No. 819,920. PATENTED MAY 8, 1906.

W. I. PHIFER.

ROTARY ENGINE.

APPLICATION FILED APR. 19, 1905.

4 SHEETS—SHEET 1.

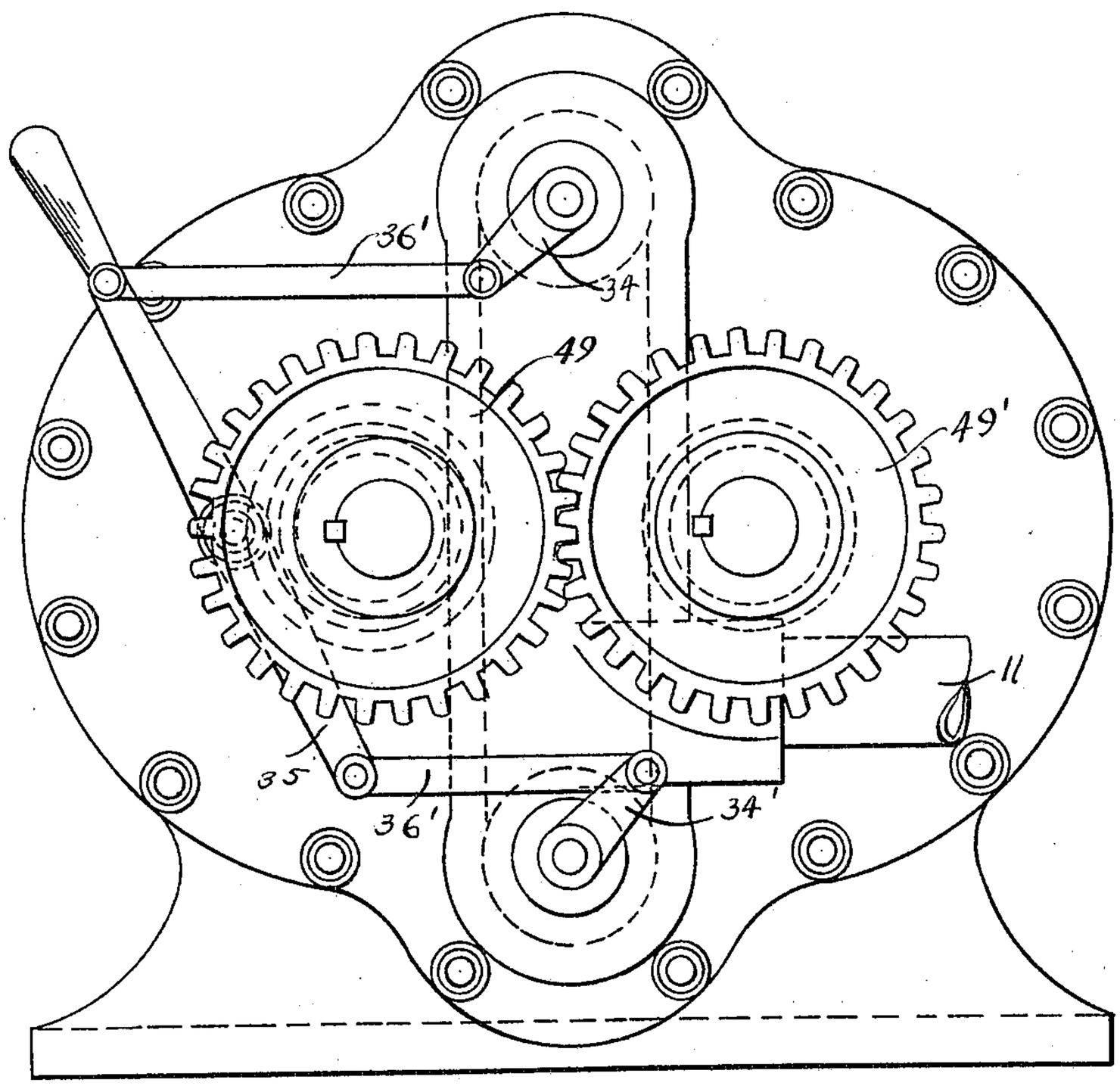

FIG. 1.

