(No Model.) 2 Sheets—Sheet 1.

F. M. BAILEY.

ROTARY ENGINE.

No. 533,406. Patented Jan. 29, 1895.

Fig. 1.

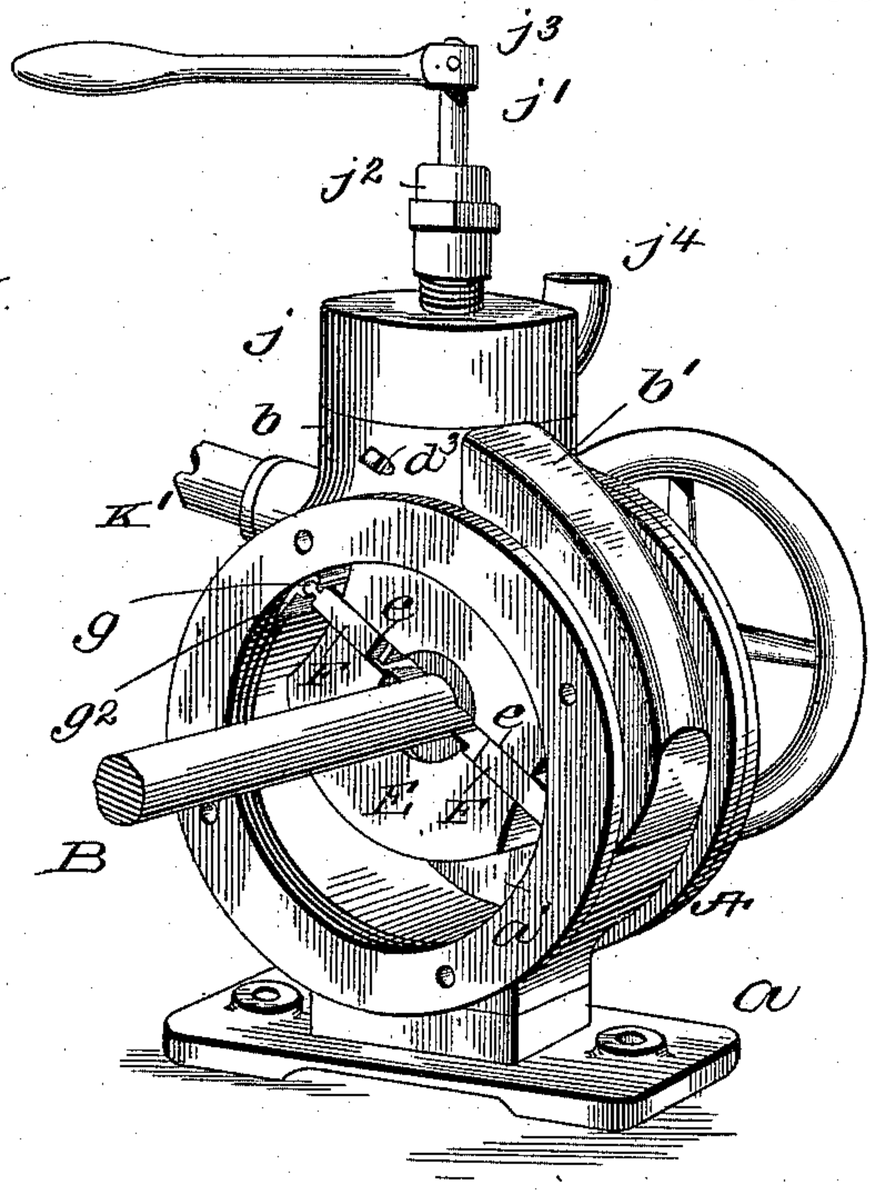
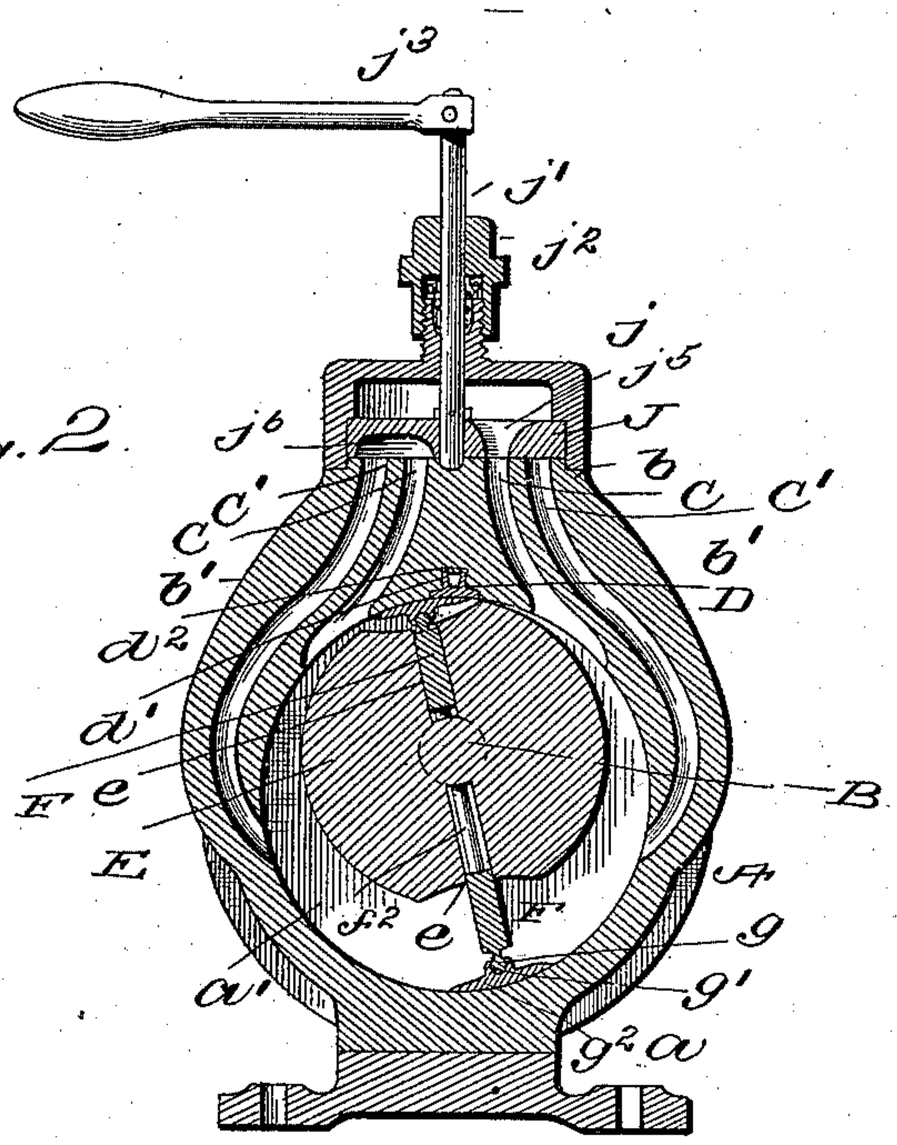


