(No Model.)

J. E. GUENTHER.

ROTARY STEAM ENGINE.

No. 591,130. Patented Oct. 5, 1897.

Fig. I.

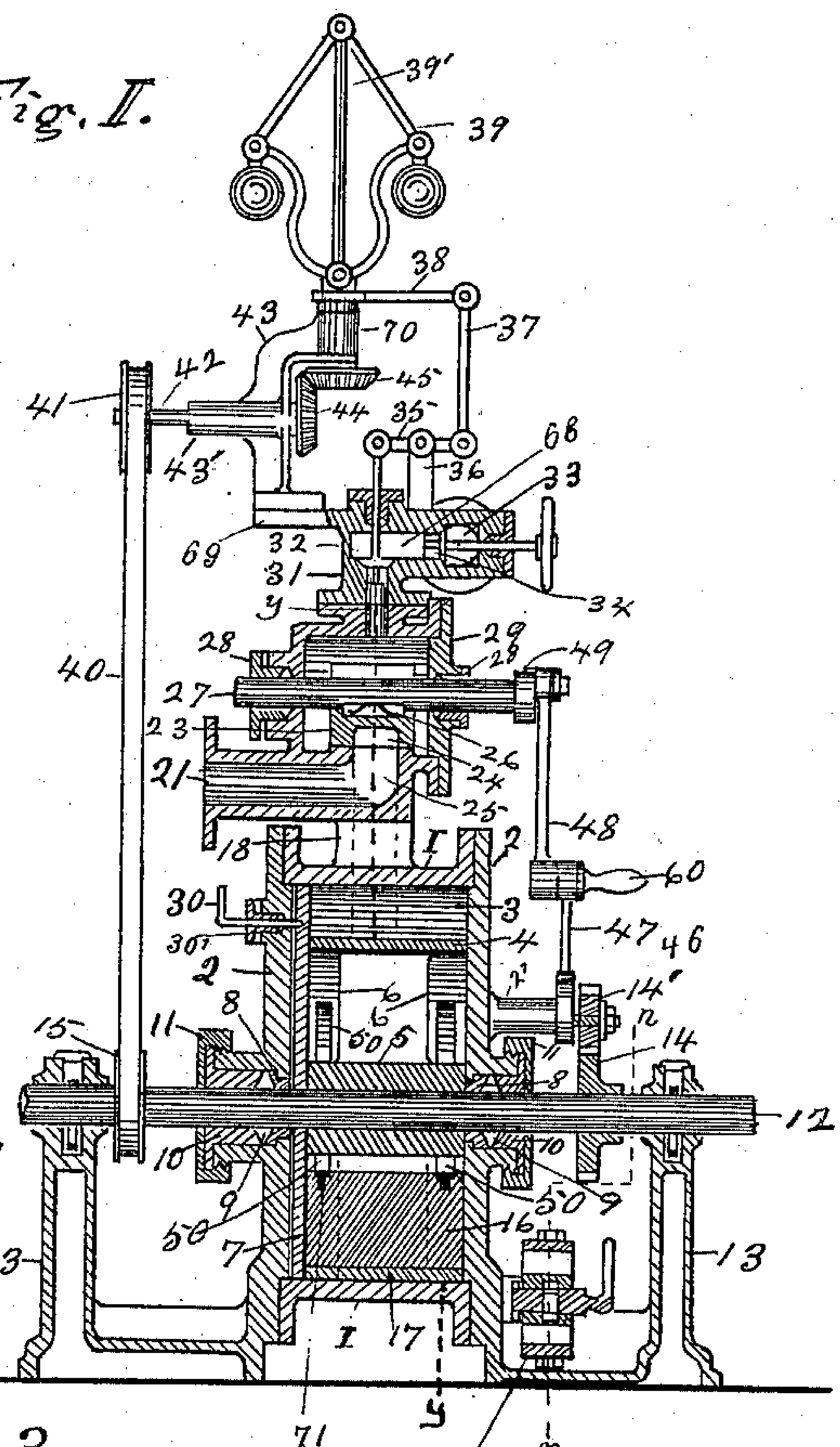


Fig. 2.

