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E. HILL.

PUMPING ENGINE.

APPLICATION FILED AUG. 29, 1901.

NO MODEL.

Fig. 1

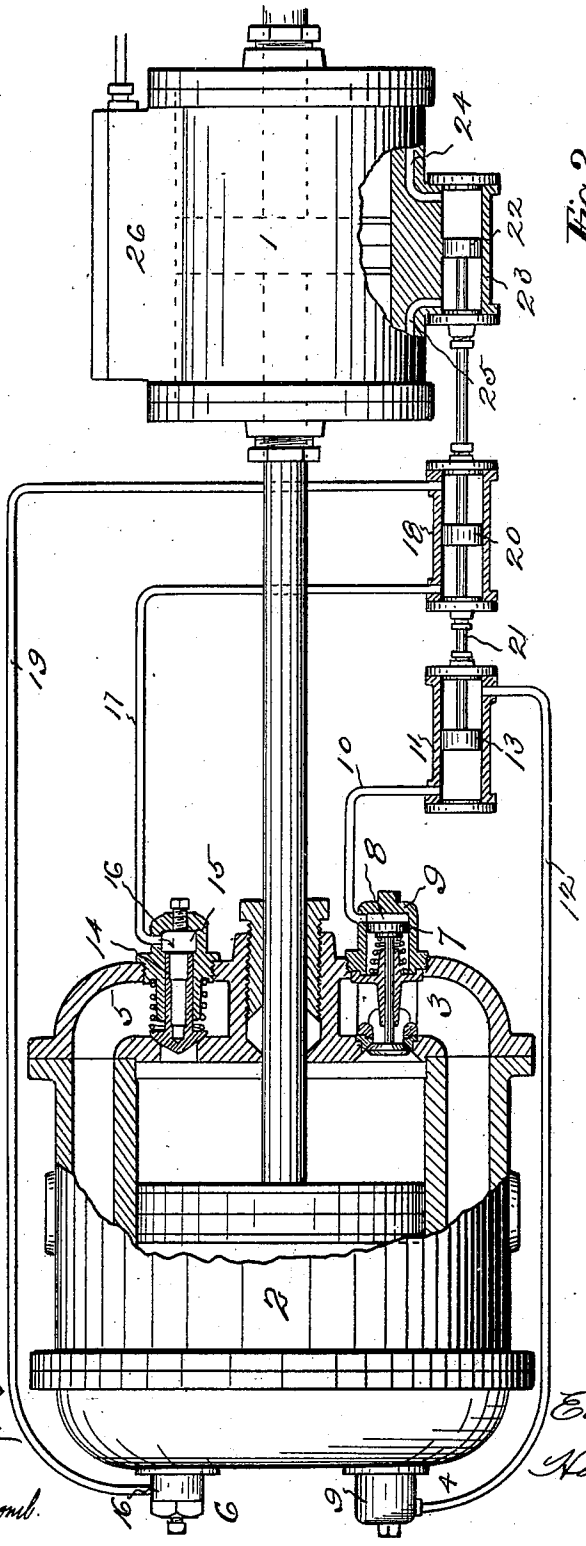
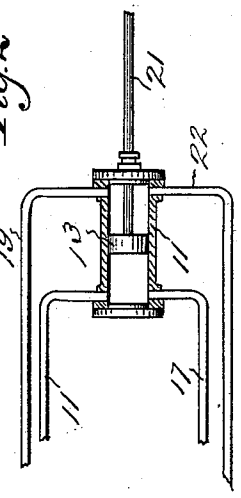


Fig. 2



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EBENEZER HILL, OF SOUTH NORWALK, CONNECTICUT.

PUMPING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 723,387, dated March 24, 1903.

Application filed August 29, 1901. Serial No. 73,687. (No model.)

To all whom it may concern:

Be it known that I, EBENEZER HILL, a citizen of the United States, residing at South Norwalk, in the county of Fairfield and State of Connecticut, have invented certain new and useful Improvements in Pumping-Engines, of which the following is a specification.

This invention relates to a novel means for opening and closing the pump-valves of a pumping-engine independently of the pumping-piston.

The object is to so construct a pumping-engine that the pump-valves will be operated energetically by a fluid actuated by the initial operating force at such times that the full effect of the pumping-piston will be realized.

The invention is particularly adapted to air-pumps; but it is applicable for pumps for forcing other fluids.

In the accompanying drawings an air-pump is shown with the pump-cylinder inlet-valve chambers connected with opposite ends of a cylinder of an auxiliary pump and with the pump-cylinder discharge-valve chambers connected with opposite ends of a cylinder of the auxiliary pump, which auxiliary pump is operated by the power that drives the main pump.

