Dec. 19, 1944. L. J. LE FEVRE 2,365,281

PUMP FOR PUMPING WATER, OIL, OR OTHER LIQUIDS FROM WELLS AND THE LIKE

Filed Feb. 9, 1944 2 Sheets-Sheet 1

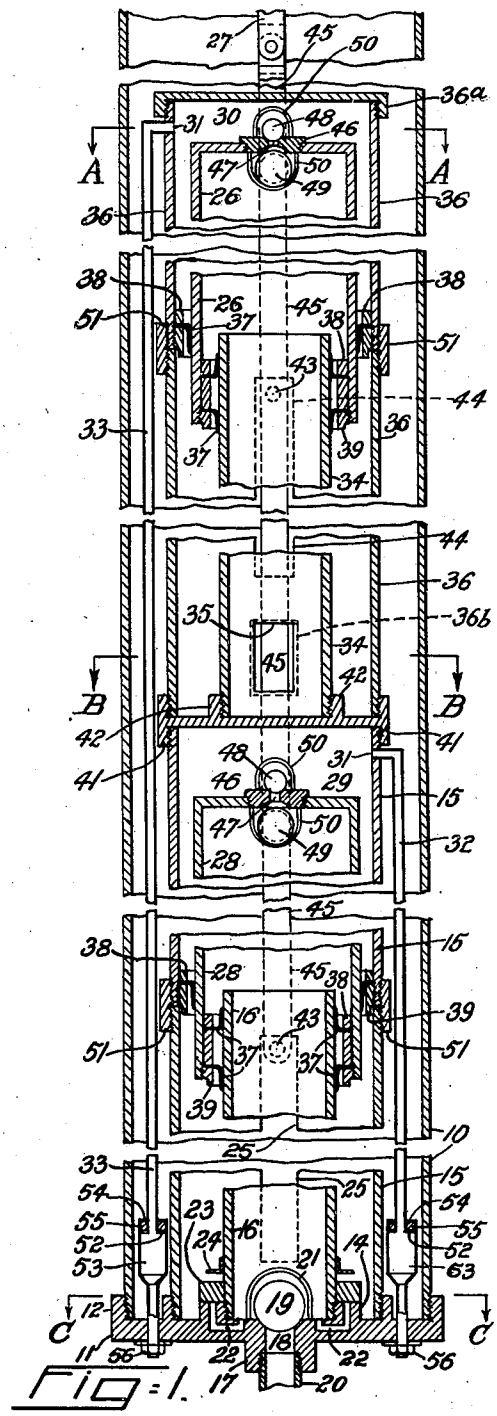


Fig. 1.

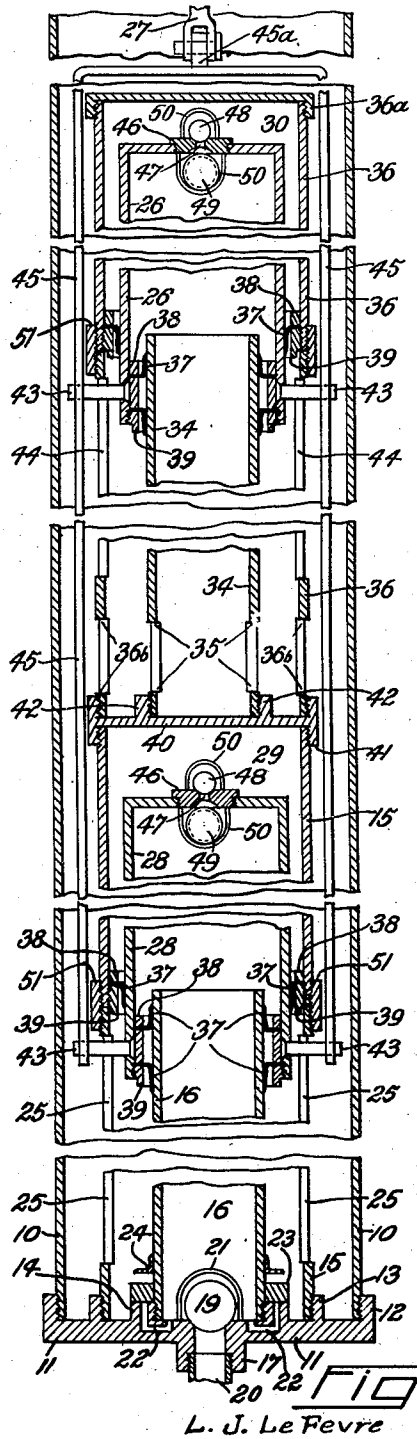


Fig. 2.

