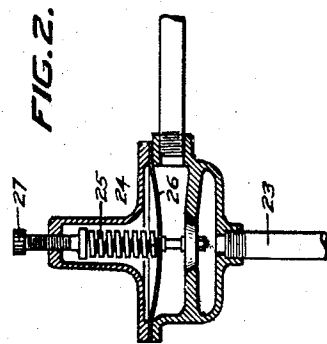
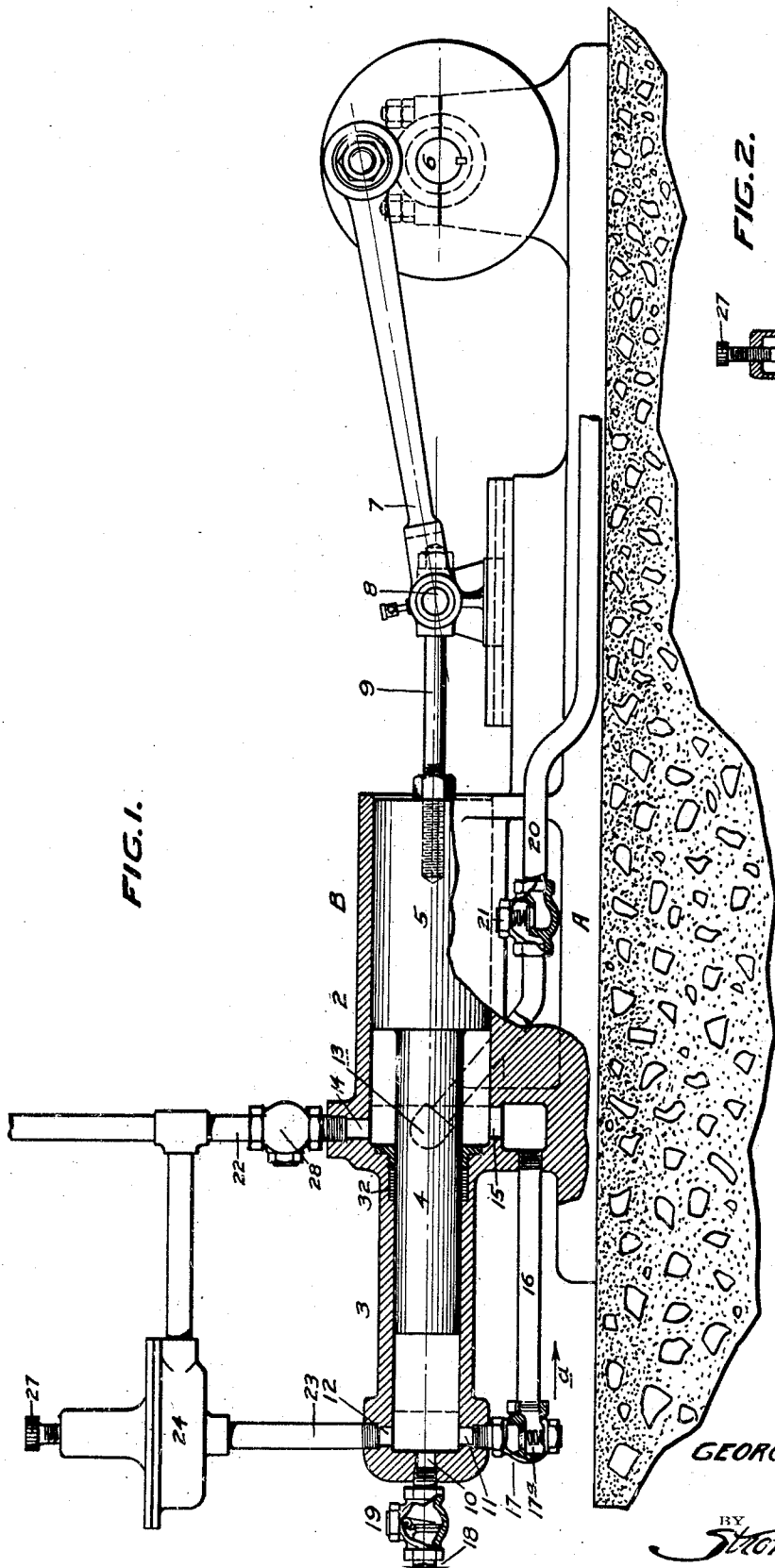


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PUMP.
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PUMP.

