No. 777,692. PATENTED DEC. 20, 1904.

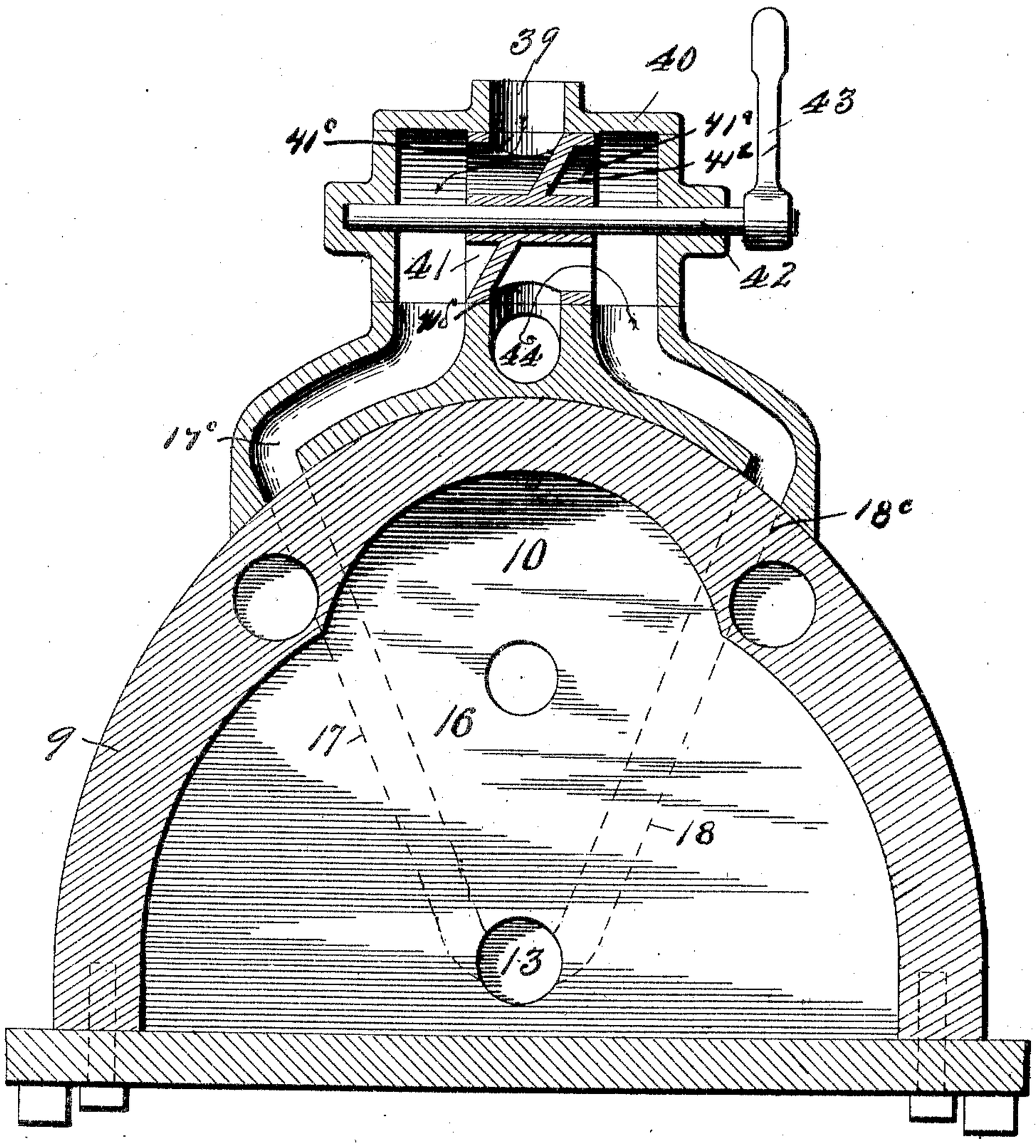
W. I. PHIFER.

ROTARY ENGINE.

APPLICATION FILED MAR. 11, 1904.

NO MODEL. 4 SHEETS—SHEET 1.

FIG. 1.



