

No. 627,427.

Patented June 20, 1899.

S. R. KIRBY.
ASTRONOMICAL SCALE.

(Application filed Dec. 8, 1898.)

(No Model.)

Fig. 1.

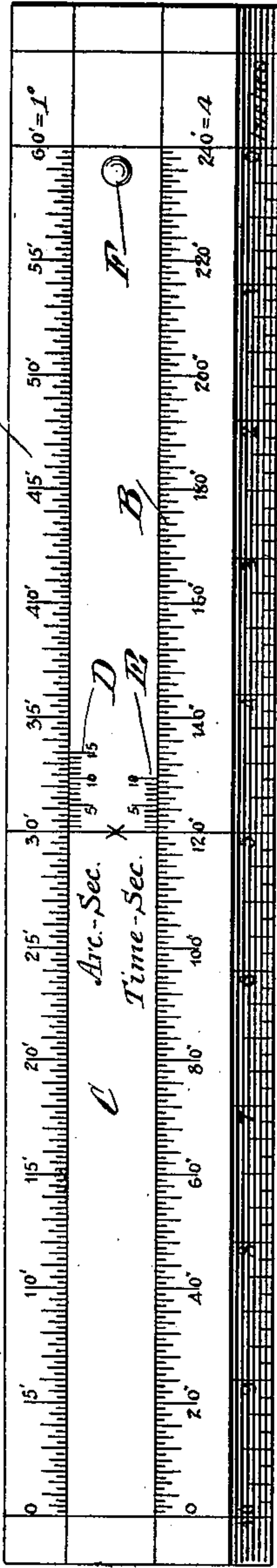


Fig. 2.

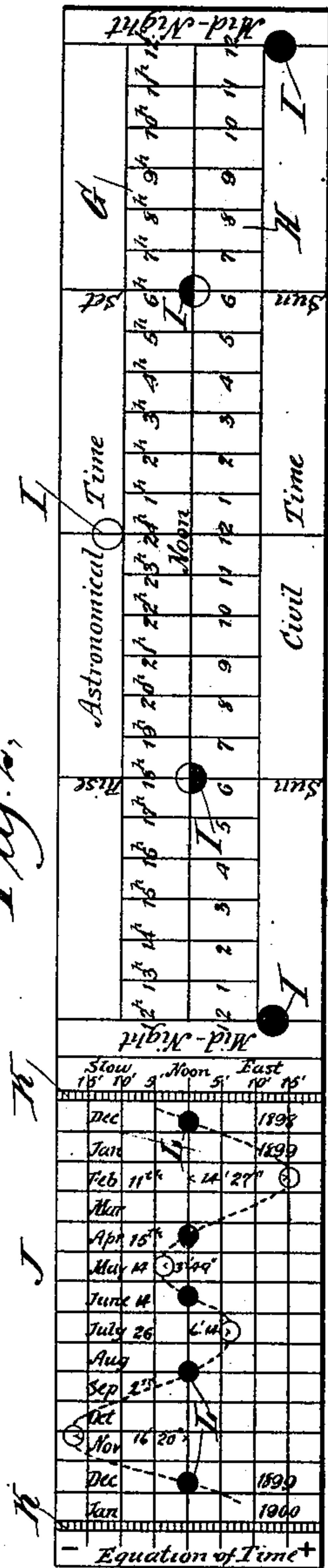


Fig. 3.



Fig. 4.

