J. A. SMITH.

ROTARY ENGINE.

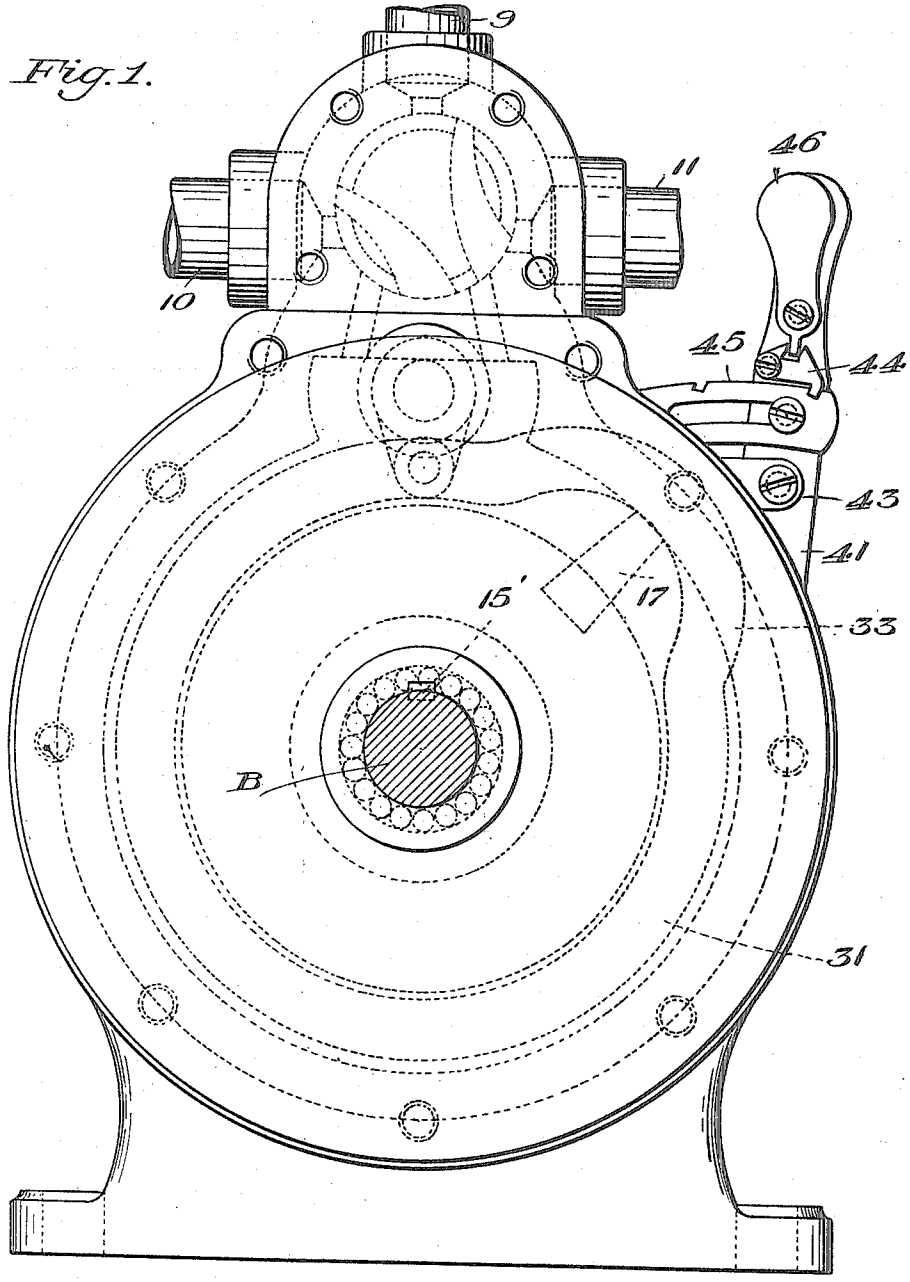
APPLICATION FILED MAR. 21, 1913. RENEWED MAY 4, 1916.

1,208,030.

Patented Dec. 12, 1916.

5 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

Chas. E. Chapin.

