

Jan. 14, 1941.

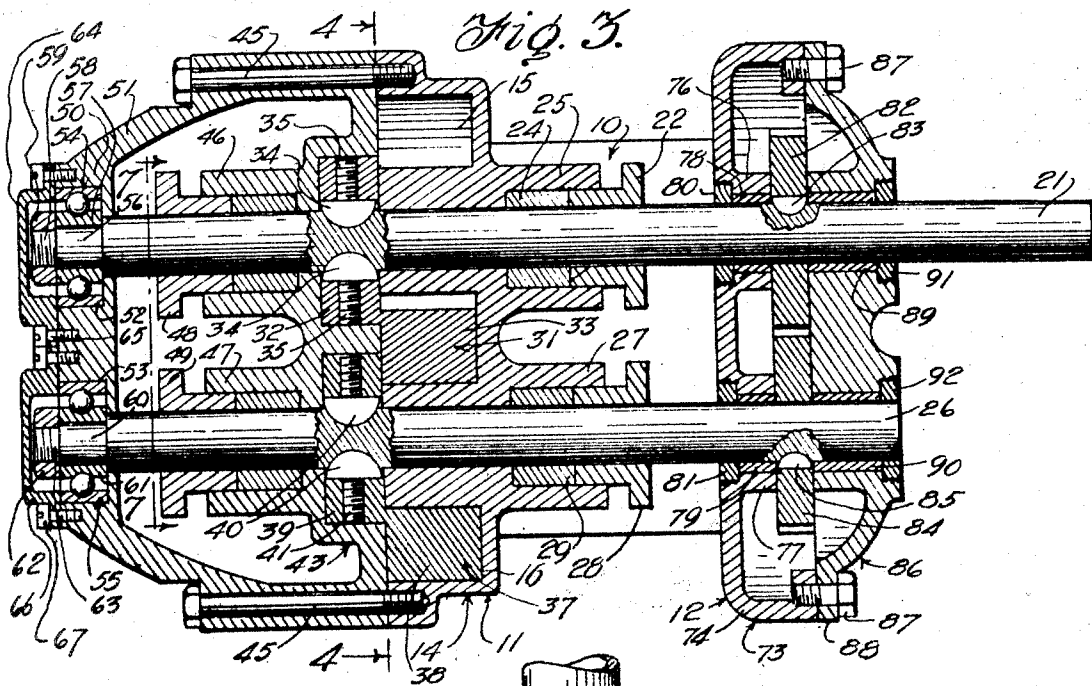
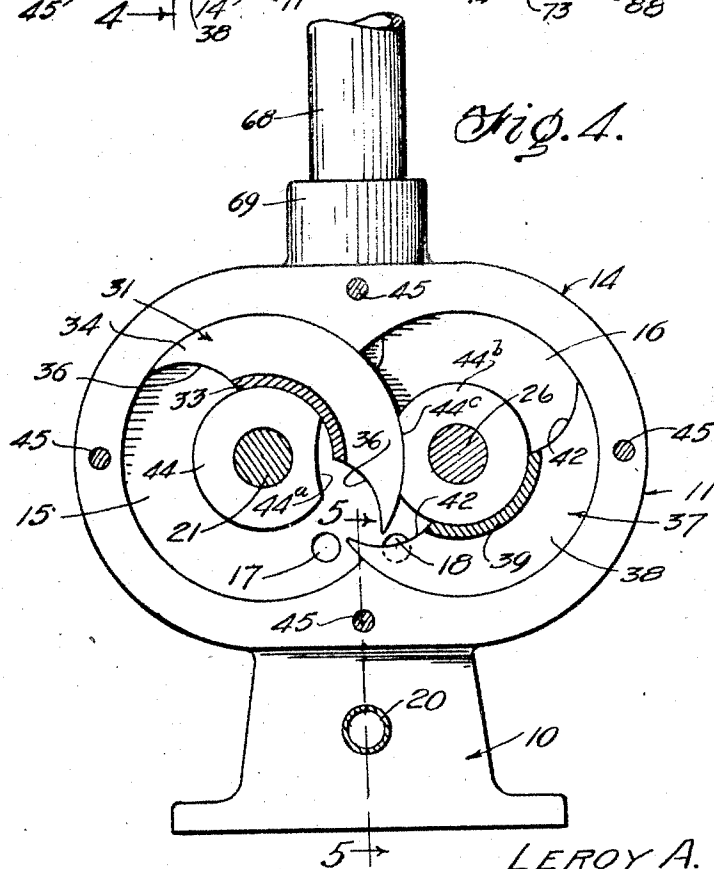
L. A. THOMSON

2,228,933

ROTARY PUMP OR COMPRESSOR

Filed Oct. 4, 1939

4 Sheets-Sheet 2



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Fig. 5.

