No. 667,414. Patented Feb. 5, 1901.

W. N. WHIPPLE.

ROTARY ENGINE.

(Application filed Mar. 19, 1900.)

(No Model.) 2 Sheets—Sheet 1.

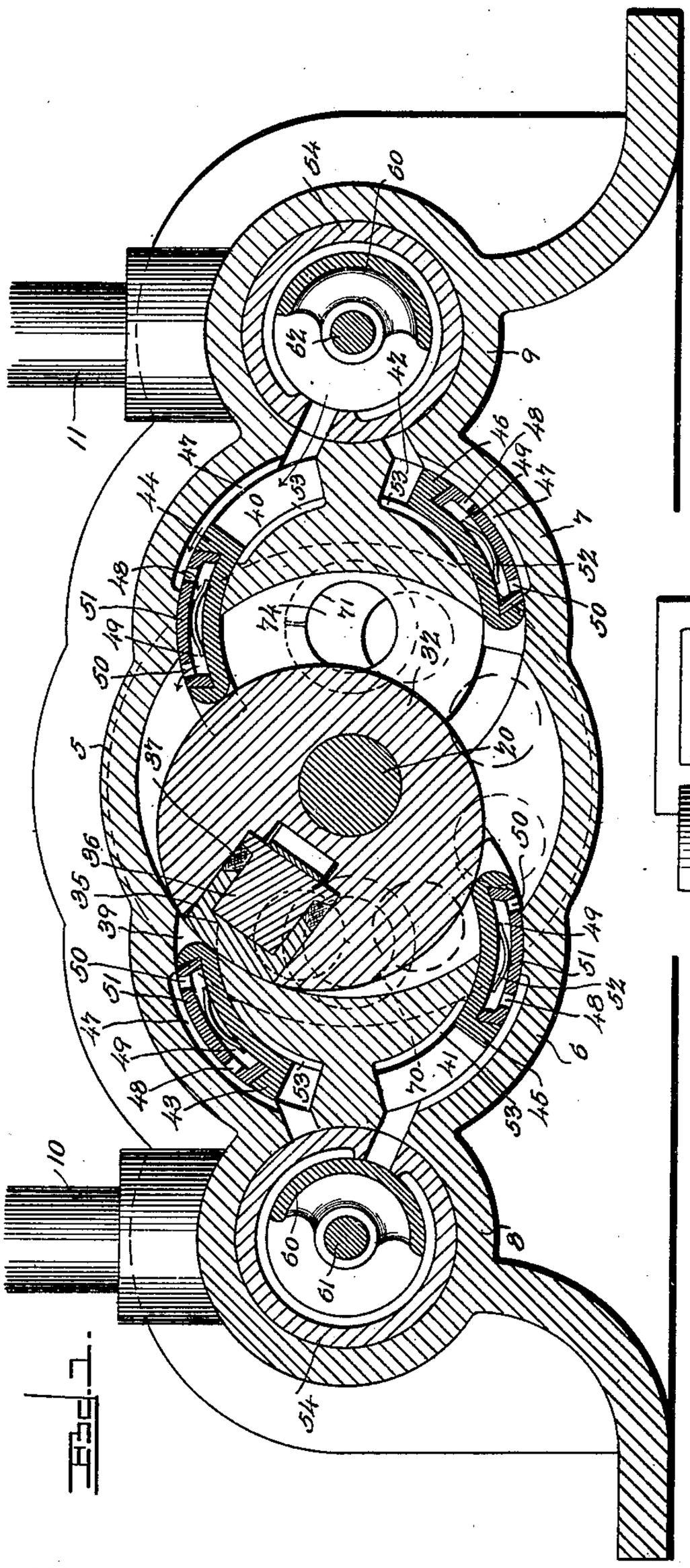

Fig. 1.

