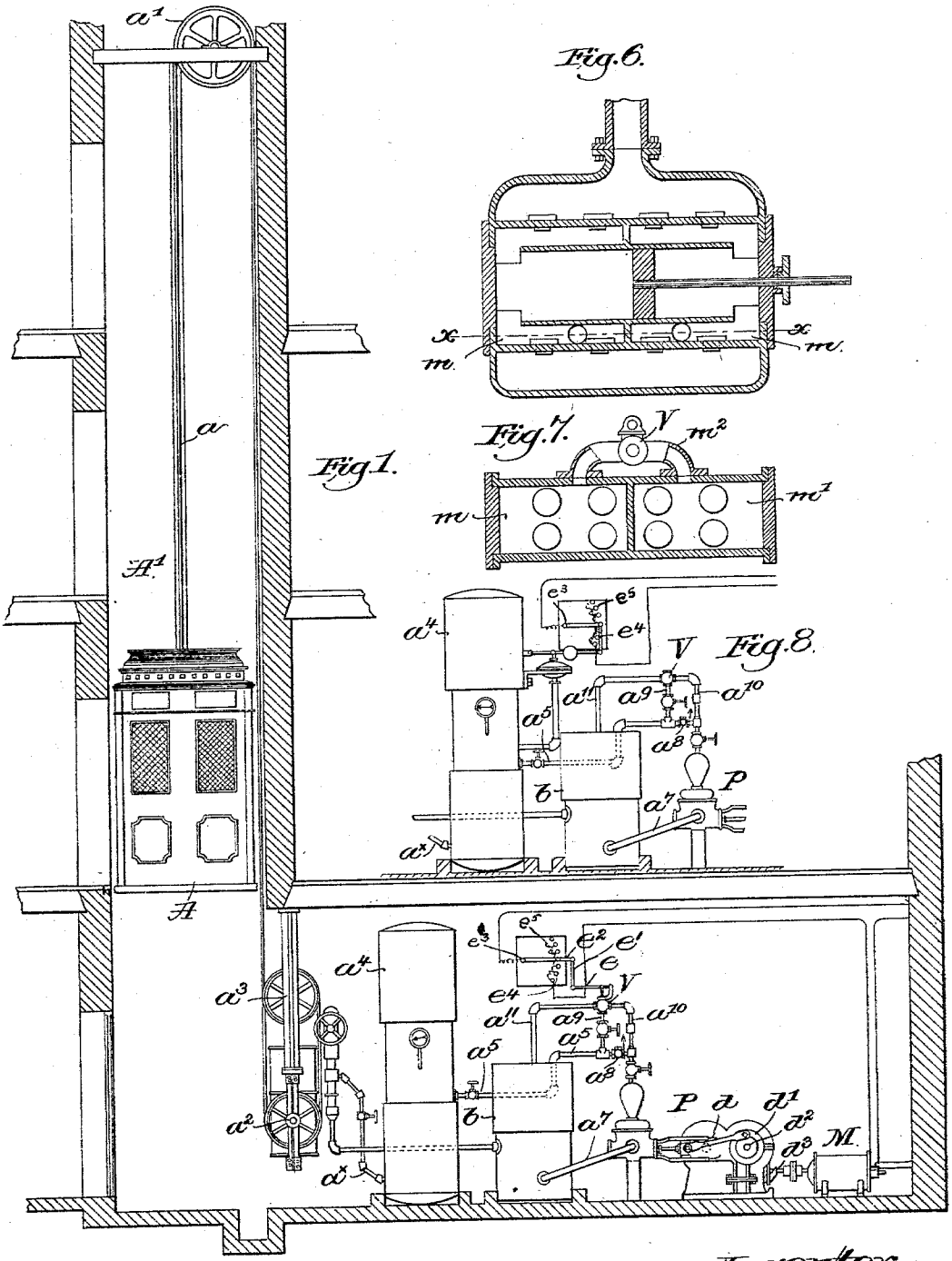
(No Model.) 2 Sheets—Sheet 1.

F. B. PERKINS.

ELEVATOR OPERATING MECHANISM.

No. 562,741. Patented June 23, 1896.



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(No Model.) 2 Sheets—Sheet 2.

