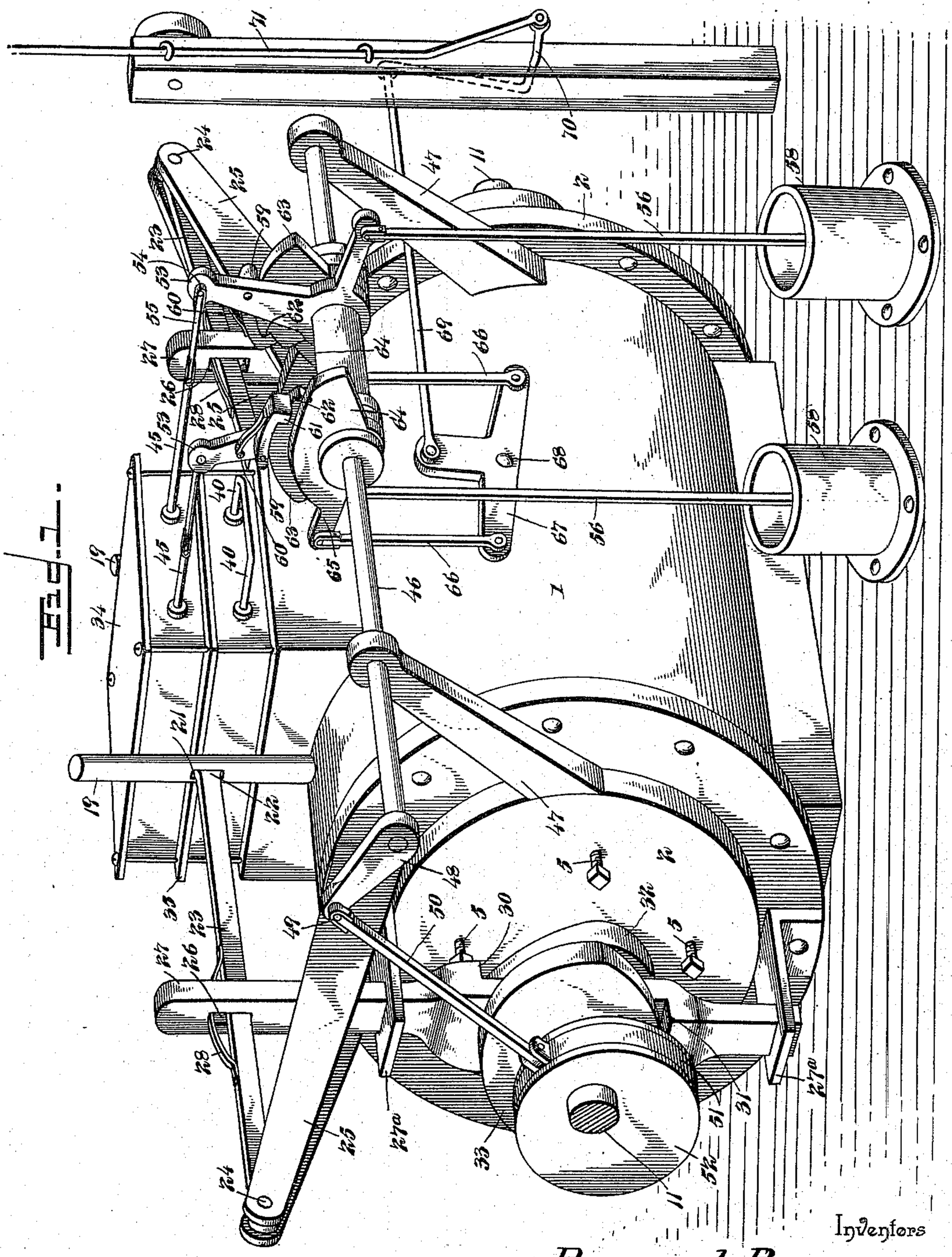
(No Model.)

3 Sheets—Sheet 1.

# R. & A. L. BAUER.

## ROTARY ENGINE.

No. 573,959. Patented Dec. 29, 1896.



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(No Model.) 3 Sheets—Sheet 2.

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## ROTARY ENGINE.

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Fig. 2.