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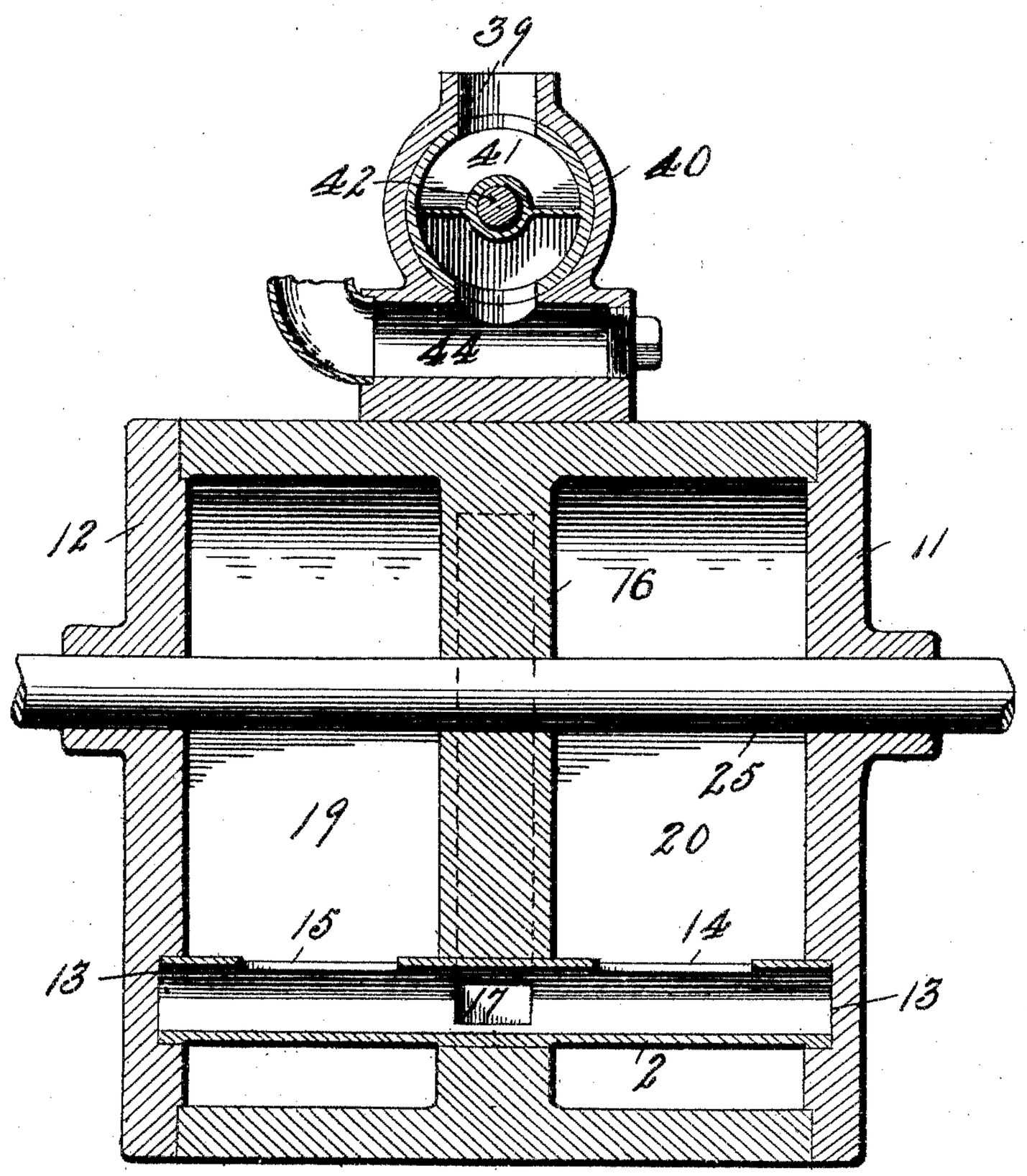
NO MODEL. 4 SHEETS—SHEET 2.

FIG. 2.



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NO MODEL. 4 SHEETS—SHEET 3.

FIG. 3.

