken from the diameter 6 leaves 5.7296, the diameter of 18 unit circumference.

Having thus described my invention what I claim is,—

1. A computing instrument comprising a casing, three disks rotatably mounted thereon, the arrangement being such that the manipulation of one of said disks imparts motion by a gearing connection to the remaining disks so as to cause the second disk to travel one revolution and 1/12 of a revolution, and the third disk to travel one revolution to each revolution of the first named disk.

2. A computing instrument comprising a casing, three disks rotatably mounted thereon, the arrangement being such that the manipulation of one of said disks imparts motion by a gearing connection to the remaining disks so as to cause the second disk to travel one revolution and 1/12 of a revolution and the third disk to travel one revolution for each revolution of the first named disk, the second disk being provided with a chart designating the circumferences of circles of given diameters.

3. A computing instrument comprising a casing, three disks rotatably mounted thereon, and a gearing connection between the said disks of such character that the manipulation of the first disk imparts motion to the second and third disks causing the second disk to travel one revolution and 1/12 of a revolution and the third disk to travel one revolution for each revolution of the first named disk, the second disk being provided with a chart having zones each divided into 12 equal parts by radial lines and containing indicia indicating successively and respectively the circumferences of circles having diameters of from 1 unit to a predetermined number of units.

4. A computing instrument comprising a casing, three disks rotatably mounted thereon, a gearing connection between the three disks, the arrangement being such that the manipulation of the first disk imparts motion to the second and third disks, causing the second disk to travel one revolution and 1/12 of a revolution and causing the third disk to travel one revolution for each revolution of the first disk, the second disk being provided with a chart designating the circumferences of circles of given diameters, the second disk also having an annular space beyond the chart divided by radial lines into 12 equal parts.

5. A computing instrument comprising a casing, three disks rotatably mounted thereon, a gearing connection between the three disks, the arrangement being such that the manipulation of the first disk imparts motion to the second and third disks, causing the second disk to travel one revolution and 1/12 of a revolution and the third disk to travel one revolution for each revolution of the first disk, the second disk being provided with a chart designating the circumferences of circles whose diameters are expressed in units from 1 to a predetermined number, the third disk being provided with a chart divided into sixteen equal spaces containing indicia arranged to successively designate the circumferences of circles having diameters of from 1/16 to 15/16 of a unit respectively.

6. A computing instrument comprising a casing, three disks rotatably mounted thereon and a gearing connection between the three disks, the arrangement being such that the manipulation of the first disk imparts motion to the second and third disks, causing the second disk to travel one revolution and 1/12 of a revolution, and the third disk to travel one revolution for each revolution of the first disk, the first disk having on its face linear subdivisions formed by markings similar to those of an ordinary scale, and having its periphery divided by milling into 140 equal parts each 10 parts being designated by a deeper cut or groove.

7. A computing instrument comprising a casing, three disks rotatably mounted thereon and a gearing connection between the three disks, the arrangement being such that the manipulation of the first disk imparts motion to the second and third disks, causing the second disk to travel one revolution and 1/12 of a revolution, and the third disk to travel one revolution for each revolution of the first disk, the first disk having on its face linear subdivisions formed by markings similar to those of an ordinary scale, and having its periphery divided by milling into 140 equal parts each 10 parts being designated by a deeper cut or groove, the third disk being provided with a chart

divided into 16 equal parts by radial lines, the said disk having an annular space beyond the chart, divided by radial lines into 14 equal parts.

8. A computing instrument comprising a casing, three disks rotatably mounted thereon and a gearing connection between the three disks, the arrangement being such that the manipulation of the first disk imparts motion to the second and third disks, causing the second disk to travel one revolution and 1/12 of a revolution, and the third disk to travel one revolution for each revolution of the first disk, the first disk having on its face linear subdivisions formed by markings similar to those of an ordinary scale, and having its periphery divided by milling into 140 equal parts each 10 parts being designated by a deeper cut or groove, the third disk being provided with a chart divided into 16 equal parts by radial lines, the said disk having an annular space beyond the chart, divided by radial lines into 14 equal parts and the said periphery of this disk being divided into 100 equal parts.

9. A computing instrument comprising a casing, three disks rotatably mounted thereon, and a gearing connection between said disks, the arrangement being such that when one of said disks has traveled one revolution, one of the other disks will have traveled one revolution and 1/12 of a revolution and the third disk will have traveled one revolution, said third disk having its face subdivided into 16 equal parts representing .0016, and divisions of 14 equal parts representing .14 so that each revolution of the first disk multiplied by three and added to .14 and .0016 indicated on the three disks, is equal to 3.1416.

In testimony whereof I affix my signature in presence of two witnesses.

JOHN J. WHITE.

Witnesses:
A. J. O'BRIEN,
BESS MITCHELL.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."