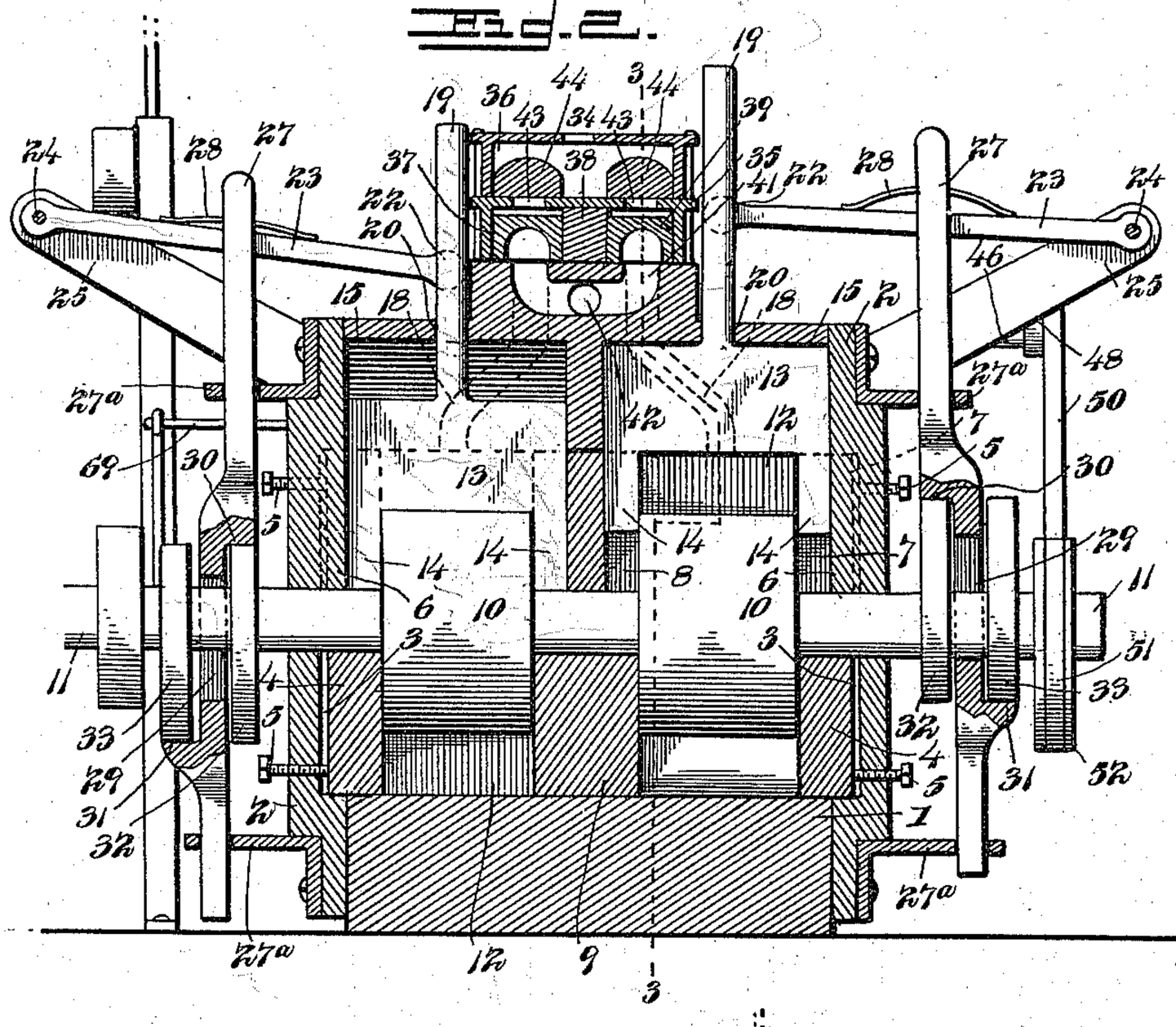
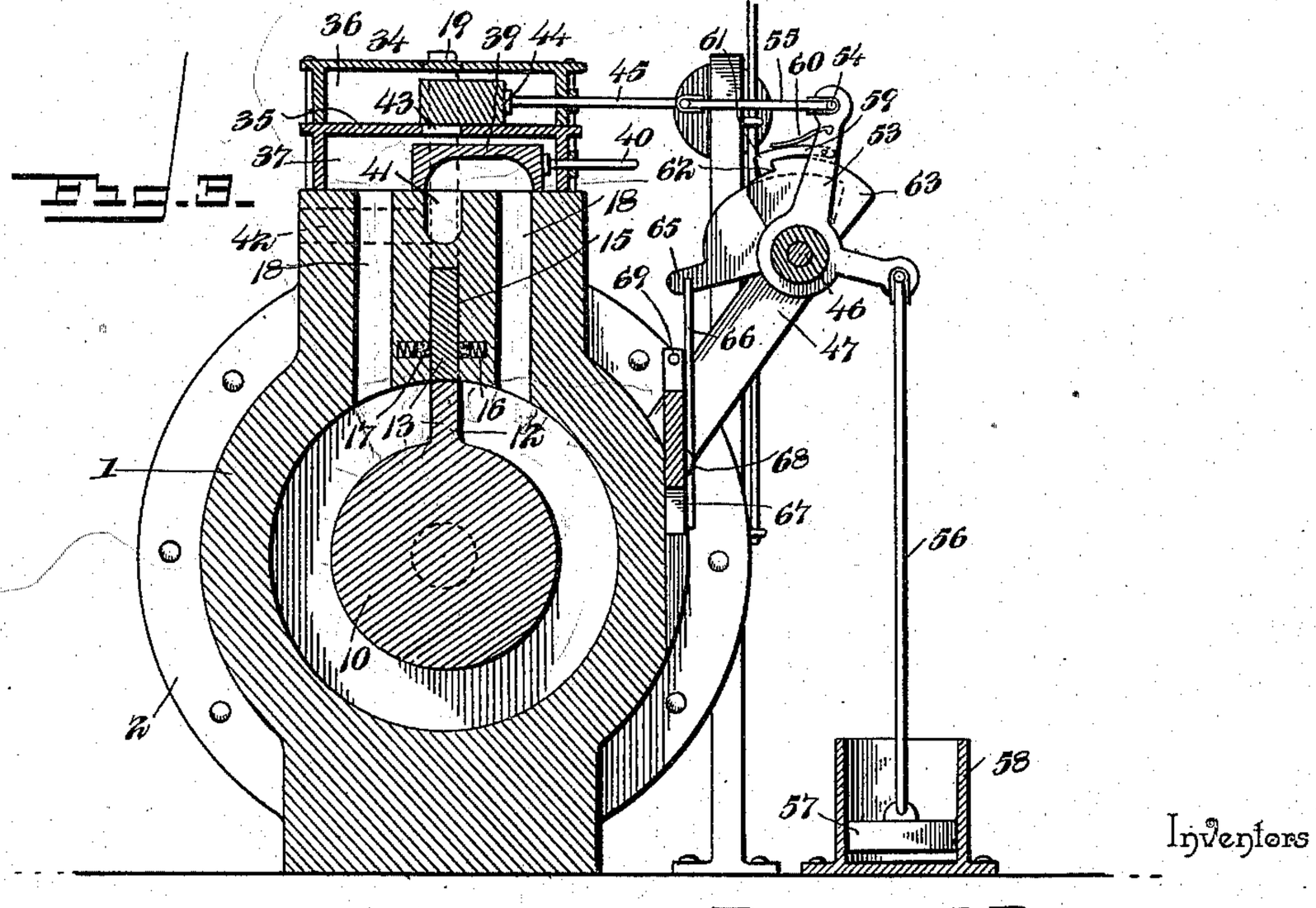



