

May 13, 1958

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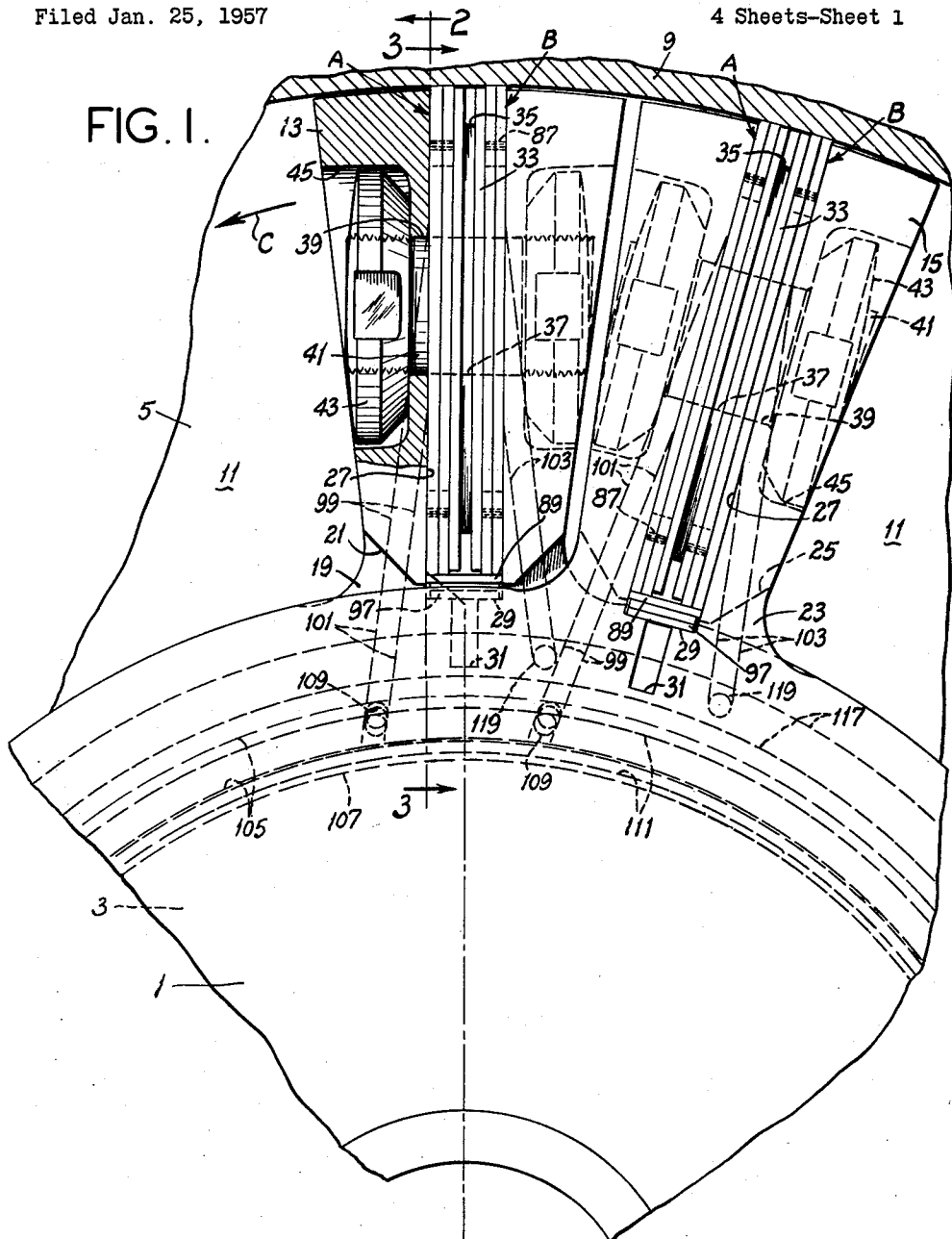
2,834,322

ROTARY ENGINE, PISTONS AND SEALING MEANS THEREFOR

Filed Jan. 25, 1957

4 Sheets-Sheet 1

FIG. 1.



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FIG. 2.

