No. 647,015. Patented Apr. 10, 1900.

C. E. MILLER.

ROTARY STEAM ENGINE.

(Application filed Aug. 23, 1899.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 2.

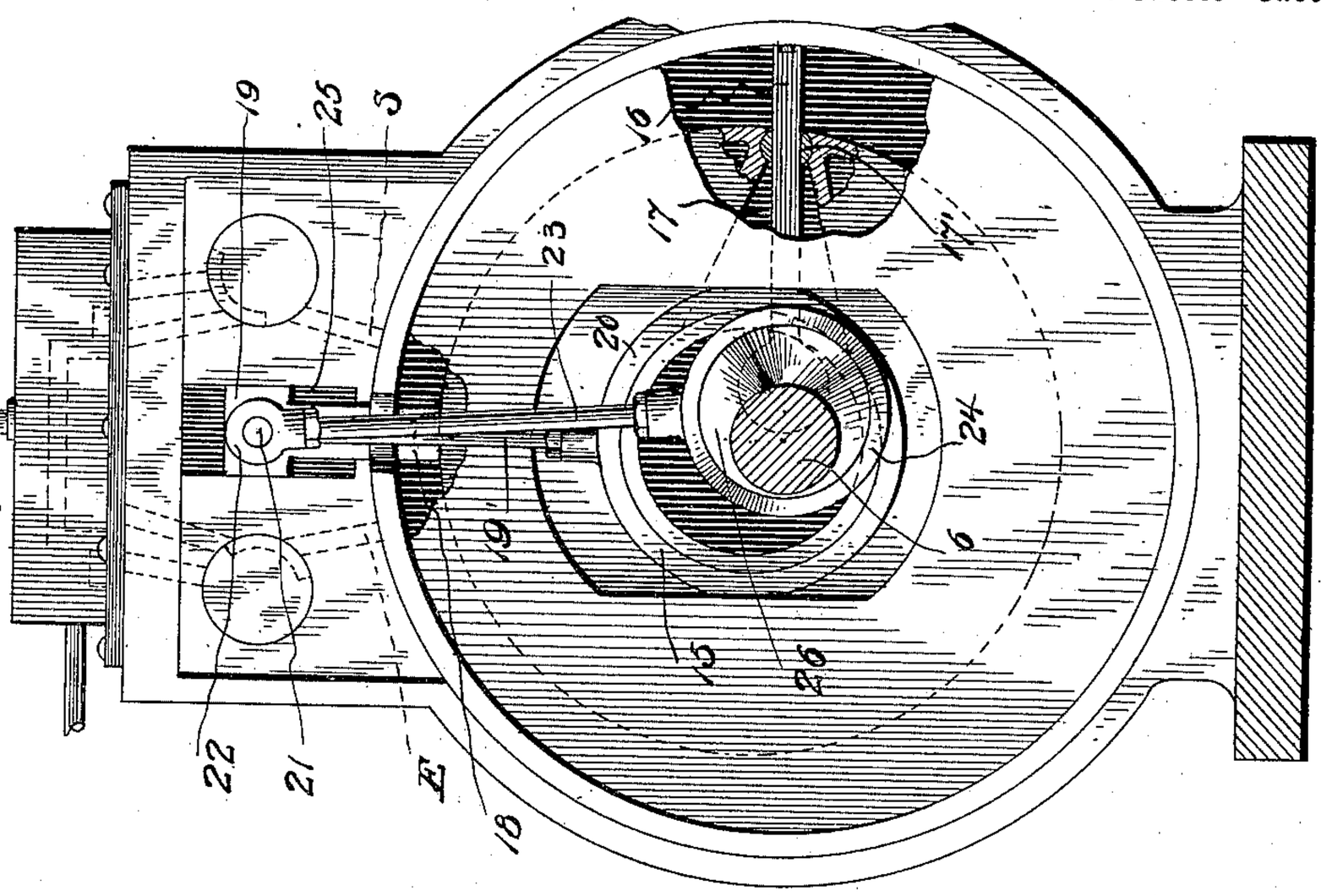
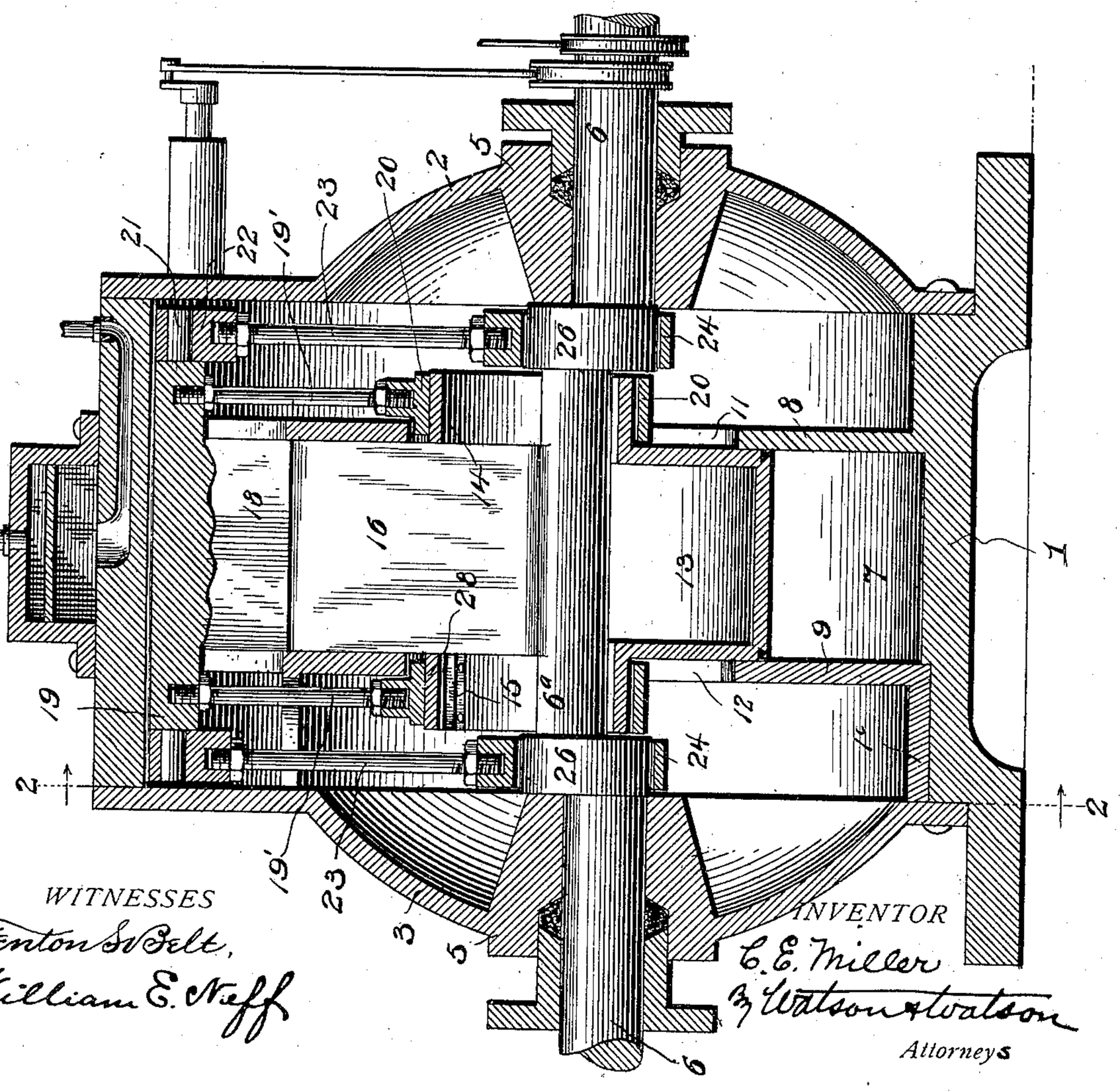