Leslie L. Pratt

INVENTOR

John A. Smith

Vernon E. Forges

his ATTORNEY

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

J. A. SMITH.

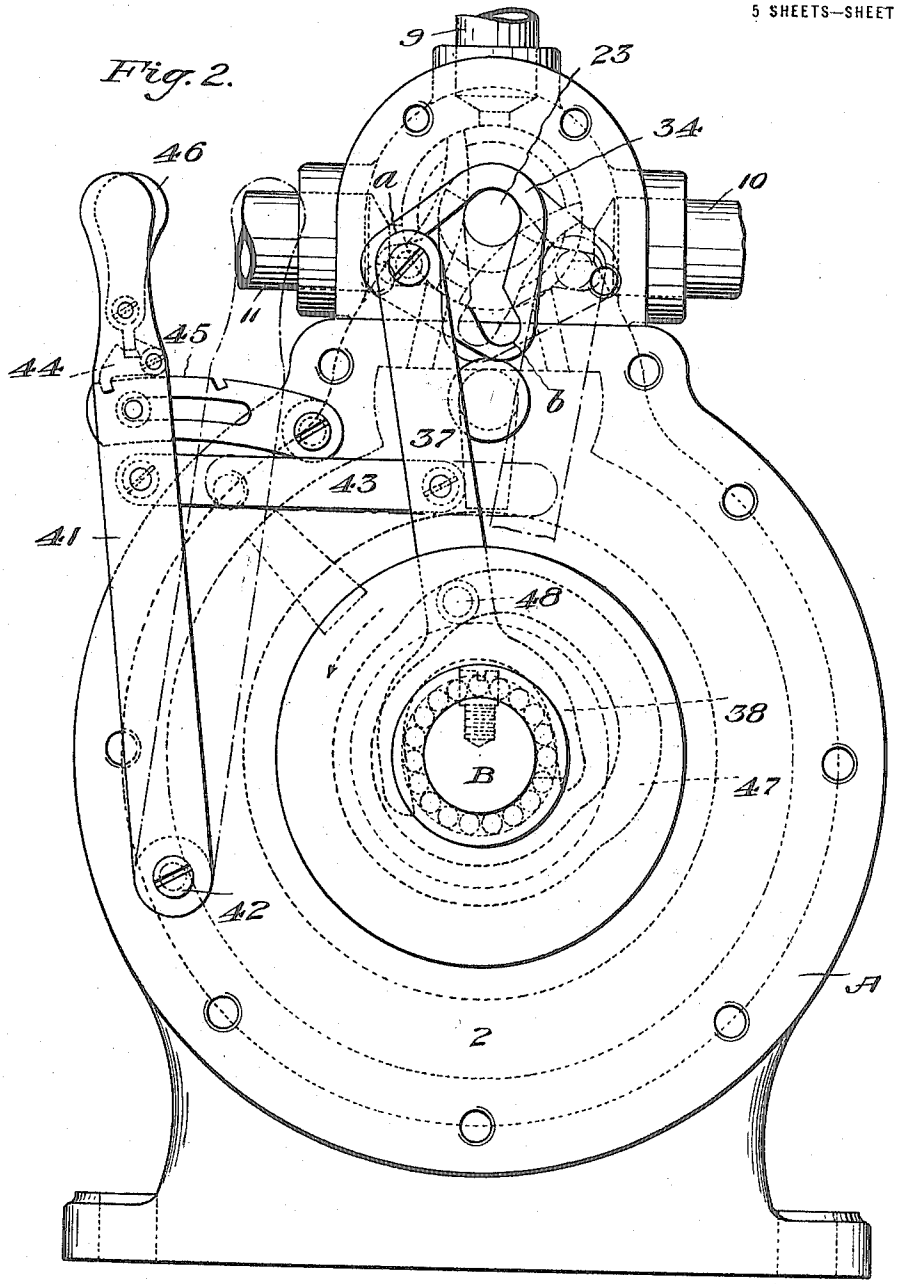
ROTARY ENGINE.

APPLICATION FILED MAR. 21, 1913. RENEWED MAY 4, 1916.

1,208,030. Patented Dec. 12, 1916.

5 SHEETS—SHEET 2.

Fig. 2.