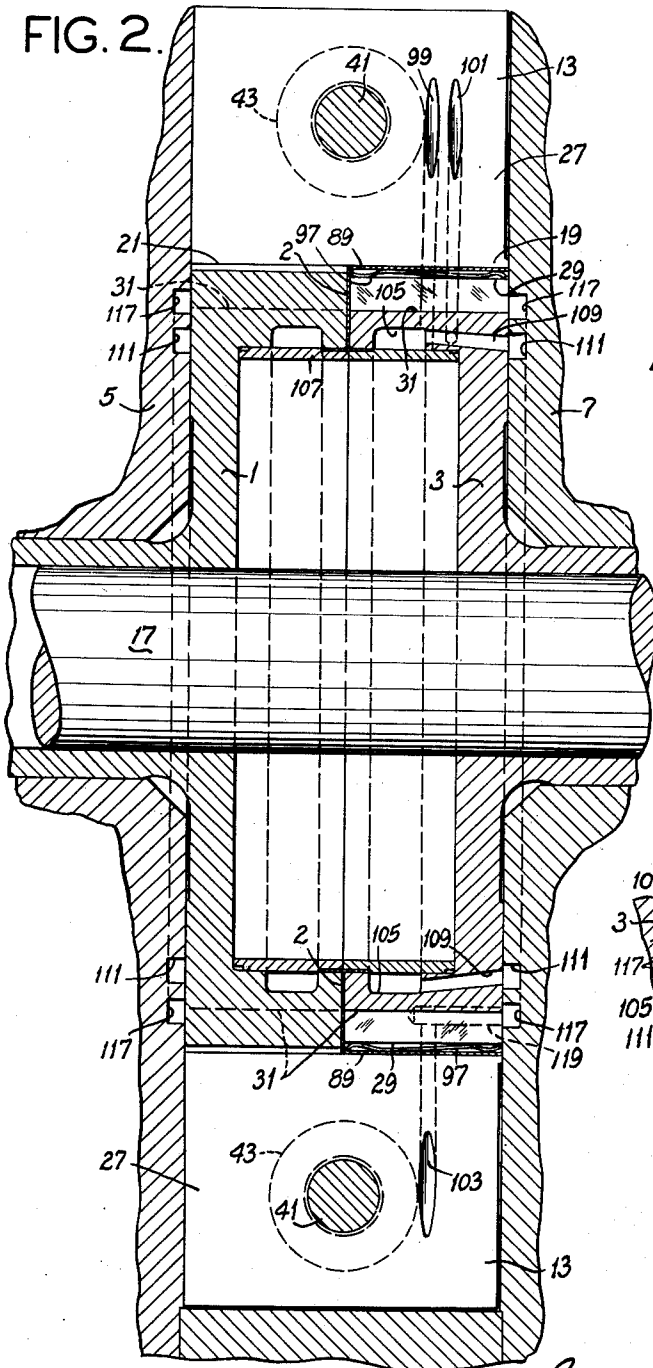
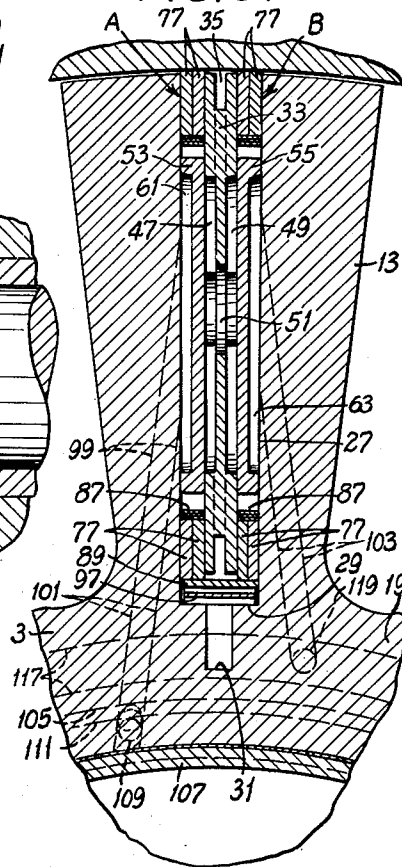


FIG. 5.



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FIG. 3.

