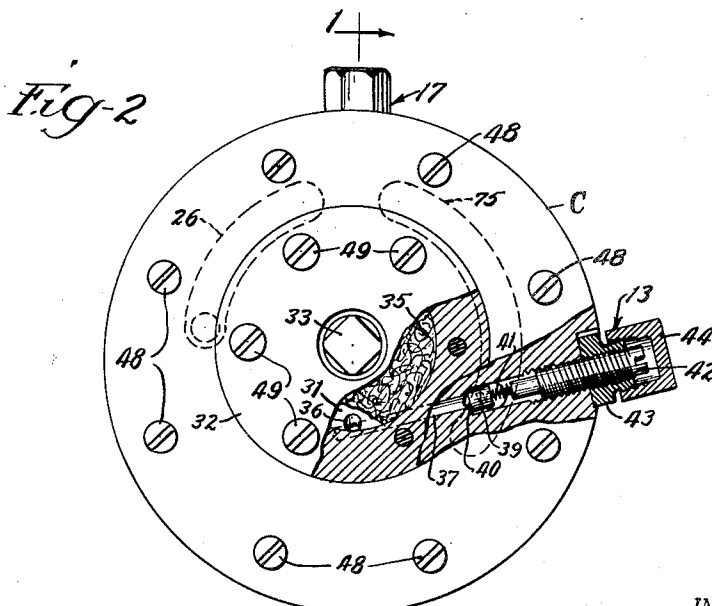
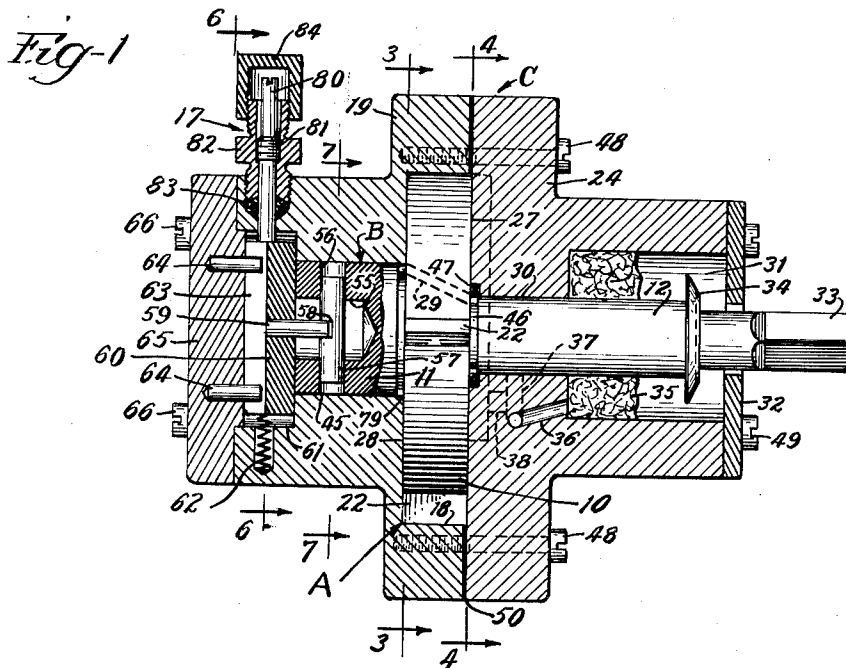