L. J. Le Fevre
Inventor
by J. Harold Hickle
Attorney

Dec. 19, 1944. L. J. LE FEVRE 2,365,281

PUMP FOR PUMPING WATER, OIL, OR OTHER LIQUIDS FROM WELLS AND THE LIKE

Filed Feb. 9, 1944 2 Sheets-Sheet 2

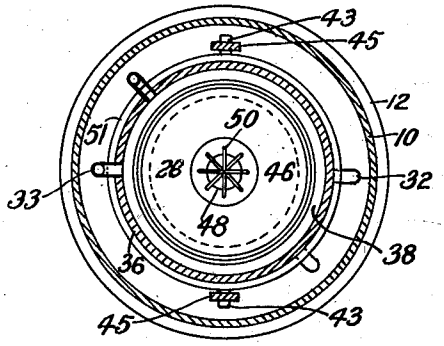


Fig. 4.

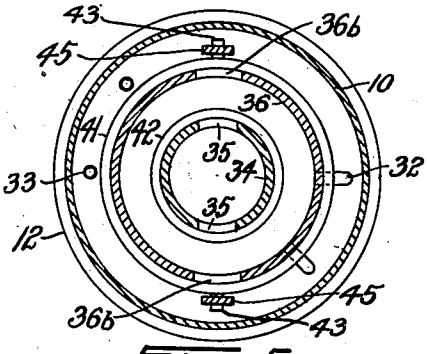


Fig. 5.

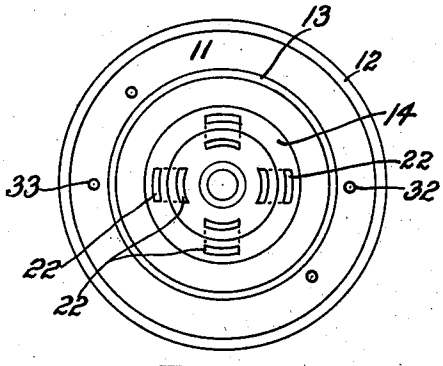


Fig. 6.

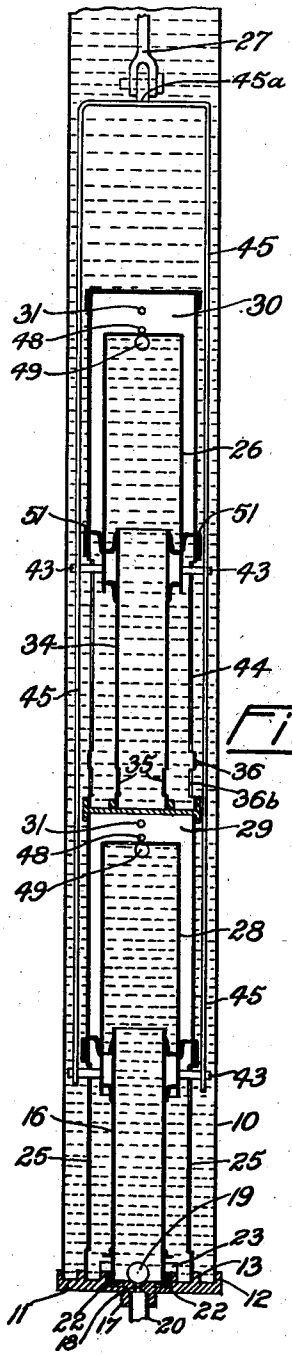


Fig. 3.

L. J. LeFevre
Inventor
by T. Hauschopfeld
Attorney

Patented Dec. 19, 1944

2,365,281

UNITED STATES PATENT OFFICE

2,365,281

PUMP FOR PUMPING WATER, OIL, OR OTHER LIQUIDS FROM WELLS AND THE LIKE

Leopold Julius Le Fevre, Point Piper, New South Wales, Australia

Application February 9, 1944, Serial No. 521,600
In Australia March 2, 1943

9 Claims. (Cl. 103—206)

This invention relates more particularly to the type of pump that is driven by a windmill. Hitherto in this class of pump the applied power on the suction stroke had not only to be sufficient to raise the water in the suction and discharge pipe but also to lift the vertical pump rod. It is known that prior attempts to compensate for the weight of the water in the delivery pipe and the pump rod, or either, have been made but the means employed are entirely different to those adopted for carrying the present invention into effect.