Fig. 3.

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(No Model.) 3 Sheets—Sheet 3.

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## ROTARY ENGINE.

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Fig. 4.

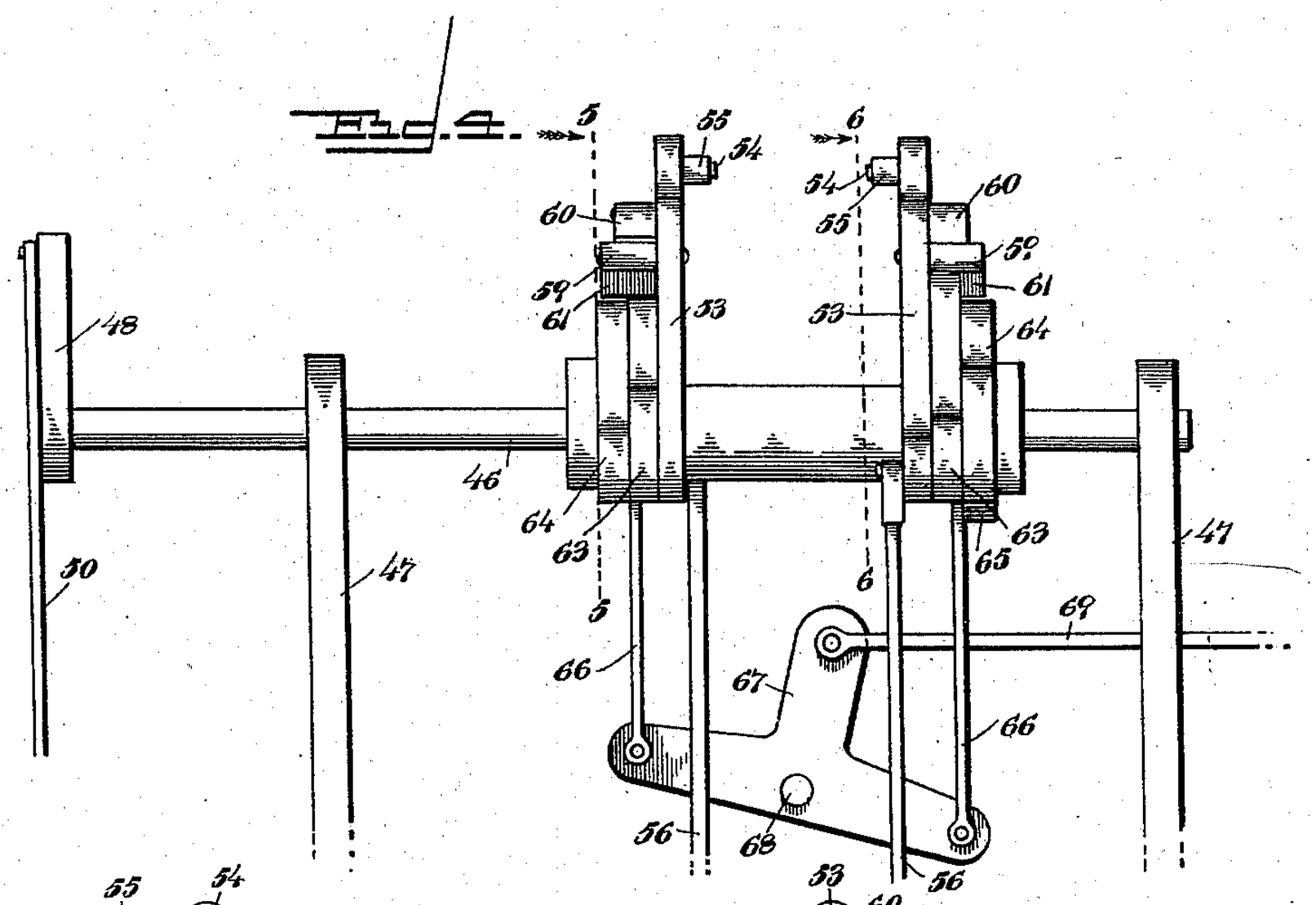



Fig. 6.