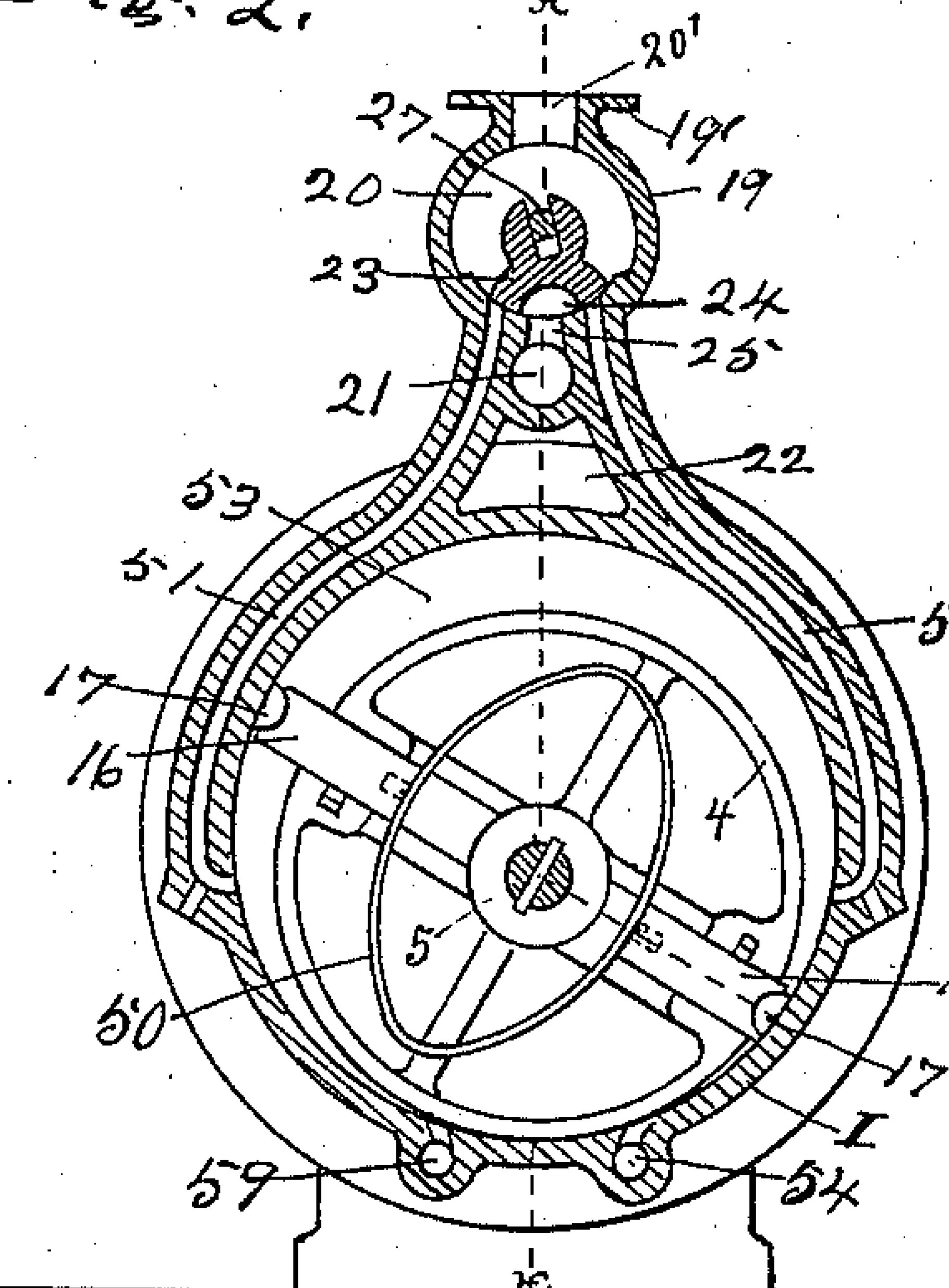


Fig. 3.