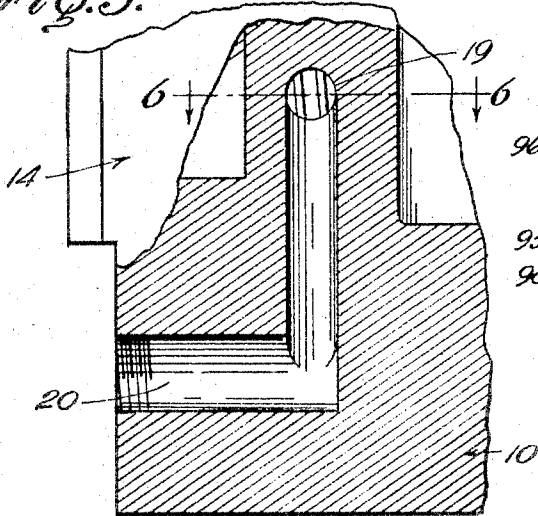


Fig. 6.

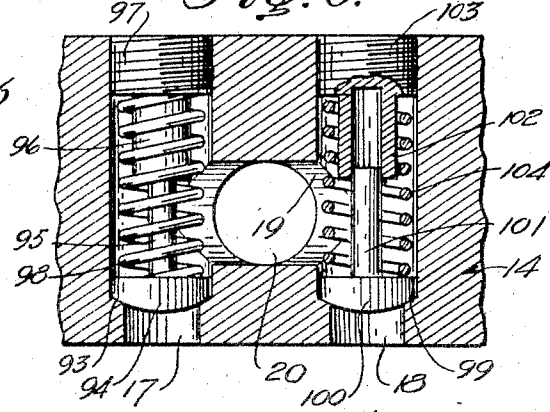


Fig. 7.

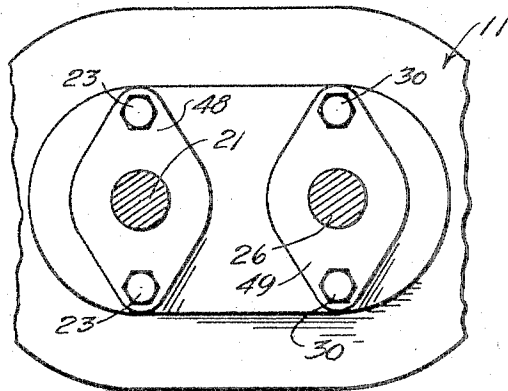


Fig. 8.

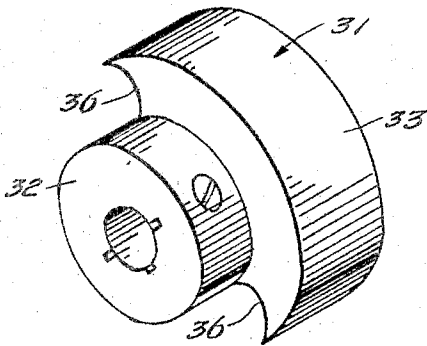
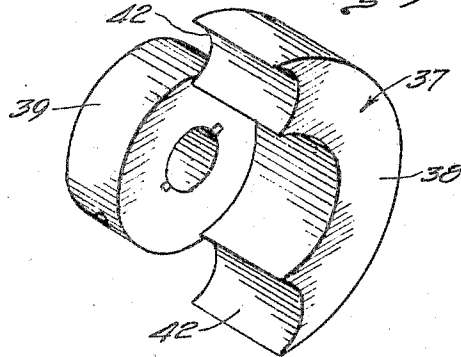


Fig. 9.