According to this invention the potential energy of the head of water in the delivery pipe connected to the pump is utilised on each up or suction stroke of pump by applying it to a separate or auxiliary sleeve piston connected to a similar pump piston and at the same time providing means whereby atmospheric pressure is maintained on the head of the pump piston in order to compensate for the weight of the pump rod and eliminate the weight of the water within the delivery pipe the percentage of compensation varying according to the weight of the pump rod and the head of water in the delivery pipe. By this means applied mechanical power required to drive the pump will be considerably reduced because each suction stroke is assisted by pressure of the head of water in the delivery pipe, the additional power thus obtained compensating for the weight of the vertical rod on each suction stroke of the pump and on the down or delivery stroke of the pump the weight of the pump rod assists to overcome the pressure of the head of water against the internal surface of the auxiliary cylinder.

In carrying the invention into effect a fixed cylinder (which may be called the pump cylinder) and a sleeve piston slidable thereon and another fixed cylinder (which may be called the auxiliary cylinder) and a coacting sleeve piston slidable thereon are arranged in axial alignment with one another and within separate fixed air cylinders the upper portion of each of which form air chambers. All of these cylinders and the coacting sleeve pistons are arranged concentrically within the delivery pipe, an annular space being provided between the inner wall of the delivery pipe and the air cylinders. The sleeve pistons are each provided with oppositely positioned pins or trunnions which project radially through slots formed in the respective fixed air cylinders to enable them to be connected together by a yoke positioned within the annular space and connected to a vertical pump rod that is power driven.

The air chambers are provided with apertures by which they are open to atmosphere through pipes provided for that purpose.

Any known means are provided for the insertion of packing or packing rings between the inner surfaces of both the sleeve pistons and the respective outer surfaces of the fixed pump and auxiliary cylinders and also between the outer surfaces of the sleeve pistons and their respective air cylinders.

The fixed pump cylinder is provided with suction and delivery apertures and appropriate valves.

A feature of this invention is that the closed end of both the pump and auxiliary sleeve pistons are each provided with a valve the seatings for which are formed on opposite sides of a plate which may be screwed into apertures formed centrally in the closed end of each sleeve piston. The upper or exterior valve may be a ball or other valve the lower one lying within the respective sleeve pistons and being a metal or other float valve, both the interior and exterior valves being respectively enclosed in suitable cages. By this means air can be expelled from the sleeve pistons so long as water therein has not risen to a height sufficient to cause the respective valves to float onto their seatings, but air cannot enter the pistons from the respective air chambers.

The invention will however be clearly understood from the detailed description which will now be given and wherein reference will be made to the accompanying drawings in which—

Fig. 1 is a sectional elevation showing a delivery pipe wherein is a pump constructed and arranged according to this invention but sections have been removed in order to conserve space.

Fig. 2 is a sectional elevation the section being taken at right angles to that shown in Fig. 1.

Fig. 3 is a diagrammatic sectional elevation on a smaller scale showing the general arrangement of the parts of this invention.

Fig. 4 is a transverse sectional view taken on the line A—A of Fig. 1, and looking in the direction indicated by the arrows.

Fig. 5 is a transverse sectional view taken on the line B—B of Fig. 1 and looking in the direction indicated by the arrows.

Fig. 6 is a transverse sectional view taken on the line C—C of Fig. 1 and looking in the direction indicated by the arrows.

According to the construction shown in the drawings the lower end of the delivery pipe **10** is securely fastened to a bottom plate or disc **11**, which is provided with three annular bosses **12**, **13**, and **14**. Each annular boss is internally screw threaded to receive the externally screw threaded lower ends of the delivery pipe **10**, the air cylinder **15** and the fixed pump cylinder **16** respectively. The plate **11** is also provided with a central boss **17** on its underneath side, such boss having an axial passage **18** the upper end

of which is shaped to form a seating for a ball valve 19 the lower end being internally screw threaded to receive the screw threaded end of the suction pipe 20. A cage 21 of known construction is employed to maintain the ball valve 19 in position. In order to establish internal communication between the fixed pump cylinder 16 and the delivery pipe 10 the plate 11 is provided with two or more U shaped passages 22 one leg of each of which terminates within the fixed pump cylinder 16 the other legs passing upwardly through and to the upper face of the boss 14. The upper horizontal end of the boss 14 is faced to form a seating for an annular valve 23 the upward movement of which is limited by an annular collar 24 secured to the fixed pump cylinder 16. This construction results in the liquid being forced through the U shaped passage at each delivery stroke of the pump thus causing the annular valve 23 to rise and permit the liquids to pass into the air cylinder 15 at the base thereof and from thence through longitudinal slots 25 (the use of which will be later described) in the air cylinder 15 into the annular space between the latter and the delivery pipe 10.