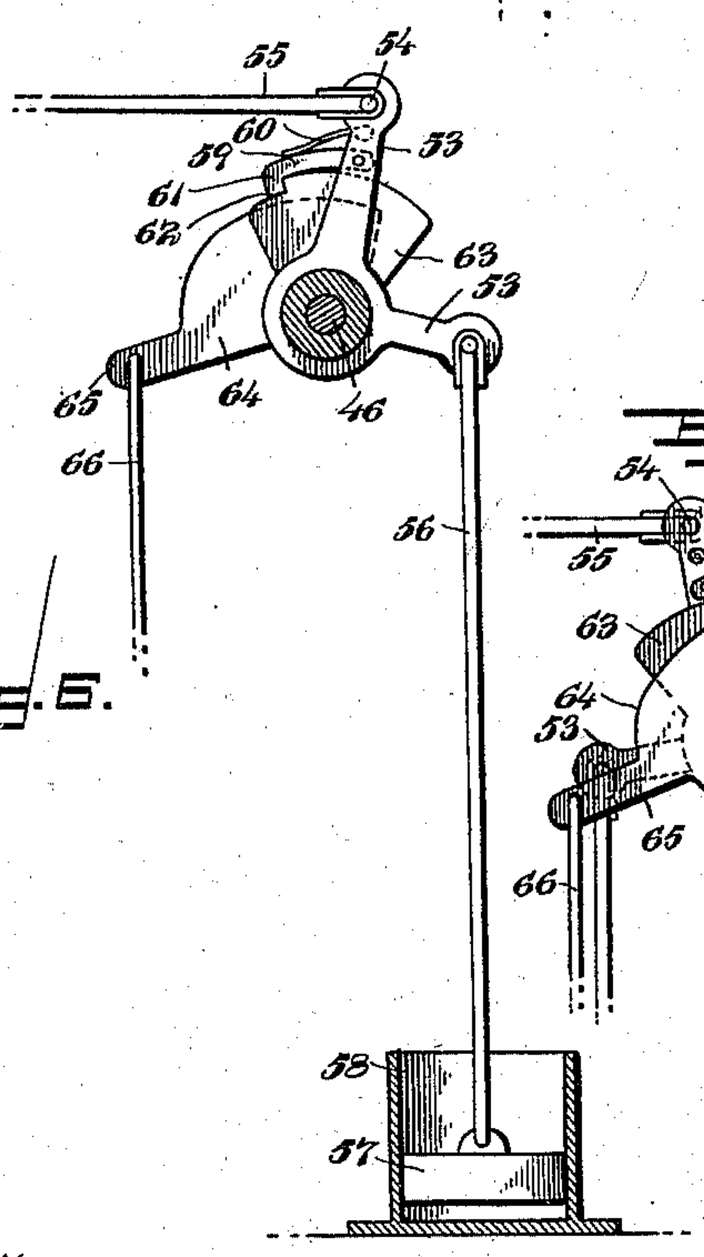



Fig. 7.

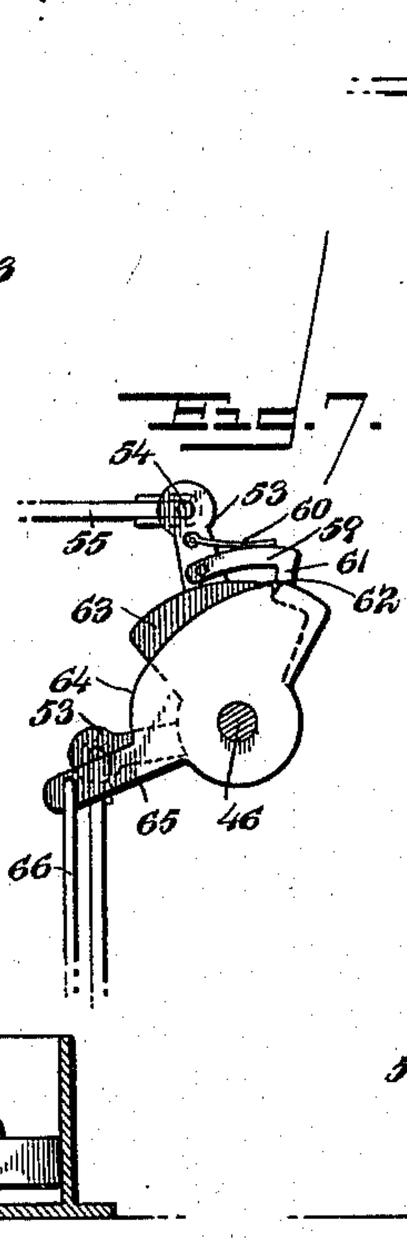
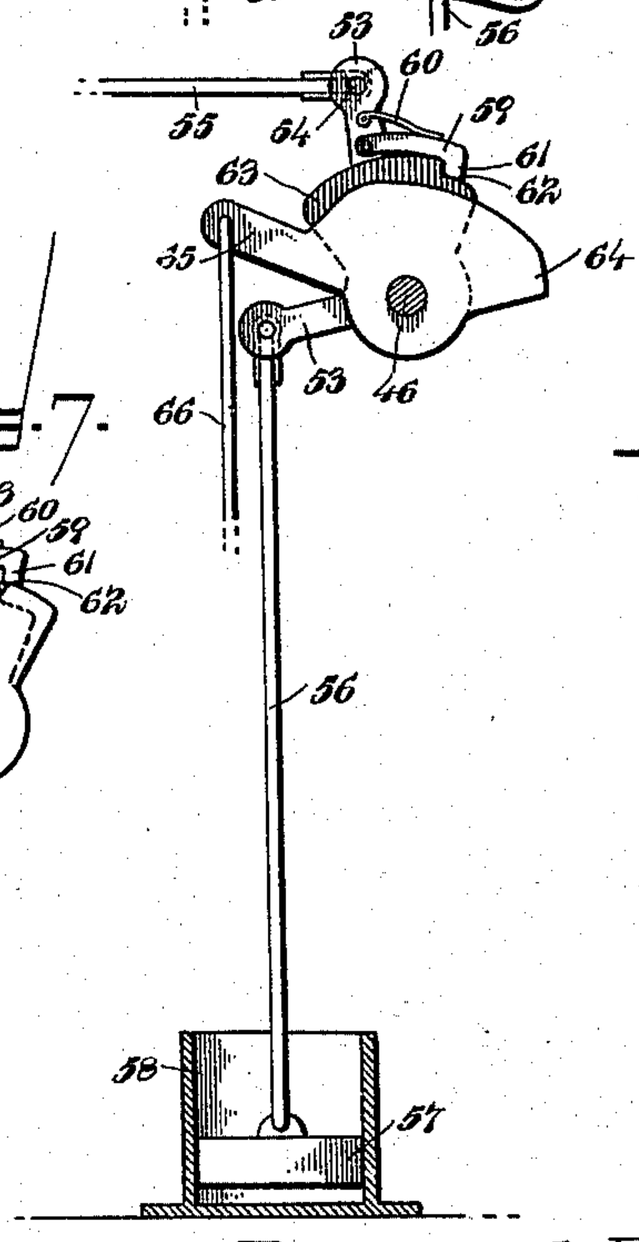



