

Feb. 25, 1936.

W. O. LUM

2,032,291

PUMPING APPARATUS

Filed July 26, 1934

2 Sheets-Sheet 1

Fig. 7.

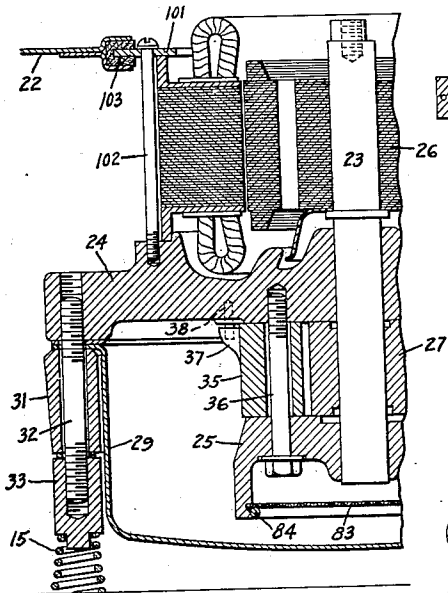


Fig. 4.

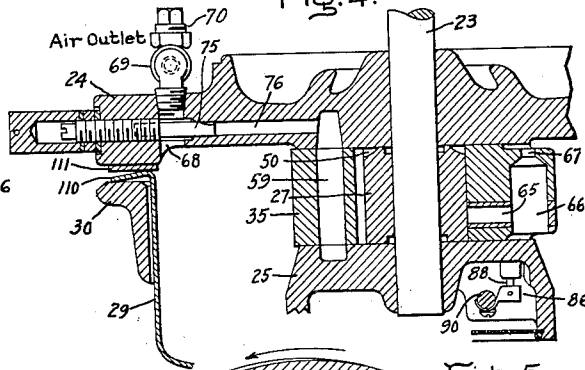


Fig. 5.

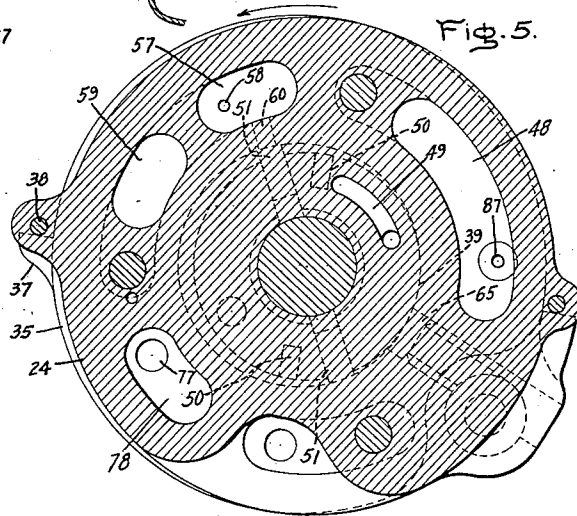


Fig. 1.

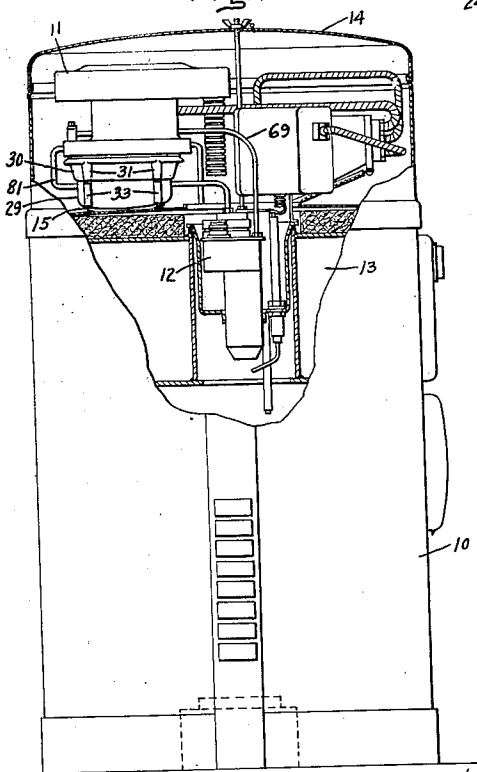
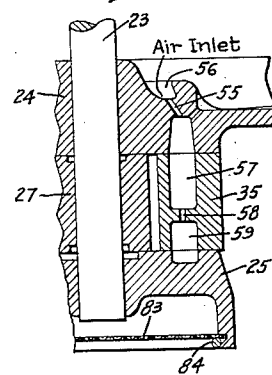


