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COMBINED MOTOR AND PUMP.

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Fig. 1.

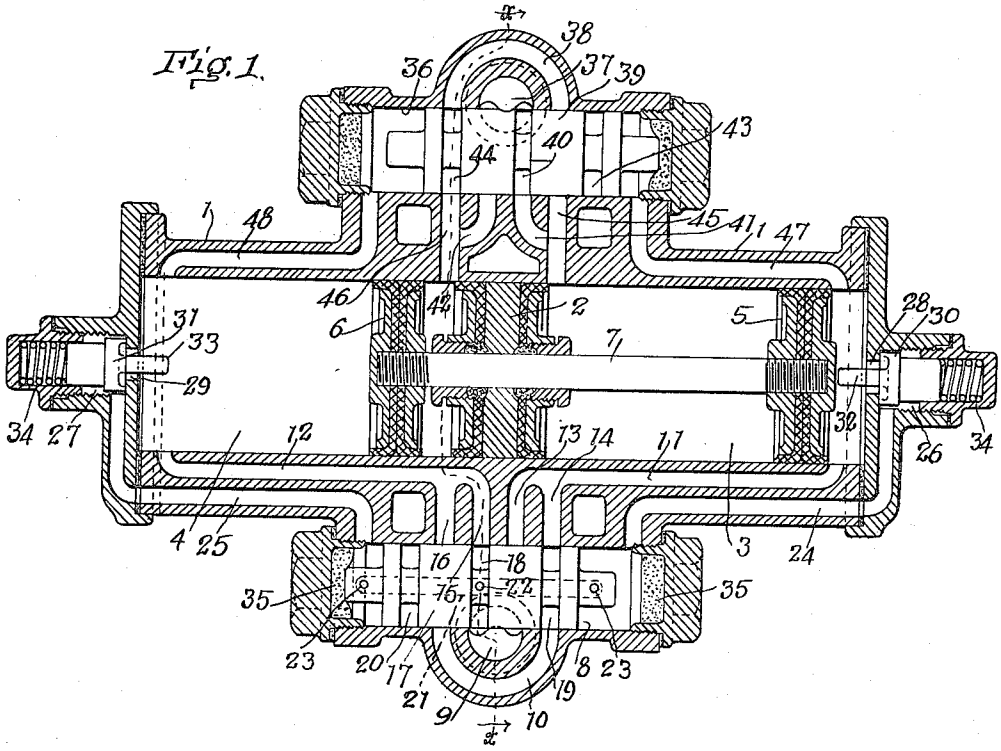
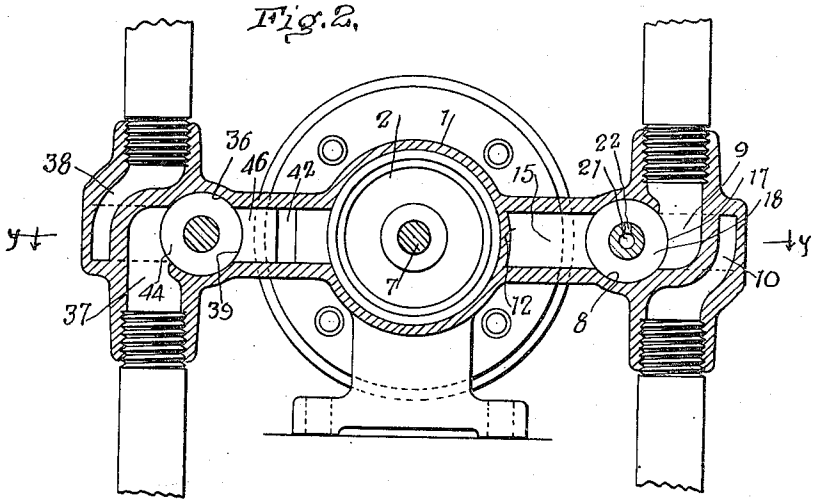


Fig. 2.



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COMBINED MOTOR AND PUMP.

1,161,787. Specification of Letters Patent. Patented Nov. 23, 1915.

Application filed November 1, 1913. Serial No. 798,647.

To all whom it may concern:

Be it known that I, FREDERICK C. NICKOL, a citizen of the United States, residing at Dayton, in the county of Montgomery and State of Ohio, have invented certain new and useful Improvements in Combined Motors and Pumps, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to a combined motor and pump and is designed more particularly for a water lift. Such a lift comprises a pump operated by water power and is utilized for distributing soft water to the bath room and lavatories of a residence where the city water is hard.

The object of the invention is primarily to provide a small compact and inexpensive mechanism of this kind which will have a high degree of efficiency.