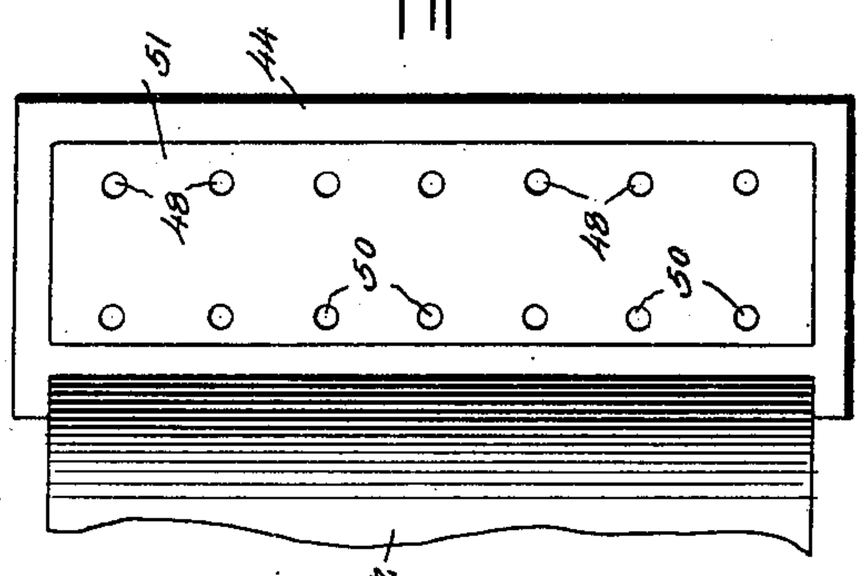

Fig. 3.

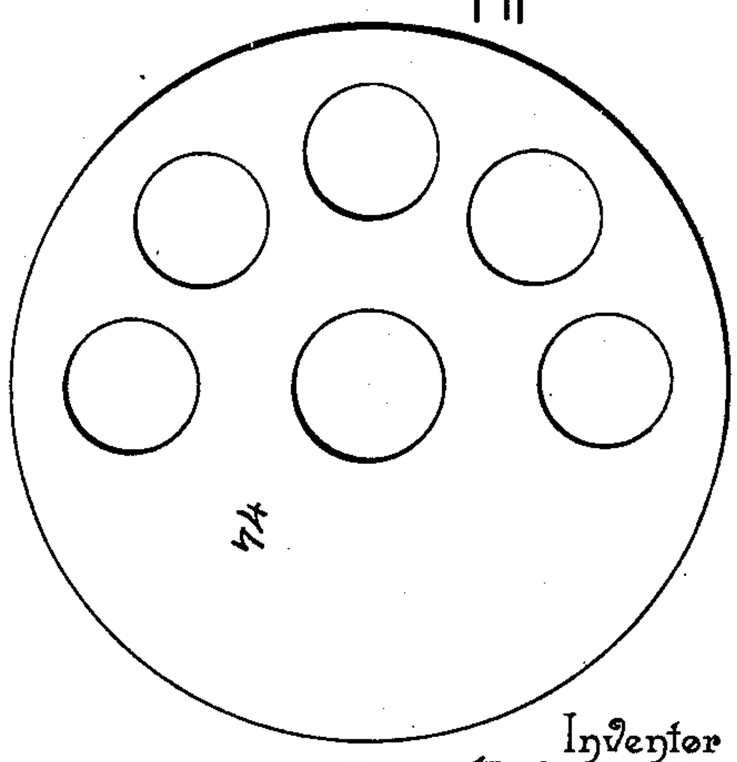

Fig. 4.

