(No Model.) 2 Sheets—Sheet 1.

J. WALKER.

ROTARY ENGINE.

No. 556,227. Patented Mar. 10, 1896.

Fig. 1

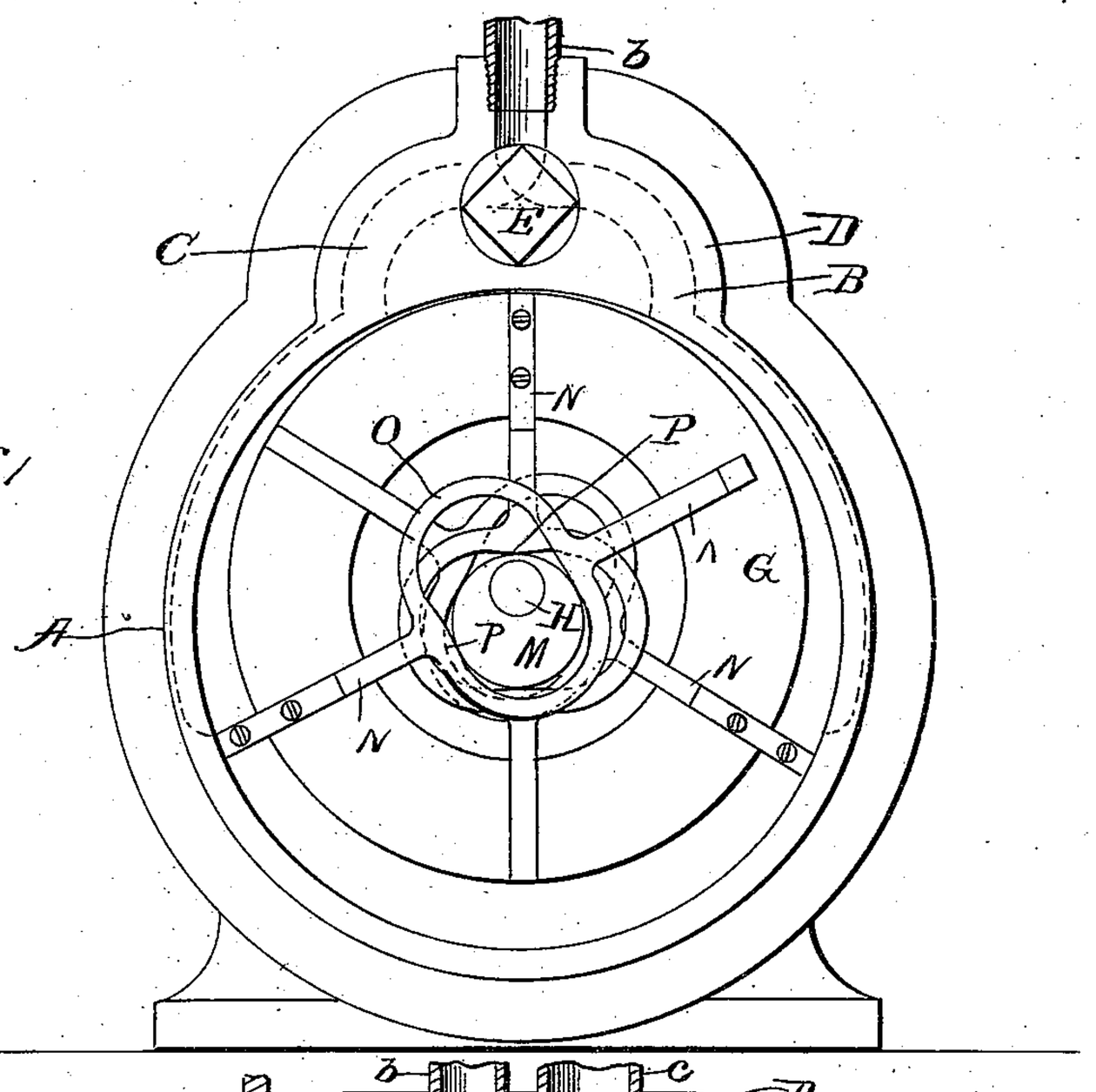
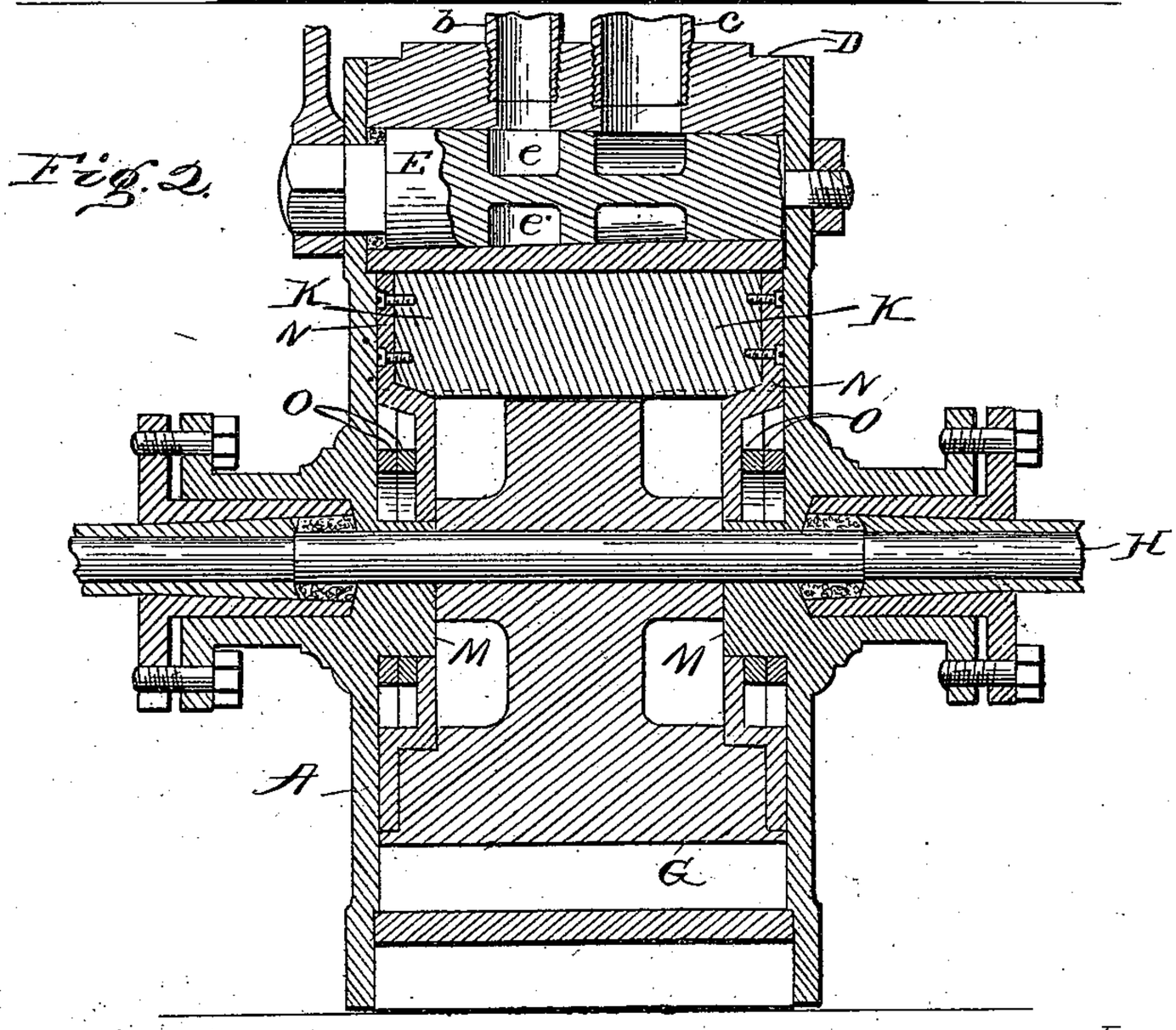