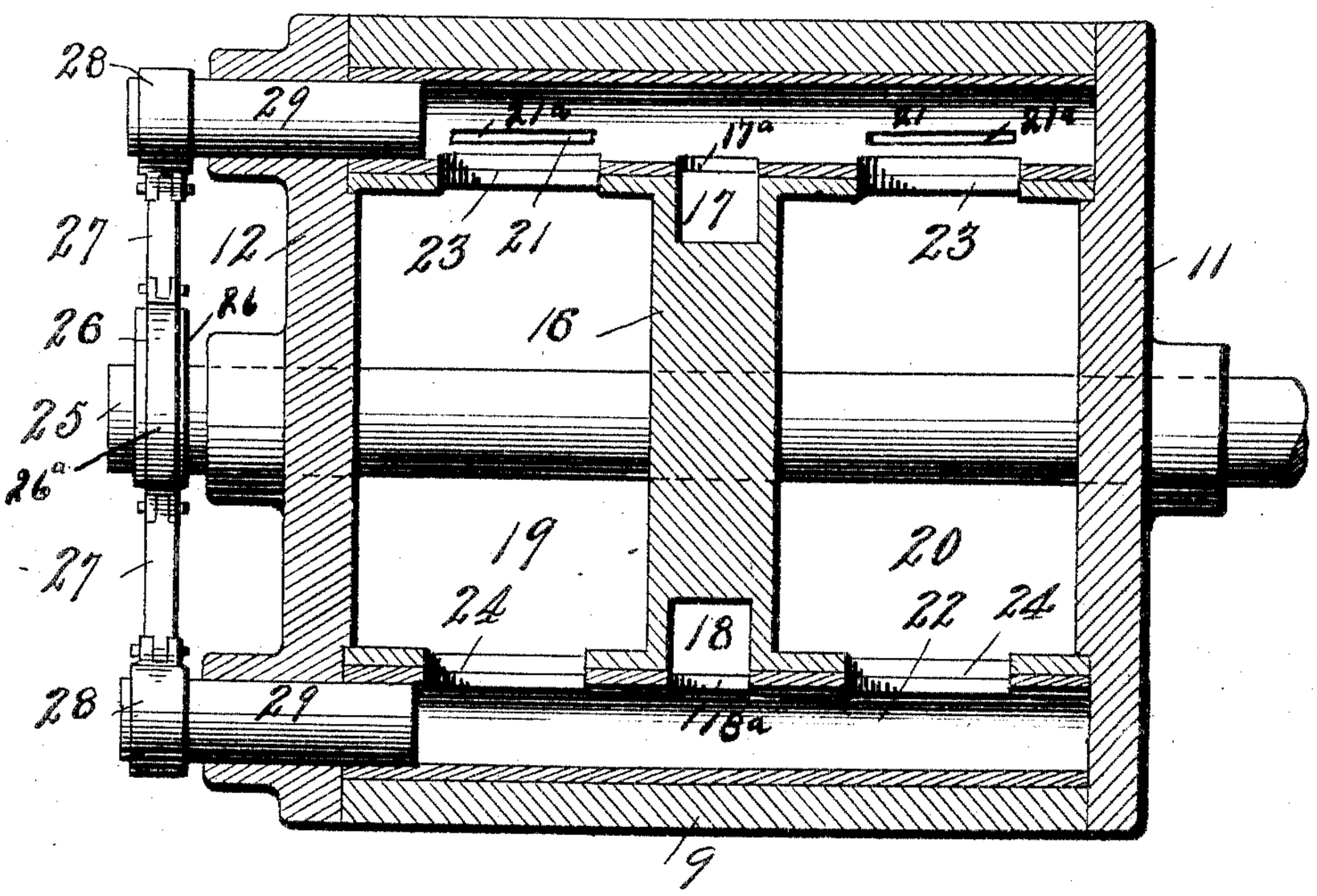
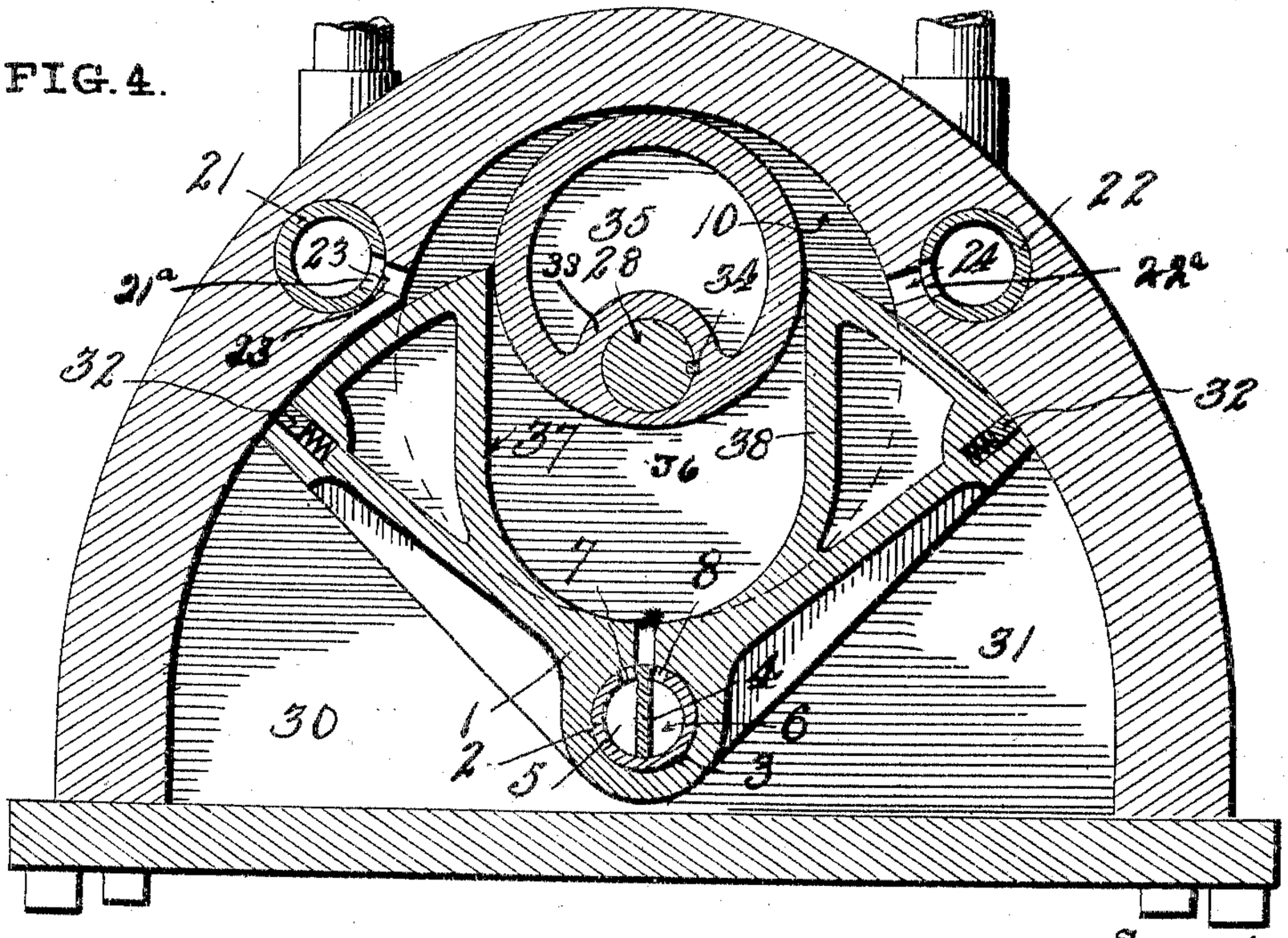


FIG. 4.