Fig. 1.



No. 647,015.

Patented Apr. 10, 1900.

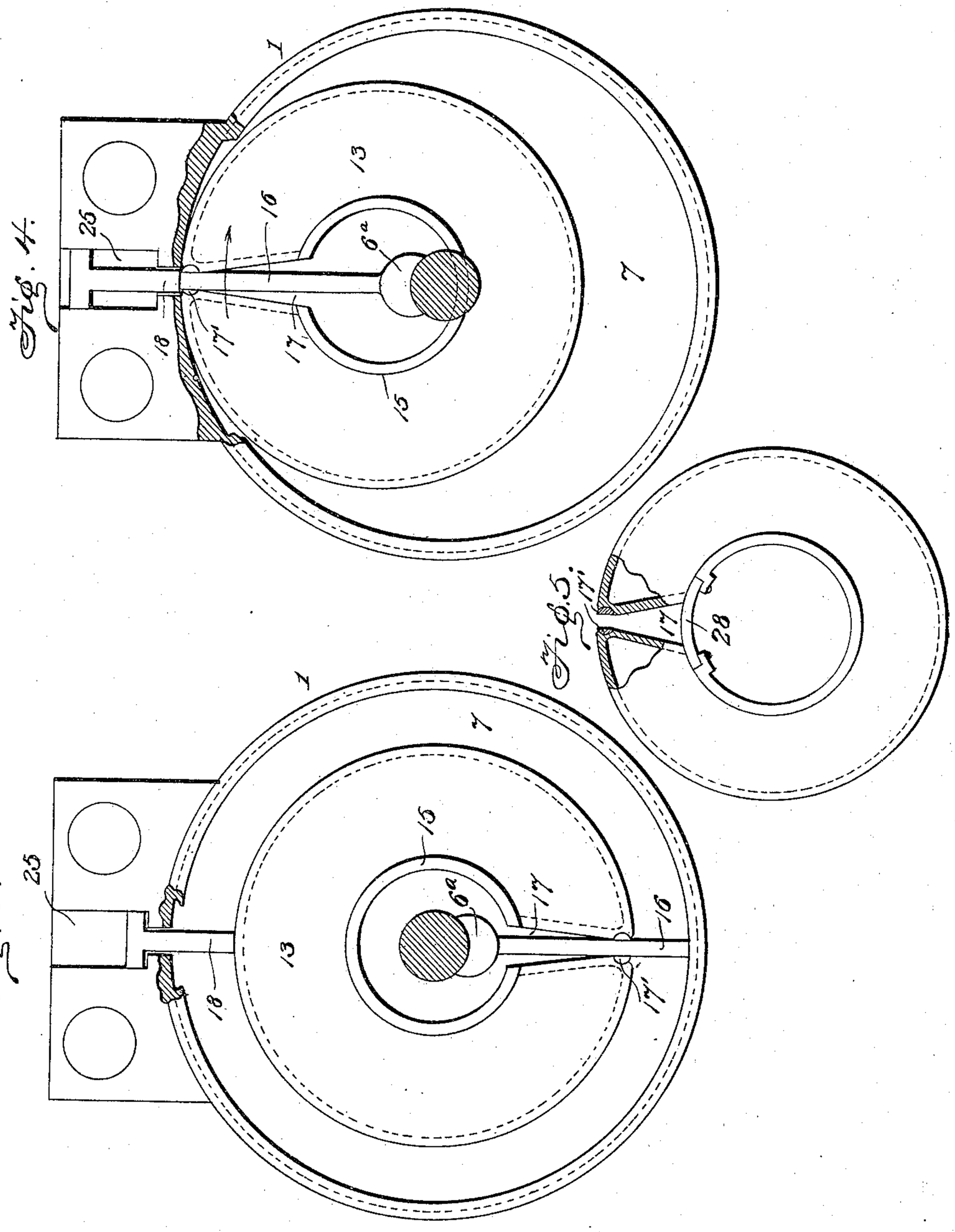
C. E. MILLER.

ROTARY STEAM ENGINE.

(Application filed Aug. 23, 1899.)

(No Model.)

4 Sheets—Sheet 2.



WITNESSES

Fenton & Pelt,

William E. Neff.

INVENTOR

C. E. Miller

By Watson & Watson

Attorneys

No. 647,015. Patented Apr. 10, 1900.

C. E. MILLER.

ROTARY STEAM ENGINE.

(Application filed Aug. 23, 1899.)

(No Model.) 4 Sheets—Sheet 3.