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

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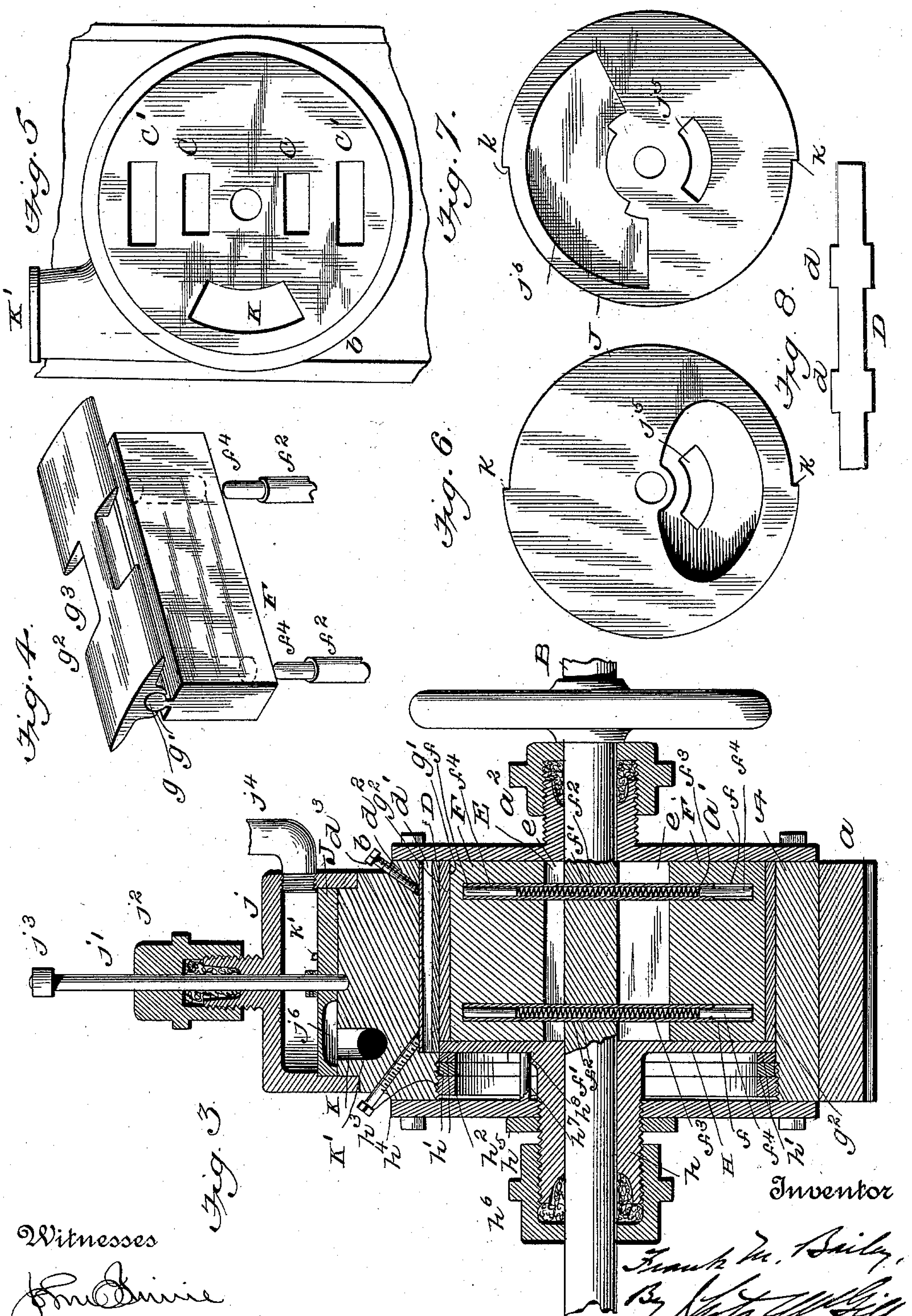

Witnesses

Inventor

Attorney

UNITED STATES PATENT OFFICE.

FRANK M. BAILEY, OF LIMA, NEW YORK, ASSIGNOR TO THE BAILEY ENGINE COMPANY, OF SAME PLACE.

ROTARY ENGINE.

SPECIFICATION forming part of Letters Patent No. 533,406, dated January 29, 1895.

Application filed June 16, 1894. Serial No. 514,780. (No model.)

To all whom it may concern:

Be it known that I, FRANK M. BAILEY, of Lima, in the county of Livingston and State of New York, have invented certain new and useful Improvements in Rotary Engines; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a new and improved rotary engine and is specially designed as an improvement on my form of engine shown and described in Letters Patent No. 484,769, dated October 25, 1892.

The principal objects of the present invention are, first, to render the engine capable of quick or instant reversal of operation; second, to compensate for wear or friction; third, to prevent any retardation of the movement of the engine by reason of any dead steam or such utilized steam as is retained in the cylinder after the exhaust port has been passed; and, fourth, to increase the general efficiency and simplify the construction of parts.

To these ends the invention comprises the novel features of construction, and the detail combination and arrangement of parts, substantially as hereinafter fully set forth and particularly pointed out in the claims.

In the accompanying drawings:—Figure 1 is a perspective view with one of the cylinder heads removed. Fig. 2 is a vertical sectional view. Fig. 3 is a longitudinal sectional view. Fig. 4 shows one of the piston plates and its wing in detail. Fig. 5 is a top plan view of the valve seat. Figs. 6 and 7 are, respectively, top and bottom plan views of the valve. Fig. 8 is a detail.

