April 2, 1946. E. W. GUTSCH 2,397,483

PUMP

Original Filed July 21, 1941

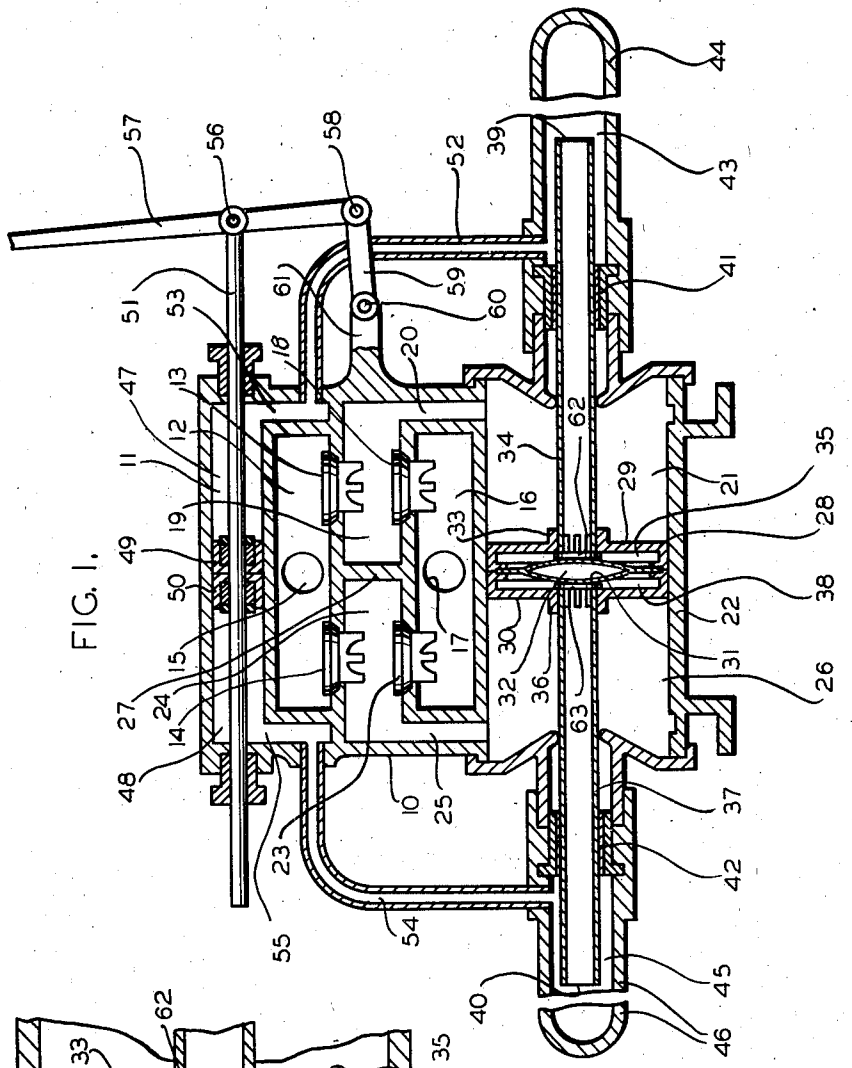


FIG. 1.

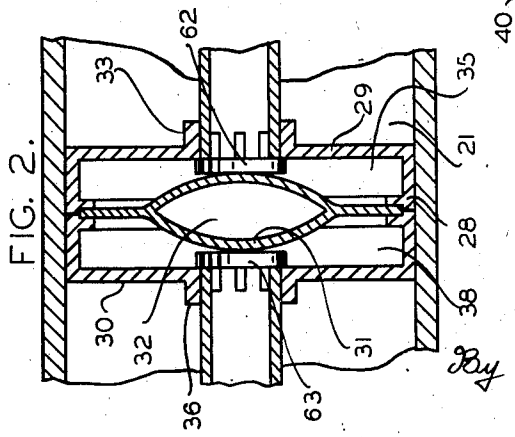


FIG. 2.

Inventor
ERNEST W. GUTSCH
By F. A. Whiteley
Attorney

Patented Apr. 2, 1946 2,397,483

UNITED STATES PATENT OFFICE

2,397,483

PUMP

Ernest W. Gutsch, Viroqua, Wis.

Original application July 21, 1941, Serial No. 403,287. Divided and this application January 21, 1944, Serial No. 519,229

6 Claims. (Cl. 103—44)

My invention relates to pumps, and has for its object to provide a pump structure having power means above the surface of the ground and the pumping means located either above or beneath the surface of the water and having operative contact between the power means and the pumping means through one or more columns of water.

