F. A. FIFIELD.

PHOTOGRAPHIC PLATE OR FILM HOLDER.

APPLICATION FILED JULY 1, 1910.

976,354.

Patented Nov. 22, 1910.

Fig. 1.

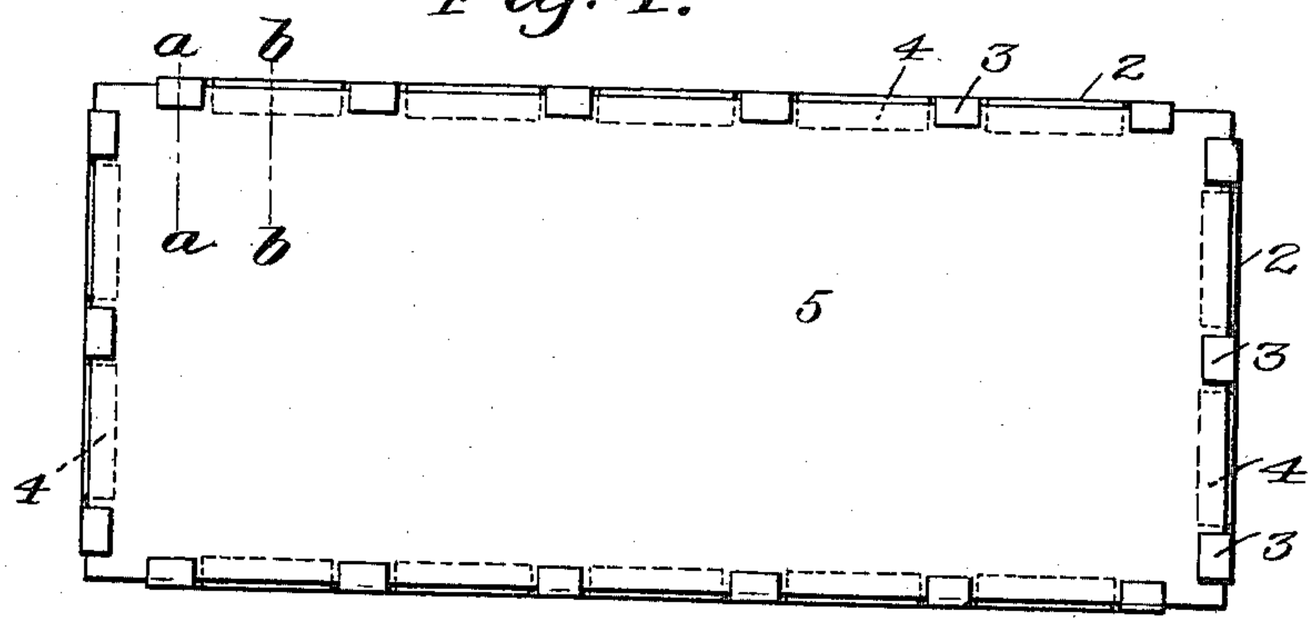

Fig. 2.