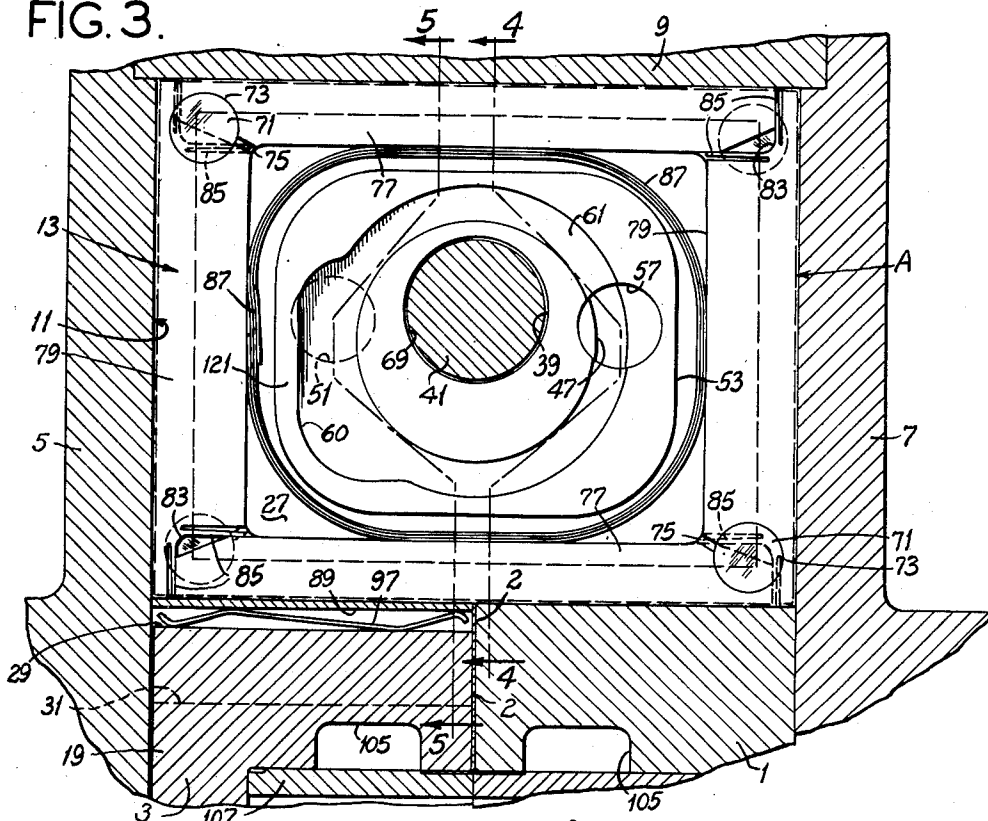
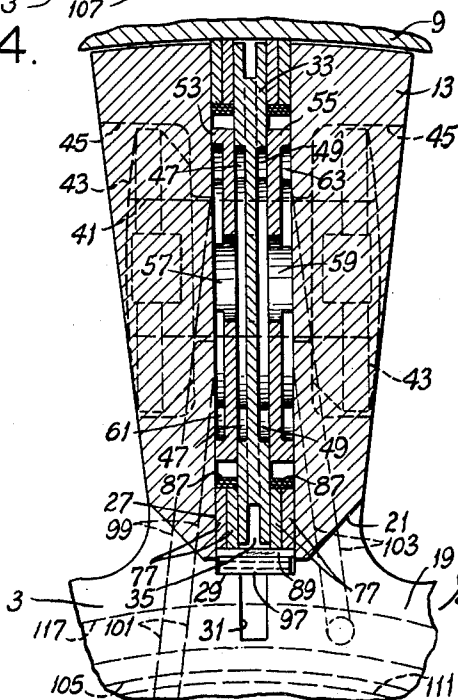


FIG. 4.



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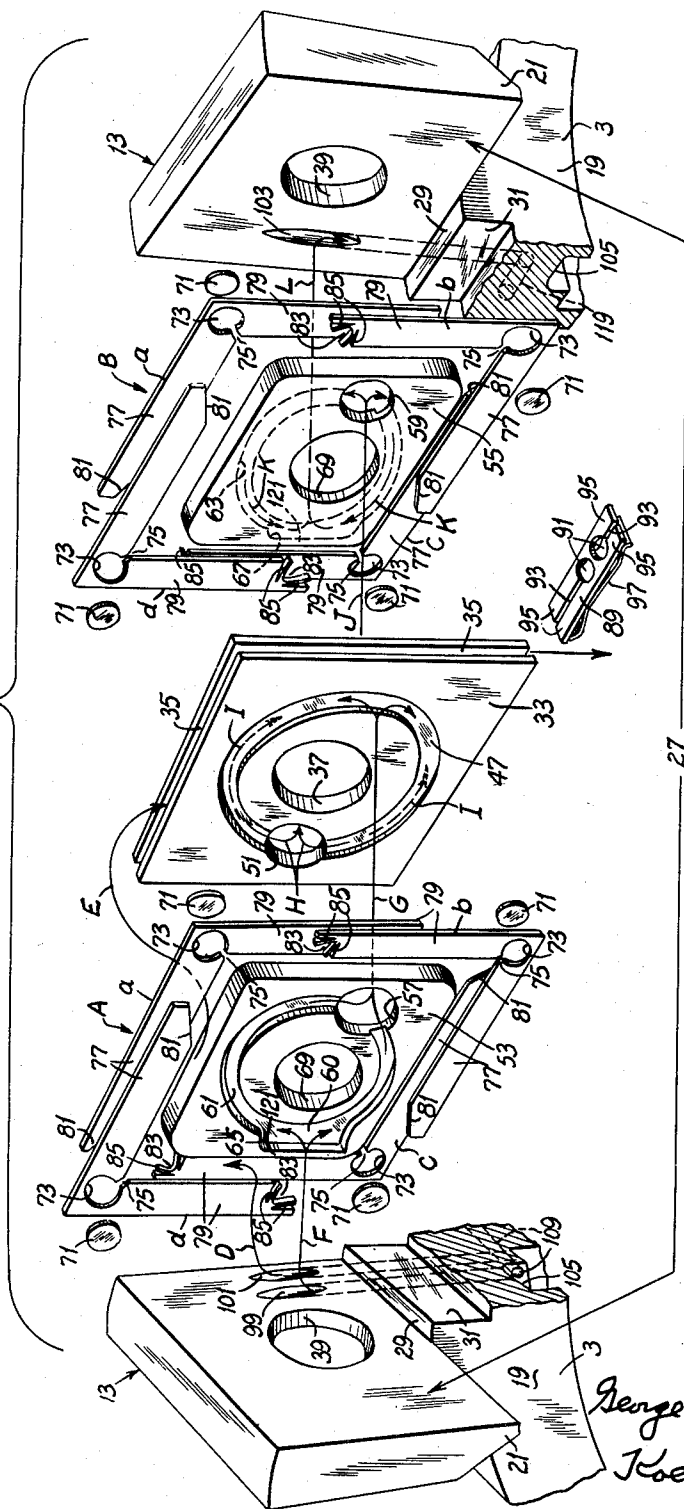
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FIG. 6.