In practice pumps, such as hand pumps, have provided a piston and cylinder located at some point from adjacent the power means at the top to a point even below the surface of the water, said piston being connected by a rod to the power means whereby the water is successively lifted by the power means, such as the down-stroke of an ordinary pump handle, to the point where it may discharge from the pump. In such constructions the pump proper must always be located below the point to which suction, that is pressure of the air upon the water translated through the pump connections to the vacuum point, can raise the water the requisite distance. In hand pumps where the water line is relatively close to the surface, the cylinder may therefore be in the pump body itself. Where the depth of the water becomes greater it may, as stated above, be located at any point down the well at sufficient depth to assure that air pressure added to the lift of the pump will raise the water.

Where the cylinder has to be at a considerable depth below ground, long connecting rods have to be employed with guides for enabling them to operate, resulting in frictional losses of power and mechanical difficulties caused by wear and injury to and mis-positioning of the connecting rods.

I have discovered that a pumping piston may be operated wholly by water pressure generated in a pressure cylinder with connections leading to the pumping cylinder such that the movement of a small amount of water applied to an enlarged surface of the pumping piston will produce a convenient and effective means of transmitting the power necessary to operate the pumping piston, thus eliminating connecting links, with the loss of energy through friction and maintenance which go with them, and with highly effective application of power to the pumping piston.

I have also discovered that exactly the same principle of operation may be effectively employed where the pumping arrangement and all its parts are entirely immersed in the water of the well.

It is a principal object of my invention, therefore, to provide a pumping means in association with a power means, said power means acting upon water in a pressure cylinder, in conjunction with means for conducting the water to the pumping piston in such a manner that the pressure may be applied over a piston area greatly in excess of the cross-sectional area of the conducting means.

It is a further object of my invention to provide a hollow pumping piston having a chamber formed therein and having a flexible diaphragm dividing the chamber into two parts with pairs of hollow guide rods and with valve means opening the passages therethrough into the chamber in the piston and of moving the columns of water alternately on opposite sides of the diaphragm to apply force to said chamber and the piston enclosing it.

It is a further object of my invention to provide the hollow piston with a flexible diaphragm dividing the space therein into two parts and having valves operable within the chamber on the inside of said piston on opposite sides of the diaphragm so that as the pressure column of water is applied alternately on either side of the piston to move it in either direction the other side of the piston will be blocked against movement of water through the piston.

It is a further object of my invention to provide a pumping piston having therein a chamber divided into two parts by a diaphragm in association with closure valves.

This application is a division of my co-pending application, Serial No. 403,287, filed July 21, 1941, which on January 25, 1944 issued as Patent No. 2,339,990.

The full objects and advantages of my invention will appear in connection with the detailed description thereof which will now be given as a part of this specification, and the novel features by means of which the above noted advantageous results are obtained will be particularly pointed out in the claims.

In the drawing illustrating an application of my invention in some of its forms:

Fig. 1 is a side elevation view of a pumping construction in one form and with pumping parts mounted to move in a horizontal direction embodying my invention.

Fig. 2 is a considerably enlarged sectional view of the valve member shown in Fig. 1, showing one of the valves open and the central diaphragm pushed in.

Referring first to Fig. 1 of the drawing, a casing 10 has formed in the upper part thereof a pressure cylinder 11. Below the pressure cylinder 11 is a valve chamber 12 provided with a pair of outlet valves 13 and 14 and communicating through an opening 15 with any suitable dis-

charge means for the water pump (not shown). Below the valve chamber 12 is a second valve chamber 16 which communicates through an opening 17 by any suitable means (not shown) with a source of water supply. A valve 18 opens from valve chamber 16 into a chamber 19 which communicates through a passageway 20 with internal end portion 21 of the pumping chamber formed within pumping cylinder 22. A second valve 23 opens from valve chamber 16 into a chamber 24 which communicates through passageway 25 with a second pumping chamber 26 within the pumping cylinder 22. The chambers 19 and 24 are separated by a partition 27 and chambers 21 and 26 are separated by a pumping piston 28.

Since the piston 28 is caused to move back and forth in the piston cylinder 22 the chambers 21 and 26 on each side of the piston 28 will be alternately expanding and contracting. When expanding, water will be caused to flow through valve 18 or valve 23 and passageway 20 or passageway 25 into either chamber 21 or chamber 26. When these chambers are being contracted water will be caused to flow through passageway 20 or 25 and valves 13 or 14 into chamber 12 and thence to the pump delivery.