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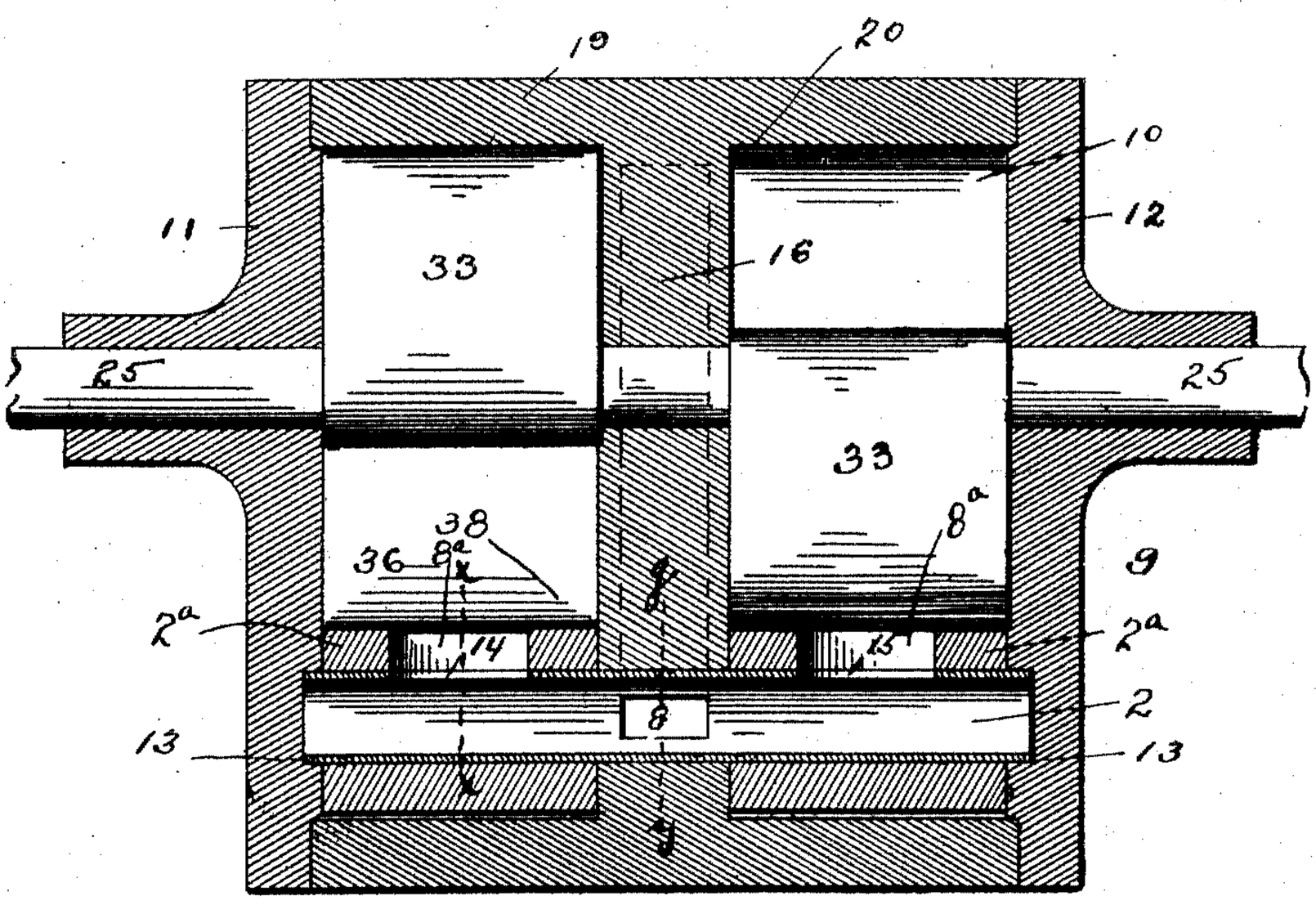
NO MODEL. 4 SHEETS—SHEET 4.

Fig. 5.



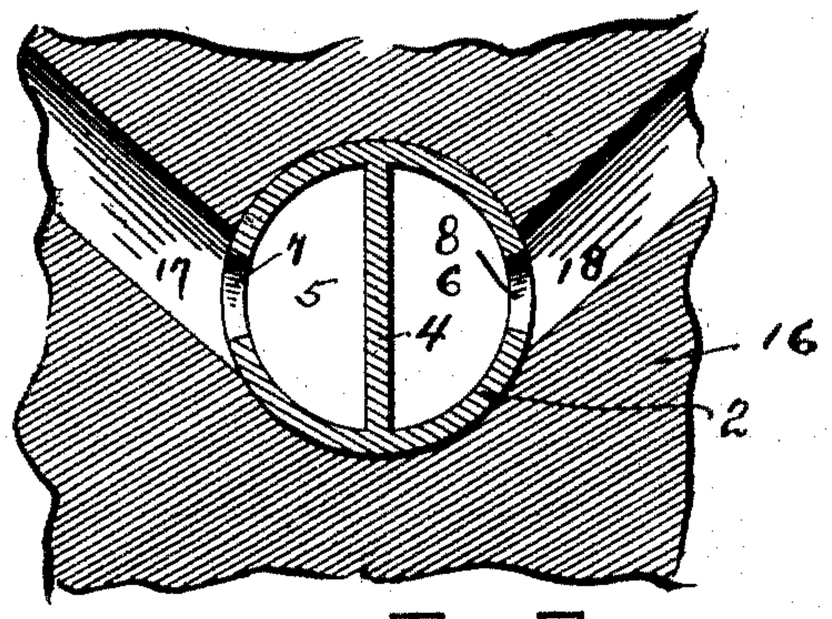


Fig. 7.