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2,834,322

ROTARY ENGINE, PISTONS AND SEALING MEANS THEREFOR

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Application January 25, 1957, Serial No. 636,416

17 Claims. (Cl. 121—49)

This invention relates to rotary engines, pistons and sealing means therefor, and more specifically, to means for reducing gas and oil leakage, wear and excessive heating. The type of apparatus to which the invention relates and upon which it is an improvement in certain respects is shown in my United States patent application Serial No. 372,222, filed August 4, 1953, for Piston-Type Machine, now Patent No. 2,796,216.

Among the several objects of the invention may be noted the provision of a rotary engine having an improved lubricated piston-ring sealing arrangement for its rectangular pistons; the provision of improved sealing ring alignment relative to the cylinder walls; and the provision of means for cooling the pistons. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of which will be indicated in the following claims.

In the accompanying drawings, in which one of various possible embodiments of the invention is illustrated,

Fig. 1 is a fragmentary transverse section of a typical alternating-piston engine, showing two adjacent pistons having the invention applied thereto;

Fig. 2 is a fragmentary axial section through the same engine, being taken on line 2—2 of Fig. 1 but extended to show, in addition, a piston opposite to the piston through which section line 2—2 passes on Fig. 1;

Fig. 3 is a fragmentary cross section, taken on line 3—3 of Fig. 1;

Figs. 4 and 5 are stepped sections taken on lines 4—4 and 5—5 of Fig. 3; and,

Fig. 6 is a diagrammatic exploded view of the parts associated with one piston, except that certain spring pressure rings have been omitted for clarity of presentation.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring now more particularly to Figs. 1 and 2, co-axial rotors of an alternating-piston engine are shown at numerals 1 and 3. These rotate in stationary frame pieces 5 and 7, respectively, which, together with an outer ring 9, form an annular or toroidal cylinder 11, of rectangular cross section. Each rotor 1 and 3 carries a number of identical pistons (four, for example), each group of four pistons being connected to or rooted on one rotor and extending over the other so as to interdigitate with the pistons on the other rotor in the cylinder 11. Pistons on rotor 3 are herein indexed 13, and those on rotor 1 are indexed 15. One each of the pistons 13 and 15 are shown in the drawings, except as to Fig. 2, wherein parts of two pistons 13 appear.

The pistons 13 and 15 are of rectangular form, substantially matching that of the cross section of the annular cylinder 11, except that there is a running clearance between them and the cylinder walls 5, 7, 9 and

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the rims of the mating rotor which the pistons overhang. This clearance requires sealing against gas and oil leakage as the pistons 13 and 15 move relatively in the cylinder 11 in performing their operations in the cycle of power events. The rotors transmit the resulting moments imparted to them to a power shaft shown at 17 by drive means (not shown, being known in the art).

The operation of an alternating-piston engine employing a cylinder, rotors and pistons of the class above described may be found in said Patent No. 2,796,216 and elsewhere in the art, and further details herein will therefore be unnecessary, particularly inasmuch as the present invention constitutes improvements in the parts per se of the pistons. A detailed description of these follows.

Each piston 13 is formed by a radially disposed root portion 19 integral with the rotor 3, having an axial extension or overhang 21 over the rim of rotor 1. Likewise, each piston 15 is formed by a radially disposed root portion 23 integral with the rotor 1, also having an axial section or overhang 25 over the rim of rotor 3. Thus the pistons interdigitate in cylinder 11.

Each piston has a relatively wide central slot 27 which bottoms in shelf portions as shown at 29 (see also Figs. 4-6). This slot 27 extends through the piston root portions where an inner narrower slot 31 is located forming an extension of slot 27.

At numeral 33 is shown a rectangular divider plate which also has substantial clearance between each of its four sides and the walls of the annular cylinder 11.

Its entire margin is grooved, as shown at 35. In its body portion it carries an opening 37, adapted to register with openings 39 in the piston on opposite sides of the slot 27 for accepting a draw-bolt or draw-stud 41. Each draw-stud 41 is threaded at opposite ends for reception of nuts 43, which become located in cavities 45 provided on opposite sides of each piston. The resulting clamping effect that may be accomplished in connection with other parts to be described, rigidly holds each plate 33. On opposite sides of each divider plate 33 are circular grooves 47 and 49. Intersecting grooves 47 and 49 is a lateral hole 51 (Figs. 5 and 6) which communicates between them.

At numerals 53 and 55 are shown rectangular side plates which are smaller than divider plate 33 and sandwich the latter. The side plates have flat inner sides where they engage the sides of the divider plate 33, thus covering the grooves 47 therein and the hole 51 therethrough. This covering effect is with the exception of holes 57 and 59 through the side plates 53 and 55, which form communications with the opposite grooves 47 and 49, respectively.