Filed Jan. 11, 1951

W. L. SANBORN
MULTIPLE PUMP

3 Sheets-Sheet 1



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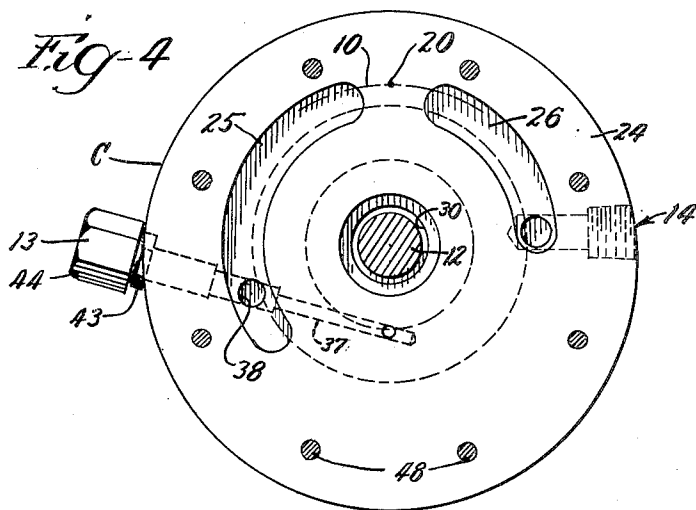
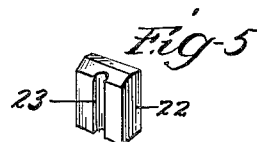
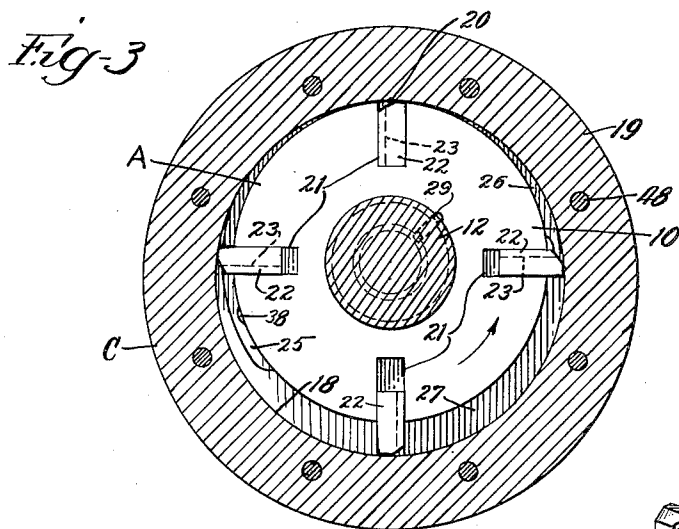
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2,655,110

MULTIPLE PUMP

Filed Jan. 11, 1951

3 Sheets-Sheet 2



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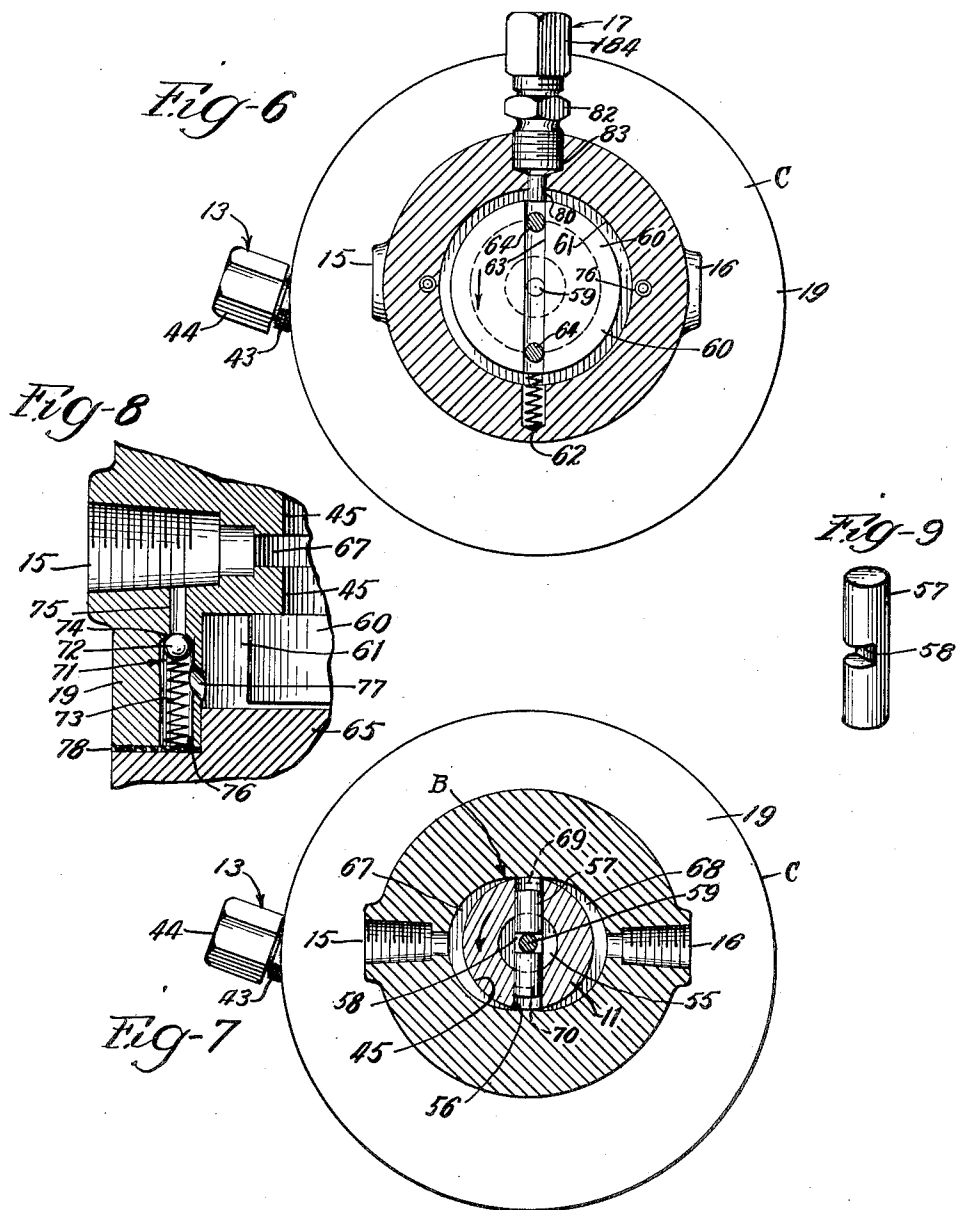
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2,655,110

