

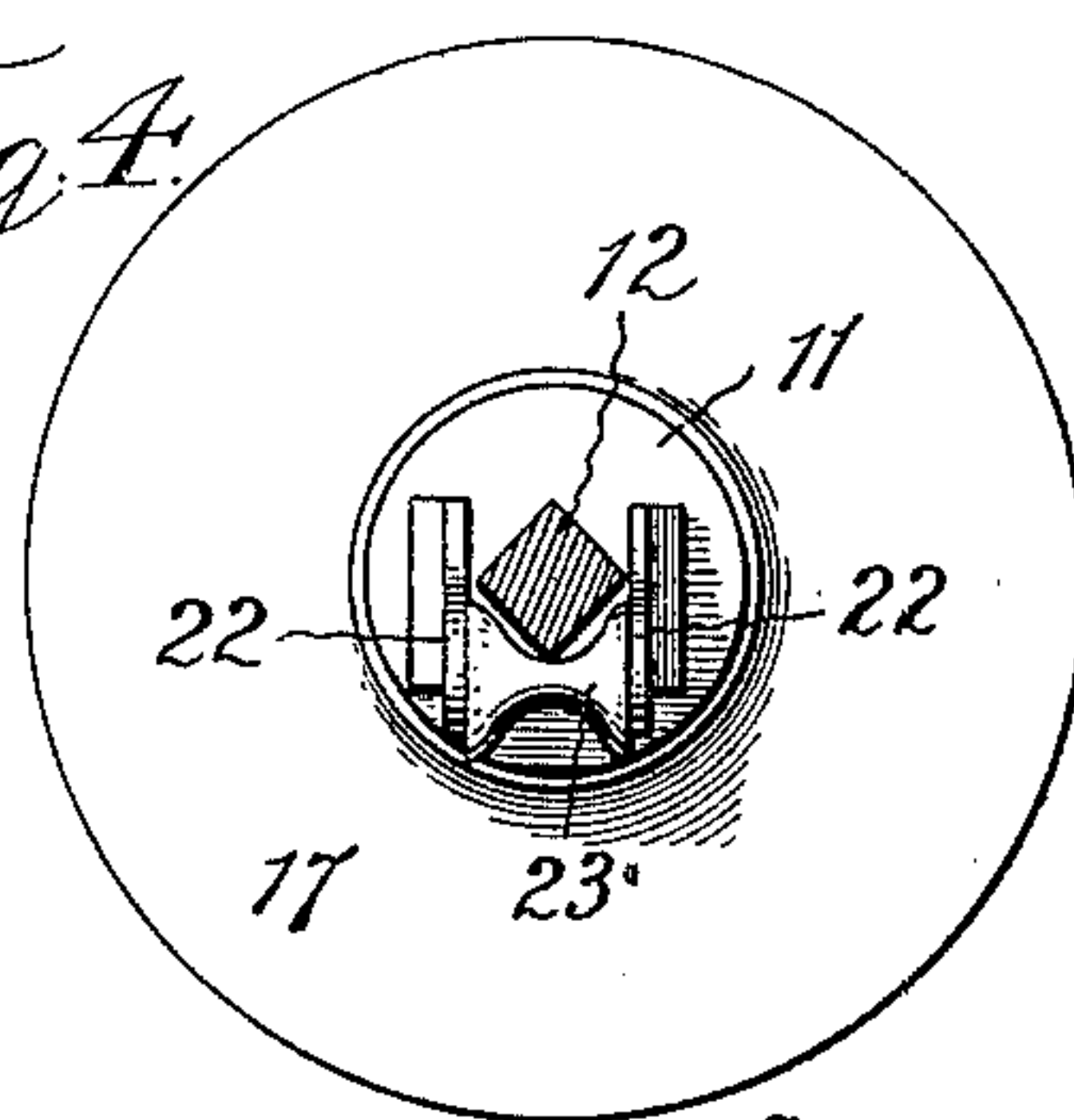