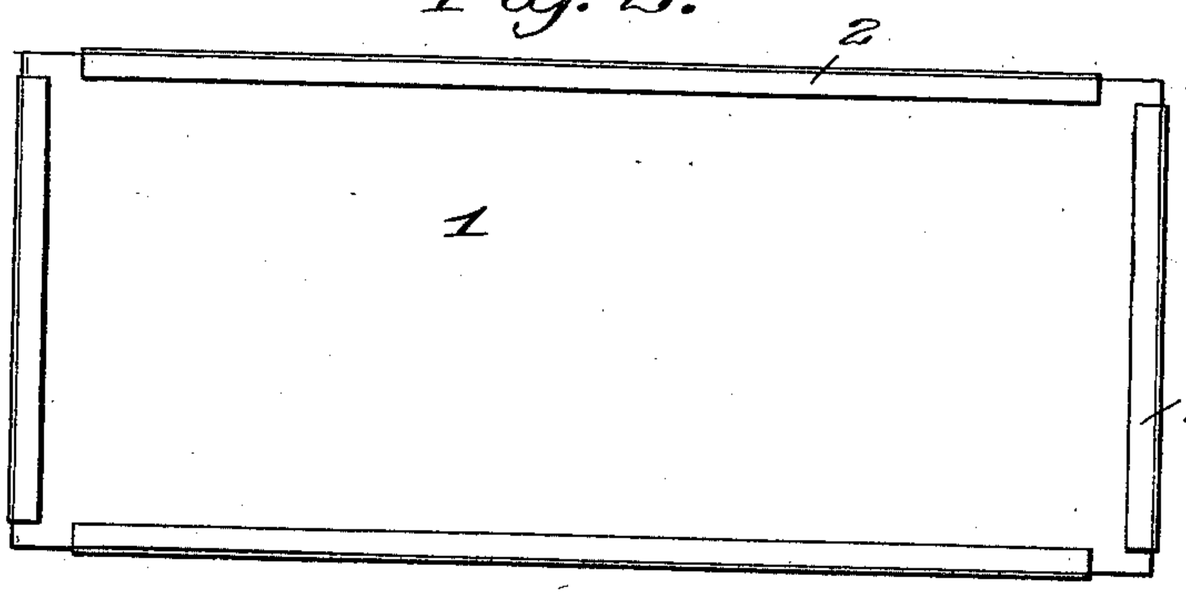

Fig. 3.

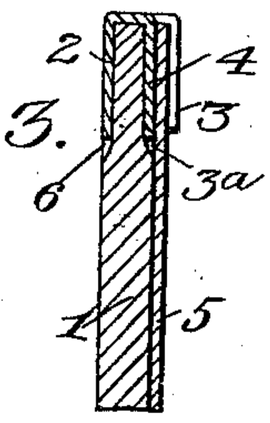

Fig. 4.

Witnesses

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ROTARY ENGINE.

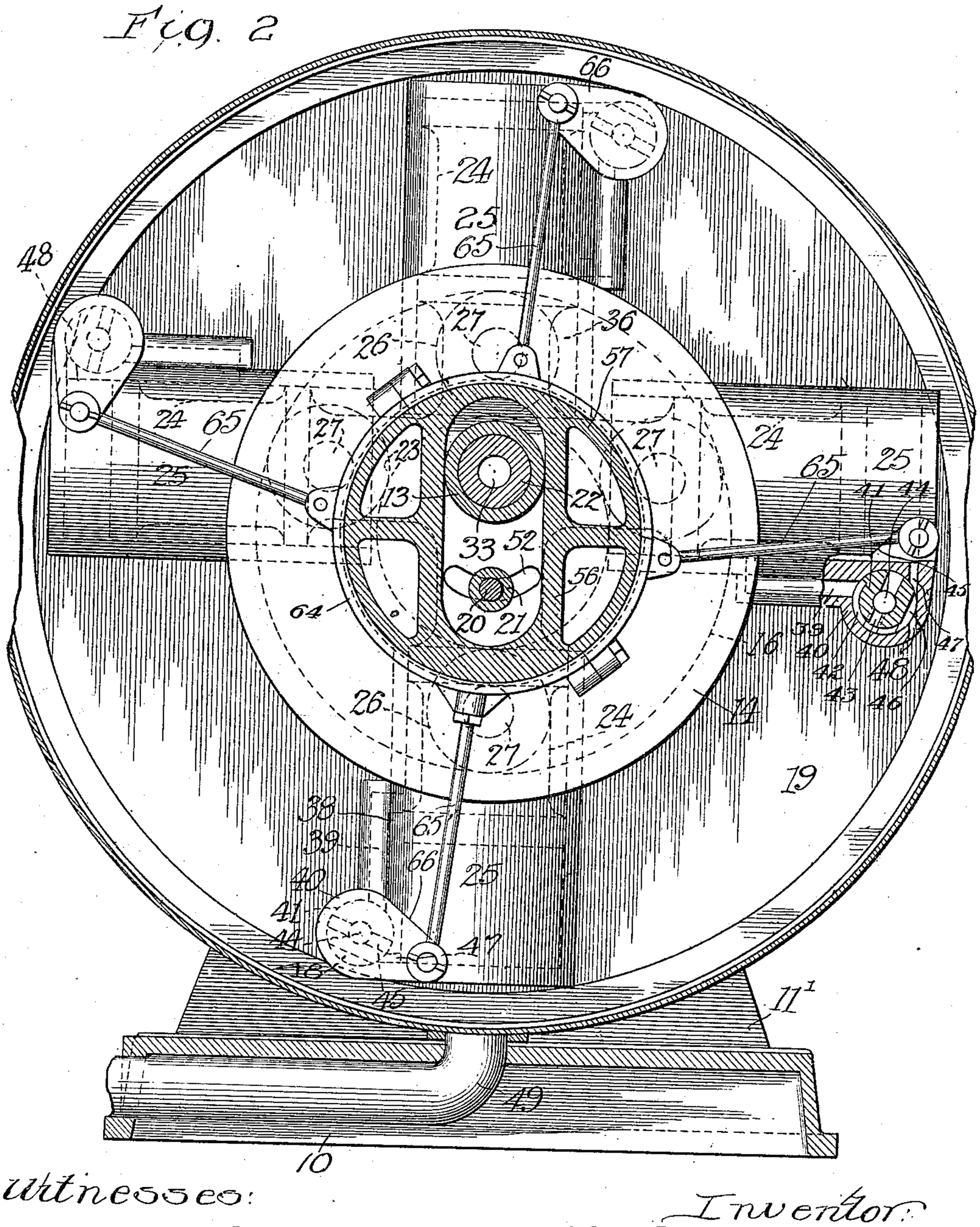
APPLICATION FILED MAR. 3, 1909.