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Specification of Letters Patent.

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To all whom it may concern:

Be it known that I, GEORGE LEANDER FISH, a citizen of the United States, residing at Modesto, in the county of Stanislaus and State of California, have invented new and useful Improvements in Pumps, of which the following is a specification.

This invention relates to a reciprocating piston pump and particularly to a pump of the compound or multi-cylinder type.

One of the objects of the present invention is to provide a reciprocating piston pump of the multi-cylinder type in which the cylinders are alined and actuated by a common piston, said cylinders varying in diameter and said piston being stepped to fit the varying cylinder diameters.

Another object of the invention is to provide separate intake and discharge ports for each cylinder to permit the liquid or fluid handled by each cylinder to discharge into separate lines or into a common line.

Another object of the invention is to provide means for bypassing the charge of one cylinder to another cylinder or to a multiple unit of cylinders to permit a direct mixing action of one or more liquids or fluids in the cylinders and then to discharge the mixture into a common line.

Another object of the invention is to provide means for maintaining a predetermined pressure on the discharge line and to automatically cause a return flow from the line to the cylinders of the pump the moment said pressure is exceeded.

Further objects will hereinafter appear.

The invention consists of the parts and the construction, combination and arrangement of parts as hereinafter more fully described and claimed, having reference to the accompanying drawings, in which—

Figure 1 is a central vertical longitudinal section through the pump.

Fig. 2 is a detail view of the diaphragm valve.

Referring to the drawings in detail, A indicates a suitable base member on which is mounted a cylinder generally indicated at B. The cylinder is in this instance provided with two chambers, one of large diameter, as shown at 2, and one of smaller diameter, as shown at 3. These cylinders may be separable with relation to each other or constructed integral, as here shown.

Mounted in the cylinders 2 and 3 and

adapted to reciprocate therein is a stepped piston consisting of two sections such as shown at 4 and 5. The piston sections 4 and 5 may be so constructed that separation of one with relation to the other is possible or they may be formed integral, as here shown. The pistons employed are of the plunger type and reciprocal movement is transmitted thereto by means of a crank shaft 6, a connecting rod 7, a cross head 8 and a piston rod 9. The pistons 4 and 5 will therefore reciprocate in unison and the material handled, whether fluid or liquid, will be admitted in unison and discharged in unison.

The cylinder shown at 3 is provided with an intake port 10, a discharge port 11 and a by-pass port 12. The cylinder shown at 2 is provided with an intake port 13, a discharge port 14 and a bypass port 15. The ports 11 and 15 are connected by means of a pipe 16 and a check valve 17 is interposed between the port 11 and the pipe 16 to prevent any flow through the by-pass pipe 16 except in one direction, or that indicated by arrow *a*. The intake port 10 is connected with a suitable source of supply, whether fluid or liquid, by means of a pipe 18. A check valve 19 mounted in said line permits the material handled to enter cylinder 3 during the suction stroke of the piston and the check valve will close during the return stroke of the piston, thus causing a discharge through port 11, as will hereinafter be described. The intake port 13 is connected by means of a pipe 20 with a suitable source of supply and this pipe is also provided with a check valve, as shown at 21 to prevent return flow through the line. The material handled by the cylinders 2 and 3 is in this instance discharged through a common pipe line such as indicated at 22. This line is connected with a by-pass port 12 formed in cylinder 3, by means of a pipe 23. For the purpose of regulating the pressure in the discharge line 22, and also for the purpose of permitting a return flow to the cylinder 3, the moment a predetermined pressure is obtained in the discharge line 22, I provide a diaphragm actuated valve 24 which is constructed substantially as shown. This valve normally retains its seat to permit the material handled to discharge through the line 22. It is, however, raised from its seat the moment a predetermined pressure is obtained and will therefore permit a re-

turn flow to the cylinder 3, as will herein-after be described.

