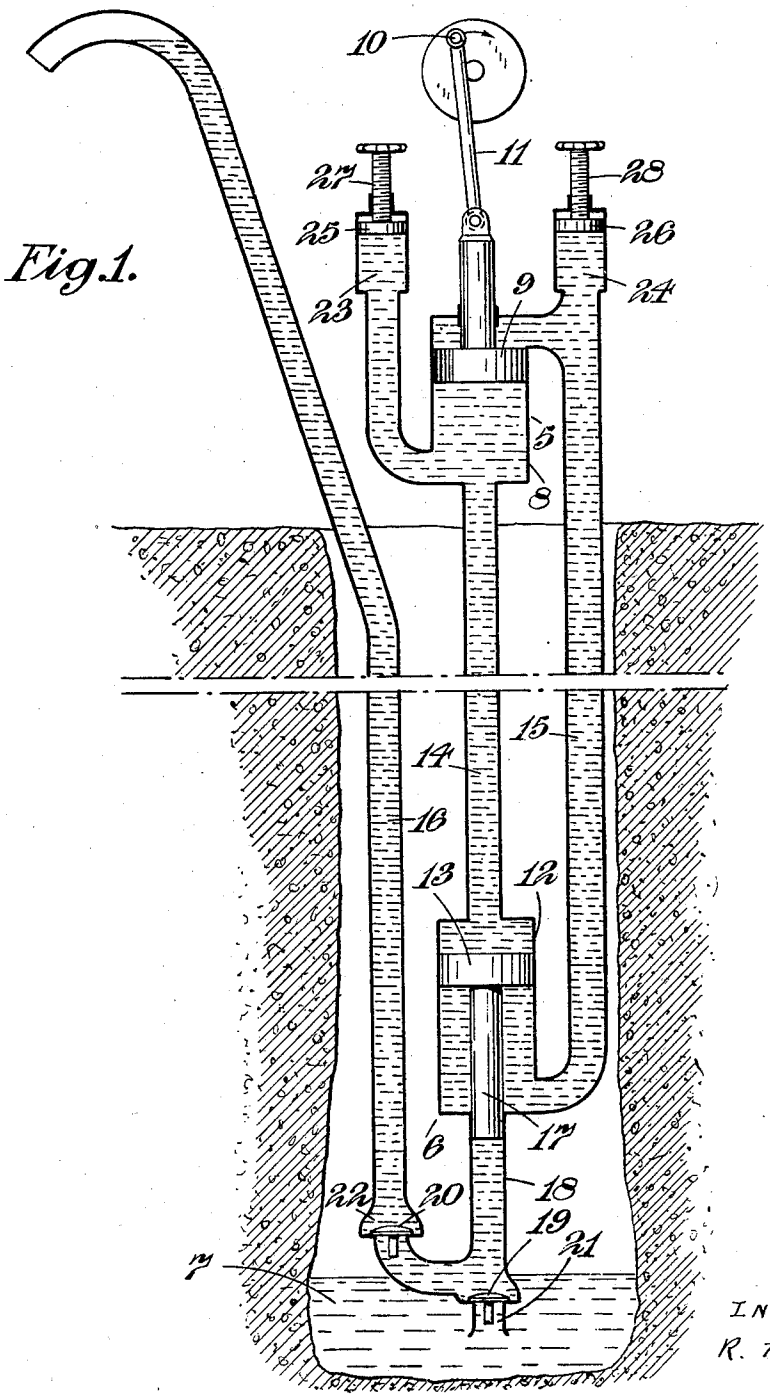
Dec. 6, 1949 R. H. DICKINSON 2,490,118

PUMP

Filed July 19, 1946 2 Sheets-Sheet 1

Fig. 1.