It has been previously stated that it is an object of this invention to provide an auxiliary piston 26 upon which the pressure of the head of water in the delivery pipe 10 is exerted in order to compensate for the weight of the pump rod 27 on each suction stroke of the pump. It will be seen however that as both the sleeve pistons 28 and 26 are located at or near the bottom of the delivery pipe 10 it is essential to provide a means whereby the pressure of the head of water in the delivery pipe shall not be exerted upon the heads of these pistons on the up stroke of the pump. For this reason air chambers 29 and 30 are provided and arranged so that the respective sleeve pistons 28 and 26 may freely move therein whilst atmospheric pressure is constantly maintained by means of vents 31 which are open to atmosphere through the respective pipes 32 and 33. Additional vents and air pipes may be provided if necessary.

The construction and arrangement of the fixed pump and the fixed pump cylinder 16 and auxiliary cylinder 34 respectively are the same with the exception that the fixed auxiliary cylinder 34 is provided with apertures 35 to permit water from the delivery pipe 10 to enter so that the pressure of the head of water may be exerted upon the interior of the auxiliary sleeve piston 26. Although the area of the slots 44 in the cylinder 36 may be sufficient to permit the water to pass freely to and from the delivery pipe through them and the apertures 35 into the fixed auxiliary cylinder 34 it is preferred to provide the cylinder 36 with apertures 36b positioned in radial alignment with the apertures 35 in the cylinder 34. The sleeve pistons 28 and 26 slide upon the respective fixed cylinders 16 and 34 and water tight joints are formed between the outer faces of the fixed cylinders 16 and 34 and the inner faces of the sleeve pistons 28 and 26 respectively and between the outer faces of the latter and the inner faces of air cylinders 15 and 36 respectively by any suitable known means, such as leather packing rings 37 of L shape in cross section which may be secured between screw threaded clamping rings 38 and 39.

The upper end of the air cylinder 15 is closed by a circular plate 40 surrounded by and integral with a short cylindrical formation 41 which projects above and below the plate both ends being internally screw threaded, the lower portion to enable it to receive the screw threaded upper end of the air cylinder 15 and the upper portion to enable it to receive the lower end of the air cylinder 36. The upper face of the plate 40 is also provided with a centrally positioned annular boss formation 42 which is internally screw threaded to receive the screw threaded end of the fixed auxiliary cylinder 34. The upper end of the air cylinder 36 is closed by a screw cap 36a. The length of both the cylinders 15 and 36 will be sufficient to enable the respective sleeve pistons to freely reciprocate therein.

It is necessary to connect the pistons 26 and 28 to one another and to connect both of them to the pump rod 27 and for this purpose both the pistons are provided with two oppositely positioned radially projecting pins or trunnions 43 which project into the space between the air cylinders 15 and 36 and the delivery pipe 10, through the respective longitudinal slots 25 and 44 cut or formed in the respective air cylinders 15 and 36. The pins or trunnions engage in suitably positioned holes or eyes formed in the respective side members of an inverted U shaped yoke 45, such side members passing downwardly through the annular space between the air cylinders 15 and 36 and the inner face of the delivery pipe 10. The yoke 45 is also provided with a centrally positioned eye 45a by means of which it is shackled to the pump rod 27.

During the operation of the pump, air may collect in either of the sleeve pistons 26 and 28 and whilst it is essential to provide a means whereby such air may escape therefrom it is also necessary to ensure that air cannot be drawn from or water be forced into the air chambers 29 or 30. In order to meet this requirement a dual purpose valve which is believed to be novel has been devised. It consists of a disc 46 adapted to be screwed into an aperture in the head of a piston such as 26. The plate 46 is provided with a central hole 47 each end of which is shaped to form a valve seating, the upper one for a ball or other suitable valve 48 and the lower one for a ball or other float valve 49 both of such valves being retained in position by means of a cage 50 of known construction. By referring to Fig. 1 or 2 it will be seen that the valve 48 will only be opened by air being forced upwardly through the aperture 47 in the seating but it will be normally closed. The valve 49 however will be normally open and will close only when water rises in the sleeve piston to a height sufficient to float it onto its seating in the plate 46 where it will remain until pressure within the piston is released at the beginning of the suction stroke.

In order to provide for access to the pistons at a point adjacent to the packing rings when removed from the delivery pipe the air cylinders 15 and 36 may be made in two parts connected together by a socket or collar 51. It will of course be necessary to remove them from the delivery pipe 10 before this can be done.