MULTIPLE PUMP

Filed Jan. 11, 1951

3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

2,655,110

MULTIPLE PUMP

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Application January 11, 1951, Serial No. 205,498

12 Claims. (Cl. 103—6)

1 This invention relates to a multiple pump, one of which preferably acts upon a liquid medium, and the other upon a gaseous medium. It is particularly useful in the oil burner field wherein the fluid medium is the fuel being consumed and the gaseous medium is the primary air for atomizing and supporting combustion.

Simplicity of construction, low power requirements for operation of the pump, easy maintenance, and elimination of troublesome mechanical seals (which term, as used throughout this specification, is intended to include stuffing boxes as well) are among the more important objects of the invention. These and others, however, will be more apparent as the disclosure proceeds and the following description is read in conjunction with the accompanying drawings in which

Fig. 1 is a vertical cross-sectional view showing a preferred embodiment of the pump, the section being taken on the line 1—1 of Fig. 2;

Fig. 2 is an end elevational view taken from the right with reference to Fig. 1 with parts broken away to expose particularly the intake valve arrangement;

Fig. 3 is a transverse sectional view taken on the line 3—3 of Fig. 1 and showing particularly the air rotor construction;

Fig. 4 is a view taken on the line 4—4 of Fig. 1 and showing particularly the air intake and discharge ports;

Fig. 5 is a perspective view showing one of the air rotor blades or pumping elements;

Fig. 6 is a transverse sectional view taken on the line 6—6 of Fig. 1;

Fig. 7 is a transverse sectional view through the oil pump, the section being taken on the line 7—7 of Fig. 1;

Fig. 8 is an enlarged fragmentary sectional view showing the check valve in the exhaust line for the oil pump; and

Fig. 9 is a perspective view showing the oil pump piston.

The invention may obviously be variously modified within the scope of the appended claims and the present disclosure of a preferred form of the invention is merely for the purpose of complying with section 4888 of the revised statutes.

General organization

Considering, therefore, by way of specific illustration that the multiple pump of this invention is to be used in an oil burner system for providing both fuel oil and compressed air to a burner nozzle, the multiple pump may comprise an air pump generally designated A, a fuel pump gen-

2 erally designated B in side-by-side relationship thereto, the rotor elements 10 and 11, respectively, of which constitute integral portions of a shaft 12 which is suitably mounted within a two-part pump housing generally designated C. The air intake for the pump A is through an adjustably tensioned check valve generally designated 13, and the air exhaust port is indicated generally at 14 (Fig. 4).

The oil intake and discharge ports are indicated at 15 and 16 in Fig. 7.

It is important to be able to adjust independently the oil and air pumps, and to this end, the volumetric delivery of the oil pump B may conveniently be altered by suitable adjustment of an adjusting device generally designated 17, and the adjustable intake valve 13 provides the necessary means for controlling the action of the air pump A. For reasons that will later appear, the use of an adjustable air intake valve is particularly advantageous in a dual pump of the type herein described.