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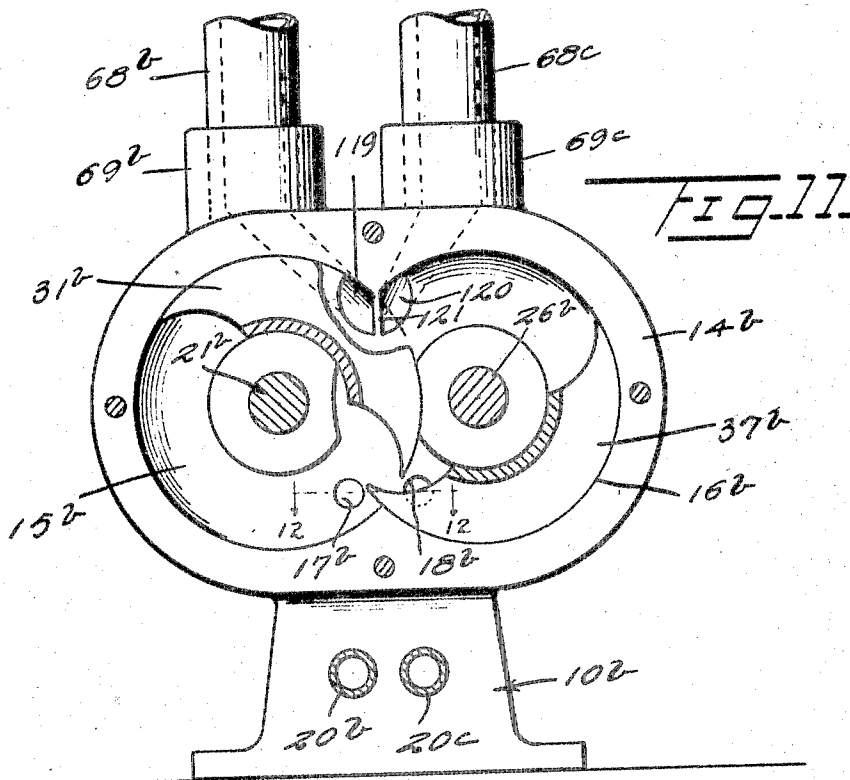
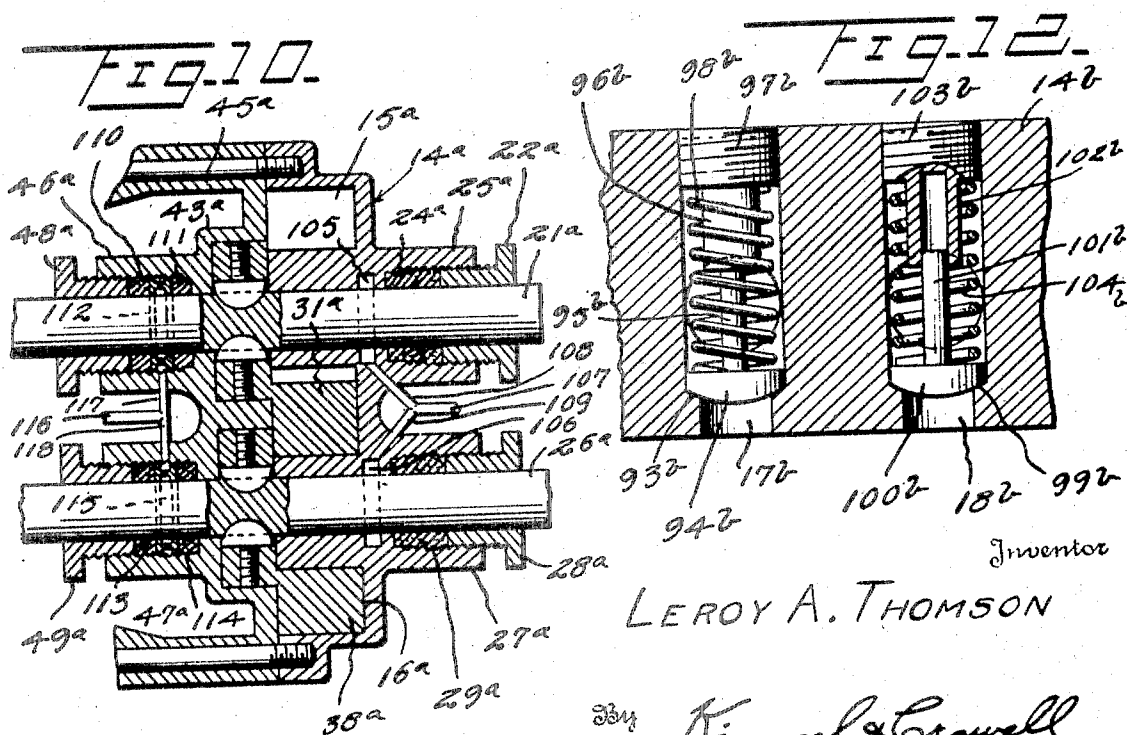
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UNITED STATES PATENT OFFICE

2,228,933

ROTARY PUMP OR COMPRESSOR

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Application October 4, 1939, Serial No. 297,928

3 Claims. (Cl. 230-141)

This invention relates to rotary pumps or compressors and more particularly to a compressor or pump which is so constructed that oil or the like will not enter the pumping chamber so as to mix with any fluid passing therethrough, and is an improvement over the structure disclosed by Patent Number 2,161,729, issued to me under date of June 6, 1939.

An object of this invention is to provide a compressor which is so constructed that it may be operated either with or without a sealing, cooling and lubricating fluid and which is also constructed that relatively close tolerances may be provided between the rotary elements so that the pump may be operated at the desired speed without undue heating or wear thereof.

Another object of this invention is to provide a pump of this character wherein water or other liquid may be used as a sealing, cooling and lubricating element, the liquid being mixed with air or gases which are passing through the pump.

