No. 786,387. PATENTED APR. 4, 1905.

H. M. SMITH.

BEARING.

APPLICATION FILED MAY 2, 1904.

4 SHEETS—SHEET 1.

Fig: 1

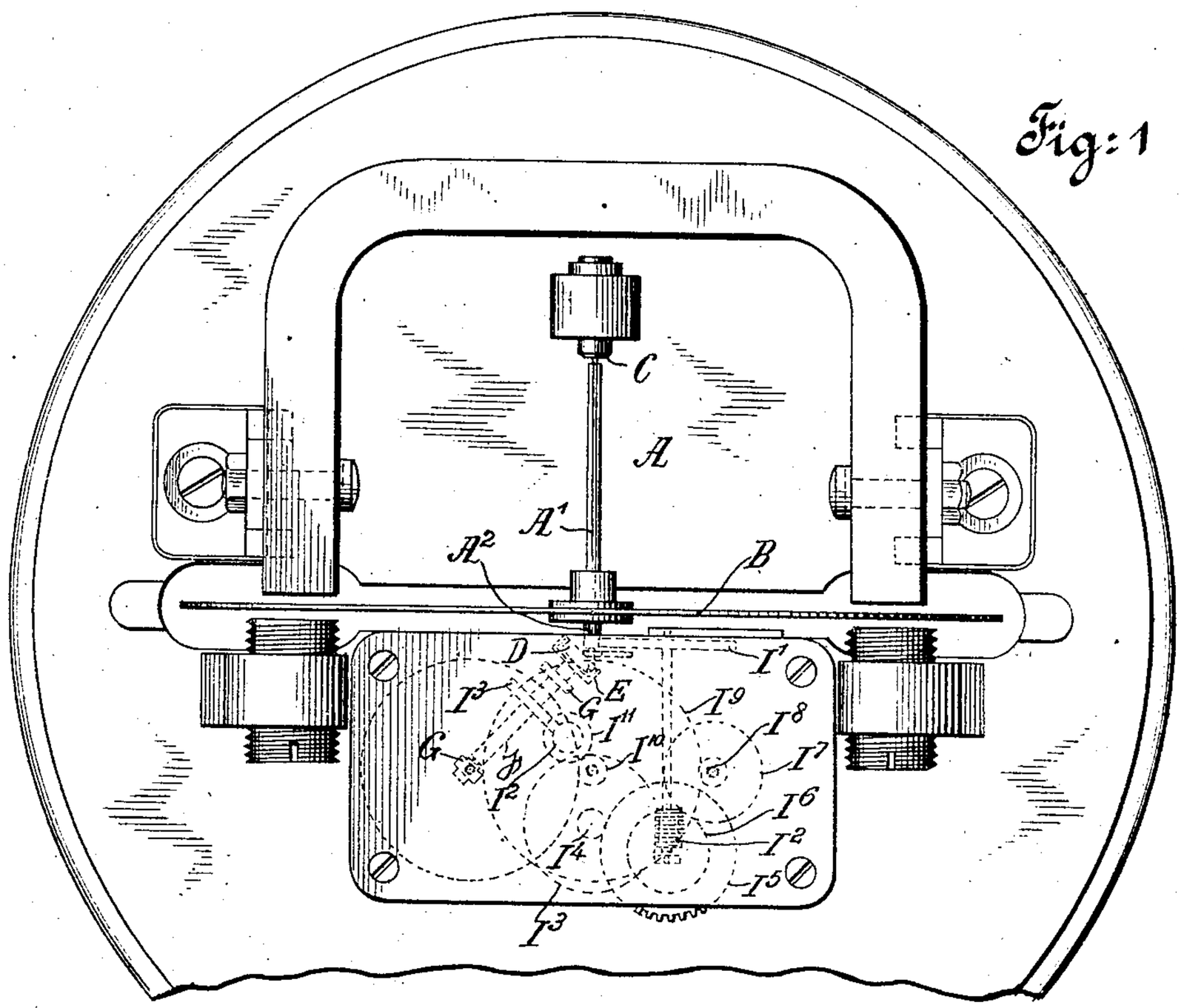
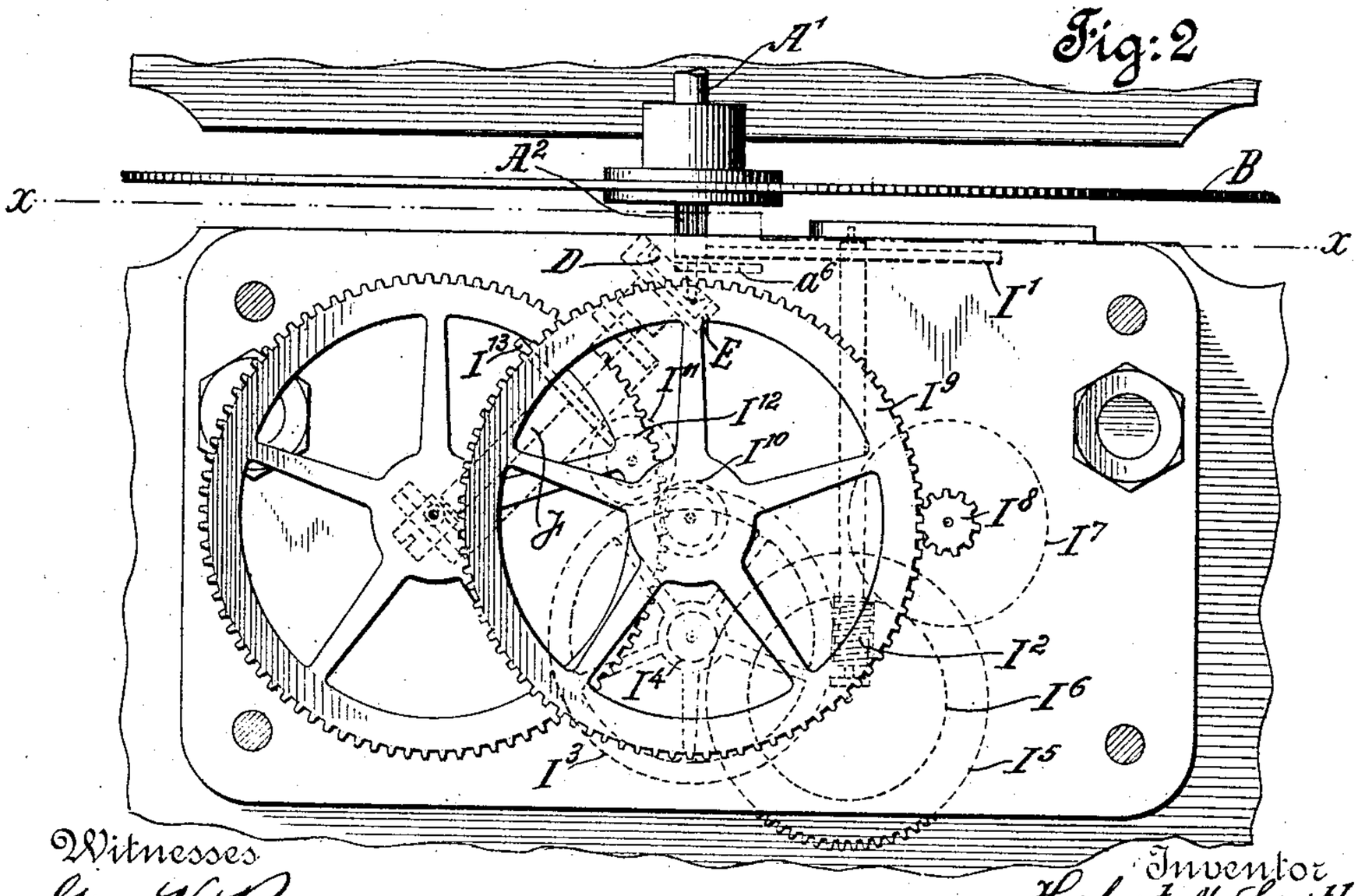