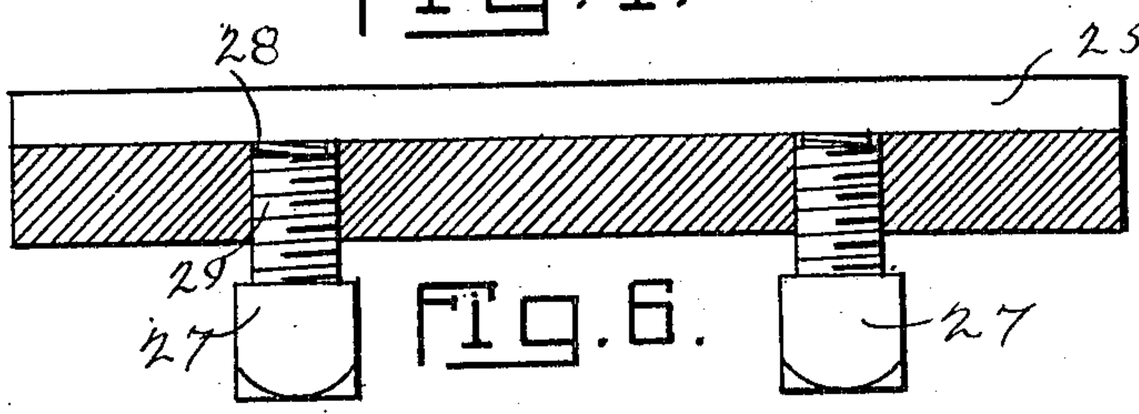

FIG. 6.

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4 SHEETS—SHEET 2.