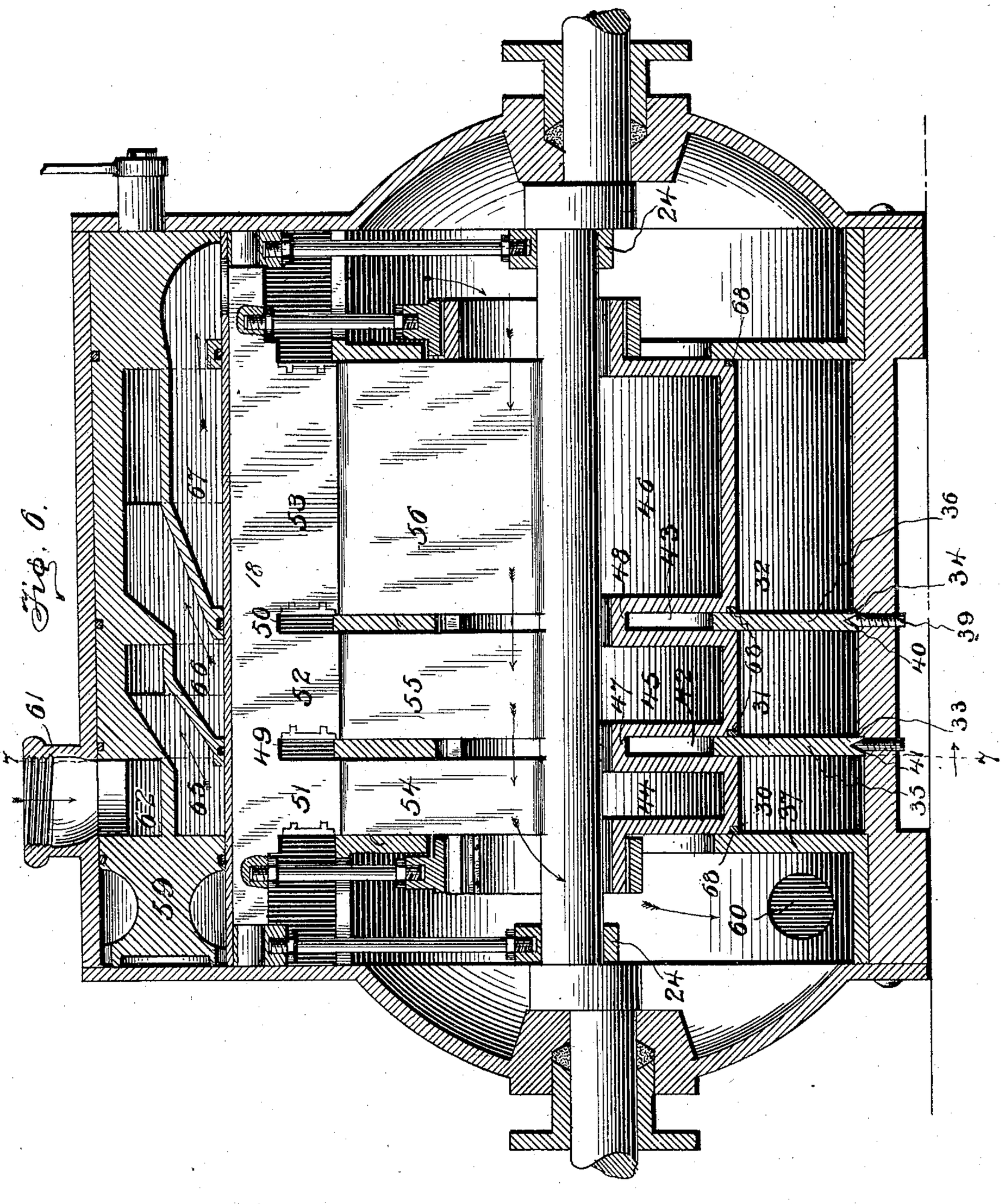


Fig. 6.

WITNESSES

Fenton S. Pelt

William E. Steff

INVENTOR

C. E. Miller

By Watson & Watson

Attorneys

No. 647,015. Patented Apr. 10, 1900.