976,355.

Patented Nov. 22, 1910.

3 SHEETS—SHEET 2.

Fig. 2



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3 SHEETS—SHEET 3.

Fig. 3.

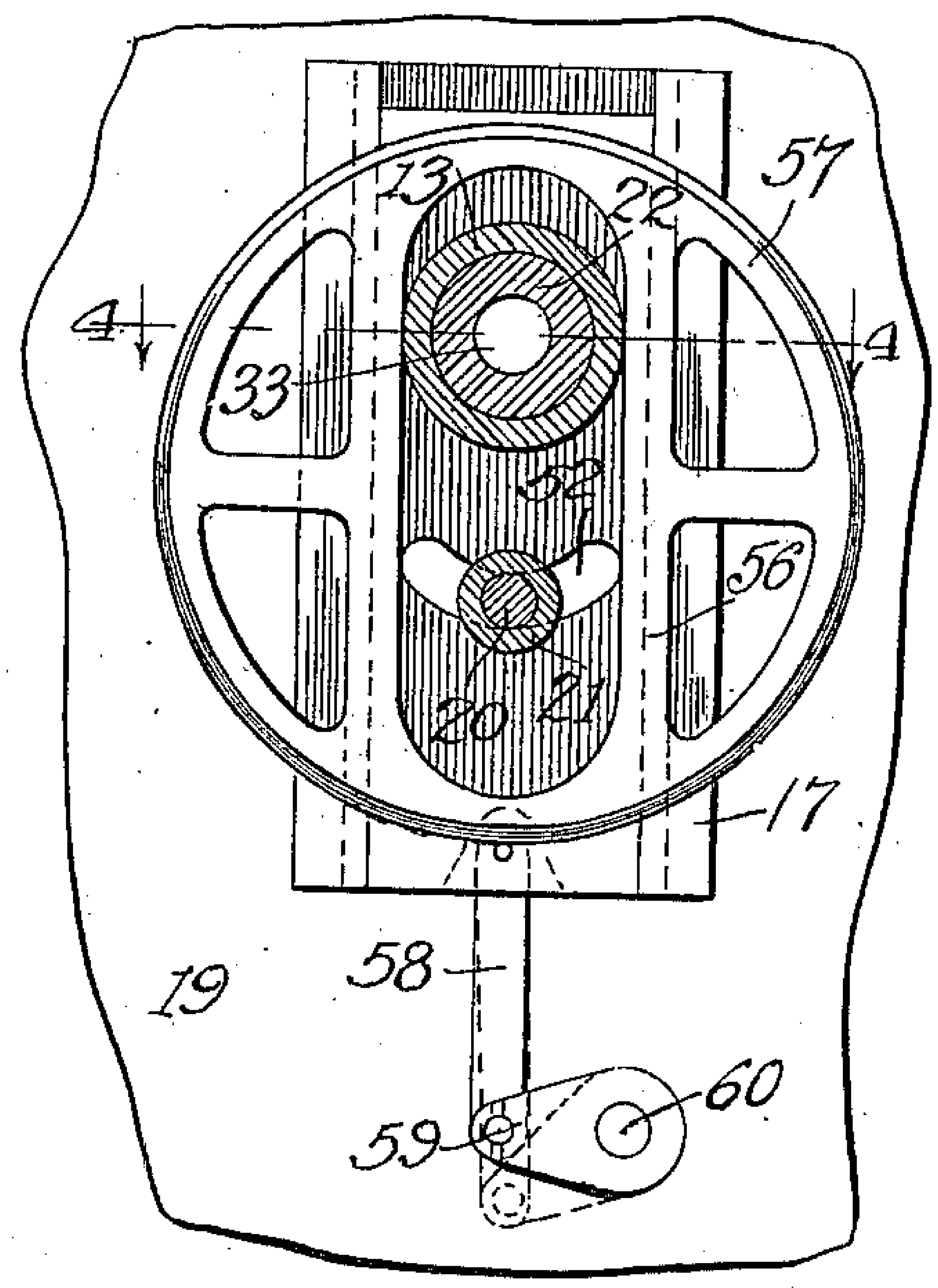


Fig. 4

