

No. 696,047.

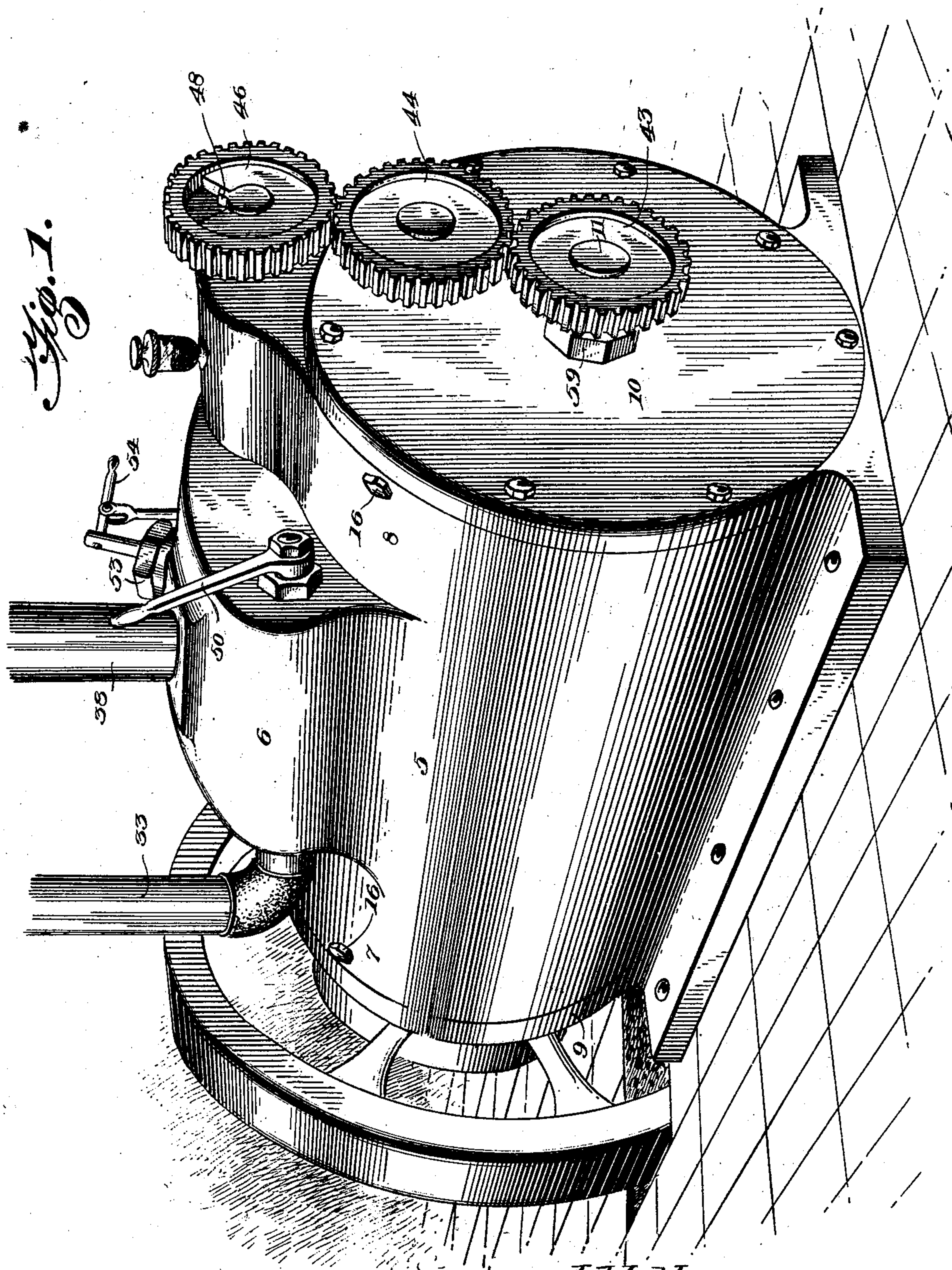
Patented Mar. 25, 1902.

