July 20, 1948. J. KELLOGG 2,445,437

FLUID PRESSURE SYSTEM

Filed Aug. 21, 1946 5 Sheets-Sheet 1

Fig. 1.

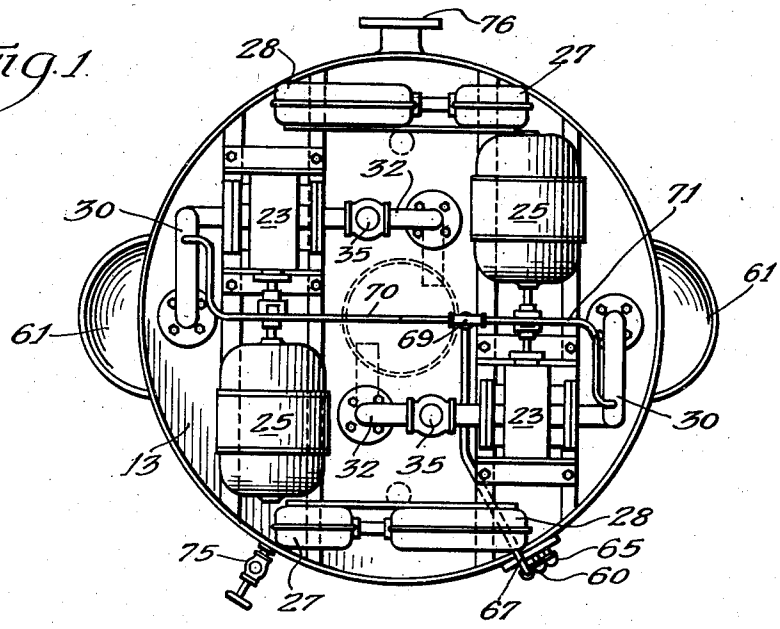
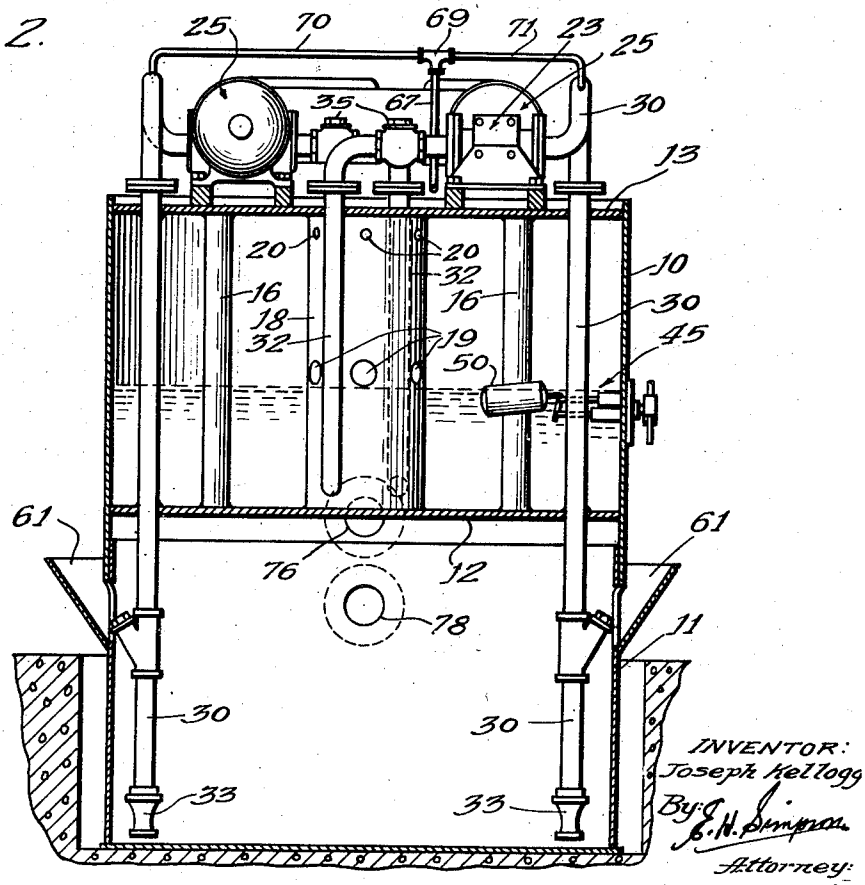


Fig. 2.