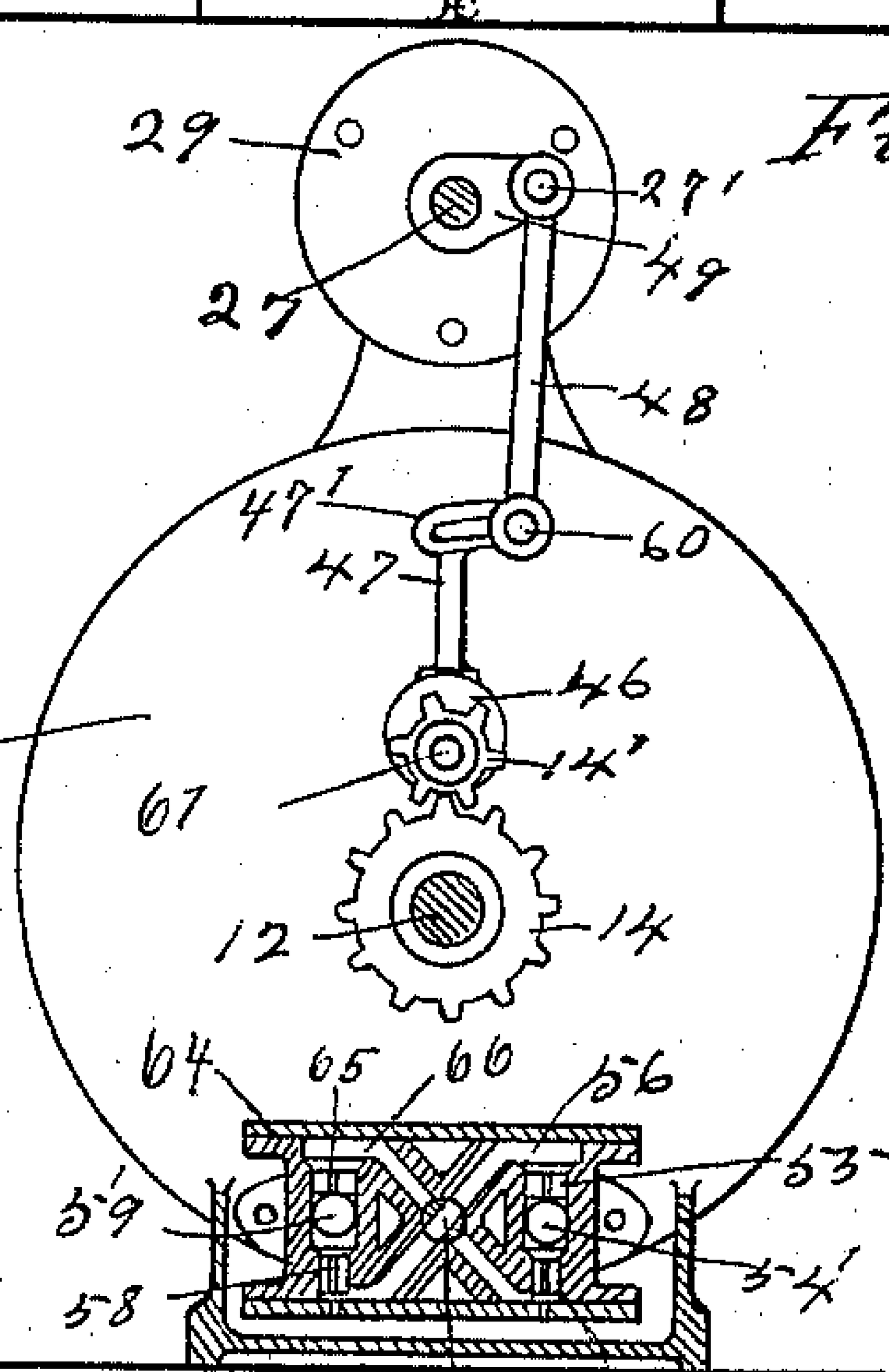


Fig. 4.