INVENTOR
R. H. Dickinson

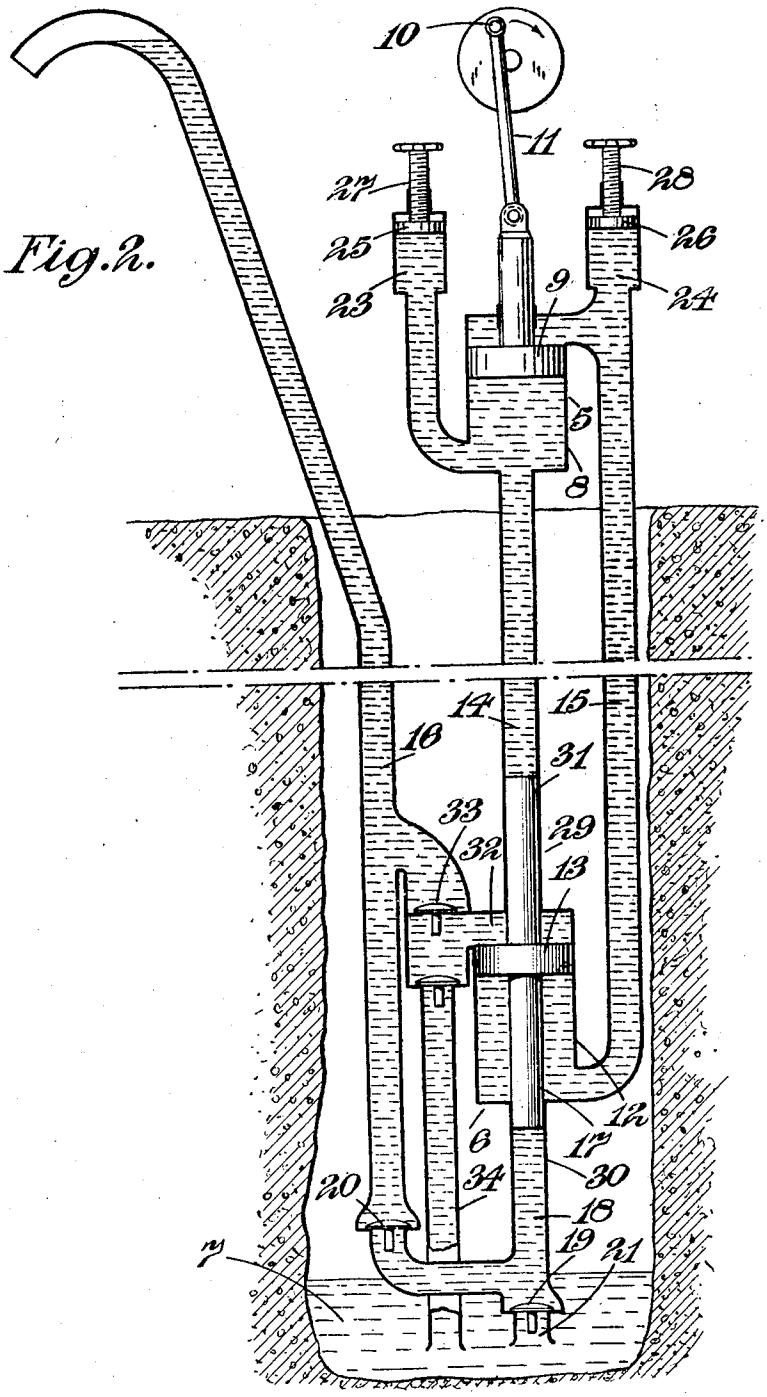
By Watson, Cole, Grindle + Watson

Dec. 6, 1949 R. H. DICKINSON 2,490,118

PUMP

Filed July 19, 1946 2 Sheets-Sheet 2

Fig. 2.



INVENTOR
R. H. Dickinson
By Watson, Cole, Grindle & Watson

Patented Dec. 6, 1949 2,490,118

UNITED STATES PATENT OFFICE

2,490,118

PUMP

Richard Harland Dickinson, Old Windsor, England, assignor to Hygroequipments Limited, London, England, a British company

Application July 19, 1946, Serial No. 684,888
In Great Britain July 23, 1945

2 Claims. (Cl. 103—44)

1

This invention concerns improvements in pumps for fluids and particularly for raising liquids from deep levels, and has for its object to provide an improved construction and arrangement which is simple in construction, reliable in operation, and requires the minimum number and weight of reciprocating parts.

