H. M. VAN ALSTYNE & W. BELL.

ROTARY ENGINE.

APPLICATION FILED APR. 12, 1909.

955,925.

Patented Apr. 26, 1910.

5 SHEETS—SHEET 1.

FIG. 1.

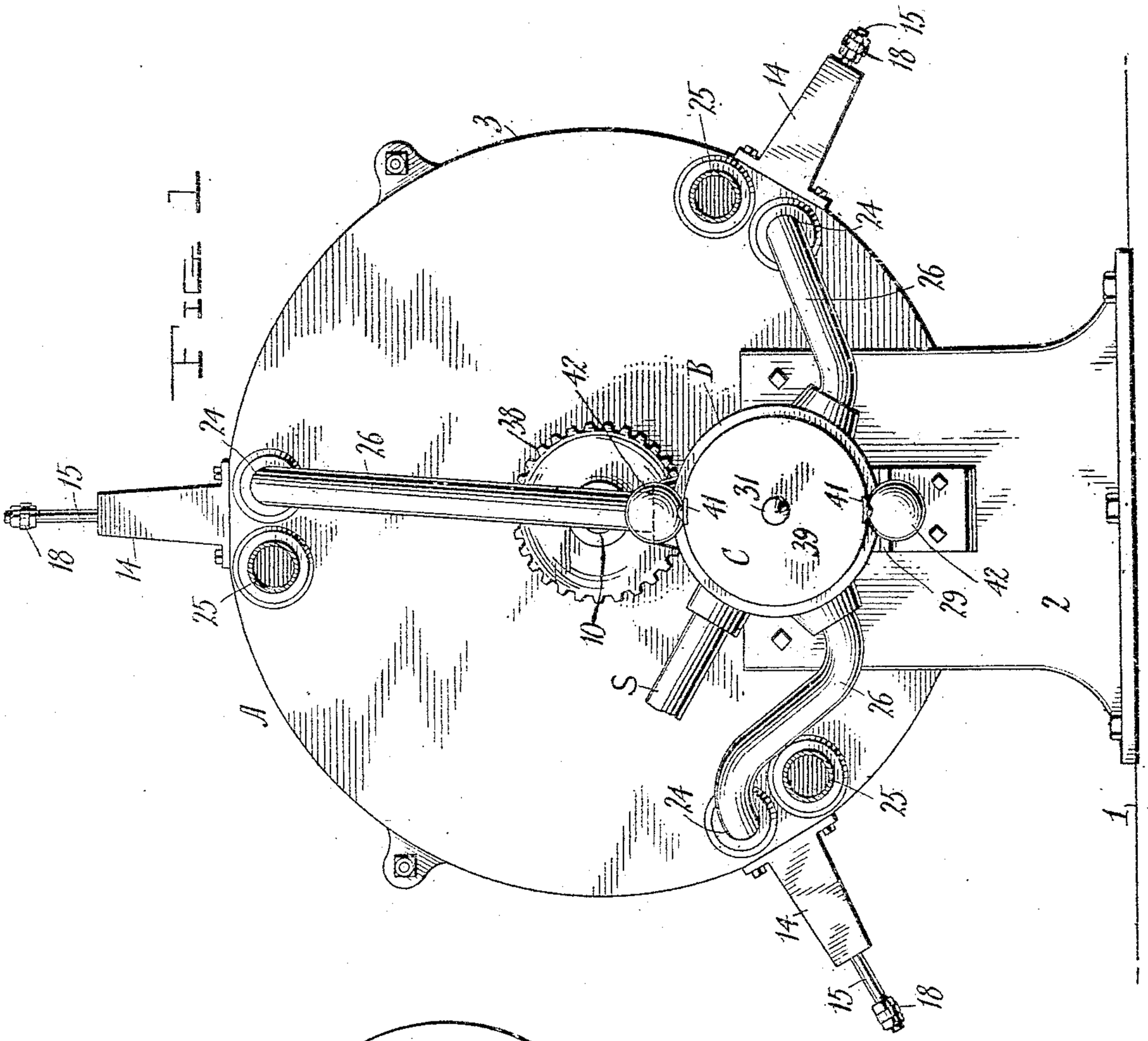
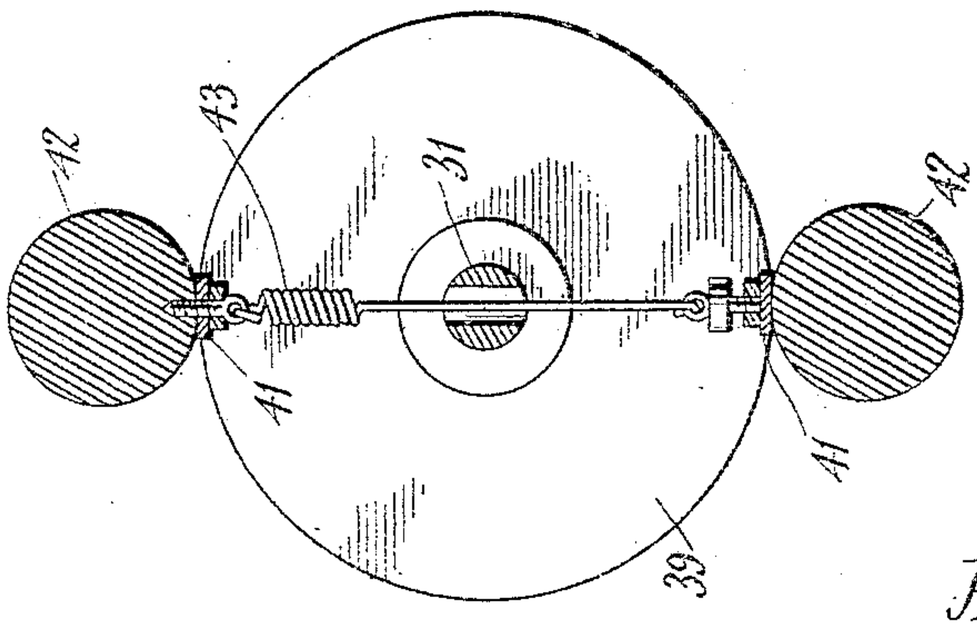


FIG. 7.