F. B. PERKINS.

ELEVATOR OPERATING MECHANISM.

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Fig. 2.

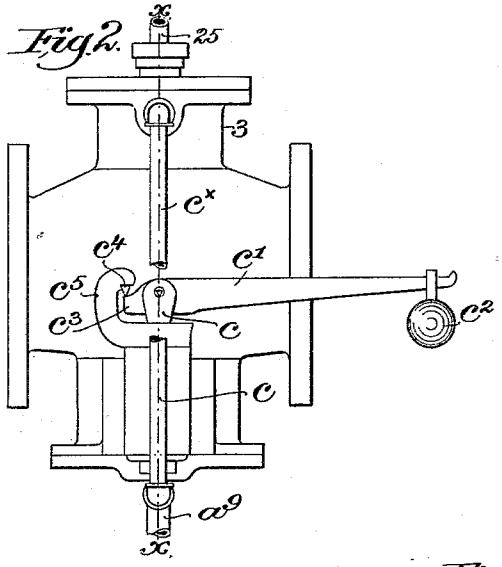


Fig. 4.

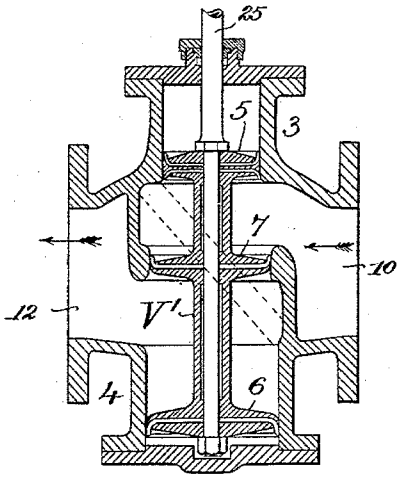


Fig. 3.

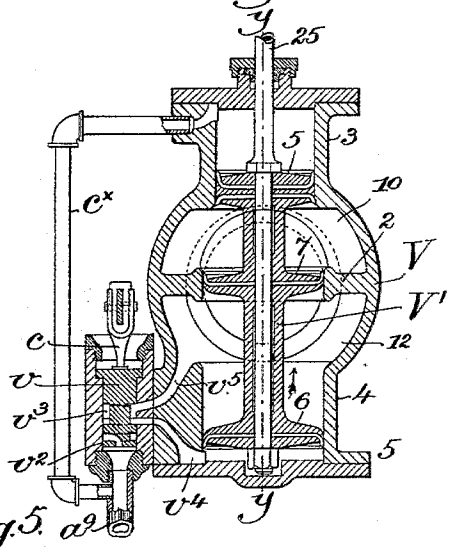
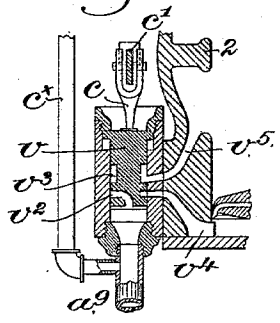


Fig. 5.



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UNITED STATES PATENT OFFICE.

FRANCIS B. PERKINS, OF BOSTON, MASSACHUSETTS.

ELEVATOR-OPERATING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 562,741, dated June 23, 1896.

Application filed May 21, 1891. Serial No. 393,596. (No model.)

To all whom it may concern:

Be it known that I, FRANCIS B. PERKINS, of Boston, county of Suffolk, State of Massachusetts, have invented an Improvement in Elevator-Operating Mechanisms, of which the following description, in connection with the accompanying drawings, is a specification, like letters on the drawings representing like parts.

This invention relates to hydraulic-elevator systems of that class wherein the fluid employed to actuate the elevator is stored in a tank under pressure by means of a pump. When the pump is operated by an electric motor, it has heretofore been considered essential to keep the motor and pump in continuous operation, as the starting and stopping of the motor and pump, under a heavy load, has had an injurious effect on the electric circuit in which the motor is placed, and which usually contains electric lights or other translating devices. It is, however, very desirable to be able to stop the motor when it is performing no work, in order to avoid useless expenditure of current, and I have discovered that by first cutting off the pressure in the pressure-tank from the pump, or, in other words, relieving the pump from its load, the pump and motor, being free from load, may thereafter be stopped and started without perceptibly affecting the circuit in which the motor is placed.