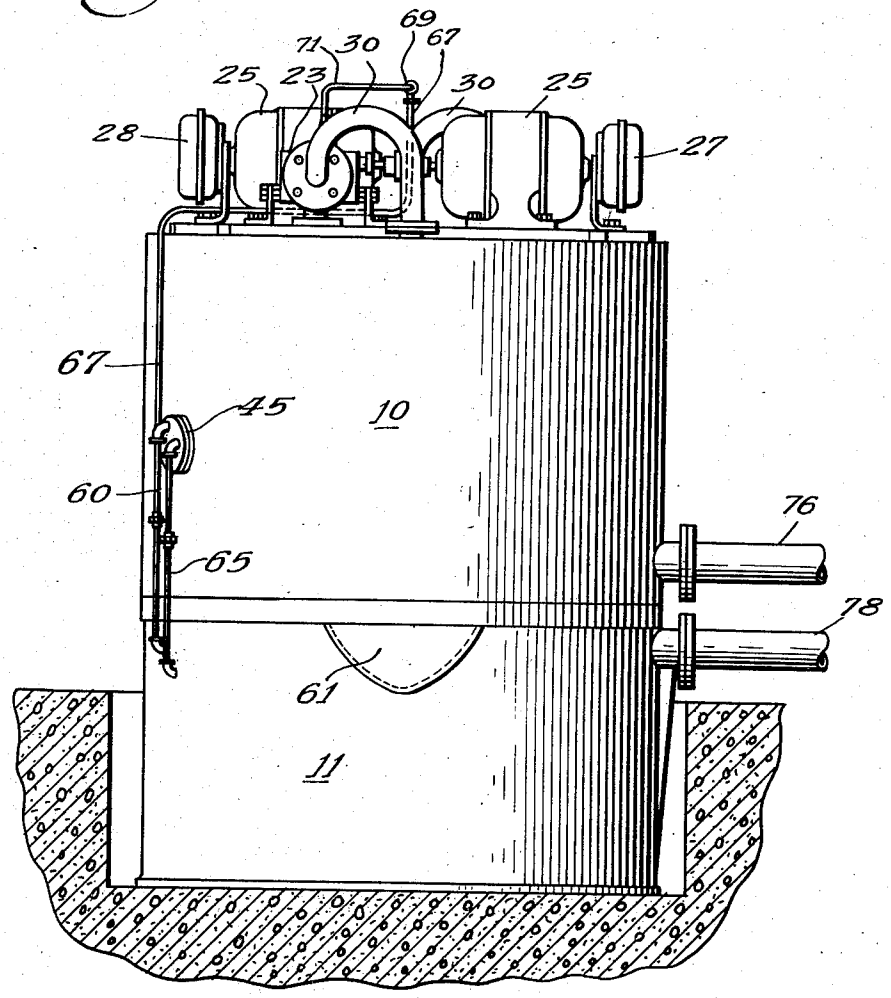
INVENTOR:
Joseph Kellogg
By: J. H. Simpson
Attorney:

July 20, 1948. J. KELLOGG 2,445,437

FLUID PRESSURE SYSTEM

Filed Aug. 21, 1946 5 Sheets-Sheet 2

Fig. 3.



INVENTOR.
Joseph Kellogg
BY
Eugene H. Simpson.
Attorney.

July 20, 1948. J. KELLOGG 2,445,437

FLUID PRESSURE SYSTEM

Filed Aug. 21, 1946 5 Sheets-Sheet 3

Fig. 4.