Witnesses

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5 SHEETS—SHEET 2.

Fig. 2

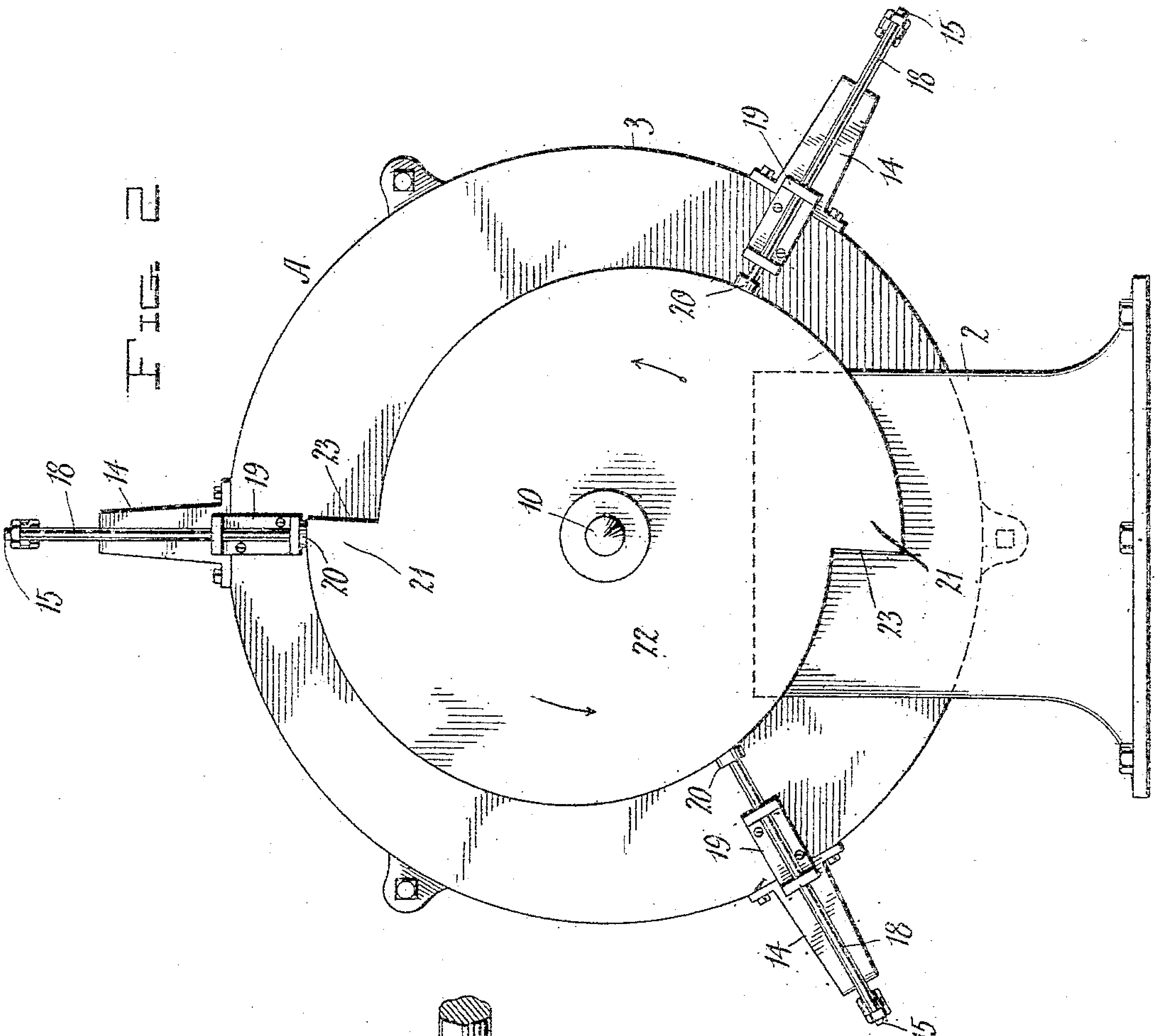
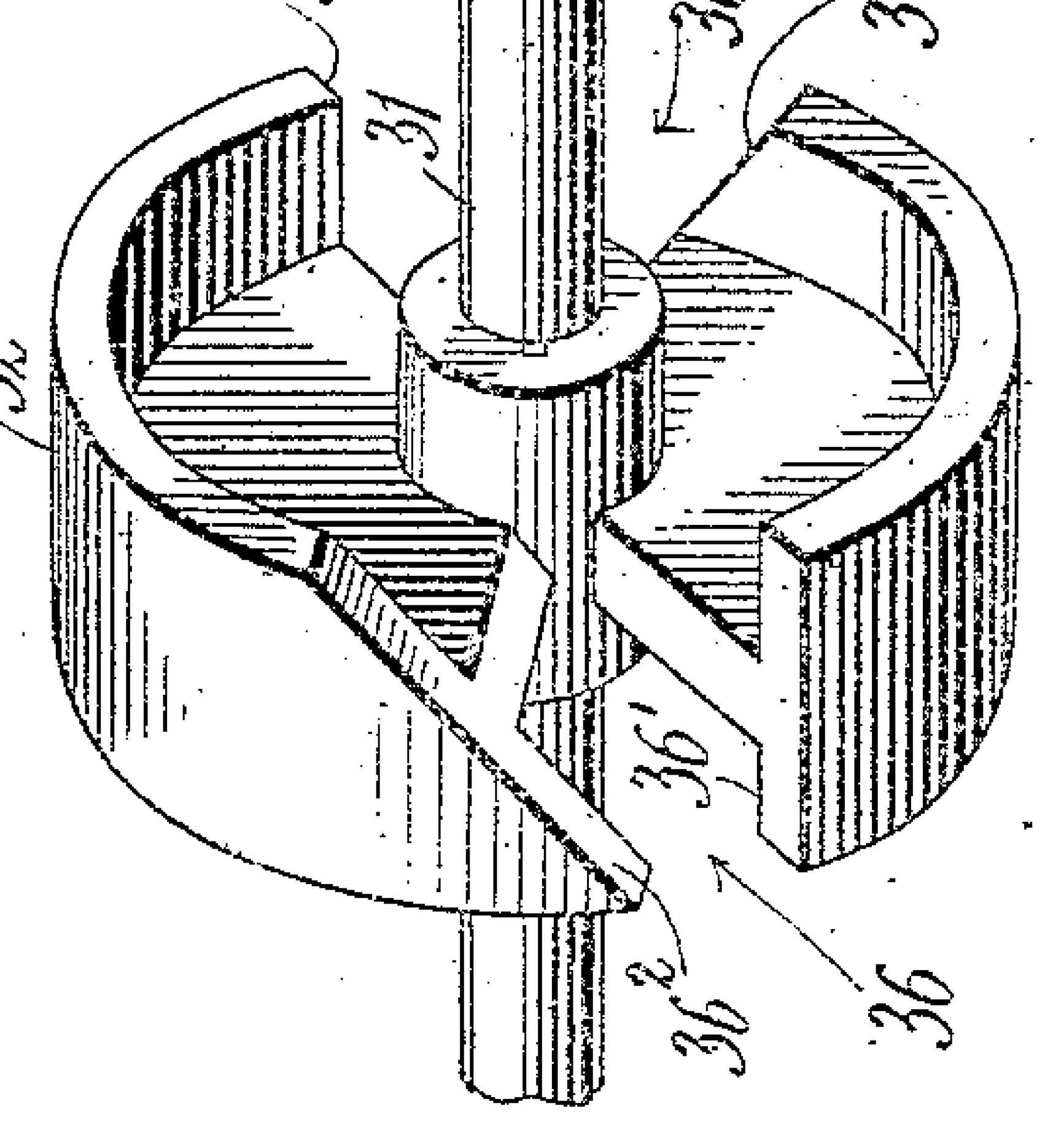