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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ROTARY ENGINE.

No. 556,227. Patented Mar. 10, 1896.

Fig. 4.

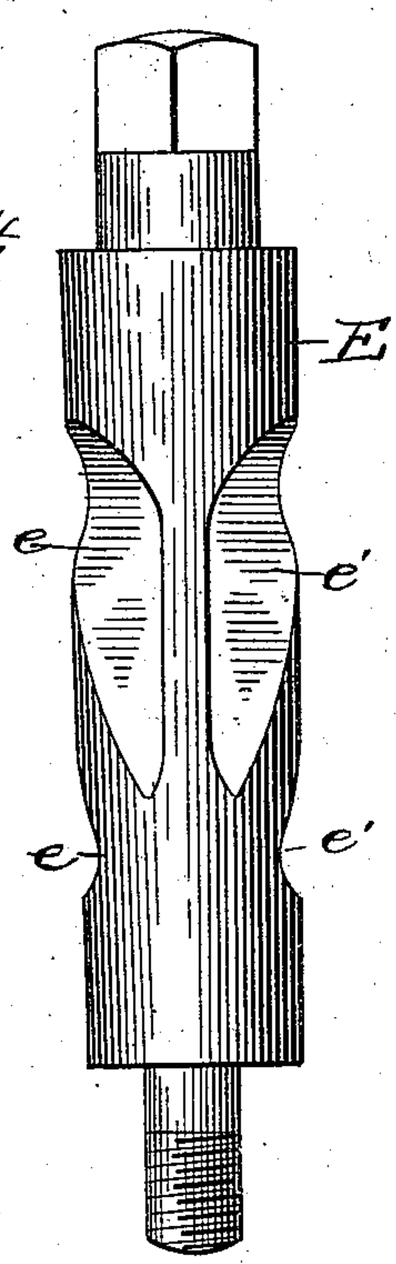
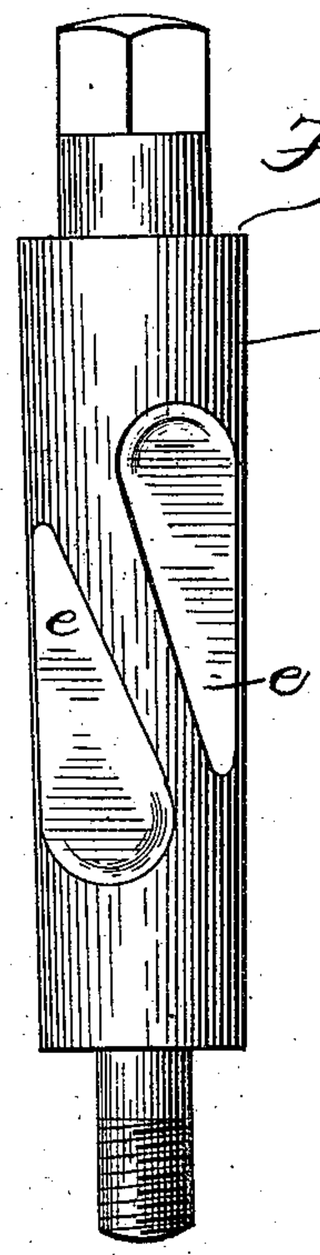
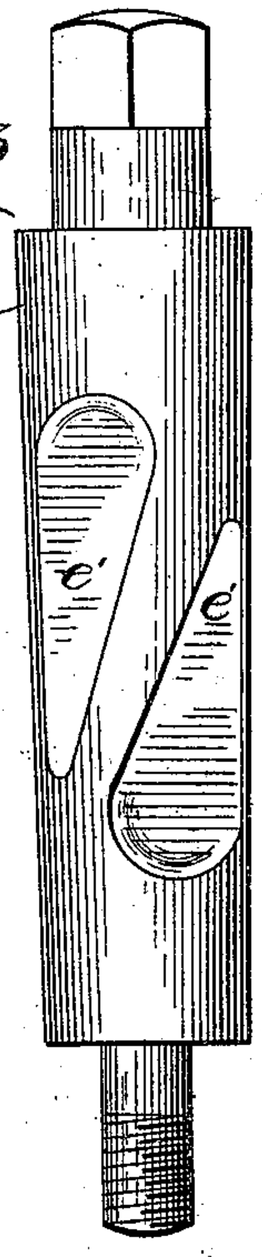


