Jan. 2, 1940. E. S. EMMONS 2,185,727

HYDRAULIC PUMP

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FIG. 1.

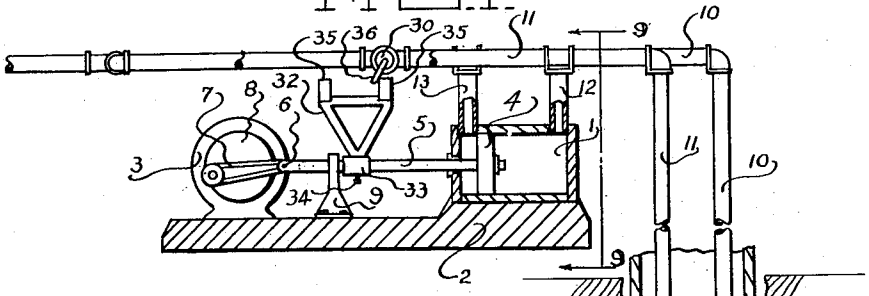


FIG. 2.

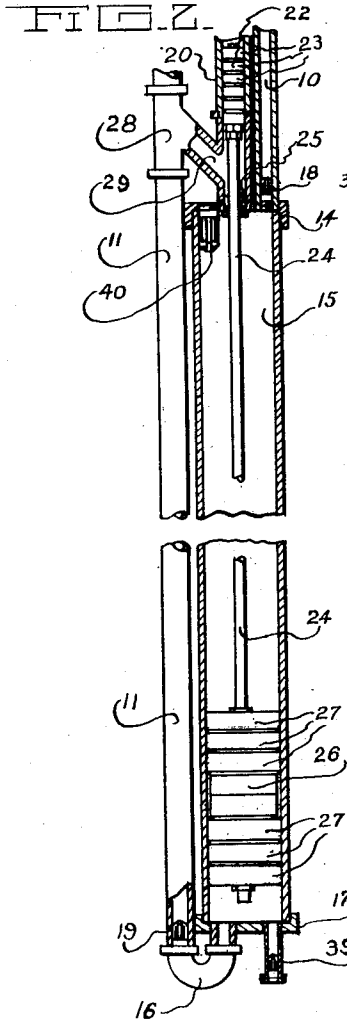
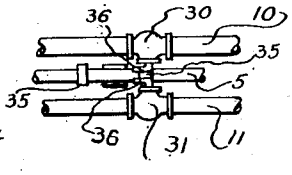


FIG. 3.



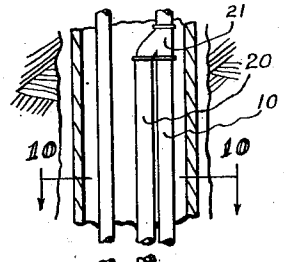
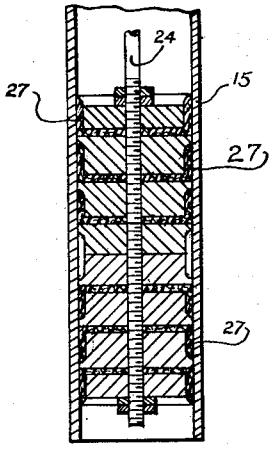
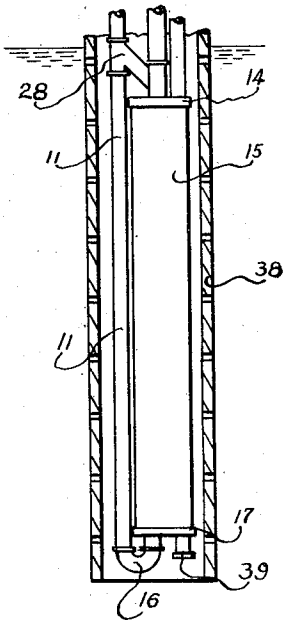


FIG. 4.





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FIG. 5.

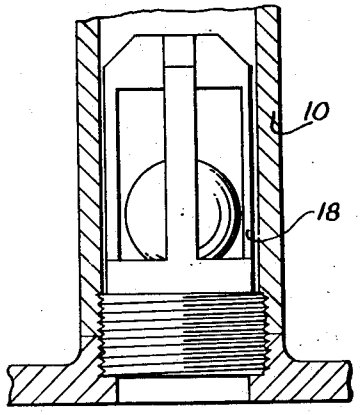


FIG. 7.