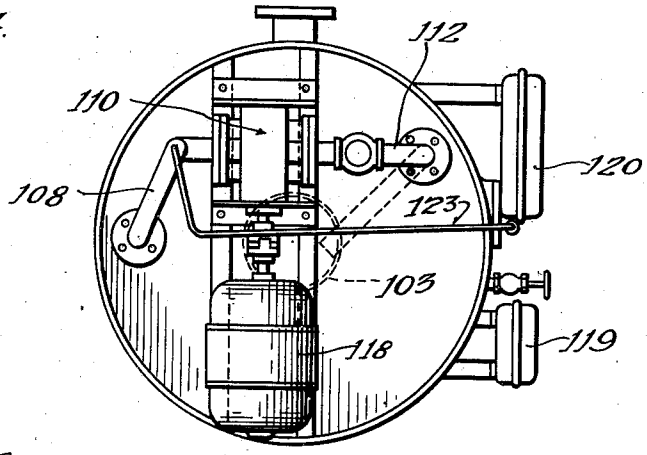
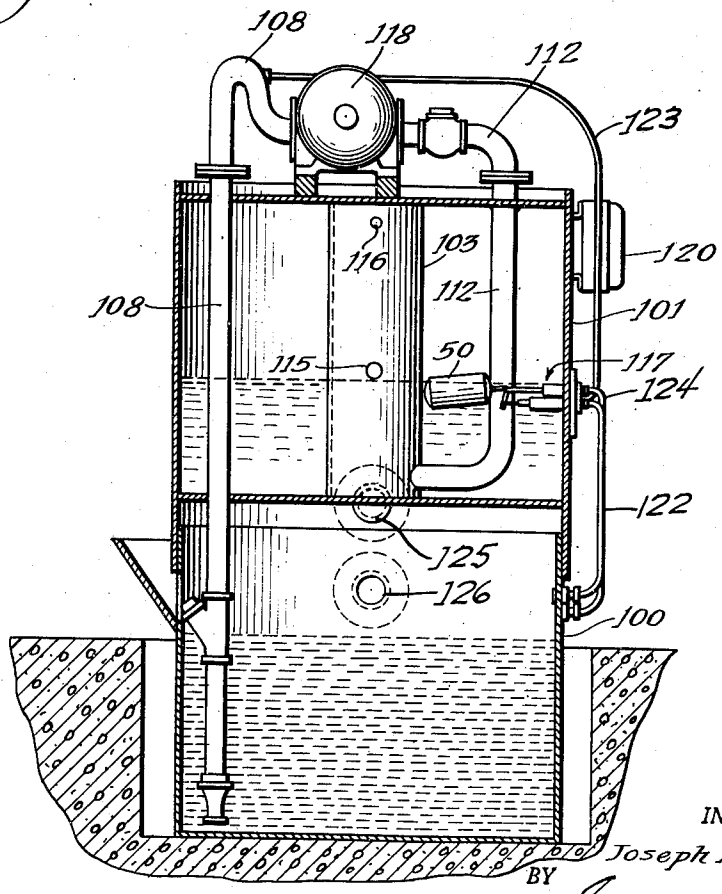


Fig. 5.