A further object of this invention is to provide in a pump of this character a pair of housings which may be secured to a stationary base, one of the housings enclosing the rotary pumping elements and the other housing enclosing gears or the like which are secured to shafts on which the pumping elements are also secured so that the gears may be provided with the desired lubricant which will not come into contact with the rotary elements in the pumping compartments.

A still further object of this invention is to provide in a pump of this kind a pair of outlet passages, one for each rotor and spring-pressed check valves for such outlet passages so as to prevent the back pressure from affecting the operation of the pump.

A further object of this invention is to provide in a pump of this kind a pair of outlet passages, one for each rotor and check valves for such outlet passages so as to prevent any back pressure from affecting the operation of the pump. This pair of outlet passages may have a single common outlet check valve, but I prefer to show separate valves on account of better efficiency. The valve or valves may be of any shape or design desired, such as spring loaded or otherwise, ball, poppet, reed shaped, or otherwise. The valve section may also be made removable for ease of cleaning and repairing.

A further object of this invention is to provide in a pump of this kind, a pair of separate intake passages and a pair of separate discharge passages, with or without check valves for same, so as to allow pumping of two different fluids, with

or without the addition of sealing, cooling or lubricating liquids, so that the fluids may be discharged substantially separate from each other.

A further object of this invention is to provide, in a pump of this kind, a pair of separate intake passages, and a pair of separate discharge passages, with or without check valves for same, and with or without the addition of sealing, cooling and lubricating liquids, so that two different fluids may be mixed within the pump and discharged together in substantially equal volumes.

A further object of this invention is to provide a pump of this kind wherein the rotors may be taken off from the operating shafts thereof without the necessity of disassembling the entire pump structure.

To the above objects and others which may hereinafter appear, the invention consists of the novel construction, combination and arrangement of parts as will be more specifically referred to and illustrated in the accompanying drawings wherein is shown embodiments of the invention, but it is to be understood that changes, variations and modifications may be resorted to which fall within the scope of the invention as claimed.

In the drawings:

Figure 1 is a detail top plan partly in horizontal section of a pump or compressor constructed according to an embodiment of this invention.

Figure 2 is a detail side elevation partly broken away and in vertical section of the pump.

Figure 3 is a sectional view taken on the line 3-3 of Figure 2.

Figure 4 is a sectional view taken on the line 4-4 of Figure 3.

Figure 5 is a fragmentary sectional view taken on the line 5-5 of Figure 4.

Figure 6 is an enlarged fragmentary sectional view taken on the line 6-6 of Figure 5.

Figure 7 is a sectional view taken on the line 7-7 of Figure 3.

Figure 8 is a perspective view of one of the rotors from one end of the rotor.

Figure 9 is a perspective view of a rotor looking in the direction opposite from Figure 8.

Figure 10 is a fragmentary sectional view similar to Figure 3 showing an improved sealing means for the shafts.

Figure 11 is a view similar to Figure 4, but showing a modified form of pump structure.

Figure 12 is an enlarged fragmentary sectional view taken on the line 12-12 of Figure 11.

Referring to the drawings, the numeral 10 designates a base structure on which are mounted a pump housing 11 and a gear housing 12. The

pump housing 11 comprises a casing 14 which is fixed to the base 10 and which is provided on the inside thereof with a pair of annular or ring-shaped compartments 15 and 16. These compartments 15 and 16 constitute pumping chambers or compartments, and an inlet passage 13 is provided in the casing 14 which at its inner end communicates with the two compartments 15 and 16.

10 The casing 14 is provided with a pair of outlet or discharge passages 17 and 18 which communicate with the compartments or chambers 15 and 16 respectively. These discharge passages or orifices 17 and 18 communicate with a connecting passage 19 which discharges into a common outlet or discharge opening 20 provided in the present instance in the base 10. A drive shaft 21 passes through the casing 14 and may or may not be journaled in the casing. The casing 14 is provided with a gland member 22 which engages about the shaft 21 and is tightly secured to the casing 14 by means of bolts 23 or the like. Soft packing 24 engages in a stuffing box 25 provided in the casing 14 so as to tightly seal the shaft 21 at one end of the casing 14. A second or driven shaft 26 passes through the casing 14 in like manner in parallel relation to the drive shaft 21 which extends through a stuffing box 27. A gland member 28 similar to the gland 22 engages in the stuffing box 27 and a sealing member 29 is positioned in the stuffing box 27. The gland 28 is held about the shaft 26 and to the casing by bolts 30 or the like. A rotor 31 comprising one of a pair of rotary pumping members is rotatably disposed in the pumping chamber 15. The rotor 31 comprises a hub 32 and a crescent-shaped or segmental off-set part 33 which is disposed within the chamber 15. The hub 32 as shown in Figure 3 is disposed exteriorly of the chamber 15 and is secured to the shaft 21 by key members 34. The key members 34 in the present instance are segmental shaped and are held against movement relative to the hub member 32 by means of a set screw 35. The opposite ends of the crescent-shaped or segmental rotor 32 are provided with arcuate or concave portions 36, the purpose for which will hereinafter be described.