Witnesses

E. K. Stewart.

Geo. H. Chandlee

By his Attorneys,

Inventor

W. N. Whipple

Church & Co.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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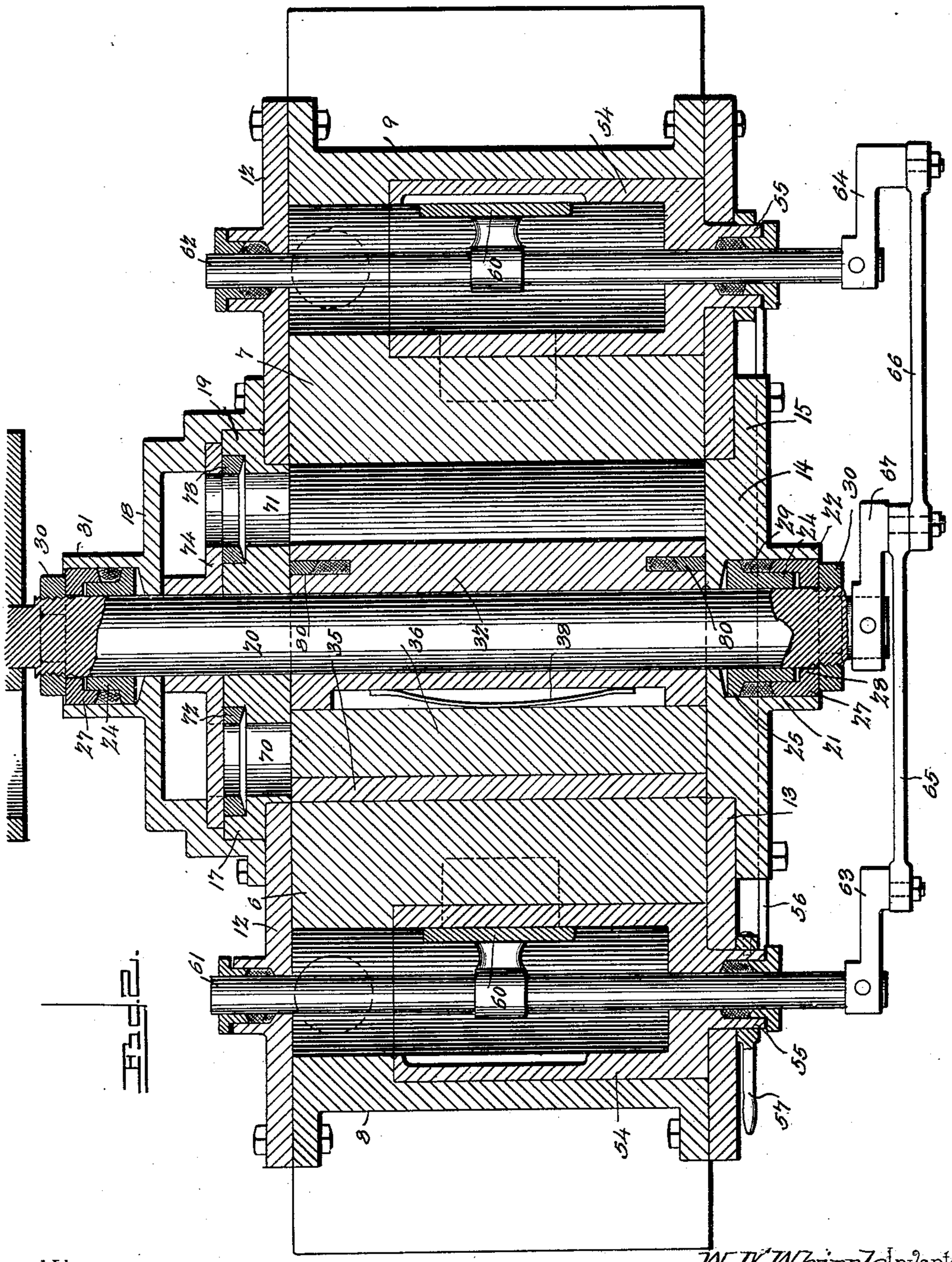

Fig. 2.

Witnesses
E. F. Stewart.
Geo. H. Chandlee

W. N. Whipple Inventor.

By his Attorneys,
Cushman & Co.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM N. WHIPPLE, OF AUBURN, NEW YORK.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 667,414, dated February 5, 1901.

Application filed March 19, 1900. Serial No. 9,312. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM N. WHIPPLE, a citizen of the United States, residing at Auburn, in the county of Cayuga and State of New York, have invented a new and useful Rotary Engine, of which the following is a specification.

This invention relates to fluid-pressure motors in general, and more particularly to that class adapted particularly for operation by steam, and has specific reference to rotary engines, one object of the invention being to provide a construction in which there will be attained a high efficiency and in which the abutments will be operable in one direction by steam-pressure and will be moved in the opposite direction by the rotary piston, a close fit of the parts being thus effected and leakage prevented.