Fig. 6.



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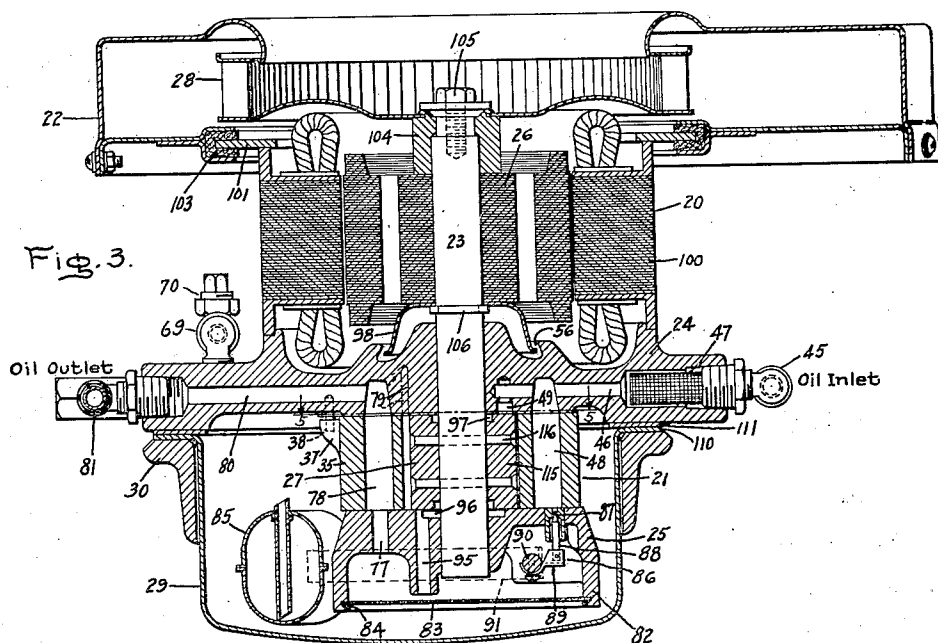
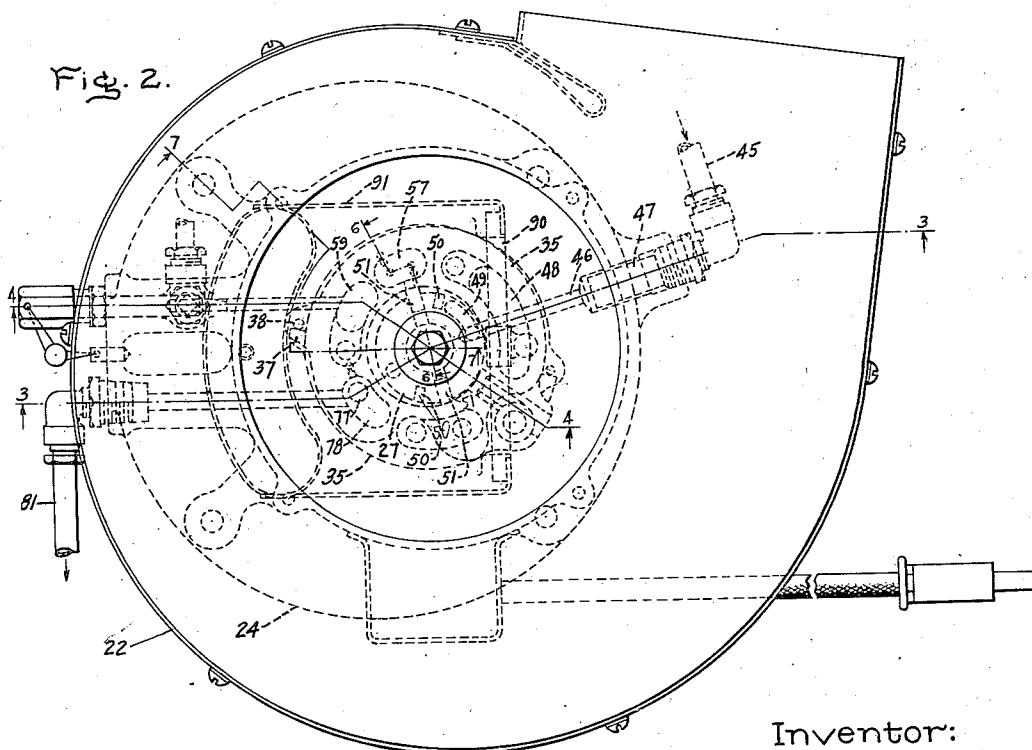
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,032,291