Specific embodiments of the present invention will now be described, by way of example, with reference to the accompanying drawing whereof—

Figure 1 is a diagrammatic view of a deep-lift pump of the single-acting type constructed to embody features of this invention, and

Figure 2 is a similar view to Figure 1 showing the invention applied to a double-acting pump.

Referring to Figure 1; the pump comprises a driving unit generally indicated by the reference numeral 5 and a pump unit indicated at 6. The driving unit is power-driven and is situated at, say, ground level whilst the pump unit is located at the low level from which the liquid 7 is to be pumped.

The driving unit 5 comprises a simple cylinder 8 and a piston 9 which is driven by any convenient prime mover, for example through the agency of a crank-pin 10 and connecting-rod 11.

The pump unit 6 also comprises a cylinder 12 and piston 13 and the cylinders of the pump unit and driving unit are placed in communication by a pair of pipe-lines 14 and 15. The latter extend respectively one from each end of the cylinders 8 and 12 with which they are in permanent open communication. A third pipe-line 16 constituting the delivery pipe of the pump is also provided from the pump unit 6 to the high level at which the liquid is to be delivered. The pipe-lines 14, 15 and 16 constitute the only structural connection between the upper driving unit 5 and the lower pump unit 6, drive from the former to the latter being transmitted hydraulically so that no mechanical moving parts extending over the whole depth of the lift are required.

The piston 13 of the pump unit 6 has formed integrally with it a pump plunger 17 which is adapted for reciprocation in a pump barrel 18. The latter communicates with the delivery pipe-line 16, suitable non-return valves 19, 20 being respectively provided at the suction and delivery ports 21, 22.

It will be noted from Figure 1 that the pump plunger 17 is made of smaller diameter than the piston 13 and that it reciprocates in the pump barrel 18 which constitutes an extension of the cylinder 12. The pump plunger 17 and barrel 18 form a single-acting pump.

2

In the operation of the unit shown in Figure 1, the two pipe-lines 14, 15 are filled with water or other convenient liquid, and the two cylinders 8 and 12 are also filled. Assuming that the respective pistons 9 and 13 are at the upper ends of their strokes, downward movement of the driving piston 9 by the crank mechanism 10, 11 operates through the column of water in pipe-line 14 to force piston 13 downwards in cylinder 12. During this movement, the water in the cylinder 12 and beneath piston 13 is displaced upwards through the pipe-line 15 and fills the upper part of cylinder 8 as piston 9 descends. On the return stroke of the piston 9 the motion of the water in the two pipe-lines is reversed and a drive is imparted to the piston 13 in the opposite direction. The piston 13 thereby reciprocates the pump-plunger 17 giving alternate suction and delivery strokes thereto.

It may be found desirable to be able to adjust the effective volume of the pipe-lines 14, 15 in order to adjust the effective length of the connection between the two pistons 9, 13. To this end means as shown in Figure 1 may be provided: the means comprises extension pipes 23, 24 communicating respectively with the upper and lower ends of the cylinder 8 and plungers 25, 26 carried one within each extension pipe, the position of the plungers being adjustable by means of the screwed spindles 27, 28. If, for example when the piston 9 is at one end of its stroke, and the piston 13 has not reached the corresponding end of its stroke, the adjustment is effected by screwing in the adjusting plunger 25 or 26 of the pipe-line 14 or 15 which will force the piston 13 into a position corresponding to that of the piston 9.

If desired, an air cushion may be provided in each of the extensions 23, 24 of the pipe-lines 14, 15 to prevent hammer blow, and also safety relief-valves may be provided on the pipe-lines to prevent damage to them in the event of some obstruction preventing movement of the pump-plunger 17.