One characteristic feature of the present invention is the absence of the usual mechanical seals which because of their inefficiency consume a considerable amount of power. The seal in the present invention is accomplished by subjecting the air pump rotor on one side to the discharge pressure of the air pump so that the rotor is effectively urged against a sealing surface which is interposed between the air pump and the oil pump. In this way, the multiple pump of this invention can deliver one and one-half gallons per hour of fuel oil, with the requisite primary air for supporting combustion on a $\frac{1}{8}$ H. P. motor utilizing not more than 130 watts in effecting this delivery. The conventional oil and air pumps now commercially available require almost double the power under such conditions, and the reason for this is because a worn mechanical seal of the rotary type takes from 22 to 40 watts each in merely overcoming the friction of the seal, whereas a stuffing box or packed seal absorbs even more power.

The air pump

The air pump A is a rotary pump which has a circular pump chamber recess 18 in the pump housing 19. The rotor 10 is also circular in form, but is eccentrically mounted within the recess 18 as best shown in Fig. 3, with the point of tangency being indicated at 20. The rotor 10 is slotted as indicated at 21 to receive pumping elements or vanes 22 which are preferably of the form shown in Fig. 5, and are made of hard,

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wear-resistant material such as Bakelite or the like. The vanes are slotted as indicated at 23 so air can not be trapped within the bottom of the slots 21 to thereby impose an unnecessary load upon the pump motor, and also to provide positive pressure behind the vanes to augment centrifugal force in holding the vanes in contact with the cylinder wall.

On the face of the mating pump housing or casing 24 are provided arcuate intake and discharge passages 25 and 26, respectively, it being noted that the ports are on opposite sides of the point of tangency 20 and considerably overlap the face of the juxtaposed rotor 10. The purpose of this overlap is so that the face 27 of the rotor 10 is subjected to the discharge pressure of the pump in order that the pump shall be forced to the left in Fig. 1 against the face 28 of the pump chamber recess 18, this face serving as a sealing surface.

It will be seen that as the shaft 12 is rotated in a counter-clockwise direction when viewed as in Fig. 3, the vanes 22 are thrown outwardly by centrifugal force and air pressure behind the vanes against the cylindrical surface of the pump chamber 18 and draw air from the intake passageway 25 due to the expanding crescent-shaped pump chamber as the rotor revolves, and the air is then compressed as the pump chamber space begins to decrease (which will occur opposite the point of tangency 20) with the compressed air being expelled through the discharge passageway 26 into a series of communications leading to the discharge port 14.

The face 28 of the pump chamber 18 (see Fig. 1) is ground smooth to form a sealing surface, and in order that this face of the rotor may be kept at relatively low pressure, the rotor 10 is pierced by a passageway 29 that connects the left face or lower pressure side of the rotor with the right face or higher pressure side of the rotor. Since the discharge port 26 considerably overlaps the face of the rotor 10, the discharge pressure exerts a force or axial thrust against the rotor 10, and continually maintains it in firm sealing engagement with the face 28 of the housing 19. In this way, normal running clearance may be provided on the right hand side of the rotor 10 (Fig. 1), and when the pump is assembled, the pump will maintain its effective seal at the surface 28 regardless of wear on the rotor.

It will be noted that the air rotor 10 is supported in somewhat cantilever fashion from the oil pump rotor 11 with which it is integral, the oil pump rotor constituting a large bearing surface for support of the oil pump rotor 11, the air pump rotor 10 and the shaft 12. The shaft 12 projects loosely through an opening 30 in the casing 24 and merely serves to transmit torque from the driving motor to the air and oil pump rotors. The shaft extends through an air intake chamber 31 and has good running clearance with a cover plate 32 which closes the air intake chamber 31. Preferably the end of the shaft 12 is flattened on one side or provided with a square head as indicated at 33 for ready attachment to a motor (not shown).

Since the oil pump rotor 11 constitutes the sole bearing support for the air and oil pump rotors, it is unnecessary to provide accurately aligned bearings, as is usual. Furthermore, the axial thrust of the air pressure causing the air rotor 10 to be maintained in sealing engagement with the surface 28 serves to maintain the shaft

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12 in its proper running position and takes away any undesirable eccentric loading on the oil pump bearing.

In order that oil which may creep along the shaft 12 into the chamber 31 will not pass outwardly through the cover plate 32, the shaft is preferably equipped with an oil spinner 34 which intercepts and centrifugally discharges any oil that may be traveling outwardly along the shaft 12 to the air intake chamber 31, where it passes through a bronze filter material 35 to one of the air intake passages 36. The bronze filter material acts also as a silencer in cutting down noise caused by air passing through the air pump.