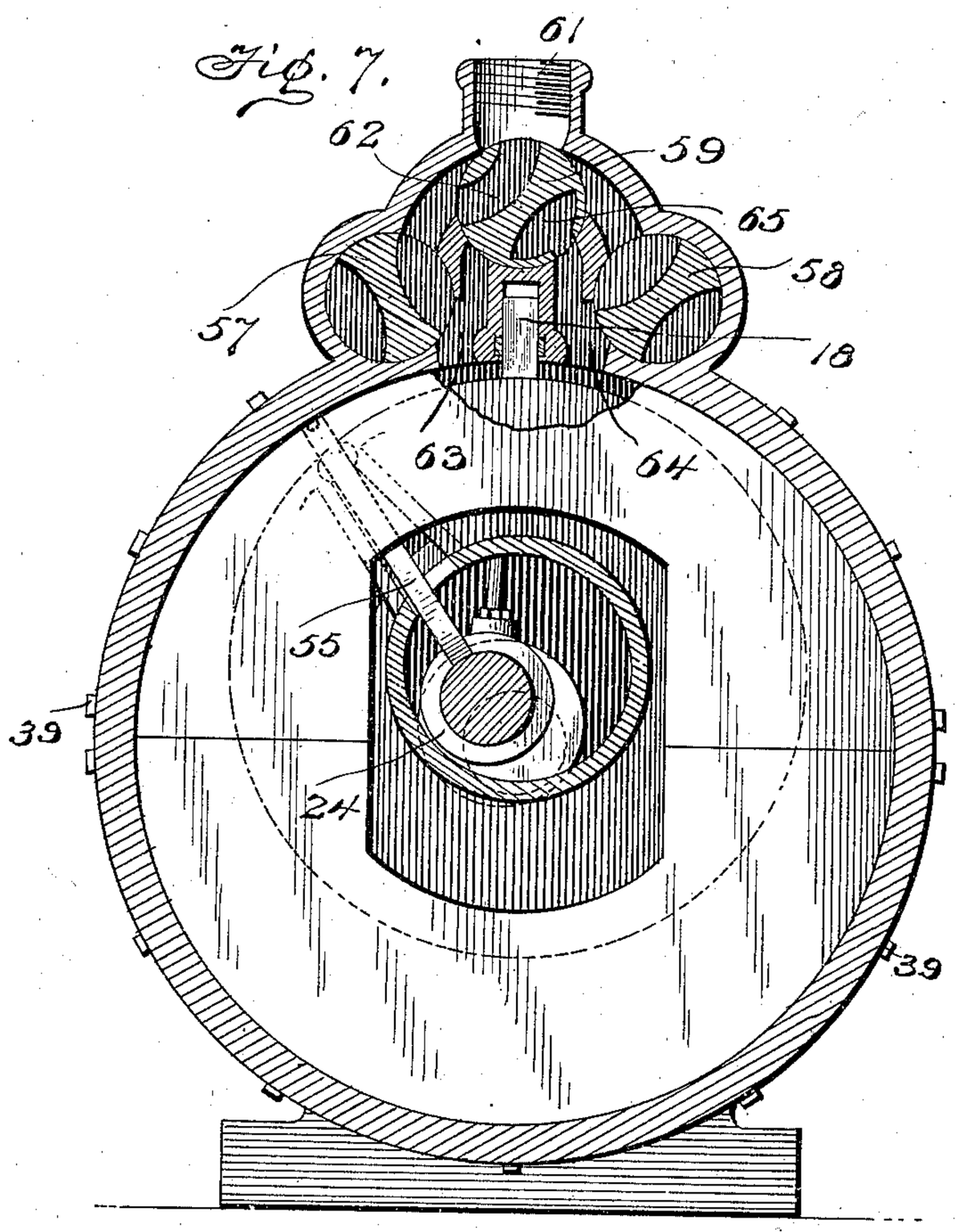
C. E. MILLER.

ROTARY STEAM ENGINE.

(Application filed Aug. 23, 1899.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 7.



Witnesses
Fenton & Pelt,
William E. Neff

Inventor
C. E. Miller
By Watson & Watson
Attorneys

UNITED STATES PATENT OFFICE.

CHARLES E. MILLER, OF SCRANTON, PENNSYLVANIA.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 647,015, dated April 10, 1900.

Application filed August 23, 1899. Serial No. 728,197. (No model.)

To all whom it may concern:

Be it known that I, CHARLES E. MILLER, a citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Rotary Steam-Engines, of which the following is a specification.

My invention comprises certain improvements in rotary engines by means of which a large piston area is exposed to the steam throughout the greater portion of the revolution and the difficulties usually encountered in effecting the movement of the piston past the abutment-plate are avoided. Other advantages following from my improvements are pointed out in the following specification.