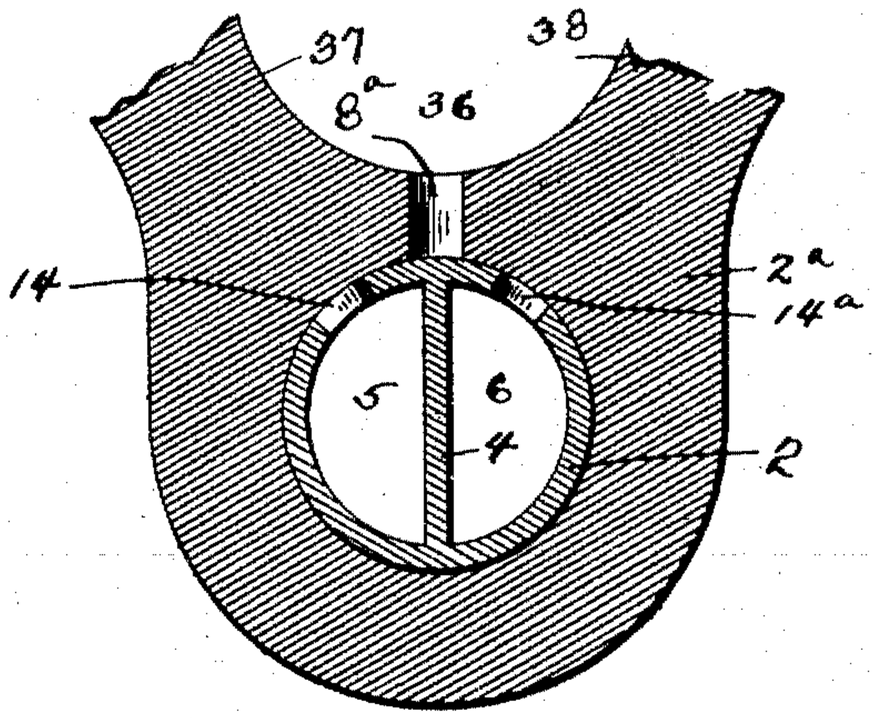


Fig. 6.

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No. 777,692. Patented December 20, 1904.

UNITED STATES PATENT OFFICE.

WASHINGTON I. PHIFER, OF CALIFORNIA, MISSOURI, ASSIGNOR OF ONE-HALF TO HENRY E. BLAKEMAN, OF CALIFORNIA, MISSOURI, OTTO CONRAD, AND W. F. QUIGLEY.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 777,692, dated December 20, 1904.

Application filed March 11, 1904. Serial No. 197,708.

To all whom it may concern:

Be it known that I, WASHINGTON I. PHIFER, a citizen of the United States, residing at California, in the county of Moniteau and State of Missouri, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

My present invention relates to improvements in rotary engines, and has for its object, among others, to provide an improved rotary engine having a greater pressure area than other rotary engines, whereby the advantage of the expansion may be obtained in a degree equal to that of the reciprocating engine.

It has for a further object to provide a rocking yoke so disposed as to follow the piston into the active area, thereby greatly reducing the quantity of steam required for a revolution without reducing the power, except for the small amount required to move the yoke. This yoke is so disposed that all pressure thereon is exerted in a line directly toward its pivotal point, whereby minimum force is necessary in order to oscillate it, thereby effecting a material saving in power. It also permits of the weight of the engine being brought to a minimum construction, while the construction is so simple as to render the cost but little compared with other forms of construction of rotary engines. I dispense with springs or delicate parts which are liable to become damaged or rendered inoperative, and as there are no parts employed in the construction which are difficult the cost will be materially lessened.

Another object in view is to provide for the compression of air in the most economical manner. This I accomplish by locating a valve in each of the ducts leading from the stationary valve to the valve-chest, the said valves being located at a point above the pivot of the valve, so as to cut off steam or other pressure fluid from the yoke-chamber and admit air instead. The piston is so disposed as to deliver all the air in the yoke-chamber at each revolution, and as two pistons are employed the flow of compressed air will be continuous, while the pistons will be driven from the pressure above. Thus it will be seen that one machine can be made to do the work of an engine and an air-compressor, and the cost of construction thereof will be less than either of such machines as now constructed.

I may or may not employ a reversing mechanism, as may be found most expedient. Such reversing mechanism when employed is simple and serves to control the flow of the pressure from the feed-pipe and to divert it in the one duct or the other, and thus alternately reversing the exhaust, and in that manner reversing the direction of movement of the piston.

I aim further at improvements in the details of construction to the end that parts shall be simple, easy to assemble, not liable to derangement or injury, and insuring efficient and reliable working of the engine.

Other objects and advantages of the invention will hereinafter appear, and the novel features thereof will be particularly pointed out in the appended claims.

