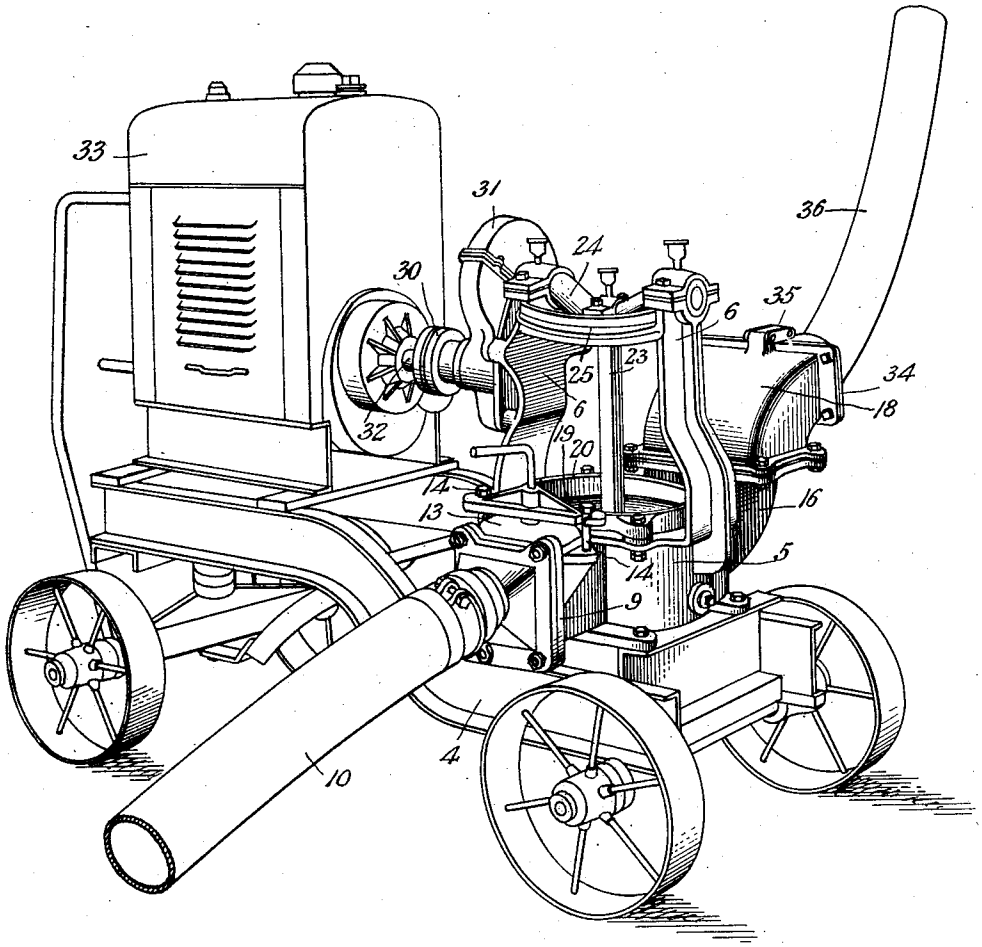
Dec. 20, 1932. J. C. GORMAN 1,891,408

DIAPHRAGM CONVERTIBLE PUMP

Filed July 8, 1931 2 Sheets-Sheet 1

Fig.1.



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Filed July 8, 1931 2 Sheets-Sheet 2

Fig. 2.