To facilitate the removal of the delivery pipe 10 from the plate 11 the lower ends of the pipes 32 and 33 may not extend to the bottom of the annular space between the delivery pipe 10 and the air cylinder 15 and may be provided with a fixed collar 52 adapted to fit into a reducing socket 53 the larger end of which is cylindrical and is closed by screw cap or a disc 54 adapted to be screwed into the socket, the collar 52 coacting therewith to form a stuffing box to con-

tain a suitable packing **55** whereby a water and air tight joint may be made at those points. The extended screw threaded smaller end of the reducing socket passes slidably through a hole in the plate **11** and the projecting screw threaded end thereof provided with a nut and washer **56**. The length of the larger end of the socket is such that when the nut and washer **56** are removed the reducing socket may be slid upwardly on the pipe **32** (or **33**) until its lower end lies freely within the annular space between the delivery pipe **10** and the air cylinder **15** when the delivery pipe may be unscrewed and raised from the plate **11**.

I claim:

1. A pump for pumping water, oil or other liquids from wells and the like and comprising a pump cylinder concentrically within its associated delivery pipe and having its lower end fixed to and closed by a plate which forms a closure at the bottom of such delivery pipe, a sleeve piston coacting with the pump cylinder, an auxiliary cylinder in said delivery pipe above said pump cylinder, said auxiliary cylinder being closed at its lower end, and a coacting sleeve piston in said auxiliary cylinder, cylindrical housings enclosing the auxiliary and pump cylinders, means for connecting the sleeve pistons to one another and to a vertical driving rod, and means whereby the pressure of the head of water in the delivery pipe is constantly exerted upon the interior of the auxiliary sleeve piston.

2. A pump for pumping water, oil or other liquids from wells and the like as claimed in claim 1 and comprising an air chamber in the upper end of each cylindrical housing and in which the respective sleeve pistons reciprocate, means for constantly maintaining atmospheric pressure within the air chambers and valves to permit air only to be ejected from the pump and auxiliary cylinders into the respective air chambers and said valves preventing the passage through them of water or air into said cylinders.

3. A pump for pumping water, oil or other liquids from wells and the like as claimed in claim 1 and comprising longitudinal slots in the lower portion of each cylindrical housing, a yoke connected to each of the sleeve pistons and to the vertical driving rod, and oppositely positioned apertures in the lower portion of the auxiliary cylinder and its cylindrical housing to establish internal communication between the delivery pipe and the auxiliary cylinder.

4. A pump for pumping water, oil or other liquids from wells and the like as claimed in claim 1 and comprising packing rings between the outer faces of the sleeve pistons and the internal faces of the respective cylindrical housings and closures at the upper end of each cylindrical housing for forming air chambers in which the respective sleeve pistons may reciprocate.

5. A pump for pumping water, oil or other liquids from wells and the like as claimed in claim 1 and comprising passages in the closure at the bottom of the delivery pipe establishing internal communication, through slots in the cylindrical housing, between the pump cylinder and the delivery pipe, and an annular valve adapted to close at the end of each delivery stroke of the pump.

6. A pump for pumping water, oil or other liquids from wells and the like as claimed in claim 1 and comprising a central boss on the underside of the plate that closes the lower end of the delivery pipe, a central hole in the plate and boss, a valve seating and valve at the upper end of said hole, and means for connecting the boss to a suction pipe.

7. A pump for pumping water, oil or other liquids from wells and the like as claimed in claim 1 and comprising oppositely positioned radial studs near the bottom of the sleeve pistons, longitudinal slots in the lower portion of the cylindrical housings, and through which the studs project into an annular space between the delivery pipe and the cylindrical housings, and a yoke connected to the studs and to a vertical driving rod that passes upwardly through the delivery pipe.

8. A pump for pumping water, oil or other liquids from wells and the like as claimed in claim 1 and comprising a central hole in the head of each sleeve piston, a disc screwed into each hole, a central vertical hole in the disc, each end of the hole terminating in a valve seating, a valve normally seated upon the upper valve seating, and a float valve normally supported adjacent to the valve seating on the underside of the disc by a cage secured to the disc.

9. A pump for pumping water, oil or other liquids from wells and the like as claimed in claim 1 and comprising a closure at the upper end of each cylindrical housing and packing means between the outer faces of the sleeve pistons and the inner faces of the respective cylindrical housings to form air chambers, holes in the walls of the cylindrical housings, a pipe connected to each hole and passing downwardly through an annular space between the inner faces of the delivery pipe and the cylindrical housing therein, through a hole in the plate that closes the lower end of the delivery pipe and thence to atmosphere, and a water tight joint at the point where the pipe passes through the plate.

LEOPOLD JULIUS LE FEVRE.