The invention is clearly illustrated in the accompanying drawings, which, with the numerals of reference marked thereon, form a part of this specification, and in which—

Figure 1 is a view, partly in end elevation and partly in section, with the piston, the rocking yoke, and the head removed. Fig. 2 is a vertical transverse section taken at right angles to Fig. 1. Fig. 3 is a horizontal section through the valves looking down. Fig. 4 is an end elevation with the head removed minus the reversing-valve. Fig. 5 is a vertical transverse section taken at right angles to Fig. 1 with the pistons in position. Fig. 6 is a cross-section on line X X of Fig. 5. Fig. 7 is a cross-section on line Y Y of Fig. 5.

Like numerals of reference indicate like parts throughout the specification and drawings.

Referring to the drawings, the numeral 9 designates the casing within which is disposed the stationary valve 2, whose ends are journaled therein at 13, and mounted upon this stationary valve is a rocking yoke 2^a, which consists of the side walls or arms 37 and 38,

providing the yoke-chamber 36. Mounted upon the shaft 25 is the piston 33, which is rigidly secured thereto by means of a key 34 in any suitable manner, being hollow at 35 for the sake of lightness. This piston is so disposed as to rotate within the yoke-chamber 36 and the interior enlargement 10 of the casing, the ends of the casing being inclosed by suitable heads 11 and 12, so that the interior of the engine is readily accessible by removing the heads. The engine is preferably constructed so as to have two sets of yokes and pistons and is divided into two chambers 19 and 20 by means of a central partition 16.

The stationary valve 2, upon which the yokes are mounted, is hollow and cylindrical and is divided centrally, by means of a longitudinal strip 4, into two longitudinal semicircular compartments 5 and 6. Provided in the shell of this valve and in communication, respectively, with the compartments 5 and 6, centrally thereof, are the ports 7 and 8, which are adapted at all times to be in communication with the lower end of the oppositely-inclined ducts or channels 17 and 18, formed in the partition 16. I further provide in the walls of the valve 2 and in communication with the compartments 5 and 6 thereof the ports 14 and 15 and 14^a and 15^a, respectively, which are adapted to aline at the proper time with the channel or port 8^a, provided centrally in the body of the yoke, near the pivot thereof, so as to empty directly into the yoke-chamber 36 for the purpose hereinafter described.

The channels or ducts 17 and 18 empty, respectively, through the ports 17^a and 18^a, into the hollow valves 21 and 22, which are provided in the body thereof, upon opposite sides of the ports 17^a and 18^a, with the ports 21^a and 22^a, which at the proper time are adapted to aline with the ports 23 and 24 for the purpose hereinafter described.

The upper ends 17^c and 18^c of the ducts 17 and 18 are adapted to be in communication with the reversing-valve and casing or chest 40, and by means of the reversing or rotary valve 41 the admission of pressure fluid to either one of the ducts 17^b and 18^b is controlled through the entrance or feed-inlet 39. By means of the reversing-valve the pressure fluid is admitted in either direction so as to cause the proper oscillation of the yoke and rotation of the piston so as to cause the duct 17^c to be an admitting-duct, while the duct 18^c is an exhaust-duct. The reversing-valve 41 consists of a shell 41^a, provided with a diagonal web 41^b and with openings 41^c and 41^d, so that when the stem 42 is operated by the handle or lever 43 the opening 41^c is either alined with the feed-inlet or entrance 39 or the exhaust-opening 44, as may be desired, so that the opening 41^d will occupy the reversed position and be either in communication with the exhaust 44 or the feed 39.

In order to operate the valves 21 and 22 so that they will properly admit the pressure fluid and allow the same to be exhausted, I mount an eccentric 26 near the end of the main shaft 25, as clearly shown in Fig. 3, around which is mounted a strap 26^a, to which is connected the links 27, which are properly connected to the cranks 28 on the stems 29 of the respective valves 21 and 22. Thus these valves 21 and 22 can be timed so as to operate properly to properly admit pressure fluid to operate the yoke and pistons and to clear the casing at the proper time for the exhaustion.

The packing of my engine is very simple, and yet perfect and complete. For instance, any leakage from the chambers into the spaces 31 and 31 (shown in Fig. 4) and which constitute condensing-chambers will soon equalize the pressure on both sides and automatically pack itself. The open space in the pistons and arms of the yoke may be filled with fibrous material and oil, thus serving the double purpose of packing and lubricating the parts. It will also be observed that the pressure fluid is exerted toward the pivot of the yoke, but that the direct pressure of the piston is at right angles thereto, thus requiring but a trifling force to oscillate the yoke. It is also obvious that by constructing the pistons hollow, as shown, the shafts are passed through the pistons near one edge, thus securing great active area for pressure and making the engine exceedingly powerful. By reason of such greater pressure area the advantageous result of expansion is obtained in the greatest degree.

From the foregoing description, taken in connection with the drawings, the operation of my improved rotary engine is readily understood; but briefly stated it is as follows: Assuming the valve to be in the position shown in Fig. 1, the pressure fluid is admitted through the entrance 39, by means of the web of the reversing-valve, into the duct 17^c, where the pressure fluid at the proper time enters into the duct 17^a into the body of the valve 21, where the same is practically split and passes through the proper ports 21^a, and as the valve is operated to allow the port 21^a to be in communication with the port 23 the pressure fluid enters into the enlargement 10 of the casing and acts upon the piston. At the same time the lower duct 17 is filled with pressure fluid, so as to enter the port 7 and fill the compartment 5 of the stationary valve 2, where it passes through the ports 14 and 15 through the channels 8^a when they are in alinement with the ports 14 and 15, thus filling the yoke-chamber with the pressure fluid. As the piston is rotated and the rocking yoke oscillated toward the right the pressure fluid which has been admitted through the ports 23 passes over and exhausts through the ports 24 and by means of the ports 22^a into the rotary valve 22, where the same enters the port 18^a into

the upper end of the duct 18c, thence upward and through the exhaust 44. At the same time that this exhaust is taking place the openings 8a aline with the ports 14a and 15a, so that the pressure fluid within the yoke-chamber is exhausted into the compartment 6 of the stationary valve 2, so that the same will enter the port 8 into the channel 18, and thus commingle with the exhaust from the ports 24 and pass out through the exit 44.

