Aug. 18, 1931. C. W. CARLTON 1,819,867

ROTARY ENGINE

Filed June 1, 1927 3 Sheets-Sheet 1

Fig. 1.

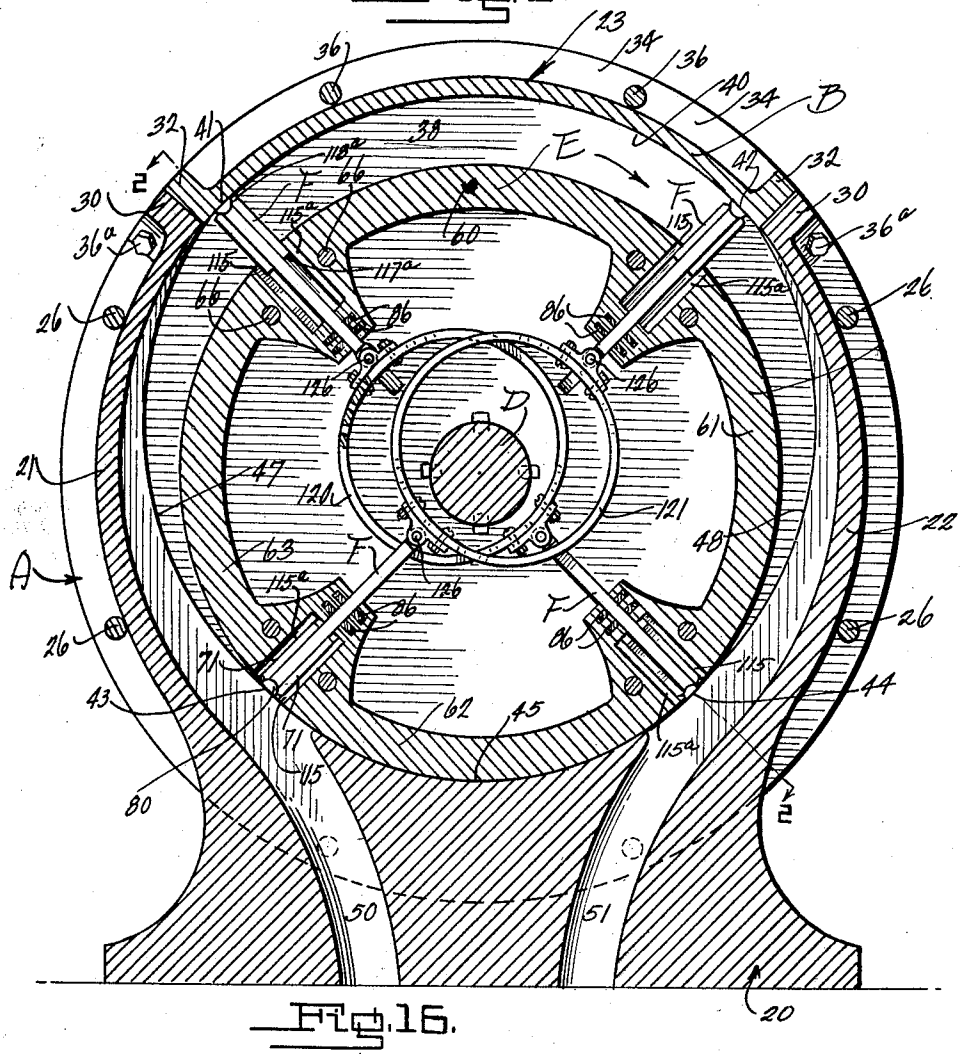
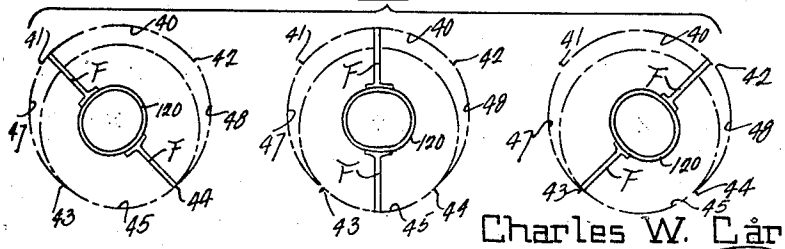


Fig. 16.



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Fig. 3.