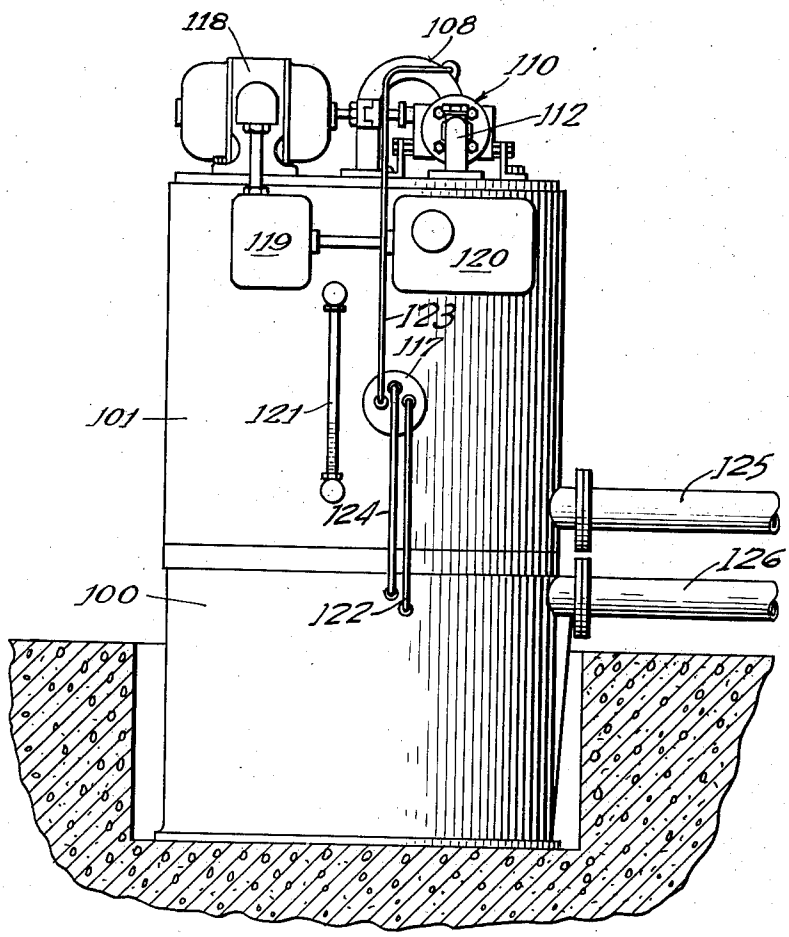
INVENTOR.
Joseph Kellogg
BY
Eugene W. Simpson.
Attorney.

July 20, 1948. J. KELLOGG 2,445,437

FLUID PRESSURE SYSTEM

Filed Aug. 21, 1946 5 Sheets-Sheet 4

Fig. 6.



INVENTOR.
Joseph Kellogg
BY
Eugene H. Simpson.
Attorney

July 20, 1948. J. KELLOGG 2,445,437

FLUID PRESSURE SYSTEM

Filed Aug. 21, 1946 5 Sheets-Sheet 5

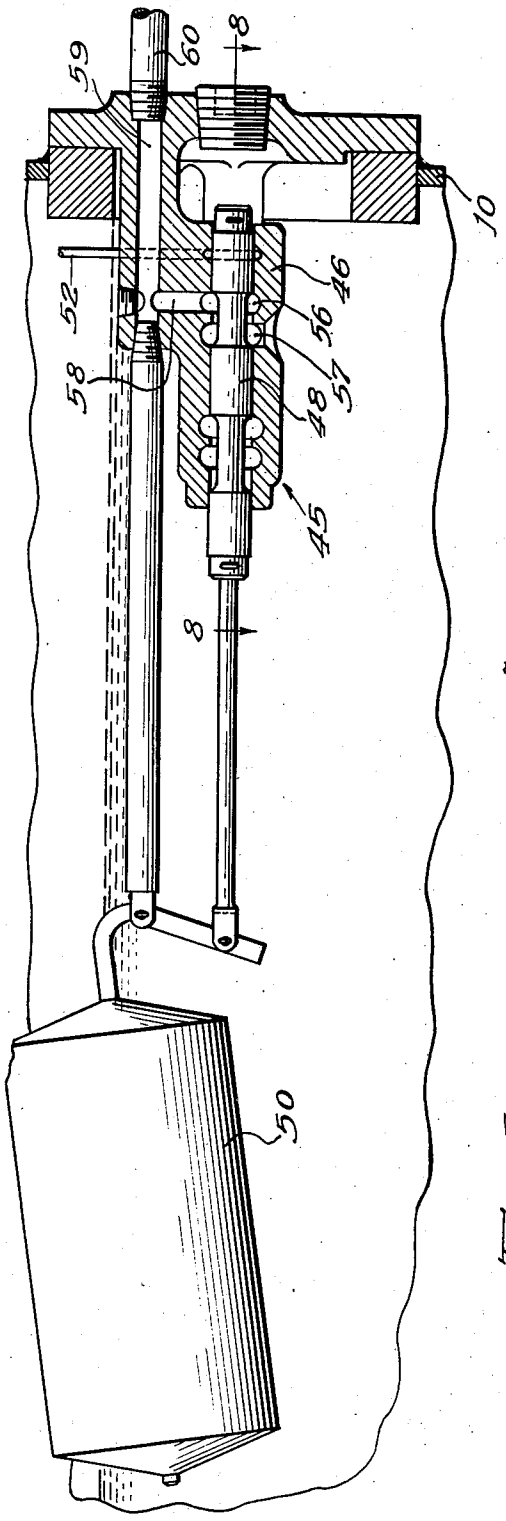


Fig. 7.