Further, it is an object of the invention to provide valves for controlling the flow of water both to the motor and to the pump which may be actuated without the use of springs, thus eliminating a very common source of trouble in water motors and analogous machinery.

Further, it is an object of the invention to so construct the mechanism that each cylinder will constitute both a motor cylinder and a pumping cylinder.

In the accompanying drawings, Figure 1 is a horizontal, sectional view, taken on the line *y y* of Fig. 2 and looking in the direction of the arrows; and Fig. 2 is a transverse, sectional view taken on the line *x x* of Fig. 1.

In these drawings I have illustrated one embodiment of my invention and have shown the same as comprising a single casing in which all the mechanism is mounted, but it will be understood that it is not essential to the operation of the mechanism that it should be embodied in a single casing, and many of the novel features thereof are applicable to a motor in which the two cylinders are separately constructed but properly connected one with the other.

In these drawings I have, as stated, employed a single casing, which is indicated at 1, and I have divided this casing centrally by a transverse partition 2, thereby forming two cylinders 3 and 4. In each of these cylinders is mounted a piston, 5 and 6, which pistons are connected one to the other by a piston rod 7 extending through a suitably packed opening in the partition or abutment 2. Each cylinder constitutes both a motor cylinder and a pumping cylinder and to this end I have provided means for introducing the motor fluid to and exhausting the same from the outer ends of the two cylinders, while the water to be pumped is introduced into and exhausted from the inner ends of the cylinders, that is, those ends adjacent to the abutment 2.

The flow of motor fluid to and from the cylinders is controlled by a suitable valve which, in the present instance, is shown as comprising a cylindrical valve chamber 8 formed in a laterally extending portion of the casing 1 and communicating with inlet and outlet openings 9 and 10, respectively. This valve chamber 8 is connected with the outer ends of the cylinders 3 and 4 by means of two conduits 11 and 12, each of which conduits communicates with the valve chamber through one of two ports, one of these ports constituting the inlet port and the other constituting the exhaust port.

As shown in the drawings the conduit 11 is provided with an inlet port 13 and an exhaust port 14, while the conduit 12 is provided with an inlet port 15 and an exhaust port 16.

Mounted within the cylindrical valve chamber is a piston valve 17 provided with ports arranged to connect the proper inlet or exhaust ports, respectively, with the inlet and outlet openings 9 and 10. The ports in the valve are preferably in the form of annular grooves, the inlet port being shown at 18 and being arranged to be moved into registration with either of the inlet ports 13 and 15.

There are two exhaust ports, 19 and 20, arranged at opposite ends of the valve members and adapted to be moved into and out of registration with the exhaust ports 14 and 16, respectively. The arrangement of the valve ports relatively to the ports of the conduits 11 and 12 is such that when the port 18 registers with the inlet port of the conduit 12 the valve port 19 will register with the exhaust port of the conduit 11, and likewise when the valve port 18 registers

with the inlet port 13 of the conduit 11 the exhaust port 16 of the conduit 12 will register with the valve port 20.

The valve 17 is a balanced valve and the movement of the same is accomplished by relieving the pressure at one end thereof and thus causing the same to be overbalanced. To this end the valve member is provided with a longitudinal port 21 connected by means of an opening 22 with the inlet port 18 and by means of openings 23 with the opposite ends of the valve chamber 8. Thus, it will be apparent that both ends of the valve chamber, at all times are, in open communication with the source of supply and that the pressure on both ends of the valve will normally be equal. Means are provided for relieving the pressure at one end of the valve chamber when it is desired to shift the valve and this is accomplished by connecting the two ends of the valve chamber by conduits 24 and 25 with valve chambers 26 and 27, which valve chambers are connected by means of ports 28 and 29 with the outer ends of the respective cylinders 3 and 4. These ports are controlled by valves 30 and 31 having valve stems 32 and 33 projecting into the adjacent cylinder in the path of the piston of that cylinder. As a result, when the piston approaches the limit of its movement in one direction it will unseat the valve at that end of the cylinder, thus establishing communication between the corresponding end of the valve chamber and the cylinder, and inasmuch as the cylinder is connected with the exhaust it will be apparent that the pressure in that end of the valve chamber will immediately drop to practically zero, permitting the pressure on the other end of the valve chamber to shift the valve longitudinally and thus reverse the flow of water through the conduits 11 and 12. The valves 30 and 31 may be held on their seats by any suitable means. In the present instance I have provided springs 34 for this purpose. Preferably, the valve chamber 8 is provided with cushions, such as blocks of soft rubber 35, to cushion the movement of the valve.

