Dec. 7, 1937. J. M. HAIT 2,101,541

LUBRICATING SYSTEM FOR VERTICAL PUMP SHAFTS

Filed April 29, 1935

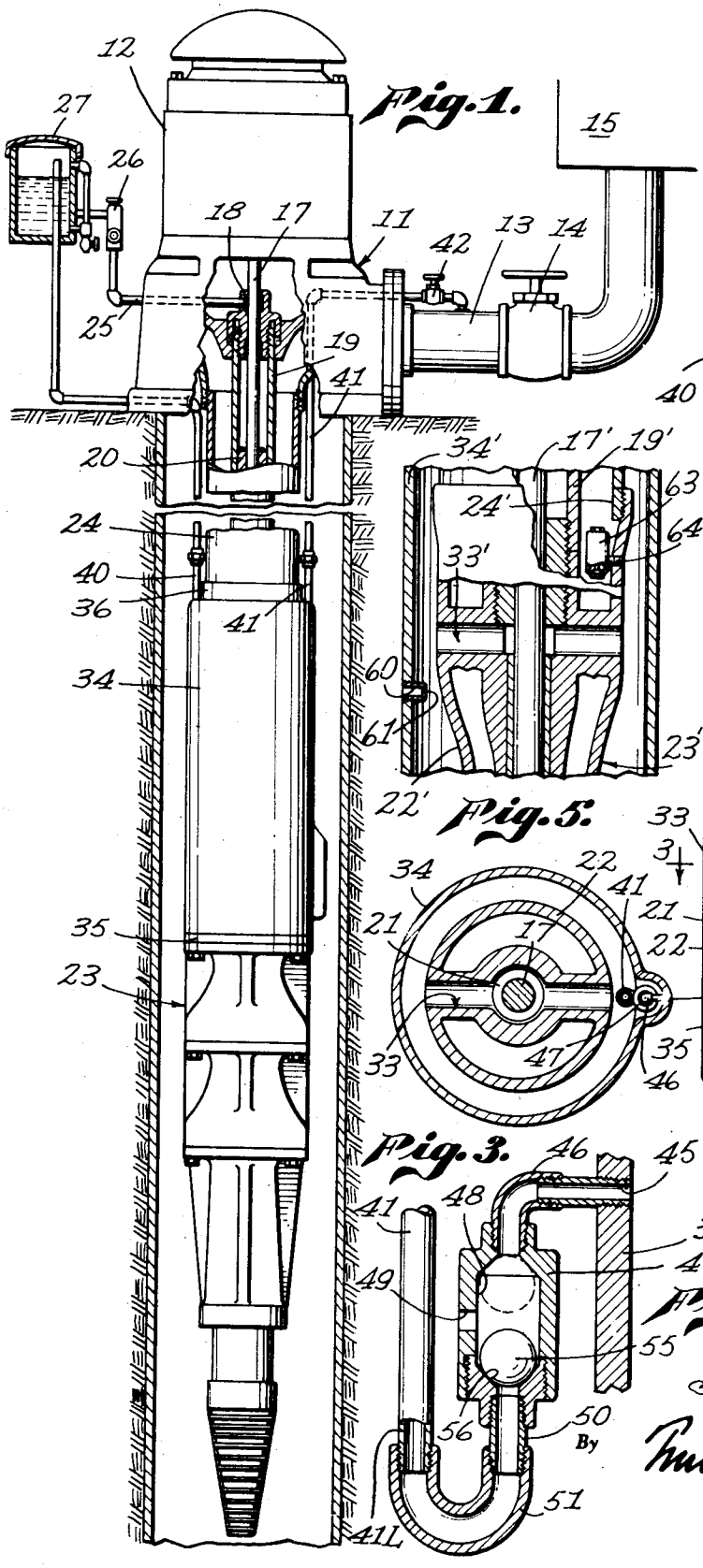


Fig. 1.

Fig. 5.

Fig. 3.