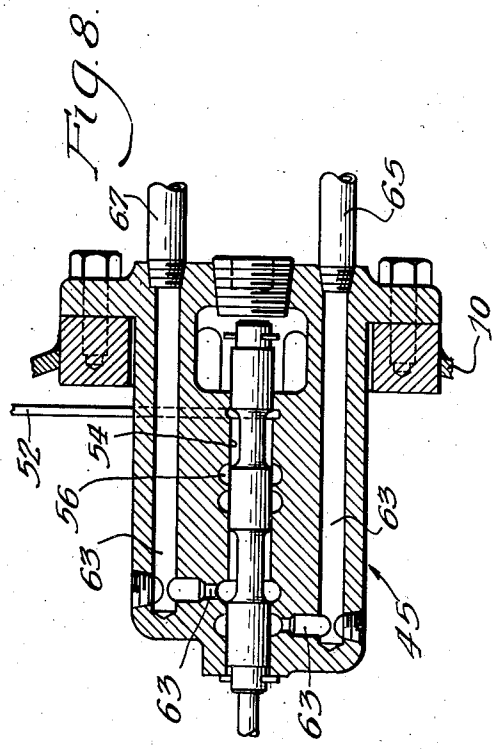


Fig. 8.

INVENTOR:
Joseph Kellogg
By: Eugene H. Simpson.
Attorney.

Patented July 20, 1948

2,445,437

UNITED STATES PATENT OFFICE

2,445,437

FLUID PRESSURE SYSTEM

Joseph Kellogg, Milwaukee, Wis., assignor to Nordberg Manufacturing Company, Milwaukee, Wis., a corporation of Wisconsin

Application August 21, 1946, Serial No. 692,009

4 Claims. (Cl. 103—6)

1

This invention relates to fluid pressure systems and more particularly to a fluid pressure system for use in connection with hydraulic brakes, or the like, and is an improvement on the application of Joseph Kellogg, Serial No. 612,932, filed August 27, 1945.

The fluid pressure system shown in co-pending application Serial No. 612,932 was built with a horizontal tank, the sump tank directly underneath and the motor and pump arranged between the sump tank and the pressure tank. It has been found that this construction, while thoroughly workable, occupies more space than necessary and it is therefore one object of the present invention to provide an oil pressure tank which will be less cumbersome and less bulky than those now in use.

Another object of the invention is to provide an oil pressure tank for fluid brakes, or the like, which will be more economical to manufacture.

A further object is to provide an oil pressure tank for hydraulic brakes, or the like, which can be more readily serviced.

Other objects will become apparent upon considering the following specification which when taken in conjunction with the accompanying drawings illustrate a preferred form of the invention.

In the drawings:

Fig. 1 is a top plan view of a pressure tank embodying the invention and showing the pumps and motors mounted thereon;

Fig. 2 is a cross-sectional view showing the interior of the tank;

Fig. 3 is an elevational view of the oil pressure tank shown in Figs. 1 and 2;

Fig. 4 is a top plan view similar to Fig. 1 showing a modified form of the invention;

Fig. 5 is a cross-sectional view showing the interior of the tank as seen in Fig. 4;

Fig. 6 is an elevational view of the modification shown in Figs. 4 and 5;

Fig. 7 is a vertical cross-sectional view of a fragment of the tank showing the float control valve in vertical cross-section; and

Fig. 8 is a cross-section taken on the line 8—8 of Fig. 7, looking in the direction of the arrows.

