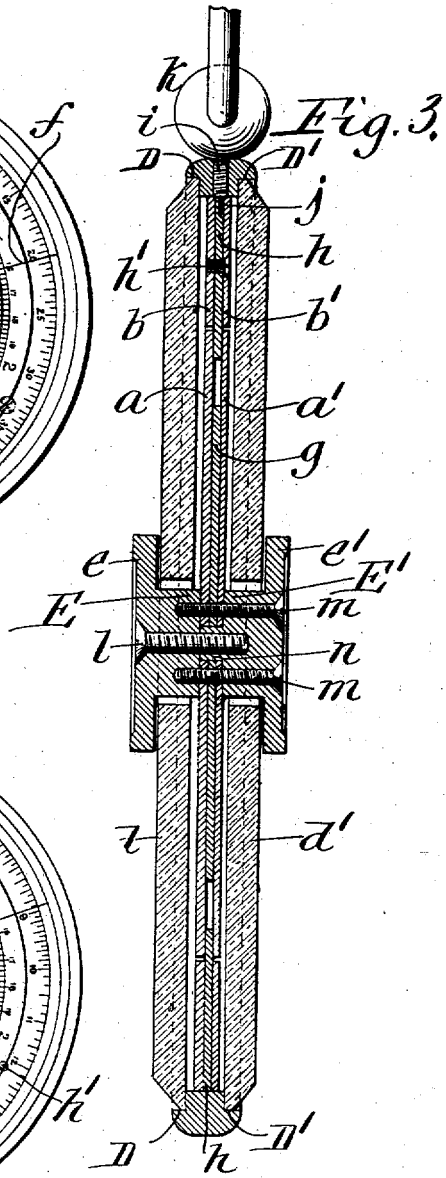
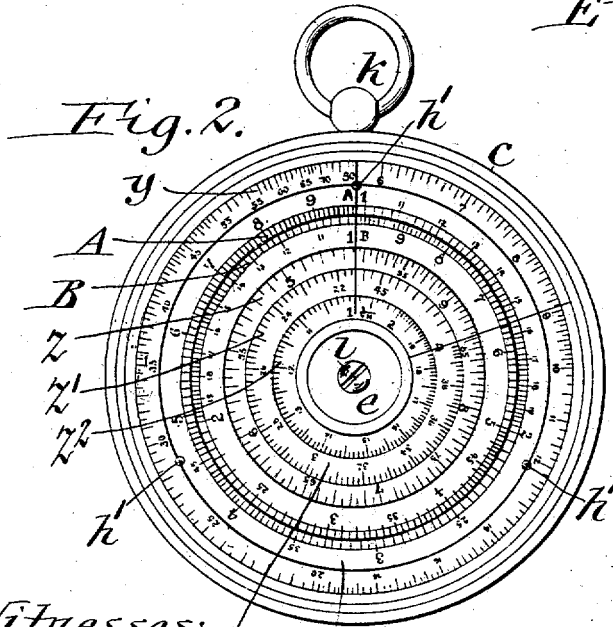
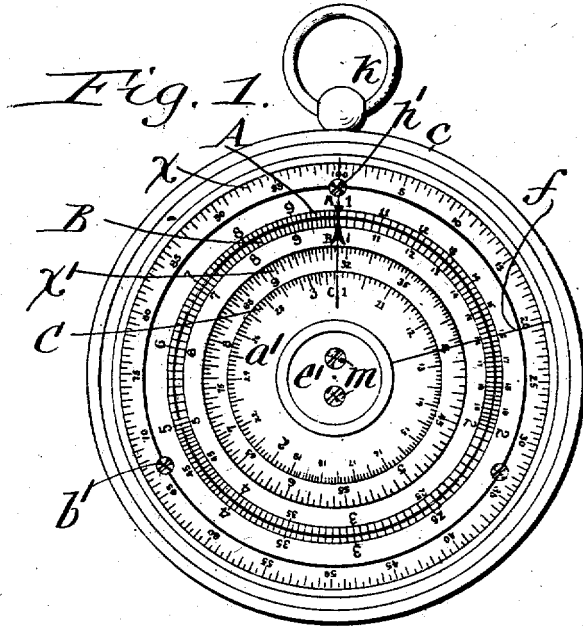


H. R. WATTS.
 CIRCULAR SLIDE RULE.
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1,017,719.

Patented Feb. 20, 1912.