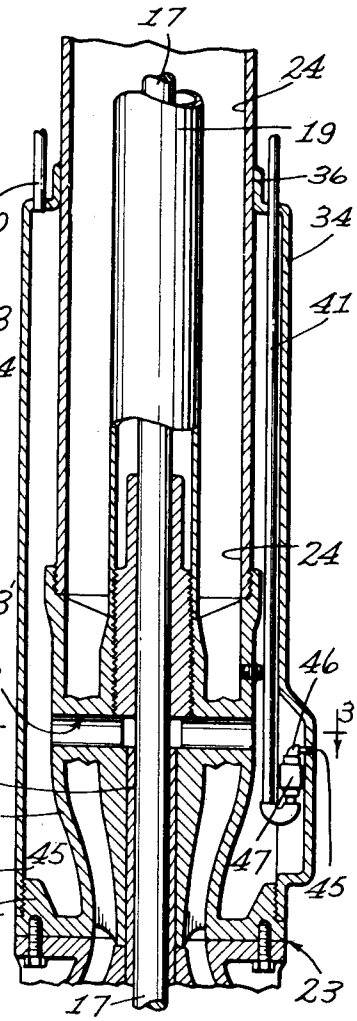


Fig. 2.

Fig. 4.

Inventor

James M. Hait

By Munn & Cushman

Attorney

Patented Dec. 7, 1937

2,101,541

UNITED STATES PATENT OFFICE

2,101,541

LUBRICATING SYSTEM FOR VERTICAL PUMP SHAFTS

James M. Hait, Los Angeles, Calif., assignor to Food Machinery Corporation, a corporation of Delaware

Application April 29, 1935, Serial No. 18,820

24 Claims. (Cl. 103—102)

This invention has to do in a general way with turbine pumps such as are used in pumping deep water wells for domestic and industrial purposes and has as its primary object the provision of improvements in pumps of the class described wherein the lubricant employed in lubricating the line shaft bearings is so controlled that it does not enter either the well water or the water being pumped whereby contamination of the water is eliminated.

The present invention is an improvement or modification of the device shown in my co-pending application Serial No. 743,562, and has as one object the provision of a lubricating system of the class described wherein the lubricant may be delivered into the line shaft enclosing tubing by the so-called "drip method" and is withdrawn or carried from the enclosing tubing through a water seal into an isolated accumulating reservoir from which it may be raised to the surface of the ground from time to time as it accumulates.

It is a further object of this invention to provide a construction of the class described wherein a by-pass is provided above the bowl assembly, such by-pass being arranged in a manner such that leakage through the top bearing in the bowl assembly is effective to carry the lubricant through the by-pass into the accumulating reservoir. The accumulating reservoir contemplated by this invention is provided with outlet means in its bottom portion to discharge the leakage just referred to, and the reservoir itself extends above the outlet of the by-pass connection a sufficient distance to effect a complete separation of the lubricant from the water which is discharged into the reservoir.

It is a still further object of this invention to provide novel means for applying fluid pressure to the interior of the accumulator chamber without the use of a secondary pressure pipe extending into the well.

This invention, like that of my co-pending application above referred to, in its preferred form, contemplates the use of the pressure of the water to raise the liquid in the accumulating reservoir to the surface of the ground but like the disclosure of my former application it may incorporate an accumulating reservoir of sufficient capacity to retain all of the lubricant which will accumulate therein between periods of shut-down and removal of the pump from the well. In this former connection, it is a noteworthy feature of a preferred form of my invention that this pressure is also used to close a check valve which controls the discharge or outlet from the accumulating reservoir into the well. The details in the construction of a preferred form of my invention, together with other objects attending its production, will be best understood from the following description of the accompanying drawing, which is chosen for illustrative purposes only, and in which

Fig. 1 is an elevational view with parts broken away showing a turbine pump assembly equipped with a preferred embodiment of my invention;

Fig. 2 is an enlarged sectional elevation showing details in the construction of the accumulator reservoir and its associated parts;

Fig. 3 is a plan section taken along the line 3—3 of Fig. 2;

Fig. 4 is an enlarged fragmentary sectional elevation showing a preferred form of valve mechanism which controls the bottom outlet or discharge from the accumulator reservoir; and

Fig. 5 is a sectional elevation similar to an intermediate portion of Fig. 2 but showing a modified form of bottom outlet or discharge connection from the accumulator reservoir.

Referring now to the drawing, reference numeral 11 indicates a discharge fitting of a conventional turbine pump which is provided with a motor or other suitable driving means 12 and has a discharge pipe 13 connecting through a suitable valve 14 with a receiving tank 15. The motor 12 is secured to the upper end of a line shaft 17 which extends downwardly through a packing gland fitting 18 mounted on the upper end portion of a shaft enclosing tubing 19. The shaft 17 is supported in the tubing 19 by means of spaced line shaft bearings 20 and its lower end portion extends through bearing 21 in the discharge manifold 22 of a bowl assembly generally indicated at 23. The portion of the shaft extending into the bowl assembly carries the impellers which are not shown. The upper end portion of the discharge manifold 22 is connected with a delivery pipe 24, the upper end of which in turn is connected in the bottom of the discharge fitting 11.