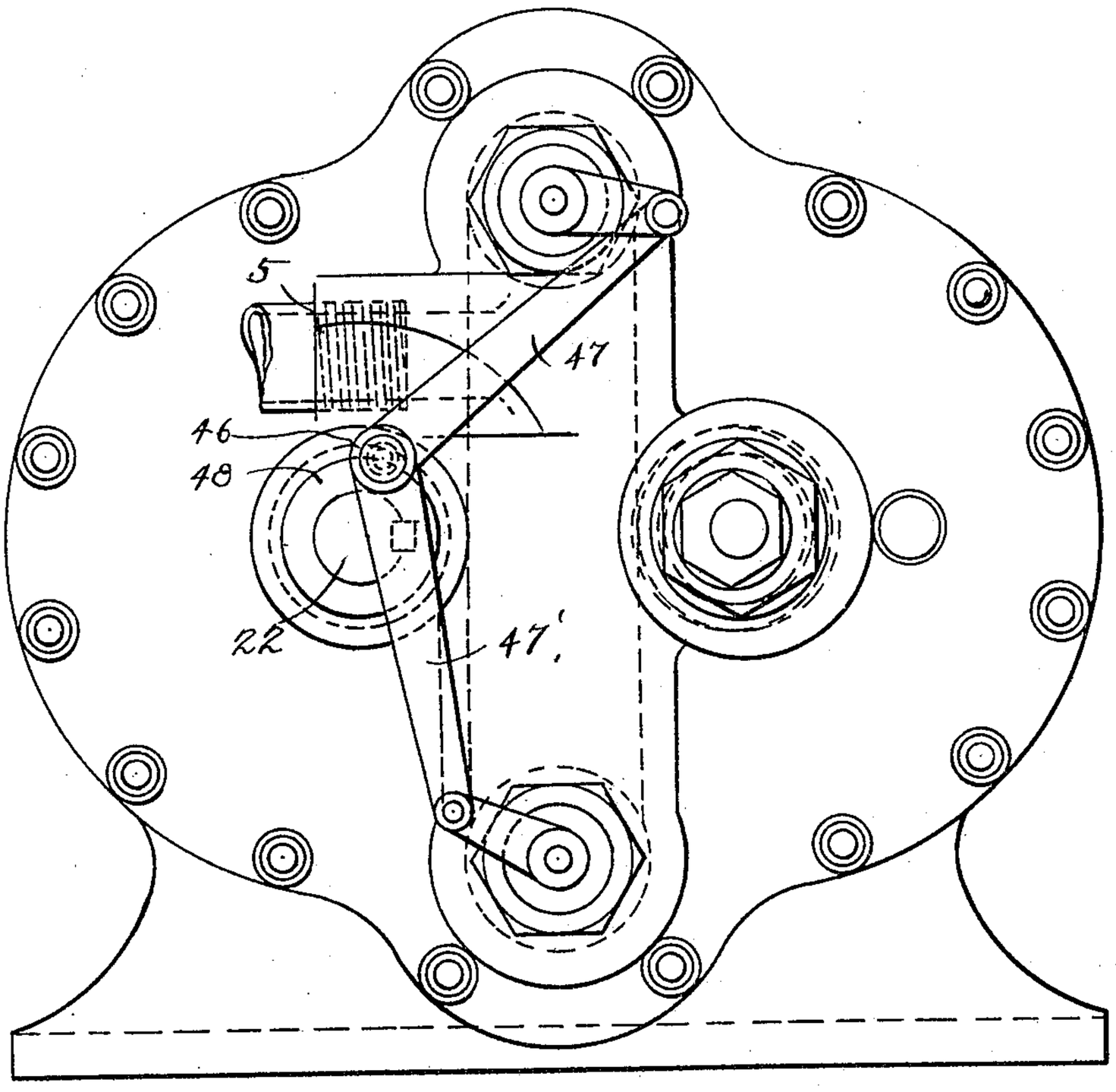

Fig. 2

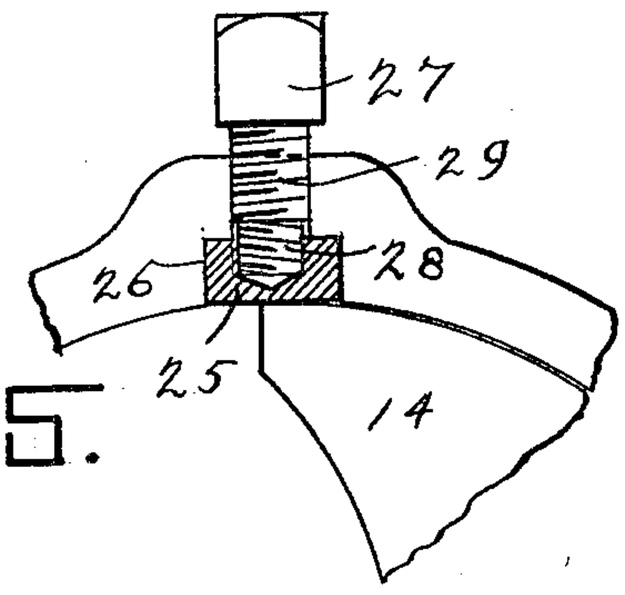

Fig. 5.

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4 SHEETS—SHEET 3.

FIG. 5.

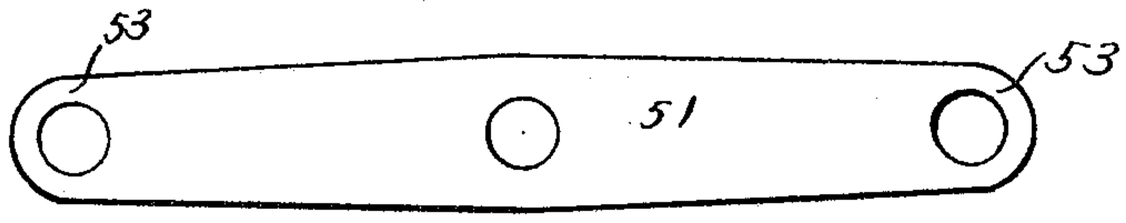

FIG. 7.

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4 SHEETS—SHEET 4.

Fig. 4.