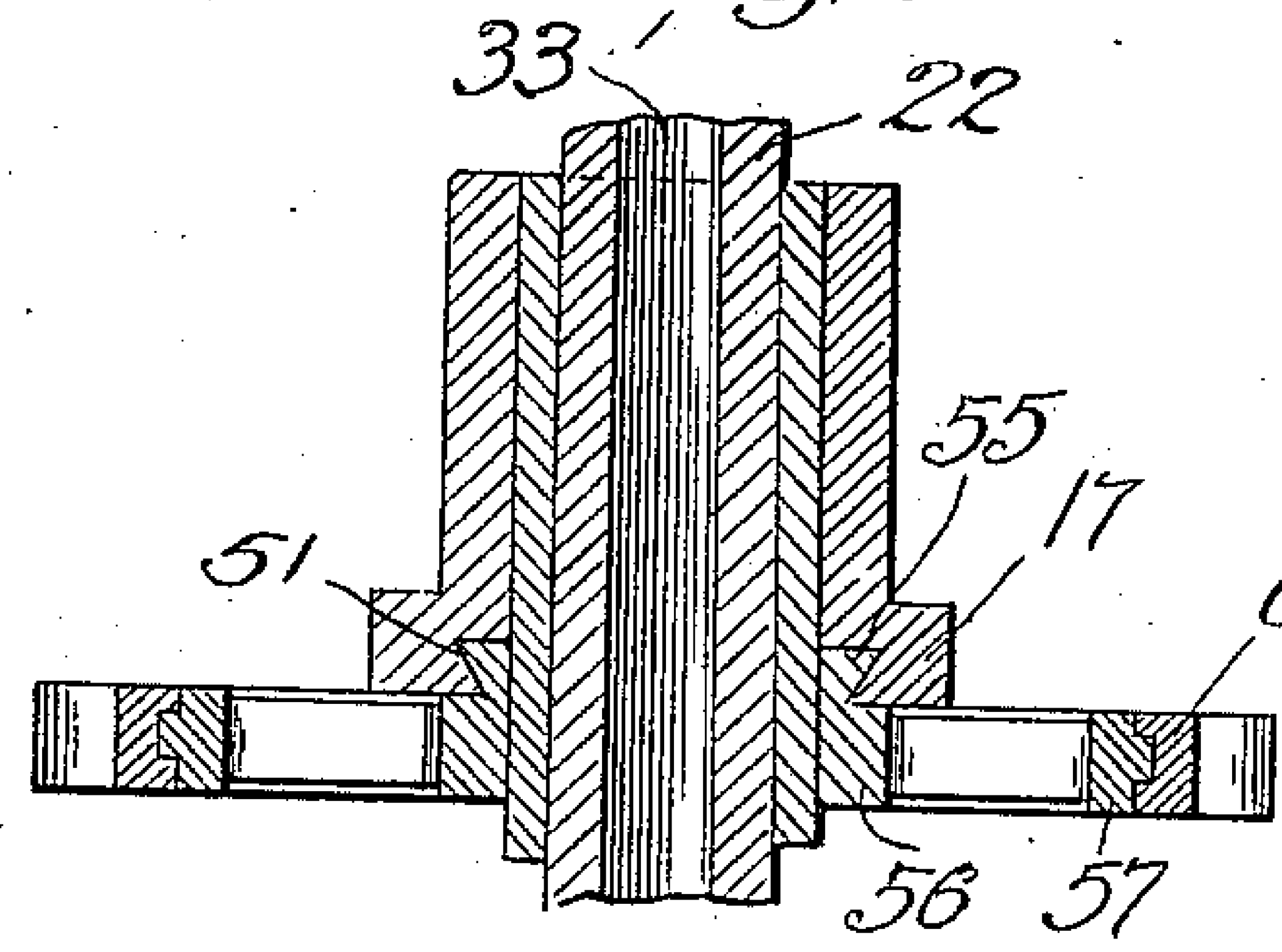
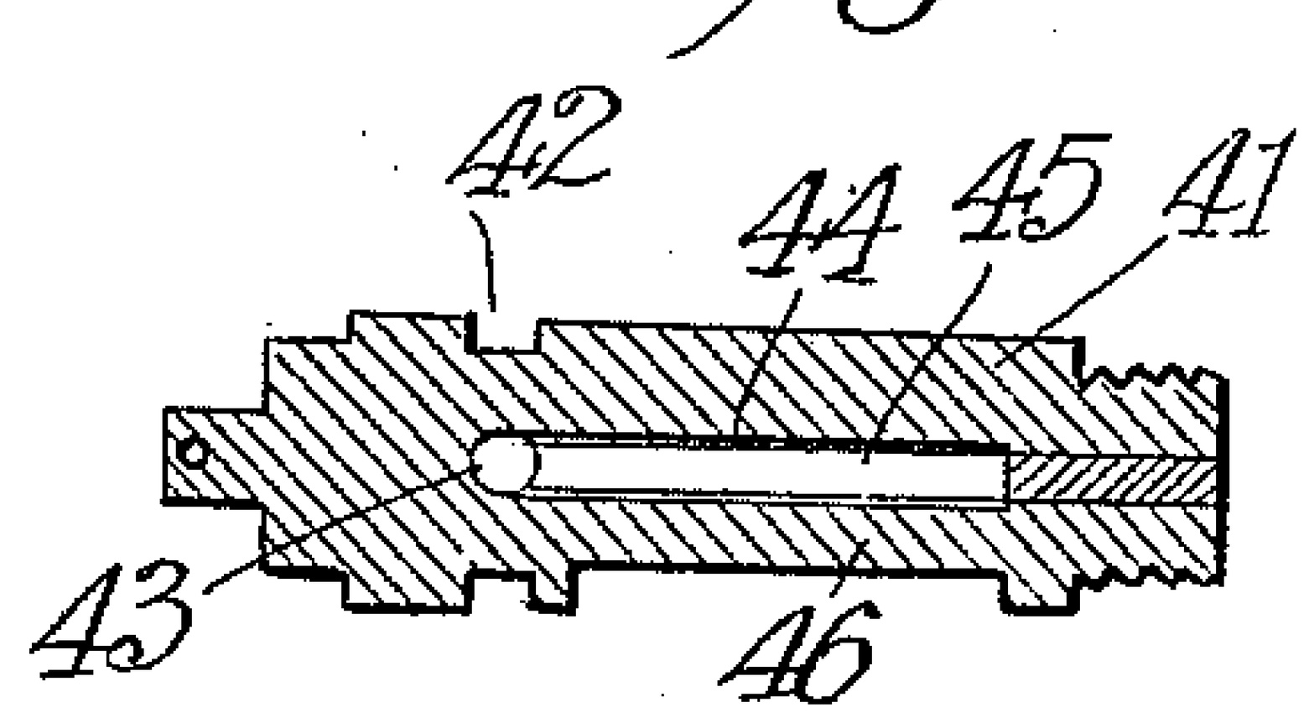


Fig. 5.