The flow of water to and from the inner ends of the cylinders 3 and 4, constituting the pumping portions of said cylinders, is controlled by a valve mechanism similar in many respects to that which controls the motor fluid. The pump and valve comprises a valve chamber 36 formed in a laterally extending portion of the main casing 1 and communicating with inlet and outlet openings 37 and 38.

A piston valve 39 is mounted in the valve chamber 36 and has an inlet port 40 to connect the inlet opening 37 with either the port 41 or a port 42, which ports lead to the inner ends of the cylinders 3 and 4, respectively. The valve chamber also has two exhaust ports 43 and 44 adapted to register, respectively, with the conduits 45 and 46, which also communicate with the inner ends of the cylinders, 3 and 4, respectively. The conduit 41 merges with the conduit 45 and the conduit 42 merges with the conduit 46, in the present construction of the device, so that there is only one port leading to the inner end of either cylinder, but obviously this is a matter of expedience only. The valve 39 is positively actuated by water pressure and to this end the valve chamber 36 is connected by conduits 47 and 48 with the outer ends of the cylinders 3 and 4, respectively. Consequently, when the motor fluid is admitted to one end of one of the cylinders the pressure will immediately be transmitted to the corresponding end of the valve chamber 36 and inasmuch as the pressure has been relieved at the opposite end of the valve chamber the valve 39 will be shifted and the pressure thereon will be maintained throughout that stroke of the piston, thereby retaining the valve in its adjusted position.

The operation of the mechanism will be readily understood from the foregoing description and briefly it is as follows: With the parts in the position shown in the drawings the pistons are moving to the right and have almost completed their stroke. The water is entering through the inlet port 18, of the valve 17, and the conduit 12 to the outer end of the cylinder 4 and is exhausting from the outer end of the cylinder 3 through the conduit 11, exhaust port 14 and valve port 19. The piston 6 is forcing the soft water out of the inner end of the cylinder 4 through the conduit 46 and valve port 44 to the outlet opening 38, while the piston 5 is drawing the water through the conduit 41, valve port 40 and inlet opening 37. The piston 5 is just engaging the valve stem 32 of the valve 30 and a slight further movement of the pistons will unseat the valve 30 and thus relieve the pressure on the right hand end of the valve 17. The pressure on the left hand end of the valve will continue and will cause the valve to be shifted to the right, thus connecting the inlet port 18 with the port 13 of the conduit 11, opening the exhaust port 16 of the conduit 12 and closing the ports 15 and 14 of the conduits 12 and 11. Consequently, the motor fluid will pass to the outer end of the cylinder 3 and start the movement of the pistons toward the left, thus causing the motor fluid to be forced out of the outer end of the cylinder 4 through the conduit 12 and exhaust port 20 of the valve 17. Before the movement of the pistons begins, however, the pressure of the motor fluid will have been transmitted through the conduit 47 to the right hand end of the pump valve chamber 36. Inasmuch as the left hand of

that chamber is in communication with the outer end of the cylinder 4 and this cylinder is in communication with the exhaust there will be no pressure on the left hand end of the valve and the pressure applied to the right hand end thereof will move the valve to the left, thus reversing the ports of the pump valve in the same manner as the ports of the motor valve were reversed and permitting the water which has been drawn into the inner end of the cylinder 3 to be forced out through the conduit 45 and enabling the piston 6 to draw water into the inner end of the cylinder 4 through the conduit 42. When the pistons reach the left hand limit of their movement the piston 6 will engage the valve stem 33 of the valve 31, thus relieving the pressure on the left hand end of the motor valve 17 and causing that valve to be again shifted to reverse the movements of the pistons 5 and 6.

While I have shown and described one embodiment of my invention it will be understood that this has been chosen for the purpose of illustration only and that I do not desire to be limited to the details of construction shown and described, for obvious modifications will occur to a person skilled in the art. For example, while we have described and claimed the motor fluid conduits as leading to the outer ends of the cylinders and the pump conduits leading to the inner ends of the cylinders it will be obvious that this arrangement is not essential and can be varied if it should be found desirable.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. In a device of the character described, the combination with two cylinders, connected pistons mounted in said cylinders, a motor fluid conduit leading to one end of each of said cylinders, and a conduit leading to the opposite end of each of said cylinders, of a valve mechanism to control the flow of fluid through said motor fluid conduits, and comprising a valve chamber having a valve member mounted therein under a balanced pressure, valve chambers arranged at and communicating with the corresponding ends of said cylinders, conduits connecting the ends of the first-mentioned valve chamber with the respective last-mentioned valve chambers, valves mounted in said last-mentioned valve chambers to control the communication with said cylinders, said valves having parts projecting into the respective cylinders and into the paths of the pistons therein, and springs to hold said valves in their closed positions.