A second rotor 37 is disposed in the pumping chamber or compartment 16 and comprises a crescent-shaped rotor 38 secured in off-set relation to a hub 39 which is fixed to the driven shaft 26 by means of key members 40. If desired, the rotors 31 and 37 may be splined onto the shafts 21 and 26 respectively. The key members 40 are held against movement relative to the hub members 39 by means of set screws 41 which may be omitted, if desired. The crescent-shaped rotor element 38 is constructed similar to the rotor 31 being provided with concave opposite end portions 42. In this manner, the rotation of the two rotors 31 and 37 may be extended in opposite directions and the concave end portions thereof may inter-engage as shown in Figure 4. The rotors 31 and 37 are adapted, during a portion of the rotation thereof, to cover up the discharge orifices 17 and 18, the covering of these orifices being done alternately so that the fluid in one of the chambers will be forced out of its discharge orifice while the other discharge port is covered by the other rotor.

A cap or closure plate 43 engages against the casing 14 and encloses the hub portions 32 and 39 of the rotors 31 and 37 respectively. The cap 43 is secured in face abutting relation to the adjacent face of the casing 14 by means of bolts 45

or clamps or the like and may be doweled, if desired. The cap 43 is provided with a pair of bushings 46 and 47 which engage about the shafts 21 and 26 respectively, and sealing glands 48 and 49 engage the stuffing boxes 46 and 47 respectively, so as to thoroughly seal the shafts 21 and 26 with respect to the cap 43. These gland members 48 and 49 are similar to the gland members 22 and 28 being detachably secured to the cap 43 by means of bolts 23 and 30 respectively.

A plate or end wall 50 is secured to the cap 43 by means of a pair of arms 51 and this plate or wall 50 is provided with a pair of sockets or recesses 52, 53 in which thrust bearing members, generally indicated as 54 and 55 respectively, are mounted. The drive shaft 21 is provided with a reduced end portion 56 engaging within the inner race 57 of the bearing 54 and this reduced end is also provided with a threaded portion 58 on which a nut 59 is threaded so as to tightly secure the inner race 57 on the reduced end 56 of the drive shaft 21. In this manner the adjacent end of the drive shaft 21 is rotatably supported by a bearing which includes a thrust bearing in the plate 50. While anti-friction bearings are shown, plain, ball or roller or other types may be used, either singly or in combination. These bearings may be secured to the shaft and to the end wall by various means other than as shown, as by threads, shoulders, tapers or snap rings. The above bearing comments apply both to the driven shaft 26 and drive shaft 21.

The driven shaft 26 is provided with a reduced end portion 60 and the inner race 61 of the bearing member 55 engages about this reduced portion 60 and is tightly held thereon by means of a nut 62 which is threaded onto a threaded end portion 63 of the shaft 26. The bearings 54 and 55 are of the thrust type which in addition also rotatably support the shafts 21 and 26 in the cap 43. A cap 64 encloses the nut 59 being detachably secured to the plate 50 by means of bolts or screws 65 or the like. A second cap 66 encloses about the nut 62 being secured to the plate 50 by means of bolts or screws 67 or the like. In this manner, when it is desired to remove the cap 43, the end caps 64 and 66 are first removed by taking out the screws 65 and 66. The holding nuts 59 and 62 are then removed from the threaded ends of the shafts 21 and 26 respectively. The bolts 45 may then be removed and the cap 43 moved axially of the casing 14.

The inlet pipe 68 is threaded into a boss 69 carried by the casing 14 and this inlet pipe 68 is preferably provided with an interior diameter relatively larger than the diameter of the inlet opening 13. A pipe 70 is disposed concentrically of the opening 13 and the pipe 68 being secured to a laterally extending pipe 71 by means of a coupling or elbow 72. The pipe 71 is provided for the purpose of admitting a fluid such as water or the like equally into the compartments 15 and 16 which fluid may act as a sealing means to thoroughly seal the rotors 31 and 37 in the compartments 15 and 16 respectively.

It will also be understood that any desired liquid may be provided for a sealing liquid so that the pump may be used for pumping either a gas, air or the like or may be used for mixing gas or air with a fluid which is forced out of the discharge opening 20. This liquid may be either water, beer or other liquid which would not adversely contaminate the fluid being pumped.