Referring to the drawings, A designates the piston cylinder or circular chamber, and *a* a suitable base to which said cylinder or chamber may be secured, or it may be made integral therewith. One end of this cylinder is closed by a head-plate *a'*, which is rigidly secured thereto, and is provided with a stuffing box a^2 coincident with an eccentrically located hole or opening through which the main driving shaft B is projected. From the top of this cylinder extends a circular enlargement *b*, from which at diametrically opposite points extend lateral branches or enlargements *b'* which are formed integral with the opposite sides of said cylinder A. Each of these branches or enlargements *b'* is provided with two separate ports or passage-ways C, C', the ports or passage-ways C' being outside of the ports C. These latter ports C', constitute the exhaust ports, while the ports C are essentially the inlet ports, but are alternately employed as auxiliary exhaust ports for back-pressure relief. The openings of these ports C at their inner ends on the surface of the bore of cylinder A are preferably elongated or substantially at right angles to the openings of the exhaust ports C'.

In a slot and suitable correspondingly-formed lateral depressions in the top of the inner surface of the cylinder A is located a compensating friction plate D against which the piston is designed to bear and by the adjustment of which compensation is had for loss by friction. This plate has two sets of lateral wings *d* (see Fig. 8) which fit in corresponding depressions in the top of the cylinder, and is also provided with two upwardly extending slightly flared flanges *d'*, which fit in the slot in the cylinder. Said slot being slightly smaller than the width of said flanges the latter firmly bind therein and hold the plate rigidly in place. On the top of these flanges rests a plate d^2 against which are designed to bear adjusting screws d^3 for regulating the position of the friction plate D as the wear thereof or the piston may render necessary.

E is a piston-head or wheel which is firmly secured to or formed integral with the operating shaft B. In this piston-head or wheel are formed two opposite longitudinal slots *e* which extend from end to end of said head or wheel and from the surface of said shaft to the periphery of the piston-head. In these slots are designed to fit two corresponding plates F in each of which are formed two holes or openings *f* which extend to near the outer longitudinal edges of said plates and in which and corresponding coincident holes *f'* in shaft B are designed to fit hollow tubes f^2 in each of which is located a coil spring f^3 and two end-lugs f^4. These springs in said tubes hold the end-lugs tight against the outer ends of the holes *f* of said plates F tending

to force the two plates apart or away from each other. The outer longitudinal edge of each plate F has formed therewith a knuckle or partially rounded flange g which is designed to fit in a correspondingly formed socket g' on the inner surface of a wing g^2. Thus a pivotal connection is had for these wings with the plates F. The end-portions of these wings are of equal width, as shown in Fig. 4, while at their centers said wings are reduced leaving a narrow neck or connecting portion g^3. The spring-pressed lugs located in the openings in plates F serving to force the latter outward, consequently constantly hold the pivoted wings tight against the inner circumference of the piston cylinder A. These wings being pivoted readily conform to the surface of the said cylinder and the action of the steam against the under side of either wing serves to bind the latter firm against the said cylinder surface. It will be seen that the piston-head or wheel is eccentrically mounted in its cylinder and that its contact is with the upper contact plate D located at the top of said cylinder. Hence by adjusting said plate compensation is readily had for any upper wear.

In order to compensate for end-wear I employ a follower-plate H which is of circular form and has an eccentrically located opening for the passage of shaft B. This follower fits snug against one end of the piston-head or wheel and coincident with its opening projects a threaded hub h. Next to this follower-plate are two split ring-washers h' so located that they will have brake joints. These split washers are held firm, one against the end of the piston-head, by an adjusting nut h^2, which is externally threaded to engage a female thread h^3 on the inner surface of the piston-cylinder. By turning this adjusting nut the washers are firmly bound in place and a steam-tight joint is obtained. The cylinder-head h^4 is then secured in place and a jam nut h^5 is screwed upon the projecting threaded hub of the follower and bearing firmly against the piston-head tends to bind all of the parts firmly together. A stuffing box h^6 is located on the projecting end of the threaded hub of said follower. Any end-wear of the piston-head or wheel is readily taken up by the removal of the cylinder-head h^4 and the readjustment of the nut h^5. A short finger h^7 projecting from the cylinder-head h^4 engages a grooved flange h^8 of the follower plate, holding the latter as against turning.