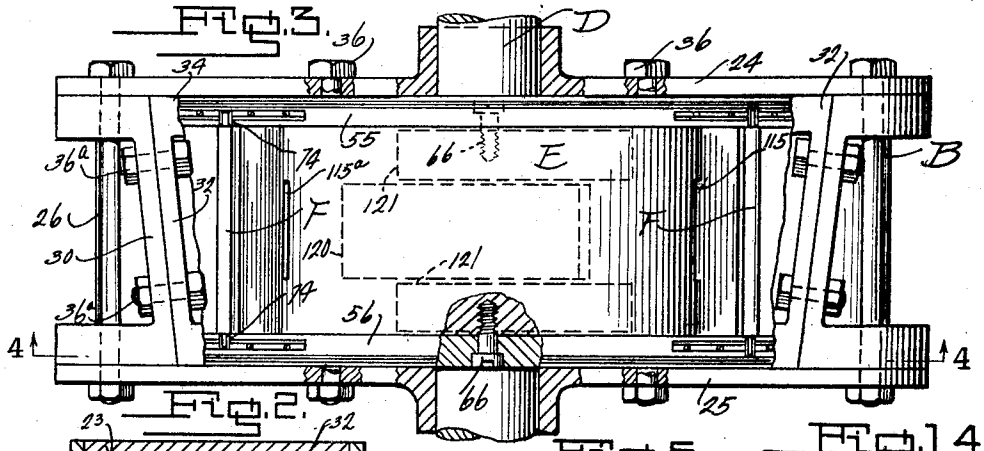


Fig. 2.

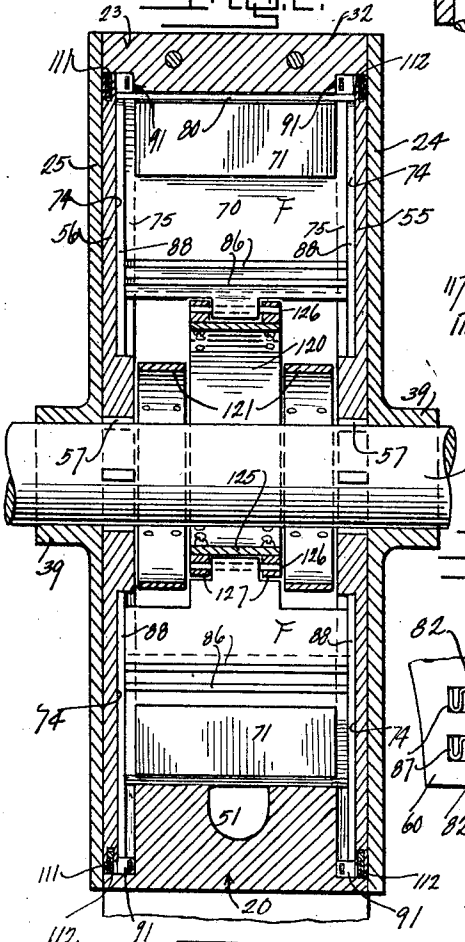


Fig. 6.

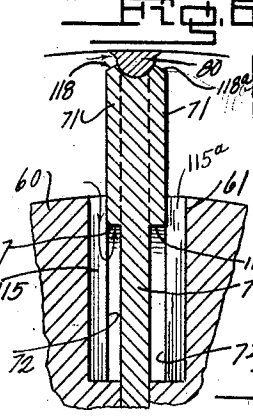


Fig. 14.

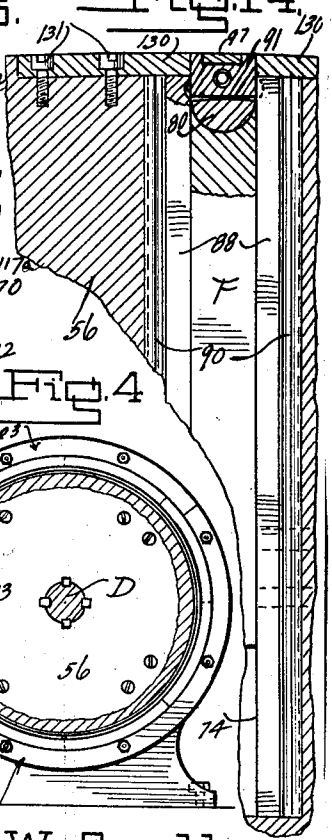


Fig. 4

Fig. 15.