Air intake regulation

Air delivered from the air intake chamber 31 to the interior of the air pump chamber recess 18, and all air and oil that may pass through the passageway 29 of the rotor 10 must pass through the air intake regulator 13. By referring to Figs. 1 and 2, it will be seen that air that enters the passageway 36 from the intake chamber 31 is moved outwardly of the casing 24 through a passage 37 which communicates with the air intake passageway 25 through a side opening 38. Seated within the passageway 37, however, is a spring-pressed check valve 39 which rests upon a seat 40 and is urged to seated position by a spring 41. The tension on the spring 41 may be varied by suitable adjustment of an adjusting screw 42 which may be locked in place by a lock nut 43. Preferably a protective cap 44 is threadedly mounted over the end of the adjusting screw 42 to discourage unauthorized manipulation of the adjusting screw 42.

Obviously, by increasing the force with which the spring 41 is urged against the check valve 39, the head pressure of the air pump is reduced, and conversely, by decreasing such pressure, the regulated head pressure is increased.

Since the passage 29 in the rotor 10 is closely adjacent to the oil pump B, some oil may pass between the running clearance of the oil pump rotor 11 and the bore 45 in the housing 19 that receives the rotor 11, with the result that this oil will tend to travel along the shaft 12 to the air chamber 31 where it is deposited on the floor of the chamber 31 by the oil spinner 34, and is then picked up by the air intake 36 where it is transmitted to the air intake passageway 25 through the check valve 39. It will be noted that when a slug of oil passes through the passageway 37 and check valve 39, the valve 39 may readily yield to accommodate the oil slug, and then immediately reseats itself for subsequent control of the air intake and air discharge pressure. In this way effective regulation of intake and discharge pressures are obtained regardless of oil content of incoming air.

It should also be noted that oil, in passing from the oil pump B to the passageway 29, must go through the running clearances of the oil pump (i. e., between the rotor 11 and the bore 45), and since this clearance is very small, the oil is effectively strained.

The shaft 12 immediately adjacent to the rotor 10 is preferably slightly undercut or grooved as indicated at 46 to provide an annular chamber to receive oil through the passageway 29, where it is held for ready distribution along the surface of the shaft by a felt washer 47 which is mounted in a suitable groove in the casing 24.

The two halves of the pump housing C, that is,

the pump housing member 19 and the casing 24, are held together by stud bolts 48, and the cover plate 32 may be secured to the casing 24 in any suitable manner as by machine screws 49.

A gasket 50 is interposed between the pump housing 19 and the casing 24 to seal effectively the joint, and to provide the desired running clearance for the rotor 10.

The oil pump

The oil pump B is a metering pump which may be adjusted to various volumetric deliveries. It is simple in construction and may readily be adjusted to produce the desired amount of oil flow.

Referring now to Figs. 1 and 7 particularly, the rotor 11, which is an integral part of the shaft 12, is of cylindrical form and rides within the cylindrical bore 45. The rotor 11 has an axial bore 55 and a transverse bore 56. The latter bore 56 constitutes a pumping cylinder within which rides a cylindrical piston 57 which is slotted at 58 (see Figs. 1 and 9) to receive a positioning pin 59 which is carried on a circular plate 60 that is vertically adjustable within a counterbore portion 61 of the housing 19 to fix the position of the pin at some desired eccentric position relative to the longitudinal axis of the shaft 12. The plate 60 is yieldingly urged upwardly by a spring 62 and is urged downwardly against the spring 62 by the adjusting device 17. The plate 60 has a vertical slot as indicated at 63 to receive vertically aligned pins 64 which are mounted on a cover plate 65 secured to the pump housing 19 by machine screws 66. The aligning pins 64 restrict movement of the plate 60 to a given line (in this case, vertical line) so that the pin 59 likewise moves along the same line.