In accordance with this invention, a regulating device actuated by pressure in the pressure-tank is employed to relieve the pump from the pressure in the pressure-tank, and at the same time, or immediately thereafter, the power employed to operate the pump is also automatically cut off by a device actuated by the pressure in the pressure-tank.

One part of this invention therefore consists in a hydraulic-elevator system containing, in combination, the following instrumentalities, viz: a pressure-tank to contain fluid under pressure to actuate the elevator, a pump in communication with said tank, and means actuated by pressure in the pressure-tank to relieve the pump from the pressure in the tank, and to control the operation of the pump, substantially as will be described.

Other features of this invention will be hereinafter described, and pointed out in the claims.

Figure 1 represents a sufficient portion of a building provided with an elevator and its operating mechanism to enable this invention to be understood; Fig. 2, a detail in elevation, on an enlarged scale, of one form of regulating-valve to be referred to; Fig. 3, a section of the valve shown in Fig. 2, taken on the line x x; Fig. 4, a section of the valve shown in Fig. 3 on line y y; Fig. 5, a detail showing the auxiliary valve in its open position with its inlet-port communicating with the inlet-port of the cylinder. Figs. 6 and 7 show my invention in another construction, and Fig. 8 a detail showing a modified arrangement to be described.

Referring to drawings, the invention is represented as embodied in one form or construction in which the elevator-car A is suspended in the well A' by ropes a, passed about sheaves a' at the top of the well and passed about suitable sheaves on the stationary and movable shafts a^2 a^3, located, as herein shown, in the basement of the building, and suitable mechanism for actuating the movable shaft a^3 to move the elevator is and may be of any usual construction.

The water or fluid employed to actuate the operating mechanism of the elevator is taken by a pipe $a^\times$ from a pressure-tank a^4, into which the fluid is forced through a pipe a^5 by any usual force-pump P, the said pump maintaining a pressure in the said tank. As herein represented, the fluid after performing its work on the operating mechanism is discharged into a discharge-tank b, the pump P having its suction-pipe a^7 also connected with said discharge-tank, so that the water or other fluid discharged into said tank may be used over again in performing its work, the above arrangement being known as the "Hinkle system." The pipe a^5, leading from the pump to the pressure-tank, is provided with a check-valve a^8, and in accordance with this invention a regulating device or valve V is connected by a pipe a^9, preferably with the pipe a^5, between the check-valve a^8 and the pressure-tank, although the said valve may be connected directly with the pressure-tank or other suitable connection thereof, if desired, the said regulating-valve serving to control or regulate the amount of delivery from the pump to the pressure-tank, as will be described.

Referring to Sheet 2 of the drawings, the pipe a^9 is connected with the valve-chamber

of an auxiliary valve v of the regulating device or valve V, the said auxiliary valve being provided with ports v^2 v^3, adapted to cooperate, as will be described, with ports v^4 v^5 in the main-valve casing.

The main-valve casing, as herein represented, contains a middle wall or partition 2, forming two chambers 10 and 12, from which lead the cylinders 3 4, the main valve V′ in the said valve-casing comprising the pistons 5 and 6, moving in the cylinders 3 and 4, respectively, and the piston 7, having its seat in the middle partition 2 of the valve-casing.

In practice the diameters of the pistons 5, 7, and 6 for the best results will be respectively in the proportion of three, four, and five inches.

Communication between the two chambers 10 and 12 of the valve-casing is controlled by the piston 7 of the valve, the chamber 10 being connected by a pipe a^{10} with the pipe a^5 between the check-valve a^8 and the pump, and the chamber 12 in the said valve has an outlet through a pipe a^{11}, which pipe I prefer should lead to the discharge-tank b, although said pipe may, if desired, lead to any other suitable place.

The auxiliary valve v of the regulating device or valve is provided, as herein shown, (see Fig. 2,) with a forked support c, in which is pivoted a lever c', supporting an adjustable weight c^2, the short arm c^3 of said lever coöperating with a suitable stop c^4, which stop is carried by an arm or bracket c^5 on the valve-casing.