Referring to the drawings, and particularly to Figs. 1, 2 and 3, the invention comprises a cylindrical pressure tank 10 mounted co-axially on a sump tank 11. The pressure tank 10 has vertical, cylindrical walls and is closed at the bottom by a plate 12 and at the top by a plate 13. A plurality of reinforcing posts 16, six of which are shown in Figs. 1 and 2, are spaced around the

2

interior of the tank 10 and joined integrally between the plate 12 and the plate 13.

A standpipe 18 is mounted between the plate 12 and the plate 13 and is integrally joined to both plates by welding to form a central support for the tank comparable to the posts 16. Apertures 19 are formed in the standpipe 18 above the normal maximum level of liquid in the tank 10. Vents 20 are formed in the upper end of the standpipe 18 to permit the free passage of air into and out of the standpipe.

The pumping equipment which is mounted on the plate 13 of the tank 10 may comprise (Figs. 1 and 2) a pair of pumps 23—23 driven by electric motors 25—25 directly connected thereto. Magnetic starters 27—27 are adapted to start the motors when the pressure in the tank is below a desired minimum and shut off the motors when the pressure is above a desired maximum. The starters 27—27 are actuated by pressure switches 28—28 responsive to pressure within the tank.

The liquid is drawn by the pumps 23—23 from the sump tank 11 through intake pipes 30—30 into the inlet side of the pumps, and is discharged from the pumps 23—23 through discharge pipes 32—32.

The intake pipes 30—30 are entirely within the peripheral walls of the tanks 10 and 11 and pass upwardly from a screened opening 33 adjacent the bottom of the sump tank 11, through the tank 11, through the bottom 12 of the tank 10, upwardly through the tank 10, through the plate 13 and to the pumps 23—23. The pipes 30 are welded or otherwise permanently fixed in both plates 12 and 13 so as to prevent the escape of pressure therearound.

The discharge pipes 32—32 lead from the discharge side of the pumps 23—23 through check valves 35—35, thence downwardly through the plate 13 and through tank 10, and enter the bottom of the standpipe 18 on the opposite sides thereof tangentially to the radius of gyration of the standpipe. The check valves 35 prevent back flow through the pumps 23—23.

The liquid from the pumps therefore passes downwardly and enters the standpipe 18 in a horizontal tangential direction causing the liquid to assume a swirling motion and form a vortex, the swirling motion causing any air in the liquid to separate therefrom. The air and liquid leave the standpipe 18 through the apertures 19 in the side of the standpipe, the apertures being above the maximum liquid level in the tank 10. Any air that might be trapped in the standpipe by a

sudden surge of oil is vented through openings 20 in the top of the standpipe 18.

The diameter of the standpipe 18 is sufficient to give adequate centrifugal action and adequate time of swirling so that all air is removed from the liquid before entering the main body of oil in the tank 10.

Proper air pressure is maintained in the tank by means of a valve, generally designated 45, Figs. 2 and 3, and shown in detail in Figs. 7 and 8. The valve comprises a body 46 having passages therethrough, to be more fully described below, and a plunger 48 adapted to uncover the various apertures as the liquid rises in the tank. The plunger 48 is controlled by a float 50 which moves the plunger in accordance with the liquid level in the tank.

When there is no oil in the tank 10 or when the oil is below a predetermined minimum, the plunger 48 is forced to the extreme right as seen in Fig. 8. In this position air is free to flow from the interior of the tank 10, through the vent pipe 52, through a central aperture 54 in the valve body 46, into an aperture 56 in the valve body surrounding the aperture 54, through passages 58 and 59 and through a pipe 60 to the top of the sump tank 11 from whence it is vented to the atmosphere through openings 61.

As the liquid level rises above the predetermined minimum the plunger 48 closes off the passage 52 from the passage 56 and allows the air pressure to build up within the tank 10 as the liquid level continues to rise.