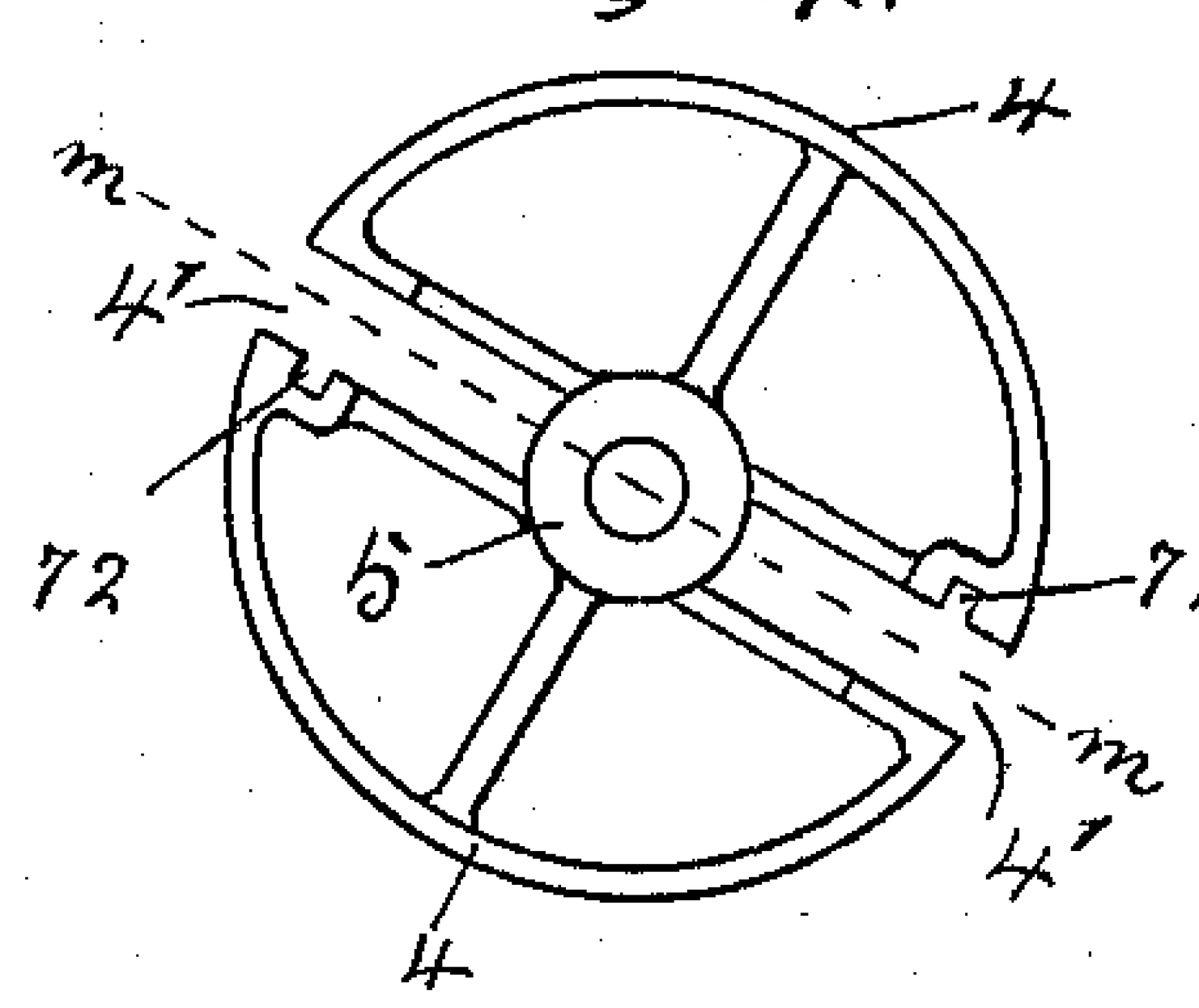
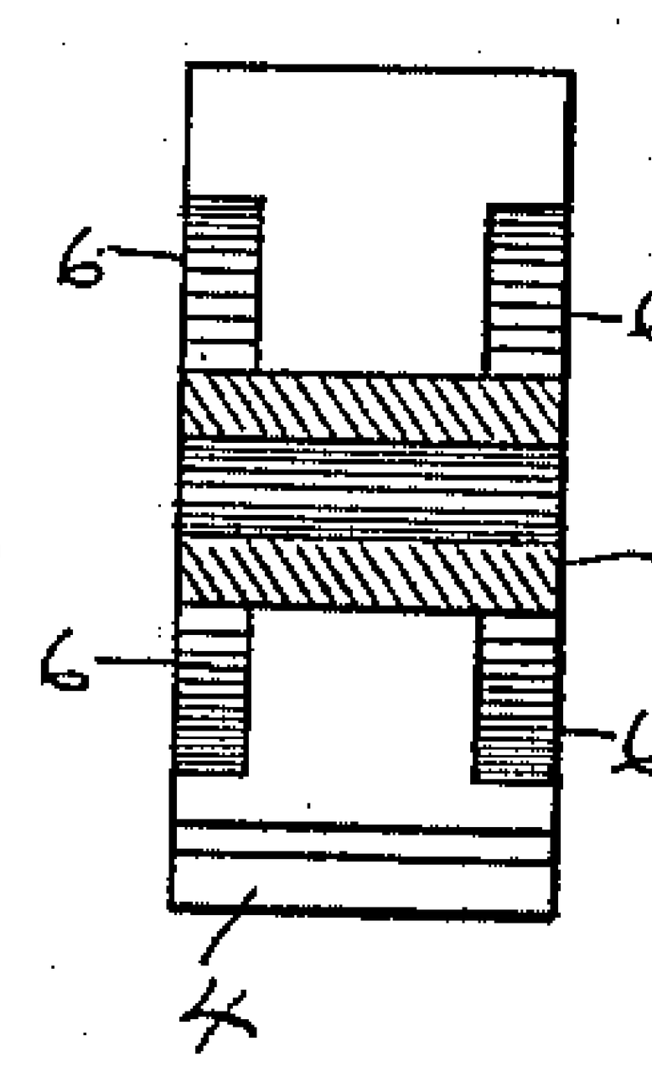