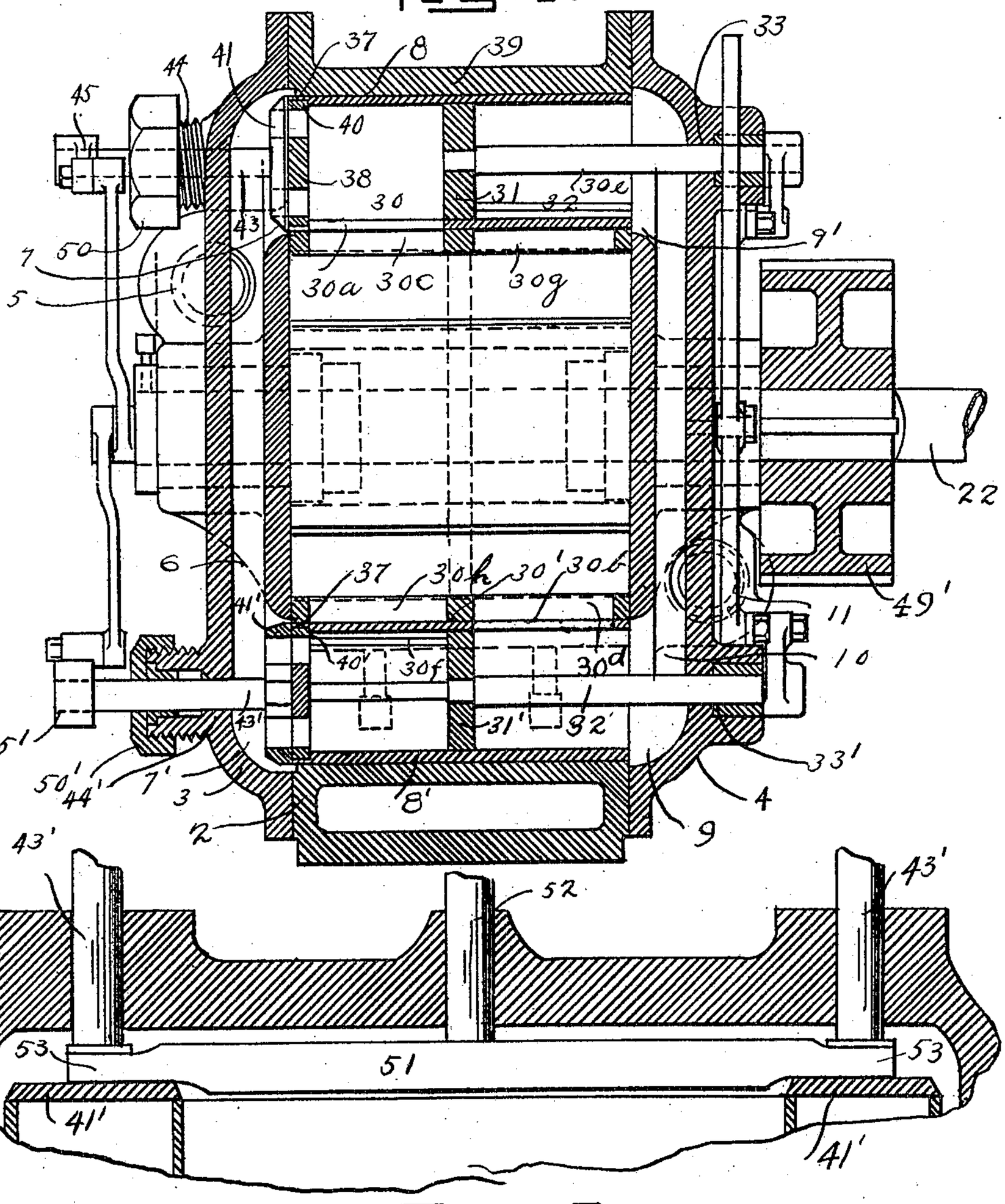

Fig. 8.

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UNITED STATES PATENT OFFICE.

WASHINGTON I. PHIFER, OF EDWARDSVILLE, ILLINOIS.

ROTARY ENGINE.

No. 819,920. Specification of Letters Patent. Patented May 8, 1906.

Application filed April 19, 1905. Serial No. 256,422.

To all whom it may concern:

Be it known that I, WASHINGTON I. PHIFER, a citizen of the United States, residing at Edwardsville, in the county of Madison and State of Illinois, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification, reference being had therein to the accompanying drawings.

My present invention relates to improvements in rotary engines; and the main object thereof is the provision of a rotary engine in which the inlet and outlet ducts are mounted in a head in which I use a peculiar shape and construction of valve and cut-off for regulating the flow of pressure fluid through said ducts to operate the engine and improved reversing mechanism whereby the pressure fluid is directed in the proper way upon the pistons without changing the entrance or outlet ports.

Another object of my invention is to provide means for advancing and retarding the abutting pistons, means whereby the bearing-points of the engine are externally adjustable, means whereby the cut-off parts may be raised away from their seats to allow a continuous flow of pressure fluid when desired, the provision of adjustable journal-bearings for the various parts, and making the pistons in sections, whereby they may be easily assembled and fastened together.

With these objects in view I produce a simple and practical form of rotary engine in which two pistons are operated in unison in the casing, the said pistons operating mechanism for controlling the supply of pressure fluid, the said pistons being of peculiar shape and so adjustable as to be in proper contact with each other while rotating within the casing.

To attain these objects, my invention consists of a rotary engine of this character having novel features of construction and combination of parts substantially as disclosed herein.

In the accompanying drawings, Figure 1 is a side elevation of the complete engine. Fig. 2 is a similar view taken from the opposite side. Fig. 3 is a view with one end removed and some parts in cross-section. Fig. 4 is a section taken on line X X of Fig. 3. Figs. 5 and 6 are detail views and show the means for adjusting the packing-pieces around the piston and in the shell. Figs. 7 and 8 are detail views of the mechanism for throwing the valves out of operation to allow the free flow of pressure fluid.