PUMPING APPARATUS

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Application July 26, 1934, Serial No. 737,063

12 Claims. (Cl. 103—7)

The invention relates to pumping apparatus and provides improvements which are particularly advantageous in an equalized pressure oil and air pump and blower unit for oil burner such as described and claimed in my Patent No. 1,986,003 of January 1, 1935, although not necessarily limited thereto.

One of the objects of the present invention is to provide an improved pump structure having intercommunicating passages, ports and surge chambers directly in the cylinder casing and end plates of the pump. In this way the various oil and air connections into and from the oil and air pressure equalizing tank enclosing the pump of my above patent may be materially simplified and improved.

Other objects are to provide an improved sound and vibration suppressing mounting for the pumping unit and also to provide improved means for removably sealing the oil and air pressure equalizing tank to the pump structure.

Still further objects are to combine an automatic float valve for maintaining a constant oil level in the equalizing tank directly with the pump structure itself; to provide an improved construction for the rotor of the double blade rotary pump; to provide an improved strainer screen mounting arrangement directly on the pump, and to provide improved means for aligning the pump cylinder casing between the end plates.

In the accompanying drawings, Fig. 1 is a side elevation of an oil burner with the casing broken away to show the improved form of oil and air pump and blower unit embodying the present invention; Fig. 2 is an enlarged plan view of the oil and air pump and blower unit; Fig. 3 is a sectional view of the unit shown in Fig. 2 along the section lines 3—3; Fig. 4 is a cross section of the unit shown in Fig. 2 on the section line 4—4 with certain parts omitted for the sake of clearness; Fig. 5 is a horizontal cross section of the unit shown in Fig. 3 on the line 5—5 showing more fully the relation of the several intercommunicating passages, ports and surge chambers formed in the pump structure; Fig. 6 is a section of the unit shown in Fig. 2 on the line 6—6 showing the air inlet and surge chamber arrangement with certain parts omitted for the sake of clearness; Fig. 7 is a half section of the unit shown in Fig. 2 on the line 7—7 showing more in detail the mounting arrangement for the blower, the motor and the unit itself.

The oil burner 10 shown in Fig. 1 is of the general type described and claimed in the co-

pending application Serial No. 505,867, filed December 31, 1930, by Aldo Macchi and assigned to the assignee of my present invention. Oil and air under pressure are supplied from the pump and blower unit 11 to the oil burner nozzle 12 which may be of the type described and claimed in the copending application of Lum and Eaton, Serial No. 691,320, filed September 28, 1933, and assigned to the same assignee. As shown, the pump and blower unit 11 is mounted on the top of the boiler 13 under the removable hood 14. The details of the improved noise and vibration suppressing coiled spring mounting supports 15 are shown in Fig. 7.