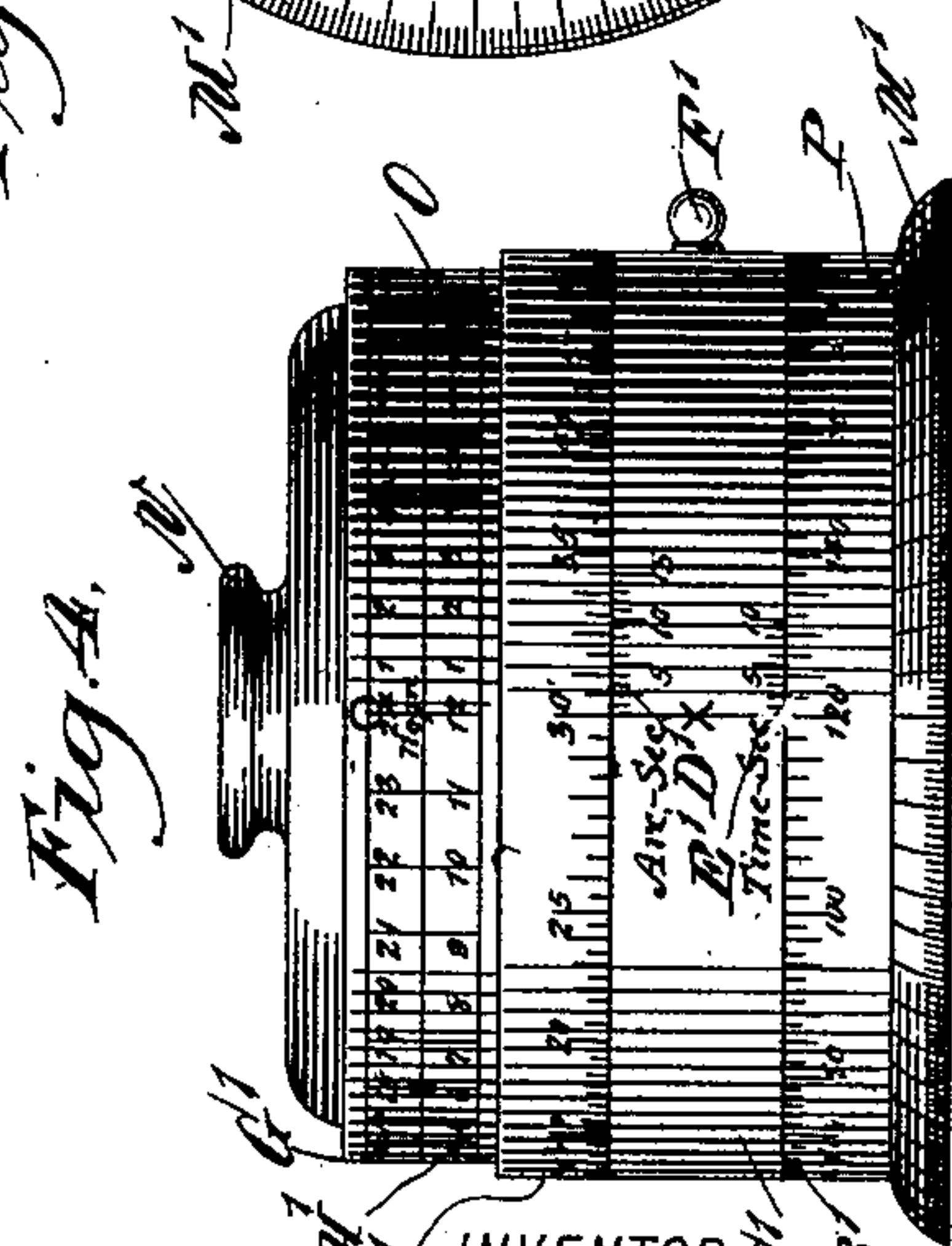
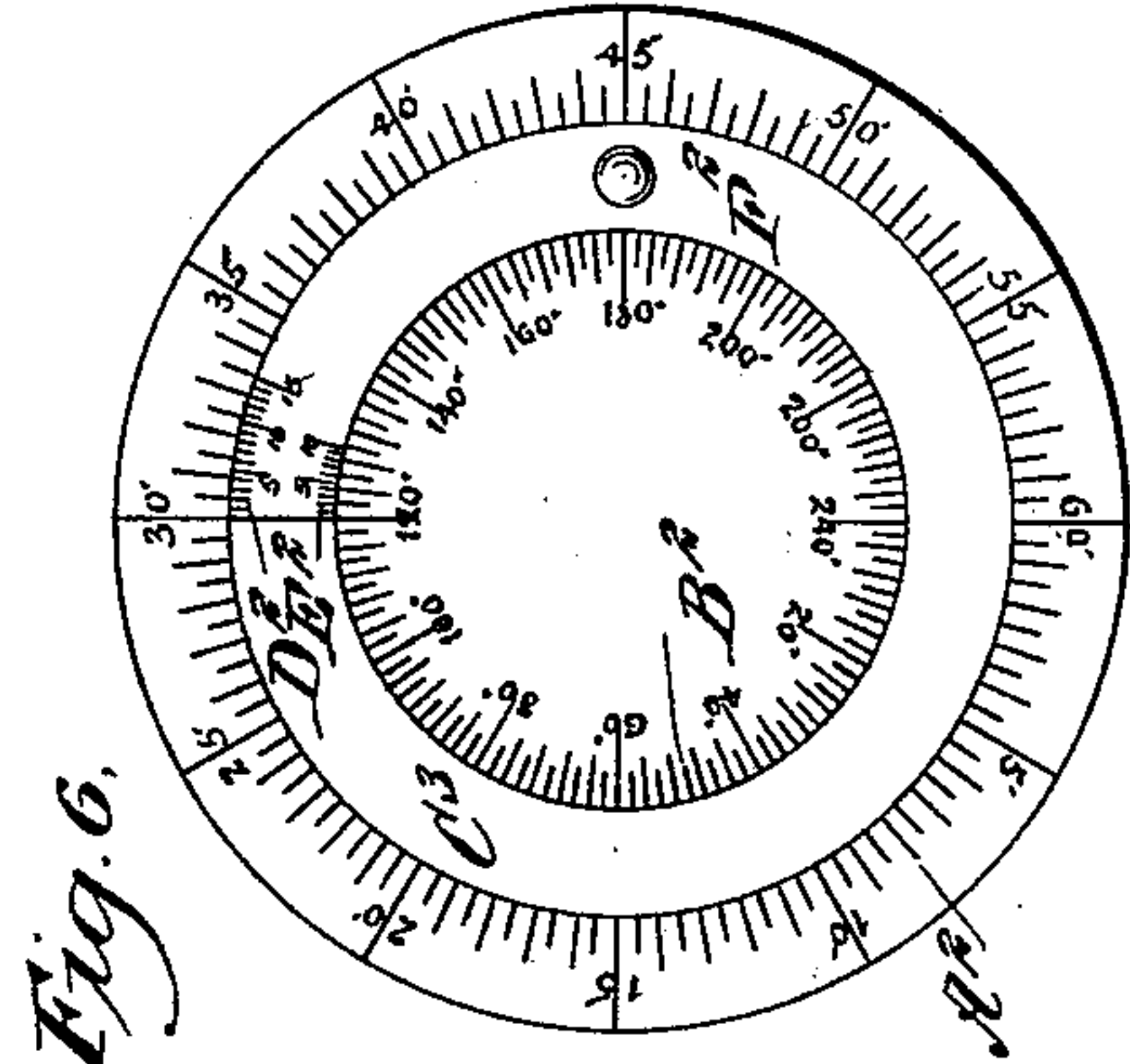