Fig. 5.




Witnesses

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Inventors

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# UNITED STATES PATENT OFFICE.

RAYMOND BAUER AND ALBERT L. BAUER, OF WHEELING, WEST VIRGINIA.

## ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 573,959, dated December 29, 1896.

Application filed January 31, 1896. Serial No. 577,569. (No model.)

*To all whom it may concern:*

Be it known that we, RAYMOND BAUER and ALBERT L. BAUER, citizens of the United States, residing at Wheeling, in the county of Ohio and State of West Virginia, have invented a new and useful Rotary Engine, of which the following is a specification.

This invention relates to rotary engines operated by steam, air, or any suitable fluid or gas pressure; and it has for its object to effect certain improvements in engines of this character whereby a maximum amount of speed and power will be obtained without any undue waste of steam. To this end the invention contemplates a rotary engine having simple and positively-operating parts that insure a steady and uniform action and admit of using the steam expansively in order that the same may be completely utilized.

With these and other objects in view, which will readily appear as the nature of the invention is better understood, the same consists in the novel construction, combination, and arrangement of parts hereinafter more fully described, illustrated, and claimed.

In the drawings, Figure 1 is a perspective view of the rotary engine constructed in accordance with this invention. Fig. 2 is a vertical longitudinal sectional view thereof. Fig. 3 is a vertical transverse sectional view on the line 3 3 of Fig. 2. Fig. 4 is an enlarged detail elevation of the valve-controlling mechanism. Fig. 5 is a detail sectional view on the line 5 5 of Fig. 4. Fig. 6 is a similar view on the line 6 6 of Fig. 4. Fig. 7 is a view similar to Fig. 5, showing the governor cam-plate adjusted to a position to hold the cam-dog disengaged from the clutch-plate, thereby temporarily stopping the movement of the slide-valve.

Referring to the accompanying drawings, 1 designates the cylinder, inclosed at its opposite ends by the main cylinder-heads 2, which are provided with inner recessed sides 3, to receive therein the inner adjustable heads 4, which register also with the interior bore of the cylinder 1, and are adjusted inwardly toward the center of the cylinder by means of suitable adjusting-screws 5, mounted in the main outer cylinder-heads 2 and engaging against the outer sides of said inner adjustable heads 4.

The inner adjustable cylinder-heads 4, working within the opposite ends thereof, are preferably secured against rotation by means of the vertically-disposed lock-ribs 6, projected from the inner sides of the main heads 2 and engaging in the vertically-disposed slots 7, formed in the upper edges of the said inner heads 4, and which slots also form guide-grooves disposed in longitudinal alinement with the guide-grooves 8, formed vertically in opposite upper sides of the central cylinder partition-disk 9, which is fitted centrally within the cylinder 1, between the opposite heads thereof, to divide the interior of the cylinder into separate and independent compartments. Within each of these compartments works a rotating shaft-head 10, mounted on the main horizontal drive-shaft 11, extending continuously through the cylinder and projected centrally through the opposite heads thereof, the opposite extremities of said shaft 11 being adapted to have suitable belt connections therewith for communicating motion to any suitable machinery.