Referring to the drawings, the numeral 1 designates the base, which has formed integral therewith the annular ring or casing 2, which has secured upon opposite sides thereof the heads 3 and 4, the head 3 being provided with the inlet-port 6, which leads into the vertical duct 6, whose ends terminate at 7 and 7′, opposite the bores 8 and 8′, formed, respectively, at the top and bottom of the casing 2, the purpose of which will presently appear. Leading from the opposite ends of these ducts are the ends 9 and 9′ of the duct 10, which is in communication and terminates in the outlet-port 11, the inlet-port 5 and the outlet-port 11 being mounted, respectively, above and below the center lines of the casing.

The casing is formed so as to provide two compartments or chambers 12 and 13, in which are rotatably mounted the coacting pistons 14 and 15, said pistons consisting of the semicircular contact-surfaces 16, terminating in the webs or rims 17, which are of such construction as to provide the curved depressions or channels 18, the purpose of which will presently appear. The ends 19 of the webs or rims are mounted in longitudinal channels or grooves 20, provided in the surface of the cylinders 21 and 21′, these cylinders being secured rigidly upon the shafts 22 and 22′ by means of keys 23. In order to assist in reinforcing the pistons, I provide the rib 24. The grooves or channels 20 are arranged in such a position as not to be diametrically opposite, the purpose of which is to allow the contact-surfaces of the respective pistons to always be together at a point slightly out of the center of the casing, so that more power will be exerted as the pressure fluid passes through the bores 8 and 8′ in the center of the chambers 12 and 13 to rotate said pistons.

In order to properly pack the pistons within their respective chambers 12 and 13, I provide the adjustable packing-strips 25, which extend the full length of the casing and are mounted within the depressions or sockets 26 formed in the inner wall of the casing and are operated upon by means of the set-screws 27, the said set-screws being provided with the two different-diametered portions 28 and 29, the surfaces of which portions are provided with opposite screw-threads, so that the packing can be properly adjusted without be-

ing disconnected from the screw. These screws are made with a larger diameter next the head and are smaller at the end. Both parts are to be threaded—one right-hand and the other left-hand. The threads are of different number—that is, one coarser and the other finer—and it is therefore obvious that as the screw is turned the packing-strip will either be drawn into its seat or moved outward, thus always leaving it not flexibly but rigidly adjustable.

Mounted so as to have a slight movement within the bores 8 and 8′ are the cylindrical valves 30 and 30′, the said valves having mounted intermediate of their length within the same the disks 31 and 31′, which are connected, respectively, to the rods 32 and 32′, which pass through the bores 33 and 33′ in the head 4 of the casing, the said rods being operated upon by means of the crank-arms 34 and 34′, which are connected to the operating-lever 35 through the medium of the links 36 and 36′. The cylindrical valves 30 and 30′ are provided with elongated slots 30^a and 30^b, which are adapted to aline, respectively, with the slots or ducts 30^c and 30^d of the casing, these ducts being upon opposite sides of the casing and arranged, respectively, toward the inlet of the valve 30 and the outlet of the valve 30′, while I provide in the walls of the valves 30 and 30′ in the other ends the slots 30^e and 30^f, which are adapted when the engine is reversed to aline with the ducts 30^g and 30^h, formed in the casing, thus allowing the pressure fluid to enter the casing from below and pass out from above without changing the position of the inlet or outlet ports. By this mechanism the cylindrical valves are slightly turned, so as to reverse the flow of the pressure fluid, so that it is caused to pass from the duct 6 to the duct 10 in opposite directions without changing the inflow and outflow of the pressure fluid.

In order to control the admission of the pressure fluid through these valves, I secure to the ends 37 and 37′ the disks 38 and 38′, which are provided with the radiating wing-shaped openings 39. These disks are so secured within the spaces 40 and 40′ as to be a part thereof. Mounted over the ends of the valves and the disks 38 and 38′ are the disk valves 41 and 41′, which are provided with the wing-shaped openings 42, which are adapted to aline with the wing-shaped openings 39, so as to properly admit the pressure fluid into the valves, the volume of the pressure fluid depending upon the opening or channel thus provided, which may be very slight or the full width or size of the openings 39 and 42. In order to operate these disks, the rods 43 and 43′ are passed through the bores 44 and 44′ of the head 3 of the casing and have their ends connected to the disks 41 and 41′, the outer ends of said rods 43 and 43′ being connected to the crank-arms 45 and 45′, which are connected together at 46 by means of the links 47 and 47′. By this means the rotation of these disks is controlled, and in order to make the same automatic the stud 46 is connected upon an eccentric arm 48, carried upon the outer end of the shaft 22, so that as the piston 16 is rotated the valves 41 and 41′ are controlled so that the pressure fluid is properly admitted to operate the pistons.