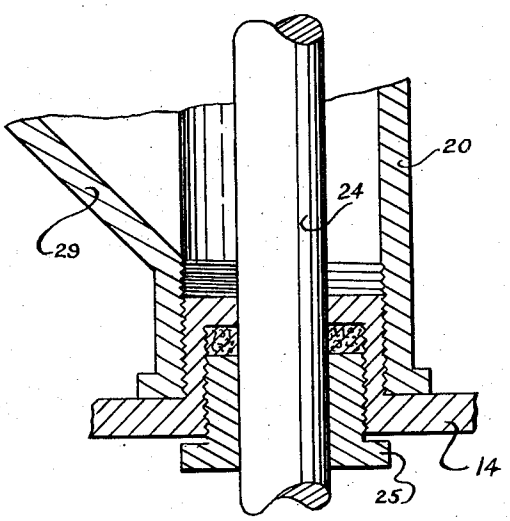


FIG. 6.

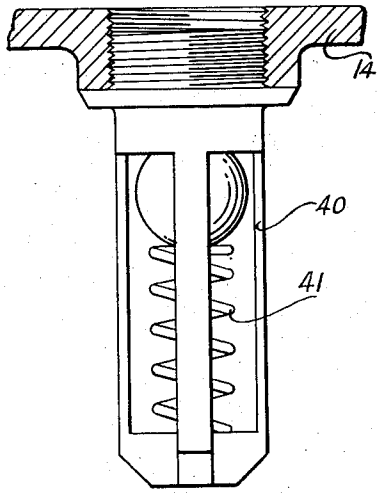
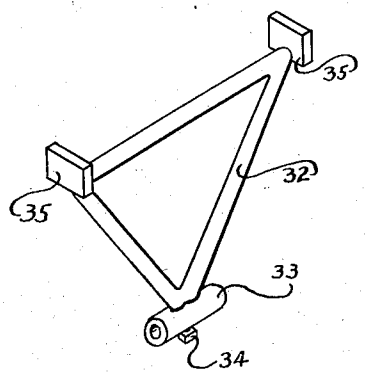


FIG. 8.



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FIG. 11.