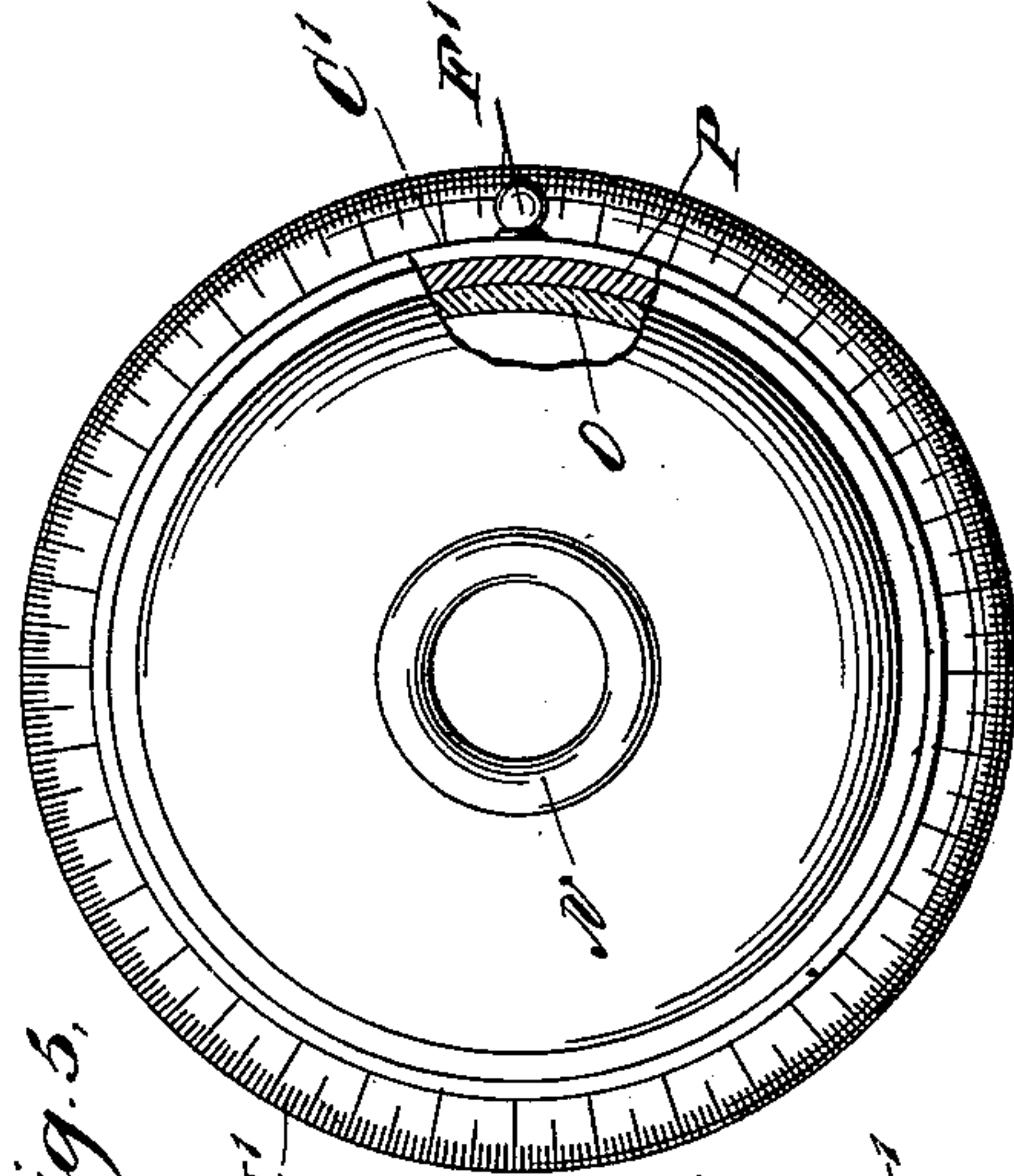