Mounted upon the opposite ends of the shafts 22 and 22′ are the gears 49 and 49′, which are adapted to mesh with each other, so that the pistons as they are revolved by the pressure fluid will combine the power, and thus transmit it through the shaft 22′ to the proper mechanism which is adapted to be operated by the engine. It will thus be seen that the main portions of the valves—namely, the cylinders 30 and 30′—are stationary except when turned for reversing the engine, the cut-off being effected by the mechanism that operates the small stems passing through the stuffing-boxes 50 and 50′, the disks 41 and 41′ being oscillated so as to normally close the hollow cylinders, but, being perforated, as they are, a small move opens or closes the ports and an exceedingly small amount of power is lost in this operation.

In order to properly raise the disks 41 and 41′ away from the end of the hollow valves, so as to permit a continuous inflow of pressure when it may be desired, I provide a means, as shown in Figs. 7 and 8, the said means consisting of a link or yoke 51, which is connected to the slidingly-mounted stem 52, which is adapted to be pulled upon, so that its ends 53, which surround the stems or shafts 43 and 43′, will cause said shafts to move slightly outward and unseat the valves 41 and 41′, thus throwing the same out of operation, so that it does not control the outward or in flow of pressure fluid from said valves.

In expansive running the valve would open for full pressure when the pistons reach the position as shown in Fig. 3, and when they have moved ninety degrees the valve will close and for the next ninety degrees the pistons will run by expansion. There will be but small loss of pressure fluid from clearance, as the active chamber is always on the same side and never empties. When by expansion the pressure has been reduced, it will be simply supplemented by the high-pressure impulse for the next quarter-revolution, and so on continuously, the high pressure never having to fill a vacuum after the engine starts. The exhaust-ports always standing open, there can be no back pressure above what will displace the atmosphere.

The means for adjusting the pistons and keeping them in close contact with each other consists of the two sleeves or bearings 52 within the projecting hub or boss 53 of the

head 3 and surround one of the shafts 22 at each end. Both of these sleeves are bored very slightly eccentric, so that when one is turned in one direction, and the other in the other direction, the shaft will move in a straight line toward the other shaft.

When the proper adjustment has been made, they are simply locked in position by means of the set-screws 53 or any other desired means. Every adjustment of the engine can be made from the exterior. The sleeve-bearings extend inside the head, the central parts 54 of the pistons being bored to accommodate them. By this means I make the engine more compact and provide shoulders upon the sleeves to prevent leakage. The bores in the pistons can also be used as oil-chambers to lubricate both the end and the journal-bearings.

From the foregoing description, taken in connection with the drawings, it is evident that I provide a thoroughly efficient and practical rotary engine of this character and one which can be used as a continuously-moving engine with a determined amount of pressure fluid applied thereto, or it may be used as an expansion-engine by allowing the pistons to operate the valves and by the simple reverse mechanism can be easily reversed without the cushioning effect generally occasioned in engines of this character as the entrance and outlet ports of the engine remain the same at all times, only changing the direction of the admission of the pressure fluid to the engine.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a rotary engine, the combination of a casing having two chambers, pistons mounted in said chambers and in contact with each other, the contact-point of said pistons being beyond the center lines of the chambers, means for introducing pressure fluid centrally of the casing for operating upon the pistons, eccentric adjusting means for the journals of said pistons to keep the pistons always in contact with each other, and a series of adjustable packings mounted in each chamber and in contact with the pistons.

2. In a rotary engine, the combination of a casing having two chambers, pistons mounted in said chambers and in contact with each other, the contact-point of said pistons being beyond the center lines of the chambers, eccentric adjusting means for keeping the pistons always in contact with each other, valves for controlling the admission and escape of the pressure fluid to said casing and a series of adjustable packings mounted in each chamber and in contact with the pistons.

3. In a rotary engine, the combination of a casing provided with a single chamber having two enlarged portions and constricted near the center thereof, pressure-fluid ducts leading to the constricted portion of said chamber, a piston mounted in each enlarged portion of the chamber, eccentric adjusting means for keeping the pistons always in contact with each other, valves for controlling the admission and escape of the pressure fluid to said chamber, and adjustable packings mounted in said chamber for engaging the surface of the pistons.