In the accompanying drawings, which illustrate my invention, Figure 1 is a vertical longitudinal section through a simple engine embodying my improvements. Fig. 2 is a section on the line 2 2 of Fig. 1, partly broken away and showing the piston at quarter-stroke. Figs. 3 and 4 are diagrams illustrating the operation of the engine. Fig. 5 is an end view of the reciprocating drum which operates within the cylinder. Fig. 6 is a vertical central section through a triple-expansion engine embodying my improvements; and Fig. 7 is a section on the line 7 7 of Fig. 6, the piston being shown in a different position.

Referring to Figs. 1 to 5, inclusive, of the drawings, 1 indicates the engine-casing having end frames 2 and 3, each provided with a journal-bearing 5, through which the shaft 6 extends. A cylinder 7 is formed within the casing transversely to the shaft. As shown, the side wall 8 of the cylinder is formed integral with the rest of the casing, while the side wall 9 is made removable. The wall 9 is provided with a flange 10, which abuts against the end frame 3, so that when the latter is bolted to the casing the side wall is securely held against the peripheral wall of the cylinder. The walls 8 and 9 are provided with vertical openings 11 and 12 opposite to each other, and through these openings the shaft 6 extends. Within the cylinder and surrounding the shaft is arranged a cylindrical drum 13, having ring-like hubs 14 and 15, which project through the openings 11 and 12, respectively. The internal diameter of the hubs is sufficiently large to permit the drum to move vertically without coming in contact with the shaft from the position shown in Fig. 3, wherein the drum is shown concentric with the cylinder, to the position shown in Figs. 1 and 4, wherein the drum is almost in contact with the upper part of the cylinder.

In order to make the drum-hubs as small as may be and yet allow an unimpeded vertical play, I preferably offset the part 6^a of the shaft within the drum in the direction of the radial piston 16, so that when the end of the piston is at the top of the cylinder and the drum raised to its highest position, as shown in Figs. 1 and 4, the lower parts of the drum-hubs may come up above the lower line of the shaft ends 6 without interference. If the shaft were straight throughout, the drum-hubs would have to be larger in order to avoid interference with the shaft. A slot 17 extends radially through the end walls and face of the drum, and the rectangular piston 16, secured to the part 6^a of the shaft, extends through this radial slot and into contact with the inner face of the cylinder. A suitable packing is fitted along the edges of the piston, and a packing 17′ is arranged across the drum at the outer end of the radial slot and bears against both sides of the piston. The side walls of the drum fit steam-tight within the cylinder, and the diameter of the drum is such that when it is raised to its highest position, almost in contact with the face of the cylinder, its lowermost part will extend below the openings 11 and 12, so that the side walls of the drum will always close said openings against the escape of steam from the cylinder.

A vertically-movable abutment-plate 18 is arranged to move in a guide-slot 25, formed in the upper part of the cylinder-casing, said slot extending transversely through the peripheral wall of the cylinder. A cross-piece 19, secured to or formed integral with the abutment-plate, extends outward on either side of the cylinder-casing, and the drum 13 is connected to said cross-piece by means of the rods 19′ and collars or bearings 20, surrounding the hubs of the drum and within which said hubs are free to turn. As shown,

the ends of the rods 19′ are oppositely screw-threaded, so that by turning the rods the adjustment between the drum and the abutment-plate may be regulated, and suitable lock-nuts are provided at the screw-threaded ends for locking the rods after adjustment has been effected. When properly adjusted, the abutment-plate will rest upon the drum with just sufficient pressure to make a steam-tight joint. The cross-piece of the abutment-plate terminates in studs 21, upon which eyes 22 are journaled, and these eyes are connected by means of rods 23 to eccentric-straps 24, surrounding the cams or eccentrics 26, which are formed upon the shaft just inside the bearings 5 and project in the same direction as the piston 16. The rods 23, like the rods 19′, are oppositely screw-threaded at their ends, so that adjustment can be effected. By this means it will be seen that the abutment-plate is supported upon the cams by means of the rods 23 and the drum is suspended from the cross-piece of the abutment-plate by means of the rod 19′, so that when the shaft is turned the abutment-plate is raised and lowered by the cams, and the drum in turn is also raised and lowered a like distance, the abutment-plate always remaining in contact with the drum.

Any suitable valve arrangement for admitting steam to the cylinder on one side of the abutment-plate and exhausting it from the opposite side and for reversing the engine may be employed, so that a detailed description of the valve-gear is unnecessary.

