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PUMP.

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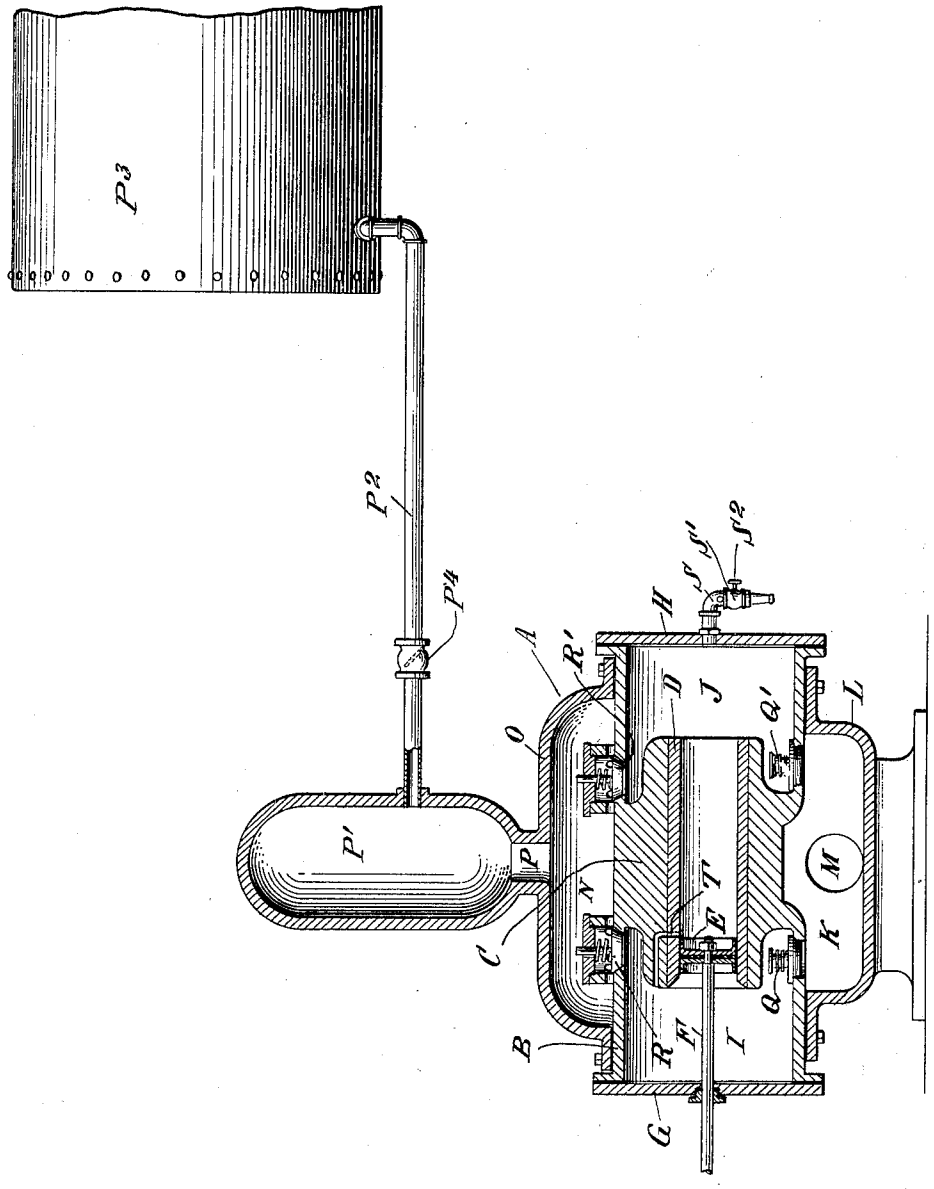
1,374,156. **Patented Apr. 5, 1921.**



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PUMP.

1,374,156. Specification of Letters Patent. Patented Apr. 5, 1921.

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To all whom it may concern:

Be it known that I, RALPH B. CARTER, a citizen of the United States, residing at Haworth, in the county of Bergen and State of New Jersey, have invented certain new and useful Improvements in Pumps, of which the following is a full, clear, and exact specification, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to improvements in power-operated pumps and is designed to overcome the difficulties encountered in the operation of pumps, as at present constructed, due to the occasional accumulation of air in the pump to such a degree that it constitutes what is known as an "air-block," which will stop the pumping of the fluid to be handled.

I have shown my invention as applied to a double-acting hydraulic pump, which may be operated from any suitable source of power, but which is particularly adapted for operation by a motor which may be automatically started and stopped, and one use to which my invention may be put is in connection with domestic or other similar water supply systems, wherein water and air are together pumped into a receiving tank, from which the water, under pressure of air in the water tank, may be led to any part of the premises desired.