As indicated more clearly in Figs. 2 and 3, the equalized oil and air pumping and blower unit 11 comprises the electric driving motor 20 which is mounted directly upon the top of the rotary oil and air pump 21 with the blower 22 mounted above the motor. The vertical pump shaft 23 has suitable bearings formed in the end plates 24 and 25 of the oil and air pump 21. Shaft 23 carries the motor rotor 26, the pump rotor 27 and the blower rotor 28 so that all rotate together. The oil and air pressure equalizing tank 29 surrounds the pump 21 to receive oil and air under pressure therefrom. Tank 29 is removably sealed in position by the clamping ring 30. Ring 30 has four equi-spaced bosses 31 with holes therein so that ring 30 can be secured in position by the clamping studs 32 having nuts 33 carrying the coiled spring mounting supports 15 as shown in Fig. 7.

The rotary pump cylinder casing 35 is clamped in position between the pump end plates 24 and 25 by means of three equispaced bolts 36 with ample clearance around the bolts as indicated in Fig. 7. In order to maintain proper alignment the cylinder casing 35 is provided with two oppositely disposed lugs 37 which are spaced to slide along the guide pins 38 mounted in the upper end plate 24 of the pump. This permits the cylinder casing 35 to be adjusted into position between the end plates 24 and 25 to provide a proper fluid-tight seal, as indicated at 39, between the cylinder wall and the pump rotor 27.

The rotary pump 21 is of the double vane type and serves to pump oil under a vacuum, mix the oil with air and discharge the mixture under pressure into the pressure equalizing tank 29. Oil is supplied to the pump from a suitable reservoir (not shown) through the oil inlet pipe 45. The oil passes from pipe 45 into the passage 46 formed in the upper end plate 24 of the pump. A large

mesh inlet oil strainer 47 is located in an enlarged portion of the passage 46.

As shown in Figs. 2 and 3, the oil inlet passage 46 intersects the enlarged incoming oil surge chamber 48 and then extends into communication with the pump oil inlet port 49. The inlet oil surge chamber 48 is formed jointly by a large arcuate shaped passage provided in the wall of pump casing 35 which extends from the upper side to the bottom side thereof and a corresponding arcuate shaped groove or recess provided in the upper plate 24 to register therewith. The pump oil inlet port 49 also is in the form of an arcuate shaped groove in end plate 24 which opens directly into the pump cylinder above the pump rotor 27. Thus the pump oil inlet port 49 is normally closed by the upper face of the pump rotor 27 which has a fluidtight seal with the upper end plates 24.

As more clearly shown in Fig. 4 the upper surface of the pump rotor 27 is provided with the two opposite grooves 50, one adjacent the trailing side of each of the two blades 51. Each groove 50 is arranged to register with the oil inlet port 49 to admit oil into the evacuated space formed behind the corresponding blade after it passes the fluid-tight seal 39 between the pump rotor 27 and the cylinder wall.

Air is admitted to the pump 21, as shown in Fig. 6, through the restricted air inlet passage 55. This restricted passage 55 extends from the oil retaining groove 56 formed in upper side of the end plate 24 around the shaft 23 to the initial incoming air surge chamber 57. The initial air surge chamber 57 is formed jointly by enlarged registering passages in both the pump casing 35 and the end plate 24. The incoming air then passes through a second restricted opening 58 into a second air surge chamber 59 which also is formed jointly by registering passages in the pump casing 35 and the lower end plate 25. The second air surge chamber 59 has one portion underlying the bottom of the initial air surge chamber 57 as shown in Fig. 6, and another portion which extends entirely from end to end of the cylinder casing 35 in parallel relation with the initial air surge chamber 57, as shown in Fig. 5. The air is admitted from the underlying portion of the second surge chamber 59 into the pump cylinder through the air inlet port 60.