WITNESSES:

Chas. E. Chapin

Leslie L. Pratt

INVENTOR

John A. Smith

Vernon E. Forbes

His ATTORNEY

THE NORRIS PETERS CO., PHOTO LITHO., WASHINGTON, D. C.

J. A. SMITH.

ROTARY ENGINE.

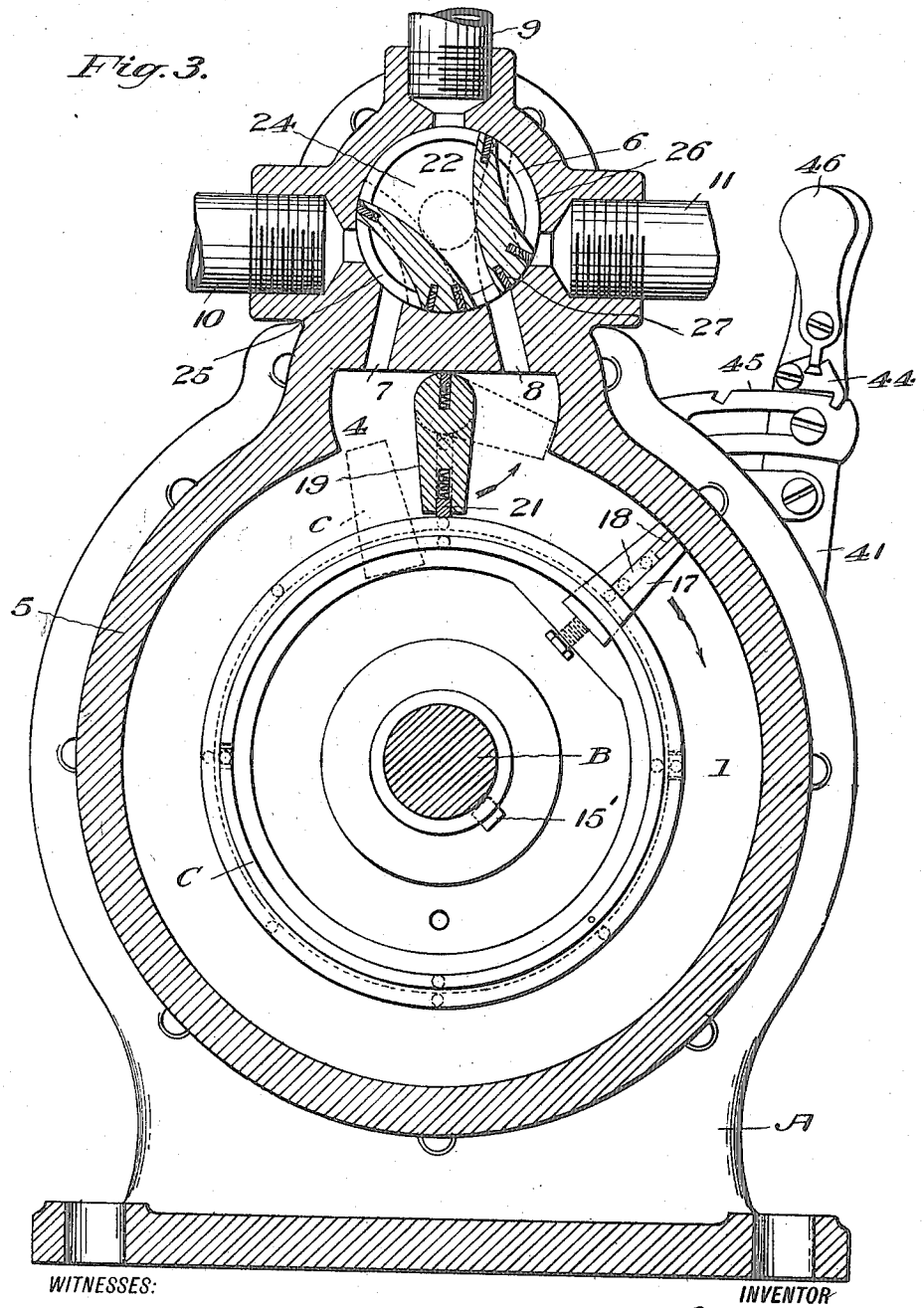
APPLICATION FILED MAR. 21, 1913. RENEWED MAY 4, 1916.