Figure 1 of the drawings is a diagrammatic view of an air-compressor that embodies the invention, with the auxiliary pump shown as adapted to be operated by steam from the main steam-cylinder. Fig. 2 is a view showing how the inlet and discharge valve chambers may be connected with a single cylinder of the auxiliary pump.

The piston in the steam-cylinder 1 and the piston in the pump-cylinder 2 are constructed and connected in the usual manner. The inlet-valves 3 and 4, at opposite ends of the pump-cylinder, and the discharge-valves 5 and 6, at opposite ends of the pump-cylinder, are of common form and arrangement. A piston or movable diaphragm 7 is fitted in the cylindrical chamber 8 in each plug 9, that supports an inlet-valve. This piston may be secured to or may be detached from the end of the adjacent valve-stem. In the form shown in Fig. 1 the end of the chamber of the inner inlet-valve is connected by a pipe 10 with the outer end of a cylinder 11 of the auxiliary pump, and the end of the chamber of the outer inlet-valve is connected by a pipe 12 with the inner end of the same cylinder of the auxiliary pump. The cylinder 11 is filled with a fluid, preferably such as is operated upon by the main pump, and as the piston 13 in this cylinder is moved in one direction the fluid is forced through one pipe to an inlet-valve chamber and drawn through the other pipe from the other inlet-valve chamber and by pressure causes the opening of one inlet-valve and by suction causes the closing of the other inlet-valve. When the piston 13 is moved in the reverse direction, the motion of the fluid is changed and the movements of the valves reversed. Each of the discharge-valves has a cylindrical stem 14, that fits as a piston in the cylindrical chamber 15 in each plug 16. The end of the chamber of the inner discharge-valve is connected by a pipe 17 with the outer end of a cylinder 18 of the auxiliary pump, and the end of the chamber of the outer discharge-valve is connected by a pipe 19 with the inner end of the same cylinder of the auxiliary pump. The cylinder 18 is filled with fluid, preferably such as is operated upon by the main pump, and as the piston 20 in this cylinder is moved back and forth the fluid is forced and drawn alternately through the pipes to and from the discharge-valve chambers, so as to cause the opening of the discharge-valves by suction and the closing of the discharge-valves by pressure.

The piston 13 in the cylinder 11 and the piston 20 in the cylinder 18 of the auxiliary pump are connected by a rod 21 with a power-piston 22 in a cylinder 23 in such manner that the reciprocation of the power-piston reciprocates the pistons in the auxiliary-pump cylinders and causes the pulsation of fluid through the pipes to the respective inlet and discharge chambers. The ends of the cylinder 23 are connected by ports 24 and 25 with the ends of the main steam-cylinder, so that as steam is admitted from the steam valve-chest 26 to the main steam-cylinder the pressure is exerted upon the power-piston of the auxiliary pump.

The auxiliary pump described has two cylinders, with the pump-inlet-valve chambers connected with opposite ends of one and the

pump-discharge-valve chambers connected with opposite ends of the other. The inlet-valve chamber and the discharge-valve chamber at the outer end of the pump-cylinder are connected with the inner ends of the respective auxiliary-pump cylinders, and the inlet-valve chamber and the discharge-valve chamber at the inner end of the pump-cylinder are connected with the outer ends of the respective cylinders of the auxiliary pump. This is the preferred arrangement where there is much difference between the pressure at the inlet and pressure at the outlet valves, for the low pressures at the inlet-valves, should any leakage occur, counteract each other upon the piston in the cylinder to which they are connected, and the high pressures at the discharge-valves, should any leakage occur, counteract each other upon the piston in the cylinder to which they are connected. This obviates the necessity of tightly packing the pistons.

It is obvious that both the inlet and discharge valve chambers at the outer end of the pump-cylinder could, if desired, be connected with the inner end of the single auxiliary-pump cylinder, and both the inlet and discharge valve chambers at the inner end of the pump-cylinder could, if desired, be connected with the outer end of the same cylinder of the auxiliary pump, as illustrated in Fig. 2. In this case, however, the pistons would have to be packed very tightly; otherwise the leakage under high pressure at the discharge-valves would affect the operation of the inlet-valves, which are subjected to lower pressure.

When steam is admitted to the right-hand end and exhausted from the left-hand end of the steam-cylinder for driving the main steam-piston forwardly, the steam-pressure is exerted upon one side and exhausted from the other side of the piston 22 in the cylinder 23, so that the piston will move forwardly and force forwardly the piston 20 in the cylinder 18 and the piston 13 in the cylinder 11. This causes fluid to be forced from the cylinder 18 through the pipe 17 to the chamber 15, so as to close the discharge-valve 5, and to be drawn into the cylinder 18 from the pipe 14, so as to open the discharge-valve 6. At the same time fluid is forced from the cylinder 11 through the pipe 10 to the chamber 8, so as to open the inlet-valve 3 and to be drawn into the cylinder 11 through the pipe 12, so as to close the inlet-valve 4. When steam is admitted to the left-hand end and exhausted from the right-hand end of the main steam-cylinder for driving the main steam-piston backwardly, the pressure acts upon the piston 22 in the cylinder 23, so as to cause the fluids to flow through the pipes oppositely and reverse the movements of the valves. When a little auxiliary pump is employed, its motions alternate with those of the main steam-cylinder, and the main-pump valves are quickly moved to their proper positions just as the main-pump piston dwells and is about to begin its return stroke. This method of operating the valves is simple, and the valves are so opened by the fluid that they offer little resistance to the incoming and outgoing air, and thus allow the main-pump piston when driven at high speed to receive and force out a full supply of fluid.