Fig: 2




Witnesses
Geo. V. Rosenbaum
R. P. Stillson

Inventor
Herbert M. Smith
By his Attorneys
Bartlett Brownell & Mitchell

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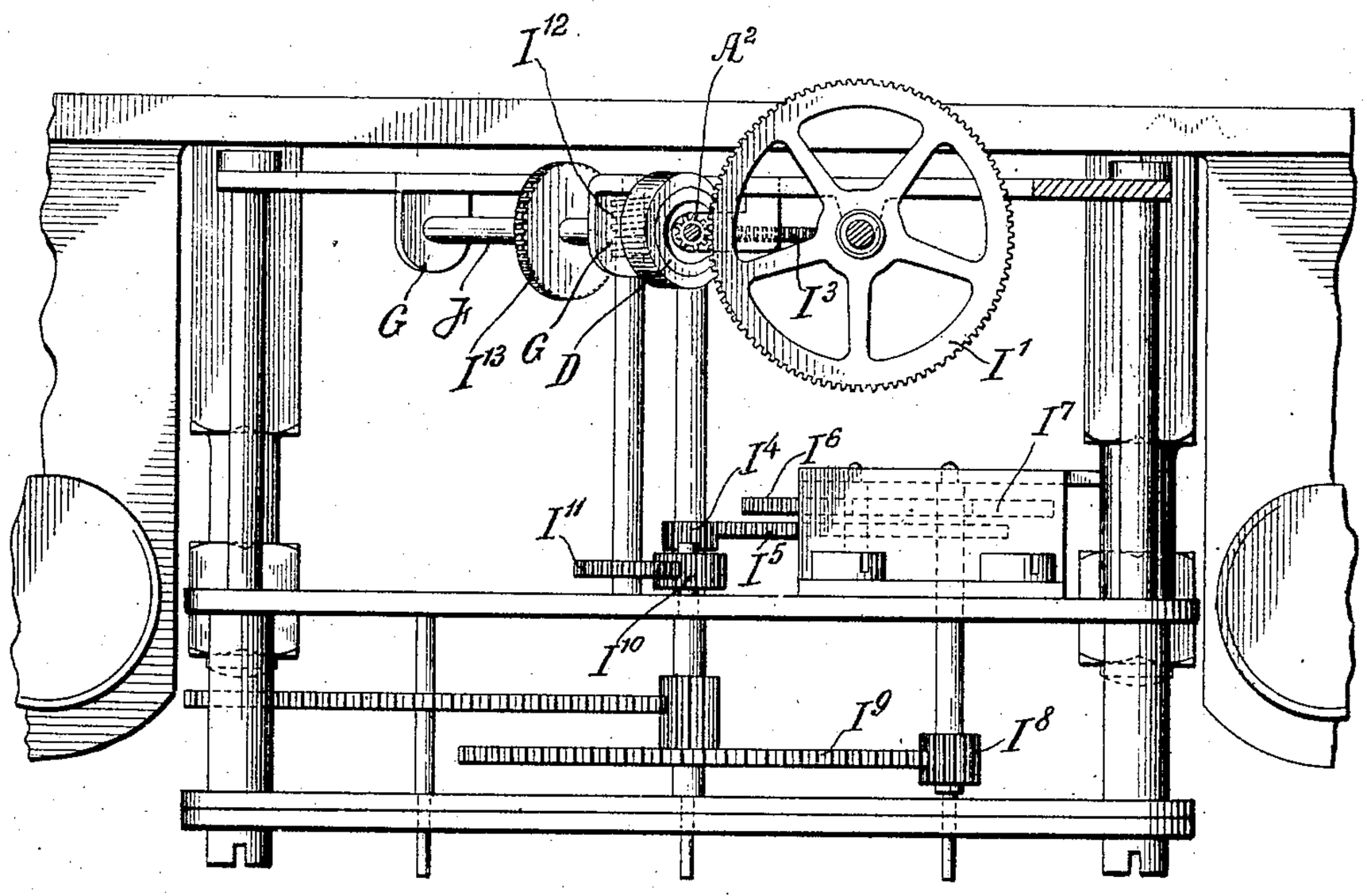
4 SHEETS—SHEET 2.