In operation the rotor 27 of the pump is driven in a counterclockwise direction as indicated by the arrow in Fig. 5. As each of the blades 51 passes the fixed fluid tight seal indicated at 39, a vacuum is created in the expanding space behind the blade. Thus as long as the corresponding notch 50 registers with the oil inlet port 49, a quantity of oil is drawn by the vacuum into the space behind the blade. As soon as each blade 51 passes the air inlet port 60, air is admitted behind the blades and destroys the vacuum. However, the vacuum is held on the oil inlet port 49 due to the fact that the groove 50 in the rotor 27 has moved out of register therewith and the top of the rotor 27 has sealed the port.

After each blade 51 has passed the air inlet port 60, the air in the pump cylinder ahead of the blades together with the oil drawn in during the previous stroke, is compressed and discharged through the air and oil outlet port 65. The outlet port 65 discharges into the oil and air separating chamber 66 which is formed directly in the wall of the cylinder casing 35. The oil passes from the bottom of the separating chamber 66 into the tank 29 which surrounds the pump 21 and the

air passes into tank 29 through the restricted opening 67 at the top of the separating chamber 66.

Air under pressure is exhausted from the upper part of the air and oil equalizing tank 29 through the air outlet passage 68 shown most clearly in Fig. 4. This outgoing air is supplied to the burner nozzle 12 through the air supply pipe 69. The removable connection plug 70 is provided for permitting the connection of a suitable air pressure gauge (not shown) to the air supply pipe 69 when desired. In order to regulate the pressure of the air in the tank 29, the adjustable bypass plug 75 is mounted in the air bypass passage 76 which extends between the air outlet 68 and the incoming air surge chamber 59, as shown in Fig. 4. If desired, the adjustment of the bypass plug 75 may be made entirely automatic by means of an air pressure regulator arrangement or by other similar regulating means.

Oil is discharged under pressure from the lower part of oil and air pressure equalizing tank 29 through the passage 77 formed in the bottom end plate 25 of the pump, as shown in Fig. 3. This oil outlet passage communicates with an oil outlet surge chamber 78 which is formed jointly by a passage in the wall of the pump casing 35 and a registering passage provided in the upper pump in plate 24. To release any air bubbles entrapped in the outgoing oil, the top of the outgoing oil surge chamber 78 is connected by the restricted bypass passage 79 with the incoming air surge chamber 59. Thus any air bubbles which collect at the top of chamber 78 are forced through passage 79 by the oil pressure. The outgoing oil free of air bubbles then passes from the surge chamber 78 through the passage 80 and the pipe line 81 to the oil burner nozzle 12.

In order to insure clean outgoing oil, the bottom end plate 25 of the pump 21 is provided with the bell-shaped wall 82 extending downwardly therefrom to provide a subchamber therein adjacent the bottom of tank 29. A fine mesh strainer screen 83 is removably mounted in a suitable groove formed at the mouth of the bell-shaped wall 82. This fine mesh screen extends over the entire area of the entrance to the subchamber and is held in position by the snap ring 84.

In order to maintain a substantially constant oil level in the oil and air equalizing tank 29, the oil float 85 is arranged to control the oil by-pass valve mechanism 86 which is mounted upon and forms an integral part of the end plate 25 of the pump. As shown in Figs. 3 and 4, the oil by-pass valve seat 87 is mounted directly in the end plate 25 so as to communicate with the incoming oil surge chamber 48. The valve stem 88 is pivotally mounted in the bracket 89 which is carried on the operating shaft 90. The shaft 90 extends through the opposite sides of the bell-shaped wall 82 which extend from the pump end plate 25 and is rotatably supported in suitable bearing formed therein. The float 85, as shown, is of arcuate shape so as to nest into the space between the pump 21 and the tank 29 due to the eccentric relation thereof. Each end of the arcuate-shaped float 85 is rigidly connected by a lever 91 to the valve operating shaft 90.