Fig. 3



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5 SHEETS—SHEET 3.

FIG. 3.

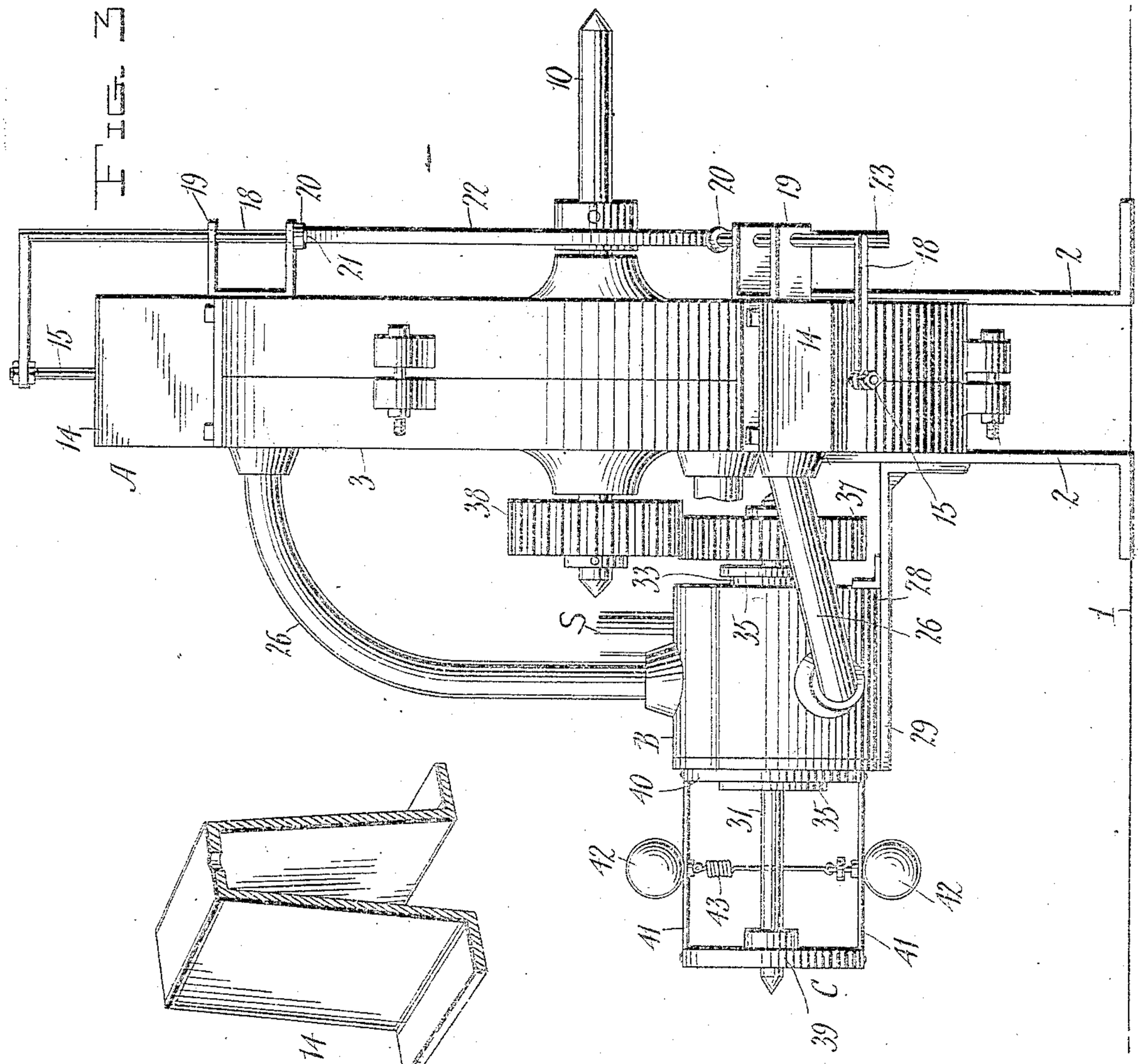
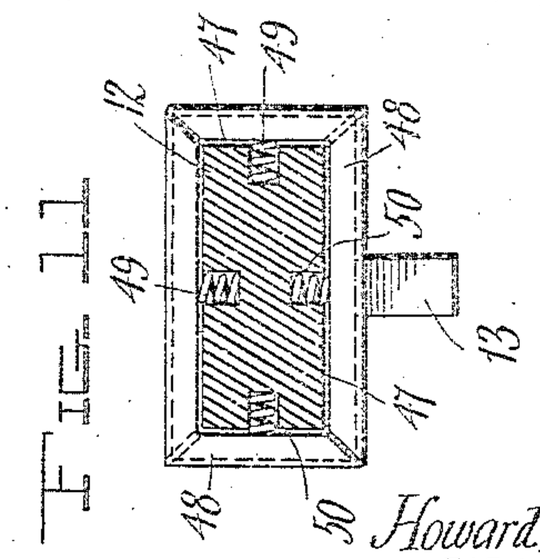


FIG. 5.