Fig: 3




Witnesses
Geo. V. Rasmussen
R. B. Stillson

Inventor
Herbert M. Smith
By his Attorneys
Bartlett Brownell & Mitchell

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4 SHEETS—SHEET 3.

Fig: 4

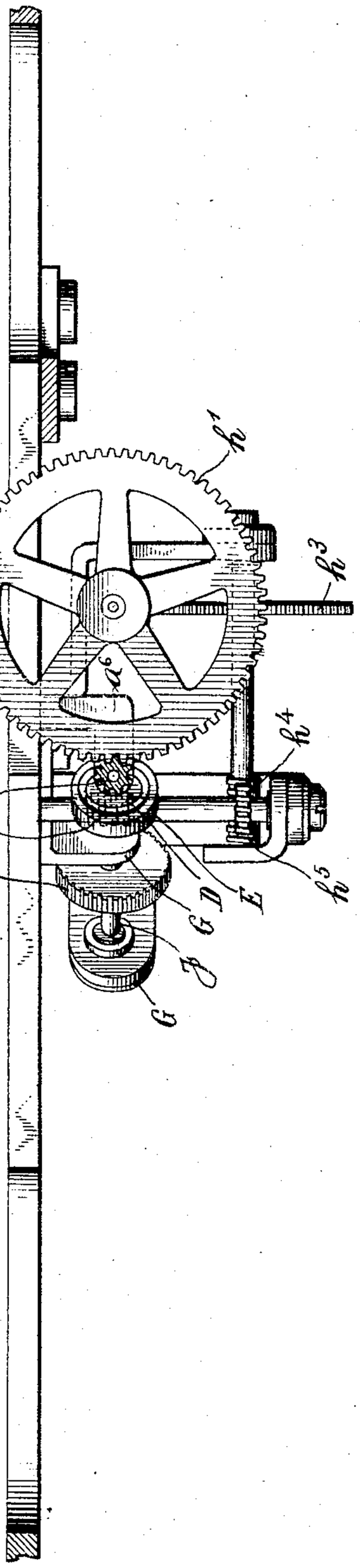
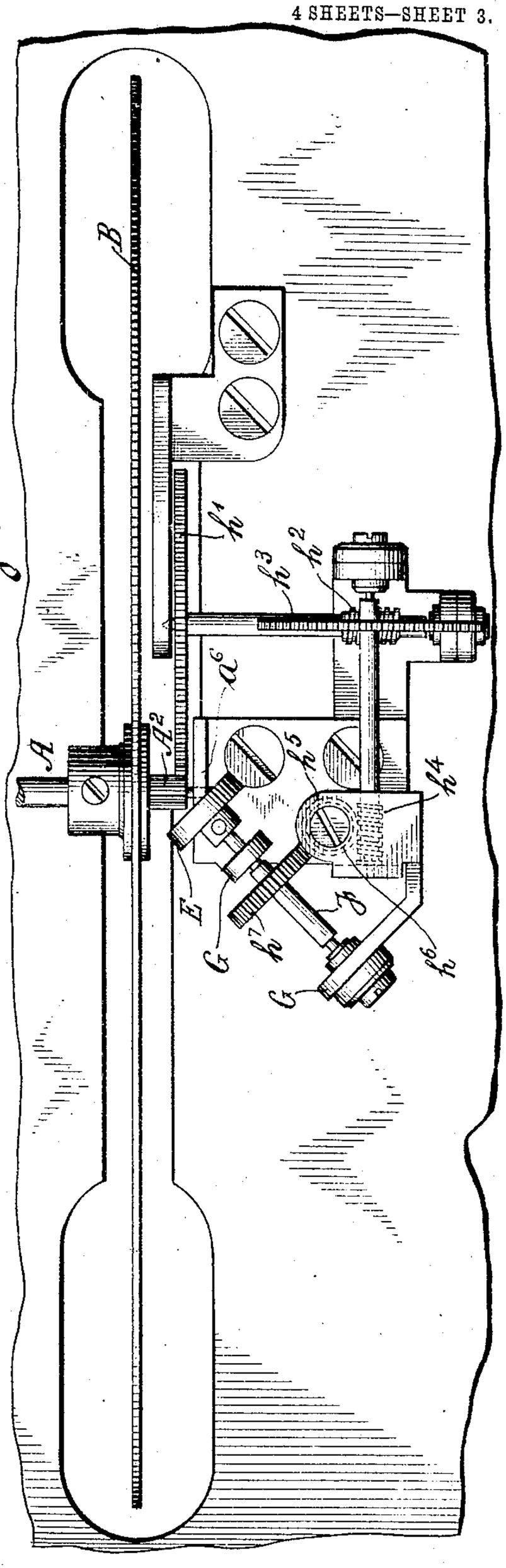



Fig: 5




Witnesses
Geo. V. Rasmussen
R. B. Allyn

Inventor
Herbert M. Smith
By his Attorneys
Bartlett Brownell & Mitchell

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H. M. SMITH.