Fig. 5.



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JOHN E. GUENTHER, OF FORT WAYNE, INDIANA.

ROTARY STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 591,130, dated October 5, 1897.

Application filed December 14, 1896. Serial No. 615,571. (No model.)

To all whom it may concern:

Be it known that I, JOHN E. GUENTHER, a citizen of the United States, residing at Fort Wayne, in the county of Allen, in the State of Indiana, have invented certain new and useful Improvements in Rotary Steam-Engines; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, which form part of this specification.

My invention relates to improvements in rotary steam-engines.

The object of my invention is to provide a cheap, simple, and efficient rotary-piston engine adapted to be operated by any proper motive fluid under pressure and to conserve more power than other motors of its class, having an improved construction and arrangement of rotary working pistons, an improved rocking or oscillating cut-off valve, and improved means for utilizing a portion of the exhaust-steam.

The novel features of my invention consist in my improved rotary pistons, improved oscillating cut-off valve and means for operating the same, and my improved means for utilizing a portion of the exhaust-steam.

My invention consists of an annular cylinder having induction and eduction steam orifices and conduits and eccentric lateral openings for the main shaft; an eccentric piston-wheel concentrically fixed upon the main shaft, which is rotatably mounted in said openings; a pair of spring-pressed diametric pistons radially slidable in diametric guideways in said wheel and against which the steam-pressure is exerted circumferentially, causing rotation thereof, and having semicircular bearing-blocks upon their working faces adapted to engage the inner surface of said cylinder throughout their revolution; an oscillating or rocking cut-off valve fixed upon a rocking counter-shaft in said cylinder; a geared and pivotal connection between the main and rock shafts, and an improved means for utilizing a portion of the exhaust-steam.

Similar reference-numerals indicate corresponding parts throughout the several views, in which—

Figure 1 is a view, partly in vertical section, taken on the broken line *x x*, Fig. 2, showing the general internal construction thereof. Fig. 2 is a vertical section of the cylinder on the broken line *y y* of Fig. 1, showing the general arrangement of the cut-off valve, the supply and exhaust channels in the cylinder, the eccentric piston-wheel, and the spring-pressed pistons slidable thereon. Fig. 3 is a side elevation of that portion of my invention shown in section in Fig. 2, looking at right angles to Fig. 1, the exhaust-steam-utilizing attachment therefor being shown in vertical central section on the line *n n*, Fig. 1. Fig. 4 is a side view of the piston-wheel, showing the radial diametric guideways for the slidable pistons. Fig. 5 is an inner edge view of Fig. 4 in section on the line *m m*, showing the recessed bearing for the ends of the pistons' springs.

The annular cylinder 1, of any proper dimensions, has proper heads 2, which may be cast integral with the bed-piece, as seen in Fig. 1, and which have opposite eccentric openings for the main shaft 12, which shaft is also revolubly mounted in suitable bearings in the supporting-standards 13, which are preferably integral with the bed-piece. The bearings for the said main shaft in the said openings in the cylinder 1 are formed of the Babbitt-metal collars 8, the stuffing-boxes 9, the loose metal collars 10, having an annular flange on the outer end thereof, as shown, and the screw-threaded collars 11, adapted to fit over said collars 10, and the annular flange surrounding the shaft-openings by a screw-threaded connection and thereby secure the said collars in position.