As best shown in Fig. 2, the piston 28 comprises two sections, 29 and 30, secured together so as to seal in a flexible diaphragm 31 formed with a central chamber 32. The sections 29 and 30 are permanently secured together in a well-known way by means not shown. Section 29 is provided with a tubular boss 33 which has mounted therein an elongated tube 34 opening into the chamber 35 formed within the piston 28 at one side of the diaphragm 31. Similarly, the section 30 is formed with a tubular boss 36 which has extending therethrough an elongated tube 37. Tube 37 opens into a chamber 38 formed in the piston on the opposite side of diaphragm 31.

As indicated at 39 and 40 the tubes 34 and 37 are open at their respective ends. Each of these tubes extends through a sealing bushing 41 for tube 34 and 42 for tube 37. The sealing bushings also serve as a guide and bearing for sliding movements of the respective tubes. Tube 34 is adapted to extend into a chamber 43 formed by a casing extension 44 and tube 37 is adapted to extend into a chamber 45 formed by a casing extension 46.

The interior of the pressure cylinder 11 is divided into two chambers 47 and 48 by means of a double piston member 49—50 fast on a power rod 51. The chamber 43 outside of sealing bushing and bearing sleeve 41 communicates through a tube 52 and a passageway 53 with the pressure chamber 47. Similarly the chamber 45 communicates outside of sealing bushing and bearing sleeve 41 through a tube 54 and a passageway 55 with the pressure chamber 48.

The power rod 51 is shown pivotally connected at 56 to a lever 57 which in turn is pivoted at 58 to a link 59 pivoted at 60 to a bracket 61 fast on the casing 10. This furnishes a power means for operating the piston 49—50 to put pressure in the column of water in either chamber 47 or 48. This would be for a hand operated pump, but obviously any other type of power means such as a prime mover may be employed for the purpose of reciprocating the compound piston 49—50.

The pumping piston 28 has a valve 62 located at the opening of tube 34 into chamber 35. Similarly there is a valve 63 which is positioned to open the end of tube 37 into chamber 38.

When the pump is in condition for operation all of the chambers, channels and passageways, above described, excepting the outlet chamber 12 will at all times be completely filled with water. Then, if the handle is pulled toward the operator the water in chamber 47 will be put under pressure equivalent to the force of the stroke. This pressure will be transmitted through chamber 47, passageway 53 and 52, chamber 43, and tube 34 upon the valve 62 which will thereby be forced open and the pressure in turn will be transmitted to the collapsed diaphragm 32 being multiplied by the area of that diaphragm. The pressure on the other side of the piston 28 is zero or negative with the result that the pump piston is moved toward the left, thus forcing the water from chamber 26 through passageway 25 into chamber 24 and thence through valve 14 into outlet chamber 12 and thence through opening 15 to the out-flow of the pump. At the same time that chamber 21 is expanded it will draw water from the source of supply through inlet opening 17, chamber 16, valve 18 and passage 20.

Upon reversal of the movement of lever 57 the pressure piston 49—50 will move along the expanded chamber 48 causing the pressure to be transmitted through passageway 55, tube 54, chamber 45, and through the open end 40 of tube 37 against valve 63 which is thereby forced open, collapsing diaphragm 31, thus transmitting the pressure force upon the whole of the inside wall of chamber 38. This will result in moving the pumping piston 28 in the opposite direction forcing water from chamber 21 through passageway 20, into chamber 19, and past valve 13 and outlet opening 15 into the water delivery. At the same time the expanding chamber 26 will draw water through passageway 25, chamber 24, past valve 23, from chamber 16, and inlet opening 17, from the source of supply.

There will, thus, be not only a continuous flow of water wherein the power applied to the pressure piston 49—50 will cause the pressure from that piston to be distributed, without moving mechanical parts other than the pistons, to the enlarged surface on the inside of the hollow piston 28.

The advantages of my invention will be apparent from the foregoing description. The primary advantage is, of course, that the power is applied in a multiplied form to the pumping piston through what is in effect an extensible, incompressible water plunger. Water is, of course, incompressible at workable pressures, and since the pressure cylinder itself and all of the conduits leading therefrom to and including the interior chamber of the hollow piston and including the hollow tubular guide members connected therewith, are continuously kept completely filled with water, the result is at the same time to eliminate mechanical connections and parts, to substantially eliminate friction and to multiply distribute the power applied to the pumping piston over substantially its entire area in operating it first in one direction and then in the other.

A further advantage is the ease and simplicity with which the stream of water being pumped is controlled and moved from the well. Other advantages reside in the general simplicity of construction, a construction embodying relatively few parts and the fact that it is a construction which lends itself with unusual efficacy to the production of small hand pumps.