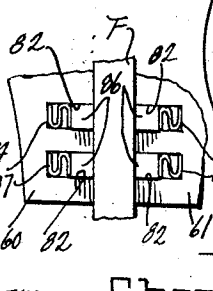
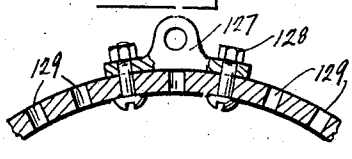


Fig. 13.



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Fig. 5.

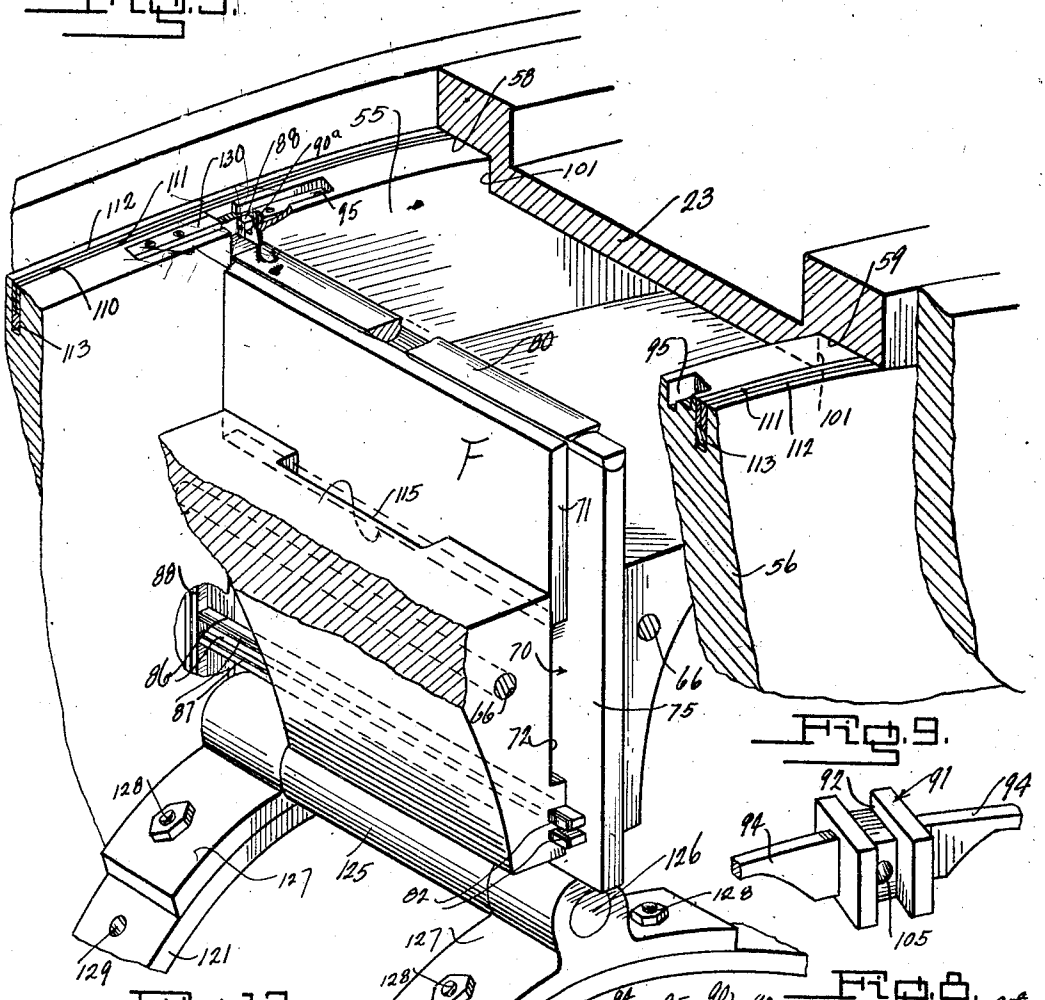


Fig. 9.

Fig. 12.