By adjusting the screws 5 the inner adjustable cylinder-heads 4 are adjusted inwardly, so as to provide a steam-tight joint with the ends of the rotating shaft-heads 10, and said rotating shaft-heads 10 are provided with peripheral piston-flanges 12, which have a registering steam-tight fit within the annular steam-space surrounding the shaft-heads 10, and it will therefore be observed that the said piston-flanges 12 are rotated in steam-tight contact with the inner surface or sides of the cylinder 1 and with the adjacent sides of the central partition-disk 9 and the inner heads 4 of the cylinder. Arranged to coöperate with the piston-flange 12 in each compartment of the cylinder 1 is a vertically-reciprocating abutment-plate 13, the opposite end edges of which slide in the oppositely-located guide-grooves of the inner cylinder-head and the central partition-disk 9, and the said abutment-plate is provided at its opposite ends with short depending guide extensions 14, which also work within the said guide-grooves and at one side of the ends of the rotating shaft-head 10, directly below the abutment-plate, whereby the latter may be held in a perfectly steam-tight contact with the periphery of the shaft-head when adjusted down

onto the same to form an impact for the steam admitted into the cylinder at one side of the said plate.

The vertically-reciprocating abutment-plate 13 within each compartment of the cylinder works in a slide-recess 15, formed in the top of the cylinder above each compartment therein, and at opposite sides of the slide-recesses 15 the cylinder is provided with packing-grooves 16, which receive spring-adjusted packing 17, normally held in contact with the opposite sides of the sliding abutment-plates 13, in order to prevent the escape of steam through the said recesses 15, and at directly opposite sides of the recesses 15 the cylinder 1 is provided with the ports 18, which respectively provide for the admission and exhaust of the steam or other fluid employed to operate the engine. This construction provides a pair of the ports 18 for each compartment of the cylinder, so that the steam or other fluid may be admitted into each compartment through one of said ports at one side of the abutment-plate 13 in such compartment and exhausted from the compartment through the other port at the opposite side of the abutment-plate, as will be readily understood by those skilled in the art, and at this point it is to be noted that the opposite abutment-plates have an alternate reciprocation in order to properly clear the rotating piston-flanges 12, which are disposed directly opposite to each other, whereby one piston-flange at a time will be receiving the impact of the steam and thereby exerting an independent action to rotate the main drive-shaft 11.

Each of the vertically-reciprocating abutment-plates 13, working over and on the shaft-head 10, directly therebelow, is provided with a stem 19, extended from its upper edge and working through a guide-opening 20, formed in the top side of the cylinder, and the said stem 19 is provided therein at a point above the top of the cylinder with an opening 21, which loosely receives the rounded pivot end 22 of an oscillating adjusting-lever 23, pivotally mounted at its outer end, as at 24, between a pair of offstanding supporting-arms 25, projected outwardly and upwardly from one end of the cylinder 1. Each oscillating adjusting-lever 23 for each of the abutment-plates 13 at an intermediate point of its end is arranged to loosely work within the slot 26, formed in the upper end of a reciprocating adjusting-bar 27, guided to slide in the perforated upper and lower guide-brackets $27^a$, attached to and projected outwardly from the adjacent end of the cylinder, and fitted within the slot 26 of said adjusting-bar and arranged to bear on the upper side of the adjusting-lever 23 is a bowed spring 28, the function of which will be presently referred to.

Each of the vertically-reciprocating adjusting-bars 27, arranged to work at opposite ends of the cylinder in the guide-brackets $27^a$, is provided between said guide-brackets with a vertical slot 29, receiving the shaft 11, and above and below the shaft with upper and lower reversely-disposed bearing-shoulders 30 and 31, respectively, which are respectively engaged by the cams 32 and 33, mounted fast on the shaft 11 at opposite sides of the adjusting-bar. The cam 32 is arranged at the inner side of the adjusting-bar 27 and works under and against the upper bearing-shoulder 30 thereof to provide for elevating the adjusting-bar and the lever 23, and the cam 33 is arranged at the outer side of the adjusting-bar and works over and against the lower bearing-shoulder 31 to provide for the positive retraction or depressing of the adjusting-bar to secure the downward adjustment of the adjusting-lever 23 and the abutment-plate 13, having a connection therewith.

The corresponding cams 32 and 33 at opposite ends of the cylinder are reversely or oppositely disposed with respect to each other in order that the opposite adjusting-bars 27 may have an alternate reciprocation, and at this point it will be observed that the cams 32 provide for elevating the abutment-plates 13 as the piston-flanges 12 approach such abutment-plates in order to allow the said piston-flanges to readily pass under the abutment-plates, after which time the cams 33 draw the bars 27 downward and slide the abutment-plates down onto the shaft-heads 10, and after the adjusting-levers 23 have reached their downward limit of movement the cams 33 continue to slightly draw the adjusting-bars 27 downward, and thereby compress the springs 28, which will tighten the contact of the abutment-plates 13 with the shaft-heads 10, as will be readily understood.

The top side of the cylinder through which the ports 18 extend is flat to receive thereon the steam-chest 34, having a horizontal valve-seat partition 35, which divides the said steam-chest into separate upper and lower valve-chambers 36 and 37, respectively, and the lower of said valve-chambers 37 is divided longitudinally by a vertical partition 38, separating the lower valve-chamber 37 into separate compartments, each of which accommodates therein a sliding reversing-valve 39, working on the flat top of the cylinder over the ports 18 therein. The reversing-valves 39 have connected therewith a common stem 40, extending through one end of the chamber 37, so that the valves may be readily controlled, and the said reversing-valves are of an ordinary construction, having concaved lower sides, so as to connect either of the ports 18 for each compartment of the cylinder with an exhaust-channel 41, formed in the top of the cylinder between each pair of the ports 18 and communicating with the main exhaust-passage 42, extending to the outer air. It will therefore be seen that by adjusting the reversing-valves 39 live steam may be admitted into the separate compartments of the cylinder at either side of the abutment-plates

13, working therein, and exhausted from the opposite side of said abutment-plates, thereby providing simple and efficient means for reversing the direction of rotation of the engine.