The operation of the novel parts of the engine will be clear from an inspection of Figs. 2, 3, and 4 of the drawings. In Fig. 4 the piston is shown at the point of passing the abutment-plate. In this position the abutment-plate has been raised by the cams upon the shaft, so that it does not interfere with the passage of the piston. The drum is also raised to the top of the cylinder. When the piston turns to the right, as indicated by the arrow, the cams cause the abutment-plate and drum, which are always in contact with each other, to gradually move downward. The drum moves perpendicularly, being held from lateral motion by the vertical walls of the openings 11 and 12, which form guides for the bearings 20, supporting the drum. As the drum moves downward the end of the piston gradually protrudes, and when the piston passes the steam-port S steam is admitted between the piston and the abutment-plate. The piston is thereby driven around, turning the drum upon its hubs within the bearings 20. The downward movement of the drum enlarges the steam-space between the drum and the cylinder, and the piston area increases until the piston reaches the quarter-stroke, as shown in Fig. 2. When the piston reaches the quarter-stroke, its greatest area is exposed to the steam, and this area is continuously exposed until the three-quarter stroke is reached, when the rising of the drum gradually diminishes the piston area until the zero-point is reached in passing the abutment-plate, as indicated in Fig. 4. Fig. 3 indicates the position of the parts at half-stroke, the drum in this position being concentric with the interior of the cylinder. When the piston turns to the right, as indicated in these figures, the steam will of course exhaust through the port E.

The shaft, cams, and piston are preferably made in one piece, and one of the drum-hubs is made with a removable section 28 (see Fig. 5) in line with the slot in the drum, so that the piston may be inserted.

Figs. 6 and 7 illustrate a compound engine embodying my improvements. In Fig. 6, which is a longitudinal section through a triple-expansion engine, there are three cylinders—the high-pressure cylinder 30, the intermediate 31, and the low-pressure 32—of successively-greater widths and each successive cylinder being of slightly-smaller diameter than the preceding one, so as to provide annular shoulders 33 and 34, against which the partition-plates 35 and 36, separating the cylinders, abut. The partition-plates are made in two parts 37 and 38, as shown in Fig. 7, and they are held in position against the shoulders by means of threaded bolts 39, which pass through the casing and are provided with tapering points 40, which bear against the sides of tapering slots 41 in the perimeters of the partition-plates. The partition-plates are formed with openings 42 and 43, corresponding with the openings 11 and 12 in the side walls 8 and 9. The drum is similar to the drum in the previously-described figures, except that it is divided into three sections 44, 45, and 46 by contracted portions 47 and 48. The contracted portions are evenly grooved on the outside, as shown, and the partitions 35 and 36 fit within these grooves. Each section is provided with a suitable peripheral packing-ring 68 on one or both sides. The drum is suspended from the ends of the abutment-plate 18 in the same manner as the drum in Fig. 1. The eccentric-straps 24 in this instance are mounted upon the eccentric portion of the shaft instead of upon cams, as in Fig. 1, the result being the same. The abutment-plate is divided by slots 49 and 50 into three sections 51, 52, and 53, corresponding to the three cylinders, each section of the abutment-plate being properly packed. Pistons 54, 55, and 56, preferably made integral with the shaft, extend through the radial slot in the drum and operate in the cylinders 30, 31, and 32, respectively, these pistons being also suitably packed around the edges. The engine is provided with suitable cut-off valves 57 and 58 and a reversing-valve 59, through which steam is admitted to the cylinders, and an exhaust-port 60. When the reversing-valve is in the position shown in Fig. 7, the steam entering through the steam-pipe 61, port 62 in the reversing-valve, and cut-off valve 57 passes into the high-pressure cylin-

der through inlet-port 63, driving the pistons around to the left. After the piston has made a revolution the steam exhausts through port 64 and passage-way 65 in the reversing-valve into the intermediate cylinder, and after passing around through the intermediate cylinder it passes through the passage-way 66, similar to the passage-way 65, into the low-pressure cylinder, from whence it exhausts through passage-way 67 down into the casing, through the center of the drum, and out through the exhaust-port 60. In passing around through the casing and drum to the exhaust-port any oil carried along with the steam is distributed upon the working parts of the engine within the casing, keeping said parts lubricated. By turning the reversing-valve so that the steam will enter through the cut-off valve 58 and port 64 the engine will be reversed.