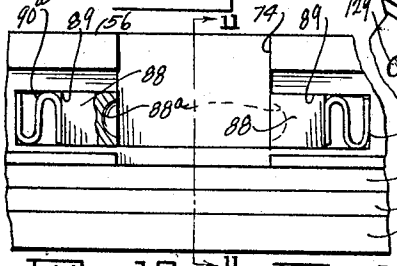


Fig. 8.

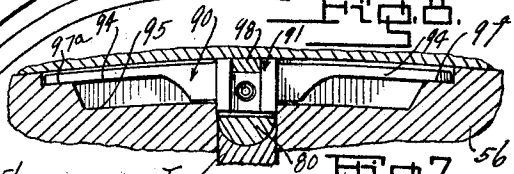


Fig. 7.

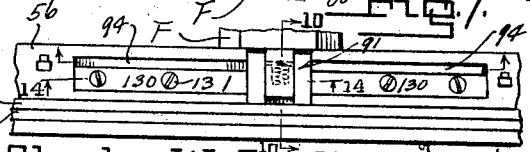


Fig. 10.

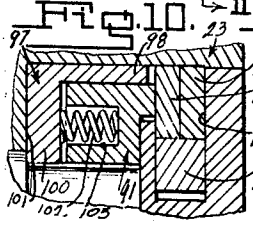
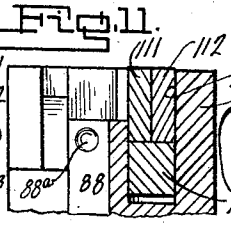


Fig. 11.



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Patented Aug. 18, 1931

1,819,867

UNITED STATES PATENT OFFICE

CHARLES W. CARLTON, OF SYRACUSE, NEW YORK

ROTARY ENGINE

Application filed June 1, 1927. Serial No. 195,830.

This invention relates to improvements in rotary engines.

The primary object of this invention is the provision of an improved rotary engine, embodying structural features capable of application to rotary engines, fluid motors, rotary pumps, turbines, or the like, and including more particularly a practical and economical construction by means of which motive fluids may most efficiently operate against the pistons of the rotor with but little frictional resistance.

A further object of this invention is the provision of an improved rotary engine construction embodying slidable pistons carried by the rotor, with structural features thereof enabling the motive power to assist in moving the piston to a working position.

A further object of this invention is the provision of an improved rotary engine construction embodying a stator having a chamber therein so designed that the rotor pistons will have reached their fullest extended positions prior to the full application of the power stroke.

A further object of this invention is the provision of an improved rotary engine construction embodying a stator with detachable features which will permit facile assemblage or disassemblage of internal parts.

A further object of this invention is the provision of an improved packing construction between rotor and stator parts of a rotary engine, which will lessen friction and insure a sealed connection between the rotor and stator parts.

A further object of this invention is the provision of improved means for mounting and operating reciprocatory pistons of the rotors of rotary engines or the like.

Other objects and advantages of this invention will be apparent during the course of the following detailed description.

In the accompanying drawings, forming a part of this specification, and wherein similar reference characters designate corresponding parts throughout the several views,

Figure 1 is a vertical sectional view taken through the improved rotary engine transversely thru the axis of rotation of the rotor thereof.

Figure 2 is a transverse sectional view taken through the engine substantially on the line 2—2 of Figure 1.

Figure 3 is a fragmentary plan view of details of the improved engine.

Figure 4 is a fragmentary sectional view taken substantially on the line 4—4 of Figure 3, this view Figure 4 being on a reduced scale with respect to Figure 3.

Figure 5 is a fragmentary perspective view showing more particularly certain operating details of the rotor and stator, and more particularly showing packing features and the sliding pistons of the rotor.

Figure 6 is a vertical sectional view taken through one of the pistons of the rotor, showing the relation in which the motive fluid operates on the construction thereof to facilitate the extension of the piston to an operating position.

Figure 7 is a fragmentary plan view showing an end connection of a sliding piston in its rotor and the adjacent packing features thereof.

Figure 8 is a sectional view taken substantially on the line 8—8 of Figure 7.

Figure 9 is a perspective view of part of a packing member used to seal the connection between the rotor and stator features of the engine at the ends of each piston.

Figure 10 is an enlarged sectional view taken substantially on the line 10—10 of Figure 7, showing more particularly the packing and sealing features at the ends of each of the pistons with respect to the stator and rotor parts.