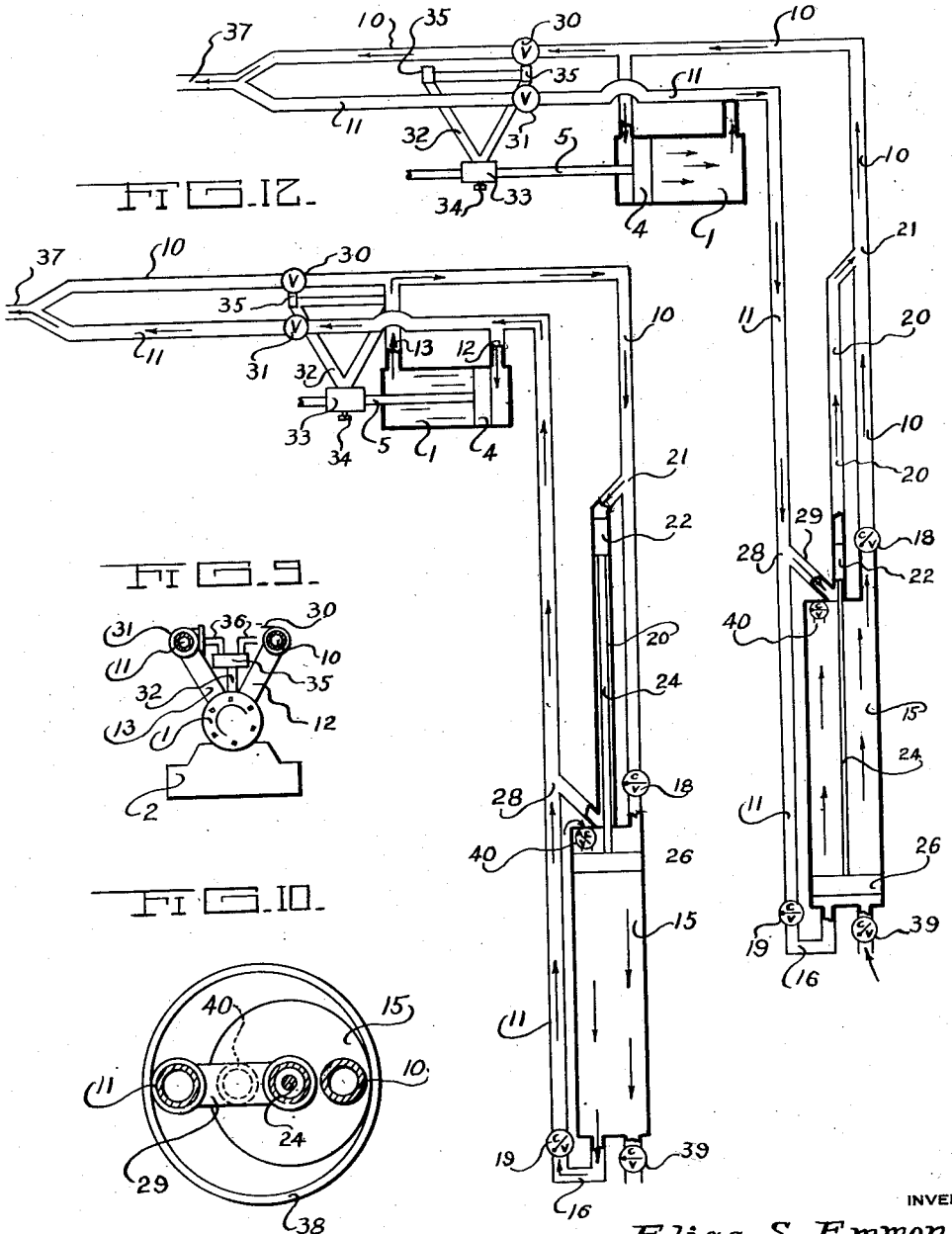


FIG. 12.

FIG. 9.

FIG. 10.

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UNITED STATES PATENT OFFICE

2,185,727

HYDRAULIC PUMP

Elias S. Emmons, Fort Worth, Tex., assignor to P. B. Barnett and J. E. Ashenfelder

Application August 3, 1936, Serial No. 94,065

1 Claim. (Cl. 103—44)

This invention relates to hydraulic pumps for oil, water, and the like, and it has particular reference to a type of pump wherein the fluid is lifted to the earth's surface by hydraulic pressure and its principal object resides in the provision of a novel arrangement of parts affording an economical means of raising liquid from an oil, or water well by forcing a portion of the said liquid back into the well providing a hydraulic lift for reciprocating plungers arranged beneath the surface of the said fluid.

Another object of the invention resides in the provision of a device of the character described comprising an arrangement of elements which can be lowered into an oil well casing of conventional type and caused to function to provide a continuous flow of the fluid therefrom and thus eliminating much of the attendant cost of producing oil by conventional methods which consists in the use of pump jacks, sucker rods, and other equipment, and whose efficiency is comparatively minimized due to the necessity for the provision of a long string of sucker rods and power equipment required to operate the latter.

Broadly, the invention seeks to comprehend the provision of a pump or lift whereby the equipment required to accomplish the desired results comprises only a portion of that ordinarily found necessary to lift such fluids yet affords an assembly whose original cost and maintenance is greatly minimized since few working parts are required for its efficient operation.

While the foregoing objects are paramount other and lesser objects will become manifest as the description proceeds taken in connection with the appended drawings wherein:

Figure 1 is a side elevational view of the operating equipment at the earth's surface and a cross section of a well showing the equipment assembled therein.

Figure 2 is a cross sectional view of the upper and lower plungers illustrating the arrangement of check valves, by-passes, and the like.

Figure 3 is a fragmentary plan view of the valve operating mechanism illustrated in Figure 1.

Figure 4 is an enlarged cross sectional view of the lower plunger illustrated in Figure 2.

Figure 5 is a cross sectional view of one form of check valve utilized in the invention.

Figure 6 illustrates another form of check valve.

Figure 7 is a detailed cross sectional illustration of a stuffing box for a rod connecting the upper and lower plungers.

Figure 8 is a perspective illustration of a valve actuating device.

Figure 9 is an end view of the pumping apparatus and a valve arrangement taken on lines 9—9 of Figure 1.

Figure 10 is a lateral cross section taken on lines 10—10 of Figure 1.

Figure 11 is a diagrammatic illustration of the entire pump assembly illustrating, by arrows, the direction of the flow of the liquid when the piston in the upper cylinder is in one position, and

Figure 12 is a diagrammatic illustration showing, by arrows, the flow of the liquid when the piston in the upper cylinder is in the opposite position to that shown in Figure 11.

Primarily, therefore, the invention comprises a cylinder 1 which is supported by a base 2 upon which is also supported a motor or other power unit 3, as shown in Figure 1. A piston 4 is operatively disposed within the cylinder 1 and is reciprocated therein through the medium of a rod 5 whose opposite end is pivotally connected at 6 to pitman 7 concentrically attached to a drive wheel 8 which is mounted upon the main shaft of the motor 3. The piston rod 5 is supported by a bearing 9 which is secured to the base 2 intermediate the motor 3 and the cylinder 1.