A gear casing 73 is secured to the base 10 in spaced relation to the casing 14 and comprises a 75

stationary housing 74 which is fixed to the base 10 and may be connected to the casing 14 by a connecting bar or brace 75. The casing 14 is provided on the inside thereof with a pair of bushings 76 and 77 which engage about the shafts 21 and 26 respectively. The bearing sleeves 78, 79 are provided in the bushings 76 and 77 respectively and are held in place by a press fit or otherwise. Oil seals 80 and 91 are provided about shaft 21 and oil seals 81 and 92 are provided about shaft 26 to prevent leakage of lubrication oil from the gear casing 12 along the shafts 21 and 26.

A driving gear 82 is fixedly secured to the drive shaft 21 by means of a key 83 or the like and a driven gear 84 is fixedly secured to the driven shaft 26 by means of a key 85 or the like. The gears 82 and 84 mesh with each other so that the driven shaft 26 will rotate in a direction opposite from the drive shaft 21. A closure plate 86 is secured to the outer open end of the casing 74 by means of bolts 87 or the like. The closure member 86 is constructed in substantially a cup-shaped form being provided with an exterior flange 88 through which the bolts 87 engage. The closure member 86 is also provided with bearing sleeves 89 and 90 engaging about the drive shaft 20 and the driven shaft 26 respectively. These bearing sleeves are held in the closure member 26 by means of a press fit or otherwise by nuts 91 and 92 respectively.

The casing 14 is provided with a valve seat 93 in the discharge port 17 and a valve member 94 engages on this seat. The valve member 94 is provided with a valve stem 95 which is slidable in a sleeve 96 carried by a nut 97 threaded into the casing 14 from the exterior thereof. A spring 98 engages at one end against the valve head 94 and at the other end engages against the nut 97 being disposed partly about the sleeve 96 which is integral with the nut 97.

The casing 14 is also provided with a valve seat 99 in the passage or port 18 and a valve 100 engages on this seat 99. The valve 100 is provided with a stem 101 which is slidable in a sleeve 102 carried by a nut 103 threaded into the casing 14 from the exterior thereof. A spring 104 engages at one end against the valve member 100 and at the other end engages against the nut 103 and is partly disposed about the sleeve 102. Normally the valve members 94 and 100 are in closed position under the tension of the springs 95 and 104 respectively, and are opened by pressure of the fluid from the chambers 15 and 16. When the pressure in the discharge passage 20 is greater than the pressure in the chambers 15 and 16, the valves 94 and 100 will be held in closed position so that there will not be any reverse flow of the fluid through the pump structure. The valve design shown is only one of many which may be used. It should be understood that my invention is not limited to any one valve design, but that any desirable variety may be used, depending upon the requirements to be satisfied.

In Figure 10 there is disclosed an improved means for providing a liquid sealing for the drive shafts 21^a and 26^a. The casing 14^a is formed with a pair of annular compartments 15^a and 16^a similar to the structure shown in Figures 1 to 4 inclusive and a pair of rotors 31^a and 38^a are secured to the shafts 21^a and 26^a respectively and a bushing 25^a is disposed about the shaft 21^a. The second bushing 27^a is disposed about the shaft 23^a and gland members 22^a and 28^a are threaded into the bushings 25^a and 27^a. A packing 24^a is disposed in the bushing 25^a and is adapted

to be compressed about the shaft 21^a by the tightening of the gland member 22^a. A packing 29^a is disposed in the bushing 27^a and is adapted to be tightened by the gland member 28^a.

The housing 14^a is provided with an annular groove or chamber 105 inwardly of the packing member 24^a and the housing 14^a is also provided with a second annular chamber 106 about the shaft 26^a and inwardly of the packing 29^a. A pipe 107 provided with a pair of branches 108 and 109 is adapted to be connected at one end to a source of liquid supply such as oil or the like and the branch 108 communicates with the pipe 107 and with the annular chamber 105. The branch 108 communicates with the pipe 107 and with the annular chamber 106.

The cap 43^a is secured as by bolts 45^a to the housing 14^a and includes a pair of bushings 46^a and 47^a about the shafts 21^a and 26^a. Gland members 48^a and 49^a are threaded into the bushings 46^a and 47^a respectively. A pair of packing members 110 and 111 are disposed in the bushing 46^a and a spacer member or washer 112 is interposed between the two packing members 110 and 111. This spacer member 112 is preferably apertured to permit a sealing liquid discharged in the space between the two packing members 110 and 111 to contact with the shaft 21^a. A pair of packing members 113 and 114 are disposed in the bushing 47^a and a spacer member 115 is interposed between the two packing members 113 and 114. This spacer member 115 is of an apertured type to permit a sealing liquid engaging in the space between the packing members 113 and 114 to contact with the shaft 26^a. A pipe 116 is adapted to be connected at one end to a source of liquid supply and the opposite end of the pipe 116 is connected to a pair of branch pipes 117 and 118 which are connected to the bushings 46^a and 47^a respectively. These branches 117 and 118 are adapted to discharge a sealing liquid between the respective pairs of packing members.