Having described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In a rotary engine, the combination with a steam-cylinder having inlet and outlet ports, of an axially-mounted shaft extending through said cylinder, a piston secured to said shaft, a rotatable drum surrounding the shaft within the cylinder and having an opening through which the piston extends, a movable abutment-plate in contact with said drum and means for moving said drum toward and from the periphery of the cylinder.

2. In a rotary engine, the combination with a steam-cylinder having inlet and outlet ports, of an axially-mounted shaft extending through said cylinder; a piston secured to said shaft, a rotatable drum surrounding the shaft within the cylinder and having an opening through which the piston extends, a movable abutment-plate in contact with and mechanically connected to said drum, and means for moving said drum toward and from the periphery of the cylinder.

3. In a rotary engine, the combination with a steam-cylinder having inlet and outlet ports, and a radially-movable abutment-plate between said ports, of an axially-mounted shaft extending through said cylinder, a piston secured to said shaft, a rotatable drum surrounding the shaft within the cylinder and having an opening through which said piston extends, hubs upon either end of said drum, bearings surrounding said hubs and adjustably connected to the abutment-plate, and means operated from the shaft for imparting a reciprocating motion to the abutment-plate.

4. In a rotary engine, the combination with a steam-cylinder having inlet and outlet ports, and a radially-movable abutment-plate between said ports, of an axially-mounted shaft extending through said cylinder, a piston secured to said shaft, a rotatable drum surrounding the shaft within the cylinder and having an opening through which said piston extends, hubs upon either end of said drum, bearings surrounding said hubs and adjustably connected to the abutment-plate, eccentric parts upon the shaft, straps surrounding said eccentric parts, and adjustable rods connecting said straps with the abutment-plate.

5. In a rotary engine, the combination with a steam-engine casing having a shaft mounted therein, of a cylinder arranged transversely to the shaft and having end walls provided with openings through which the shaft extends, the opposite walls of said opening forming guideways, a vertically-movable drum within the cylinder surrounding the shaft and having hubs, bearings for said hubs movable within the guideways, an abutment-plate in contact with the drum and mechanically connected to said bearings, eccentric parts upon the shaft, straps upon said parts, and rods connecting said straps with the abutment-plate.

6. In a compound rotary engine, a casing having a shaft mounted therein, pistons secured to said shaft, a series of concentric cylinders arranged transversely to the shaft and separated by partition-plates, the end walls of the cylinders and the partition-plates having openings therein through which the shaft extends, a rotatable drum surrounding the shaft within the cylinders and having slots through which the piston extends, said drum having a section fitting within each cylinder and contracted portions connecting said sections and extending through the openings in the partition-plates, a movable abutment-plate having sections in contact with the sections of the drum, bearings suspended from said abutment-plate and in which said drum is mounted, eccentric parts upon the shaft, and connections between said eccentric parts and the abutment-plate.

7. In a compound rotary engine, a series of concentric cylinders separated by partition-plates, the ends of said cylinders and the partition-plates having openings therein, an axially-mounted shaft extending through said cylinders and having pistons connected thereto, a rotatable drum surrounding the shaft and having a section fitting within each cylinder and contracted portions connecting said sections and extending through the openings in the partition-plates, slots in the drum-sections through which the pistons extend, an abutment-plate having sections in contact with the sections of the drum, bearings suspended from said plate in which the drum is mounted, and means for imparting a reciprocating motion to the abutment-plate.

8. In a compound rotary engine a series of concentric cylinders separated by partition-plates, each cylinder having an inlet and an outlet port, a radially-movable abutment-plate having a section arranged between the ports of each cylinder, an axially-mounted shaft extending through the cylinders, pistons upon said shaft, a rotatable drum surrounding the shaft and having sections fitting within the cylinders and contracted por-

tions connecting said sections and extending through openings in the partition-plates, said drum being suspended from the abutment-plate, a slot in the drum through which the pistons protrude, and means operated from the shaft for imparting a reciprocating motion to the abutment-plate.

9. In a rotary engine, a shaft having an offset central portion and a piston formed integral therewith, in combination with a drum having hubs at either end, one of said hubs having a removable section, and a slot extending through the face and ends of the drum in line with said removable section, substantially as described.

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

CHARLES E. MILLER.

Witnesses:
VINCE H. FABEN,
A. E. MALTBY.