Figure 11 is a sectional view taken substantially on the line 11—11 of Figure 12.

Figure 12 is a fragmentary plan view of details of the stator and rotor walls with certain parts of the packing removed.

Figure 13 is an enlarged fragmentary sectional view showing the means of relatively connecting the pistons on oval shaped mounting rings.

Figure 14 is a fragmentary sectional view taken substantially on the line 14—14 of Figure 7.

Figure 15 is an end view of a piston, showing its packing therefor at the base of the same as carried by the rotor parts.

Figure 16 is a diagrammatic representation of different relative positions of a pair of pistons with respect to the rotor casing in the stator chamber.

In the drawings, wherein for the purpose of illustration is shown but a preferred embodiment of this invention, the letter A may generally designate the improved rotary engine, which may comprise a stator B; rotor C mounted on a shaft D; the rotor C preferably comprising a rotor casing construction E within which pistons F slidably reciprocate in a cooperative relation with the rotor and stator.

Referring to the construction of the stator B, the same preferably comprises a base 20, having walls 21 and 22 arcuating upwardly therefrom, and having a complementary arcuated top wall or cover 23 associated therewith. Side stator walls 24 and 25 are provided, and it is to be noted that the arcuated walls 21 and 22 of the base portion 20 are provided with flanges at the margins thereof, against which the side plates 24 and 25 abut; being secured thereto by transverse bolts 26 extending thru said flanges and preferably at the exterior surface of the walls 21 and 22.

At the upper ends the stator walls 21 and 22 are provided with upwardly extending flanges 30, arranged diagonally or in acute angled relation with respect to the parallel planes of the stator walls 24 and 25. The top wall or cover 23 at the ends thereof is provided with outwardly extending diagonally sloping walls 32, and it is provided with side outwardly extending flanges 34 for abutment against the inner surfaces of the stator side walls 24 and 25, as illustrated in Figure 3 of the drawings. The walls 30 and 32 are adapted to receive transverse bolts 36^a therethrough for detachably securing the cover wall 23 in place, and similarly the flanges 34 are secured to the side walls 24 and 25 by transverse bolts 36.

When the stator is assembled as above described, it provides a rotor compartment 38 therein, between the base 20, its side walls 21 and 22, and the top wall 23. This compartment 38 is of unusual formation. A shaft D is rotatably supported in suitable bearings 39 provided centrally on the stator walls 24 and 25, which shaft D intersects the compartment 38 in a definite relation. The inner surface 40 of the wall or cover 23 is concentrically arranged with the shaft D, between the points 41 and 42, at which the top pistons F rest, as illustrated in Figure 1 of the drawings. The lower surface of the stator compartment 38, from the point 43 to the point 44, is also concentric with the center of the shaft D, on a radius, which is less than the radius from which the surface 40 is struck. The arcuated surfaces 47 and 48 completing the periphery of the compartment 38 are eccentric with respect to the axis of the shaft D; the surface 47 concavely sloping from the location 43 to the location 41; and the concaved surface 48 sloping from the location 44 upwardly to the location 42.

An intake port or passageway 50 is arranged through the base 20, extending from the bottom thereof upwardly and opening in the compartment 38 on the surface 45 just below the location 43; the said port 50 extending through the base 20 entirely along the peripheral portion 47 of the compartment 38, and at its upper end terminating at the location 41, so that the motive fluid may be fed into the compartment 38 through the passageway or port 50, over a relatively long portion of the compartment 38, the fluid acting on the pistons F with its full force only when the pistons F have passed the point 41 and are then fully extended, as will be subsequently mentioned. An exhaust port 51 is similarly provided in the base 20 at the opposite side of the compartment 38, extending through the base and having an opening on the surface 45 below the point 44; the exhaust port or passageway 51 opening in the compartment 38 entirely along the peripheral portion 48 up to the point 42 above described, so that the exhaust commences to take place immediately when the piston F starts its retraction along the surface 48, as will be subsequently mentioned.