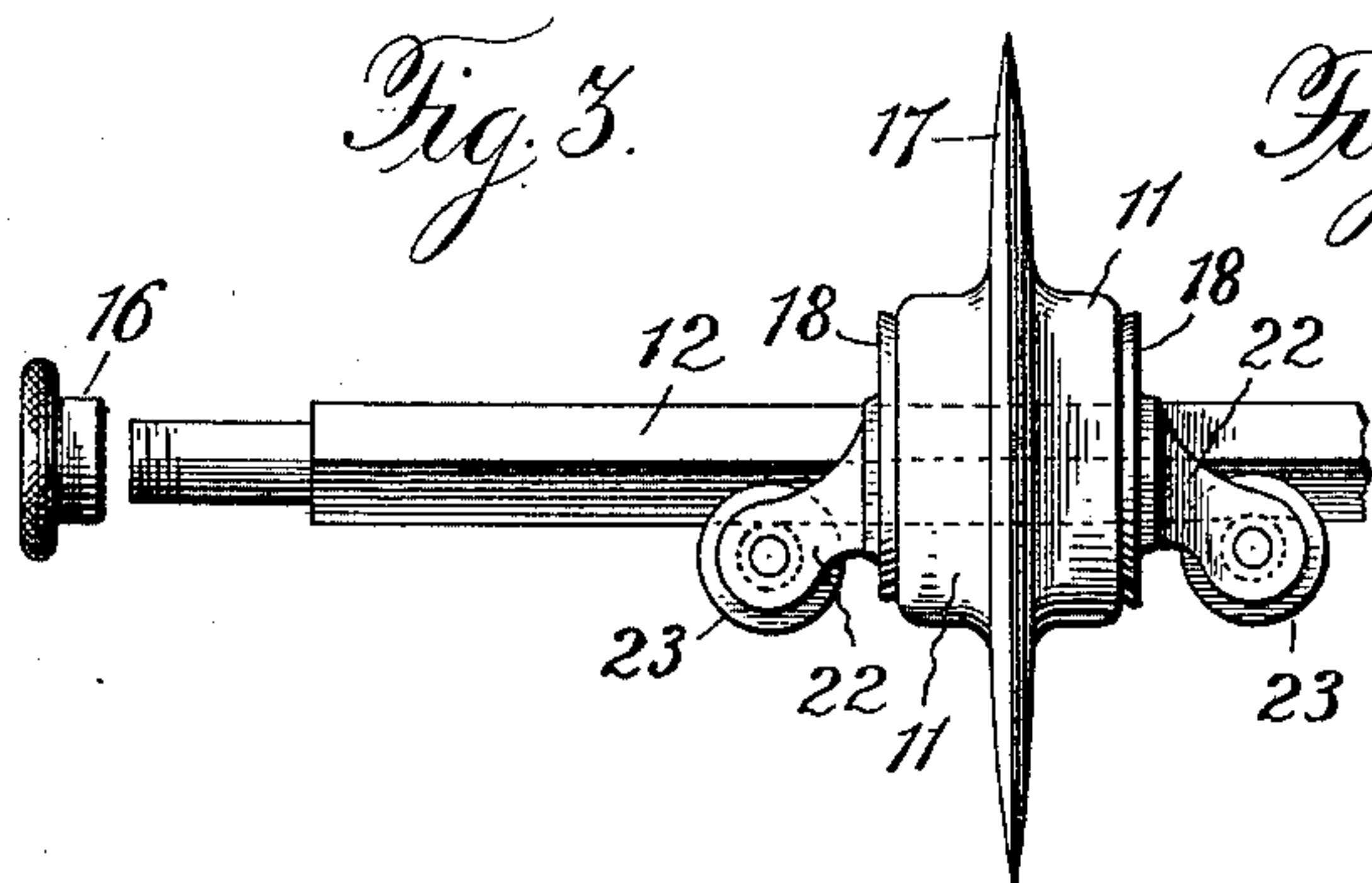