It will be observed that the pipes a^{10}, the chambers 10 and 12 of the valve-casing, and the pipe a^{11} constitue a fluid passage-way through which the fluid delivered by the pump may be diverted, and that the passage-way is controlled by the piston-valve 7, which valve is operated by a motor consisting of the piston 6, working in a cylinder 4, and a valve v, which controls the flow of the actuating fluid for this motor to and from the cylinder 4. This motor is arranged to be operated by the fluid-pressure within the storage-tank, and serves to move the valve 7 so as to divert the flow of fluid from the pump whenever the pressure in the tank becomes excessive, and to again direct it to the tank when the pressure therein becomes reduced.

In operation fluid is taken from the discharge-tank b by the pump and forced under pressure through the pipe a^5 into the pressure-tank a^4, from which tank it is taken as required for the operation of the elevator, the position of the auxiliary valve v of the regulating-valve V′ then being as shown in Figs. 2 and 3, the said valve v being kept in its lowermost position by action of the weight c^2 on the lever c, the ports v^4 v^5 then being in communication with each other, the valve V′ being in its lowermost position, as shown, its piston 7 cutting off communication between the chambers 10 and 12 of the valve-casing. When the pressure in the pressure-tank a^4 shall have risen to a certain predetermined point, as, for instance, one hundred pounds, said pressure, acting through the pipe a^9, will overcome the action of the weight c^2, tending to keep the auxiliary valve in its lowermost position, and will lift said auxiliary valve to its elevated position, Fig. 5, cutting off the communication from the port v^4 to the port v^5, and permitting fluid under pressure from the pipe a^9 to enter through the valve v and port v^4 to the under side of the piston 6 of the valve V′, moving said valve V′ to its elevated position to establish communication between the chambers 10 and 12, the discharge from the pump P then passing through the pipe a^{10}, chambers 10 and 12, and out through the pipe a^{11} into, as herein represented, the discharge-tank b, the check-valve a^8 holding back the pressure in the pressure-tank a^4, and relieving the pump of the load due to that pressure. When the pressure in the pressure-tank a^4 shall have become reduced by operation of the elevator, the weight c^2 will again force the auxiliary valve v of the regulating-valve to its lowermost position, Fig. 3, to cut off the pressure in the pipe a^9, and upon the under side of the piston 6, and reëstablish the communication between the ports v^4 v^5, permitting the constant pressure through the pipe $c^\times$ at the top of the piston 5 to force the valve V′ to its lowermost position, Figs. 3 and 4, to interrupt or cut off the communication between the chambers 10 12 and compel the delivery from the pump to again pass through the check-valve a^8 and pipe a^5 into the pressure-tank a^4 to renew the pressure therein. When the valve V′ is thus moved down, the water which was confined within the cylinder 4 and below the piston 6 escapes through the ports v^4, v^3, and v^5 into the chamber 12, when it passes onward into the pipe a^{11}. It will thus be seen that when the pressure in the tank a^4 has reached a predetermined point the regulating device or valve V′ will operate to cut off or divert the delivery of the pump and thereby relieve the same from its load, turning the delivery to one side away from the tank a^4, the pressure-tank remaining cut off from the pump until the pressure shall have been reduced, when the valve V′ will operate to again connect the pump with the tank to renew the pressure.

The pump P may and preferably will be actuated by electricity, and, as herein represented, the pump has its plunger moved by a connecting-rod d, jointed to and moved by a crank d' on a shaft d^2, carrying a worm-wheel actuated by a worm on a shaft d^3, which latter is belted or directly connected, as shown, with an electric motor M.

When an electric motor is employed to actuate the pump, it is desirable to stop the motor and pump during the period in which the pressure in the tank a^4 remains at the required maximum point in order to avoid useless expenditure of power; but as hitherto