In a plane aligned with the transverse bore 56 of the rotor 11, arcuate intake and discharge grooves 67 and 68 are formed in the wall of the bore 45. These grooves lie on opposite sides of the vertical center line as best shown in Fig. 7, and the grooves are in communication with the intake and discharge ports 15 and 16 respectively. It will be seen that when the positioning pin 59 is adjusted to a position concentric with the axis of the shaft 12, the piston 57 will remain stationary within the bore 56, and the oil pump under such circumstances has zero delivery. When, however, the pin 59 is adjusted to a position above the center of the shaft 12, the top of the piston 57 will occupy the position indicated by the dotted line 69 in Fig. 7, while the bottom of the piston will occupy the position indicated by the dotted line 70 in the same figure (i. e., when the rotor 11 is in a position such that the bore 56 lies in a vertical plane). When the rotor 11 is now rotated in a counter-clockwise direction, the top of the piston 57 will move inwardly relative to the rotor, thereby drawing oil from the intake groove 67 into the top of the bore 56. After the rotor has moved through 180°, at which time the pump chamber area will be at maximum, the piston will move outwardly and expel the oil into the discharge groove 68 and out through the discharge port 16.

Obviously, each end of the piston produces a similar pumping action on each revolution of the rotor, and in effect, what the positioning pin 59 does is to adjust the stroke of the piston 57 to vary the oil delivery and metered flow.

Instead of adjusting the positioning pin 59 to a position above the axis of the shaft 12, it could be adjusted to a position below such axis, in which case, the flow of oil through the pump would be

reversed with the port 15 and groove 67 being discharge passageways, while the port 16 and groove 68 would become intake passageways.

The oil pump B is preferably provided with a pressure relief device which is shown in Fig. 8, and which presupposes that the pin 59 has been positioned below the axis of the rotor 11 so that the port 15 is, in this instance, the discharge port. The pressure relief device consists of a ball check valve generally designated 71, and comprises a ball 72 urged by a spring 73 against a seat 74 in passageway 75 which is in communication with the discharge port 15. The spring 73 lies within a bore 76 that communicates with the chamber 61 through a port 77. The cover 65 when applied to the housing 19 (after fitted with a suitable gasket 78) urges the spring against the ball 72, and under ordinary circumstances, keeps the ball against its seat 74. If, however, pressure in the oil discharge line should become excessive, the ball 72 may yield, permitting oil to flow through the port 77 into the chamber 61, where it may flow back to the intake passage for the oil pump through similar passageways associated with the other port 16. It will be understood that the spring 73 and ball 72 are used only on the discharge side of the pump so that once the oil enters the chamber 61, it may flow freely to the intake side of the pump for recirculation.

Although a twin piston oil pump has been shown and described, it is possible to employ a four piston arrangement, such as shown in the copending application of Earl J. Senninger, Serial No. 657,359, filed March 27, 1946, now Patent No. 2,575,074.

As heretofore stated, oil that finds its way along the rotor bearing surface to the groove 79 which separates the rotor 10 from the rotor 11, is effectively strained due to the small clearance between the rotor 11 and the bore 45, and thereupon, this oil goes through the passageway 29 to lubricate the shaft 12 and also the sides of the rotor 10.

The adjusting device 17 consists of an adjusting screw 80 which is threaded as indicated at 81 into a nipple 82 that has a packing gland 83 at its lower end to prevent oil in the chamber 61 from flowing outwardly along the adjusting screw 80. The screw 80 bears against the plate 60 to fix the position of the plate, and hence the positioning pin 59, with reference to the axis of the shaft 12. A dust cap 84 is preferably provided over the projecting end of the adjusting screw 80.

General comments

It will be seen that the multiple pump of this invention has no mechanical seals, either of the conventional rotary type or of the stuffing box type, and yet the air pump is effectively sealed from the oil pump and from the atmosphere, and the oil pump is likewise effectively sealed to the extent that it is desirable from the air pump and from the atmosphere. Also, the air pump may be independently adjusted through the intake valve adjusting device for obtaining the desired volumetric flow of air through the pump, and likewise the oil pump may have its volumetric delivery separately adjusted.

The multiple pump is adapted to run at usual motor speeds on the order of 1725 R. P. M.'s, but may of course be run at higher or lower speeds.

It will be understood that in referring to "an air pump" throughout the specification and claims, it is intended that other gaseous me-

diums may be used as well as air, and the specification and claims should be construed accordingly.

I claim:

1. In a combination oil and air pump, a housing having a circular air pump chamber therein one side face of which constitutes a sealing surface, and the opposed side face thereof having a discharge port, a rotor mounted in the air pump chamber, pumping elements associated with the rotor adapted to produce a pumping action in the pump chamber when the rotor is rotated, means for rotating the rotor, said discharge port overlapping the adjacent side of said rotor, whereby the rotor is urged into sealing engagement with said sealing surface, said housing also having an oil pump chamber adjoining the air pump chamber adjacent said sealing surface, an oil pump rotor in the oil pump chamber mounted rigidly with and rotating with the air pump rotor, and means for relieving pressure along said sealing surface.