2. In a device of the character described, the combination with two cylinders, connected pistons mounted in said cylinders, a valve chamber communicating with a source of fluid supply and with an exhaust line, conduits extending from said valve chamber to the outer ends of the respective cylinders, other conduits extending from the outer ends of said valve chamber to the outer ends of the respective cylinders, a piston valve mounted in said valve chamber and adapted to connect said first-mentioned conduits with either said source of supply or said exhaust, said valve having an axial conduit communicating with said source of supply and with the opposite ends of said valve chamber, and piston-actuated valves to control the flow of fluid through those conduits which connect the outer ends of said valve chamber with the outer ends of said cylinders.

3. In a device of the character described, the combination, with two cylinders, pistons mounted in the respective cylinders and connected one with the other, means to alternately admit motor fluid to and exhaust the same from the outer end of each of said cylinders, of conduits leading to the inner ends of the respective cylinders, valve mechanism to connect said conduits alternately with inlet and outlet pipes, and means whereby the pressure of the motor fluid in the outer ends of said cylinders will control said valve mechanism.

4. In a device of the character described, the combination, with two cylinders, pistons mounted in the respective cylinders and connected one with the other, means to alternately admit motor fluid to and exhaust the same from the outer end of each of said cylinders, of conduits leading to the inner ends of the respective cylinders, valve mechanism to connect said conduits alternately with inlet and outlet pipes, said mechanism comprising a valve chamber communicating at its opposite ends with the outer ends of said cylinders, and a valve mounted in said valve chamber, whereby the motor fluid in one of said cylinders will act upon said valve to shift the same and reverse the flow of water through the valve mechanism.

5. In a device of the character described, a casing having two cylinders formed therein, arranged in longitudinal alinement and having valve chambers arranged on the opposite sides of said cylinders, one of said valve chambers having conduits connecting the same with the outer ends of both of said cylinders and the other of said valve chambers having conduits connecting the same with the inner ends of both of said conduits, pistons mounted in the respective cylinders and connected one with the other, valve members mounted in the respective valve chambers to control the flow of fluid to and from the respective ends of said cylinders, and fluid pressure controlled devices for shifting both of said valves.

6. In a device of the character described,

a casing having two cylinders formed therein, arranged in longitudinal alinement and having valve chambers arranged on the opposite sides of said cylinders, one of said valve chambers having conduits connecting the same with the outer ends of both of said cylinders and the other of said valve chambers having conduits connecting the same with the inner ends of both of said conduits, pistons mounted in the respective cylinders and connected one with the other, valve members mounted in the respective valve chambers to control the flow of fluid to and from the respective ends of said cylinders, means for subjecting one of said valves to balanced pressure, and means actuated by said pistons for relieving the pressure on one side of said valve.

7. In a device of the character described, a casing having two cylinders formed therein, arranged in longitudinal alinement and having valve chambers arranged on the opposite sides of said cylinders, one of said valve chambers having conduits connecting the same with the outer ends of both of said cylinders and the other of said valve chambers having conduits connecting the same with the inner ends of both of said conduits, pistons mounted in the respective cylinders and connected one with the other, valve members mounted in the respective valve chambers to control the flow of fluid to and from the respective ends of said cylinders, means for subjecting one of said valves to balanced pressure, means actuated by said pistons for relieving the pressure on one side of said valve, and means for subjecting the other of said valve members to the pressure of the motor fluid.

8. In a device of the character described, a casing having two cylinders formed therein, arranged in longitudinal alinement and having valve chambers arranged on the opposite sides of said cylinders, one of said valve chambers having two conduits leading therefrom to the outer end of each of said cylinders and the other of said valve chambers having conduits leading to the inner ends of the respective valve chambers and other conduits leading to the outer ends of said valve chambers, of a balanced valve mounted in the first-mentioned valve chamber to control the flow of motor fluid through one set of said conduits, pistons mounted in said cylinders, valves actuated by said pistons for controlling the other set of conduits to establish connection between one end of said valve chamber and said cylinder, and a second valve mounted in said second valve chamber to control the flow of fluid through the conduits leading to the inner ends of said cylinders and subjected, through the conduits leading to the outer ends of said cylinders, to the pressure of the motor fluid in said cylinders.

In testimony whereof, I affix my signature in presence of two witnesses.

FREDERICK C. NICKOL.

Witnesses:
F. W. SCHAEFER,
H. L. HAMMAKER.