Fig. 5.



WITNESSES:

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ASTRONOMICAL SCALE.

SPECIFICATION forming part of Letters Patent No. 627,427, dated June 20, 1899.

Application filed December 6, 1898. Serial No. 698,436. (No model.)

To all whom it may concern:

Be it known that I, STEPHEN R. KIRBY, of the city of New York, borough of Manhattan, in the county of New York and State of New York, have invented a new and Improved Astronomical Scale, of which the following is a full, clear, and exact description.

My invention relates to a device which is in the form of a scale and is used for transforming units of longitude into units of time and for illustrating other astronomical matter pertaining to navigation.

My invention comprises the novel features hereinafter described and claimed.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a view of one-half of my device displayed upon a flat ruler. Fig. 2 is a view of the opposite side of the same. Fig. 3 is a transverse sectional view of the form of construction shown in Figs. 1 and 2. Figs. 4 and 5 are elevation and plan views of the same device constructed in the form of a cylinder, and Fig. 6 shows the manner in which the time and longitude transformer may be constructed as a disk.

The object of my invention is to construct a device which may be kept conveniently at hand and which will clearly indicate certain points connected with the relationship of time and longitude and which is frequently used by navigators.

In transforming units of time into units of longitude it is necessary ordinarily to do considerable figuring, which with my device may often be accomplished without any figuring. Also in transforming astronomical time into civil time it is often confusing to get the hour and day exactly right, as the astronomical day begins at noon, while the civil day begins at midnight, the two thus overlapping each other.

As shown in Figs. 1, 2, and 3, my invention is constructed as a ruler. Upon one face of this is formed a scale A, which is laid out to represent seconds of an arc or longitude, while parallel with this and separated at a slight distance therefrom is a scale B, which is laid off to represent seconds of time, the two scales being so figured that the marks

directly opposite each other correspond—that is, the minutes and seconds of longitude are exactly opposite the minutes and seconds of time corresponding thereto. Between these two scales is a sliding bar C, which is used as a vernier, said scale having two verniers D and E laid out thereon and respectively adjacent the scales A and B. The vernier D is laid out with fifteen divisions, while the vernier E has ten divisions. These verniers make it possible to obtain the corresponding figures for divisions smaller than those represented by a single division upon the scales A and B and are used in the same manner as any vernier.