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UNITED STATES PATENT OFFICE.

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ROTARY ENGINE.

976,355. Specification of Letters Patent. Patented Nov. 22, 1910.

Application filed March 3, 1909. Serial No. 481,097.

To all whom it may concern:

Be it known that I, LEE O. GILLILAND, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

My invention relates to improvements in engines, and more particularly in engines in which the piston-structure, comprising a plurality of pistons, and the cylinder-structure, comprising a plurality of cylinders, are mounted for rotation upon eccentric axes, so that during coördinate rotation of the piston-structure and cylinder-structure the cylinders may have rectilinear movement with respect to their appropriate pistons.

Among the objects of my invention are to provide an engine of the character described which is simple in construction and efficient in operation, wherein the radial pistons form a central structure and the cylinders work radially beyond the pistons; wherein ready escape of spent energizing fluid is provided for to permit such escape in a direction not opposed by centrifugal effect, wherein the entire structure may be completely housed, wherein improved valve gearing is provided, and wherein the construction is improved in general and in detail.

In the drawings; Figure 1 is a vertical central section of an engine embodying my invention, the invention being herein illustratively shown as applied to a steam engine; Fig. 2 is a vertical section on line 2—2 of Fig. 1, looking in the direction of the arrow; Fig. 3 is a fragmentary section on line 3—3 of Fig. 1, looking in the direction of the arrow; Fig. 4 is a section on line 4—4 of Fig. 3, and; Fig. 5 is a detailed section of a valve.

In the embodiment shown a base 10 has mounted thereon pedestals or standards 11, 11′, provided at their upper ends with bearing hubs 12, 12′, which afford support to sleeves 13, 13′, carrying at their inner ends circular plates 14 and 14′ respectively, having in their confronting faces annular recesses 15, the peripheral walls 16 whereof form tracks.

The circular plate 14 is spaced apart from a pedestal 11 to leave room for a valve-operating mechanism to be described. At a suitable distance from the smooth outer face of said plate is arranged an opposing face plate 17, carried by sleeve 18 interposed between the hub 12 and sleeve 13. A circular housing 19, concentric with the circular plates 14, 14′ is preferably provided, the side walls of said housing being preferably clamped between the standards and the inwardly contiguous stationary parts, which are the face plates 17 on the one side and the circular plate 14′ on the other.

As part of the means for fastening these stationary structures together a bolt 20 may be provided connecting the standard 11, face plate 17 and circle plate 14, and in part surrounded by a spacing sleeve 21, while on the opposite side a bolt 21′ is shown as indicative of means for securing the standard, casing and circle plate together.

The sleeves 13 and 13′ which are eccentric to the center of the tracks 16, afford support for a shaft 22, on which is fixedly mounted, by means of keys or otherwise, a piston structure 23, comprising a suitable number of pistons 24, herein shown as four in number, and preferably integrally connected, the working ends of said pistons being obviously at their outer ends. Enveloping the several pistons 24 are corresponding cylinders 25, each an independent structure carrying at diametrically opposite points small wheels 26 mounted upon bearing pins or trunnions 27, and fitting neatly in the recesses 15 of the opposed circle plates 14 and 14′, to roll upon the track surfaces 16 thereof. The eccentricity of the track with respect to the shaft 22 is such, that during a complete revolution of the piston structure, a cylinder, rotarily carried by the piston, effects the radial movements with respect to the piston constituting a complete reciprocatory cycle of movement.