1,208,030.

Patented Dec. 12, 1916.

5 SHEETS—SHEET 3.

Fig. 3.



WITNESSES:

Chas. E. Chapin

Leslie L. Pratt

INVENTOR

John A. Smith

Vernon E. Hodges

his ATTORNEY

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

J. A. SMITH.

ROTARY ENGINE.

APPLICATION FILED MAR. 21, 1913. RENEWED MAY 4, 1916.

1,208,030.

Patented Dec. 12, 1916.

5 SHEETS—SHEET 4.

Fig. 4.

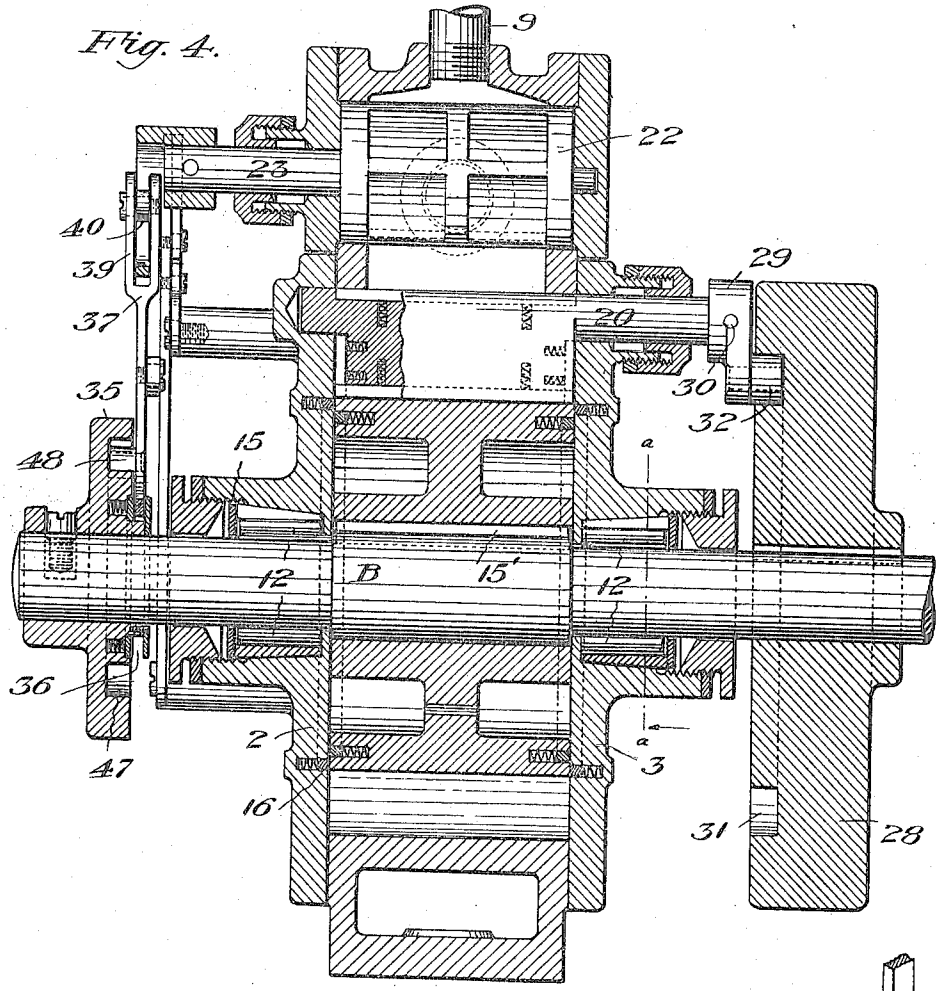


Fig. 5.

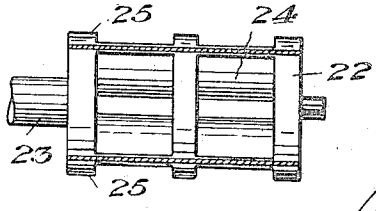


Fig. 6.