The cylinder 1 has an upwardly-tapering extension terminated by a spherical steam-box 19, having a steam compartment or chamber 20, provided with the vertical induction-orifice 20′ and the exhaust-port 25, leading into the lateral exhaust-outlet 21. The said box 19 is closed by a centrally-apertured head 29, having an annular flange adapted to be bolted to a coincident annular flange on said box. In the opening in said head 29 and in a corresponding diametric opening in said box the rock-shaft 27 is rotatably mounted, the said opening being made steam-tight by proper stuffing-boxes 28.

On the outer extended end of the shaft 27 is fixed the rigid crank 49, Figs. 1 and 3, having a wrist-pin 27′, on which the upper end of the pitman 48 is pivoted. At a proper point on the said shaft 12 the gear-wheel 14 is rigidly fixed and is adapted for an actuating engagement with the pinion 14′, which is fixed on the short counter-shaft 61, rotatably mounted in the sleeve or bearing 2′, integral with its adjacent cylinder-head 2. The eccentric 46 is also rigidly fixed on the shaft 61, adjacent to the said pinion 14′. The arm 47, arranged in vertical alinement with said eccentric, has its lower end adapted for an actuating engagement with the perimeter of said eccentric and has its upper end provided with a slotted head 47′, in which the handle 60 is loosely mounted and in which it is adapted for longitudinal adjustment for the purpose of reversing the engine. The revolution of the said eccentric 46 thus imparts to said arm 47 a vertical reciprocating movement, which by its pivotal connection with the pitman 48 and the crank 49 imparts to the said rock-shaft 27 and the rigid cut-off valve thereon a rocking or oscillatory movement, hereinafter more fully described.

In the annular working chamber 3 the eccentric piston-wheel, having a hub 5 and an integral perimeter divided into two equal parts or sections by the diametric radial guideways 4′, is adapted for rotation by being keyed or fixed on the main shaft 12. In the said guideways 4′ the radially-slidable pistons 16 are mounted and have their inner ends secured to the opposite sides of said springs 50, elliptical in form and of sufficient strength to normally force the said pistons outwardly to the limit of their radial extension. The width of the said piston-wheel—*i. e.*, of its hub 5 and its perimeter 4—is equal to that of the working chamber 3. The pistons 16 are also of the same width. All leakage of steam at the sides of said wheel or said pistons is prevented by the tightly-fitting steam-packing plate or disk 7, arranged adjacent to one of the said cylinder-heads, and which can be tightened at pleasure by a plurality of screws 30, which pierce the said cylinder-head and enter slightly the said plate and are mounted in a proper stuffing-box 30′, Fig. 1. The opposite sides of the said guideways 4′ are provided upon opposite sides of the said hub with the recesses or notches 6, Fig. 5, adapted to receive and contain the adjacent edges of the said springs 50, Fig. 2, arranged near the opposite sides of the said pistons and adapted for an actuating engagement with said pistons by a yielding pressure against the inner ends thereof, whereby the said pistons are normally forced outwardly under the tension of said springs. The opposite sides of said guideways, and near the outer end thereof, are provided with lateral notches 72, Fig. 4, adapted to secure and contain proper steam-packing. The outer end of the said pistons is provided with a longitudinal concave recess adapted to receive and contain the adjacent convex face of the steel bearing-blocks 17, whose length is equal to the width of the said pistons, and whose outer slightly convex face bears against the perimeter of the working chamber 3. The convex surface of the said bearing-blocks 17 is thus maintained in constant coincidence with the working face of the pistons throughout their revolution, forming a steam-tight joint. The said vertical extension of the cylinder 1 is preferably provided with a lateral opening 22, having no function other than reducing the weight and material thereof. The perimeter of the said cylinder is provided with the steam-channels 51 and 52, leading from the steam-chamber 20 to the working chamber 3 on opposite sides thereof and at points below the axis of the said eccentric piston-wheel, which is so arranged in the working chamber as to leave a considerable steam-space in the upper part thereof and is adapted to form a steam-tight contact with the bottom of said chamber intermediate said steam-ports 54 and 59, whereby the said steam-space 53 will at all times be in direct communication with either the exhaust-outlet 21 or the steam-supply chamber 20 by means of the said steam-conduits 51 and 52. At or near the middle of its length the said rock-shaft 27 is reduced in size and is firmly embraced by the longitudinally-slotted top of the cut-off valve 23, Fig. 2. In the bottom of the said slot is arranged a spring 26, adapted to bear against a coincident undercut portion of said shaft for the purpose of holding the said valve firmly upon its concave seat upon the bottom of said chamber 20 throughout its rocking movements.