FIG. 11.



Witnesses

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5 SHEETS—SHEET 4.

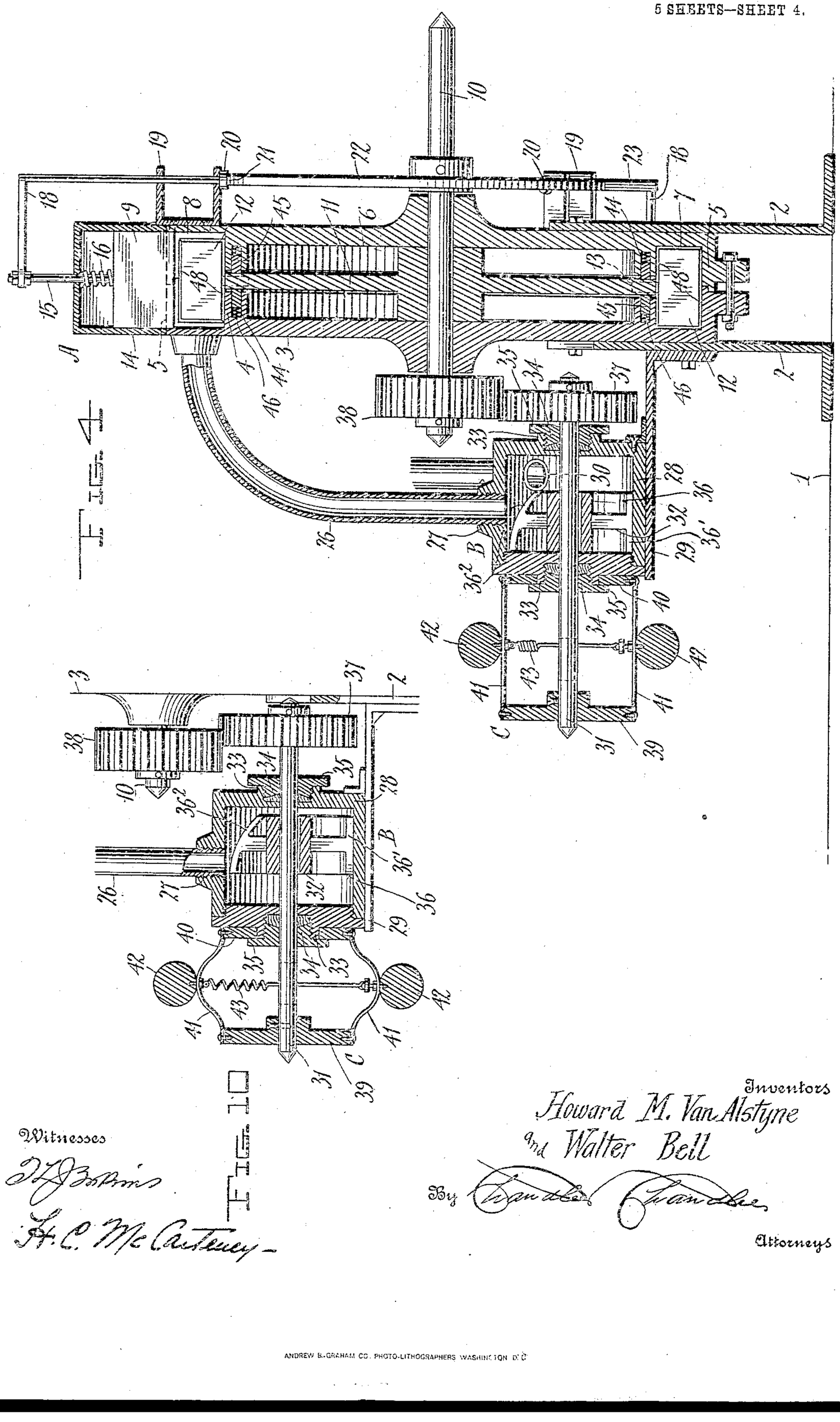

FIG. 4.

FIG. 10.

Witnesses

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5 SHEETS—SHEET 5.