I claim:

1. A pump including a pressure cylinder, a pis-

ton therein dividing it into two chambers, a pump cylinder of larger diameter than the pressure cylinder, a piston in said pump cylinder dividing it into two chambers, said last-named piston being formed to provide an interior chamber extending over the greater part of the total area of the pump piston, a diaphragm wall dividing said chamber into two parts, conduits leading from the respective chambers of the pressure cylinder to the interior of said pump piston from opposite sides of said diaphragm wall, all of said cylinders, chambers and conduits being at all times filled with liquid, part of said conduits including hollow piston rods connected to convey fluid pressure from opposite sides of the pressure piston to the interior of the pump piston from opposite sides to the diaphragm wall.

2. A pump including a pressure cylinder, a piston therein dividing it into two chambers, a pump cylinder of much larger diameter than that of the pressure cylinder, a piston in said pump cylinder dividing it into two chambers, said last-named piston being formed to provide an interior chamber extending over the greater part of the total area of the pump piston, a diaphragm wall dividing said chamber into two parts, conduits including hollow slidable piston rods leading from the respective chambers of the pressure cylinder to the interior of said pump piston at opposite sides of said diaphragm wall, valves cooperating with the opening from said hollow piston rods into the piston chamber and actuating to alternately open and close the same in response to alternate fluid pressure impulses through said hollow piston rods on opposite sides of the pump piston, all of said cylinders, chambers and conduits being at all times filled with liquid.

3. A pump including a pressure cylinder, a piston therein dividing it into two chambers, means for reciprocating said piston, a diaphragm wall dividing said chamber into two parts, a pump cylinder of larger diameter than the pressure cylinder, a piston in said pump cylinder dividing it into two chambers, said last named piston being formed to provide an interior chamber extending over the greater part of the total area of the pump piston, a diaphragm wall dividing said chamber into two parts, conduits including hollow slidable piston rods leading from the respective chambers of the pressure cylinder to the interior of said pump piston at opposite sides of the diaphragm wall, all said cylinders, chambers and conduits being at all times filled with liquid, exhaust and inlet passageways connecting with the chambers in the pump cylinder, and check valve means in the respective exhaust and inlet passageways to control movement of liquid into and out of each of said first named chambers for effecting continuous delivery of liquid when the pressure piston is reciprocating.

4. A pump for liquid including a pressure cylinder, a double acting plunger in said cylinder, means for reciprocating said plunger, a pump cylinder, a hollow double acting piston within said pump cylinder, hollow piston rods projecting from the sides of said piston in said pump cylinder, a diaphragm wall in said pump cylinder piston, passageways leading from either side of the plunger in said pressure cylinder to said hollow piston rods and diaphragm wall, said pressure and pump cylinders and said passageways leading thereto being filled with liquid, exhaust and inlet passageways connecting with said pump cylinder on either side of the piston thereof, and pairs of check valves leading to said outlet and inlet passageways.

5. A double acting pump including a double acting pressure cylinder and piston means, a double acting pump cylinder and hollow piston means, inlet and outlet passageways, conduit passageways leading from either side of the piston in said pressure cylinder to the enlarged inside area of the pump piston, a diaphragm wall in said hollow pump piston separating said passageways, passageways leading from either side of the piston in said pump cylinder to said inlet and outlet passageways, and pairs of check valves in said passageways leading from either side of the piston in the pump cylinder, whereby when the pressure piston is moved in one direction and all of the passageways are filled with liquid, the fluid pressure from said pressure cylinder will be directed through a small conduit against the diaphragm in the enlarged area in the inside of the hollow pump piston operating the pump piston to force liquid out of the pump cylinder and out of one of the exhaust valves and causing liquid to be drawn in through said inlet opening past one of the inlet check valves and into the pump cylinder, and when the pressure piston is operated in the opposite direction, the reverse operation takes place, thereby providing a double acting pump.

6. A pump including a pressure cylinder, a reciprocable piston in said pressure cylinder, means for operating said piston, a pump cylinder, a hollow double acting piston in said pump cylinder, an outlet chamber, a pair of check valves in said outlet chamber, an inlet chamber, a pair of check valves in said inlet chamber, an enlarged area formed in said pump piston, a flexible disc-like diaphragm wall dividing the space in said hollow pump piston, hollow piston rods leading to the spaces in the pump piston on opposite sides of the diaphragm wall, conduits connecting either side of said pressure cylinder to said hollow piston rods, and a volume of liquid maintained in the passageways leading from either side of the piston in said pressure cylinder to the hollow piston rods and spaces on opposite sides of the diaphragm wall in the piston of the pump cylinder to provide a confined fluid means for reciprocating the pump piston to force liquid in and out of said pump by the reciprocation of said pressure piston.

ERNEST W. GUTSCH.