On their outsides the side plates 53 and 55 are provided with circular grooves 61 and 63, respectively (Fig. 4), which branch from the holes 57 and 59, respectively (Fig. 6), and which terminate in offset pockets 65 and 67, respectively. Each side plate 53 and 55 also has a hole 69 which registers with the holes 37 and 39 for passage of the draw-stud 41.

The sum of the thicknesses of the divider plate 33 and of the side plates 53 and 55 is closely equal to that of the width of the slot 27. Thus when these plates are snugly inserted into the slot and the draw-stud inserted through aligned holes 37, 39 and 69 and the nuts 43 drawn up, the portions of the piston on opposite sides of slot 27 are drawn together to clamp the plates tightly in the positions illustrated in the drawings. The result is a rigid cantilever forming the piston. Thus two rectangular spaces are left in the slot 27 around the side plates 53 and 55. These respectively accommodate sets A and B of dihedral ring parts.

Each set A and B of ring parts is constituted by four flat two-legged dihedral members *a*, *b*, *c*, *d* and four loose-

fitting flat circular plugs in the shapes of discs 71, all of closely equal thicknesses. The discs 71 of the dihedral members *a*, *b*, *c* and *d* are adapted to fit loosely into openings 73 at their corners. These openings have slotted connections 75 with the insides of the dihedral members, so that the rectangular leg portions 77 and 79 of the dihedral members may spring slightly relative to one another without destroying the loose fits of the discs 71. Thus the loose discs 71 in the openings 73 are in the nature of floating filler plugs adapted to aid in obstructing leakage. The members *a*, *b*, *c*, *d* are composed of a suitable spring-type of steel for the purposes above described.

Each of the legs 77 is beveled at its outer end, as shown at 81. Each of the legs 79 contains a substantially right-angular notch 83, the sides of which are relieved by slots to form spring fingers 85. These at right angles to one another engage the beveled ends of the legs 77. A pair of the dihedral members, such as *b* and *d*, or *a* and *c*, is adapted when brought together with such engagement between their spring fingers and beveled ends to form a rectangle with the discs 71 located in the openings 73. Another adjacent pair of dihedral members, including inserted discs, is likewise assembled to form a rectangle but turned through 180°, so that the contacting pairs of ends are located under the discs 71 of the other pair. Thus each of ring sets A and B is constituted by two pairs of dihedral members and four inserted plug discs 71. The respective sets *a*, *b*, *c*, *d* are on opposite sides of the divider plate 33. The total thickness of each set is such that its members *a*, *b*, *c*, *d* are relatively movable and are biased outward under reactions from the spring fingers 85 and also from reaction from a circular spring ring 87, shown in Figs. 1-5 but omitted from Fig. 6.

Each of the spring rings is formed by a multi-looped strip spring anchored to itself at its ends and adapted to be pressed from a circularly looped form to the semi-rectangular form within dihedral parts *a*, *b*, *c*, *d* as shown for example in Fig. 3. The result is that the dihedral members *a*, *b*, *c*, *d* are inwardly contacted and pressed outward against the cylinder walls, in addition to the pressure obtained by reactions of the fingers 85. Thus it will be understood that while the divider plate 33 and side plates 53 are rigidly clamped and held by the draw-stud 41, the ring sealing parts of assemblies A and B float relatively and are biased outward into resilient rubbing engagement with the sides of the annular cylinder 11. The discs 71 resist corner leakage through the openings 73 which, with slots 75, are responsible in part for the springiness of the legs 77 and 79 of the dihedral members *a*, *b*, *c*, *d*.

It will be seen that the smaller slot 31 is in communication with the peripheral groove 35 around the divider plate 33. In order to support and align the lower legs 77 of both ring assemblies A and B, there is provided on the bottom shelves 29 of each slot 27 just over slot 31 a supporting plate 89, which has two holes 91 through it with slots 93 extending to its ends. Thus openings and lateral spring fingers 95 are formed, so that the plate will pass fluid and will springingly engage with the sides of the bottom of slot 27 within the root portion of the respective piston. The lengths of the plates are such that they extend throughout the widths of the root portions. A divider ring 2 between rotors engages the plate ends. Beneath each plate is a leaf spring 97, which rests upon the shelves 29 at the bottom of slot 27 and is above slot 31. This spring 97 presses the plate 89 upward to aid in holding the dihedral members *a*, *b*, *c*, *d* in rectangular alignment at all operating speeds; that is to say, rocking of any inner dihedral member is prevented.

In one side of the slot 27 in each piston are two oil inlet ports 99 and 101 (see the top of Fig. 2 and left side of Fig. 6), and on the other side is a port 103 (see the bottom of Fig. 2 and right side of Fig. 6). Port 99 leads to an annular passage 105 in the respective rotor enclosed

by a ring 107. Passages 109 lead from the annular passage 105 to fixed annular grooves 111 in the stationary parts 5 or 7. Each groove 111 is connected by suitable stationary passages (not shown) with a supply of hydraulic fluid, such as oil, under pressure.