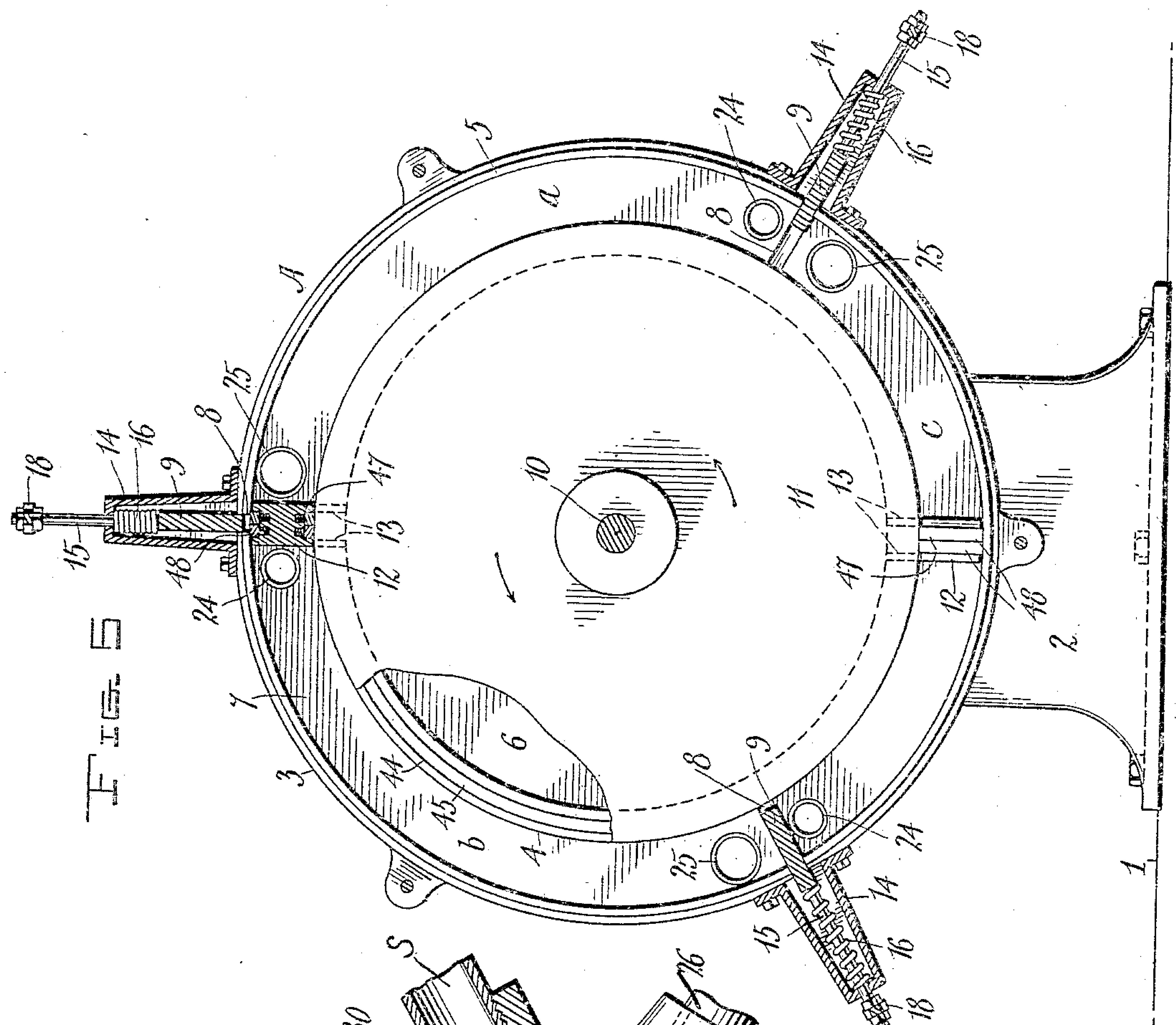

Fig. 5

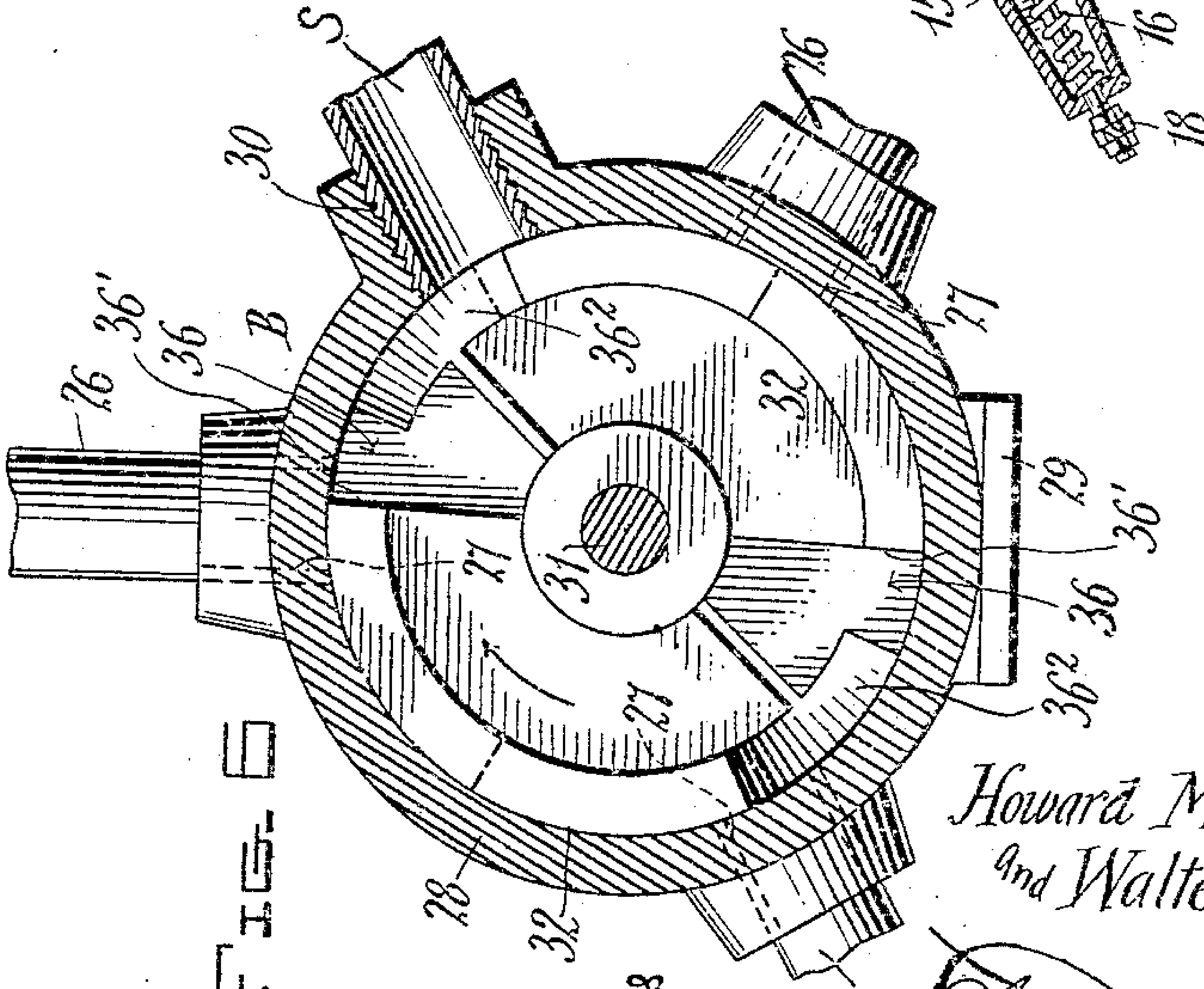

Fig. 6

Witnesses

[signature]

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Attorneys

UNITED STATES PATENT OFFICE.