When the liquid level rises above the predetermined minimum the plunger 48 opens a passage 63 (Fig. 8) which permits air to flow from within the tank 11 where it is at atmospheric pressure, through a pipe 65, through the passage 63 in the valve body 46, past the plunger 48, through a pipe 67, through a T 69, through pipes 70 and 71 and into one or both inlet pipes 30 of the pumps 23—23. The pumps 23—23 therefore draw in both liquid and air when the level of liquid in the tank 10 is above a predetermined minimum and discharge a mixture of liquid and air into the standpipe 18.

A sight gauge 75 is provided on the exterior of the tank 10 to indicate visually the oil level therein. Oil from the tank 10 may be withdrawn through a delivery pipe 76 and delivered to a hydraulic brake actuator (not shown). Oil is returned from the hydraulic brake actuator and enters the sump tank 11 through an opening 78.

The form of the invention shown in Figs. 4, 5 and 6 is suitable to smaller installations or installations requiring less frequent use of the hoist.

In Figs. 4, 5 and 6 a cylindrical sump tank 100 has a cylindrical pressure tank 101 mounted axially thereon. The pressure tank is reinforced by a concentric standpipe 103 which is secured to both the top 105 and bottom 106 of the pressure tank 101.

Oil from the sump tank 100 flows upwardly through an inlet pipe 108 into the inlet side of a pump 110, and is discharged from the pump 110 under increased pressure, through a pipe 112. The pipe 112 passes into the tank 101 and discharges the oil into the bottom of the standpipe 103 so that the oil enters the standpipe substantially tangentially to the radius of gyration of the interior of the standpipe.

Air is separated from the liquid entering the standpipe in the manner described above, and is discharged either through openings 115 or through vent openings 116. The liquid, free of air, is discharged from the standpipe 103 through the openings 115, the openings 115 being above the normal desired maximum oil level in the tank 101.

Air pressure within the tank 101 is built up and maintained by a float control valve 117, which is identical in construction and operation to the valve 45 used in the pressure tank shown in Figs. 1, 2 and 3 and shown in detail in Figs. 7 and 8. When the level of oil in the tank 101 is above the desired minimum the air valve opens permitting air to flow from the sump tank 100 through a pipe 122, past the valve 117, through a pipe 123 and into the inlet side of the pump 110. When the oil level rises above a desired maximum oil is returned from the tank 101 through the valve 117 and the pipe 124 to the sump tank 100.

The motor 118 which operates the pump 110 is controlled by a starter 119 and a pressure switch 120. The pressure switch operates at a predetermined minimum pressure within the tank 101 to start the motor 118 and operates at a predetermined maximum to stop the motor.

Oil may be withdrawn from the tank 101 through a pipe 125 and delivered to the brake, and returned from the brake actuating mechanism through a pipe 126 to the sump tank 100. A sight gage 121 is provided to visually indicate the liquid level in the tank.

Operation

In operation the motors 25 may be started with the oil in the tank 10 below the desired predetermined minimum and the air pressure within the tank at atmospheric.

When the electricity is turned on, the pressure switches 28—28 both operate to close the starters 27—27, starting both motors 25—25 and hence both pumps 23—23 start pumping oil from the tank 11, through the strainers 33, through the intake pipe 30, and into the intake side of the pumps 23.

During the starting operation, when the oil is below the predetermined minimum, the air in the top of the tank 10 is vented to atmosphere through the vent tube 52 and the pipe 60. As soon as the level of liquid in the tank 10 rises above the predetermined minimum the passage through the vent tube 52 to atmosphere is closed by the valve plunger 48 so that no further air is vented.

The liquid entering the intake of the pumps 23—23 is discharged from the pumps 23—23 under considerable pressure and passes downwardly through the pipes 32—32 and enters the standpipe tangentially to the radius of gyration of the interior area of the standpipe. The entering liquid therefore assumes a whirling movement in the standpipe 18 which causes a vortex to be formed as the liquid rises in the standpipe. The whirling liquid causes the heavy liquid to be thrown to the outside, permitting any air in solution to pass out through the surface of the vortex and enter the tank 10 through either the ports 19 or the ports 20.

As liquid is pumped into the standpipe 18 the vortex rises until the upper level rises above the ports 19, at which time the air free liquid is discharged out through the ports 19 into the body of liquid in the tank 10.