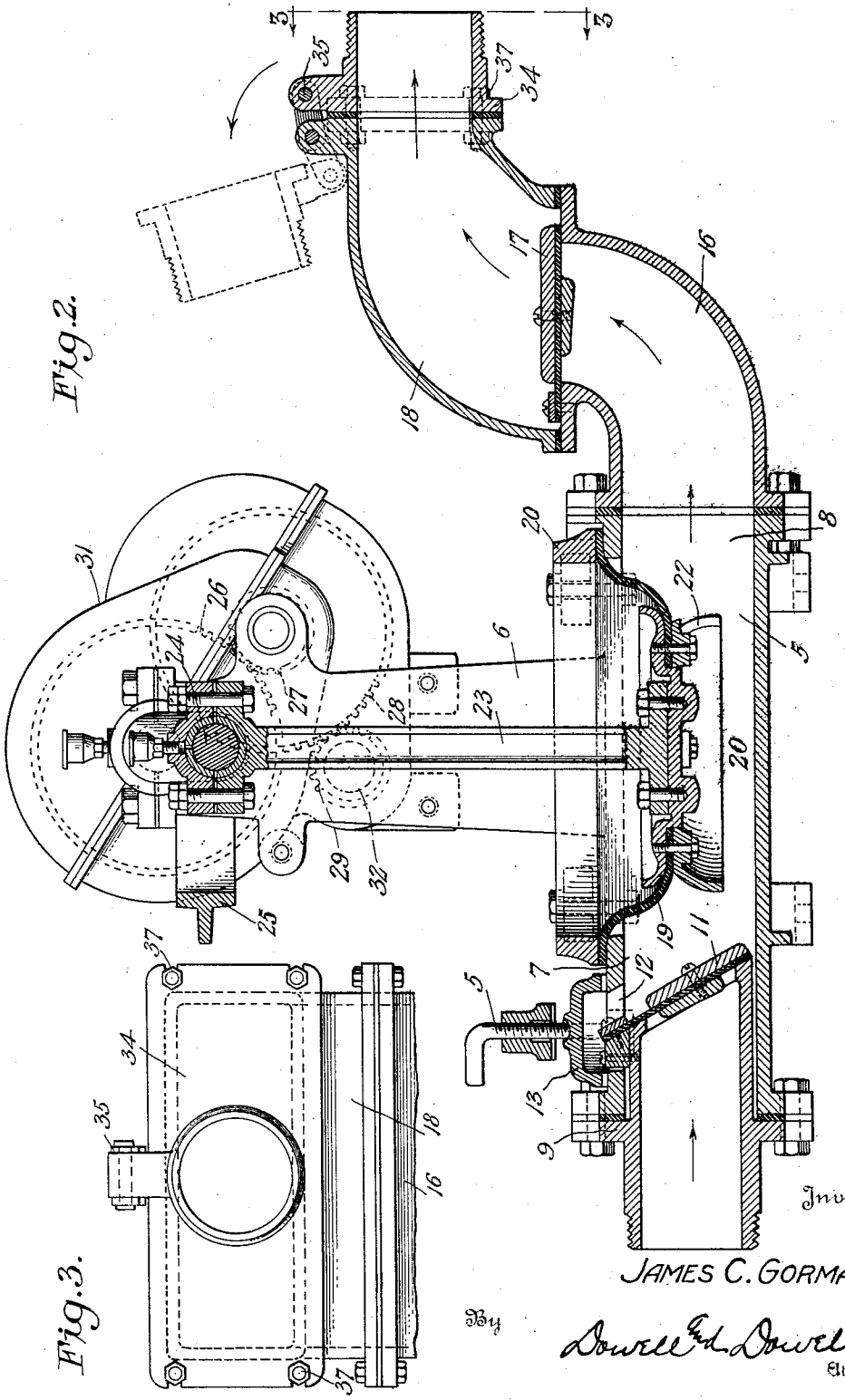


Fig. 3.

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UNITED STATES PATENT OFFICE

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DIAPHRAGM CONVERTIBLE PUMP

Application filed July 8, 1931. Serial No. 549,547.

This invention relates to suction diaphragm pumps, more especially of the closed type used for drainage purposes, and aims to provide an improved heavy-duty pump convertible from open-discharge to force-lift operation and vice versa by a very simple expedient of mere adjustment.

Drainage pumps suitable for various construction and engineering projects must not only have a large water capacity, but be capable of handling or passing considerable mud and solid material without liability of fouling or breakage. Simplicity is a prime requisite in addition to sturdiness and durability under hard constant usage. There are two distinctly different forms in which such pumps are generally made, one being the open-spout discharge form for use where the drainage is to be spilled out at the pump and the other being the coupled-conduit discharge form for use where the drainage must be forced away and usually up to a distant point. Neither serves the purpose of the other and as it is desirable to eliminate the necessity of having both forms for the different operative requirements, several pumps adapted to conversion from one to the other form or operative result have been devised. These however have required special equipment and bothersome alterations which along with structural inadaptabilities render them not altogether satisfactory. The present invention is intended to provide a pump easily and ideally adaptable to either form or mode of operation.

It will be best understood by further description with reference to the appended drawings illustrating one practicable and very simple embodiment thereof.

In said drawings:—

Fig. 1 is a perspective view of the machine as placed in position for operation;

Fig. 2 is a vertical sectional elevation of the pump proper on enlarged scale showing the various structural features; and

Fig. 3 is a front elevation of a movable part serving to convert the pump instantly from open-discharge to force-lift operation, said view being taken on the line 3—3 of Fig. 2.

The illustrative pump including a suitable power plant is portably mounted on a drop-frame truck 4 so as to be as low as possible to the drainage level. It embodies a casing 5 of bowl-like form open at the upper end, into which the operating plunger extends from above. Bracket members 6 at opposite sides and desirably integral therewith provide journalling support for the crank-shaft as later described. Said casing has a liberally wide inlet passage 7 and a like outlet passage 8 formed opposite one another to provide a direct water channel therethrough, the outlet passage being directed upwardly to dispose its port with controlling valve above that of the inlet passage for a purpose to hereinafter appear.