HOWARD M. VAN ALSTYNE AND WALTER BELL, OF RENSSELAER, NEW YORK.

ROTARY ENGINE.

955,925. Specification of Letters Patent. Patented Apr. 26, 1910.

Application filed April 12, 1909. Serial No. 489,324.

To all whom it may concern:

Be it known that we, HOWARD M. VAN ALSTYNE and WALTER BELL, citizens of the United States, residing at Rensselaer, in the county of Rensselaer, State of New York, have invented certain new and useful Improvements in Rotary Engines; and I do hereby 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.

The present invention has reference to improvements in rotary engines, and it aims, primarily, to provide an exceedingly simple, durable, and powerful engine of that type comprising a cylindrical casing having an interiorly located annular chamber intersected at regular intervals by transverse slots, in each of which is fitted a slide valve or gate and a piston provided with a pair of diametrically-opposite heads arranged for movement in said chamber.

More especially, the invention resides in the particular devices employed for effecting the movements of the above-mentioned valves, for supporting the latter, and for guiding the same during such movements, and in the particular construction of the members of the engine casing.

The invention further resides in the provision of an improved controlling valve for regulating the supply of motive fluid to the cylinder, said valve having a series of pockets formed therein, from which the fluid is discharged through a series of outlet openings formed in the valve casing, each opening communicating through a conduit, with one of the inlet openings with which the main casing or cylinder is provided.

The invention still further resides in the provision of an improved governor which is secured to the shaft which carries the controlling valve above referred to, the movement of the governor caused by the centrifugal force of its weights effecting an endwise movement of said shaft, in consequence of which the valve is moved to one side, thereby cutting off the steam earlier in the stroke, with a resultant reduction in power and speed.

The preferred embodiment of the invention is illustrated in the accompanying drawings, in which corresponding parts or features, as the case may be, are designated by the same reference characters throughout the several views.

Of the said drawings, Figures 1 and 2 are elevations of the complete invention taken from opposite sides. Fig. 3 is a front elevation. Fig. 4 is a vertical section. Figs. 5, 6 and 7 are vertical sections through the cylinder, the valve casing, and the governor at right angles to the section plane of Fig. 4. Fig. 8 is a perspective view of the valve. Fig. 9 is a sectional perspective view of one of the guides for the slide valves. Fig. 10 is a fragmental vertical section, showing the valve in position to close the outlet ports in the valve casing. Fig. 11 is an enlarged sectional view of one of the piston heads.

Referring more particularly to the drawings, A designates generally the engine proper, B the valve mechanism for controlling the supply of steam or other motive fluid thereto, and C the governor secured to the shaft which carries the above-mentioned valve.

The engine A consists, as shown, of a base 1 upon which is mounted a pair of L-shaped brackets 2 arranged in spaced relation to each other, the engine casing or cylinder 3 being disposed between said brackets, which latter are bolted at their upper ends to the sections of the cylinder. Both sections of the cylinder are in the form of circular plates, as shown in Fig. 5, said plates being connected together by bolts which are passed through alining perforations formed in the pairs of ears with which the sections are provided at suitable intervals. Each section of the casing is further provided with inner and outer concentric annular flanges 4 and 5 arranged in spaced relation to each other, the flanges of one section being arranged directly opposite those of the other section, so as to provide a cylindrical inner chamber 6 and an annular outer chamber 7 which are separated from each other by the inner flanges 4 which latter terminate short of each other. The mating outer flanges 5 form the peripheral wall of the engine cylinder, said wall being provided with a series of three transverse slots 8 which extend practically the entire width thereof and communicate with the chamber 7, which latter is thus divided into three equal sections, communication between said sections being normally cut out by means of a series of gates or slide valves 9 which are movable bodily through the slots 9 above referred

to into and out of the chamber. The side walls of the cylinder have formed therein alining axial openings through which extend the ends of the engine shaft 10 to which latter is rigidly secured a circular plate 11 which is disposed within the interior of the cylinder and extends between the mutually-adjacent spaced ends of the flanges 4. At each of two diametrically-opposite points, said plate is provided with a pair of inwardly-extending notches, each pair having fitted therein a pair of fingers 13 formed upon the lower edge of a piston head 12, the dimensions of which are approximately those of the chamber 7.

Disposed directly above each of the slots 8, and likewise arranged transversely of the cylinder is a housing 14 U-shaped in cross section, whose top wall is provided with a central opening through which projects the stem 15 formed upon the outer longitudinal edge of the corresponding gate, which latter is normally forced inwardly through the slot by means of an expansible coil spring 16 which embraces said stem and bears at one end against the above mentioned edge of the gate and at the other end against the inner face of the top wall of the housing. The projecting outer end of each stem has connected thereto the free end of the shorter or horizontal arm of an L-shaped rod 18 whose vertical arm extends through alining perforations formed in the arms of a C-shaped bracket 19 which projects laterally from the outer face of the right hand section of the cylinder and is secured thereto in any preferred manner. The free end of the last mentioned arm of each rod 18 terminates in an enlargement or head 20. The heads 20 of the rods 18 lie in the path of motion of the cams 21 formed upon a cam plate 22 secured to the engine shaft, the shoulder portions 23 of the cams being disposed diametrically opposite each other. The rotation of the cam will therefore successively move the several gates outwardly of their slots.

Each section of the annular chamber 7 is provided at opposite ends with an inlet opening 24 and with an outlet opening 25 which are formed through the left hand wall of the cylinder which latter is thickened at such points. In each inlet opening is fitted one end of a supply pipe 26 whose other end is fitted in an outlet opening 27 formed in the peripheral wall of a cylindrical casing 28 supported upon a horizontal bracket 29 bolted at its inner end to the left hand bracket 2, said casing wall being further provided with an inlet opening 30 in which is fitted one end of the main supply pipe.