2. In a combination oil and air pump, a housing having a circular air pump chamber therein one side face of which constitutes a sealing surface, and the opposed side face thereof having a discharge port, a rotor mounted in the air pump chamber, pumping elements associated with the rotor adapted to produce a pumping action in the pump chamber when the rotor is rotated, means for rotating the rotor, said discharge port overlapping the adjacent side of said rotor, whereby the rotor is urged into sealing engagement with said sealing surface, said housing also having an oil pump chamber adjoining the air pump chamber adjacent said sealing surface, an oil pump rotor in the oil pump chamber mounted rigidly with and rotating with the air pump rotor, and means for relieving pressure along said sealing surface, said pressure-relieving means including a passageway through the rotor.

3. In a multiple pump, a pump housing having an oil pump chamber and an air pump chamber in side-by-side relationship, a shaft rotatably supported in the housing and having an oil pump rotor and an air pump rotor rigidly mounted thereon for rotation within said oil and said air pump chambers, respectively, pumping elements carried by said rotors, intake and discharge passages leading to the oil and air pump chambers, respectively, said passages including an air discharge port in the pump housing communicating with the discharge side of the air pump chamber and substantially overlapping the side of the air pump rotor that is remote from the oil pump, whereby said air pump rotor is urged by the discharge pressure of the air pump into sealing engagement with the opposed face of the air pump chamber, and means for relieving pressure along said opposed face of the air pump chamber, said pressure-relieving means including a passageway through the air pump rotor.

4. In a multiple pump, a pump housing having an oil pump chamber and an air pump chamber in side-by-side relationship, a shaft rotatably supported in the housing and having an oil pump rotor and an air pump rotor rigidly mounted thereon for rotation within said oil and said air pump chambers, respectively, pumping elements carried by said rotors, intake and discharge passages leading to the oil and air pump chambers, respectively, said passages including an air discharge port in the pump housing communicating with the discharge side of the air

pump chamber and substantially overlapping the side of the air pump rotor that is remote from the oil pump, whereby said air pump rotor is urged by the discharge pressure of the air pump into sealing engagement with the opposed face of the air pump chamber, said oil pump rotor having an extended bearing in said pump housing and constituting the main bearing support for the shaft and said rotors, and means for relieving pressure along said opposed face of the air pump chamber, including a passageway communicating with the oil pump chamber, extending through said air pump rotor, and communicating with said intake passage for the air pump.

5. In a multiple pump, a pump housing having an oil pump chamber and an air pump chamber in side-by-side relationship, a shaft rotatably supported in the housing and having an oil pump rotor and an air pump rotor rigidly mounted thereon for rotation within said oil and said air pump chambers, respectively, pumping elements carried by said rotors, intake and discharge passages leading to the oil and air pump chambers, respectively, said passages including an air discharge port in the pump housing communicating with the discharge side of the air pump chamber and substantially overlapping the side of the air pump rotor that is remote from the oil pump, whereby said air pump rotor is urged by the discharge pressure of the air pump into sealing engagement with the opposed face of the air pump chamber, means including a passageway for delivering oil that has leaked into the space between the oil pump rotor and the air pump rotor to said intake passage for the air pump, and an adjustable check valve in said intake passage for the air pump located intermediate the air pump chamber and the passageway that communicates with said space between said air pump rotor and said oil pump rotor, said adjustable check valve including resilient means urging said check valve to seated position, said resilient means being yieldable to permit oil to pass through said check valve, and means to vary the force with which said resilient means urges said check valve to seated position to control the discharge pressure of said air pump.

6. In a multiple pump, a pump housing having an oil pump chamber and an air pump chamber in side-by-side relationship, a shaft rotatably supported in the housing and having an oil pump rotor and an air pump rotor rigidly mounted thereon for rotation within said oil and said air pump chambers, respectively, pumping elements carried by said rotors, intake and discharge passages leading to the oil and air pump chambers, respectively, said passages including an air discharge port in the pump housing communicating with the discharge side of the air pump chamber and substantially overlapping the side of the air pump rotor that is remote from the oil pump, whereby said air pump rotor is urged by the discharge pressure of the air pump into sealing engagement with the opposed face of the air pump chamber, said oil pump rotor having an extended bearing in said pump housing constituting the main bearing support for said shaft and rotors, and means for relieving pressure on said opposed face of the air pump chamber including a passageway through said air pump rotor, and an adjustable check valve in the intake passage for said air pump, whereby the discharge pressure of the air pump may be controlled.