J. H. HOUSEMAN.  
ROTARY ENGINE.

(Application filed Apr. 4, 1901.)

(No Model.)

2 Sheets—Sheet 1.



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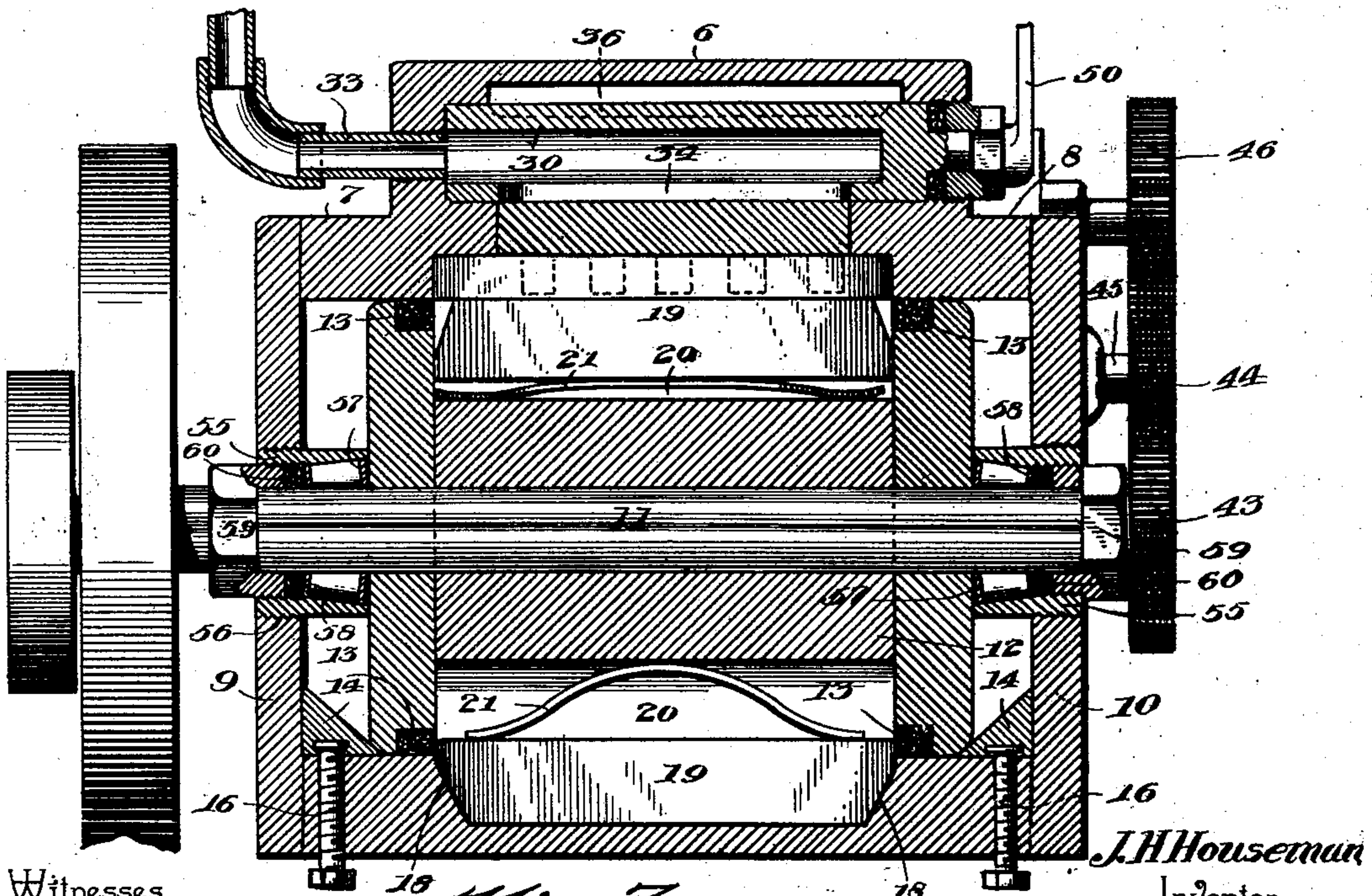
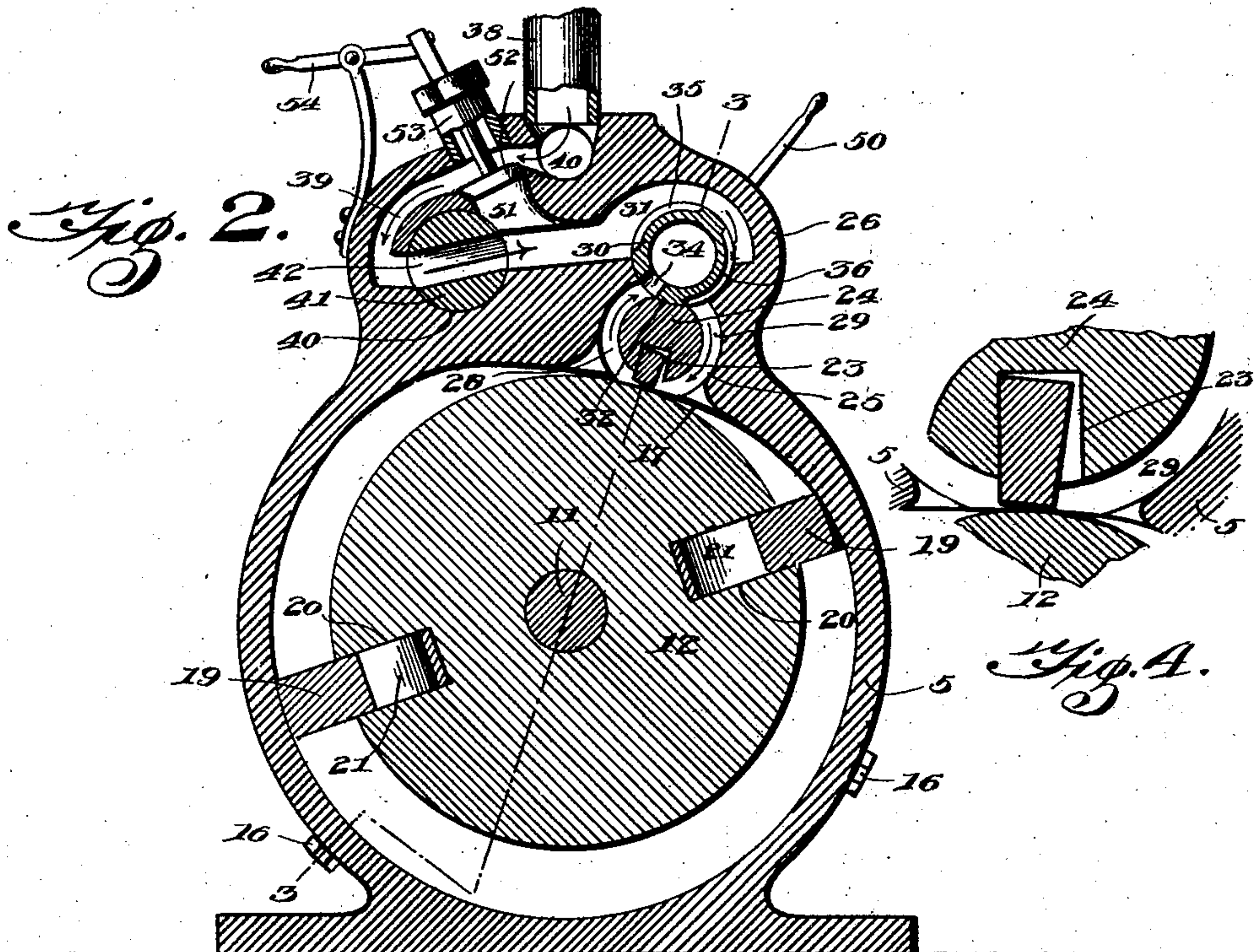
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2 Sheets—Sheet 2.