The side walls of the casing are provided with alining axial openings through which extend the ends of a horizontal shaft 31 having rigidly secured thereto a cylindrical valve 32 located interiorly of said casing, the side walls of which latter are provided with integral annular bushings 33 formed concentric with the openings above referred to and adapted to receive threaded plugs 34. These plugs are provided with axial openings which register with the first mentioned openings and extend through the enlarged head portions 35 of the plugs whose inner faces, as shown in Fig. 4, bear against the adjacent faces of said bushings. The inner ends of the plugs terminate short of those of the bushings to provide spaces for the reception of gaskets of rubber or other suitable material.

The valve 32, as shown in Fig. 8, is provided with a pair of pockets 36 formed by splitting the peripheral wall thereof at diametrically opposite points, each pocket having a straight side 36′ and a long or inclined side 36^2. The valve is disposed normally adjacent the left-hand side wall of the casing, and its width is slightly more than half the distance between the inner faces of the casing walls, the widest portions of the pockets being normally in line with the outlet portions 27.

The right hand end of the valve shaft has secured thereto a gear 37, which meshes with a similar gear 38 secured to the adjacent end of the engine shaft, the thickness of the last-mentioned gear exceeding somewhat that of the gear 37. The other end of the valve shaft carries the governor C which latter, as shown, comprises a disk 39 and a ring 40 arranged in spaced relation to each other and connected by a pair of flat springs 41, the disk having its hub portion secured directly to said shaft, while the ring has its inner portion extending into the annular seat formed between the head of the left hand plug 34 and the adjacent wall of the valve casing. Each spring 41 has secured centrally thereto a weight 42, the two springs being connected together by a supplemental retractile coil-spring 43, which extends through an opening formed in the valve shaft, as shown in Fig. 7.

By reason of the fact that the gears 37 and 38 are of exactly the same size, the engine and valve shafts will rotate at the same speed, as will be apparent. When therefore, the speed of the latter shaft becomes excessive, the weights 42 will fly outwardly in opposite directions, owing to the centrifugal force exerted thereupon, as a result of which the springs 41 will buckle, thus drawing the disk 39 toward the ring 40, and forcing the shaft inwardly. The valve being rigidly secured to said shaft will move therewith, thus gradually decreasing the width of those portions of the pockets which aline with the several outlet openings 27, or in other words, cutting off the steam supplied to the main

casing earlier in the stroke, the speed of the engine and valve shafts decreasing in consequence.

In the operation of the invention, as a whole, steam is admitted into the interior of the valve casing through the main supply pipe S. Of the three outlet openings or ports 27 with which the pockets successively register, the valve being in the position in Fig. 6, the right hand port is completely closed, the left hand port partly closed, and the upper or central port partly open. The sections of the annular chamber 7 are designated, for convenience, *a*, *b* and *c*, which characters indicate, respectively, right and left hand sections, and the lower or central section. Hence, when the valve is in the abovementioned position, the first mentioned section is completely empty of steam, while the second section is about to be filled, and the third section is partly exhausted, as shown in Fig. 5. Also the upper piston head 12 is just about to cross the upper inlet port, while the lower piston head is midway the two ports of the lower section. Hence, when the upper piston has passed said inlet port, the steam admitted through the latter will fill the space between the upper piston head and the adjacent gate, and will force the piston to rotate in the direction of the arrow, the arrangement of the cam shoulders 23 with respect to the piston heads being such that they lie in the same plane as the rear faces of the latter. As the piston continues its rotation, the steam contained in the lower section *c* will exhaust through the lower outlet port, the section *a* remaining empty of steam until the lower piston head passes the lower right-hand gate and starts across the adjacent inlet port, whereupon steam will start to flow through the latter, as will be apparent, the right-hand outlet port in the valve casing being uncovered as said piston head reaches said inlet port. During the rotation of the piston, the gates are successively raised by the cam disk, the gates being operated simultaneously with the passage of the piston heads across the adjacent outlet ports 25.

It will thus be understood that the movements of the valve and piston are synchronous and that the gates are held normally in closed position by the springs 16 and are opened or moved outwardly against the action of said springs by the cam disk. It is also to be noted that there is no possibility of the piston stopping upon a dead center, owing to the fact that there are three sections of the steam chamber, for which reason there is at all times a full head of steam behind one piston head or the other. Furthermore, the danger of back pressure is avoided, since each section is completely exhausted before being refilled. The provision of the controlling valve prevents the engine from running at a dangerously high rate of speed, and at the same time, permits the supply of steam, when used as the motive fluid, to be cut off from each section when the piston head has traveled only partway therethrough, thus utilizing the expansive power of the steam already admitted to force the piston head to travel the remaining distance. Finally, the simplicity and durability of the engine is extremely great, since there are but few parts, none of which are subjected to excessive wear.

It is also the purpose of the inventors to produce a steam tight joint between the chambers 7 and 6, to prevent the admission of steam into the latter, and its subsequent escape therefrom by leakage or otherwise. To this end each of the two mating flanges 4 has formed in its outer face a circumscribing groove 44 whose depth is approximately equal to the width of the flange, each groove having fitted therein an annular packing strip 45 which is yieldingly forced outwardly thereof and into contact with the adjacent face of plate 11 by means of a series of expansible coil-springs 46, said springs being disposed within the grooves between the bottom walls thereof and the inner edges of the strips, as shown in Fig. 4. Escape of steam around the edges of the piston heads is likewise prevented by forming the edges thereof with continuous grooves 47 in which are seated L-shaped packing strips 48. (See Fig. 11.) These strips, like the strips 45, are normally forced outwardly of their grooves by means of expansible springs 49 which are fitted in seats 50 formed by extensions of the said grooves.

What is claimed is:

1. A rotary engine, comprising a cylindrical casing having its interior divided into spaced inner and outer concentric slots, and its peripheral wall provided with a series of transverse slots communicating with the outer chamber; a housing disposed directly in line with each slot; a gate disposed within each housing and slidable through the adjacent slot into and out of said outer chamber, to divide the latter into a plurality of sections, each section being provided at one end with an inlet opening and at the other end with an outlet opening; means for normally holding said gates at the limit of their inward movement; a shaft extending through alining axial openings formed in the side walls of the casing; a piston secured to said shaft and consisting of a disk provided at diametrically-opposite points with a pair of transversely-disposed heads arranged to travel in said outer chamber; means for admitting a motive fluid through the inlet ports into said chamber against the rear faces of said heads; a member secured to each gate; and means secured to said shaft and arranged for engagement

with said members, for successively moving said gates outwardly to permit said heads to pass from one section to another.