J is the steam inlet valve located in an inclosing casing j firmly secured to the circular enlargement b of cylinder A and having its operating stem j' extending upward through a stuffing box j^2 and provided with an operating handle j^3. The steam inlet pipe j^4 opens into this casing near the upper end thereof and above the valve. In the latter is formed a steam-inlet port j^5 and in its under side is an exhaust chamber j^6 which is closed at the top and open at the bottom. This chamber is designed to form the connection between either of the main exhaust ports and the auxiliary relief port and the outlet port K formed in the valve-seat and with which connects a pipe K′ for conveying off exhaust-steam. Two shoulders k, k, are formed on the periphery of this valve, the same being designed to engage a suitable stop k' in the valve-casing to limit the movement of the valve in either direction.

To start the engine the operator turns the valve J causing its port j^5 to register with one of the steam supply or inlet ports C. When in this position the adjacent exhaust port C′ is closed, while the main exhaust port K and the opposite exhaust port C′ and its adjacent port C, which is now serving as an auxiliary relief, are thrown into communication by the exhaust chamber j^6 in the under side of the valve J.

To instantly reverse the operation of the engine it is only necessary for the operator to turn the valve so as to throw the inlet port j^5 into line with the other steam inlet port C, which was before serving as an auxiliary exhaust, closing its adjacent port C′, and opening up the previously closed port C′ and the port C which was previously used as a supply port, thus throwing these two latter ports into communication with the main outlet port K, the port C previously used for supplying steam now serving as an auxiliary exhaust for back-pressure. In this way the operation of the engine can be instantly reversed, or by moving the valve only one-half of the limited distance the operation of the engine can be instantly stopped.

The operation of my improved rotary engine will be apparent to those skilled in the art, as will also the advantages thereof. It will be seen that steam being admitted through either one of the ports C will fill the space between one of the plates F and its wings and the inner circumference of the piston-cylinder or chamber and instantly cause the rotation of the piston-head and rotary-shaft B. As the wing of either plate F passes the exhaust port C′ steam is permitted to escape therethrough and as the piston continues its revolution any back pressure is relieved through the auxiliary-relief which is formed by the other steam port C. By making the pivoted wings in the manner described, that is, with a central narrowed connecting neck, no impediment or cessation in the operation of the engine is experienced as the said wings pass over the steam-inlet ports, which latter are not closed by the passage of said wings. The wings being pivoted they will instantly turn in the desired direction according to the revolution of the piston head, and the steam acting against the under side of either wing will bind the same tight against the surface of the cylinder.

By means of my improved rotary engine a very rapid rotation of the shaft is obtained

and the direction of rotation of said shaft can be changed instantly by simply moving the valve-stem handle. In addition to this advantage all friction caused by wear both at the top and the end of the piston-head or wheel is readily compensated for by the means shown and described.

I claim as my invention—

1. The combination with the piston head or wheel, of the cylinder therefor, having an upper extension or enlargement forming a valve seat and two sets of opposite ports opening at their ends at the top of said extension and on the interior of said cylinder, the circular valve fitted on said seat having a single-steam-inlet port extending therethrough and an exhaust chamber in its under side designed to coincide with both ports on one side of said cylinder when the said steam-inlet port is coincident with one of said ports on the other side of said cylinder, the stem for said valve, the inclosing case secured to said extension, and the operating handle secured to said valve-stem, substantially as set forth.

2. In a rotary engine, the piston-head or wheel, the cylinder therefor having an upper circular extension, a casing fitting on said extension having a steam supply pipe opening thereinto, and an upper central opening, steam inlet and exhaust ports leading from each side of the top of said extension and opening at their lower ends into said cylinder, the circular valve fitted on the upper end of said circular extension having an inlet port and an exhaust chamber, the vertical stem extending from said valve through said central opening in said casing, and the exhaust pipe leading from one side of said circular extension, substantially as set forth, the said inlet port of said valve being designed to register with one of said ports on one side of said cylinder, while the exhaust chamber of said valve is coincident with both ports on the other side thereof, as stated.

3. In a rotary engine, the cylinder provided with steam-inlet and outlet ports, the piston-head or wheel having two opposite slots, plates fitted in said slots having coincident holes therein, tubes fitted in said coincident holes of both plates and having spring-pressed lugs at their ends, and wings pivotally connected to the outer edges of said plates and held tight against the inner surface of said cylinder by the spring pressure on said plates, substantially as set forth.