arranged frequent stopping and starting of the motor has been found to injuriously affect the circuit in which the motor is placed and which usually contains one or more electric lights or other translating devices. The reason for this effect upon the circuit is that, as hitherto commonly constructed, the pump when started up must immediately begin to work against the high pressure already in the tank, thus throwing such a load upon the pump to be overcome by the motor in starting that the shock to the line is noticeable in the electric lights in the line; but with my improved system, employing the regulating device or valve V, the pressure in the tank is cut off and kept back from the pump when it has reached a predetermined point, so that if the pump is thereafter stopped, there being no pressure upon its delivery side, it may be again started by the motor free from initial load, the first few strokes by the motor serving to gather sufficient pressure to move the check-valve a^8 and again establish communication with the pressure-tank. To permit the pump to be so stopped and started, the valve-stem 25 of the valve V′ of the regulating-valve V may be extended through the valve-casing and at its outer end be jointed to and move the arm e, connected at its outer end by a link e' with the switch or rheostat-lever e^3, the latter being pivoted at e^3 and adapted to move in one or the other direction over the series of contacts e^4 e^5, connected by varying resistances with the circuit in which the motor M is placed. Thus when the valve V operates to cut off the communication between the pump and the pressure-tank it will by the same movement move the rheostat-lever e^2 over the contacts e^4, to thus cut the motor M from the circuit to stop the pump, and when the valve V operates to again establish communication between the pump and the pressure-tank the motor M will by the same movement of the valve be again gradually thrown in circuit and the pump started. The operation of the valve V being gradual, while the movement of the rheostat-lever is more rapid, permits the motor to start the pump before the communication between the pump and the pressure-tank is fully established, so that the pump practically starts without pressure or load to work against, the load being thrown upon it gradually by the opening of the valve, so that the effect of cutting the motor so gradually in and out of the line is not noticeable in the lights or translating devices also in the line.

The switch or rheostat-lever is herein shown as moved by the stem of the regulating-valve V, this being the preferable construction, but the same result may be obtained by employing an arrangement such as shown in Fig. 8, wherein the switch or rheostat-lever is moved by a separate valve or regulator, it being operated independently of the valve V, but at the same time and with the same effect as if it were operated directly by the valve.

When the pump is disconnected or cut off from the pressure-tank and permitted to continue in operation, I prefer that it should discharge into the discharge-tank b, through the pipe a^{11}, as shown in Fig. 1, but I desire it to be understood that any other suitable arrangement controlled by the regulating device or valve whereby the pump may continue its operation may be employed, as, for instance, such as shown in Figs. 6 and 7, wherein the two chambers or ports m m' at the suction end of the pump-cylinder are shown connected at one side by a pipe m^2, in which the valve V is placed, the said valve being connected by a pipe a^9, as previously described, with the pressure-tank or a connection thereof. When the pressure in the tank shall have reached the predetermined point, the valve V will operate to establish the communication from the chamber m to the chamber m' through the pipe m^2, so that the operation of the pump will cause the water or other fluid to move back and forth through the pipe m^2 from one chamber to the other as the pump-piston is reciprocated in the cylinder, thus accomplishing in a practical way the identical result accomplished by the arrangement shown in Fig. 1.

I claim—

1. In a hydraulic-elevator system, the combination of the following instrumentalities, namely; a tank to contain fluid under pressure to actuate the elevator, a pump which supplies the tank, a pressure-operated governing device controlled by the pressure within the tank, and connected with the pipe which leads from the pump to the tank, a fluid passage-way controlled by the said governing device and through which the fluid delivered by the pump is diverted whenever the pressure in the tank becomes excessive, and a cut-off device arranged between the pump and the tank and operated whenever the governing device is operated, substantially as set forth.

2. In a hydraulic-elevator apparatus, the combination of a tank to contain fluid under pressure to actuate the elevator, a pump which supplies the tank, a fluid passage-way through which the fluid from the pump may be diverted away from the tank, a valve controlling such passage-way, and a motor controlled by the pressure within the tank and actuating the said valve, whereby when the pressure becomes excessive, the said passage-way is opened for the water from the pump, and when the pressure is reduced, it is closed, substantially as set forth.

3. In a hydraulic-elevator system, the combination of the following instrumentalities, viz: a closed tank to contain fluid under air-pressure to actuate the elevator, a pump in communication therewith and arranged to supply it with the motor fluid, a motor for driving the pump, and governing devices operated by the pressure in the tank, and operatively connected first to cut off communi-

cation between the pump and the tank, and then to stop the motor which drives the pump, substantially as specified.