In other respects the structure shown in Figure 10 is similar to the structure shown in Figures 1 to 4 inclusive.

In Figures 11 and 12 there is disclosed a modified form of this pump structure wherein the housing 14^b is disclosed similar to the housing 14, being provided with a pair of annular chambers 15^b and 16^b. A rotor 31^b is disposed in the chamber 15^b and is secured to a drive shaft 21^b. A rotor 37^b is disposed in the chamber 16^b and is secured to a driven shaft 26^b.

The housing 14^b is provided with an intake port 119 communicating with the chamber 15^b and an intake pipe 68^b is secured to a boss 69^b. A second intake port 120 is formed in the housing 14^b which communicates with the chamber 16^b and an intake pipe 68^c is mounted in a boss or bushing 69^c. The pipe 68^c communicates with the port 120. A dividing wall or partition 121 divides the two ports 119 and 120.

The housing 14^b is provided with an outlet port 17^b which communicates with a discharge port 20^b mounted in the base 10. The housing 14^b is also provided with an outlet port 18^b communicating with the chamber 16^b and an outlet or discharge port 20^c communicates with the outlet 18^b. A check valve 94^b is adapted to engage a seat 93^b and is constantly held against the seat 93^b by means of a spring 98^b. The valve member 94^b is provided with a stem 95^b and this stem 95^b is slidable in a guide member 96^b car-

ried by a spring tensioning plug 97^b which is threaded into the housing 14^b.

A second check valve 100^b is adapted to be held on a seat 99^b by means of a spring 104^b.

5 The valve 100^b is provided with a stem 101^b which is slidable in a guide member 102^b. The guide member 102^b is carried by a threaded plug 103^b.

With a construction as shown in Figures 10 and 11 two different fluids may be pumped and 10 kept substantially separate one from another and discharged separately from the discharge ports 20^b and 20^c.

In the use and operation of this pump or compressor the pipe 60 is adapted to be connected to 15 a source of fluid supply or if desired may be opened to the atmosphere. The pipe 71 is connected to a source of liquid supply such as water, beer or other liquid which may be used as a sealing means in the pumping chambers 15 and 16. 20 The drive shaft 21 is connected to the source of power supply and rotation of the drive shaft 21 will effect reverse rotation of the driven shaft 26. The rotation of the rotors 31 and 37 will produce a partial vacuum in the pumping chambers 15 and 16 so as to draw in the fluid through 25 the supply pipe 68 and through the inlet opening 13. As shown in Figure 4, the casing 14 has a hub portion 44 which is cut out as at 44^a on the side thereof confronting the opposite hub 30 portion in the chamber 16 which is designated 44^b. In this manner the rotor 37 is able to swing past the hub 44 and the rotor 31 is able to swing past the hub portion 44^b which is cut out as at 44^c. The fluid drawn into the casing 14 by rotation 35 of the rotor 31 will be carried around in the pumping chamber 15 and as the rotor 37 passes the outlet opening 18 further rotation of the rotor 31 will cause the fluid to impinge against the confronting arcuate side of the rotor 37 and 40 then be forced out through the discharge passage or port 17. The valve 94 will at this time be forced into an open position so that the liquid or fluid will pass through the connecting passage 19 and into the common outlet 20. The rotation 45 of the rotor 37 will effect similar discharge of the liquid or fluid through the discharge port 18 and cause the valve 100 to be forced to an open position. Due to the fact that the gear structure for the rotors is mounted in a separate housing 50 from the pumping member 11 the lubricant used in the gear housing will not seep into the pumping chambers and the rotors may be given closer tolerances in the annular pumping chambers 15 and 16 than is ordinarily the case. This closer 55 tolerance between the rotors and the walls of the pumping chambers will make it possible to operate the pump without the use of a sealing or lubricating fluid, but if desired a sealing fluid in the form of water or the like may be discharged 60 into the casing 14 through the fluid pipe 70, 71 which is disposed concentrically in the inlet opening 13.

Where it is desired to take the pump proper apart, this procedure may be accomplished by 65 taking the cap members 64 and 66 off of the bearing plate 50 and loosening the nuts 59 and 62 from the shafts 21 and 26. The bolts 45 may then be withdrawn or removed thus permitting the removal of the cap or closure plate 43. The 70 rotors 31 and 37 may then be removed from the shafts 21 and 26 respectively by loosening the set screws 35 and 41 which will permit the hubs 32 and 39 to be pulled off of the shafts 21 and 26 respectively. This procedure makes it 75 necessary to open the gear housing 73 so that

none of the lubricant in this housing will flow onto the rotors or any of the parts associated therewith. The glands or stuffing boxes 22, 28, 48, 49 seal the shafts 21 and 26 in the pumping member 11 so that when the device is in assembled condition the lubricant in the form of 8 oil or grease from the gear housing 73 will not enter the pumping chambers.