To provide suitable steam passages for the introduction and eduction of steam to and from the cylinders I provide a steam pipe 30 communicating with the stationary steam chest 31 surrounding a portion of the shaft 22, beyond the standard or pedestal 11, suitably packed with reference to the shaft, and having constant communication through radial openings 32, in the shaft, with an interior duct 33, therein, which is in open communication with radial ducts 34 in the several pistons, such duct 34 in each piston having communicating therewith a transverse passage 35, leading to an annular steam space 36 encircling the piston between its

ends, and of radial length equal to or in excess of the length of stroke of the piston with respect to the cylinder. Each cylinder is provided exteriorly with a longitudinal rib 38, through which extends a duct 39, at one end arranged for constant opening into the steam space 36, and at its opposite end opening into one end of a valve housing 40 also formed upon the exterior of the cylinder. Within the housing 40 is arranged a suitable valve, preferably an oscillating valve, which in the specific construction shown is a tapering valve 41, provided with an annular channel 42, constantly communicating with the end of duct 39, with which communicates a diametrical duct 43 communicating with the longitudinal steam passage 44, into which opens ports 45 from the central portion of the periphery of the valve. The valve is likewise provided with an exhaust passage 46 formed by flattening the surface of the valve between its ends to some desired chord. A port 47 is made tangentially from the housing 40 through the side of the cylinder adjacent its extreme end, in such position that by oscillation either the inlet or exhaust port of the valve may be brought into register therewith. The casing of the valve is likewise provided with a port 48 disposed to register with port 46 when the latter is in register with cylinder port 47, so that the exhaust from the cylinder may take place directly into the housing 19. The housing in turn is provided with an exhaust pipe 49 leading from its bottom and extending to any suitable point of discharge.

For operating the valve I provide an eccentric construction wherein the eccentric strap is connected by links to all of the valves, and is rotatable with the cylinder structure about a relatively stationary eccentric. Also I provide means whereby the degree of eccentricity of said relatively stationary eccentric may be adjusted radially with respect to the axis of rotation of the cylinders to reverse or vary the cut-off of the engine, and means whereby it may be adjusted rotarily to vary the "lead" of the valves. To this end, as more particularly illustrated in Figs. 3 and 4, I provide the face plate 17 with a dove-tailed recess, or groove 51, crossing radially the plate center and the shaft center, and with an arcuate slot 52 to receive the bolt 20 heretofore described, so that when the bolt 20 or any other clamping or positioning devices for the face plate is loosened the latter may be rotarily adjusted by movement of its sleeve 18 by means of any suitable appliance, typified by wrench or lever shown in dotted lines at 53. Into the groove 51 fits a corresponding gib 55 carrying a skeleton frame structure 56 bearing the rim 57, which constitutes the eccentric. In addition to its rotative adjustment the eccentric 57 may be readily adjusted, and to this end there is pivotally connected to the frame 57 of the eccentric a link 58, at its lower extremity connected to a lever 59, which is carried by a shaft 60, extending through a suitable bearing in the casing and rotatably adjustable in any fashion, as by a hand wheel 61, arranged to be engaged and held in position by a latch 62. The eccentric 57 is encircled by a strap 64, which has pivotally connected thereto three links 65, and fixedly connected thereto a fourth link 65′ each of said links engaging at its outer end a rocker arm or lever 66, suitably connected with a corresponding valve 41.

When desired the engine may be equipped with speed reducing gearing, and in the drawing 68 is a pinion on the shaft 22, driving a gear 69 mounted on a shaft 70, journaled in suitable bearings provided in standards 11′ and 71.

In the operation of the engine above described the eccentric 57, is radially adjusted from "dead center" position shown to such point of eccentricity above or below the center of rotation of the cylinders as to give an appropriate length of movement to the valves to secure the desired direction of rotation and proper cut-off, and it may also be rotatively adjusted to cause the valves to operate with the desired lead. The connections, of course, are such that a valve will open to admit steam to its cylinder as the latter stands approximately at the end of its in-stroke with reference to the piston, the steam passing in through pipes 30, chest 31, passages 33, 34, 35, 36 and 39 to the valve 43, and thence through the valve ports into the cylinder. The expansion of the steam, tending to drive the cylinder and piston relatively to out-stroke position, causes rotation of the cylinders and pistons together in their respective orbits, until the cylinder under consideration reaches approximately the point where the piston and cylinder stand in full out-stroke position, at which time, owing to the action of the eccentric, the valve will have opened to permit the egress of steam through the ports 47 and 48 and the valve channel 46. The valves will, of course, all be operated in suitably timed relation, as the eccentric strap is carried in rotation through its rigid connection with link 65′ and by the various adjustments of the eccentric commensurate adjustment of all of the valves are effected.