4. In a rotary engine, the combination of a casing provided with a chamber having enlarged ends and having a constricted portion longitudinal of the central portion thereof, heads for said casing one provided with an inlet and the other with an outlet, pistons rotatably mounted within said chamber and in contact with each other, a vertical duct provided in each head opposite the constricted portion of the chamber, bores through the casing in communication with the ends of said vertical duct of the head for causing communication between said ducts and the chamber, and valves located in said ducts for controlling the admission and exit of pressure fluid.

5. In a rotary engine, the combination of a casing provided with a chamber having enlarged ends and having a constricted portion longitudinal of the central portion thereof, heads for said casing one provided with an inlet and the other with an outlet, pistons rotatably mounted within said chamber, adjusting means for holding the pistons always in contact with each other, a vertical duct provided in each head opposite the constricted portion of the chamber, bores through the casing in communication with the ends of said vertical duct of the head for causing communication between said ducts and the chamber, and valves located in said ducts for controlling the admission and exit of pressure fluid.

6. In a rotary engine, the combination of a casing provided with a chamber having enlarged ends and having a constricted portion longitudinal of the central portion thereof, heads for said casing one provided with an inlet and the other with an outlet, pistons rotatably mounted within said chamber and in contact with each other, a vertical duct provided in each head opposite the constricted portion of the chamber, bores through the casing in communication with the ends of said vertical duct of the head for causing communication between said ducts and the chamber, valves located in said ducts for controlling the admission and exit of pressure fluid, and reversing mechanism connected to the valves for causing the pressure fluid to enter into the chamber in the opposite direction.

7. In a rotary engine, the combination of a casing provided with a chamber having enlarged ends, a piston mounted in the end of each chamber and adapted to be in rolling contact with each other, bores centrally ar-

ranged above and below said chamber and in communication therewith, heads secured to the ends of the casing and provided with vertical ducts in communication with said bores upon opposite sides thereof, an admission-port in communication with one of the ducts of one head, an exhaust in communication with the duct of the other head, a cylindrical valve mounted in each of said bores provided with a disk in one end thereof having a series of openings in one end thereof, an oscillating valve opposed to said disk provided with openings adapted to aline with the openings of the disk, and mechanism connected to the pistons for oscillating said valve and controlling the flow of pressure fluid to the chamber.

8. In a rotary engine, the combination of a casing provided with a chamber having enlarged ends, a piston mounted in the end of each chamber and adapted to be in rolling contact with each other, bores centrally arranged above and below said chamber and in communication therewith, heads secured to the ends of the casing and provided with vertical ducts in communication with said bores upon opposite sides thereof, an admission-port in communication with one of the ducts of one head, an exhaust in communication with the duct of the other head, a hollow cylindrical valve mounted in each of said bores provided with a disk in one end thereof having a series of openings, an oscillating valve opposed to said disk provided with openings adapted to aline with the openings of the disk, mechanism connected to the pistons for oscillating said valve and controlling the flow of pressure fluid to the chamber, and means connected to the cylindrical valves for operating the same to reverse the direction of the flow of the pressure fluid.

9. In a rotary engine, the combination of a casing having two chambers, pistons mounted in said chambers and in contact with each other, centrally-arranged rotary valves operably connected to the pistons so as to be revolved thereby, means to control the flow of pressure fluid through the valves to give a forward or reverse motion to the pistons, and means to disconnect the controlling means to allow a continuous flow of pressure fluid through the proper valve in the desired direction.

10. In a rotary engine, the combination of a casing, a pair of contacting pistons mounted therein, valves controlled by the pistons to admit pressure fluid at the proper time, means for controlling the valves to direct the pressure fluid to operate the pistons either forward or reverse, and means controlling the said last-mentioned means, whereby pressure fluid is allowed to flow continuously in the proper direction, when desired.

11. In a rotary engine, the combination of a casing having two chambers, pistons mounted in said chambers and in contact with each other, centrally-arranged rotary valves operably connected to the pistons so as to be revolved thereby, means to control the flow of pressure fluid through the valves to give a forward or reverse motion to the pistons, means to operate said controlling means and allow a continuous flow of pressure fluid in the desired direction, and a series of adjustable packings mounted in each chamber adapted to contact the pistons.

12. In a rotary engine, the combination of a casing, a pair of contacting pistons mounted therein, valves controlled by the pistons to admit pressure fluid at the proper time, means for controlling the valves to direct the pressure fluid to operate the pistons either forward or reverse, means to cause the pressure fluid to be directed continuously, and a series of adjustable packings mounted in each chamber adapted to contact the pistons.