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4 SHEETS—SHEET 4.

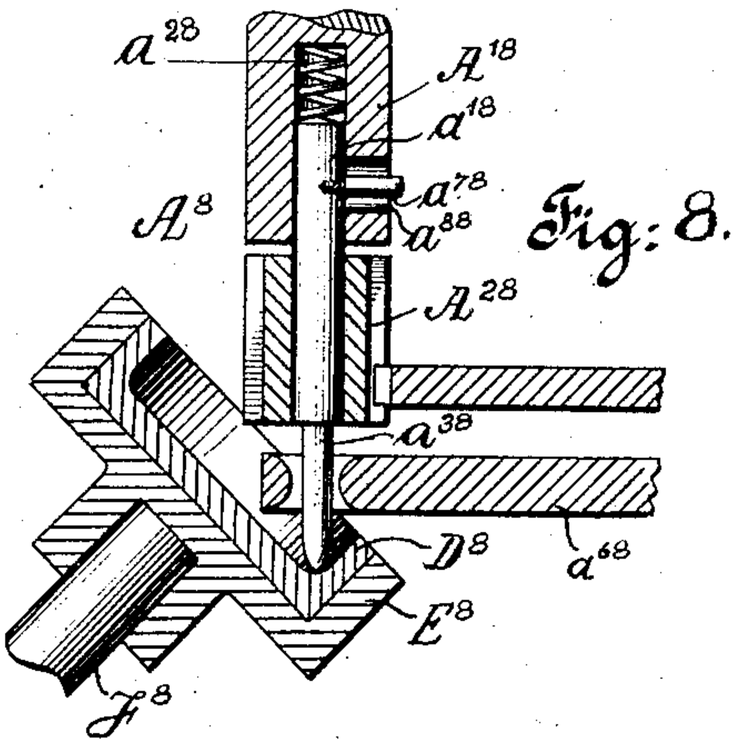


Fig: 8.

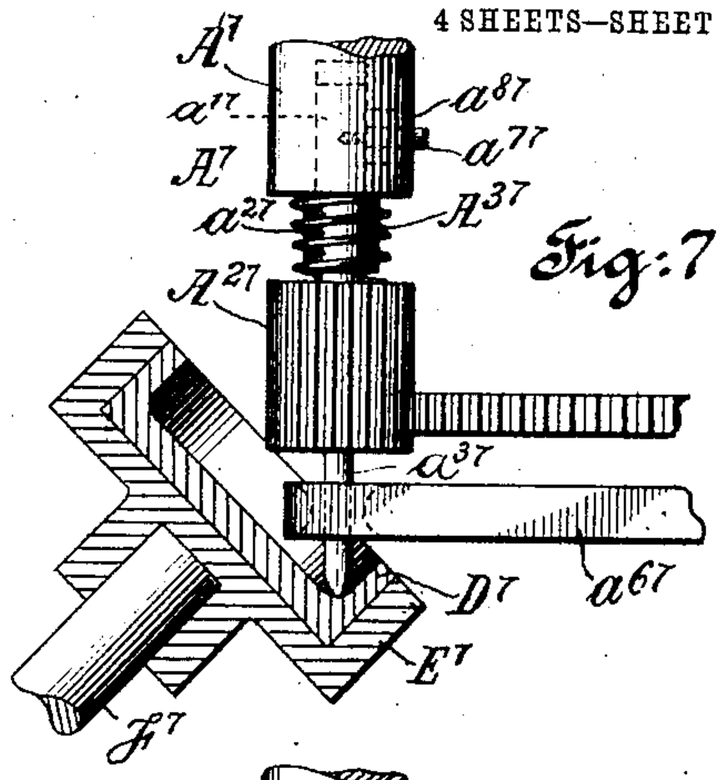


Fig: 7.

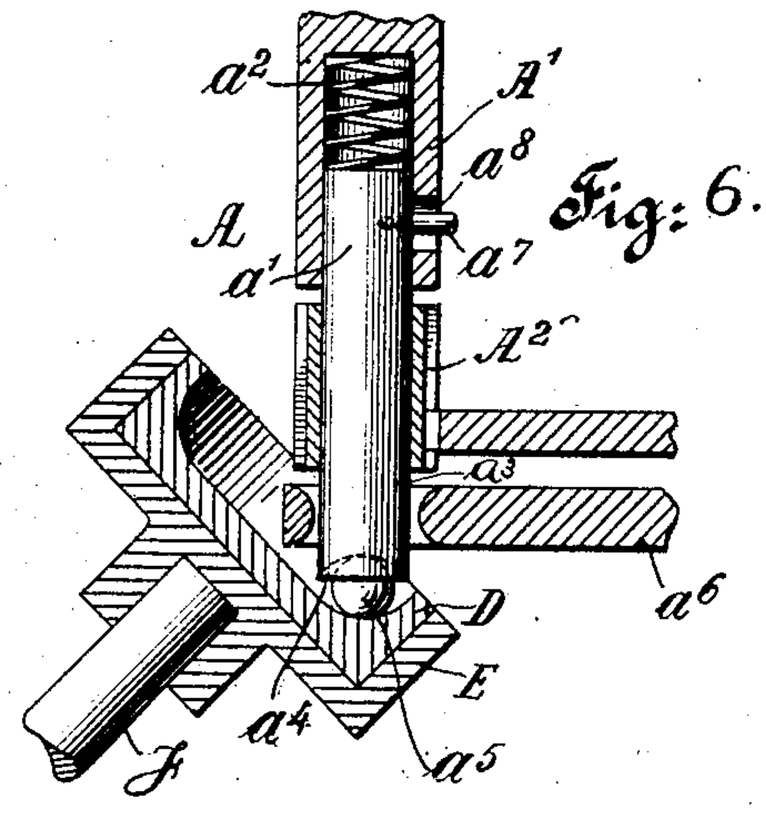


Fig: 6.