I claim as my invention—

1. A pumping-engine having a main pump with inwardly-opening inlet and outwardly-opening discharge valves, closed chambers containing parts of said valves, a reciprocating auxiliary pump, a fluid connection between the main-pump-operating cylinder and the auxiliary-pump-operating cylinder, whereby the latter is operated by the same fluid as the former, and a single fluid-conduit connecting each closed main-pump valve-chamber with the auxiliary pump whereby fluid is through each single conduit forced to and drawn from each pump-valve chamber by the auxiliary pump for accelerating the opening and closing of the main-pump valves, substantially as specified.

2. A pumping-engine having a main pump with inlet and discharge valves, an auxiliary pump with a motor-cylinder, fluid connections between the auxiliary pump and the main-pump valve-chambers whereby the auxiliary pump by forcing fluid to and drawing fluid from the valve-chambers causes the opening and closing of the main-pump valves, and steam connection between the auxiliary-pump motor-cylinder and the main steam-cylinder whereby the auxiliary-pump piston is operated alternately with the main steam-piston, substantially as specified.

3. A pumping-engine having a main pump with inwardly-opening inlet and outwardly-opening discharge valves, an auxiliary pump, fluid connections between the main-pump inlet-valve chambers and the opposite ends of a forcing-cylinder of the auxiliary pump, and fluid connections between the main-pump discharge-valve chambers and the opposite ends of a forcing-cylinder of the auxiliary pump whereby the auxiliary pump by forcing fluid to and drawing fluid from the valve-chambers accelerates the opening and closing of the main-pump valves, substantially as specified.

4. A pumping-engine having a main pump with inlet and discharge valves, an auxiliary pump with a motor-cylinder, fluid connections between the main-pump inlet-valve chambers and opposite ends of a cylinder of the auxiliary pump, fluid connections between the main-pump outlet-valve chambers and opposite ends of a cylinder of the auxiliary pump whereby the auxiliary pump by forcing fluid to and drawing fluid from the valve-chambers causes the opening and closing of the main-pump valves, and steam connection between the auxiliary-pump motor-cylinder and the main steam-cylinder whereby the auxiliary-pump piston is operated in

unison with the main steam-piston, substantially as specified.

5. A pumping-engine having a main pump with inlet and discharge valves, an auxiliary pump having three cylinders, one of which is a motor-cylinder, fluid connections between the main-pump inlet-valve chambers and opposite ends of a cylinder of the auxiliary pump, fluid connections between the main-pump discharge-valve chambers and opposite ends of a cylinder of the auxiliary pump, steam connection between the main steam-cylinder and opposite ends of the motor-cylinder of the auxiliary pump whereby the auxiliary pump is operated by the power that drives the main pump and causes fluid to open and close the respective inlet and discharge valves independently of, but in unison with the main-pump piston, substantially as specified.

6. A pumping-engine having a main pump with inwardly-opening inlet and outwardly-opening discharge valves, an auxiliary pump, fluid connections leading from the chambers back of the inlet and discharge valves to opposite ends of an auxiliary-pump forcing-cylinder, and a steam connection with the auxiary-pump motor-cylinder whereby the opening and closing of the inlet and discharge valves are accelerated by fluid actuated by the force operating the main pump, substantially as specified.

7. A pumping-engine having a main pump, an auxiliary pump, a fluid connection between the main-pump-operating cylinder and the auxiliary-pump-operating cylinder, whereby the latter is operated by the same fluid as operates the former, and a single fluid-conduit connecting a closed chamber containing a portion of a main-pump valve with the auxiliary pump, whereby fluid is by the auxiliary pump pulsated in the single conduit to accelerate the opening and closing of the main-pump valve, substantially as specified.

8. A pumping-engine having a main pump and fluid connections leading from chambers adjacent to main-pump valves to opposite ends of a cylinder containing fluid, and a steam connection from the main-pump motor-cylinder to a motor-cylinder that is connected with the fluid-cylinder, whereby the fluid in the fluid-cylinder is moved by the initial force which actuates the main pump, for accelerating the operation of the pump-valves, substantially as specified.

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