The horizontal valve-seat partition 35 of the steam-chest 34 is provided therein with a pair of steam-passages 43, communicating, respectively, with the separate compartments of the lower valve-chamber 37 and respectively covered and uncovered alternately by the alternately-reciprocating sliding cut-off valves 44, working within the upper valve-chamber 36, over the said steam-passages. The alternately-reciprocating sliding cut-off valves 44 are provided with valve-stems 45, working through one end of the steam-chest and having a connection with the valve-controlling mechanism now to be described.

At the side of the cylinder 1 where the valve-stems 45 reciprocate in and out is arranged a horizontal rock-shaft 46.

The horizontal rock-shaft 46 is mounted in the bearing-brackets 47, projected from one side of the cylinder 1, and has connected to one end thereof the rock-arm 48. The rock-arm 48 has pivotally connected to its outer extremity, as at 49, one end of the eccentric-rod 50, the other end of which rod connects with the eccentric-strap 51, encircling the shaft-eccentric 52, keyed on one end of the main drive-shaft 11, and providing means, through the medium of the connections 50 and 48, for communicating an oscillatory or rocking motion to the rock-shaft 46.

Between the bearing-brackets 47 the rock-shaft 46 has loosely mounted thereon a pair of spaced reversely-disposed bell-crank valve-levers 53, to the upper extremities of which levers are loosely connected at 54 one end of the short connecting-links 55, the other ends of which links connect with the outer extremities of the valve-stems 45, thereby completing a connection between each valve-stem and one of said bell-crank levers 53. By reason of the reverse disposition of the bell-crank levers 53 the lower arms of said levers are disposed, respectively, at opposite sides of the rock-shaft 46, and pivotally connected to said lower arms of the bell-crank levers are the upper ends of the weight-rods 56, the lower ends of which rods connect with the piston-weights 57, snugly working in the air-cylinders 58, arranged on the base or floor supporting the engine.

The bell-crank valve-levers 53, which are loosely mounted on the rock-shaft 46, have pivotally connected to one side of the upper arms thereof one end of the clutch-dogs 59, normally depressed by means of springs 60, arranged thereover and attached to the upper arms of the said levers 53. The normally spring-depressed clutch-dogs 59 are curved and are provided at their free extremities with the clutch-tooth 61, adapted to normally positively engage the peripheral notch 62 of the oscillating clutch-plates 63, secured fast on the shaft 46 at one side of the bell-crank levers 53. The clutch-teeth 61 of the clutch-dogs 59 are wider than the said clutch-plate 63, and are also disposed over the cam edges of the governor cam-plates 64, which are loosely mounted on the shaft 46 at one side of the clutch-plates 63. The governor cam-plates 64 are provided at one side with short arm extensions 65, to which are pivotally connected the upper ends of the connecting-links 66, the lower ends of which links are respectively connected to opposite extremities of an oscillating T-lever 67, pivotally mounted at 68 at one side of the cylinder 1. The central arm of said T-lever 67 has pivotally connected to its upper extremity one end of a connecting-rod 69, the other end of which rod has a bell-crank connection 70 with the stem 71 of an ordinary speed-governor, whereby the operations of said governor will provide for oscillating the T-lever 67 in either direction and thereby adjusting the position of the governor cam-plates 64.

The two sets of clutches and governor cam-plates used in connection with said bell-crank valve-levers are also reversely disposed with respect to each other in order to provide for an alternate reciprocation of the sliding cut-off valves 44, as will be readily understood by those skilled in the art.

With the clutch-dogs 59 normally engaged with the oscillating clutch-plates 63, which are fastened on the shaft 46, the bell-crank valve-levers 53 will be necessarily locked with the said oscillating clutch-plates and will be oscillated with the rock-shaft, thereby providing means for reciprocating the sliding cut-off valve, and at this point it will be noted that while the oscillating clutch-plates 63 provide for oscillating the levers 53 in one direction the partial vacuum produced in the air-cylinders 58 by the elevation of the piston-weights 57 will provide for the oscillation of said valve-levers in the opposite direction. Now in the event of the speed of the engine becoming abnormal the speed-governor, through the medium of the connections described, will oscillate the T-lever 67 and thereby turn the governor cam-plate 64 on the shaft 40, so as to carry the cam edges of such plates under the clutch-dogs 69 and lift the teeth of such clutch-dogs out of engagement with the notches 62 of the clutch-plates 63. This operation entirely disconnects the valve-levers 53 from the clutch-plates 63, and the oscillations of the rock-shaft will not move the said valve-levers, which will remain in a position drawn by the piston-weights 57, so as to entirely cut off the steam from passing into the lower valve-chamber 37 and from thence into the cylinder. In this position of the parts, with the clutch-dogs held elevated above the clutch-plates, the latter will freely oscillate back and forth under such dogs; but when the speed of the engine again reaches normal the governor will operate so as to turn the

governor cam-plates in a direction which will carry the cam edges thereof from under the teeth of the clutch-dogs and thereby allow the clutch-dogs to again spring back into engagement with the peripheral notches of the clutch-plates, so as to connect the levers 53 with the shaft 46 and again provide for the reciprocation of the sliding cut-off valves. It is to be noted at this point that the valve-controlling mechanism just described will operate to cut off the steam or other operating fluid at a point before the rotating shaft-heads have made a complete revolution, thereby providing means for working the steam expansively to complete the stroke or complete rotation of the piston, which essentially consists of the shaft-head 10 and the piston-flange 12.