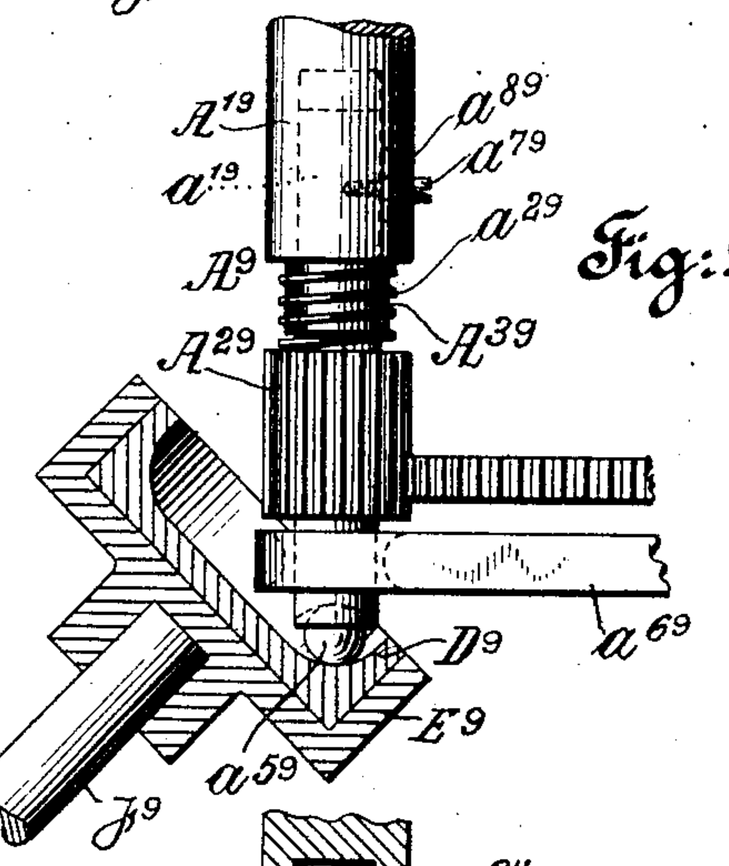


Fig: 9.

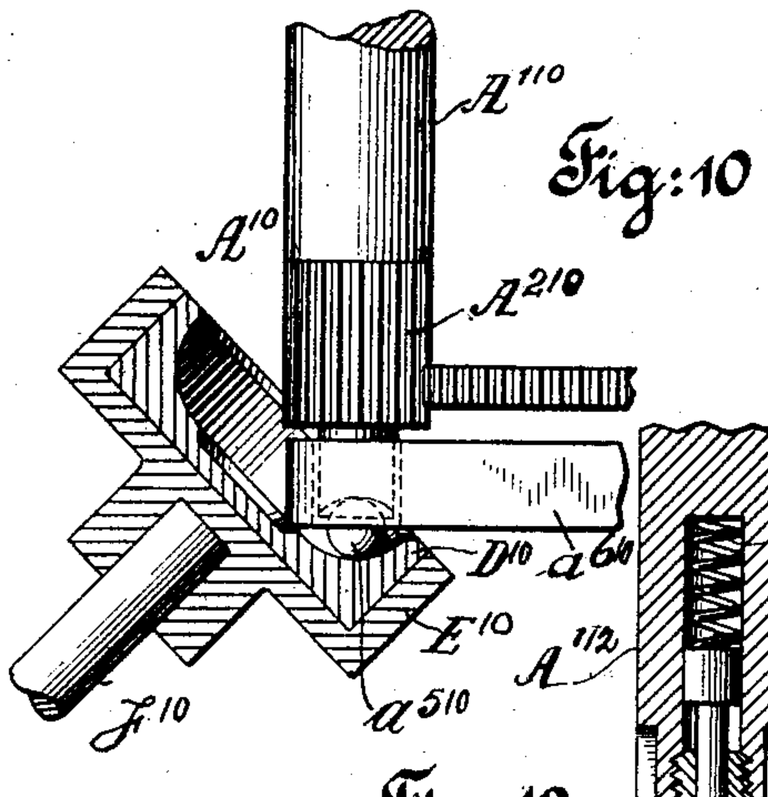


Fig: 10

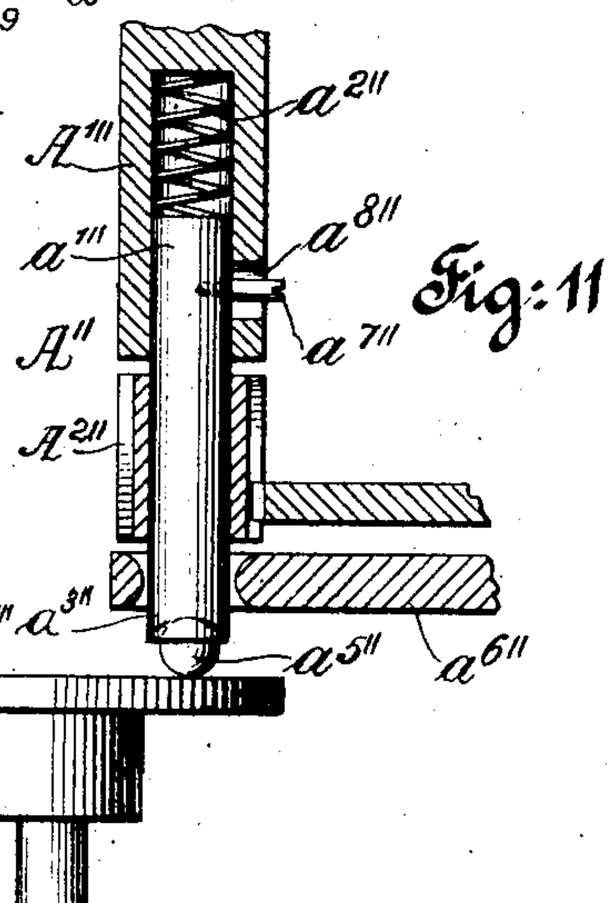


Fig: 11.