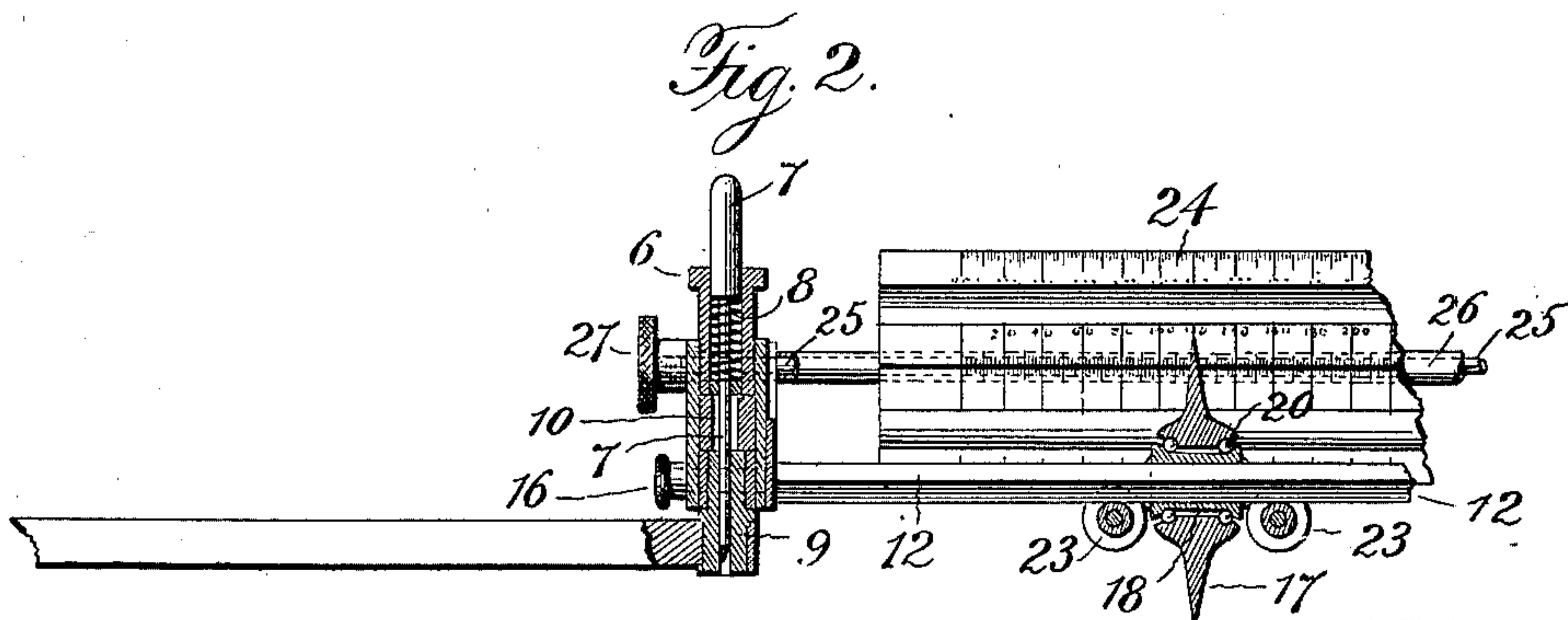