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# UNITED STATES PATENT OFFICE.

JAMES H. HOUSEMAN, OF CONRAD, IOWA.

## ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 696,047, dated March 25, 1902.

Application filed April 4, 1901. Serial No. 54,359. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES H. HOUSEMAN, a citizen of the United States, residing at Conrad, in the county of Grundy and State of Iowa, have invented a new and useful Rotary Engine, of which the following is a specification.

This invention relates to rotary engines, and more particularly to the expansion type of engines, the object of the invention being to provide a construction which will have a high efficiency, wherein the valve mechanism will be positively and accurately operated, and in which the direction of rotation of the piston may be reversed at will.

A further object of the invention is to provide for displacement of the cut-off valve when the engine is reversed, so that steam will be admitted at the proper times in both directions of movement of the piston.

Other objects and advantages of the invention will be apparent from the following description.

In the drawings, forming a portion of this specification, and in which like numerals of reference indicate similar parts in the several views, Figure 1 is a perspective view showing the complete engine. Fig. 2 is a vertical section through the engine, taken in a plane at right angles to the engine-shaft. Fig. 3 is a section on line 3 3 of Fig. 2, with the reversing-valve in its intermediate position and the piston-heads in alignment therewith; and Fig. 4 is a detail view, on a larger scale, of the abutment of the engine.

Referring now to the drawings, the engine consists of a cylinder 5, having a central expansion-chamber 6 and the reduced end portions 7 and 8, the heads 9 and 10 of the cylinder having bearings therein to receive the piston-shaft 11, these bearings being hereinafter specifically described. Upon the shaft 11 is fixed the annular piston 12, the ends of which enter the reduced end portions of the interior of the cylinder, the ends of the piston being grooved peripherally to receive packing-rings 13, which bear against the inner faces of the reduced portions of the cylinder to prevent passage of steam longitudinally of and beyond the ends of the piston, and to properly center the piston in the cylinder triangular blocks 14 are disposed in the

end portions of the cylinder and have adjusting-screws 15 connected thereto and engaged with threaded perforations in the wall of the cylinder. By rotating these screws the blocks are moved radially of the cylinder, and the piston, which rests with its ends thereagainst, is correspondingly adjusted. The expansion-chamber of the cylinder has a regular curvature concentric with the piston, excepting at the upper portion thereof and at one side of its vertical diameter, where it is flattened, as shown at 17, to touch the piston. The end walls of the expansion-chamber, resulting from the reduction of the diameter of the interior of the cylinder, are beveled, as shown at 18, to conform to the bevels at the ends of the piston-heads 19. These piston-heads consist of metal blocks slidably disposed in slots 20, formed longitudinally of the piston, and which are held normally and yieldably projected by means of the leaf-springs 21, disposed in the slots and bearing against the bottoms of the slots and the under sides of the blocks, so that the outer edges of the heads are held against the inner surface of the cylinder, the beveled formation of the heads and the ends of the expansion-chamber insuring a close fit between the contacting faces as they may wear away. When the piston in its rotation brings a head thereof to the flattened portion of the expansion-chamber, this flattened portion acts to press the head inwardly, and when the head is carried beyond the flattened portion it moves outwardly, this inward and outward movement being, of course, gradual, and as the flattened portion touches the piston it is here that the abutment of the engine is located.

The abutment of the engine is shown at 22 and consists of a plate or block, which is slidably mounted in the groove 23, formed longitudinally of a plug or core 24, which is disposed centrally in a cylindrical chamber 25 in the chest 26 of the engine, and leading around the plug or core from the upper side thereof to opposite sides of the abutment and through the wall of the expansion-chamber are the two steam passages or ports 28 and 29, which form the inlet and outlet ports of the cylinder interchangeably. Thus if steam be admitted through port 29 it will enter between the abutment and the piston-heads successively to ro-



tate the piston to the right, and when the piston-head finally reaches the abutment the steam behind it will be exhausted through the port 28, the lower portion of the wall of each of these ports being slotted, as shown in Fig. 2, to permit of exhaust of steam before the head has reached the abutment. If steam be admitted through port 28, the direction of rotation of the piston will be reversed and the steam will be exhausted through port 29.