My improved means for utilizing a portion of the exhaust-steam consists of a separate box 64, Figs. 1 and 2, detachably mounted to one cylinder-head 2 at or near the base thereof, having steam-passages 54′ and 59′ adapted to register with the said ports 54 and 59, respectively, and having a valved connection with the steam-passages 56 and 66 by means of the respective check-valves 55 and 67 and 65 and 58. The said steam-passages 56 and 66 are provided at their intersection with a two-way check-valve 57, which is employed in a well-understood manner when the engine is reversed. By this means that portion of the exhaust-steam remaining below the lower end of the steam-conduit 52 when the same is shut off therefrom by the revolving pistons will be forced outwardly through the port 54 and will reënter the working chamber through the port 59 by means of the said valved passages 54′, 56′, and 59′. To the annular flange 19′, on the top of the said steam-box 19, is rigidly bolted the hollow casting 31, having an annular flange upon its base coincident with the said flange 19′ and provided with a horizontal steam-chamber 68, whose outlet-port is controlled by the adjustable feed-valve 34. The said chamber 68 has an

outlet vertical steam-passage registering with the said inlet-port 20′ and is controlled by the puppet-valve 32. The said casting 31 has a lateral steam-opening 33 leading to the boiler, is arranged at right angles to the chamber 68, and is connected therewith by means of said valve 34.

Upon a laterally-projecting flange 69 the upright casting 43 is rigidly bolted, having a vertical sleeve 70, in which the vertical shaft 39′ for the centrifugal governor 39 is loosely mounted, and carries upon its lower end the bevel gear-wheel 45. The said casting 43 also has an integral horizontal sleeve 43′, in which the shaft 42 is rotatively mounted, carrying upon its inner end the rigid bevel gear-wheel 44 in mesh with the said wheel 45 and carrying upon its outer extended end the fixed pulley 41, adapted to be connected with and driven by a fixed pulley 15 on the main shaft 12, in vertical alinement therewith, by the belt 40. In the top of the said casting 31 is fixed the upright bracket 36, in the slotted top of which is pivotally fulcrumed the horizontal lever 35, to the inner end of which is pivoted the vertical stem for the said valve 32, and to the outer end of which is pivoted the lower end of the lever-arm 37, whose upper end is pivoted to the outer end of the horizontal lever 38. The inner end of said lever is secured to the governor 39 and is slidable on said shaft 39′, whereby the said steam-supply valve is regulated by the said governor in the manner hereinafter more fully described.

The operation of my invention thus described is obvious and, briefly stated, is as follows: The feed or supply valve 34 being set by the operator to admit the desired amount of steam from the boiler-pipe through the opening 33, the steam enters the said chamber 68 through the valve 32 and the port 20′ into the steam-chamber 20, and thence into the working chamber 3 through the steam-channel 51, and exerts a circumferential pressure on the adjacent piston 16, causing rotation of the eccentric piston-wheel in which it is mounted, and consequently of the main shaft 12, on which said wheel is fixed. The abutment is formed by the contact of the perimeter of the piston-wheel with the inside of the cylinder at its lower portion, Fig. 2. The expansive force or tension of the said elliptical springs 50 keeps the radially-slidable pistons forced outwardly with the bearing-blocks of their working faces in contact or yielding engagement with the inner face of the cylinder. As the pistons are diametric and the piston-wheel is eccentrically arranged, whereby a considerable crescent-shaped steam-space 53 is left in the upper part of the working chamber, it is obvious that one or the other of the said pistons will at all times be under steam-pressure in said space 53, producing continuous rotation thereof. It will be seen in Fig. 2 that almost instantly after the piston 16 passes the lower end of the steam-channel 51, forming the induction-port to the working chamber, the other piston 16′ will have passed or uncovered the lower end of the steam-channel 52, forming the exhaust-port therefor, thereby permitting the escape of the exhaust-steam in the path of said piston 16, the said pistons presumably rotating to the right in Fig. 2, while at the same time a constantly-increasing supply of live steam is simultaneously admitted to the rear of said piston 16 for driving the same. When the piston 16′ has passed or uncovered the said exhaust-port, it will obviously drive before it all the remaining exhaust-steam and force it out of the port 54 through said passages 54′, 56, and 59′ and cause it to reënter the working chamber through the said port 59, thereby utilizing a large amount of exhaust-steam. As before shown, the revolution of said shaft 12 produces a corresponding rocking or oscillation of the rock-shaft 27 through its geared connection therewith, thereby oscillating the said cut-off valve 23 for the purpose of alternately covering and uncovering the upper end of the said steam-channels 51 and 52, respectively.