A further object of the invention is to provide an arrangement of valve which will permit reversal of the engine and also to so construct and arrange the various parts that the parts will run smoothly, with a minimum of wear and with little loss of energy due to steam-leakage.

Other objects and advantages of the construction 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 vertical longitudinal section taken through the engine. Fig. 2 is a longitudinal horizontal section taken through the engine and showing portions in elevation. Fig. 3 is a plan view of one of the movable abutments and showing it in contact with the rotatable piston. Fig. 4 is an elevation of the rotary disk for cutting off the exhaust.

Referring now to the drawings, the engine of the present invention comprises a cylinder 5, having radially-extending portions 6 and 7 to receive the movable abutments, and these portions 6 and 7 in turn communicate with valve-casings 8 and 9, to which lead the steam-supply pipes 10 and 11. A plate 12 at one side of the engine covers the adjacent ends of the abutment-casings and valve-casings, while a second plate 13 covers the ends of the abutment-casings and valve-casings at the opposite side of the engine. The plates 12 and 13 have openings therein, which register with the ends of the cylinder 5, and the opening in plate 13 is closed by a cylinder-head 14, which enters the opening and lies flush with the inner face of the plate, said head having a radial flange 15, which lies against the outer face of the plate and is secured thereto by means of screws in the usual manner. In the opening in plate 12 is disposed a similar head 17, which is held in place by means of a cap 18, which engages the outer face of the flange 19 of the head 17, this cap 18 being in turn held in place by screws, as shown.

Openings are formed in the cylinder-heads 14 and 17 and also in the cap 18, these openings being in axial alinement mutually and with the cylinder 5, and through these openings is passed the engine-shaft 20. The bearings for the shaft 20 are carried by the head 14 and the cap 18, respectively. The bearing in the head 14 is formed by countersinking the outer end of the opening therethrough, as shown at 21, and forming an annular flange 22, surrounding the countersink, with its inner face forming a continuation of the inner face of the countersink. In the countersink 21 is disposed a collar or gland 24, which tightly encircles the shaft and having a flange 25 upon its outer face and at its inner end, this flange fitting the countersink. A second collar or gland 27 is disposed to receive the outer end of the collar or gland 24 and has an exterior diameter to fit snugly within the countersink, while at its outer end it has an inner peripheral flange 28, which tightly encircles the shaft. Between the flange 25 and the inner end of the collar or gland 27 is disposed a packing-ring 29, and thus as the collar 27 is moved in the direction of the flange the packing is expanded radially and is packed to prevent leakage of steam between the collar or gland 27 and the wall of the recess in the cylinder-head. The shaft turns directly against the collars, which latter are of cast-iron or other suitable material, and the packing does not come in contact with the moving parts, so that its life is preserved. To thus compress the packing, a nut 30 is screwed upon the shaft and directly engages the collar 27. In this construction the gland 24 is of more durable material than the cylinder-head and may be readily replaced when it

has become worn to an extent to permit leakage between it and the shaft. The slidable sleeve 27 may be operated to compress the packing when required. It will be noted also that the flange 28 of the sleeve 27 lies closely upon the shaft.

The bearing upon the cap 18 is in all respects the same as that just described, the bearing, however, being located wholly within a flange 31 upon the cap, as illustrated.

Within the cylinder 5 is a cylindrical piston 32, which is eccentrically mounted upon the shaft 20 and is of such diameter and has such arrangement that it touches with its line of greatest eccentricity the inner face of the cylinder. To maintain this engagement by compensation for wear, a slot 34 is formed longitudinally of this portion of the cylinder, and in the slot is slidably disposed a packing rod or plate 35, which is U-shaped in cross-section and sets upon a block 36 therebelow, this block 36 having its outer portion narrowed to receive the packing-plate, while its lower portion is broadened to slidably fit the slot. Between the outer faces of the broadened portions, which form, in effect, flanges, and the inner ends of the plate 35 are disposed packing-strips 37, of yieldable packing, and the plate and block are held yieldably projected into proper operative positions by a bow-spring plate 38, which bears at its ends against the bottom of the slot 34 and presses with its bow against the block 36.