Reference numeral 25 indicates an oil delivery pipe which is used to deliver lubricant into the top portion of the packing nut 18 or at any other suitable point at or near the upper end of the shaft enclosing tubing 19. The pipe 25 may be fed with lubricant in any suitable manner such as by means of a drip feeder 26 which is shown as being connected to a lubricant reservoir 27, similar in construction to that shown in my co-pending application above referred to. The lu-

bricant introduced into the tubing 19 in this manner flows downwardly along the line shaft through the various line shaft bearings 20 and into the lower end of the shaft enclosing tubing where it accumulates until the weight of the column of lubricant counter-balances the static head of the water in the well, at which point the bottom of the column of lubricant has reached the by-pass port or by-pass means generally indicated by reference numeral 33.

At this time it is pointed out that the use of a by-pass such as 33 is conventional construction in ordinary turbine pumps, being necessary to relieve the line shaft enclosing tubing of the pressure of the pump which leaks through the top bearing 21 and would otherwise completely fill the line shaft enclosing tubing and prevent proper lubrication of the line shaft bearings. In usual practice, however, the lubricant which travels outwardly through the by-pass ports in the manner just referred to is discharged directly into the well, but in the present invention the outlet opening of the by-pass conduit 33 is completely enclosed by a lubricant separating chamber which is shown as comprising an elongated sleeve 34 which surrounds the discharge pipe 24, this sleeve being secured at its lower end to a flange 35 formed on the fitting 22 and having its upper end 36 welded or otherwise suitably secured to the pipe at a substantial distance above the point at which the by-pass 33 has its outlet in the accumulating chamber.

With this arrangement, as the water and oil are discharged through the pipe or conduit 33 into the accumulating chamber, the oil by virtue of its difference in specific gravity immediately separates and rises to the top of the elongated accumulating chamber where it can be delivered to the surface of the ground by the application of suitable pressure within the accumulating chamber through a lubricant return pipe indicated at 40 which is shown as having its upper end situated within the receiving reservoir 27 but which, as will be readily apparent, may empty into any suitable reservoir at the ground surface.

For the purpose of applying this intermittent pressure to the accumulating reservoir, thereby forcing the lubricant to the surface of the ground, I show in Fig. 1 what I may term a pressure conduit indicated at 41, such conduit being connected through a valve 42 with the main discharge pipe 13. When it is desired to purge the accumulator reservoir of its contents the valve 42 is opened and, if additional pressure is desired, the valve 14 may be slightly closed to obtain such additional pressure.

Inasmuch as the water which leaks through the bearing 21 and the by-pass conduit 33 has a potential head equal to that of the pump assembly itself, it is important that some means for draining the accumulator reservoir of water into the well be provided to prevent the pipes 40 and 41 and the tubing 19 being completely filled with water. Furthermore, in order that the purging operation can be efficiently carried out it is important that the outlet in the accumulator reservoir, to take care of the leakage from the pump through the bearing 21 just mentioned, either be of a nature such that it can be closed when the water pressure is applied to effect the purging operation or that it be restricted to an area substantially less than the area of the pipe 40 so that virtually all of the flow during the application of this excessive pressure will take place through the pipe 40.

As one preferred means of effecting the closure of an outlet in the bottom portion of the accumulator reservoir during the application of purging pressure thereto, I show in Figs. 2, 3 and 4 an outlet port 45 provided in the bottom portion of the accumulator reservoir, such port being connected through a pipe 46 with a valve housing 47. The valve housing 47, as is clearly shown in Fig. 4, is provided with an enlarged chamber 48, such chamber having an inlet port 49 formed in its wall and being provided with a connection 50 through which it is connected to a U-fitting 51 which in turn is connected to the lower end 41L of the pressure pipe 41. Within the chamber 48 is a ball check valve 55 which normally rests upon a seat 56 formed in the fitting 50. With this arrangement it will be seen that under normal operations the pressure differential established between the interior of the accumulator chamber and the water in the well, by virtue of leakage from the pump through the bearing 21, is effective to cause a flow of water (the oil having risen to the top) through the ports 49 into the chamber 48 and on out through the connection 46 into the water of the well. When pressure is applied through the pipe 41, the water entering the chamber 48 forces the check valve 55 up against the seat in the top of the chamber 48, thereby closing the outlet into the well and causing all of the water to enter the accumulator reesrvoir through the port 49 and thereby effect the purging operation.