To reverse the engine, it is simply necessary to turn the handle or lever 43 in a downward position, causing the opening 41c to be in alinement with the exhaust 44, while the opening 41d is in alinement with the entrance-port 39, thus causing the pressure fluid to flow in the reverse direction, entering the engine-compartment and the yoke-compartment, respectively through the ports 24 and 8a when the ports 8a are in alinement with the stationary-valve's ports 14a and 15a, the exhaust occurring through the channel 17 and 17c.

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

1. In a rotary engine, an oscillatory yoke, a stationary valve upon which the same is mounted and which serves as its pivot, and an eccentric piston mounted for movement in the chamber of said yoke.

2. In a rotary engine, an oscillatory yoke, a stationary valve upon which the yoke is mounted and which serves as its pivot, and a piston mounted for movement between the arms of the yoke and constructed to exert pressure thereon at right angles to the pivotal point of the yoke, the pressure of the pressure fluid being exerted toward the pivot of the yoke.

3. In a rotary engine, an oscillatory yoke, a piston mounted for movement between the arms of the yoke and constructed to exert its pressure thereon at right angles to the pivotal point of the yoke, the pressure fluid being exerted toward the pivot of the yoke, and a stationary valve serving as a pivot for said yoke.

4. In a rotary engine, the combination of a stationary valve, means for conducting pressure fluid to said valve, rotary valves adapted to receive pressure simultaneously with the stationary valve, an oscillatory yoke pivotally mounted on said stationary valve and provided with a chamber, a piston eccentrically mounted for movement within the chamber of the yoke, and means whereby pressure fluid is conducted from one portion of the stationary valve to the other portion and whereby the pressure fluid is exhausted through the opposite side of the engine.

5. In a rotary engine, the combination of a casing provided with channels leading from the top toward the sides in opposite directions, rotary valves mounted intermediate of the channels for causing communication alternately with the interior of the casing and the channels, a stationary valve mounted in the casing and provided with two chambers, each chamber being in communication respectively with the lower end of said channels, a yoke pivotally mounted on said stationary valve adapted to receive pressure fluid from the stationary valve at the apex thereof, and pistons mounted to revolve within the yoke-chamber and the casing of the engine.

6. In a rotary engine, the combination of a casing provided with channels leading from the top toward the sides in opposite directions, rotary valves mounted intermediate of the channels for causing communication alternately with the interior of the casing and the channels, a stationary valve mounted in the casing and provided with two chambers, each chamber being in communication respectively with the lower end of said channels, a yoke pivotally mounted on said stationary valve adapted to receive pressure fluid from the stationary valve at the apex thereof, pistons mounted to revolve within the yoke-chamber and the casing of the engine, and reversing mechanism for controlling the pressure fluid so as to cause it to pass into either one of the channels of the casing to operate the yoke and pistons and control the reverse movement thereof.

7. In a rotary engine, the combination of an oscillatory yoke provided with a chamber, a stationary valve upon which the yoke is mounted and which serves as its pivot, a piston eccentrically mounted for movement within the chamber of the yoke, rotary valves disposed above the pivot of the yoke one adapted to control the admission and the other to control the exhaust of the pressure fluid from the engine.

8. In a rotary engine, the combination of a casing, an oscillatory yoke provided with arms forming a yoke-chamber mounted in the casing, a stationary valve upon which the yoke is mounted and which serves as its pivot, a piston eccentrically mounted for movement within the chamber of the yoke and rotary valves mounted above the pivot of the yoke to control the admission and exhaust of the pressure fluid from the casing.

9. In a rotary engine, the combination of a casing, a stationary valve mounted in the lower end thereof, said casing being provided with channels in the walls thereof in communication with said stationary valve, an oscillatory yoke mounted upon said valve and provided with a chamber, a piston eccentrically mounted for movement within the chamber of the yoke, and rotary valves adapted to be used conjointly within the stationary valve to control the admission and exhaust of the pressure fluid from the casing.

10. In a rotary engine, the combination of a casing, said casing being provided with condensing-chambers upon opposite sides of the valve of the yoke, and with channels leading

from the top toward the sides in opposite directions, rotary valves mounted intermediate of the channels for causing communication alternately with the interior of the casing and the channels, a stationary valve mounted in the casing and provided with two chambers, each chamber being in communication respectively with the lower end of said channels, a yoke pivotally mounted on said stationary valve adapted to receive pressure fluid from the stationary valve at the apex of the stationary valve, and pistons mounted to revolve within the yoke-chamber and the casing of the engine.