To communicate the ports 28 and 29 interchangeably with the steam-supply and each alternately with the supply and exhaust, a cylindrical or plug valve 30 is provided and is disposed in the chamber 31 of the steam-chest in such manner as to cover the upper ends of both ports, the core 24 having a longitudinal cross-sectionally arcuate groove 32 in its upper face, which the lower face of the plug-valve enters. The plug-valve is hollow and one end thereof communicates with the exhaust-pipe 33, and in the side of the valve is a longitudinal slot or port 34, leading to the interior thereof, and which port when the valve is rocked registers with the ports 28 and 29 interchangeably to communicate them alternately with the exhaust-pipe. In the outer face of the plug-valve there are formed two steam-channels 35 and 36, which extend part way around the plug and are so disposed that when the port 34 is in registration with port 28 passage 36 is in communication with port 29 to permit of passage of steam through the passage or channel to port 29 and thence to the expansion-chamber of the cylinder. When the valve is rocked to the opposite position to communicate port 34 with port 29, then passage or channel 35 is in communication with port 28 to permit of passage of steam through the latter to the cylinder at the opposite side of the abutment from port 29.

Connected with the steam-chest is a supply-pipe 38, and between its point of communication and the chamber 31 is a passage 39, which includes an annular chamber 40, in which is disposed a rotatable plug cut-off valve 41, having a port 42 therethrough and which when in one position connects the passage-sections at opposite sides thereof, while at other times it cuts off communication between these two sections of the passage. As the port 42 is formed diametrically through the valve, the sections of the passage are of course brought into communication twice during each complete rotation of the valve, and the steam through the passage is cut off and turned on an equal number of times to correspond to the number of piston-heads carried by the piston. To rotate the cut-off valve at the same speed with the piston, so that steam may be admitted at the proper times, the engine-shaft is provided with a gear 43, meshing with a gear 44 on a stub-shaft 45 on the end of the cylinder, and which in turn meshes with a gear 46 on the protruding end of the spindle of the cut-off valve, the several gears being of equal diameters,

with the exception of the central gear, which may of course have any desired diameter. If the gears were rigid upon their shafts, the cut-off valve would always be moved to admit steam to the cylinder when the piston-heads reached the same point, and while this would be proper in one direction of rotation of the piston it would result in admitting steam in advance of each head when the engine was reversed. To prevent this, the gear 46 is mounted loosely upon the spindle of the cut-off valve and has a segmental recess therein, in which is disposed a spline or pin 48, which permits of limited movement rotatably of the gear upon the spindle, and this rotation is about forty degrees, which is equal to the angular distance between the positions of the heads at opposite sides of the abutment when steam should be admitted to drive the piston in opposite directions. Thus when the reversing-valve is operated to reverse the direction of the rotation of the piston the gear 46 has forty degrees of lost motion with respect to the valve, and the heads of the piston will thus be permitted to move past the abutment before steam is admitted. The reversing-valve is provided with a lever for operating it.

In order that the engine may be started should it stop at any time when the cut-off valve is closed, a by-pass 51 is formed around the cut-off valve and is provided with a valve 52 for opening and closing it, the stem of the valve being passed through a stuffing-box 53 and having a lever 54 for operating it.

The bearings for the piston-shaft include each a bushing 55, which is screwed into an opening 56 in a head of the cylinder and the inner surface or bore of which is tapered in the direction of the outer end of the bushing, the inner end of the bushing being partly closed by a washer 57, which encircles the shaft and bears against the end of the piston. In the bushing are disposed frusto-conical rollers in contact with the inner face of the bushing and with the shaft, and against the outer minor ends of the rollers is disposed a washer 58. A stuffing-plug 59 is screwed into the end of the bushing, and between it and the outer washer is disposed stuffing material 60.