In such water supply plants, it is desirable that the pumping means shall be thrown into operation automatically when the water in the tank recedes to a certain level, and cut out of operation when the water in the tank has reached a certain desired quantity. It is also desirable that such an automatically acting plant shall not require the presence of an attendant to look after its operation, to accomplish all of which objects it is of course necessary that the operation of the pump shall not be interrupted by the occurrence of an "air-block," as above referred to.

The principal object of my invention therefore is, to provide, in a double-acting pump, means whereby, when an air-block occurs, in the pump chamber, the same may be immediately overcome, without allowing any interruption in the operation of the apparatus.

My invention will be made clear, by the following description taken in connection with the accompanying drawing, which represents, in vertical section, a hydraulic pump to which my invention is applied and, in elevation, partly broken away, a tank for receiving water under pressure of air.

Referring to the construction illustrated, A represents, in whole, the pump, comprising a casing B, formed centrally with an inwardly projecting casting C, which is longitudinally bored to receive a piston cylinder D, wherein reciprocates a piston E, actuated, through the piston rod F, from any suitable source of power. The ends of the casing B are closed by heads G, H, providing, respectively, the pump chambers I, J. Secured to the lower portion of the casing B, is a suction chamber K, formed by the casing L, said suction chamber being provided with a water inlet M, which may be connected to a well or other source of water supply.

Secured to the upper portion of the casing B is provided a discharge chamber N, formed by the bonnet O, which chamber, through the passageway P, connects with an air chamber P′, from which leads a pipe P^2, connecting the air chamber P′, with the tank P^3, said pipe being provided with a check valve indicated at P^4.

Suction valves Q, Q′, are provided in passageways, leading from the suction chamber K to the pump chambers I, J, and discharge valves R, R′, are located in passageways, leading from the pump chambers I, J, to the discharge chamber N.

In the head H is an air-inlet indicated at S, having a check valve S′, which air inlet may, when desired, be entirely closed by a hand valve indicated at S^2.

Extending longitudinally into the casting C and thence, angularly thereto, into the interior of the piston cylinder D, is a small port, indicated at T, which constitutes the important feature of my invention, whereby fluid under compression in the pump chamber I may be conveyed from said pump chamber to the interior of the piston cylinder D, at the opposite side of the piston, the port T, being opened for the admission of such fluid immediately when the port is uncovered, at the very end of the stroke of the piston. It will be seen that the chamber I, will be in communication with

the interior of the piston chamber, at the stated opposite side of the piston for a momentary period of time only, and just prior to the return movement of the piston in that direction.

The operation of the device will be clear when it is understood that a condition of air-block in a pump chamber occurs when the amount of air and water therein are so proportioned, one to the other, that under the compression of the piston, there is no sufficient force to raise the discharge valves and suction valves, to discharge and admit fluid, the air in the pump chamber providing an elastic cushion against which the piston acts to compress the air, and rebounding on the expansion of the air so compressed without any resultant fluid-pumping operation, and this condition will continue as long as the state of equilibrium, which permits it, continues to exist. As soon, however, as this state of equilibrium is broken, as for example, when additional fluid, either water or air or both, is added to the chamber in which the air-block occurs, the added material, supplementing the material already in the pump chamber, will furnish the required force-transmitting medium, to be acted upon by the piston, whereby the discharge valve of the pump may be opened for the discharge of the fluid acted upon, and on the receding movement of the piston, sufficient vacuum will be produced to provide for the admission of fluid through the suction valves so that the pumping operation may proceed. This is precisely what my invention accomplishes. Assuming that there is an air-block in the pump chamber J, owing to there being not sufficient water to be acted upon and open the valve R′, and just enough air to result in the piston simply compressing the latter, and then rebounding on the expansion of the air, on the withdrawal of the piston E fluid will be compressed in the pump chamber I, and, as the piston E passes by, and opens, the port T, the compressed fluid in the piston chamber I will be conveyed through said port into the piston cylinder just ahead of, and to be acted upon by and on the return stroke of, the piston, and this additional fluid in the pump chamber J will furnish the additional medium needed, in connection with that already in the pump chamber J, to open the valve, when acted upon by the piston.

The condition of "air-block" to which I have above referred may arise in any ordinary hydraulic pump, but a pump which has an air inlet to the exterior atmosphere, and is designed especially to pump both air and water, to place the latter under compression by the air, in a storage tank, is particularly subject to such an air-block, and this condition my form of apparatus will obviate in either case. In the pump chamber I there will be no such likelihood of an air-block occurring as in the pump chamber J, but if it should occur, when the piston acts against the air forming such a block a small quantity of the fluid in said chamber will be discharged through the port T, when the piston uncovers the latter on its compressing stroke, thereby providing sufficient vacuum when supplemented by the vacuum created by the recession of the piston to open the suction valve Q and thereby provide the necessary quantity of fluid to be acted upon, to open the discharge valve R on the next stroke of the piston and continue the pumping operation.