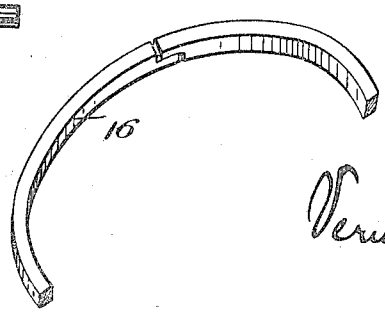
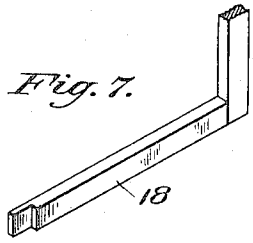


Fig. 7.



WITNESSES:

Chas. E. Chapin

Leslie L. Pratt

INVENTOR

John A. Smith

Vernon E. Cooper

his ATTORNEY

THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

J. A. SMITH.

ROTARY ENGINE.

APPLICATION FILED MAR. 21, 1913. RENEWED MAY 4, 1916.

1,208,030. Patented Dec. 12, 1916.

5 SHEETS—SHEET 5.

Fig. 8.

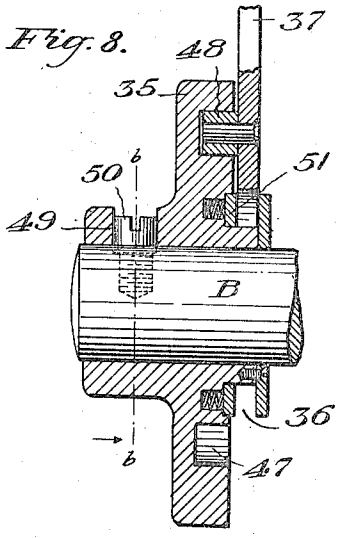


Fig. 9.

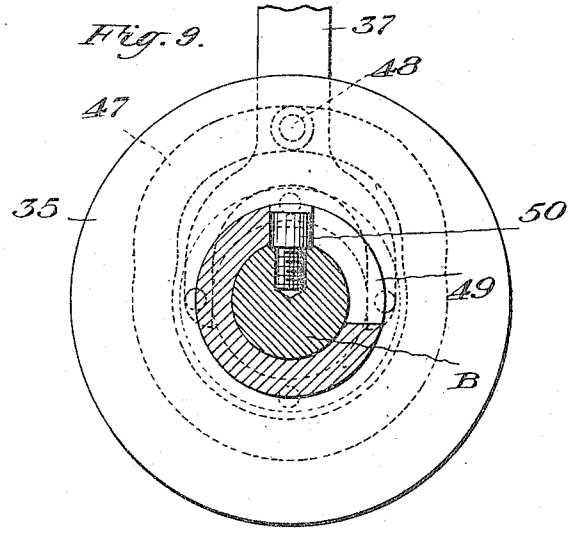


Fig. 10.

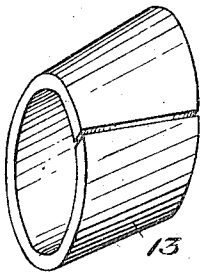


Fig. 11.

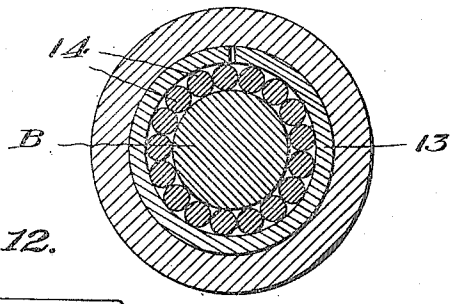
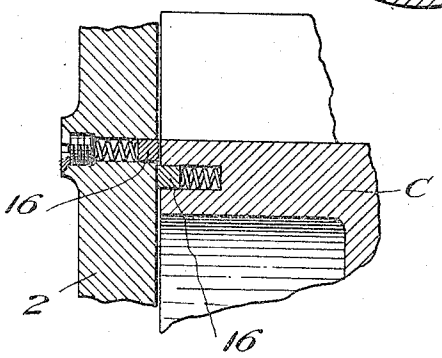


Fig. 12.