In operation as the level of the oil in the tank 29 rises, the float 85 also rises and opens the by-pass valve 88 to permit a regulated quantity of oil to pass directly from the bottom portion of the tank 29 through the by-pass valve seat 87 into the incoming oil surge chamber 48. As 75

a result the increase of the oil level in the tank 29 is checked as the float 85 assumes the position at which the regulated quantity of oil bypassed is just sufficient to maintain a substantially constant level of the oil in the tank 29.

For lubricating and sealing purposes oil from the tank 29 is supplied through the passage 95, shown in Fig. 3, to the oil channel 96 formed by the opposing recesses in the lower end plate 25 and the bottom of the pump rotor 27. This oil channel 96 insures an adequate supply of oil to seal the bottom side of the rotor 27 and to lubricate the bearings of shaft 23 and other moving parts. Oil passes from the channel 96 through the inner portions of the slots in the rotor 27 behind the blades 51 into the oil channel 97 at the top of the rotor 27. As shown more clearly in Figs. 4 and 5, the oil channel 97 is formed by an arcuate recess or groove extending around the inner periphery of the upper face of each of the two rotor blocks 115 adjacent the shaft 23. Similar recesses or grooves in the lower face of the blocks form the oil channel 96. These recesses or grooves in the blocks 115 serve to interconnect the two blade grooves between the ends of blocks 115 to permit free passage of oil therebetween as the blades 51 are reciprocated in the blade grooves during operation of the pump. The oil in channel 97 insures adequate lubrication of the upper bearing of shaft 23 in the end plate 24 as well as a proper fluid-tight seal of the upper side of the rotor 27 with end plate 24. Any oil which may leak through the shaft bearing in the upper end plate 24 is thrown into the oil groove 56 by the oil deflecting cone 98. This leakage oil is carried from the groove 56 along with the incoming air through the restricted air inlet passage 55 shown in Fig. 6.

The stator 100 of the motor 20 carries the energizing windings, as shown in Fig. 3, and is held in position on top of the upper pump end plate 24 by means of the clamping ring 101 and the clamping bolts 102, as shown in Fig. 7. The stator clamping ring 101 also serves to support the casing 22 of the blower with a channel shaped annular washer of felt or similar resilient material 103 interposed between the grooved edge of casing 22 and the supporting ring 101. This annular resilient mounting arrangement permits the blower casing 22 to be rotated freely around the ring 101 into proper position to supply air to the furnace 10, as shown in Fig. 1, and prevents transmission of noise or vibration from the rotating parts to the blower casing. The blower rotor 28 is secured to the mounting collar 104 which has a suitably shaped opening therein to engage with the flat side of the reduced top portion of the shaft 23, shown in Fig. 7. The fastening bolt 105 serves to secure the blower rotor 28 fixedly in position on the end of the shaft 23 and at the same time clamp the rotor 26 of the motor firmly in position against the collar 106 on shaft 23.

As shown in Fig. 4, the upper rim 110 of the tank 29 is overturned so that normally it is of conical tapering form. However, when the clamping ring 30 is clamped into position by tightening the nuts 33, the rim 110 of the tank is flexed so as to seal the upper edge of the tank 29 firmly against the washer 111 and thereby prevent leakage of air or oil from the tank as shown in Fig. 3.

As shown in Fig. 3, the rotor 27 of the pump is formed of two complementary parts 115 which are riveted in position on the shaft 23. As more

clearly shown in Fig. 5, the two parts 115 of the rotor 27 are in the form of arcuate or complementary semi-cylindrical blocks. These blocks are held in position on the shaft 23 by means of the rivets 116 which have countersunk heads to provide a smooth exterior surface for the rotor 27. The ends of the blocks 115 are in spaced apart parallel relation just sufficient to receive the blades 51 of the pump in sliding engagement therebetween.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. Pumping apparatus including a cylindrical tank, a pump mounted eccentrically inside the tank on the top wall thereof for pumping liquid into the tank, and a liquid by-pass control valve mechanism for the pump having a sector shaped float nested in the space provided between the pump and the tank.