It is not necessary that the pump should be of the single-acting type as described with reference to Figure 1, and in a modified construction shown in Figure 2 the pump-unit 6 is constituted by a cylinder 12 in which a piston 13 is reciprocated, with extensions 29, 30 at either end of the cylinder. One of these extensions (29) receives a plunger 31, carried by the piston 13 and communicates with the hydraulic pipe-line 14 so that the pressure transmitted from the driving piston 9 operates on this plunger to move it in one direction. The annular space 32 around this plunger

constitutes one chamber of the pump, and an extension 17 on the piston 13 operating in a bore 18 of smaller size than the cylinder 12 constitutes the other chamber of the pump. The pipe-line 15 is connected to the cylinder 12 as shown; the pump-plunger is therefore operated in one direction by pressure acting on the plunger 31 and in the other direction by pressure acting on the annular space surrounding the extension 17 and acting on the lower face of piston 13. The two pump spaces 18 and 32 communicate through non-return valves 20 and 33 respectively with a single delivery pipe 16 up to the higher level and the pump space 32 connects with a suction pipe 34 which extends into the liquid 7 to be raised.

It will be seen from the above description that the only connection between the driving unit 5 at the upper level and the pump unit 6 at the lower level is constituted by three pipes, two of which (14, 15) are filled with liquid for transmitting a drive hydraulically from the upper unit to the lower unit, and the third of which (16) is the delivery pipe. These pipes may be arranged side-by-side in a suitable bore hole, or they may be nested one within the other as concentric pipes, or two of them may be located inside the third, such arrangements being useful when the diameter of the bore hole or the like is limited.

It will further be appreciated that since the two pipe-lines 14, 15 are both filled with liquid, and are of the same length, the pressure due to the static head of liquid on the two sides of the piston of the pump unit 6 is balanced, and there is no tendency for the working fluid to leak in either direction around said piston; also if these pipe-lines are filled with the liquid which is being pumped, any small leakage which may occur as between the pump chamber (18 or 18 and 32) and the cylinder 12 is immaterial, but such leakage is not likely to occur since on the delivery stroke of the pump the pressures are substantially balanced in the two chambers when the open end of the delivery pipe is at about the same level as the driving unit.

In another embodiment of the invention the driving unit comprises a pair of piston and cylinder assemblies, the pistons being reciprocated as described and in synchronism whilst one driving cylinder is connected to one end of the cylinder of the pump unit and the other driving cylinder

is connected to the other end of the pump-unit cylinder. In each of the embodiments described the piston of the pump unit may be moved in one direction hydraulically by the driving unit and be moved in the opposite direction by spring means acting on said piston.

It will be seen that this invention provides a very simple form of pump in which the number of moving parts is reduced to a minimum, and which is easily installed in a shaft, or in a bore hole since no moving parts extend from the operating motor at the top to the pump-plunger at the bottom.

I claim:

1. A deep lift pump comprising a first cylinder and piston contained therein, a pair of oppositely disposed coaxial plungers directly connected to the piston and contained in cylindrical extensions of the cylinder, a second piston and cylinder device, a pair of pipe lines connecting one end of said second cylinder to one end of said first cylinder and the other end of said second cylinder to the cylindrical extension at the other end of said first cylinder, and means to vary the effective volume of each of the pipe lines for adjusting the mean position of the first piston.

2. A deep lift pump as claimed in claim 1, wherein the means to vary the effective volume of each of the pipe lines comprises, for each pipe line, a container in open communication therewith, a plunger carried within the container and means for adjusting the position of said plunger within the container to vary its volume.

RICHARD HARLAND DICKINSON.

REFERENCES CITED

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

UNITED STATES PATENTS

Number	Name	Date
251,593	Jamieson	Dec. 27, 1881
1,304,411	Tobin	May 20, 1919
2,127,168	Grant	Aug. 16, 1938
2,162,748	Richards et al.	June 20, 1939

FOREIGN PATENTS

Number	Country	Date
555,357	Germany	1932