Ports 101 are connected with appropriate ones of the passages 109, so as also to receive oil under pressure from grooves 111. Outside of the grooves 111 are grooves 117 in the stationary parts 5 and 7. These grooves 117 communicate with the lower slots 31 in the respective rotors 1 and 3 and are connected by suitable means (not shown) with a sump for receiving returned oil and for permitting the separation therefrom of any entrained leakage gas, as will be made clear below. Each port 103 (Fig. 2) is connected with a cross port 119 in its respective rotor, communicating with one of the annular grooves 117. As will be seen from the left end of Fig. 6, a thin portion 121 of the side plate 53 separates ports 99 and 101. The corresponding thin portion 121 of the other side plate 55 at the right end lies with respect to port 103 so as to place the enlargement 67 of groove 63 in communication with said port 103.

Operation is as follows, assuming that both pistons 13 and 15 are moving in the direction shown by the dart C in Fig. 1:

Each piston during a cycle is subjected to events which tend to cause gas leakage from the front to the rear side of a piston. The bulk of the leakage is avoided by the fact that the spring-legged dihedral ring-forming members *a*, *b*, *c*, *d* are spring-pressed against the cylinder walls by the fingers 85 and springs 87 and, in addition, are held in good alignment under any vibration at any speed by means of the radially biased, spring-pressed plate 89. In order to augment the spring pressure in biasing the dihedral members *a*, *b*, *c*, *d* against the cylinder walls, hydraulic pressure is used. This is obtained from the oil pressure in grooves 111, transmitted through port 109 and 101 into the space within ring assembly A around its side plate 53 and within its dihedral assembly *a*, *b*, *c*, *d*. This is suggested by the dart D in Fig. 6. This oil under pressure does not reach the grooves 61 in plate 53 but surrounds this plate. It may, however, to some extent leak radially outward through the surfaces between the members *a*, *b*, *c*, *d* of the ring assembly A and pass on over into the plane of the divider plate 33, as indicated by the dart E in Fig. 6. However, the floating discs 71 in the openings 73 minimize corner leakage. Thus gas from ahead of the piston may leak past assembly A, along with the stated oil leakage. Since the friction in passing through or around the ring assembly A reduces oil and gas pressure, these are not disposed to pass by the ring assembly B. On the other hand, the path of least resistance will be followed, which is through the groove 35 of plate 33, and thus through the slot 27, holes 91, slot 31, then into the appropriate outer peripheral groove 117, and finally to the oil sump connected with that groove. In the sump the gas will separate from the oil by the usual bubble flotation which occurs in liquid-gas mixtures.

The action thus far described may be termed an out-gassing action with concomitant oil removal as regards any leakage of the pressurized oil employed to expand the ring assembly A into cylinder wall engagement. This avoids leakage of gas and oil through or across assembly B to a position behind the piston, which would be undesirable.

A third action accomplished by the invention may be followed from a consideration of Fig. 6. Oil under pressure in passage 109 for cooling purposes reaches annular passage 105 and port 99. This part of the oil for cooling does not commingle in the piston with that part for ring expansion escaping from port 101, although the latter has some relatively small cooling functions. Rather, the part which primarily cools comes out individually, as indicated by the dart F in Fig. 6, being separated from

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that illustrated by the dart D. Wall 121 of groove 61 effects the separation so that dart F reaches only pocket 60 which communicates with groove 61 in plate 53. This then flows through groove 61 and through hole 57, as indicated by dart G, entering groove 47 on one side of the central divider plate 33. It then passes through this groove 47 in plate 33 and into hole 51 through this plate, as shown by the darts H. Since hole 51 is in communication with the circular groove 49 on the other side of the divider plate 33, the latter becomes filled. This groove 49 cannot conveniently be shown or seen in Fig. 6, but Fig. 5 shows it. However, in Fig. 6 the dotted darts I show the progress through this groove 49 on the back of plate 33. Finally, the connected hole 59 in side plate 55 is reached, as indicated by dart J, which brings about passage through plate 55 to the grooves 63 thereon (Fig. 4; and see the dotted lines 63 in Fig. 6). As shown by dotted darts K in Fig. 6, the oil finally reaches the pocket 67 connected with grooves 63. Since this pocket is in communication with the outlet port 103, the oil reaches the latter as shown by dart L. It then proceeds through port 103, passage 119, to the outlet groove 117, the latter (as will be recalled) being connected to the oil sump. The function of the oil thus rapidly circulated is to cool the piston, the various passages through the plates 33, 53 and 55 functioning as long-path heat exchangers since they are in metallic contact throughout large areas with the sides of the piston and of course in close contact with the circulating oil. It will be noted, as respects the hydraulic circuit defined by darts F, G, H, I, J, K, L., that it is totally enclosed and subjected to no possibility of leakage from the piston. The trailing ring assemblies B of each piston behind its center plate 33 are subjected to no high leakage pressures and, consequently, the sealing as well as the cooling efficiency of the system is quite high.