The inlet passage is capped by a plate-member 9 bolted to the casing and having a threaded nipple for connection of a hose 10 through which the water to be drained from an excavation is drawn up by pump suction. Said member in this instance has a hollow body portion fitting into the passage with its end providing the seat for a closure-valve 11 disposed at fifteen or more degrees inclination to the horizontal and opening inwardly. The seat for this valve obviously may be otherwise formed as in the walls of the passage, but the described arrangement is considered more advantageous.

Said inlet controlling valve is of the "flap" type comprising a flexible sheet piece fastened at the top to the aforesaid portion of the plate and weighted by metal washers on both sides for gravity closing. It yields of course to the inflow of water and such mud or solid material as may be drawn therewith by suction of the pump on upward stroke of the plunger, but seats to close the intake port on down stroke of the plunger to eject a charge. Its gravity closing and pressure to seat is aided not only by its inclination but also by the liquid in the pump casing during the discharge stroke.

Access to this valve for replacement when necessary is afforded through an opening 12 in the intake passage, which is normally closed by a cover-plate 13 held down by side clamp-bolts 14 and also by a central tensioning screw 15 as shown in Fig. 1.

The outlet passage is directed upwardly in this instance by a bend coupling 16 bolted to the casing and terminating in a seat for a closure valve 17 disposed horizontally above the level of the inlet passage. This outlet controlling valve is similar to the aforesaid inlet valve and operates correspondingly in the same direction, being fastened to the end of the aforesaid coupling adjacent its seat as shown. It lifts of course with the flow of water expelled from the pump casing on down stroke of the plunger but effectually closes the port against indraft of air with suction on upward stroke of the plunger. Its gravity closing and pressure to seat is aided by water bearing against its outer side as a small quantity is retained thereabove to do as next described.

To said coupling is connected a spout-member 18 bending in opposite direction and therewith forming an S-shaped extension of the outlet passage. This member provides a trap space around the aforesaid outlet valve to hold a small quantity of the discharge water thereabove for more effectual sealing against air intake as before stated. Most of the water of course expels out through the member as the plunger forces it with down stroke. Further description with reference to said member will be given later.

It may here be stated that gaskets are applied between parts or connections where leakage is otherwise likely to occur, such being represented but not specifically mentioned at the different points because the need therefor is obvious and well understood.

In the opening at top of the pump casing, a flexed diaphragm 19 works up and down with plunger action. This diaphragm is clamped over said opening by a ring 20 around the edge secured by bolting to the casing, such arrangement being most advantageous in affording easy removal and replacement without necessity of dismantling or disturbing other parts of the pump. Its center is clamped between outer and inner plates comprising the plunger 21 giving it movement and which relieves strain thereon by transmitting the opposite stroke forces uniformly. As thus applied, the diaphragm lasts longer than in the ordinary diaphragm pump because none of the water is discharged through it and gravel or silt from the water accordingly have no chance to settle with a cutting action in its fold. Wear however is unavoidable and when replacement becomes necessary, it is unclamped from the plunger by removing the bolts shown holding the two plate parts of the latter together, these being disposed conveniently to wrench appliance like those of the outer clamping ring.

The inner plate part of the aforesaid plunger is cut out or recessed at the discharge side as represented at 22 to allow free expulsion of any solid material along with the water drawn into the casing and so assure clear or unfouled passage through the pump. The wall of the plate at the inlet side of course gives greater force to expulsion as the plunger moves downward since it prevents backwash.

The plunger is rigidly attached by bolting to the end of an actuating rod 23. The latter connects with the throw of a crank-shaft 24, which is journaled above in bearings provided on the ends of the aforementioned bracket members (6) at the pump casing's sides. An arcuate tie-brace 25 between these members serves to steady and hold them in alignment but might be omitted if the members are more heavily cast as may be preferred in some cases and the shaft mounting is of course largely a matter of choice.

Said crank-shaft carries a gear 26 forming part of a reduction gear train shown comprising intermediate jointly rotated gears 27 and 28 driven by pinion 29 on a stub-shaft having flexible coupling 30 with the drive shaft of the power plant. The several gears of this train which need not be described in greater detail, are enclosed in a casing 31 at the pump side. The drive shaft with which said coupling is made in this instance comprises the crank-shaft 32 of an internal combustion engine 33, although some other power or driving means might of course be used.