The predetermined pressure on the discharge line 22 is regulated by means of a spring 25 mounted above the diaphragm 26, with which the valve is provided, the tension of the spring 25 being in turn regulated by means of an adjusting screw 27. It is therefore possible to regulate the pressure on the discharge line, as desired, and to automatically maintain said pressure during the operation of the pump. Return flow from the discharge line is only permitted to enter the cylinder 3 and it is therefore necessary to provide a check valve 28 between the discharge port 14 and the pipe line 22.

The general operation of the pump will be as follows: With power transmitted to the crank shaft 6 it can readily be seen that a reciprocal movement will be transmitted in unison to the pistons 4 and 5. Each forward stroke of the pistons will therefore produce a vacuum or suction in the respective cylinders, causing the checks 21 and 19 to open and the fluid or liquid handled, to enter. The reverse stroke of the pistons will create a pressure in the respective cylinder chambers and will furthermore discharge the fluid or liquid handled, through the ports 11 and 14. The fluid or liquid handled by the cylinder 3 discharges through port 11, check 17 and pipe 16 and therefore enters the cylinder 2 through the by-pass port 15 during the compression or discharge stroke of the piston 5. The fluids or liquids handled by the separate cylinders are thus mixed in the cylinder 2 and are finally discharged through port 15 directly into the main line 22. The pressure building-up in the line will finally actuate the diaphragm valve and cause the same to be raised from its seat, thereby permitting a return flow through the pipe 23 to the cylinder 3. It is therefore impossible to build up a pressure in the main line exceeding a predetermined pressure as the diaphragm valve may be regulated to maintain any pressure desired.

By referring to Fig. 1, it will be seen that the check valve 17 is retained against the seat by means of a spring 17^a. This is of considerable importance in the present instance as the vacuum or suction produced in the cylinder 2 during the outward movement of piston 5 might otherwise have a tendency to pull the valve away from its seat and thereby draw part of the charge admitted to cylinder 3 into cylinder 2 during the suction stroke. This objection is avoided in the present instance as the tension of spring 17^a is sufficient to overcome any degree of vacuum which might be produced in the cylinder chamber 2. Mixing of the fluids or liquids handled will therefore only take place during the discharge

stroke of the pistons and not previous thereto.

A pump constructed as here shown can be used to advantage in many instances; for instance, it is possible to handle a liquid by means of the cylinder 3 and a fluid by means of the cylinder 2 and then to mix the liquid and the fluid before discharging it into the main discharge line 22. Or it will be possible to pump two different fluids or two different liquids and to mix the same before discharging into the main line and if desired, it is also possible to handle separate fluids or liquids and discharge the same into separate lines. It can furthermore be seen that the pump is absolutely automatic in operation as the diaphragm valve will automatically return the product handled, to the cylinders, the moment a predetermined pressure is exceeded.

By referring to Fig. 1, it can be seen that a stuffing box 32 is positioned at the outer end of cylinder 3. Such a stuffing box is not required under all conditions; for instance, when the fluids or liquids pumped are mixed in the cylinder 2, but may be employed to advantage when handling separate fluids or liquids which are discharged into separate lines.

While the two cylinders are here shown, I wish it understood that any suitable number required may be mounted in alinement if it is desired to handle more than two fluids or liquids. The general construction will, however, remain the same and a single stepped piston will be employed in all instances. A pump constructed, as here shown, can be used to great advantage when mixing various oils, supplying pipe lines with oil, oil burning devices, atomizing various liquids, feeding explosive engines, or when supplying oil and air lines of locomotives, or emulsifying oils, mixing liquids and air or gases, mixing of gases, mixing of acids, producing air pressure in orchard or other similar spraying devices, and for maintaining air pressure in water tanks, etc.