The bar C is represented as extending substantially throughout the length of the scale. This, however, is not necessary, as the movement needed is only sufficient to enable the scale to be moved a distance corresponding with the length of the vernier thereon. To facilitate movement of the bar, a knob or button F is provided. Upon the beveled edge of the scale a rule may be laid out, as indicated at M, said rule being laid either in inches or centimeters, as desired. Upon the opposite side of the ruler are two scales, one showing the corresponding hours of astronomical and civil time for a day and the other graphically illustrating the equation of time. The first scale consists of two parts divided by cross-lines into twenty-four divisions, each of which represents an hour of time and is provided with a number indicating the number of the hour. The civil day is shown as beginning at midnight and numbering from "1" to "12," the day being divided into two parts in the ordinary manner, the number of each hour being duplicated. The divisions representing the astronomical day are numbered from "1" to "24," the numbers from "1" to "12" being placed in the divisions opposite the corresponding bars representing the afternoon of the civil day. Upon the scale is also placed a symbol representing the sun and indicating by its appearance the times of day. At midnight this symbol is shown as beneath the scale and as a solid black circle. At sunrise and sunset, which are placed at six o'clock, the same being the average times of sunrise and sunset, the symbol is placed upon the line between the two

scales and is represented as a circle having the lower half black and the upper half shown simply in outline. The symbol representing noon is placed above both scales on the noon-line and is a circle shown wholly in outline.

The scale which represents the equation of time consists of a number of cross-lines forming spaces which represent the months of the year and other lines at right angles to these which represent the difference of time. A central line is assumed to be the noon or meridian line. At each end of the scale is a band K, which has greater subdivision, so that the minutes may be read more accurately. Upon the surface of this scale is a curved line, shown herein as representing by its intersection with the two sets of lines the amount which the sun is fast or slow at any time of the year. Distance to one side of the meridian line is assumed to represent the amount which the sun is fast at any particular time and distance to the left of the same line to represent the amount which the sun is slow at any particular time. The sun is represented upon this curved line at the point where it crosses the meridian by a solid black circle L, and the extremes of its position are represented by outline circles. I have also shown the exact amount of the variation at these extreme positions by inserting the minutes or seconds which the sun is slow or fast.

In Figs. 4, 5, and 6 the same device is embodied in somewhat different construction. The device shown in these figures is in the form of a cylinder. The scales A and B, with the vernier-slide C, are represented by the scales A' and B' of the cylinder and the ring C'. The ring C' is provided with a button F', by which it may be slightly rotated. It is evident that the scales are identical in the two cases, and the only difference is that one is upon a cylinder while the other is upon a plane. The scales shown upon the opposite side of the ruler are shown at H' and G' just above the scale A'. This device may be constructed as a holder for an inkstand, as indicated at N, or be made simply as a paper-weight. The bottom of this may have a

slightly-flaring face, as shown at M', upon which may be marked the degrees into which a circle is divided.

In Fig. 6 the scales A and B are shown as in the form of a disk, the scale B², which corresponds with the scale B, being placed within the scale A², which corresponds with the scale A, and the vernier-slide being formed as a ring C², which slides between the two. This device is constructed in such a form that it may be kept upon a desk or in any other convenient place and may be used for purposes of instruction or reference.

The use of the time-transforming scales will often save considerable time when such transformations are to be effected. The use of the scales showing the difference between civil and astronomical time will often save mistakes. The device, as a whole, forms an interesting and instructive device which also may be made ornamental as well as useful in other ways.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. A device for use to graphically illustrate time and longitude relationships and to facilitate computations therein, having two adjacent scales representing respectively in their proper proportions units of time and longitude, a vernier-slide having a vernier for each scale, a scale having opposingly marked thereon the corresponding hours of the astronomical and civil day, and a scale graphically representing the yearly equation of time, substantially as described.

2. A device for transforming units of time and longitude, comprising two opposing scales indicating respectively the two units in proper proportion and a vernier-slide having two vernier-scales thereon for use one with each scale whereby minute subdivisions of one unit may be transformed into the other by direct reading.

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