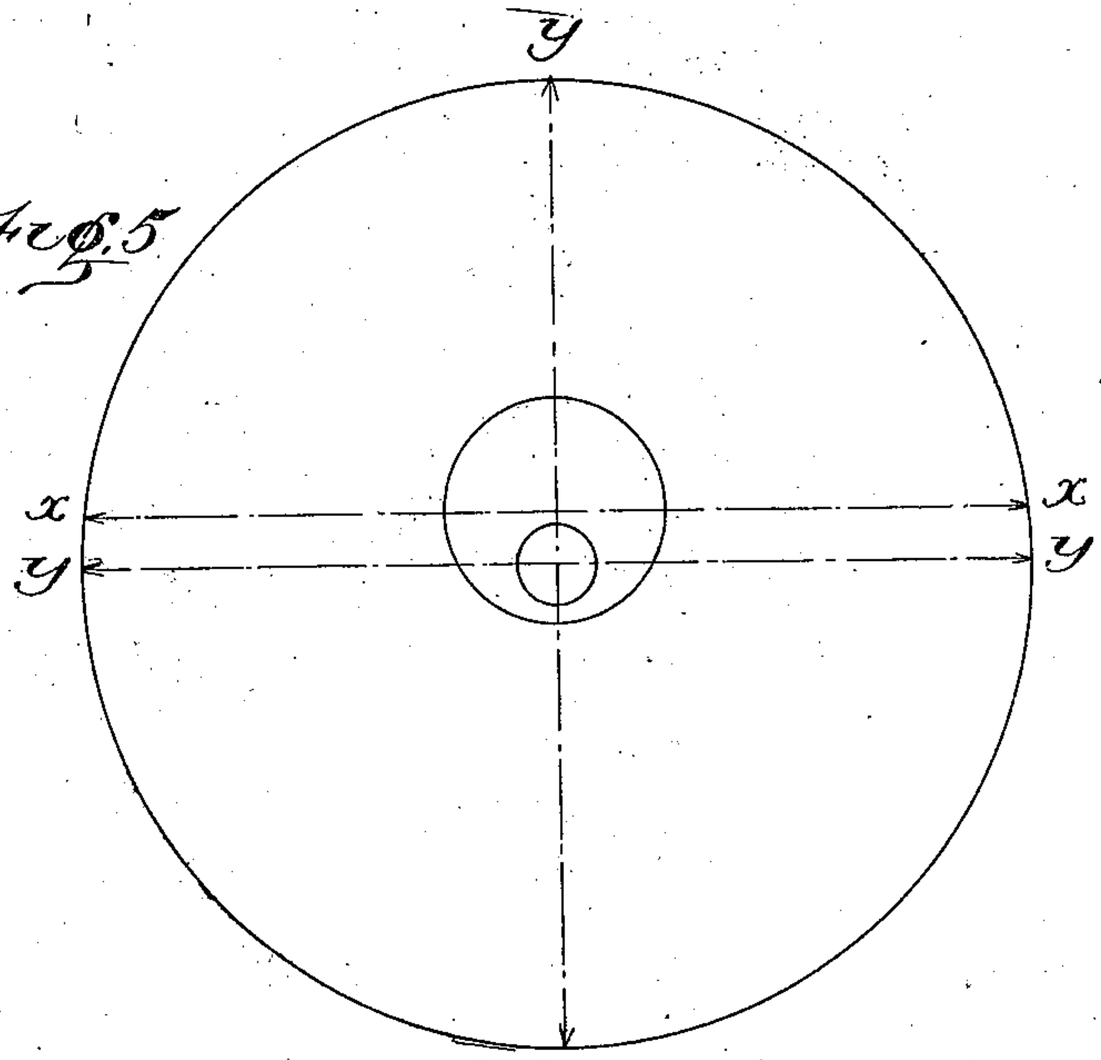
Fig. 3





y

Fig. 5



y

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UNITED STATES PATENT OFFICE.

JOSEPH WALKER, OF CLARK'S GREEN, ASSIGNOR, BY DIRECT AND MESNE ASSIGNMENTS, OF A PART TO HORATIO N. PATRICK AND GEORGE W. BEEMER, OF CLARK'S SUMMIT, PLUMMER S. PAGE, CASSIUS C. STACKHOUSE, FRANK H. JERMYER, G. M. CARPENTER, F. E. STONE, AND P. S. PAGE, OF SCRANTON, EDWARD MILES, OF DALTON, AND GEORGE E. STEVENSON, OF WAVERLY, PENNSYLVANIA.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 556,227, dated March 10, 1896.

Application filed June 27, 1895. Serial No. 554,235. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH WALKER, of Clark's Green, in the county of Lackawanna and State of Pennsylvania, 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 same, reference being had to the accompanying drawings, forming a part of this specification, and to the letters of reference marked thereon.

This invention relates to improvements in rotary engines, and especially, though not exclusively, to the type of eccentric-cylinder engines, the prime object being to provide a construction wherein a steam-tight joint between the ends of the abutments and inner circumference of the cylinder is insured without creating friction and without the necessity of employing expansible abutments or spring-packings to compensate for the inequality in the diameter of the cylinder taken in the line of the abutment when at different points in their rotation, due to the eccentric position of the shaft and cylinder with relation to each other.