When pumping any liquid, it is generally necessary to place one or more air chambers on the pump and the line into which the liquid is discharged. This is obviated in the present instance as a sufficient amount of air may be admitted to one or more of the cylinders to produce the cushioned effect required, thereby eliminating pounding or hammering, even though air chambers are entirely eliminated.

While a more or less specific construction is here shown, I wish it understood that this may be varied to suit different applications; similarly, that the materials and finish of the several parts employed may be such as the experience and judgment of the manufacturer may dictate.

Having thus described my invention, what

I claim and desire to secure by Letters Patent is—

1. A pump including a plurality of cylinders, connected pistons in the cylinders, means to operate the pistons, an inlet and an outlet for each cylinder located at spaced points thereon, one of said cylinders having a by-pass port separate from its inlet and outlet, and means connected to the outlet of the other cylinder and to said by-pass port to by-pass fluid from said other cylinder to the first named cylinder.
2. A pump comprising a plurality of alined cylinders of increasing diameter, a common piston mounted in said cylinders and provided with offset portions to fit the several cylinders, means for transmitting a reciprocal movement to the piston, means for by-passing the charge of one cylinder to another cylinder and an inlet for each cylinder independent of the by-pass means and leading into the cylinder at points spaced from the by-pass.
3. A pump comprising a plurality of alined cylinders of increasing diameter, each having spaced inlets and outlets at their compression ends, a common piston mounted in said cylinders and provided with offset portions to fit the several cylinders, means for transmitting a reciprocal movement to the piston, and means for by-passing the charge of one cylinder to another cylinder during the discharging stroke of said cylinder.
4. A pump comprising a plurality of alined cylinders of increasing diameter, a common piston mounted in said cylinders and provided with offset portions to fit the several cylinders, means for transmitting a reciprocal movement to the piston, a separate intake and discharge port formed in each cylinder, and a by-pass port formed in each cylinder, said ports permitting the discharge of one cylinder to be by-passed to another cylinder and during the discharge stroke of both cylinders.
5. A pump comprising a plurality of alined cylinders of increasing diameter, a common piston mounted in said cylinders and provided with offset portions to fit the several cylinders, means for transmitting a reciprocal movement to the piston, a separate intake and discharge port formed in the compression end of each cylinder, and a by-pass port formed in each cylinder, said ports permitting the discharge of one cylinder to be by-passed to another cylinder of larger diameter, and during the discharge stroke of both cylinders.
6. A pump comprising a plurality of alined cylinders of increasing diameter, a common piston mounted in said cylinders and provided with offset portions to fit the several cylinders, means for transmitting a reciprocal movement to the piston, a separate intake and discharge port formed in each cylinder, a common discharge line for the cylinders, and means for automatically causing a return flow to the cylinders the moment a predetermined pressure is obtained in the discharge line.
7. A pump comprising a plurality of alined cylinders of increasing diameter, a common piston mounted in said cylinders and provided with offset portions to fit the several cylinders, means for transmitting a reciprocal movement to the piston, a separate intake and discharge port formed in each cylinder, a by-pass port formed in each cylinder, said ports permitting the discharge of one cylinder to be by-passed to another cylinder, a discharge pipe connected with said last named cylinder, a by-pass connection between said line and the first named cylinder, and means in said by-pass connection for maintaining a predetermined pressure in the discharge line.
8. A pump comprising a plurality of alined cylinders of increasing diameter, a common piston mounted in said cylinders and provided with offset portions to fit the several cylinders, means for transmitting a reciprocal movement to the piston, a separate intake and discharge port formed in each cylinder, a by-pass port formed in each cylinder, said ports permitting the discharge of one cylinder to be by-passed to another cylinder, a discharge pipe connected with said last named cylinder, a by-pass connection between said line and the first named cylinder, and a diaphragm actuated valve in said by-pass connection, adapted to automatically maintain a predetermined pressure in the discharge line.
9. A pump comprising a plurality of alined cylinders of increasing diameter, a common piston mounted in said cylinders and provided with offset portions to fit the several cylinders, means for transmitting a reciprocal movement to the piston, a separate intake and discharge port formed in each cylinder, and a by-pass port formed in each cylinder, said ports permitting the discharge of one cylinder to be by-passed to another cylinder, a discharge pipe connected with said last named cylinder, a by-pass connection between said line and the first named cylinder, and a diaphragm actuated valve in said by-pass connection adapted to cause a return flow to the first named cylinder the moment a predetermined pressure is obtained in the discharge line.
10. A pump comprising a pair of alined cylinders, one of small diameter, one of larger diameter, a piston slidably mounted in said cylinders and offset to fit the respective cylinders, means for transmitting a reciprocal movement to said pistons, a by-pass port, a discharge port and an intake