11. In a rotary engine, the combination of a casing, said casing being provided with condensing-chambers upon opposite sides of the valve of the yoke, an oscillatory yoke provided with arms forming a yoke-chamber mounted in the casing, a piston eccentrically mounted for movement within the chamber of the yoke, and rotary valves mounted above the pivot of the yoke to control the admission and exhaust of the pressure fluid from the casing.

12. In a rotary engine, the combination of a casing provided with condensing-chambers upon opposite sides of the valve of the yoke, a stationary valve mounted in the lower end thereof, an oscillatory yoke mounted upon said valve and provided with a chamber, a piston eccentrically mounted for movement within the chamber of the yoke, and a rotary valve adapted to be used conjointly within the stationary valve to control the admission and exhaust of the pressure fluid from the casing.

13. In a rotary engine, the combination of a casing having a partition provided with ducts therein, rotary valves having ports for communication with the chambers upon opposite sides of the partition, oscillatory yokes, eccentric pistons mounted for operation within the chamber of the yoke, and a stationary valve forming the pivot on which the yokes turn, said stationary valve having ports for communication with said ducts and with said chambers.

14. In a rotary engine, an oscillatory yoke, a stationary valve upon which the same is mounted and which serves as its pivot, said stationary valve being divided into two longitudinal chambers which are adapted to be in communication with the entrance and exhaust and with the engine's casing, a piston eccentrically mounted for movement within the chamber of the yoke, and rotary valves disposed above the pivot of the yoke, one to control the admission and the other the exhaust of the pressure fluid.

15. In a rotary engine, an oscillatory yoke, a stationary valve upon which the same is mounted and which serves as its pivot, and an eccentric piston mounted for movement in the chamber of said yoke, said stationary valve being divided into two longitudinal chambers which are adapted to be in communication with the entrance and exhaust and with the engine's casing.

16. In a rotary engine, an oscillatory yoke, a piston mounted for movement between the arms of the yoke, and constructed to exert its pressure thereon at right angles to the pivotal point of the yoke, the pressure fluid being exerted toward the pivot of the yoke, and a stationary valve serving as a pivot for said yoke, said valve being divided into two chambers which are adapted to be in communication with the entrance and exhaust of the engine and with the engine's casing.

17. In a rotary engine, the combination of a stationary valve, said valve being divided into two longitudinal chambers which are adapted to be in communication with the entrance and exhaust and with the engine's casing, means for conducting pressure fluid to said valve, rotary valves adapted to receive pressure simultaneously with the stationary valve, an oscillatory yoke pivotally mounted on said stationary valve and provided with a chamber, a piston eccentrically mounted for movement within the chamber of the yoke, and means whereby pressure fluid is conducted from one portion of the stationary valve to the other and whereby the pressure fluid is exhausted through the opposite side of the engine.

18. In a rotary engine, the combination of a casing provided with channels leading from the top toward the sides in opposite directions, rotary valves mounted intermediate of the channels for causing communication alternately with the interior of the casing and the channels, a stationary valve mounted in the casing divided into two longitudinal chambers which are adapted to be in communication with the entrance and exhaust and with the engine's casing, a yoke pivotally mounted on said stationary valve adapted to receive pressure fluid from the stationary valve at the apex thereof, and pistons mounted to revolve within the yoke-chamber, and the casing of the engine.

19. In a rotary engine, the combination of a casing, a stationary valve mounted in the lower end thereof, said casing being provided with channels in the walls thereof in communication with said stationary valve, an oscillatory yoke mounted upon said valve and provided with a chamber, a piston eccentrically mounted for movement within the chamber of the yoke, and rotary valves to control the admission and exhaust of the pressure fluid from the casing, said stationary valve being divided into two longitudinal chambers which are adapted to be in communication with the entrance and exhaust and with the engine's casing.

20. In a rotary engine, the combination of a casing provided with condensing-chambers upon opposite sides of the valve of the yoke, a stationary valve mounted in the lower end thereof, said stationary valve being divided

into two longitudinal chambers which are adapted to be in communication with the entrance and exhaust and with the engine's casing, an oscillatory yoke mounted upon said stationary valve and provided with a chamber, a piston eccentrically mounted for movement within the chamber of the yoke, and a rotary valve adapted to be used conjointly within the stationary valve to control the admission and exhaust of the pressure fluid from the casing.

21. In a rotary engine, the combination of a casing having a partition provided with ducts therein, rotary valves having ports for communication with the chambers upon opposite sides of the partition, oscillatory yokes, eccentric pistons mounted for operation within the chamber of the yoke, and a stationary valve forming the pivot on which the yokes turn, said stationary valve having ports for communication with said ducts and with said chambers and being divided into two longitudinal chambers for communication with the entrance and exhaust and with the casing of the engine.

22. In a rotary engine, the combination of a casing, said casing being provided with condensing-chambers upon opposite sides of the valve of the yoke, and with channels leading from the top toward the sides in opposite directions, rotary valves mounted intermediate of the channels for causing communication alternately with the interior of the casing and the channels, a stationary valve mounted in the casing and provided with two chambers each chamber being in communication respectively with the exhaust and entrance port and with the engine's casing, a yoke pivotally mounted on said stationary valve adapted to receive pressure fluid from the stationary valve at the apex thereof, and pistons mounted to revolve within the yoke-chamber and the casing of the engine.

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

WASHINGTON I. PHIFER

Witnesses:
H. E. BLAKEMAN,
JAMES L. BUCHANAN.