Fig: 12.

Witnesses
Geo. V. Rasmussen
Robt. S. Allyn

Inventor
Herbert M. Smith
By his Attorneys
Barrett Brownell & Mitchell

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No. 786,387. Patented April 4, 1905.

# UNITED STATES PATENT OFFICE.

HERBERT M. SMITH, OF GREAT BARRINGTON, MASSACHUSETTS, ASSIGNOR TO STANLEY INSTRUMENT COMPANY, OF GREAT BARRINGTON, MASSACHUSETTS, A CORPORATION OF MASSACHUSETTS.

## BEARING.

SPECIFICATION forming part of Letters Patent No. 786,387, dated April 4, 1905.

Application filed May 2, 1904. Serial No. 205,927.

*To all whom it may concern:*

Be it known that I, HERBERT M. SMITH, a citizen of the United States, residing at Great Barrington, county of Berkshire, and State of Massachusetts, have invented certain new and useful Improvements in Bearings, of which the following is a full, clear, and exact description.

My invention relates to improvements in bearings for electric meters and other delicate apparatus, and is particularly useful in connection with instruments where a vibration of the revolving shaft is liable to roughen or injure the wearing-surface of a supporting-jewel.

It has for its object to produce a bearing in which the wearing-surface may be renewed from time to time without the removal and insertion of a new part.

My invention further has for its object the production of such a bearing so constructed as to be shifted by the revolving shaft supported thereby in such a way that its wearing-surface is automatically renewed.

It further has for its object the production of a shifting bearing in which the supported shaft shall be automatically centered whatever the position of the bearing may be and also the attaining of other advantages of construction hereinafter pointed out, and specifically referred to in the claims.

In jewel-bearings as heretofore constructed it has been necessary whenever a jewel has become worn or roughened to remove the jewel entirely from the meter and replace it by a new jewel, this necessitating not only the cost of a new jewel, but also the cost of a man's time, and, furthermore, permitting of the introduction of error in registration during the time between the roughening of the jewel and its replacement. I have, however, invented a bearing in which the jewel has an extended wearing-surface and is capable of being shifted either continuously or from time to time, so as to present new wearing-surfaces to the shaft supported thereby, with the result that the wearing-surface can be kept in good condition, either automatically or otherwise, with the least possible attention and expense. It is obvious that this wearing-surface can be of various shapes and can be shifted in various ways. Thus, for instance, a plane surface might be used or a convex surface might be used and the same shifted so as to have the shaft contact with every portion thereof before the entire surface was roughened, or the surface could be mounted so as to revolve upon an axis eccentric to the axis of the revolving shaft, in which case the points of contact would lie within a circle. Instead of being shifted so as to bring the points of contact within a circle it might be shifted so as to bring the points of contact within a spiral, thus making use of a greater part of the surface. In view of the capacity of easy or automatic renewal the jewel need not be made of precious stone, as has heretofore been the practice, but may be made of glass or other suitable material, polished, so as to present a suitable wearing-surface.

I have found that bearings embodying my invention are particularly valuable in connection with alternating-current meters of the disk type, in which the vibration of the disk is particularly liable to roughen the wearing-surface, so as to introduce error in the meter-readings, and I have therefore shown and described it in that connection, although it is by no means limited to such use.

The following is a description of my invention, reference being had to the accompanying drawings, in which—

Figure 1 is a front elevation showing my invention in connection with an alternating-current meter of the disk type. Fig. 2 is an enlarged detail showing a train of gearing employed in connection with my invention. Fig. 3 is a plan view, partly in section, on line *x x*, Fig. 2. Fig. 4 is a plan view of a modification. Fig. 5 is a front elevation of that modification. Fig. 6 is a detail of the preferred form of the end of the rotating shaft and the bearing-surface of Fig. 1. Figs. 7, 8, 9, 10, 11, 12 are modifications of what is shown in Fig. 6.