What I claim is:

1. In a force pump, the combination of a cylinder, a casing having chambers in communication with each end of the cylinder, an air inlet to one of said chambers, a piston reciprocating in said cylinder, and means adapted to permit the escape of an appreciable amount of air or very small amount of water from one chamber to the other during the movement of the piston away from said air inlet and to prevent the same on the return movement.

2. In a force pump, the combination of a casing having a cylinder therein and combined suction and force chambers in open communication with each end of the cylinder and larger than the cylinder, a piston in the cylinder, inlet and discharge valves for said chambers, an air inlet to one of said chambers, and means adapted to open free communication between the chambers in one movement of the piston and close in the other.

3. In a force pump, the combination of a cylinder, a casing having chambers in communication with each end of the cylinder, a piston in said cylinder, a small passage between said chambers adapted to permit the passage of only a small amount of water, and an air inlet passage leading to one of said chambers.

4. In a force pump, the combination of a casing having a cylinder therein, and suction chambers in open communication with the cylinder, a piston in the cylinder, inlet and discharge valves for the suction chambers, an air inlet passage to one chamber, means for opening communication between the suction chambers on the movement of the piston away from said air inlet and closing the same on the return movement, and a check valve in said air passage.

5. In a force pump, the combination of a cylinder, a casing having chambers in communication with each end of the cylinder, an air inlet to one of said chambers, a piston reciprocating in said cylinder, a passage between said chambers adapted to permit the escape of an appreciable amount of air or a very small amount of water, said pis-

ton acting as a valve in said passage closing during the movement of the piston toward said air inlet.

6. In a force pump, the combination of a casing having a cylinder therein and combined suction and force chambers in open communication with each end of the cylinder and larger than the cylinder, reciprocating means within the cylinder adapted to draw water into and expel it from said chambers in coöperation with inlet and discharge valves in said chambers, an air inlet to one of said chambers, a passage connecting the chambers, and means adapted to freely open said passage in one movement of said reciprocating means and close the same in the other.

7. In a force pump, the combination of a cylinder, a casing having chambers in communication with each end of the cylinder, a piston in said cylinder, a small passage around said piston adapted to permit the passage of only a small amount of water, and an air passage leading to one of said chambers.

8. In a force pump, the combination of a casing having a cylinder therein and suction chambers in open communication with the cylinder, reciprocating means within the cylinder adapted to draw water into and expel it from said chambers in coöpertion with inlet and discharge valves in said chambers, a passage between said chambers, means adapted to close said passage on the movement of said reciprocating means toward one chamber, an air inlet passage leading to said chamber, and a check valve in said passage.

9. In a pump, the combination of a casing, a cylinder therein, chambers in communication with the cylinder, reciprocating means within the cylinder adapted to draw water into and expel it from the chambers in coöperation with inlet and discharge valves in said chambers, a small relief passage between said chambers, means adapted to close said passage consequent upon the movement of said reciprocating means toward one chamber, an air inlet passage leading to said chamber, and an adjustable valve in said passage.

10. The combination, in a force pump, of a casing, a cylinder therein, suction chambers in communication with the cylinder, reciprocating means within the cylinder adapted to draw water into and expel it from the chambers in coöperation with inlet and discharge valves in said chambers, a passage between said chambers, means adapted to close said passage on the movement of said reciprocating means toward one chamber, an air inlet passage leading to said chamber, a check-valve and an adjustable valve in said passage.

11. A force pump having a cylinder and a piston therein and adapted to present water to each side of the piston, a suction chamber in communication with the piston at one side thereof having inlet and discharge valves, a port around the piston, said piston acting as a valve for closing said port when the piston is moving toward the chamber, and means for admitting a small amount of air into the chamber upon the suction movement of the piston.

12. In a force pump, the combination of a cylinder, a chamber in communication therewith, a valved inlet and a valved outlet for said chamber, an air inlet passageway to said chamber, a piston in said cylinder, a passage around said piston, said piston acting as a valve for closing said passage during the movement of the piston toward said chamber.

13. The combination of a cylinder, a chamber in communication therewith, a valved inlet to said chamber, a valved outlet from said chamber, a piston in said cylinder having a passage around it, an independent air passage to said chamber, and a check valve in said air passage.

14. The combination of a cylinder, chambers respectively in communication with the opposite ends of the cylinder, said chambers having inlet and outlet valves, a piston reciprocating in said cylinder, a passage between said chambers, an air inlet into one of said chambers, and a check-valve in the inlet passageway.

15. The combination of a cylinder, chambers in communication with the opposite ends of the cylinder, a piston reciprocating in the cylinder, means coöperating with said piston for opening communication between said chambers on one movement of said piston and closing it in the other, an air inlet passageway independent of the piston to one chamber, and a check-valve in the inlet passageway.

RALPH B. CARTER.