A pair of pipes or tubes 10 and 11 are provided and the pipe 10 communicates with one end of the cylinder 1 through a connection 12, while the pipe 11 is connected into the said cylinder 1, and connection 13, as illustrated in Figure 1, and the piston 4 in the said cylinder operates between the two communications 12 and 13 thus providing an alternate intake and discharge medium as the piston 4 operates within the cylinder 1, as illustrated in Figures 11 and 12.

The tubes or pipes 10 and 11 extend downwardly into the well, as shown in Figures 1, 11 and 12, and the pipe 10 terminates within the cap 14 of the larger and lowermost pump cylinder 15 situated in the lower portion of the well and beneath the fluid level. The pipe 11 extends downwardly alongside the cylinder 15 and communicates with the lower end of the cylinder 15 through a return bend 16 which is threaded into the lower cap 17 of the cylinder 15, as illustrated in Figures 1 and 2. A conventional ball check valve 18 is secured within the lowermost end of the pipe 10 where the latter enters the cap 14 of the cylinder 15, as shown in Figure 2, and the pipe 11 is also provided with a similar check valve 19.

Threaded into the cap 14 of the cylinder 15 is a smaller cylinder 20 whose uppermost end is threaded into a Y-branch 21 connected into the

pipe 10, as shown in Figures 1, 11 and 12, which branch affords a communication between the top of the cylinder 20 and the pipe 10. A plunger 22, provided with a series of cups 23, is operatively arranged within the cylinder 20 and is provided with a rod 24 which extends downwardly through a packing gland 25 in the cap 14 of the cylinder 15. The lowermost end of the rod 24 is connected to the upper end of a larger plunger 26 operating within the cylinder 15 and which piston is also provided with a series of cups 27. It is desirable to arrange a portion of the cups 23 and 27 on the plungers 22 and 26 in opposite directions, that is, to arrange some of the cups on these elements in such a manner as to be directed downwardly while others are directed upward'y in order to provide efficient operation of these elements in either direction. This arrangement is illustrated more in detail in Figure 4 and is conventional in its scope. A Y-bend 28 is also provided on the pipe 11 which affords a communication 29 with the lowermost end of the cylinder 20 upon the cap 14 of the cylinder 15, as shown in Figure 2.

Each of the pipes 10 and 11 are provided with valves 30 and 31 at the earth's surface, as shown in Figures 1 and 3, and each are alternately opened and closed by a reciprocating member 32 which is adjustably attached at 33 to the piston rod 5 of the piston 4. The integral sleeve 33 of the member 32 is adapted to surround the rod 5 and be secured thereto, when properly adjusted, by a set screw 34, or the like. As the rod 5 operates, therefore, in its reciprocating movement the lugs 35 on each end of the member 32 engage the arms 36 of the valves 30 and 31, as shown in Figure 3 to open and close the same.

Since the valves 30 and 31 are opposingly arranged, each engagement of the lugs 35 with the arms 36 thereof will open one of the said valves and close the other thereby allowing the fluid to flow through the said pipes 10 and 11 alternately, as shown by the arrows in Figures 11 and 12. It will be noted by reference to Figures 11 and 12 that the pipes 10 and 11 communicate with a common outlet 37 for the fluid circulated alternately through the pipes 10 and 11 in the course of the operation of the device, as illustrated by the arrows in Figures 11 and 12.

While the device herein described is illustrated within an oil well casing 38, it is equally advantageous to utilize the same beneath any liquid surface, such as a dug well, a lake, or any body of water having a sufficient depth to permit this assembly to be submerged therein for efficient operation. It is considered desirable, however, to adapt the device to use for the production of petroleum from oil wells by reason of the fact that same is both efficient and economical in its operation.

In operation, therefore, the motor or engine 3 operates the piston 4 within the cylinder 1 forwardly of the cylinder 1 from the position shown in Figure 1 expelling the fluid from the latter through the pipe 11, as shown by the arrows in Figure 11, downwardly through the communication 29 into the lowermost end of the cylinder 20 and beneath the plunger 22 operating therein urging the latter upwardly. By reason of the connection through the rod 24 between the plunger 22 and the plunger 26 in the lower cylinder 15, the action of the liquid pressure through the pipe 11 and against the lower end of the plunger 22 will operate the plunger 26 upwardly in the cylinder 15 expressing the liquid therefrom through the check valve 18, the pipe 10, the valve 30, and outwardly through the common discharge or outlet 37.