A further object is to provide a compact structure wherein the number of joints through which steam may leak, so as to produce an injurious effect, is reduced to the minimum, and a structure wherein the piston may be rotated in either direction at will and with equal power.

Referring to the accompanying drawings, Figure 1 is a sectional elevation of a rotary engine embodying my present invention. Fig. 2 is a section at right angles to Fig. 1. Fig. 3 is an elevation of the reversing-valve shown as though cut in half and the circumference of both halves turned toward the observer. Fig. 4 is an elevation at right angles to Fig. 3. Fig. 5 is a diagrammatic illustration of the differences in diameter of the circumference of the cylinder which must be compensated for in order to secure a steam-tight bearing between the ends of the abutments and inner circumference of the cylinder.

Like letters of reference in the several figures indicate the same parts.

The letter A indicates the cylinder proper, which is preferably struck on a true circle and provided with ports B and C at the top, these ports being adapted to serve one as the inlet and the other as an exhaust port, depending of course upon the direction of rotation of the piston. The ports B and C lead up to a valve-casing D and terminate at diametrically-opposite points therein, as shown in Fig. 1. The exhaust and live-steam pipes *b* and *c* open into the valve-casing at the top, one being located in front of the other—that is to say, in the structure shown the live-steam pipe *b* is located in front of the exhaust-pipe *c*, as will be seen by reference to Fig. 2. The valve-casing D contains a valve E of the rotary type, Figs. 3 and 4, having on diametrically-opposite sides recessed or cut-out portions *e e'* respectively arranged in opposite positions with relation to each other. This construction of valve opens the port on one side to the exhaust and the port on the opposite side to live steam when the valve is in one position, and when turned half-way over it reverses the conditions—that is to say, the port formerly open to exhaust is now connected with the live-steam pipe and the port formerly connected with the live steam is now open to exhaust.

The valve is so proportioned as that when turned to an intermediate position the live-steam port will be completely closed by the body of the valve, and hence with a single rotary valve I can stop or start the engine in either direction.

In engines of the character illustrated a rotary piston G is journaled within the cylinder, being preferably mounted rigidly on a drive-shaft H, which extends through the cylinder-heads in suitable bearings and is packed in the ordinary manner. This shaft

is eccentric to the inner circumference of the cylinder, and as a result the piston runs at one side in immediate proximity to the inner circumference of the cylinder, and so constitutes what might be called the "fixed abutment" between which and the movable abutments the force of the steam is expended in rotating the piston.

The movable abutments (lettered K) are mounted in radial slots in the piston, being preferably three in number, disposed regularly in the circumference of the piston, and adapted to be projected so as to bear lightly against or be so close to the inner circumference of the cylinder as that practically no steam can escape between the two.

By providing three movable abutments I am enabled to secure the full steam-pressure on one of the abutments all the while by extending the ports for the inlet and exhaust steam down to a point on each side where two adjacent abutments will simultaneously pass said ports. Thus, as illustrated in Fig. 1, as the abutment on the left-hand side passes the live-steam port and the steam enters behind the same, the abutment on the left-hand side passes the exhaust-port and the steam between the abutments is given a free vent. This condition holds good with the full steam-pressure on the abutment on the right until it reaches the exhaust-port, when the third abutment will have reached the live-steam port, and so on.

The abutments, it will be observed, in this class of engine in order that they may work without packings in the piston must work in slots radial to the shaft or center of rotation of the piston, and when this is so the abutments throughout a portion of their revolution do not cross the center of the cylinder, as will be seen from the diagram Fig. 5, wherein the line $x\,x$ shows the position of the abutment and the line $y\,y$ the center of the cylinder. Hence it follows that throughout that portion of the revolution of the piston in which the abutments are not radial to the cylinder they would, under ordinary circumstances, be in contact with the inner circumference of the cylinder and throughout that portion of their rotation, during which they are radial or approximately radial to the cylinder, there would be a space between the ends of the abutment and the inner circumference of the cylinder. This would occasion a binding of the abutments throughout a portion of their revolution and a looseness which would allow of considerable leakage throughout the other portion of their revolution, and in engines as heretofore constructed the difficulty has been overcome in two ways, the most common being to arrange the abutments radial to the cylinder and allow them to pivot or work laterally in the piston, packings being provided to allow of such movement, and, secondly, the abutments have been arranged, as in the present instance, radial to the piston, and springs or spring-pressed packings have been provided for holding the end of the abutment against the inner circumference of the cylinder.