WITNESSES:

Chas. E. Chapin

Leslie L. Pratt

INVENTOR

John A. Smith

Vernon E. Hodges

his ATTORNEY

THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JOHN A. SMITH, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO SMITH ENGINE COMPANY, OF SAN FRANCISCO, CALIFORNIA.

ROTARY ENGINE.

1,208,030. Specification of Letters Patent. Patented Dec. 12, 1916.

Application filed March 21, 1913, Serial No. 755,908. Renewed May 4, 1916. Serial No. 95,500.

To all whom it may concern:

Be it known that I, JOHN A. SMITH, a citizen of the United States, residing at San Francisco, in county of San Francisco and State of California, have invented certain new and useful Improvements in Rotary Engines, of which the following is a specification.

My invention relates to an improvement in rotary engines, and more particularly to rotary engines of the expansion type.

The object of this invention is to provide an engine so constructed that fluid will be supplied only when the engine is working at its highest efficiency.

The invention relates to still other novel features of construction and combinations of parts which will be hereinafter described and pointed out in the claims.

In the accompanying drawings, Figure 1 is a view in side elevation taken from the power side of the engine; Fig. 2 is a similar view taken from the opposite side of the engine; Fig. 3 is a vertical sectional view taken at right angles to the power shaft; Fig. 4 is a vertical sectional view taken parallel of the power shaft; Fig. 5 is a view in side elevation of the fluid-control valve; Fig. 6 is a fragmentary perspective view of one of the packing rings used to make the moving parts fluid-tight; Fig. 7 is a fragmentary perspective view to show the arrangement of the packing strips used on the piston and the turning abutment; Fig. 8 is an enlarged detail vertical sectional view to better illustrate the cam which operates the fluid-control valve; Fig. 9 is a transverse vertical sectional view on the line *b*—*b* of Fig. 8; Fig. 10 is a view in perspective to better illustrate one of the bushings used in the journal between the power shaft and casing; Fig. 11 is a vertical sectional view on the line *a*—*a* of Fig. 4 to better show the bearing; and Fig. 12 is an enlarged detail view to show the manner of applying the packing rings to the parts.

The casing A comprises an expansion chamber 1, which is closed by the heads 2 and 3. An abutment chamber 4 is provided in the surrounding wall 5 of the expansion chamber and opens into the expansion chamber. A fluid-valve chamber 6 is formed in the wall beyond the abutment chamber 4, and leads 7 and 8 establish connection at two points between the valve chamber and the abutment chamber.

A fluid-supply pipe 9 connects with the valve chamber 6 to supply fluid thereto, and it is evident that the supply through this pipe might be controlled by any arrangement of the valves as the occasion might require. At opposite points the exhaust pipes 10 and 11 lead into the valve chamber.

A power shaft B is journaled in suitable bearings 12, 12 on the heads 2 and 3 of the casing and it is preferable that these bearings be so formed that they can be adjusted to take up wear.

As better shown in Figs. 10 and 11, a contractible cone bushing 13 is provided, between which and the power shaft B roller bearings 14, 14 are received. As the bushing wears, it may be forced farther into the seat provided in the casing heads, by the manipulation of a screw-threaded presser washer 15, and the bearing will again be restored to its normal condition.

A runner C is secured to the power shaft B, by a key 15′, and a fluid-tight connection is formed between the runner and the casing heads 2 and 3 by spring-pressed packing rings 16, 16, one of which is better shown in Fig. 6. The runner is of sufficiently less outer diameter than the inner diameter of the expansion chamber that a substantial expansion chamber is left between it and the inclosing wall 5.

A piston 17 is carried by the runner moving in the expansion chamber, and a fluid-tight packing is formed between the piston 17 and the heads 2 and 3 and the inclosing wall 5 by spring-pressed packing strips 18, 18, which are received in properly positioned grooves in the piston.

A turning abutment 19 is positioned in the chamber 4 to be equidistant from the leads 7 and 8, which establish connection between the chamber 4 and the valve chamber 6. Suitable packing strips 21 are connected in the abutment 19 to cause the abutment to form a fluid-tight barrier in the fluid chamber when in its normal position.