13. In a rotary engine, the combination of a casing, coacting pistons mounted therein, valves divided centrally having an entrance and exhaust port, a slidingly-mounted rotary controlling-disk operably connected to the pistons to admit the pressure fluid as desired, and means to disconnect the disk from the valves to allow the pressure fluid to flow continuously, in the desired direction.

14. In a rotary engine, the combination of a casing, coacting pistons mounted therein, valves for controlling the admission and exhaust of pressure fluid to the pistons controlled by the pistons, means for controlling the direction of the admission of the pressure, means for disconnecting said means to cause pressure fluid to flow continuously, and a series of adjustable packings mounted in each casing adapted to contact the pistons.

15. In a rotary engine, the combination of a casing, coacting pistons mounted therein, valves divided centrally having an entrance and exhaust port, a slidingly-mounted rotary controlling-disk operably connected to the pistons to admit the pressure fluid as desired, means to disconnect the disk from the valves to allow the pressure fluid to flow continuously in the desired direction, and a series of adjustable packages mounted in the casing adapted to contact the pistons.

16. In a rotary engine, the combination of a casing, a pair of coacting pistons mounted therein, cylindrical valves for controlling the admission and exhaust of the pressure fluid from the casing so arranged as to be given a slight turn, said valves being divided centrally so as to have an entrance and exhaust compartment, and an opening for each compartment.

17. In a rotary engine, the combination of a casing, a pair of coacting pistons mounted therein, cylindrical valves for controlling the admission and exhaust of the pressure fluid from the casing so arranged as to be given a slight turn, said valves being divided cen-

trally so as to have an entrance and an exhaust compartment, means for controlling the admission of the pressure fluid to the proper valve to regulate the direction in which the pistons revolve, and means for disconnecting said last-mentioned means so as to allow the continuous flow of pressure fluid through the casing in the proper direction.

18. In a rotary engine, the combination of a casing, coacting pistons mounted therein, cylindrical valves located above and below the central portion of the casing for controlling each an entrance and exhaust port entering the casing above and below.

19. In a rotary engine, the combination of a casing, coacting pistons mounted therein, cylindrical valves located above and below the central portion of the casing for controlling each an entrance and exhaust port entering the casing above and below, manually-operated means for simultaneously operating the valves so that their respective ports are in alinement so that one is opposite the entrance-port while the other is opposite the exhaust-port, means operably connected with the pistons for controlling the admission of the pressure fluid at the proper time, to the pistons, and means for operating the last-mentioned means for disconnecting them so as to allow a continuous flow of pressure fluid to the pistons.

20. In a rotary engine, the combination of a casing, a pair of coacting pistons mounted therein, cylindrical valves for controlling the admission and exhaust of the pressure fluid from the casing so arranged as to be given a slight turn, said valves being divided centrally so as to have an entrance and exhaust compartment, an opening for each compartment, and a series of adjustable packings mounted in the casing adapted to contact the pistons.

21. In a rotary engine, the combination of a casing, a pair of coacting pistons mounted therein, cylindrical valves for controlling the admission and exhaust of the pressure fluid from the casing so arranged as to be given a slight turn, said valves being divided centrally so as to have an entrance and an exhaust compartment, means for controlling the admission of the pressure fluid to the proper valve to regulate the direction in which the pistons revolve, means for disconnecting said last-mentioned means so as to allow the continuous flow of pressure fluid through the casing in the proper direction, and a series of adjustable packings mounted in each chamber adapted to contact the pistons.

22. In a rotary engine, the combination of a casing, coacting pistons mounted therein, cylindrical valves located above and below the central portion of the casing for controlling each an entrance and exhaust port entering the casing above and below, and a series of adjustable packings mounted in the casing adapted to contact the pistons.

23. In a rotary engine, the combination of a casing, coacting pistons mounted therein, cylindrical valves located above and below the central portion of the casing for controlling each an entrance and exhaust port entering the casing above and below, manually-operated means for simultaneously operating the valves so that their respective ports are in alinement so that one is opposite the entrance-port while the other is opposite the exhaust-port, means operably connected with the pistons for controlling the admission of the pressure fluid at the proper time to the pistons, means for operating the last-mentioned means for disconnecting them so as to allow a continuous flow of pressure fluid to the pistons and a series of adjustable packings mounted in the casing adapted to contact the pistons.

In testimony whereof I affix my signature in presence of two witnesses.

WASHINGTON I. PHIFER.

Witnesses:

ATLANTA PHIFER,

LEDLIE PHIFER.