The casing E of the rotor C preferably comprises side walls 55 and 56, keyed as at 57 on the shaft D, and respectively in sliding relation at the inner sides of the walls 24 and 25 of the stator B. These walls 55 and 56, at their outer marginal portions are received within guide grooves 58 and 59 formed in the concave peripheral surfaces of the walls of the stator about the compartment 38 at each side thereof; these guide grooves being more particulary illustrated in Figure 5 of the drawings. The rotor casing E furthermore comprises complementary segments 60, 61, 62 and 63, each preferably of approximately 90°, which are bolted as by counter sunk screws 66, to the side walls 55 and 56 of the rotor casing; said segments 60 to 63 inclusive being in circular arrangement concentric with the shaft D so that the outer peripheries or surfaces thereof will abut in substantially sliding engagement with the surface portion 45 of the stator compartment 38, during the rotation of the rotor C as illustrated in Figure 1 of the drawings. When the segments 60 to 63 are thus bolted to the rotor side walls, a substantially crescent-shaped portion of the compartment 38 is open above the rotor segments between the intake and exhaust ports 50 and 51, as illustrated in Figure 1, and it is in this crescent-shaped portion of the compartment 38

that the pistons F operate during the power stroke. The ends of the adjacent segments comprising the casing E are spaced to permit a sliding or reciprocation of the pistons F therebetween, in a relation to be more fully described hereinafter. It is to be noted that the segments of the casing E have such a tight connection with the side walls of the rotor so as to prevent any leak of motive fluid past such connection, and if desirable packings may be provided to insure against such leakage.

Referring to the pistons F, each of the same comprises a flat body 70, slidable in the space between the ends of adjacent segments of the rotor casing E. These pistons are radially reciprocable with respect to the shaft D in the spaces between the segments 60 to 63 inclusive, and at the opposite sides thereof, at the outer end, the body 70 is enlarged at 71; the segments being recessed at 72 to slidably receive the portions 71 of each piston, in a sliding relation, as illustrated in Figure 6 of the drawings. The walls 55 and 56 of the rotor are grooved at 74 for each of the pistons F, to slidably receive the side portions 75 of the body 70 of the respective piston therein, as illustrated in the various figures of the drawings.

Each of the pistons F along the outer edge thereof is grooved, and has a packing strip 80 therein, of suitable material, extending entirely along the body 70, and at its ends extending along the top of the side portions 75 of the body. In cross section this packing strip 80 is half circular and extends upwardly above the top edges of the portions 71 of the piston.

As a means of retaining the piston body 70 in a fluid tight engagement between the segments between which it slides and also with respect to the side walls 55 and 56 of the rotor, it is preferred to provide parallel grooves 82 at each of the ends of each segment 60 to 63 inclusive; these grooves 82 being parallel and extending entirely across the segments parallel with the shaft D, and the grooves 82 being in facing relation with the similar grooves of an adjacent spaced segment, at a location below the recesses 72 above described. In these grooves 82 packing strips 86 are adapted to be received, urged against the opposite sides at the base of the piston body 70 by means of resilient substantially S-shaped springs 87 which extend the length of the strips 86 and along the bottoms of the grooves 82, as well illustrated in Figure 15 of the drawings. These strips 86 and their springs extend beyond the opposite sides of the segments on which disposed, and into the side walls 55 and 56 in facing relation with the grooves 74. These packing strips 86, however, terminate short of the opposite end edges of the body 70 of the piston F. In the grooves 74 of the side walls 55 and 56, at each side of the groove are disposed radial packing strips or lengths 88, in elongated grooves 89 disposed in the said side walls of the rotor facing the grooves 74; substantially S-shaped springs 90^a being provided in said grooves 89 at the bottoms thereof, for urging said strips 88 into or towards the grooves 74, and consequently forcing the said packing strips into engagement at opposite sides of each end 75 of each piston body 70, to provide a leak proof passage connection for the sliding of the ends 75 of the piston body in the grooves 74 of the side walls 55 and 56 of the rotor. These packing strips 88 and their springs 90^a are well shown in Figure 12 of the drawings, and again in Figure 14 of the drawings, as well as elsewhere. It is to be noted that the packing strips 86 above described extend up to and in abutment with the strips 88, as illustrated in Figure 5 of the drawings.