It will be observed that in the operation of the engine, when the eccentric is so set that on the in-movement of the cylinder the valve channel 46 opens a through passage from the cylinder to the exterior of the valve housing by the path 47, 46, 48, exhaust steam and water of condensation is not compelled to travel inward toward the axis of rotation of the cylinder in making its es-

cape from the cylinder, and so there is no tendency to accumulate water as there is in the construction where the exhaust is led back toward the axis of rotation before being permitted to escape. The accumulation of water, therefore, if the engine is operated by steam, is positively prevented by arranging the parts so that the flow of water will not be opposed by the centrifugal effect of the rotation.

It will be understood that I do not intend to limit myself to the character of fluid agent employed in driving the engine and it will be obvious that its simplicity of construction, economy and number of parts and efficiency in operation, render it available for many and diverse uses.

Having described my invention, what I claim is;

1. In an engine, the combination of a rotatable piston structure providing a series of radial pistons, a shaft therefor to which the piston structure is fixed, sleeves surrounding the shaft, plates carried by said sleeves providing circular tracks eccentric to the shaft, separated independently movable cylinders on said pistons having guiding connection with said tracks, and supports for the sleeves and shaft.

2. In an engine, the combination with a rotatable piston structure providing a series of relatively fixed radial pistons, a shaft therefor to which the piston structure is fixed, independently movable cylinders on the said pistons, means for guiding the cylinders in a circular path eccentric to the piston-axis, valves for admitting and exhausting fluid to and from the cylinders, arranged at the outer ends of the cylinders, and means for operating said valves, comprising an eccentric adjustable to vary both its degree and its angle of eccentricity relative to the axis of rotation of the piston structure.

3. In an engine, rotatable radial pistons, cylinders thereon, means guiding said cylinders in a path eccentric to the piston-axis comprising a plate having a track in one surface engaged by parts on the cylinders, a face plate confronting and spaced apart from the track plate, an eccentric provided with a gib engaging one plate for radial adjustment thereon, means for adjusting said plate, means for adjusting said eccentric, a strap for said eccentric, links connected to said strap, and exhaust valves at the outer extremities of the cylinders, operatively connected to said links.

4. In an engine, a shaft, radial pistons secured thereto, independently movable cylinders on said pistons, plates on the shaft provided with circular tracks eccentric to the shaft, means on the cylinders engaging said tracks, supports for the shaft and track plates, a face plate opposing the exterior of one track plate provided with a groove, an eccentric provided with a gib engaging said groove, an eccentric strap, links connected thereto, valves at the outer ends of the cylinders controlling the admission and exhaust of fluid, connected with said links, a housing for the engine parts, and means accessible from outside of the housing for adjusting the eccentric on the face plate to vary its degree and angle of eccentricity.

5. In an engine, a shaft, radial pistons fixedly connected thereto providing exterior annular recesses near their ends, fluid-supply connections to said recesses, an independently movable cylinder for each piston associated with the annular recesses to form thereof a fluid receiving chamber and forming with each piston end a working chamber, and means for controlling the passage of power-transmitting fluid from one said chamber to the other.

6. In an engine, a shaft, radial pistons fixedly connected thereto, each providing an exterior recess near its end, independently movable cylinders for the pistons, each said recessed piston and the cylinder forming a separate supply and working chamber within the cylinder, means for constantly supplying power-transmitting fluid to said supply chamber in said cylinder, means of fluid-communication from said chamber to the working chamber and from the latter to the exterior of the cylinder, and means for controlling fluid-flow from the first said chamber to the second and from the second to the exterior of the chamber.

7. In an engine, a shaft, radial pistons fixedly connected thereto, independently movable cylinders on the pistons, valves at the exterior ends of the cylinders, an eccentric and a plurality of links arranged to control the valves, an adjusting means for the eccentric comprising a manually operable member connected to the eccentric through a train consisting of a shaft, a rocking lever on the shaft, and a link pivotally connected to both the lever and the eccentric; and latching means for the manually operable member.

In testimony whereof I hereunto set my hand in the presence of two witnesses.

LEE O. GILLILAND.

In the presence of—

FORÉE BAIN,

MARY F. ALLEN.