2. A vertical electric motor driven pump having a removable tank for the fluid pumped surrounding the bottom of the pump, a clamping ring having vertically extending fastening means for securing the tank to the pump, and resilient means mounted on said fastening means for resiliently supporting the tank and the pump.

3. A vertical electric motor driven pump, a removable tank for the fluid pumped surrounding the bottom of the pump, a clamping ring having vertically extending fastening studs for securing the tank to the pump with screw threaded clamping nuts on the bottom of said studs provided with resilient springs for resiliently mounting the motor driven pump and the tank.

4. A pump comprising an annular cylinder casing having guide lugs extending from the opposite sides thereof, a pair of end plates having means for clamping the cylinder casing therebetween, and cooperating guide pins on one of the end plates operable into abutting sliding engagement with said guide lugs for aligning the cylinder casing between the end plates.

5. A rotary pump comprising a cylinder casing having guide lugs extending from the opposite sides thereof, a shaft having a rotor operable in the cylinder, a pair of end plates each having a bearing for the shaft and provided with means for clamping the cylinder casing between the end plates, and cooperating guide pins on one of the end plates operable into abutting sliding engagement with said guide lugs for aligning the rotor in the cylinder.

6. In a rotary blade pump, the combination of a shaft and a pair of complementary semi-cylindrical blocks secured on opposite sides of the shaft with the ends thereof in opposing spaced relation to form the blade grooves of the pump rotor and each having a fluid passage formed therein for interconnecting the blade grooves.

7. Fluid pumping apparatus including a casing having a pumping cylinder and a separate fluid surge chamber formed therein and extending between the ends of the casing, a displacement member operable in the pumping cylinder, and a pair of end plates for closing the ends of the pumping cylinder and the fluid surge chamber, one of said plates having a passage for the fluid pumped formed therein to register with said fluid surge chamber and communicating with the pumping cylinder.

8. Fluid pumping apparatus including a casing having a pumping cylinder and a plurality of separate fluid surge chambers formed therein and extending between the ends of the casing, a displacement member operable in the pumping

cylinder, and a pair of end plates for closing the ends of the pumping cylinder and the fluid surge chambers, each of said plates having a passage for the fluid pumped formed therein to register with a different one of said fluid surge chambers and communicating with the pumping cylinder.

9. A fluid pump including a displacement member and a closed casing therefor having a pumping cylinder and a plurality of intercommunicating fluid surge chambers formed therein with a restricted port for the fluid pumped communicating between the pumping cylinder and one of the surge chambers and a restricted passage for the fluid pumped communicating with another one of said intercommunicating surge chambers.

10. A fluid pump including a casing having a pumping cylinder and a separate fluid surge chamber extending between the ends thereof, a displacement member operable in the pumping cylinder, a pair of end plates for closing the ends of the pumping cylinder and the fluid surge chamber, one of said end plates having a fluid inlet passage formed therein to register with said fluid surge chamber and communicating with the pumping cylinder and the other of said end plates having a fluid inlet port formed therein to register with said fluid surge chamber, and valve mechanism mounted on said other end

plate for regulating the flow of fluid through the fluid inlet port formed therein.

11. A fluid pump including a casing having a pumping cylinder and a separate fluid surge chamber extending between the ends of the casing, a displacement member operable in the pumping cylinder, a pair of end plates for closing the ends of the pumping cylinder and the fluid surge chamber, one of said end plates having a fluid inlet passage formed therein communicating with the pumping cylinder and the fluid surge chamber and the other of said end plates having a passage formed therein communicating between the outlet of the pump and said fluid surge chamber, and a by-pass valve mechanism mounted on said other end plate for regulating the flow of fluid through the passage formed therein.

12. Pumping apparatus including a tank, a pump mounted in the tank for pumping liquid into the tank, said pump having walls extending therefrom to form a subchamber inside the tank having an outlet passage for the fluid pumped extending therefrom, a float in the tank, and by-pass valve mechanism for the pump mounted in said subchamber and connected to be operated by said float for maintaining a substantially constant liquid level in the tank.

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