As the level of liquid in the tank 10 continues to rise, the float 50 causes the plunger 48 to move outwardly to uncover the ports 63, permitting air to flow from within the sump tank 11 (at atmospheric pressure) through the pipe 65, through the passage 63, through the pipe 67, the

T 69 and one or both of the pipes 70 and 71, to enter the inlet pipes 30—30 of the pumps 23—23. When the passage way 63 is opened by the plunger valve 48, the pump draws in both air and liquid, the mixture of air and liquid being discharged through the pipe 32 into the standpipe 18, where it is separated by centrifugal action as outlined above.

As air continues to be pumped with the liquid, the air pressure within the tank 10 continues to build up, and the liquid level continues to rise until it reaches a desired maximum. When the liquid level reaches a desired maximum the plunger 48 moves out to the position shown in Fig. 7, opens the passages 57, 56, 58, 59 and permits oil to pass out through the pipe 60 and back into the sump tank 11. Thus the liquid level in the tank 10 remains substantially constant at the maximum desired liquid level while continued pumping of air and liquid serves only to increase the pressure within the tank 10.

When the pressure within the tank 10 reaches a predetermined maximum, the pressure switches 28—28 shut off both motors 25—25 to stop further pumping.

When, due to use of the liquid in the tank, the pressure drops a predetermined amount, one of the pressure switches 28 will cut in one pump 23 to rebuild the oil in the tank. Should the pressure drop faster than it can be replenished by one pump, the second pressure switch 28 will cut in the second pump when the pressure reaches a desired minimum.

It will be realized that the hereinbefore described forms of the invention are to be taken merely as preferred examples thereof and that various changes in size, shape and arrangement of parts may be made without departing from the spirit of the invention or the scope of the subjoined claims.

That which is claimed as new and is desired to be secured by Letters Patent of the United States is:

1. An oil pressure system of the character described comprising, a base, a pressure tank mounted on the base, a standpipe having apertures therethrough, said standpipe being mounted co-axially within said pressure tank and integrally connected to the top and bottom thereof to reinforce the tank, and means to introduce fluid into said standpipe tangentially thereof and adjacent the lower end to separate air from liquid.

2. An oil pressure system of the character described comprising, a base, a pressure tank mounted on the base, a standpipe having apertures therethrough, said standpipe being mounted axially within said pressure tank and integrally connected to the top and bottom thereof to reinforce the tank, and a pump mounted above said pressure tank to deliver fluid into said standpipe tangentially thereof and adjacent the lower end to separate air from liquid.

3. An oil pressure system of the character described comprising, a cylindrical base, a cylindrical pressure tank mounted on the base, said pressure tank including a flat top and a flat bottom, a standpipe having apertures therethrough, said standpipe being mounted axially within said pressure tank and integrally connected to the top and bottom thereof to reinforce the tank, a plurality of reinforcing posts integrally connected to both the top and bottom of said pressure tank and spaced about the pressure tank between the standpipe and the periphery of said pressure tank, and means to introduce fluid into said standpipe tangentially thereof and adjacent the lower end to separate air from liquid.

4. An oil pressure system of the character described comprising, a base, a cylindrical pressure tank mounted on the base, said pressure tank including a flat top and a flat bottom, a standpipe having apertures therethrough, said standpipe being mounted axially within said pressure tank and integrally connected to the top and bottom thereof to reinforce the tank, a plurality of reinforcing posts integrally connected to both the top and bottom of said pressure tank and spaced about the pressure tank between the standpipe and the periphery of said pressure tank, and a pump mounted above said pressure tank to deliver fluid into said standpipe tangentially thereof and adjacent the lower end to separate air from liquid.

JOSEPH KELLOGG.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,567,148	Jennings	Dec. 29, 1925
1,623,103	Frederick	Apr. 5, 1927
2,228,401	Pressler	Jan. 14, 1941
2,347,472	Dorward	Aug. 25, 1944
2,396,864	Logan	Mar. 19, 1946