Referring more particularly to the draw-

ings, A represents the revolving shaft of an alternating-current meter carrying the closed-circuited disk B, upon which the energizing-coils act in the usual manner. This shaft A is mounted in an upper bearing C and a lower cup-shaped bearing or support D, the latter being made of glass or other suitable material carried by a receptacle E and mounted on the shaft F, which is carried by trunnions G G, so as to revolve on an axis inclined to the axis of the shaft A. The shaft A in the preferred form, as shown in Fig. 6, is made up of a shank portion A′ and a pinion $A^2$, carrying at one end a plug $a'$, entering the shank A′ and engaging with the end of a compression-spring $a^2$. The pinion $A^2$ carries at its other end a projection $a^3$, having a cup-shaped depression $a^4$, in which is a ball $a^5$, constituting the bearing-surface of the shaft A upon the jewel D. The projection $a^3$ is surrounded by a guide $a^6$ to hold the same against movement due to any unusual conditions. The plug $a^2$ is kept from revolving within the part A′ by a pin $a^7$ working in the slot $a^8$. The spring $a^2$ acts to relieve the jewel D somewhat from the pounding due to any vibaation of the shaft. While the revolving bearing D can be shifted by hand from time to time, I prefer to cause it to be shifted automatically by the revolution of the shaft which it supports. This can be done either in connection with the integrating-train when the device is used in connection with meters or by means specially provided for that purpose. In Figs. 1 to 3 a device is shown in which the wearing-surface is shifted through the integrating-train of the meter. This is brought about by placing the pinion $A^2$ upon the lower end of the shaft A and transmitting its movement to the registering-train and causing the registering-train to revolve the shaft carrying the cup-shaped jewel D. In the drawings the pinion $A^2$ drives the gear I′, from which the motion is transmitted to the worm $I^2$, from worm $I^2$ to wheel $I^3$, from wheel $I^3$ to pinion $I^4$, from pinion $I^4$ to gear $I^5$, from gear $I^5$ to ratio-wheel $I^6$, from ratio-wheel $I^6$ to ratio-wheel $I^7$, from ratio-wheel $I^7$ to pinion $I^8$, from pinion $I^8$ to train-wheel $I^9$, from train-wheel $I^9$ to gear $I^{10}$, from gear $I^{10}$ to gear $I^{11}$, from gear $I^{11}$ to worm $I^{12}$, from worm $I^{12}$ to wheel $I^{13}$, from wheel $I^{13}$ to the shaft F and jewel connected therewith.

In the operation of the device it will be seen that the jewel D having its axis of rotation inclined at an angle to the axis of rotation of the shaft A will as it is revolved by the shaft A present to the end of that shaft new wearing-surfaces, such new wearing-surfaces being arranged in a circle or curve which is inclined to the axis of the shaft A. It will further be seen that the curve constituting the bottom of the cup, together with the curve constituting its periphery, will result in the location of the lowest point in the cup at the point where the lower end of the shaft should be located, thus tending to center the shaft at that point, whatever the position of the cup may be, in such a way that the shaft will be automatically centered at the proper point, the tendency being to move to the point at which it will be normal to the surface it engages.

In the form shown in Figs. 4 and 5 the means for gearing the shaft of the revolving jewel to the shaft supported thereby are somewhat simpler, being independent of any registering-train. They consist of the pinion $A^2$, gear $h'$, worm $h^2$, gear $h^3$, worm $h^4$, pinion $h^5$, worm $h^6$, and gear $h^7$, which is mounted upon the shaft of the wheel. By this means it is easily possible to make the jewel revolve a single time for a million or more revolutions of the supported shaft, which in a meter would mean that a new wearing-surface would be continuously presented to the revolving shaft during a complete revolution of the jewel, which in all probability would never occur more than once in a year or longer.

Referring to the modifications shown in Figs. 7, 8, 9, 10, 11, 12, Fig. 7 shows a compound shaft $A^7$, consisting of the shank portion $A^{17}$ and the pinion $A^{27}$, with its plug $a^{17}$ and projection $a^{37}$, the plug $a^{17}$ entering the bore of the main portion $A^{17}$ and a yielding connection being established between parts $A^{17}$ and the part $A^{27}$ by the spring $a^{27}$, surrounding the reduced portion $A^{37}$, depending from the part $A^{17}$. The parts $a^{67}$, $a^{77}$, $a^{87}$, $D^7$, $E^7$, and $F^7$ perform functions similar to parts $a^6$ $a^7$ $a^8$ D E F in the construction shown in Fig. 6. In Fig. 8 the compound shaft $A^8$ embodies parts $A^{18}$ $A^{28}$ $D^8$ $E^8$ $F^8$ and $a^{18}$ $a^{28}$ $a^{38}$ $a^{68}$ $a^{78}$ $a^{88}$, which correspond to parts $A^{17}$ $A^{27}$ $D^7$ $E^7$ $F^7$ $a^{17}$ $a^{27}$ $a^{37}$ $a^{67}$ $a^{77}$ $a^{87}$ in Fig. 7, with the difference that the part $A^{18}$ does not have a depending projection and the spring $A^{28}$ is located within the bore of the main portion $A^{18}$ and engages with the upper end of the plug $a^{18}$. In the structure shown in Fig. 9 the parts making up the compound shaft $A^9$ are represented by reference-letters $A^{19}$ $A^{29}$ $A^{39}$ $D^9$ $E^9$ $F^9$ $a^{19}$ $a^{29}$ $a^{39}$ $a^{69}$ $a^{79}$ $a^{89}$, which correspond in structure and function to the parts $A^{17}$ $A^{27}$ $A^{37}$ $D^7$ $E^7$ $F^7$ $a^{17}$ $a^{27}$ $a^{37}$ $a^{67}$ $a^{77}$ $a^{87}$ of Fig. 7, respectively. In this construction, however, a ball $a^{59}$ is inserted between the part $a^{39}$ and the jewel $D^9$ similar to the ball $A^5$ in the construction shown in Fig. 6. In Fig. 10 the main shaft $A^{10}$ is made up of two parts $A^{110}$ and $A^{210}$. The part $A^{210}$ has a projection between which and the jewel $D^{10}$ is a ball $a^{510}$. The jewel $D^{10}$ is contained in the case $E^{10}$, which is supported by the shaft $F^{10}$. A guide $a^{610}$ is provided of sufficient breadth to encircle the ball, as well as the part of the projection on the lower part of the pinion $A^{210}$. In the construction shown in Fig. 11 the compound shaft $A^{11}$ is made of the main portion $A^{111}$ and the pinion $A^{211}$ with its projections therefrom. The projection $a^{111}$ from the pinion enters the bore of the main portion and