In each of the abutment-casings 6 and 7 there is formed an arc-shaped passage 39 and 40, opening into the upper portion of the cylinder, and an additional arc-shaped passage 41 and 42, respectively opening into the lower portion of the cylinder, the points of communication of these passages with the cylinder being equidistant peripherally of the cylinder and the passages of each casing being portions of a common circle.

In each passage 39, 40, 41, and 42 there is disposed a segmental abutment 43, 44, 45, and 46, respectively, and these abutments are adapted for slidable movement into and out of the cylinder. The outer ends of the abutments rest directly against the rotary piston at times, and they are projected into these positions by the steam which is fed to the cylinder. To secure this projection of the abutments, the valve-casings 8 and 9 communicate with the cylinder through the abutment-passages, so that the steam may exert direct pressure against the inner ends of the abutments and force them outwardly and into the cylinder. In the outer face or wall of each of the abutment-passages is formed a steam-channel 47, and with this channel communicates a port 48 in the outer face of the adjacent abutment. This port leads to a longitudinal steam-passage 49 in the abutment, and from this passage leads a discharge-port 50 in the outer face of the abutment and near its outer end, so that when the abutment is projected into the cylinder to the proper extent the steam in the abutment-passage may flow directly into the cylinder. The ports 48 and 50 are formed in a plate 51, which is slidably disposed in each abutment and is held pressed outwardly by means of bow-springs 52, and thus is a steam-tight joint maintained between the abutment and the passage in which it slides. Additional steam-passages or slots 53 are formed in the inner faces of the abutment-passages, so that pressure against the sides of the abutment may be equalized and binding of the abutment be prevented. The abutments are returned from their projected positions by pressure of the piston in rolling thereagainst, it being understood that when the engine (illustrated in Fig. 1) is rotated to the left the steam-supply is cut off from the passages 39 and 42 and is admitted only to passages 40 and 41. To thus cut off the supply-steam, the valve-casings 8 and 9 are formed cylindrical, and in these casings are disposed hollow cylindrical linings 54, each of which has a longitudinal slot which is adapted to register with the upper and lower abutment-passages alternately. These linings, which are in effect reversing-valves, are each provided with a hollow trunnion 55, which is passed through the plate covering one end of the casing, and upon this trunnion is mounted an operating-crank. The cranks of the two trunnions are connected by a connecting-rod 56, and a handle 57 is provided for reciprocating the rod to operate the valves simultaneously. The valves are so set that when the upper abutment-passage at one side is in communication with the cylinder the lower passage at the other side will also be in communication. The valves may be also operated to rock the valves into positions to cut off all flow of steam to the cylinder, and thus stop the engine.

From the above description it will be seen that if steam be admitted through abutments 44 and 45 alternately the cylinder will be driven to the left, while if the passages of these abutments be cut off from the valve-casings and steam is admitted through abutments 43 and 46 alternately the direction of the piston will be to the right. This change in direction is accomplished by rocking the valves 54, as above described. To secure this alternate feed of steam to the members of each coöperating pair of abutments, a rotary segmental valve 60 is disposed within each cylindrical valve 54, each of these valves having a curvature of one hundred and eighty degrees. These valves are fixed upon shafts 61 and 62, having cranks 63 and 64, which are connected by means of rods 65 and 66 with a crank 67 on the shaft 20, the valves 60 being so adjusted that when one is in a position to cover the ports leading to the abutment-passages the other valve will be in a position to uncover its adjacent similar ports. In this way the valves 60 are automatically operated to properly feed and cut off the

supply of steam to the cylinders. The trunnions 55 of the valves 54 carry stuffing-boxes, in which the shafts 61 and 62, respectively, are mounted at one end, the opposite ends of the shafts having bearings in stuffing-boxes carried by the plate at the opposite side of the engine.