The anti-friction members 54 and 55 carried 10 by the bearing plate 50 not only rotatably support the shafts 21 and 26 respectively in the cap 43, but also provide thrust bearings which will hold the shafts 21 and 26 against endwise movement. The thrust bearings 54 and 55 are readily 15 removed from the reduced ends 56 and 60 respectively of the shafts 21 and 26 by loosening of the nuts 59 and 62.

A pump constructed according to this invention is capable of operating at a relatively high speed so as to produce the desired suction force 20 and may operate either with or without a sealing means which sealing means may also perform the added function of cooling the pumping chambers and the parts associated therewith as well as absorbing the heat of compression of the gases 25 being handled. In this manner it is not necessary to provide a jacketed casing structure about the pump chambers in order to adequately cool the structure.

The gears 82 and 84 may be readily removed 30 from the gear housing 73 by removal of the cap 86 thus permitting the longitudinal movement of the gears 82 and 84 which as shown in Figure 3 are held against endwise movement by means of confronting bushings 76 and 77 and 35 the associated bushings carried by the cap member 86.

What I claim is:

1. In a fluid pump, a housing structure formed with a pair of rotor chambers, a pair of oppositely 40 revoluble simultaneously operable parallel rotor operating shafts journaled in said structure, a pair of oppositely disposed rotors of like form each operating in a rotor chamber and formed of a hub fixed to one of said shafts and a crescent-shaped part carried by and offset with respect to 45 the hub, an independent fluid inlet opening into the upper portion of each chamber and an independent fluid outlet of bore-like form for each chamber, said rotors being so related to said pair 50 of inlet openings whereby one of said inlet openings is uncovered by the crescent-shaped part of one rotor at a time when the other inlet opening is covered by the crescent-shaped part of the other rotor, each of said outlets having an upper 55 horizontal part leading rearwardly from and opening at its forward end into the inner side of the lower portion of a chamber, a depending vertically disposed part opening at its upper end into the horizontal part intermediate the ends 60 of the latter and a forwardly extending lower horizontal part opening at its forward end at the front of the housing and at its rear end into the lower end of said vertical part, the wall of each of said upper horizontal parts being formed 65 intermediate its ends with a check valve seat, a spring controlled check valve within each upper horizontal part for correlation with the valve seat in such part, and adjustable means within each upper horizontal part threadedly engaging 70 with the wall of such part for adjusting the tension of the check valve in such part and for closing the rear end of the latter.

2. In a fluid pump of that type including a pair of rotor chambers, the combination of a pair 75

of oppositely revolvable simultaneously operable rotor operating shafts each extending into a rotor chamber, a pair of oppositely disposed rotors of like form each arranged in a rotor chamber and including a hub fixed to a rotor shaft and a crescent-shaped portion offset with respect to the hub, a pair of fluid inlet means each for a chamber, a pair of fluid outlet means each for a chamber, said rotors being so related to said pair of fluid intake means whereby one of said fluid inlet means is uncovered by the crescent-shaped portion of one rotor at a time when the other fluid intake means is covered by the crescent-shaped portion of the other rotor, each of said outlet means provided intermediate the ends with a check valve seat, check valves within said outlet means for correlating with said seats and each consisting of a head and a stem, adjustable threaded valve tensioning plugs, arranged within and threadedly engaging with the wall of said outlet means, sleeves carried by said plugs and engaging about said stems, and springs engaging about said sleeves bearing at one end against said plugs and at their other ends bearing against said heads.

3. In a fluid pump, a rotor housing formed with a pair of rotor chambers, the combination of a pair of oppositely revolvable simultaneously operable rotor operating shafts each extending into

a rotor chamber, a pair of oppositely disposed rotors of like form each arranged in a rotor chamber and including a hub fixed to a rotor shaft and a crescent-shaped portion offset with respect to the hub, an independent fluid inlet for each chamber, an independent fluid conducting off means for each chamber formed with a horizontally disposed portion opening at one end into a chamber and formed adjacent said end with a check valve seat, said rotors being so related to said pair of fluid inlets whereby one of said fluid inlets is uncovered by the crescent-shaped portion of one rotor at a time when the other fluid inlet is covered by the crescent-shaped portion of the other rotor, each of conducting-off means having a discharge end opening at the periphery of the housing below said horizontal portion thereof, check valves within said horizontal portion and correlating with said seats, each valve including a head and a stem, adjustable valve tensioning plugs threadedly engaging with the walls of said conducting off means for closing the other ends of said horizontal portions, sleeves carried by said plugs and engaging about said stems, and coiled springs about said sleeves bearing at one end against said plugs and at their outer end against said heads.

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