In the form of my invention shown in Fig. 5 I show a modification which, in most respects, is identical with the form shown in Fig. 2, and all of the parts corresponding to those shown in Fig. 2 are indicated by the same reference numeral distinguished by the prime mark. In this form of my invention, however, instead of providing a positively operated valve to effect the closure of the outlet or discharge port in the bottom portion of the accumulator reservoir, I provide an outlet fitting 60 which is shown as being in the nature of a nipple having a very small orifice 61 therein. The orifice 61 is of sufficient size to take care of the normal leakage of the pump through the bearing 21 but is of substantially less area than the internal area of the pipe 40, so that during the application of pressure to the interior of the accumulator reservoir, the flow through the orifice 61 is so restricted that substantially all of the flow takes place through the lubricant return pipe corresponding to the pipe 40 shown in Fig. 1.

In this form of my invention, I also show a novel means of applying fluid pressure to the interior of the accumulating chamber. This is accomplished through the use of a pressure relief valve 63 which has its inlet communication with the interior of the delivery pipe and has its outlet opening 64 communicating with the interior of chamber 34'. The valve 63 is set to open at a pressure in substantial excess of the normal operating head of the pumps, so that in normal operation it remains closed. When it is desired to purge the reservoir, a valve on the discharge line, corresponding to the valve 14, is closed until the pressure on the pump side of the line exceeds the pressure for which the valve 63 is set, at which pressure the valve 63 opens to deliver pressure fluid direct from the delivery pipe 24' into the reservoir 34', thereby purging the same of its contents.

It will be apparent from the foregoing description that the device contemplated by this invention is of simple form and construction and can be easily and economically installed upon turbine

pumps of standard type without making any substantial changes in the standard construction.

It is to be understood that, while I have herein described and illustrated one preferred form of my invention, the invention is not limited to the precise construction described above but includes within its scope whatever changes fairly come within the spirit of the appended claims.

I claim as my invention:

1. In a turbine pump having a bowl assembly, a line shaft extending through said bowl assembly, a tubing enclosing said line shaft, and a delivery pipe enclosing said tubing, the combination of: by-pass means interposed between the interior of said tubing and the exterior of said pipe at a point above said bowl assembly; an elongated housing surrounding said pipe and enclosing the outlet of said by-pass, said housing having an outlet opening at its lower end portion; a liquid return conduit connecting the top portion of said housing with the surface of the ground; and means for applying pressure within said housing to force the liquid therein through said return conduit to the surface of the ground.

2. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing, and a delivery pipe enclosing said tubing, the combination of: means for delivering lubricant into the top of said tubing; by-pass means connecting the interior of said tubing with the exterior of said pipe at a point above said bowl assembly; a separating chamber communicating with the outlet of said by-pass and extending a substantial distance above said by-pass, said separating chamber having an outlet opening at its lower end portion communicating with the well; a liquid return conduit connecting the top portion of said chamber with the surface of the ground; and means for applying pressure within said chamber to force the liquid therein through said return conduit to the surface of the ground.

3. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing, and a delivery pipe enclosing said tubing, the combination of: means for delivering lubricant into the top of said tubing; by-pass means connecting the interior of said tubing with the exterior of said pipe at a point above said bowl assembly; a separating chamber communicating with the outlet of said by-pass and extending a substantial distance above said by-pass, said separating chamber having an outlet opening at its lower end portion in spaced relation with the outlet of said by-pass and communicating with the well; a liquid return conduit connecting the top portion of said chamber with the surface of the ground; and means for applying pressure within said chamber to force the liquid through said return conduit to the surface of the ground.

4. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing, and a delivery pipe enclosing said tubing, the combination of: means for delivering lubricant into the top of said tubing; by-pass means connecting the interior of said tubing with the exterior of said pipe at a point above said bowl assembly; a separating chamber communicating with the outlet of said by-pass and extending a substantial distance above said by-pass, said separating chamber having an outlet opening at its lower end portion below the outlet of said by-pass and communicating with the well; a liquid return conduit connecting the top portion of said chamber with the surface of the ground; and means for applying pressure within said chamber to force the liquid therein through said return conduit to the surface of the ground.

5. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing and a delivery pipe, the combination of: means for delivering lubricant into the top of said tubing; by-pass means having an inlet in said tubing at a point above said bowl assembly; a lubricant separating chamber communicating with the outlet of said by-pass means and extending a substantial distance above said by-pass; said separating chamber having an outlet opening in its bottom portion communicating with the liquid in the well; a lubricant return conduit communicating with the top portion of said chamber; and means for applying pressure to the interior of said chamber to force the liquid therein through said return conduit to the surface of the ground.

6. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing and a delivery pipe, the combination of: means for delivering lubricant into the top of said tubing; by-pass means having an inlet in said tubing at a point above said bowl assembly; a lubricant separating chamber communicating with the outlet of said by-pass means and extending a substantial distance above said by-pass, said separating chamber having an outlet opening in its bottom portion spaced away from the outlet of said by-pass and communicating with the liquid in the well; a lubricant return conduit communicating with the top portion of said chamber; and means for applying pressure to the interior of said chamber to force the liquid therein through said return conduit to the surface of the ground.

7. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing and a delivery pipe, the combination of: means for delivering lubricant into the top of said tubing; by-pass means having an inlet in said tubing at a point above said bowl assembly; a lubricant separating chamber communicating with the outlet of said by-pass means and extending a substantial distance above said by-pass, said separating chamber having an outlet opening in its bottom portion situated below the outlet of said by-pass and communicating with the liquid in the well; a lubricant return conduit communicating with the top portion of said chamber; and means for applying pressure to the interior of said chamber to force the liquid therein through said return conduit to the surface of the ground.

8. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing and a delivery pipe, the combination of: means for delivering lubricant into the top of said tubing; by-pass means having an inlet in said tubing at a point above said bowl assembly; a lubricant separating chamber communicating with the outlet of said by-pass means and extending a substantial distance above said by-pass, said separating chamber having an outlet opening in its bottom portion communicating with the liquid in the well; a lubricant return conduit communicating with the top portion of said chamber; and means for applying pressure to the interior of said chamber to force the liquid therein through said return conduit to the surface of the ground, said last mentioned means comprising a valved pipe having an inlet in said delivery pipe and an outlet in the bottom portion of said chamber.

9. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing and

a delivery pipe, the combination of: means for delivering lubricant into the top of said tubing; by-pass means having an inlet in said tubing at a point above said bowl assembly; a lubricant separating chamber communicating with the outlet of said by-pass means and extending a substantial distance above said by-pass outlet; a lubricant return conduit communicating with the top portion of said chamber, said chamber having an outlet, of substantially less area than said return conduit, situated in the bottom portion of said chamber and communicating with the liquid in the well; and means for applying pressure to the interior of said chamber to force liquid therein through said return conduit to the surface of the ground.

10. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing and a delivery pipe, the combination of: means for delivering lubricant into the top of said tubing; by-pass means having an inlet in said tubing at a point above said bowl assembly; a lubricant separating chamber communicating with the outlet of said by-pass means and extending a substantial distance above said by-pass outlet; a lubricant return conduit communicating with the top portion of said chamber, said chamber having an outlet, of substantially less area than said return conduit, situated in the bottom portion of said chamber and communicating with the liquid in the well; and means for applying pressure to the interior of said chamber to force liquid therein through said return conduit to the surface of the ground, said last mentioned means comprising a valved pipe having an inlet in said delivery pipe and an outlet in the bottom portion of said chamber.

11. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing and a delivery pipe, the combination of: means for delivering lubricant into the top of said tubing; by-pass means having an inlet in said tubing at a point above said bowl assembly; a lubricant separating chamber communicating with the outlet of said by-pass and extending a substantial distance above said by-pass outlet; a lubricant return conduit communicating with the top portion of said chamber; a valved pressure pipe extending into the bottom portion of said chamber; a valve housing mounted on the inner end of said pressure pipe and having an opening communicating with the interior of said chamber; outlet means connecting the interior of said valve housing with the exterior of said separating chamber; and a check valve in said valve housing, normally positioned to permit free flow of liquid through said housing from the interior to the exterior of said chamber, said check valve being arranged to close the passage to the exterior of said chamber upon the application of pressure through said pressure pipe.

12. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing and a delivery pipe, the combination of: means for delivering lubricant into the top of said tubing; by-pass means having an inlet in said tubing at a point above said bowl assembly; a lubricant separating chamber communicating with the outlet of said by-pass and extending a substantial distance above said by-pass outlet; a lubricant return conduit communicating with the top portion of said chamber; a valved pressure pipe extending into the bottom portion of said chamber; a valve housing mounted on the inner end of said pressure pipe and having an opening communicating with the interior of said chamber, in spaced relation with said by-pass outlet; outlet means connecting the interior of said valve housing with the exterior of said separating chamber; and a check valve in said valve housing, normally positioned to permit free flow of liquid through said housing from the interior to the exterior of said chamber, said check valve being arranged to close the passage to the exterior of said chamber upon the application of pressure through said pressure pipe.

13. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing and a delivery pipe, the combination of: means for delivering lubricant into the top of said tubing; by-pass means having an inlet in said tubing at a point above said bowl assembly; a lubricant separating chamber communicating with the outlet of said by-pass and extending a substantial distance above said by-pass outlet; a lubricant return conduit communicating with the top portion of said chamber; a valved pressure pipe extending into the bottom portion of said chamber; a valve housing mounted on the inner end of said pressure pipe and having an opening communicating with the interior of said chamber in a plane below said by-pass outlet; outlet means connecting the interior of said valve housing with the exterior of said separating chamber; and a check valve in said valve housing, normally positioned to permit free flow of liquid through said housing from the interior to the exterior of said chamber, said check valve being arranged to close the passage to the exterior of said chamber upon the application of pressure through said pressure pipe.

14. In combination with a vertical well turbine pump having a bowl assembly and a shaft enclosing tubing: means for delivering lubricant into the upper end of said enclosing tubing; by-pass means having an inlet in said tubing above said bowl assembly; a separating chamber communicating with the outlet of said by-pass and extending a substantial distance above said by-pass outlet; a lubricant return pipe communicating with the top of said separating chamber; and a pressure pipe communicating with the interior of said chamber, said chamber having outlet means situated below said by-pass outlet and communicating with the water in the well.

15. In combination with a vertical well turbine pump having a bowl assembly and a shaft enclosing tubing: means for delivering lubricant into the upper end of said enclosing tubing; by-pass means having an inlet in said tubing above said bowl assembly; a separating chamber communicating with the outlet of said by-pass and extending a substantial distance above said by-pass outlet; a lubricant return pipe communicating with the top of said separating chamber; and a pressure pipe communicating with the interior of said chamber, said chamber having outlet means situated below said by-pass outlet and communicating with the water in the well, said outlet means comprising a valve housing mounted on the inner end of said pressure pipe and having an opening communicating with said chamber, an outlet connection in said housing communicating with the exterior of said chamber, and valve means in said housing operative upon the application of pressure from said pressure pipe to close said last mentioned outlet connection.

16. In combination with a vertical well turbine pump having a bowl assembly and a shaft en-

closing tubing: means for delivering lubricant into the upper end of said enclosing tubing; by-pass means having an inlet in said tubing above said bowl assembly; a separating chamber communicating with the outlet of said by-pass and extending a substantial distance above said by-pass outlet; a lubricant return pipe communicating with the top of said separating chamber; and a pressure pipe communicating with the interior of said chamber, said chamber having an outlet opening of substantially less area than said lubricant return conduit, said outlet opening being situated below said by-pass outlet.

17. In combination with a vertical well turbine pump having a bowl assembly, a water delivery pipe and a shaft enclosing tubing: means for delivering lubricant into the upper end of said enclosing tubing; by-pass means having an inlet in said tubing above said bowl assembly; a separating chamber communicating with the outlet of said by-pass and extending a substantial distance above said by-pass outlet; a lubricant return pipe communicating with the top of said separating chamber; conduit means between said water delivery pipe and said separating chamber; and an automatic valve in said last mentioned conduit operable when the pressure in said delivery pipe is increased substantially above the normal operating head, to conduct pumped liquid from said delivery pipe into said separating chamber thereby forcing the contents of the separating chamber to the surface of the ground through said return pipe.