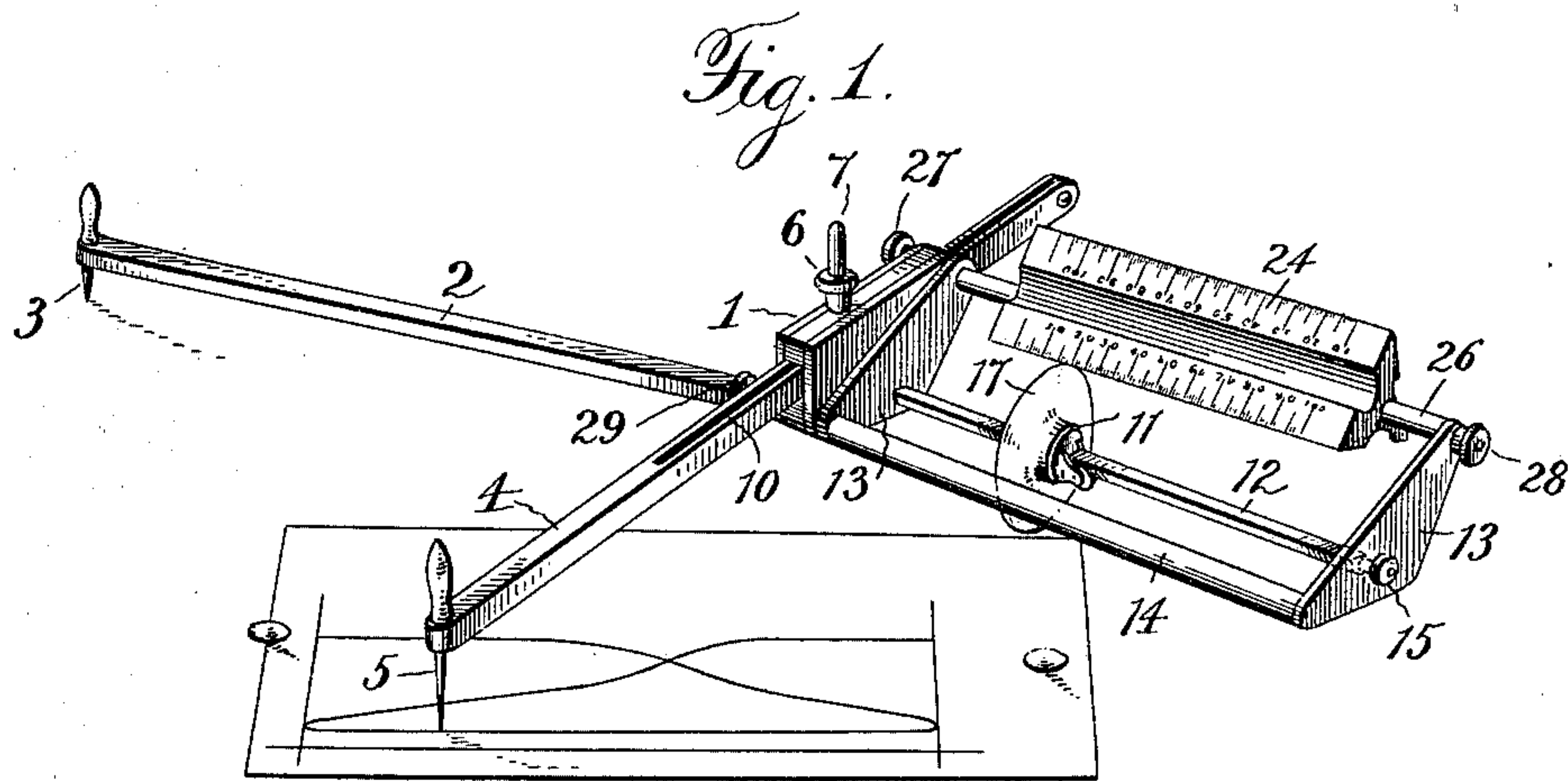
No. 672,581.