engages with a spring $a^{211}$ contained therein. The pinion and plug are kept from turning by a pin $a^{711}$ in a slot $a^{811}$. The pinion $A^{211}$ is provided with a downward projection $A^{311}$, which is supported by a ball $a^{511}$, which in turn is supported by the bearing-surface $D^{111}$. A guide $a^{611}$ surrounds the downward projection $A^{311}$, so as to maintain the shaft in position. In the construction shown in Fig. 12 there is the main portion $A^{112}$, having a bore in which is guided the enlarged head of a bearing portion $b^{12}$, which head is engaged by the spring $a^{212}$. The main portion has formed directly on it gear-teeth $A^{212}$ and has its bore closed by a screw-plug $b^{112}$. A guide $a^{612}$ surrounds the lower part of the wearing portion $b^{12}$, which rests upon the supporting-surface $D^{112}$.

My invention admits of many other modifications and is not necessarily limited to surfaces such as here shown or to surfaces which revolve about an axis, but may be embodied in many forms, such as would naturally suggest themselves to a skilled mechanic.

I do not claim, broadly, in this application the invention embodied in the thrust-bearing herein shown and described irrespective of the location of the pinion and the nature of the support, the same being made the subject-matter of claims in a pending application, Serial No. 223,392, filed February 6, 1904.

What I claim is—

1. In a thrust-bearing, the combination of a support and a revolving shaft consisting of a main portion, a second portion having both a pinion and a wearing-surface one of said portions having a projection entering a recess in the other and a spring interposed between said portions, said wearing-surface engaging said support and a gear meshing with said pinion.

2. In a thrust-bearing, the combination of a support and a revolving shaft consisting of a main portion, a second portion having a wearing-surface one of said portions having a projection entering a recess in the other and a spring interposed between said portions, said wearing-surface engaging said support, said second portion carrying a pinion and gearing engaged by said pinion.

3. In a thrust-bearing the combination of a vertical revolving shaft, a bearing for the end thereof having a curved surface and means for moving the bearing so as to present new wearing-surfaces to said end.

4. In a thrust-bearing the combination of a vertical revolving shaft, a support for the end thereof having a concave surface and means for revolving the support on an axis different from that of the shaft.

5. In a thrust-bearing the combination of a vertical revolving shaft, a support for the end thereof having an endless concave surface and means for revolving the support on an axis different from that of the shaft.

6. In a thrust-bearing the combination of a vertical revolving shaft, a support for the end thereof having a concave surface and means for presenting different parts thereof to said shaft, said parts lying in a curved line.

7. The combination of a revolving shaft, a support therefor having a curved surface and means for presenting different parts thereof to said shaft, said parts lying in a curved line located in a plane inclined to the axis of said shaft.

8. The combination of a vertical revolving shaft, a cup-shaped support therefor and means for moving the same so as to present new surfaces to said shaft.

9. The combination of a vertical revolving shaft, a cup-shaped support therefor and means for rotating the same about an axis differing from the axis of said shaft.

10. The combination of a revolving shaft, a support therefor having a cup-shaped wearing-surface and means for rotating the same about an axis inclined to the axis of said shaft.

11. The combination of a vertical revolving shaft, a support therefor having an extended surface and means for moving said support so as to present new wearing-surfaces to said shaft, said means being actuated by said shaft.

12. The combination of a revolving shaft, a support therefor having an endless curved surface and means for moving said support so as to present different parts of said surface to said shaft, said means being actuated by said shaft.

13. The combination of a revolving shaft and a ball movable relatively thereto, the same constituting a shaft and a support therefor having an extended surface engaging with said ball and means for moving said support so as to present new wearing-surfaces on said support to said ball.

14. The combination of a rotating shaft, a support for said shaft having an extended surface, means for moving said support so as to present new wearing-surfaces to said shaft and a spring interposed between the main part of said shaft and the portion engaging with said wearing-surface.

15. A revolving-jewel meter-bearing consisting of a shaft, a support for said shaft having an extended surface revoluble about an axis other than that of said shaft, a train driven by said shaft and means driven by said train for moving said surface so as to present new parts thereof to the end of said shaft.

16. A revolving-jewel meter-bearing consisting of the combination of a jewel adapted to revolve about an axis, a vertical shaft supported thereby and revolving on an axis out of alinement with said jewel-axis.

17. A revolving-jewel meter-bearing consisting of the combination of a jewel adapted to revolve about an axis, a vertical shaft supported thereby and revolving on an axis out of alinement with said jewel-axis, and means for continuously revolving said jewel.

18. A revolving-jewel meter-bearing consisting of a jewel adapted to revolve about an axis, a vertical shaft supported by end contact with said jewel at a point eccentric to said axis, and means for revolving said jewel.

19. A revolving-jewel meter-bearing consisting of a jewel adapted to revolve on an axis, a shaft supported by end contact with said jewel at a point eccentric to said jewel-axis and adapted to revolve about anaxis inclined to said jewel-axis.

20. A revolving-jewel meter-bearing consisting of a jewel having a curved surface and adapted to revolve about an axis, a vertical shaft supported by end contact with said jewel at a point eccentric with said axis, and means for revolving said jewel.

21. A revolving-jewel meter-bearing having a cup-shaped surface and consisting of a jewel adapted to revolve on an axis, a shaft supported by end contact with said jewel at a point eccentric to said jewel-axis and adapted to revolve about an axis inclined to said jewel-axis.

Signed at Great Barrington, Berkshire county, and State of Massachusetts, this 15th day of April, 1904.

HERBERT M. SMITH.

Witnesses:

PARLEY RUSSELL,

E. T. GREEN.