A fluid valve 22 is journaled in the fluid chamber 6, and has a stem 23 thereof extending through a suitable stuffing box in the head 2. A valve 22 is formed to have a fluid-supply duct 24 to extend diametrically therethrough. This duct is made rather constricted on the one side, and broadens out until, on the opposite side, the opening covers a considerable extent of the circumference.

The sides of the valve 22, at points at right angles to the diametrical extent of the fluid-supply duct, are made to form conducting channels 25 and 26. Suitable packing strips 27 are provided on the valve structure to establish a fluid-tight connection between the several passages.

A balance or cam wheel 28 is connected to the power shaft B by keying or any other approved manner at a point beyond the head 3 of the casing.

The shaft 20 of the turning abutment 19 extends through this head, and on its outer end has a crank arm 29 secured by a pin 30. The cam wheel has a cam groove 31 cut in the side thereof adjacent the head 3, and a friction roll 32 is secured on the free end of the crank arm to be received in this cam groove. The cam groove, as better shown by the dotted lines in Fig. 1, is, throughout its greater extent, circular, with the power shaft B as a center, and at a point corresponding to the disposition of the piston 17 on the runner C has an outward bend, as at 33.

It will be seen that as the power shaft is turned, the friction roll 32 will be held in the cam groove 31, and when the outward bend 33 is reached, the crank arm 29 will be moved, thus transmitting a movement to the turning abutment 19. The turning of the abutment is automatic in its action, and the abutment is brought to a position that the piston 17 may pass it.

A double crank arm 34, the form of which is better shown in Fig. 2, is secured on the valve stem 23. A cam disk 35 is received on the end of the power shaft B beyond the head 2 of the casing A. This cam disk has on its one side a peripheral groove 36. A forked lever 37 has a forked end 38 thereof received in this groove, and a bifurcated portion 39 on the opposite end of the lever 37 embraces the double crank arm 34 secured to the valve stem 23. A friction roll 40 is mounted in the bifurcated portion to travel in the cut-away portion of the crank arm 34, and as shown in Fig. 2, this friction roll may occupy either the position indicated at *a* or at *b*.

A hand lever 41 is pivoted at 42 to the head 2 of the casing, and a link 43 is pivoted to the hand lever 41 and with the lever 37, so that, as the hand lever is moved, the lever 37 will be moved from the operating position *a* to the operating position *b* of the crank arm 34, as the case may be.

The hand lever 41 is held in its adjusted position by a latch 44, which engages with the notches of the segmental rack 45, and is released therefrom by a handle 46. A cam groove 47 is formed in the face of the cam disk 35 adjacent the head 2. A configuration of this groove is better shown by the dotted line in Fig. 2.

A friction roll 48 is mounted on the side of the lever 37 to be received in the cam groove 47, and as the disk is turned through the rotation of the power shaft B, the lever 37 is consequently shifted radially away from and toward the center of rotation. The lever 37 is held to its operating position by the link connection 43 with the hand lever 41.

The operation of the engine is as follows: The hand lever 41 is shifted to bring the fluid valve to the position shown in Fig. 3. At this position, the fluid passes through the fluid duct 24, lead 8, abutment chamber 4, and expansion chamber 1. At this point the fluid bears against the abutment 19 and against the piston 17 carried by the runner C. This causes the piston to be moved, and the runner and power shaft are rotated in the direction of the arrow. When the piston has attained the position indicated at *c* by the dotted lines, the abutment 19 must be turned if the rotation of the runner is to continue. When the runner has been turned to this point, the bend 33 of the cam groove 31 engages the friction roll 32, and through the crank arm 29 and the shaft 20, the abutment is turned to the position indicated by dotted lines. During the supply of the fluid through the fluid duct 24 on the compression side of the piston, the fluid contained in the expansion chamber on the opposite side of the piston would normally be compressed. This tendency, however, is overcome by the channel 25, establishing connection between the lead 7 and the exhaust pipe 10, so that the fluid head of the piston is exhausted through this exhaust pipe. Now, when the abutment is turned to a position to permit of the passage of the piston, the fluid supply would escape to the exhaust, and it is therefore desirable that the fluid supply be cut off. This is accomplished through the lever 37 and its connections. During the supply of the fluid through the duct 24, the friction roll 48 has been in the greater arc of the cam groove 47. The beginning of this position is shown in Fig. 2. The lever is held radially from the center of rotation, the crank arm 34 is held up, and a connection is established between the fluid conduit 24 and the passage 8, but when the travel of the disk has been sufficient that the roll 48 passes into the lesser arc of the groove 47, then the lever 37 is drawn toward the center of rotation. The crank arm 34 is drawn down, thus turning the valve 22 to the position indicated by the dotted lines in Fig. 3, and shutting off the connection between the fluid duct 24 and the lead 8. As the cam disk 25 is turned due to the rotation of the power shaft B, the lever 37 is again moved in a radial direction from the center of rotation, and the connection from the fluid