Further referring to the packing means for the pistons F, between the rotor and stator parts thereof, a spring member 90 seats in a socket 95 on the outer periphery of each of the rotor walls 55 and 56, above each of the end portions 75 of the piston body, as shown in Figure 8. Each spring member 90 preferably comprises a polygonal shaped body 91, provided with an L-shaped groove 92 therein along the top and inner surfaces, as shown in Figure 9. The body 91 at opposite sides has spring arms which rest on the stator at their free ends, at 97^a, in flexed condition to urge the body 91 toward the seat 58 or 59 of the stator walls. In the L-shaped groove 92 is adapted to be received an L-shaped packing piece 97 of approval material, as shown in Figure 10, which includes an upper leg 98 seating in the top groove portion and urged by the resiliency of the member 90 into seating engagement with the annular seat 58 or 59, along which the outer peripheries of the rotor walls 55 and 56 slide. The L-shaped member 97 furthermore includes an inner leg 100 which is adapted to seat against a side wall 101 on the stator, forming a side wall of the groove 58 or 59; this leg 100 being urged by means of a compressed spiral spring 102, into engagement with the surface 101; the body 91 being provided with a special socket 105 for receiving the spring 102, in the relation illustrated in Figures 9 and 10 of the drawings.

The outer peripheries of the rotor walls 55 and 56 are peripherally grooved at 110, outwardly of the socket 95 above described, for receiving therein packing rings 111 and 112, each of which are divided into four sections, as illustrated in Figure 4 of the drawings; a split expansion ring 113 resting in the bottom of the groove 110, as illustrated in Figures 10 and 11 of the drawings for urging the sections of said rings 111 and

112 into a sealing engagement against the tracks 58 and 59 of the stator walls.

The pistons F are aided by the operating fluid to seat against the inner peripheries of the rotor walls comprising the compartment 38. As to this feature, referring to Figures 5 and 6, it is to be noted that a port 115 is provided at the fluid pressure side of each piston F, in an end of each rotor segment. This port permits the operating fluid to enter the same and enter the recess 72 beneath the shoulder 117 of the enlarged portion 71 of the piston body; the fluid pressing against the shoulder 117 and forcing the piston F radially outward with its packing 80 against the inner peripheral surface of the stator housing, as illustrated in Figure 6. However, this tendency of the motor fluid to urge the pistons radially outwardly is counteracted, to some extent by an application of the motive fluid on the upper shoulder 118 of the piston body, laterally of the packing 80, as illustrated in Figure 6; but as this shoulder 118 is less in area than the shoulder 117, the net result of operation of the motive fluid at the pressure side of the piston is to urge the piston F radially outward. Of course the motive fluid acts on the packing 80 in the relation illustrated in Figure 6 to more firmly seat the same against the inner periphery of the stator compartment in which the rotor operates.

The engine is preferably of the reversible type, and therefore ports 115[a] are provided in the segments 60 to 63 inclusive, at the opposide sides of the piston F from the ports 115, which enables the motive fluid to reach the shoulders 117[a] when the fluid uses port 51 as an intake; it being understood that motive fluid when the motor is thus reversed also acts on the shoulders 118[a], and that the resultant of the pressure during the power stroke when reversing will be to force the pistons at the outer packing ends 80 into engagement with the walls of the expansion chamber.

Referring now to the connection of the pistons F, it is observed that the pistons F are connected in pairs, that is, diametrically opposed pistons are connected together, and it is preferred that two pair of pistons be provided, in a right angled relation with respect to each other. The means of connecting the pistons together is novel, as illustrated in Figures 1 and 5 of the drawings. A pair of the pistons F are connected together by means of a resilient oval-shaped spring ring 120, eccentrically arranged surrounding the shaft D. This spring ring 120 is located centrally between the side walls 55 and 56 of the rotor, and at each side of this spring are provided other spring rings 121, also resilient and oval-shaped in formation, of the same peripheral dimensions as the spring 120, but less in width than the same, both of the rings 121 being intended to connect merely one pair of the pistons F together.