4. In a rotary engine, the cylinder having steam-inlet and outlet ports, the piston-head or wheel mounted in said cylinder having two opposite longitudinal slots, plates fitted in said slots having coincident holes therein, hollow tubes extended into said coincident holes of both plates, lugs in both ends of said tubes and a spring in each of said tubes bearing outwardly on said lugs forcing the outer ends of said plates toward the inner surface of said cylinder, substantially as set forth.

5. In a rotary engine, the cylinder having steam-inlet and outlet ports, the piston head or wheel mounted in said cylinder having two opposite longitudinal slots, plates fitted in said slots having each two holes therein closed at their outer ends, two hollow tubes extended into the coincident holes of said plates, lugs in the ends of said tubes, springs in said tubes bearing outwardly on said lugs forcing the same against said closed ends of said holes, and the wings pivotally connected to the outer longitudinal edges of said plates, substantially as set forth.

6. In a rotary engine, the piston head or wheel having opposite sliding plates and wings pivoted to the outer longitudinal edges of said plates having widened ends and narrow connecting portions, substantially as set forth.

7. In a rotary engine, the piston-head or wheel having opposite slots, plates fitted in said slots having knuckles or rounded flanges on their outer longitudinal edges, wings having sockets conforming to said knuckles or flanges and also having widened ends and narrow connecting portions, and springs bearing outwardly on said plates holding said wings in contact with the piston-cylinder, substantially as set forth.

8. In a rotary engine, the cylinder having steam-inlet and outlet ports, said inlet ports at their inner ends being elongated in the direction of the curvature of said cylinder, the piston-head or wheel having opposite sliding plates, and wings pivoted on the outer longitudinal edges of said plates having narrow central portions and outer widened ends, substantially as set forth.

9. In a rotary engine the combination of the cylinder having a slot in its upper portion, a friction-plate having upper slightly flared flanges fitted in said slot, and the eccentrically mounted piston-head or wheel designed to contact with said plate, substantially as set forth.

10. In a rotary engine, the combination of the cylinder having a slot in its upper portion, a friction plate having upper slightly flared flanges fitted in said slot, a plate resting on said flanges, adjusting screws bearing against said latter plate, and the eccentrically arranged piston-head or wheel, substantially as set forth.

11. In a rotary engine, the combination with the cylinder having head-plates, of the piston-head or wheel eccentrically mounted in said cylinder, a follower-plate fitting against one end of said piston-head or wheel, and having a hub projecting through one of said head-plates, and adjustable means for engaging said hub for adjusting and holding said follower plate, substantially as set forth.

12. In a rotary engine, the combination with the cylinder, and the head-plates therefor having eccentrically arranged openings, of the piston-head or wheel having its shaft extended through said openings, the follower-plate having a threaded-hub extended through

said opening of one of said head-plates, adjustable means for forcing said follower plate against one end of said piston-head or wheel, and the jam-nut working on said threaded hub and binding against said head-plate, substantially as set forth.

13. In a rotary engine, the combination with the cylinder, of the piston head or wheel, the follower-plate fitted against one end of said piston-head or wheel, the circular-washers adjacent to said follower-plate, and the adjusting nut for binding said washers against said follower-plate, substantially as set forth.

14. The combination with the cylinder having an interior screw-thread, of the piston-head or wheel, the follower-plate fitted against one end of said piston-head or wheel, the circular washers, and the threaded adjusting nut engaging said thread of said cylinder and binding said washers against said follower-plate, substantially as set forth.

15. The combination with the cylinder having an internal screw-thread, and the head-plates having eccentrically arranged openings, of the piston-head or wheel, the shaft therefor, the circular follower-plate fitted against one end of said piston-head or wheel and having a threaded hub extended through the opening in one of said head-plates, the circular washers, the threaded adjusting nut working in the thread of said cylinder for binding said washers against said piston-head, and the jam-nut working on said threaded hub and designed to bind against the adjacent head-plate, substantially as set forth.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

FRANK M. BAILEY.

Witnesses:
H. C. GILBERT,
LANDON PARMELE.