supply pipe 9 to the expansion chamber 1 is again established.

To reverse the engine, the latch 44 of the hand lever 41 is disengaged from the notch of the segment 45, and is brought to a position that the friction roll 40 of the lever 37 is removed from the position *a* to the position *b* in the crank arm 34. The parts then occupy the position indicated by the dot-and-dash lines in Fig. 2, a connection will be established by the fluid conduit 24 and lead 7 from the fluid supply pipe 9 to the expansion chamber 1 on the opposite side of the abutment 19. This will cause the runner C carrying the piston 18 to travel in the opposite direction, and as the cam wheel 28 is secured on the shaft, the swinging of the turning abutment 19 will be in the opposite direction, and the piston will be permitted to pass. The operation of the fluid valve will also be identical with the exception that the operation will be in connection with the lead 7. To obtain the most efficient result, it is desirable that the cutting off of the supply be timed slightly before the raising of the turning abutment, and to make this difference in the forward and reverse, I have provided the hub of the cam disk 35 with a peripheral slot 49, and a pin 50 is received in the power shaft B to work in this groove. The power shaft will have slight movement before the cam disk is turned. This cam disk has a turning fit on the power shaft, but to insure the disk being held until the shaft has turned the proper distance, a spring-held washer 51 is provided on the inner face of the cam disk in position to bear against the lever 57.

It is evident that the motive fluid may be a liquid or gas, and equally good results be obtained, it will also be seen that the greatest efficiency is obtained for the fluid pressure expended, and that the engine when once started in the forwarding and reverse is automatic in its action and is equally powerful in both directions.

It is evident that slight changes might be made in the form and arrangement of the several parts described without departing from the spirit and scope of my invention, and hence I do not wish to be limited to the exact construction herein set forth, but:—

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

1. An engine comprising a casing having a valve chamber and an expansion chamber, said chambers in communication with each other, a rotary piston mounted in the expansion chamber and a valve mounted in the valve chamber, a shaft on which the piston is mounted, inlet and exhaust pipes leading to the valve chamber, said valve having passages for conducting the steam to the expansion chamber, and for conducting the exhaust steam from the expansion chamber, a double crank arm connected to the valve having a slot therein, a lever having connection with the crank arm and adapted to be held at either terminus of the slot for imparting an oscillatory movement to the valve upon the actuation of the lever for admitting and cutting off the supply of steam to the expansion chamber, means for actuating the lever from one terminus of the slot to the other for regulating the direction of movement of the valve, and means on the shaft for imparting movement to the lever for operating the valve.

2. An engine comprising a casing having a valve chamber and an expansion chamber, said chambers having leads for forming a communication therebetween, a rotary piston mounted in the expansion chamber and a valve mounted in the valve chamber, a shaft on which the piston is mounted, inlet and exhaust pipes leading to the valve chamber, said valve having a duct and channels, the duct for conducting the steam to the expansion chamber, and the channels for conducting the exhaust steam from the expansion chamber to the exhaust pipes, one of said channels always forming a communication between the expansion chamber and the exhaust pipe, a double crank arm connected to the valve having a slot therein, a lever having connection with the crank arm and adapted to be held at either terminus of the slot for imparting an oscillatory movement to the valve upon the actuation of the lever for admitting and cutting off the supply of steam to the expansion chamber, means for actuating the lever from one terminus of the slot to the other for regulating the direction of movement of the valve, and means on the shaft for imparting movement to the lever for operating the valve.

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

JOHN A. SMITH.

Witnesses:
L. E. Lee,
Flora Hall.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."