Witnesses: a
 Alfred Borkenhagen
 Richard Sommer

Inventor
 Herbert Richard Watts
 by Geyer & Popp
 Attorneys

UNITED STATES PATENT OFFICE.

HERBERT, RICHARD WATTS, OF BROOKLANDS, ENGLAND.

CIRCULAR SLIDE-RULE.

1,017,719.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, HERBERT RICHARD WATTS, a subject of the King of England, residing at Brooklands, in the county of Chester, England, have invented new and useful Improvements in Circular Slide-Rules, of which the following is a specification.

The object of this invention is to provide a circular slide rule in which the parts are reliably connected so that they will not become displaced or loose during ordinary use, also to prevent warping or distortion of the parts and interference with the free use of the instrument, and also to simplify the construction so as to permit of making the same at reduced cost.

In the accompanying drawings: Figures 1 and 2 are front and rear face views of my improved circular slide rule. Fig. 3 is a cross section of the same, on an enlarged scale.

Similar letters of reference indicate corresponding parts throughout the several views.

My improved circular slide rule comprises two dial disks a, a^1 arranged within two dial rings b, b^1 each disk and ring together forming a dial. The two dials are surrounded by a metal rim or frame c and protected on both sides by transparent panes or disks d, d^1 which are seated at their edges in rabbets D, D^1 formed on opposite sides of the rim and which may be constructed of glass, celluloid or other suitable material. Each pane bears a cursor or hair-line f marked radially thereon and is capable of being revolved by the two thumbs of the hands of the operator in order to set the cursor or hair-line to the required position. The center disks a, a^1 of the dials are revolved by pressing the sections e, e^1 of a thumb piece on opposite sides between the finger and the thumb of the hand and then turning these parts relatively to each other to the required position.

A spacing disk or washer g of brass or other metal is interposed between the central parts a, a^1 of the dials and a spacing ring h is interposed between the outer parts b, b^1 of the dials. The inner edges of the dial rings b, b^1 stop short of the corresponding edge of the spacing ring h and the outer edges of the dial disks project beyond the outer edge of the spacing disk and bear against opposite sides of the inner edge of

the spacing ring, thereby holding the movable parts of the dial in place relatively to each other. The outer dial sections b, b^1 are secured to opposite sides of the spacing ring h by any suitable means but preferably by one or more screws h^1 and cement and the three parts b, b^1, h , thus united are held against turning in the rim by a screw i of a hanger passing radially through a threaded opening in the rim and provided at its inner end with a dowel pin or spur j which enters an opening in the spacing ring and provided at its outer end with a handle or loop k for suspending the instrument.

The two sections e, e^1 of the thumb piece have hubs E, E^1 on their inner sides which project through central openings H, H^1 in the glass disks and bear against the outer sides of the central dial sections b, b^1 . The latter are connected with the spacing washer g and thumb pieces e, e^1 so that these parts turn together, by a central connecting screw l and two side connecting screws m, m arranged on opposite sides of the central screw. If desired the central screw may be omitted. One of the thumb pieces has a hollow dowel n at its inner end which enters openings in the centers of the dial sections a, a^1 and washer g for centering the same. This means of fastening together the thumb piece sections, the dial centers and the washer is superior to the means heretofore employed for this purpose and is also less expensive to make.

By constructing the washer and spacing ring of metal the same are not liable to warp or distort and make the instrument work hard and wear unduly.