As shown in Fig. 2, when the cut-off valve is rocked to the right it uncovers the upper end of the steam-channel 51 for the admission of a supply of live steam from the steam-chamber 20, at the same time uncovering the upper end of the steam-channel 52 by causing it to register with the opening 24, leading to the exhaust-outlet 21. The rocking of said valve 23 to the left will of course close the upper end of both of said steam-channels.

When it is desired to reverse the engine, the operator adjusts the lower end of the piston 48 to the opposite end of the elongated slot in the head of said lever 47 by means of the handle 60, after which the rocking of the cut-off valve to the left will so uncover the said steam-channels 51 and 52 as to place the former in communication with the exhaust-port 24 and the latter in communication with the steam-chamber 20, thereby reversing the direction of the rotation of the working pistons and of the main shaft 12. The direction taken by the utilized exhaust-steam through the box 64 is also reversed.

Having thus described my invention and the operation of the same, what I desire to secure by Letters Patent is—

1. In a rotary engine, the combination of the main shaft 12; the gear-wheel 14 fixed thereon; the counter-shaft 61 carrying the fixed meshing gear-wheel 14′ and the eccentric 46; the lever-arm 47 slotted as described; the pitman 48 pivotally connecting the said lever-arm with the crank 49; the crank 49 fixed on the rock-shaft 27; the rock-shaft 27 rotatably mounted in proper steam-tight bearings in the top of the cylinder as shown; and the cut-off valve 23 fixed on said rock-shaft as described, and having an expansion-spring arranged therein to secure the said valve upon its seat, and adapted to regulate the

supply and exhaust of motive fluid to the working chamber of said cylinder, all substantially as described.

2. In a rotary engine a cylinder 1 having a chambered vertical extension provided with an induction-port, a steam-chamber for the cut-off valve, an exhaust-outlet, and steam-conduits arranged as shown connecting the said steam-chamber with the working chamber; a piston-wheel concentrically fixed on the main shaft and eccentrically arranged in said working chamber, provided with diametric guideways for the pistons, and adapted to form an abutment by the contact of its perimeter with the inside of the cylinder; a pair of rotatable spring-pressed diametric pistons radially slidable in said guideways, and against which the motive pressure is exerted circumferentially in a crescent-shaped steam-space in the upper portion of the working chamber; and a pair of elliptical springs arranged in said wheel as described, and having their sides secured to the inner end of said pistons and adapted to normally force the said working pistons outwardly, in combination with the main shaft 12; the gear-wheel 14 fixed thereon; the counter-shaft 61 carrying the meshing gear-wheel 14′ and the eccentric 46; the lever-arm 47 slotted as described; the pitman 48 pivotally connecting the said lever-arm with the crank 49; the crank 49 fixed on the rock-shaft 27; the rock-shaft 27 rotatably mounted in proper steam-tight bearings in the top of the cylinder as shown; and the cut-off valve 23 fixed on said rock-shaft as described, and having an expansion-spring arranged therein to secure the said valve upon its seat, and adapted to regulate the supply and exhaust of motive fluid to the working chamber, all substantially as described.

Signed by me, at Fort Wayne, Allen county, State of Indiana, this 8th day of December, A. D. 1896.

JOHN E. GUENTHER.

Witnesses:

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IDA L. ROSS-LEWIN.