2. A rotary engine, comprising a cylindrical casing having its interior divided into spaced inner and outer concentric chambers, and its peripheral wall provided with a series of transverse slots communicating with the outer chamber; an exteriorly-located transverse housing secured to said wall in direct alinement with each slot, the top of each housing having a perforation formed therethrough; a shaft extending through alining axial openings formed in the side walls of the casing; a piston secured to said shaft and comprising a disk provided at diametrically-opposite points with a pair of transversely-disposed heads arranged to travel in said outer chamber; a gate disposed within each housing and slidable through the adjacent slot into and out of said outer chamber, to divide the latter into a plurality of separate sections, each section being provided at one end with an inlet opening and at the other end with an outlet opening, each gate including a stem projecting through the opening in the corresponding housing; means for normally holding said gates at the limit of their inward movement; means for admitting motive fluid through the inlet openings against the rear faces of said heads, for rotating said piston; a member secured to the projecting end of each stem; and a cam secured to said shaft and provided with a pair of diametrically-opposite cam surfaces arranged for engagement with said members, to successively raise said gates and to permit said heads to pass from one section to another.

3. The combination of a cylindrical casing provided with inlet and outlet openings; a shaft extending through alining axial openings formed in the side walls of the casing; a piston secured thereto provided with a plurality of piston heads; a valve casing located adjacent the first mentioned casing and provided with inlet and outlet openings; a shaft extending through alining openings; a valve secured to said shaft and provided with pockets arranged for registration with said outlet openings; means for admitting a motive fluid into the interior of the valve casing through the inlet opening therein to fill said pockets; pipe connections between said outlet openings and the inlet openings in the first mentioned casing, to admit the fluid into the interior of the latter, for rotating said piston; and driving connections between the first and last mentioned shafts, for rotating the latter and said valve, to move said pockets into registration with the outlet opening and the valve casing.

4. The combination, of a cylindrical casing, provided with inlet and outlet openings; a shaft extending through alining axial openings formed in the side walls of the casing; a piston secured to said shaft provided with a plurality of piston heads; a valve casing located adjacent the first-mentioned casing and provided with inlet and outlet openings; a shaft extending through alining axial openings formed in the side walls of the valve casing; a valve secured to said shaft and provided with pockets arranged for successive registration with said outlet openings; means for admitting motive fluid through said inlet openings into the interior of the valve casing, to fill said pockets; pipe connections between the outlet openings in the valve casing and the inlet openings in the first-mentioned casing, to admit the fluid into the interior of the latter for rotating the piston; driving connections between the first and last mentioned shafts for rotating the latter and said valve; and a governor secured to said last-mentioned shaft.

5. The combination, of a cylindrical casing, having its interior divided into inner and outer concentric chambers; means for dividing the outer chamber into a plurality of separate sections, each section having an inlet and outlet opening; a shaft extending through alining axial openings formed in the side walls of the casing; a piston secured to said shaft and provided with a pair of diametrically opposite heads arranged to travel in said outer chamber; a valve casing located adjacent the first mentioned casing and provided with an inlet opening and a series of outlet openings, said outlet openings corresponding in number to the inlet openings in the first mentioned casing; a shaft extending through alining axial openings formed in the side walls of the valve casing; a valve secured to said shaft and provided with pockets arranged for successive registration with said outlet openings; means for admitting motive fluid into the interior of the valve casing through the inlet opening therein to fill said pockets; pipe connections between said outlet openings and the inlet openings in said first mentioned casing, for directing the fluid into the interior of said outer chamber and against the rear faces of said heads for rotating said piston; and driving connections between the first and last mentioned shafts for rotating the latter and said valve.

6. The combination of a cylindrical casing provided with inlet and outlet openings; a shaft extending through alining axial openings formed in the side walls of the casing; a piston secured to said shaft; a valve casing located adjacent the first mentioned casing and provided with inlet and outlet openings; a shaft extending through alining axial openings formed in the walls of the valve casing; a valve secured to said shaft

and provided with pockets arranged for registration with said outlet openings; means for admitting motive fluid into the interior of the valve casing through the inlet opening therein to fill said pockets; pipe connections between said outlet openings and the inlet openings in the first mentioned casing, for directing the fluid into the interior of the latter to rotate the piston; driving connections between said shafts for rotating the same in unison; and a governor secured to said last mentioned shaft and connected with the adjacent side wall of the valve casing, for imparting an endwise movement to said shaft and valve when the speed at which the former rotates becomes excessive.

7. The combination of a cylindrical casing provided with inlet and outlet openings; a shaft extending through alining openings formed in the side walls of the casing; a piston secured to said shaft provided with a plurality of piston heads; a valve casing located adjacent the first mentioned casing and provided with inlet and outlet openings; a shaft extending through alining axial openings formed in the side walls of the valve casing; a valve secured to said shaft and provided with pockets arranged for registration with said outlet openings; means for supplying motive fluid through said inlet opening to the interior of the valve casing, for filling said pockets; pipe connections between said outlet openings and the inlet openings in the first mentioned casing, for supplying the fluid to the interior of the latter to rotate the piston; driving connections between the first and last mentioned shafts for rotating the same in unison; and a governor connected to one end of said last mentioned shaft and mounted upon the adjacent side wall of the valve casing, for imparting an endwise movement to said shaft and valve when the speed at which the former rotates becomes excessive.

8. The combination of a valve casing provided with inlet and outlet openings; an endwise movable shaft extending through alining openings formed in the end walls of the casing; a valve secured to said shaft and provided with tapering pockets arranged to register with said outlet openings; means for admitting a motive fluid into the interior of said casing through said inlet opening; means for rotating said shaft; and a governor connected to one end of said shaft and mounted upon the adjacent wall of the casing, for imparting an endwise movement to said shaft and valve when the speed at which the former rotates becomes excessive, to vary the effective area of said pockets.

In testimony whereof, we affix our signatures, in presence of two witnesses.

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WALTER BELL.

Witnesses:
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JOHN BELL.