Patented Apr. 23, 1901.

E. J. WILLIS.  
PLANIMETER.

(Application filed Mar. 6, 1901.)

(No Model.)



Witnesses  
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# UNITED STATES PATENT OFFICE.

EDWARD JONES WILLIS, OF RICHMOND, VIRGINIA.

## PLANIMETER.

SPECIFICATION forming part of Letters Patent No. 672,581, dated April 23, 1901.

Application filed March 6, 1901. Serial No. 50,105. (No model.)

*To all whom it may concern:*

Be it known that I, EDWARD JONES WILLIS, a citizen of the United States, residing at Richmond, in the county of Henrico and State of Virginia, have invented certain new and useful Improvements in Planimeters; 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 figures of reference marked thereon, which form a part of this specification.

My invention relates to planimeters for ascertaining areas and determining the mean effective pressure and horse-power of steam-indicator diagrams, and more particularly operating upon the principle of the planimeter patented to me November 13, 1894, by Letters Patent No. 529,008, and reissued September 22, 1896, No. 11,568, in which is employed a measuring-wheel, whose axis is perpendicular to the tracer-arm and the wheel capable of movement along this axis, and a scale arranged for measuring such movement, said planimeter being the first of its kind embodying such movement.

The present invention consists in certain features hereinafter particularly described, although embodying and operating upon the same principle as the elements described and claimed in my said Letters Patent, reference being had to the accompanying drawings, forming a part hereof, and in which—

Figure 1 is a perspective of a polar planimeter having my invention applied thereto and showing an indication-card. Fig. 2 is an elevation of the instrument, partly in section, and with parts broken away. Fig. 3 is a front elevation of the measuring-wheel mounted upon a spindle, on an enlarged scale; and Fig. 4 is an end view of Fig. 3.

In the drawings, the numeral 1 indicates what for convenience may be designated as the "frame" of the instrument, to which is pivotally connected the fulcrum-arm 2, provided at its outer end with the pin or point 3, and 4 designates the tracer-arm 5, provided at its outer end with the tracer-point, said arm having a sliding connection with the frame 1 in any suitable manner, but preferably by passing it through an opening made in the frame,

so as to permit the tracer-arm to be adjusted to the point desired. Suitable means will be provided for locking the tracer-arm to its adjusted position, the means which I prefer to employ being a set-screw 6, which will pass into the frame and bear against the tracer-arm, so as to lock the arm to its adjusted position. The set-screw 6 is made hollow, so as to permit the passage of a depressible pin 7 and also to receive a spring 8, which will hold the pin in a normally-raised position, said pin being adapted to be projected below the point at which the fulcrum-arm is pivotally connected to the frame, which pivotal connection may be effected by the hollow pivoting-screw 9, below which the pin will extend when projected, this pin when projected and the pin or tracer-point 5 at the end of the tracer-arm serving as the measuring-points in ascertaining the length of the card. For the purpose of permitting the tracer-arm to be adjusted while the pin 7 is depressed the tracer-arm is formed with a longitudinal slot 10, through which the pin will pass and which will permit the adjusting of the tracer-arm without interference from the pin. Under this construction the set-screw 6 serves not only to lock the tracer-arm, but also serves as a guide for the depressible pin and also as a casing for the spring which normally holds the pin elevated.

The measuring-wheel, which is designated by the numeral 11, has its axis perpendicular to the tracer-arm and is capable of movement along this axis. This wheel is mounted on a spindle 12, which spindle is supported in any suitable manner. As illustrated, one end of this spindle has a bearing in the frame 1 and the other end has its bearing in an arm or bracket 13, said bracket in this instance being one of two brackets 13, which in connection with a connecting-rod 14 constitute an open frame suitably supported from the frame 1. The spindle 12 is illustrated as provided at one end with a thumb-nut 15 and at the other end with a thumb-nut 16, which nuts screw on the threaded end of the spindle, so as to secure the same against longitudinal movement. I am not, however, limited to any particular means or manner of supporting the spindle, and the open frame is not essential as a support for the spindle.