In the latter instance the spring-pressure causes an undue amount of friction between the ends of the abutments and inner circumference of the cylinder, wearing both of these surfaces away rapidly and in a short while making the engine wasteful and useless.

In the present instance I have designed a mechanism which will hold the abutments in such intimate relation to the inner circumference of the cylinder as to form practically steam-tight bearings, and at the same time I hold the abutments in check and absolutely prevent any grinding of the same against the cylinder, and to accomplish this I provide abutment-operating eccentrics M, held against rotation by being connected rigidly with the heads of the cylinder, if so desired, and on the inner ends of the abutment-operating arms N, I provide yokes O, which surround the eccentric. These yokes have been provided before in connection with spring-pressed abutments or packings, but in the present instance the yokes are so shaped as that the abutments are slightly withdrawn during that portion of the revolution wherein the abutments are tangential to the center of the cylinder and allowed to project, or more properly are positively projected, a slightly greater distance when the abutments are radial or approaching a radial position to the center of the cylinder.

The particular shape of the yokes, it will be seen from Fig. 1, consists in giving them a slight projection or re-entrant curved bearing-surface at the point P on the side immediately beneath the abutment and a corresponding recess on the opposite side, the whole effect being to form a yoke with a slightly-curved aperture, in which the eccentric works. Thus, as the eccentric works from the central point toward either end of the yoke, the abutments are retracted to a slightly-greater extent than when the eccentric is at the central position, the result being, as before stated, that the ends of the abutments are held in intimate relation to the inner circumference of the cylinder without, however, grinding against the same or being permitted to recede far enough to allow of the leakage of steam past the abutment.

The eccentric has a rolling contact with the yoke, and there is consequently but very slight friction at this point, and by eliminating the friction from the ends of the abutments it is found that the engine may be run continuously and at a very high speed without deterioration.

In the preferred construction of engine and as illustrated the bodies of the abutments only extend inward a relatively short distance, and at each end they are rigidly connected with and are adapted to be moved by the said arms

N, the latter being at the center superposed one upon the other so as to all co-operate with the same eccentric. Fig. 2 shows these arms with the yokes or central portions superposed one above the other and the ends of the inner arms deflected outward, so as to lie in slots in the ends of the piston with their outer faces flush with said ends and in position to form steam-tight bearings against the heads of the cylinder.

The whole construction is cheap and simple in the extreme, there being no complicated parts to get out of order or be worn by the rapid rotation of the piston.

Having thus described my invention, what I claim as new is—

1. In a rotary engine, the combination with the cylinder and rotary piston therein, of the two ports leading to opposite sides of said cylinder, a valve-casing into which said ports open at opposite points in the same plane and exhaust and live-steam passages opening into said casing in line with each other, of a rotary valve in said casing having the two independent oppositely-arranged channels on diametrically-opposite sides for opening communication between either one of the two cylinder-passages and either one of the live-steam or exhaust ports; substantially as described.

2. A valve for rotary engines consisting of the rotary body having on each of the diametrically-opposite sides thereof two external channels or cut-out portions leading from the ends in opposite directions toward the center, whereby inlet and exhaust ports arranged in line with each other may be connected with either one of the diametrically oppositely-arranged cylinder-ports located centrally of the valves; substantially as described.

3. In a rotary engine the combination with the cylinder, the rotary piston and the eccentric of the longitudinally-movable abutments in said piston and the yokes having the re-entrant curved bearing-surfaces co-operating with said eccentric for operating the abutments, substantially as described.

4. In a rotary engine, the combination with the cylinder, the piston eccentrically arranged therein and the eccentric, of the abutments mounted in bearings radial to the center of rotation of the piston and the yokes having the re-entrant curved bearing-surfaces co-operating with the eccentric for operating the abutments; substantially as described.

5. In a rotary engine, the combination with the cylinder, the rotary piston mounted therein and having the series of radial abutment-slots and the stationary eccentrics at each end of said piston, of the abutments mounted in the abutment-slots and the abutment-operating arms connected with the ends of said abutments and having the superposed yokes at their central portions surrounding the eccentric and having the re-entrant curved bearing-surface; substantially as described.

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