Advantages over prior rotary piston sealing methods are:

(1) Outgassing of leakage gas passing the first set of ring parts A is provided for, as well as outflow of ring-pressurizing and ring-lubricating oil that leaks past said rings, both being led out through the grooves of the divider plate 33 before the second set of rings B is reached, and both passing to the sump.

(2) Efficient heat-exchange means is provided in the piston for removing substantial quantities of heat by rapid oil circulation therethrough without leakage into the engine cylinder from the hydraulic circuit carrying the oil. This cooling oil also passes to the same sump as receives the leakage gas and leakage of ring pressurizing oil.

(3) Both sets of rings sets A and B are kept in good alignment relative to the cylinder walls under all vibrations according to various engine speeds. This improved alignment is due to the action of the spring-pressurized plate 89 in the outgoing slots 27 and 31 and also the right-angular reactions of the spring fingers 85 on the ends of the dihedral members *a, b, c, d*.

(4) The loose plug discs 71 in the openings 73 in the corners of the dihedral ring pieces inhibit corner leakage without interfering with the desired springiness between the legs of the dihedral members *a, b, c, d*.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. In a rotary piston engine, a frame having an annular cylinder and at least one fluid inlet and at least one fluid outlet, a pair of rotors, pistons on each rotor inter-

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digitating in the cylinder, annularly disposed and radially movable sealing means contained in each piston, a fluid off-take passage in each piston forming a connection with said fluid outlet, said off-take passage in each piston relative to piston movement being located behind said sealing means, whereby any leakage of gas past said sealing means may pass through said off-take passage to said fluid outlet, a fluid inlet passage in each piston forming a connection with said fluid inlet and adapted to deliver hydraulic pressurizing fluid within the radially movable sealing means to bias said sealing means against the cylinder wall, any radial leakage of said hydraulic pressurizing fluid past the sealing means also passing through said off-take passage to said fluid outlet, said piston having hydraulic coolant circulating passages disposed therein adapted to prevent commingling of said coolant with said hydraulic pressurizing fluid within the piston, said coolant circulating passages having connections with said fluid inlet and outlet respectively.

2. In a rotary piston engine, a frame having an annular cylinder and at least one fluid inlet and at least one fluid outlet, a pair of rotors, pistons on each rotor interdigitating in the cylinder, each piston comprising side portions, a central divider plate peripherally grooved to provide a fluid take-off passage having a connection with said outlet and two lateral smaller plates with a clamping member holding together the side portions and said three plates, a movable sealing assembly around each side plate, whereby any leakage of gas past one sealing assembly may pass through said peripherally grooved take-off passage to said fluid outlet, a fluid inlet passage in each piston forming a connection with said fluid inlet and adapted to deliver hydraulic pressurizing fluid within one radially movable sealing assembly to bias it against the cylinder wall, any radial leakage of said hydraulic pressurizing fluid past said one sealing assembly also passing through said peripherally grooved take-off passage to said fluid outlet, said piston having connected hydraulic coolant circulating passages formed through said plates adapted to prevent commingling of said coolant with said hydraulic pressurizing fluid within the piston, said coolant circulating passages having connections with said fluid inlet and outlet respectively.

3. A rectangular piston assembly for rotary engines comprising an integral body portion having a relatively broad slot providing spaced side portions rooted in a rotor of the engine and extending axially from a marginal portion thereof, said side portions having holes therethrough, an individual rectangular peripherally grooved intermediate divider plate and smaller individual rectangular side plates sandwiching said intermediate plate and adapted therewith snugly to fit within said relatively broad portion of the slot between said side portions, said plates having holes therethrough for a draw-stud passing through said holes adapted to clamp said plates between the side portions, and ring sealing elements disposed around the side plates.

4. A rectangular piston assembly made according to claim 3, wherein said side portions and plates have connecting passages forming a coolant circulating channel through the assembly, which channel is out of communication with space around the side plates.

5. A piston assembly for rotary engines comprising a body portion rooted in a rotor of the engine and extending axially from a marginal portion thereof, said body portion having a slot and holes therethrough on each side of the slot, an individual rectangular intermediate divider plate and individual rectangular side plates sandwiching said intermediate plate and adapted therewith snugly to fit within said slot, said plates having holes therethrough, a draw-bolt passing through said holes and clamping the plates between the sides of the slot, each side plate being smaller than the intermediate plate, movable ring sealing elements disposed around the side plates, a pressure

plate within said slot, and spring means under said pressure plate adapted to force it against said ring sealing elements to prevent misalignment thereof.

6. A piston assembly made according to claim 5, including a relatively narrow extension of said slot providing an outlet and shelves supporting said spring means.

7. A piston assembly for rotary engines comprising a member rooted in a rotor of the engine and extending axially from a marginal portion thereof, said member having draw-bolt holes therethrough and having a slot separating the member into two clamping portions, an individual intermediate divider plate and individual side plates sandwiching said intermediate plate and adapted therewith snugly to fit within said slot and to be sandwiched by the clamping portions, said plates also having draw-bolt holes therethrough, a clamping draw-bolt passing through said holes, each side plate being smaller than the intermediate plate to provide a space around it between the intermediate plate and a clamping portion, ring-sealing assemblies in the spaces around the side plates, spaced oil inlets in one clamping portion, one of said inlets communicating with said space around one of the side plates, said plates having communicating openings therethrough adapted to register so as to form a continuous passage therethrough from one clamping portion to the other and separate from the spaces around the side plates, the other oil inlet communicating exclusively with the part of the passage in one side plate, said other clamping portion having an oil outlet communicating with another part of the passage in the other side plate.