4. In a hydraulic-elevator system, the combination of the following instrumentalities, viz: a tank to contain fluid to actuate the elevator, a pump in communication therewith, an electric motor connected with and to operate said pump, a current-controlling device in and for the motor-circuit and actuated by the variations in the pressure of the elevator-actuating fluid, and a governing device for closing the communication between the pump and the tank and diverting the discharge from the pump also operated by the variations in pressure of the elevator-actuating fluid, substantially as and for the purpose specified.

5. In a hydraulic-elevator system, the combination of the following instrumentalities, viz: a tank to contain fluid to actuate the elevator, a pump in communication therewith, an electric motor connected with and to operate said pump, a current-controlling device in and for the motor-circuit, a pressure-relieving device for the pump operated by the variations in pressure of the elevator-actuating fluid, and connections between said pressure-relieving device and current-controlling device, whereby the latter is operated by the former, substantially as described.

6. In an elevator apparatus, the combination of the following instrumentalities, viz: a tank to contain a motor fluid under pressure for actuating the elevator, a pump which supplies the said tank, a pipe communicating between the pump and the tank, a check-valve in the said pipe, and a pressure-relieving device for the pump operated by the variations in the pressure of the actuated fluid in the tank and serving to cut off communication of the pump with the tank when the pressure arrives at or exceeds a predetermined amount, substantially as specified.

7. In a hydraulic-elevator apparatus, the combination of the following instrumentalities, viz: a storage-tank to contain motor fluid under pressure for operating the elevator, a pump for supplying the tank with the motor fluid, a pipe connecting the said tank and pump, a check-valve arranged therewith to prevent back pressure from the tank, the motor which drives the pump, and the governing devices operated by the pressure of the motor fluid in the tank and arranged first to cut off the pump from the tank and then to stop the motor which operates the pump, substantially as specified.

8. In a hydraulic-elevator system, the combination of the following instrumentalities, viz: a pressure-tank to contain fluid under pressure to actuate the elevator, a pump which delivers into the said tank, and a regulating device adapted to control the flow from the pump to the tank, and governed by the pressure within the latter, and consisting of a weighted auxiliary valve upon which the pressure within the tank acts and a main valve V which controls the flow of fluid through the pipe connecting the pump and the tank, the said main valve being in communication with the storage-tank through a passage-way which is controlled by the said auxiliary valve, substantially as set forth.

9. In a hydraulic-elevator system the combination of the following instrumentalities, viz: a pressure-tank to contain fluid under pressure to actuate the elevator, a pump, a delivery-pipe connecting the same with said tank, a discharge-pipe for said delivery-pipe and a regulating device having a main valve to control the said discharge-pipe, and a governing device actuated by pressure in said tank to control said main valve, substantially as described.

10. In an elevator-operating mechanism, the combination of the following instrumentalities, viz: a pressure-tank to contain the fluid for actuating the elevator under pressure, a pump having its outlet-pipe connected to the inlet-pipe for the pressure-tank, a check-valve in the said inlet-pipe, and a valve in the discharge or outlet pipe of the pump operated by pressure in the tank when the said pressure has reached a predetermined point, substantially as described.

11. In an elevator-operating mechanism, the combination of the following instrumentalities, viz: a pressure-tank to contain the fluid for actuating the elevator under pressure, a waste or discharge tank, a pump having its suction-pipe connected to the discharge-tank, an inlet-pipe for the pressure-tank connected to the outlet-pipe for the pump, a check-valve in the said inlet-pipe, and a valve in the discharge or outlet pipe of the pump operated by pressure in the tank when the said pressure has reached a predetermined point or amount, substantially as described.

12. In an elevator-operating mechanism, a pressure-tank to contain the fluid for actuating the elevator under pressure, a waste or discharge tank, a pump having its suction-pipe and its outlet-pipe connected to the discharge-tank, an inlet-pipe for the pressure-tank connected to the discharge-pipe of the pump, a check-valve in the said inlet-pipe, and a valve in the discharge-pipe for the pump operated by pressure in the tank, when the said pressure has reached a predetermined point, an electric motor to operate the pump, a switch in circuit with said motor, and intermediate connections joining the said switch with the valve in the discharge-pipe, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

FRANCIS B. PERKINS.

Witnesses:
FREDERICK L. EMERY,
EDWARD F. ALLEN.