With this construction it will be seen that there is provided a simple and durable engine the parts of which are efficiently packed, while the direction of rotation of the piston may be reversed at will.

In practice modifications of the specific construction shown may be made and any suitable materials and proportions may be used for the various parts without departing from the spirit of the invention.

It will be noted that the abutment is tapered from its upper edge downwardly, while the recess in which it is disposed has parallel sides, the greatest width of the abutment being somewhat greater than that of the recess. Thus, as shown in the drawings,



the steam-pressure against one side of the abutment acts to tilt it, so that one lower edge impinges against the piston, the steam-pressure against the upper face of the abutment acting to hold it snugly down against the piston. When the direction of rotation is reversed in the manner above described, the steam-pressure moves the abutment to the other side of the recess and tilts it oppositely, as will be understood.

What is claimed is—

1. In a rotary engine, the combination with a cylinder including a central expansion-chamber and reduced end portions, a piston in the cylinder and having its ends disposed in the reduced portions of the cylinder, said piston having longitudinal slots therein, heads slidably mounted in the slots and having means for holding them yieldably projected and in contact with the periphery and end walls of the expansion-chamber, means for moving the heads into the piston, a chamber opening at one side into the cylinder, a plug disposed centrally in the chamber and spaced from the walls thereof to form ports leading to the cylinder, an abutment in the plug and entering the cylinder at a point between the ports, a valve-seat in the upper side of the plug, a steam-supply, a valve in the seat for communicating the ports alternately with the steam-supply, a steam-exhaust, said valve being adapted to communicate the ports with the exhaust alternately with their communication with the supply, and a cut-off valve for the steam-supply operably connected with the piston.

2. A rotary engine comprising a cylinder having a piston rotatably mounted therein, a chest for the cylinder, a chamber communicating with the chest and cylinder, a plug in the chamber and separated from the walls thereof to form steam-ports leading from the chest to the cylinder at an abutment in the plug between the ports, a hollow oscillatory plug-valve disposed in the chest and having a port opening thereinto and adapted for registration with the ports interchangeably, to communicate them with the interior of the plug, an exhaust-pipe with which the plug-valve communicates, said valve having also peripheral channels communicating with the

chest and adapted for registration with their respective ports interchangeably with the registration of the port in the plug-valve therewith, a steam-supply leading to the chest and a cut-off valve between the supply and the plug-valve and operably connected with the piston.

3. In a rotary engine, the combination with a cylinder and its piston, of an abutment, a socket in which said abutment is guided, said abutment having a widened base about equal to the width of the socket and converging side walls so disposed with respect to the socket-walls that the abutment, under pressure of the steam, will present a sharp edge or corner for contact with the periphery of the piston in both directions of movement of the engine.

4. A rotary engine comprising a cylinder having a piston therein and provided with heads, an abutment in the cylinder, a steam-chest having ports leading to the cylinder at opposite sides of the abutment, an exhaust, a valve for communicating the ports alternately and interchangeably with the chest and the exhaust, a steam-inlet for the chest, a cut-off valve between the steam-inlet and the reversing-valve and having a spindle, a gear-wheel mounted loosely upon the spindle and having a segmentally-recessed portion fitting over a spline or pin on said spindle, and gearing connecting said gear-wheels to the main shaft of the engine, substantially as specified.

5. In a rotary engine, the combination with a cylinder having openings in its ends, of bushings engaged with the openings and having their bores tapered outwardly, a piston in the cylinder and having a shaft disposed through the bushings, frusto-conical rollers disposed between the shaft and bushings, and stuffing-glands engaged with the bushings, said glands and rollers having washers disposed therebetween.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

JAMES H. HOUSEMAN.

Witnesses:

JOHN MORROW, Jr.,  
J. T. HOUSEMAN.