The front face of the circular slide rule shown in Fig. 1, is that which contains five circles of scales which are arranged and used as follows:—The outer one a on the front ring b^1 is a scale of logarithms. The front cursor or hair-line f is moved over any number on the inner scale A on the front ring b^1 and the log is read on scale x . Scale A on the ring b^1 and scale B on the front disk a^1 are calculating scales for multiplication, division and proportion. Square roots are extracted by associating the scale B with scales x^1 and x^2 on the front disk a^1 . To multiply, move the arrow on the front disk under any number on scale A and over any number on scale B and read the answer on scale A . To divide any number on scale A , put the divisor on scale B under the divi-

dend on scale A and the arrow on scale B will point to the quotient on scale A. For proportion, put any number on scale B under any number on scale A and the proportion of those numbers will be the same around the whole of the scales A and B. The circular scales x^1 and C arranged on the front dial disk bear the square roots of numbers on scale B. The cursor or hair-line is moved over any number on scale B and the square-root is read on scales x^1 and C.

The rear face of the circular slide rule contains six circles of scales which are arranged and used as follows:—The outer scale y on the ring b is a scale of angles, it represents the degrees. To find the sine of any angle, move the cursor or hair-line of the rear disk d over the degree which that angle represents and read the sine on rear scale A of the rear ring b .

The rear scales A and B on the rear ring b and disk a are calculating scales for inverse proportion and are used as follows:—
 Example: If ten men do a certain amount of work in eighteen days, how many men will it take to do it in six days? Operation: Set ten on rear scale B to eighteen on rear scale A and under six on rear scale A read the answer thirty on rear scale B. The rear scales A and B have the same divisions, but they are reversed to one another. Scales z , z^1 and z^2 on the rear disk a form a continuous scale and bear the cube roots of numbers on rear scales A and B. The rear hair-line is moved over any number on rear scale B and the cube roots are read on the rear scale z , z^1 or z^2 .

I claim as my invention:

1. A circular slide rule comprising a spacing ring, dial rings secured to opposite sides of the spacing ring and having their inner edges stopping short of the corresponding edge of the spacing ring, a spacing disk arranged within the spacing ring, and dial disks secured to opposite sides of the spacing disk and arranged within the dial rings and having their outer edges projecting beyond the corresponding edge of the spacing disk and engaging with opposite sides of the spacing ring.

2. A circular slide rule comprising a spacing ring, dial rings secured to oppo-

site sides of the spacing ring and having their inner edges stopping short of the corresponding edge of the spacing ring, a spacing disk arranged within the spacing ring, dial disks secured to opposite sides of the spacing disk and arranged within the dial rings and having their outer edges projecting beyond the corresponding edge of the spacing disk and engaging with opposite sides of the spacing ring, and a screw connecting said spacing and dial rings.

3. A circular slide rule comprising a spacing ring, dial rings secured to opposite sides of the spacing ring and having their inner edges stopping short of the corresponding edge of the spacing ring, a spacing disk arranged within the spacing ring, dial disks secured to opposite sides of the spacing disk and arranged within the dial rings and having their outer edges projecting beyond the corresponding edge of the spacing disk and engaging with opposite sides of the spacing ring, a rim inclosing said spacing and dial rings, and a hanger having a screw passing through a threaded opening in the rim and provided with a dowel entering the edge of the spacing ring.

4. A circular slide rule comprising a spacing ring, dial rings secured to opposite sides of the spacing ring and having their inner edges stopping short of the corresponding edge of the spacing ring, a spacing disk arranged within the spacing ring, dial disks secured to opposite sides of the spacing disk and arranged within the dial rings and having their outer edges projecting beyond the corresponding edge of the spacing disk and engaging with opposite sides of the spacing ring, said spacing and dial disks being provided with central openings, and thumb pieces secured centrally to opposite sides of the dial disks and one of said thumb pieces being provided with a dowel which enters the openings of said spacing and dial disks.

Witness my hand this sixth day of January, 1911.

HERBERT RICHARD WATTS.

Witnesses:

JOHN JESSOP,

FREDK. WM. BROOKS.