Reverting now to the aforedescribed spout member (18), a capping plate 34 therefor is attached by a pivoted link or hinge connection 35 so as to swing against or away from its end. This plate is formed with a threaded nipple for coupling of a hose 36 for conducting the discharge to a point away from and also above the pump. It is fastened over the spout-member's mouth by two or more bolts 37 preferably secured therein so as not to drop out when unfastened and swung free. In the full line position shown, the plate adapts the pump to force-lift discharge operation, but when swung to the dotted line position uncovering the spout, it adapts the pump to open discharge operation and so converts the same from one to the other of the two described forms by the simple expedient of adjusting to either position. The only tool required for the conversion is a wrench to fasten or unfasten the bolts. It is accordingly not only simple but most convenient in accomplishing the intended purpose.

The pump thus constructed and convertible is capable of handling anything that will flow through the intake hose, which is usually of the standard four-inch size. The arrangement of the intake and exhaust valves opposite one another and at different levels and inclinations promotes a very strong suction force of the pump and renders it more efficient in operation than other known forms. It is also proof against fouling with mud and other material drawn thereinto with the

water, the recessing of the plunger part assuring clear-out with each down stroke. When operating in open spout discharge, the described pump has a capacity of thirteen thousand gallons per hour on low lift and will work efficiently up to a total lift of twenty-five feet, at which its maximum capacity is six thousand gallons per hour. When operating in force-lift discharge it is capable of pumping under any head up to thirty-five feet and at this maximum head has a capacity of five thousand gallons per hour. A duplex construction on the same principles would of course have a much higher capacity.

As various modifications with changes in form and arrangement of parts may be made without departing from the scope of the invention, the appended claims are not intended to limit the same to the specific construction shown.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. A pump having a nozzle attachment with hose-coupling in swing connection with the pump discharge mouth adapted to convert the pump from open discharge to force-lift operation by simple adjustment from position free to position over said mouth without attachment or removal of any element.

2. A pump having an outlet valve above its intake, a discharge spout beyond and above said valve, and a nozzle member with hose-coupling in hinged connection with said spout; said member being adapted to swing over and away from the mouth of the spout with simple fastening in either position so as to convert the pump from force-lift to open discharge operation and vice versa without attaching, removing or adjusting any other part.

3. A pump having a discharge spout beyond its outlet valve and a capping-member hinged to said spout and adapted to swing fastening thereover in a closing position; said capping-member being formed with a threaded nipple for attachment of a hose and functioning to convert the pump from force-lift to open discharge or vice versa according to whether it is fastened over or swung away from the spout opening.

4. In a pump having a spout beyond the outlet valve, a hose attachment for converting the pump from open discharge to force-lift operation and vice versa, comprising a capping-member hinged to the spout so as to swing over its end and formed with a threaded nipple having a hose connection, and clamp bolts swiveled to swing into position holding said capping-member over the spout end.

5. A pump having coupling means including a hose in movable connection with the pump discharge conduit beyond the outlet valve for converting the same from an open discharge to a force-lift pump and vice versa by movement and simple adjustment of said coupling means from an open to a closed position without attaching or removing any element.

6. A pump having a coupling member with attached hose in swiveled connection with the pump discharge conduit beyond the outlet valve for converting the same from open discharge to force-lift operation and vice versa by swing and simple adjustment of said coupling member from an open to a closed position without attachment or removal of any element.

7. In a pump, a discharge conduit having a capping member with connected hose attached thereto beyond the pump outlet valve so as to swing from an opening to closing position over the conduit mouth and convert the pump from open discharge to force-lift operation and vice versa without attaching, adjusting or changing any other part.

8. A pump having an outlet valve and discharge mouth above the level of the pump intake provided with a capping member with attached hose in hinge connection with said mouth adapting the pump to be converted from force-lift to open-discharge operation and vice versa by simple adjustment of said member from an open to a closed position.

9. A diaphragm pump comprising an open-topped casing having a through passage providing the intake and discharge ports at different levels; one-way valves controlling said ports; a piston member extending through and connecting with a flexible diaphragm marginally clamped around the open-top edge of the casing, a spout connecting with the discharge port beyond and above the outlet valve; and a permanent attachment to said spout adapted to convert the pump from open discharge to force lift operation and vice versa; said attachment comprising a capping-plate hinged to the spout so as to swing over the end thereof and formed with a threaded nipple having a hose connection, together with bolts swiveled to swing into position clamping the plate in place.

10. In a pump, a nozzle plate with hose attachment in hinged connection with the pump discharge spout beyond the outlet valve adapted to swing and fastening over the spout so as to quickly convert the pump from open discharge to force lift operation and back again at will without any other appliance or change.

In testimony whereof I affix my signature.

JAMES C. GORMAN.