Under my present invention the measuring-wheel 11 comprises a blade or disk 17 and a collar or sleeve 18, which passes through the hub of the disk or blade, ball-bearings 20 being interposed between the sleeve and the hub of the disk or blade, the latter being free to rotate upon the sleeve, and the balls serving to reduce the friction to a minimum. The collar or sleeve 18 slides upon the spindle 12 and is free to move lengthwise thereof, and for the purpose of reducing the friction between the sleeve and the spindle the opposite ends of the sleeve are each provided with brackets 22, in which are journaled the antifriction rollers or wheels 23, which contact with the spindle 12, so as to reduce the friction in the sliding movement of the sleeve and its disk along the spindle. The sleeve is preferably prevented from revolving upon the spindle by any suitable means which will permit it to slide thereon without turning. For this purpose I prefer to make the spindle 12 polygonal in cross-section, the interior of the sleeve 18 being correspondingly shaped.

Under the construction described the measuring-wheel is capable of moving along its axis perpendicularly to the tracer-arm by the sliding of the sleeve lengthwise of the spindle 12, and at the same time the disk or blade portion of the wheel is capable of a rotary movement.

In connection with the measuring-wheel there will be employed a scale upon which will be indicated the movement of the measuring-wheel along its axis perpendicularly to the tracer-arm, so that after tracing a figure the result may be read from the scale. I am not confined to any particular location of this scale nor to any particular arrangement or construction of parts by which the movement of the measuring-wheel along its axis perpendicularly to the tracer-arm is indicated upon the scale and from which the reading is made; but as one form and arrangement of scale for the purpose I have illustrated the triangular-shaped scale 24, such as is illustrated in Letters Patent No. 542,511, granted to me July 9, 1895; but I do not limit myself to such form and location of scale, as it is only necessary that some suitable scale be employed upon which will be indicated the movement of the measuring wheel or blade along its axis, which is perpendicular to the tracer-arm. When, however, the form of scale illustrated is used, it may be supported in the open frame by clamping it to the brackets 13 of such frame by any suitable means—for instance, by a spindle 25, passed through a hollow spindle or sleeve 26, to which the scale is secured, a thumb-nut 27 being applied to a threaded end of the spindle 25, the oppo-

site end of the spindle being provided with a thumb-piece 28, which bears against the bracket 13, while the thumb-nut 27 bears against the side of the frame 1 through which the spindle 25 passes. The thumb-nut 27 on the spindle 25 and the thumb-nut 29 on the threaded end of the portion of the rod 14 which passes through the frame 1 serve as means for securing the open frame to the frame 1. I am not, however, confined to the particular means shown for securing the open frame and supporting it from the frame 1, nor am I confined to the use of the open frame as a support for the scale, the form and location of the scale and the open frame supporting it being given merely as an illustration of what may be employed.

The invention sought to be covered in this application lies in the measuring-wheel, whatever other novel features appearing being subject-matter for another application.

Having described my invention and set forth its merits, what I claim is—

1. A planimeter comprising a tracer-arm, a measuring-wheel whose axis is perpendicular to said tracer-arm, said wheel consisting of a slidable sleeve and a blade or disk rotatable upon the sleeve, a spindle for the sleeve to slide upon, and a scale by which the movement of the wheel is measured.

2. A planimeter comprising a tracer-arm, a measuring-wheel whose axis is perpendicular to said tracer-arm, said measuring-wheel consisting of a slidable non-rotatable sleeve and a blade or disk upon the sleeve, a spindle for the sleeve to slide upon, and a scale by which the movement of the wheel may be measured.

3. A planimeter comprising a tracer-arm, a measuring-wheel whose axis is perpendicular to said tracer-arm, said measuring-wheel consisting of a slidable sleeve, a blade or disk rotatable upon the sleeve, and ball-bearings between the sleeve and the blade or disk, a spindle for the sleeve to slide upon, and a scale by which the movement of the wheel may be measured.

4. A planimeter comprising a tracer-arm, a measuring-wheel whose axis is perpendicular to said tracer-arm, said wheel consisting of a slidable sleeve and a blade or disk upon the sleeve, a spindle for the sleeve to slide upon, antifrictional bearings for the sleeve against the spindle, and a scale by which the movement of the wheel may be measured.

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

EDWARD JONES WILLIS.

Witnesses:

W. R. MAKKER,  
ALEX F. RYLAND.