As the liquid in the chamber 15 is forced upwardly through the pipe 10, in the manner just described, a portion of the same is drawn into the cylinder 1 through the communication 13, which connects the pipe 10 with the cylinder 1, in the manner shown in the diagrammatic illustration in Figure 11, the arrows indicating the direction the flow of the liquid as the piston 4 is moved forwardly in the cylinder 1 to express the liquid therefrom through the communication 12 into the pipe 11.

It is pointed out that the capacity of the cylinder 1 will equal that of the cylinder 20 since it is necessary to displace all of the liquid contained in the cylinder 1 into the cylinder 20 upon the movement of the piston 4 in the said cylinder 1. Likewise, the length of the cylinder 20 and the cylinder 15 are the same in order that a coordinate movement of the plungers 22 and 26 will result.

The upward movement of the plunger 26 in the cylinder 15 will draw a fresh supply of fluid into the cylinder 15 through a check valve 39 in the cap 17 secured to the lowermost end of the cylinder 15. The action of the liquid is shown clearly by the arrows in Figure 11.

As the piston 4 is drawn in the opposite direction in the cylinder 1 on its return stroke, as illustrated by the arrows in Figure 12, liquid in the cylinder 1 is expelled through the communication 13 in the opposite end thereof into the pipe 10 and downwardly through the Y-branch 21 into the top of the cylinder 20 urging the plunger 22 downwardly therein and moving the plunger 26 to the lowermost end of the cylinder 15 expressing the fluid from the latter through the return bend 16 and the check valve 19 upwardly through the pipe 11 and the valve 31 and thence out through the common outlet 37, as illustrated in Figure 2. As the plunger 26 is drawn upwardly in the cylinder 15 the fluid is drawn into the latter through the check valve 39, the check valve 19 being closed during this operation and as the plunger 26 is urged downwardly in the cylinder 15 the fluid is drawn into the latter through the check valve 40 arranged in the cap 14 and which is urged in its closed position by a spring 41. This valve is shown in detail in Figure 6.

Particular attention is directed to Figures 11 and 12 wherein is shown by arrows the direction of flow of the liquid through the entire arrangement of the pipes 10 and 11 and the cylinders 15 and 20. It will be noted that there is full reciprocating action of the piston 4 and the two plungers 22 and 26 which lifts the liquid to the earth's surface on each movement in either direction. This is accomplished through the medium of the arrangement of valves 30 and 31 as well as the check valves previously described. Thus, by forcing the liquid downwardly through the pipe 11 and into the cylinder 20 beneath the plunger 22 and urging the latter upwardly therein it is possible to raise the plunger 26 in the cylinder 15 causing the liquid therein to be expelled through the pipe 10 and, upon reversing the flow of liquid through the pipe 10 downwardly into the top of the cylinder 20 urging the plunger 22 to a lowermost position and consequently the plunger 26 to its lowermost position in the cylinder 15, the liquid therein contained is forced upwardly through the pipe 11

and out through the discharge pipe 37, the check valves 19 and 39 functioning to cause the fluid in the cylinder 15 to be by-passed through the return bend 16 secured in the cap 17 of the cylinder 15.

Although the invention has been described with great particularity, certain changes and modifications may be resorted to from time to time by those skilled in the art and such changes and modifications as may be considered within the spirit and intent of the invention may also be considered as falling within the scope of the appended claim.

What is claimed is:

A hydraulic pump comprising a surface cylinder, a piston within the surface cylinder, a piston rod attached to the said piston and extending through one end of the said piston through the medium of the said rod, a pair of tubes, one of which communicates with one end of the said surface cylinder through a pipe connection, whereas the other tube communicates with the other end of the said cylinder through another pipe connection, valves in the said tubes positioned within the proximity of the said piston rod, means attached to the said piston rod alternately actuating the said valves, a pair of subsurface cylinders arranged in axial alignment with respect to each other, pistons within each of the said subsurface cylinders, a cap providing a partition between the said subsurface cylinders, a piston rod attached to the subsurface pistons and through said cap, branched communications connecting corresponding ends of the said subsurface cylinders with each of the said surface tubes, check valves positioned within the branched communications between the connections with the said subsurface cylinders, an inlet check valve within the said cap and one of the said subsurface cylinders, and another inlet check valve within the other end of the last named cylinder.

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