8. A piston assembly for rotary engines comprising a member rooted in a rotor of the engine and extending axially from a marginal portion thereof and including a radial slot forming spaced body portions, said body portions having draw-bolt holes therethrough, an individual intermediate divider plate and individual side plates sandwiching said intermediate plate and adapted therewith snugly to fit within said slot and to be sandwiched by the body portions of the piston, said plates having holes therethrough for reception of said draw-bolt when positioned in the holes of the body portion, said draw-bolt clamping the body portions and plates in a rigid assembly, each side plate being smaller than the intermediate plate to provide a space around it between the intermediate plate and a body portion, an oil pressure inlet in one body portion on one side of the slot, said inlet communicating with the space around an adjacent side plate, said intermediate plate having a peripheral groove adapted to receive oil leakage from the space occupied by it, and an extension of said slot in the rotor adapted to carry off oil from said peripheral groove in the intermediate plate.

9. A piston assembly for rotary engines comprising a member rooted in a rotor of the engine and extending axially from a marginal portion thereof and having a radial slot therein forming spaced body portions, said body portions having draw-bolt holes therethrough, an individual intermediate divider plate and individual side plates sandwiching said intermediate plate and adapted therewith snugly to fit within said slot and to be sandwiched by the body portions of the piston, said plates having holes therethrough for reception of said draw-bolt when positioned in the holes of the body portion, said draw-bolt clamping the body portions and plates in a rigid assembly, each side plate being smaller than the intermediate plate to provide a space around it between the intermediate plate and a body portion, said plates having facial grooves and cross-connecting holes adapted to form a continuous coolant passage therethrough, one side of said slot having a coolant oil inlet connecting with said coolant passage and the other side of the slot having a coolant oil outlet connecting with said coolant passage.

10. Dihedral sealing ring elements for engine pistons comprising flat angled legs joined at a corner portion, an opening in the corner portion connected by a slot with the inside of the dihedral shape adapted to provide springing action between the legs, and a loosely fitting plug interfitting said opening adapted to resist corner leakage through the opening.

11. Dihedral sealing ring elements made according to claim 10, wherein said opening is circular and the plug is a round disc.

12. Dihedral ring elements for rotary engine pistons comprising flat angled legs joined at a corner portion, an opening in the corner portion connected by a slot with the inside of the dihedral shape adapted to provide springing action between the legs, and a plug interfitting said opening adapted to resist corner leakage through the opening and to fit loosely in any sprung or unsprung condition of the legs.

13. A dihedral ring element for rotary engine pistons comprising flat angled first and second legs joined at a corner portion, the end of the first leg having two transversely related end contact portions and the second leg being provided with a two-sided notch, a spring finger extending from each side of the notch, each finger being engageable with one end contact portion of the first leg of another similar dihedral ring element to provide transversely directed contact pressures.

14. A dihedral ring element for rotary pistons made according to claim 13 wherein said first leg is beveled between said end contact portions for cooperation with the notch in the engaged similar dihedral ring element.

15. A dihedral ring element for rotary engine pistons comprising flat angled legs joined at a corner portion, a circular opening in the corner portion connected by a slot with the inside of the dihedral shape adapted to provide springing action between the legs, and a loosely fitting circular disc interfitting said opening adapted to resist corner leakage through the opening, the end of one leg having an inside beveled portion and the other leg being provided with a two-sided notch each side of which has a spring finger extending therefrom, said fingers being engageable with beveled portions of a leg of another similar dihedral ring element, whereby several pairs of dihedral elements may be adjacently organized with contacting fingers and beveled ends adjacent disc-filled openings at the corners of alternate pairs so as to form a radially movable rectangular spring ring-sealing assembly.

16. A piston assembly for rotary engines comprising a body portion rooted in a rotor of the engine and extending axially from a marginal portion thereof, said body portion having a slot and holes therethrough on each side of the slot, an individual intermediate divider plate and individual side plates sandwiching said intermediate plate and adapted therewith snugly to fit within said slot, said plates having holes therethrough, a draw-bolt passing through said holes and clamping the plates between the sides of the slot, each side plate being smaller than the intermediate plate, movable ring-sealing elements disposed around the side plates, a pressure plate within said slot and spacedly spanning said intermediate plate and contacting with said ring-sealing elements, and spring means under said pressure plate adapted to force it against said ring-sealing elements to prevent misalignment thereof.

17. A piston assembly for rotary engines comprising a body portion having a slot containing annularly disposed relatively movable ring elements, a pressure plate within said slot and outside of the annulus constituted by said ring elements, and spring means adapted to press upon said plate in a direction to force it to align said ring elements in a direction from the outside of the annulus.

No references cited.