Each of the pistons F at the inner end of the body 70 is provided with a transversely apertured barrel or bearing portion 125, adapted to receive a pivot pin 126 therethrough. Adjustable bearing straps 127 are provided on the rings 120 and 121, for each bearing pin of the piston; detachably connected by means of bolts 128 to any of a plurality of openings 129 in the oval shaped spring rings 120 and 121. As is illustrated in Figure 5 of the drawings the particular piston F of that view is shown as connected to the outer spring rings 121, as is also the diametrically opposed piston. The other pistons as is well shown in Figure 2 of the drawings, are pivotally connected to the central ring 120. It is readily apparent that in view of the oval shape of the rings 120 and 121, the opposing pistons may be connected with a variable spring action, urging them against the inner periphery of the stator walls of the chamber 38. This spring action that the springs have in forcing their respectively connected pistons against the inner periphery of the chamber 38 is very slight.

From the foregoing description of the structure of the improved rotary engine, it is believed the operation will be apparent. The rotor moves in the direction indicated by arrow in Figure 1 of the drawings, and it is to be noted that the motive fluid actuates on the top of the piston until the piston has passed the point 41, thus tending to lessen friction. As soon as it passes the point 41, however, the motive fluid acts with full force on the power sides of the piston F, and the resultant of the motive fluid action on the packing 80 and shoulders 118 and 117 is to radially force the piston into a sealing engagement with the inner periphery 40. The motive fluid thus has a practically perfect seal insofar as the piston F is concerned, for imparting the full force of the expansion of the motive fluid to the rotation of the rotor. The motive fluid acts from the point 41 to the point 42, thru an arc of about 90°, which is the main part of the power stroke, and immediately thereafter the motive fluid is released thru the port 51; it being understood that the pistons at their outer peripheries ride along the surfaces 45, 47 and 48 during the intake and exhaust.

An additional feature of the packing construction is the provision of cap strips 130, detachably held by screws 131 in the sockets 95 provided therefor in the top of the periphery of the rotor walls; the ends of these caps 130, as shown in Figure 14 of the drawings, covering the piston sealing packing 88.

It is to be noted that in the packing strips 88, at the upper ends thereof, small recesses 88[a] are formed so as to extend in facing relation with the groove for the sides of the

pistons, and which recesses 88[a] are for the purpose of inserting suitable tools for removal of the packing strips.

It is apparent that the pistons are fully extended during the power stroke, and there is no reciprocation or sliding of the same in the rotor. It is readily apparent that all parts may be with facility attached or detached from the opening when the cover or wall 23 of the stator is removed. The packing rings 112 are preferably made sectional, as illustrated in Figure 4, to permit their ready attachment or detachment with respect to the stator thru the opening when the cover 23 is removed, and it is readily apparent that the pistons may be easily removed or adjusted. The diagonal joints between the ends of the cover 23 and the other side walls of the stator are for the purpose of enabling the ends of the pistons, to move easily across these joints.

Various changes in the shape, size, and arrangement of parts may be made to the form of invention herein shown and described, without departing from the spirit of the same or the scope of the claims.

I claim:

1. In a rotary engine a stator having a compartment therein with motive fluid inlet and outlet ports, a rotor in the stator compartment comprising a casing, pistons radially slidable in said casing, and said flexible spring rings pivotally connecting said pistons in pairs, said rings being oval shaped and having means thereon for adjustably receiving the pistons at various locations thereabout.

2. In a rotary engine the combination of a rotor comprising a shaft, side walls keyed on the shaft in spaced relation, segments connected to said side walls with the ends spaced, pistons slidable in said spaces between the ends of said segments, said segments in the ends thereof facing said spaces having packing strips urged into sliding abutment against said pistons in said spaces, said side walls of the rotor being grooved to receive the sides of said pistons, said grooves having packing rings urged into sealing abutment with the pistons slidable therein.

3. In a rotary engine the combination of a stator providing side walls and an annular wall with a compartment therein, a rotor in said compartment including a shaft, an annular casing on the shaft, and pistons transversely slidable thru said annular casing, said rotor having side walls immediately facing the inner surfaces of the side walls of the stator grooved to receive the ends of said pistons, packing means carried by the rotor casing and side walls for each of said pistons, means to urge the pistons at their outer ends into abutment with the annular walls of the stator, peripheral packing rings on the side walls of the rotor having springs urging them into sealing abutment with the annular wall of the stator, and spring urged packing means on the peripheral margins of said annular walls at opposite outer corners of said pistons, in sealing abutment with the inner side of the annular wall of said stator.

CHARLES W. CARLTON.