7. In a multiple pump, a pump housing having an oil pump chamber and an air pump chamber in side-by-side relationship, a shaft rotatably supported in the housing and having an oil pump rotor and an air pump rotor rigidly mounted thereon for rotation within said oil and said air pump chambers, respectively, pumping elements carried by said rotors, intake and discharge passages leading to the oil and air pump chambers, respectively, said passages including an air discharge port in the pump housing communicating with the discharge side of the air pump chamber and substantially overlapping the side of the air pump rotor that is remote from the oil pump, whereby said air pump rotor is urged by the discharge pressure of the air pump into sealing engagement with the opposed face of the air pump chamber, an adjustable check valve in the intake passage for said air pump whereby the discharge pressure of the air pump may be controlled, means for separately adjusting the volumetric discharge of said oil pump, and means for relieving pressure along said opposed face of the air pump chamber, said pressure-relieving means including a passageway extending from said opposed face to the intake passage for the air pump.

8. In a multiple pump, a pump housing having an oil pump chamber and an air pump chamber in side-by-side relationship, a shaft rotatably supported in the housing and having an oil pump rotor and an air pump rotor rigidly mounted thereon for rotation within said oil and said air pump chambers, respectively, pumping elements carried by said rotors, intake and discharge passages leading to the oil and air pump chambers, respectively, said passages including an air discharge port in the pump housing communicating with the discharge side of the air pump chamber and substantially overlapping the side of the air pump rotor that is remote from the oil pump, whereby said air pump rotor is urged by the discharge pressure of the air pump into sealing engagement with the opposed face of the air pump chamber, said oil pump rotor having an extended bearing in said pump housing and constituting the main bearing support for the shaft and said rotors.

9. In a multiple pump, a pump housing having an oil pump chamber and an air pump chamber in side-by-side relationship, a shaft rotatably supported in the housing and having an oil pump rotor and an air pump rotor rigidly mounted thereon for rotation within said oil and said air pump chambers, respectively, pumping elements carried by said rotors, intake and discharge passages leading to the oil and air pump chambers, respectively, said passages including an air discharge port in the pump housing communicating with the discharge side of the air pump chamber and substantially overlapping the side of the air pump rotor that is remote from the oil pump, whereby said air pump rotor is urged by the discharge pressure of the air pump into sealing engagement with the opposed face of the air pump chamber, said oil pump rotor having an

extended bearing in said pump housing and constituting the main bearing support for the shaft and said rotors, said urging of the air pump rotor into sealing engagement with said opposed face of the air pump chamber aiding in maintaining the alignment of the shaft with respect to said extended bearing.

10. In a combination oil and air pump, a pump housing having a cylindrical oil pump chamber and an adjacent air pump chamber eccentrically positioned with reference thereto, said air pump chamber being of greater diameter than the oil pump chamber and having a planar, sealing, side face adjacent to the oil pump chamber and a pressure side face remote therefrom provided with a discharge port, said housing also having intake and discharge passageways for the oil pump chamber, an intake port for the air pump chamber, and intake and discharge passageways communicating with the intake and discharge ports associated with the air pump chamber, a rotary shaft mounted in the housing having an oil pump rotor portion occupying the oil pump chamber and constituting both a rotor for the oil pump and a main cantilever bearing support for the shaft, an air pump rotor portion occupying the air pump chamber, overlapping said air discharge port and having a planar side face adapted to be urged into sealing engagement with said sealing side face of the air pump chamber by the air pump discharge pressure in said air discharge port, and a stub shaft portion projecting loosely through said pressure side face of the air pump chamber, and piston and vane elements in said oil and air pump rotors respectively.

11. A combination oil and air pump as set forth in claim 10 in which means are provided for relieving pressure adjacent to said sealing side face of said air pump chamber.

12. A combination oil and air pump as set forth in claim 10 in which said oil pump includes a piston slidable within a transverse bore in said oil pump rotor portion, an adjustable positioning pin rotatably engaging said piston, the stroke of said piston being determined by the eccentric positioning of said pin with relation to the axis of rotation of said oil pump rotor portion.

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