The many advantages of the herein-described engine will be readily apparent to those skilled in the art without further description, and it will be understood that changes in the form, proportion, and the minor details of construction may be resorted to without departing from the principle or sacrificing any of the advantages of this invention.

Having thus described the invention, what is claimed, and desired to be secured by Letters Patent, is—

1. In a rotary engine, the combination of a cylinder provided with opposite end heads having inner recessed sides, and a central partition-disk provided in opposite upper sides with vertically-disposed guide-grooves, inner cylinder-heads adjustably fitted within the opposite ends of the cylinder and the recesses of said end heads, said inner adjustable heads being provided with vertically-disposed guide-grooves longitudinally alined with those in the partition-disk, the horizontal drive-shaft carrying rotating shaft-heads working in each compartment of the cylinder and provided with peripheral piston-flanges, vertically-reciprocating abutment-plates mounted to work within the upper part of the cylinder above said shaft-heads and having their ends slidably engaging in said guide-grooves, said abutment-plates being provided at their opposite ends with short depending guide extensions, means for alternately reciprocating said abutment-plates, and means for controlling the admission and exhaust of steam for each compartment of the cylinder, substantially as set forth.

2. In a rotary engine, the cylinder, a horizontal shaft carrying a rotating head working within the cylinder and provided with a peripheral piston-flange, a reciprocating abutment-plate mounted to slide within the cylinder and working against and away from said shaft-head, said abutment-plate having a stem working outside of the cylinder, an oscillating adjusting-lever pivotally supported at one end and having its other end loosely connected with the stem of said abutment-plate, an adjusting-bar supported to reciprocate at one end of the cylinder and provided at one end with a slot loosely receiving said adjusting-lever and at an intermediate point with a slot receiving the horizontal shaft, said adjusting-bar being further provided at opposite sides of the shaft with separate reversely-disposed bearing-shoulders, a pair of cams mounted on the horizontal shaft at opposite sides of the adjusting-bar and respectively working against the respective bearing-shoulders thereof, and suitably-arranged valve mechanism, substantially as set forth.

3. In a rotary engine, the cylinder, a horizontal shaft carrying a rotating head provided with a peripheral piston-flange working within the cylinder, a reciprocating abutment-plate mounted to slide within the cylinder to and away from the shaft-head and having a stem working outside of the cylinder, an oscillating adjusting-lever pivotally supported at one end and having its other end loosely connected with the stem of said abutment-plate, an adjusting-bar supported to reciprocate at one end of the cylinder and provided at one end with a slot loosely receiving said adjusting-lever, a pair of cams mounted on the horizontal shaft and engaging the said adjusting-bar to reciprocate the same, a spring arranged at one side of said adjusting-lever within the slot of said adjusting-bar, and suitably-arranged valve mechanism, substantially as set forth.

4. In an engine, the combination of a cylinder having separate compartments, and separate sets of supply and exhaust ports for each of said compartments, a valve-chamber arranged on the cylinder over the ports therein, a pair of alternately-reciprocating sliding cut-off valves mounted in said valve-chamber and having stems projecting out of the chamber, a suitably-supported rock-shaft having an eccentric connection with the drive-shaft of the engine, a pair of valve-levers loosely mounted on said shaft and having a connection with said valve-stems, a clutch connection between said valve-levers and the rock-shaft to provide for oscillating the levers in one direction, means for oscillating the valve-levers in an opposite direction, and governor-operated cams loosely mounted on the rock-shaft and adapted to engage the said clutch connections to release the valve-levers therefrom, substantially as set forth.

5. In an engine, the combination with the cylinder having suitably-arranged ports, and the drive-shaft; of the valve-chamber, a pair of alternately-reciprocating sliding cut-off valves mounted within said valve-chamber, a rock-shaft mounted at one side of the cylinder and having an eccentric connection with the drive-shaft, a pair of spaced reversely-disposed bell-crank valve-levers loosely mounted on the rock-shaft, a link connection between the upper arms of said bell-crank levers and the valve-stems, oscillating clutch-plates secured fast on the rock-shaft at one side of the bell-crank levers and provided each with

a peripheral notch, normally spring-depressed clutch-dogs pivotally connected at one end to said bell-crank levers and provided at their other free ends each with a wide clutch-tooth adapted to normally engage with the peripheral notch of the oscillating clutch-plate directly therebelow to provide a clutch connection for oscillating the bell-crank levers in one direction, means for oscillating said levers in an opposite direction, governor cam-plates loosely mounted on the rock-shaft at one side of said clutch-plates and adapted to ride under and elevate the toothed ends of said clutch-dogs, a pivotally-supported oscillating lever having a connection with each of said cam-plates to provide for turning the same, and a speed-governor connection with said oscillating lever, substantially as set forth.

In testimony that we claim the foregoing as our own we have hereto affixed our signatures in the presence of two witnesses.

RAYMOND BAUER.
ALBERT L. BAUER.

Witnesses:
THOMAS L. MCGRANAHAN,
LEE R. DUNNING.