To provide for exhausting the spent steam from the cylinder, the head 19 has two exhaust-openings 70 and 71 therein and positioned at diametrically opposite points of the head, these openings being countersunk, as shown, to receive packing-rings 72 and 73 to form a steam-tight joint between the head and a cut-off disk 74, which is fixed upon the shaft 20 and is adapted for rotation between the head 19 and the cap 18. The openings are positioned midway between their respective upper and lower abutment-passages and the disk 74 has a series of openings 74′ therein, which extend somewhat more than half-way around the disk in the form of an arc and are adapted to communicate with both openings 70 and 71 simultaneously for a short period of rotation of the engine. This disk is positioned so that the space in advance of the point of greatest eccentricity of the piston will be in communication with the proper exhaust port or opening, and in the drawings this position is shown to be with one end of the segmental opening behind the point or in line with the point of greatest eccentricity of the piston and extending to the right.

Leakage of steam around the end of the piston is prevented by packing 80, disposed in grooves in the ends of the piston, and it is of course understood that other portions are provided with such packings as will prevent all leakage.

It will of course be understood that in practice various modifications of the present invention may be made and that any suitable materials and proportions may be used for the various parts without departing from the spirit of the invention. Furthermore, it will be noted that the abutments at their ends extend beyond the ends of the piston, these projecting portions of the abutments being adapted to slide in grooves in the side plates of the engine and in the cylinder-heads, so that the abutments will not be tipped downwardly when projected into the cylinder.

What is claimed is—

1. A rotary engine comprising a cylinder, an eccentric, rotatable piston in the cylinder, an abutment-passage, a steam-inlet communicating with the passage, and a movable arcuate abutment in the passage between the inlet and the inclosure of the cylinder, whereby it may receive steam-pressure to force it into the cylinder and against the piston, said abutment having a movable plate at its convex side provided with ports, a steam-passage through the abutment, and communicating with the ports, one of said ports being positioned to lie within the cylinder and direct steam against the piston and between it, the cylinder-face and the abutment.

2. A rotary engine comprising a cylinder, a rotatable piston in the cylinder, arcuate abutments for coöperation with the piston and each having a movable plate at its convex side having ports, steam-supply passages through the abutments and communicating with the ports, means for supplying steam to the abutments to project them and subsequently rotate the piston, means for moving the plates of the abutments outwardly to pack the abutments and means for cutting off the supply of steam to the abutments to permit them to return under pressure of the piston.

3. A rotary engine comprising a cylinder, an eccentric piston rotatably mounted in the cylinder to receive pressure, abutment-passages communicating with the cylinder, steam-inlets communicating with the passages, arcuate abutments in the passages and having their convex sides including movable plates having steam-inlets therein in communication with the passages to supply steam to the abutments, outlets in the plates to supply to the cylinder, means for supplying steam to the passages, and means for cutting off the supply of steam to the passages alternately to permit the abutments to move from the cylinder.

4. A rotary engine comprising a cylinder, an eccentric, rotatable piston in the cylinder, and a movable abutment for coöperation with the piston, said abutment having a recess in one face, a plate slidably disposed in the recess and having steam-ports communicating with the recess, means for holding said plate outwardly against the adjacent face of its casing, and a steam-supply communicating with the recess through a port, to supply steam to the cylinder.

5. In a rotary engine, the combination with a cylinder of a piston rotatably mounted therein, said piston being disposed eccentric to the cylinder to move in contact with the inner face of the latter and having a longitudinal groove at its point of greatest eccentricity, a block slidably disposed within the groove and having flanges at its base in contact with the side walls of the groove, a U-shaped plate disposed upon the outer portion of the block beyond its flange and adapted for direct contact with the cylinder-face, packing between the plate and the flange upon the block, and means in the base of the slot for pressing the block and plate outwardly against the face of the cylinder.

6. In a rotary engine, the combination with a cylinder and the heads thereof, said heads having openings to receive a piston-shaft and having recesses concentric with said openings, of a bearing-box in each recess, said box comprising a collar having an exterior peripheral flange adjacent one end, a second collar disposed slidably upon the first collar and having an interior flange, the flange of

each collar lying in the path of movement of the other collar, and a packing upon the outer face of the first collar between the exterior flange thereof and the end of the second collar, the first collar and the flange of the second collar being adapted to snugly receive the piston-shaft.

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

WILLIAM N. WHIPPLE.

Witnesses:

J. ROSS COLHOUN,

GEO. H. CHANDLEE.