port formed in each cylinder, a main discharge line connected with a discharge port of the large cylinder, a pipe forming a connection between the discharge port of the small cylinder and the by-pass port of the large cylinder, a check valve in said pipe permitting the charge of the smaller cylinder to be by-passed to the larger cylinder during the discharging stroke of both cylinders, means for normally maintaining said check valve in engagement with its seat, separate pipes connected with the respective intake ports of the cylinders, and a check valve in each of said pipe lines.

11. A pump comprising a pair of aligned cylinders, one of small diameter, one of larger diameter, a piston slidably mounted in said cylinders and offset to fit the respective cylinders, means for transmitting a reciprocal movement to said pistons, a by-pass port, a discharge port and an intake port formed in each cylinder, a main discharge line connected with a discharge port of the large cylinder, a pipe forming a connection between the discharge port of the small cylinder and the by-pass port of the large cylinder, a check valve in said pipe permitting the charge of the smaller cylinder to be by-passed to the larger cylinder during the discharging stroke of both cylinders, means for normally maintaining said check valve in engagement with its seat, separate pipes connected with the respective intake ports of the cylinders, a check valve in each of said pipe lines, a check valve interposed between the discharge port and the main discharge line, permitting only an outward flow through said line, a pipe forming a connection between the discharge line and the by-pass port in the small cylinder, and a diaphragm actuated valve in said pipe, adapted to cause a return flow through said pipe the moment a predetermined pressure is obtained in the discharge line.

12. A pump including a plurality of cylinders, a piston in each cylinder, means to operate the pistons, means to conduct fluid into the compression ends of the cylinders, an outlet for each cylinder, a discharge line and means for effecting a return flow to one of the cylinders upon pressure in the discharge line reaching a predetermined point.

13. A pump including a plurality of cylinders, an inlet for each cylinder, a piston in each cylinder, means to operate the pistons, means to by-pass fluid from the compression end of one cylinder into the compression end of the adjacent cylinder, and an outlet leading from said compression end of the last named cylinder.

14. A pump including a plurality of cylinders, a piston in each cylinder, means to operate the pistons, means to conduct fluid into the compression ends of the cylinders, an outlet for each cylinder, a connection between said outlets forming also a discharge line, and means in the connection and responsive to the fluid pressure for effecting a return of the fluid to one of the cylinders upon pressure in the discharge line from the other cylinder reaching a predetermined degree.

15. A pump including a plurality of cylinders, a piston in each cylinder, the compression end wall of one cylinder being formed by the outer end wall of the adjacent cylinder, an inlet for each cylinder, and means to by-pass fluid from the compression end of said adjacent cylinder into the compression end of the first named cylinder.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

GEORGE LEANDER FISH.

Witnesses:

J. A. DUNN,

E. A. GARLICH.