18. In combination with a vertical well turbine pump having a bowl assembly, a water delivery pipe and a shaft enclosing tubing: means for delivering lubricant into the upper end of said enclosing tubing; by-pass means having an inlet in said tubing above said bowl assembly; a separating chamber communicating with the outlet of said by-pass and extending a substantial distance above said by-pass outlet; a lubricant return pipe communicating with the top of said separating chamber; conduit means between said water delivery pipe and said separating chamber; an automatic valve in said last mentioned conduit operable when the pressure in said delivery pipe is increased substantially above the normal operating head, to conduct pumped liquid from said delivery pipe into said separating chamber thereby forcing the contents of the separating chamber to the surface of the ground through said return pipe; and a restricted outlet port in said separating chamber below said by-pass outlet.

19. In combination with a vertical turbine pump having a bowl assembly, a liquid delivery tubing, and a shaft enclosing tubing; means for delivering lubricant into the upper end of said enclosing tubing; an accumulating reservoir situated near said bowl assembly and communicating with the lower end portions of said enclosing tubing; conduit means for delivering the contents of said accumulating reservoir to the surface of the ground; conduit means between the lower end of said delivery pipe and said accumulating reservoir; a pressure relief valve in said last mentioned conduit means; and valve means in said delivery pipe for restricting the flow therethrough whereby the fluid pressure in said delivery pipe is increased to open said relief valve and deliver pressure fluid from said delivery pipe into said reservoir to force the contents thereof to the surface of the ground.

20. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing, and a delivery pipe enclosing said tubing, the combination of: a by-pass conduit connecting the interior of said tubing with the exterior of said pipe at a point above said bowl assembly whereby lubricant flowing downwardly around said line shaft and water forced upwardly around said line shaft are both conducted outwardly from said tubing to the exterior of said pipe; a separating chamber surrounding said delivery pipe in the region of the outlet of said by-pass conduit and in open communication with the outlet of said by-pass conduit and extending a substantial distance thereabove wherein the lubricant separates from the water by gravitation; and normally open outlet means in the bottom portion of said separating chamber communicating with the well through which excess water received in said chamber is discharged into the well.

21. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing, and a delivery pipe enclosing said tubing, the combination of: a by-pass conduit connecting the interior of said tubing with the exterior of said pipe at a point above said bowl assembly whereby lubricant flowing downwardly around said line shaft and water forced upwardly around said line shaft are both conducted outwardly from said tubing to the exterior of said pipe; a separating chamber surrounding said delivery pipe in the region of the outlet of said by-pass conduit and in open communication with the outlet of said by-pass conduit and extending a substantial distance thereabove wherein the lubricant separates from the water by gravitation; and a restricted outlet orifice in the bottom portion of said separating chamber through which excess water received in said chamber is discharged into the well.

22. In a turbine well pump having a bowl assembly, a line shaft, a line shaft enclosing tubing, and a delivery pipe enclosing said tubing, the combination of: a by-pass conduit connecting the interior of said tubing with the exterior of said pipe at a point above said bowl assembly whereby lubricant flowing downwardly around said line shaft and water forced upwardly around said line shaft are both conducted outwardly from said tubing to the exterior of said pipe; and a separating chamber surrounding said delivery pipe in the region of the outlet of said by-pass and extending a substantial distance above said by-pass outlet wherein said lubricant separates from the water by gravitation.

23. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing, and a delivery pipe enclosing said tubing, the combination of: means for delivering lubricant into the upper portion of said tubing; a lubricant collecting receptacle mounted exteriorly of said delivery pipe, the lower portion of said receptacle being in open communication with the well; by-pass means connecting the lower interior portions of said tubing and said receptacle; a liquid return conduit having an inlet opening in the upper portion of said receptacle; and means for applying pressure within said receptacle to force liquid contained therein through said return conduit to the surface of the ground.

24. In a well turbine pump having a bowl assembly, a line shaft, a line shaft enclosing tubing, and a delivery pipe enclosing said tubing, the combination of: means for delivering

lubricant to the upper portion of said tubing; a lubricant collecting receptacle mounted exteriorly of said delivery pipe, the lower portion of said receptacle being in open communication with the well; by-pass means connecting the lower interior portions of said tubing and said receptacle; a liquid return conduit having an inlet opening in the upper portion of said receptacle; and means for delivering liquid under pressure from said delivery pipe to said receptacle to force liquid contained therein through said return conduit to the surface of the ground.

JAMES M. HAIT.