(No Model.)

# W. B. MASON.

## PUMP REGULATOR.

No. 523,900. Patented July 31, 1894.

*Fig. 1.*

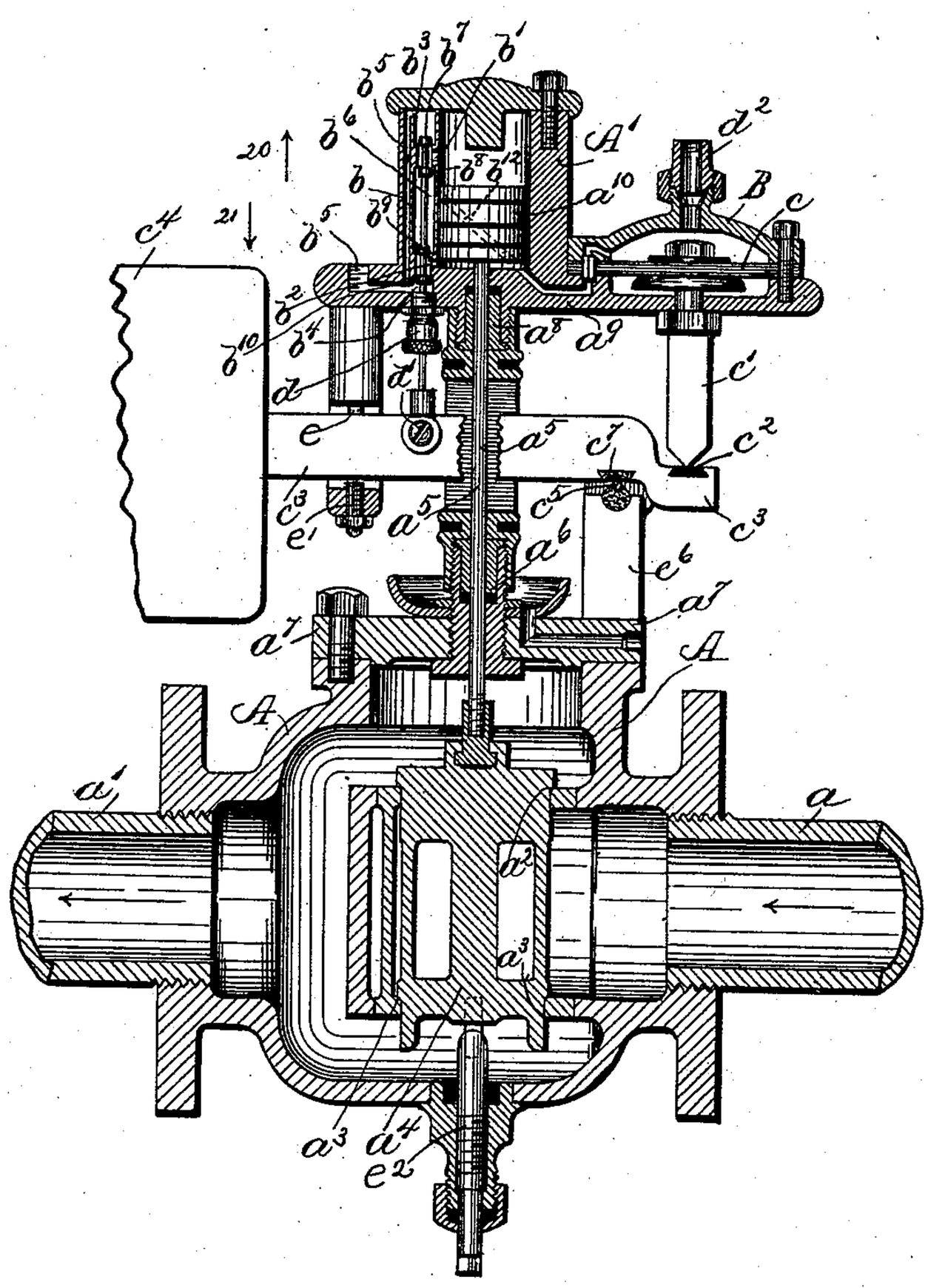
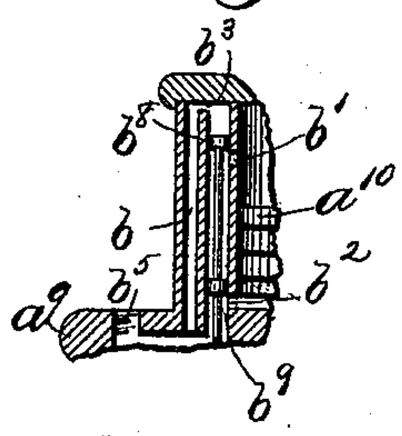



*Fig. 2.*

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# UNITED STATES PATENT OFFICE.

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## PUMP-REGULATOR.

SPECIFICATION forming part of Letters Patent No. 523,900, dated July 31, 1894.

Application filed July 11, 1893. Serial No. 480,125. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM B. MASON, residing in Boston, in the county of Suffolk and State of Massachusetts, have invented an Improvement in Pump-Regulators, 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 a pump regulator especially designed and adapted to be used in connection with the pump now commonly employed in hydraulic elevator systems.

This invention has for its object to provide a sensitively acting regulator responsive to substantially slight variations in the pressure of the fluid employed to actuate the elevator. In hydraulic elevator systems as now commonly constructed, the fluid employed to actuate the elevator is supplied by a pump, in one instance, to a closed tank commonly called the pressure tank, and in another instance, to an open tank or vessel usually located at the top of the building, to obtain the desired pressure, which in this instance is due to the column of the actuating fluid, usually water. The pump referred to, in some instances, is actuated by steam and in other instances by means of an electric motor.

My improved regulator is capable of being adapted, with very slight changes as will be described, to be used to govern the action of the pump both when driven by steam and when driven by an electric motor. When the electric motor is employed to drive the pump, it is desirable that the motor should not be stopped when the fluid pressure has reached a predetermined point, and to effect this result, the pump is provided with a by-pass having in it a valve, normally closed when the fluid pressure is below the predetermined point, but which is opened when the pressure equals or exceeds the said predetermined point, so that the pump may be kept in operation without supplying fluid to the tank.

In accordance with this invention, the main valve of my improved pump regulator may constitute the by-pass valve, and in order that the invention may be clearly understood, I will specifically describe hereinafter, the construction and operation of the regulator when so used.

The main valve of the regulator, preferably made as a balanced double seated valve, is connected to and operated by a piston, located in a cylinder provided with a water inlet port communicating with a valve chamber or chest, in which is located a valve for the said piston, and which will be hereinafter referred to as the auxiliary valve, the valve chest being in communication with the fluid-containing-tank through a diaphragm-containing-chamber. The diaphragm-containing-chamber has located in it a diaphragm actuating a stem or rod, which, in accordance with my invention, acts upon a weighted lever, to which the auxiliary valve is directly connected to be moved thereby. In order to render very sensitive the operation of the auxiliary valve and thereby of the regulator, the weighted lever is fulcrumed upon a knife edge, and the projection or stem on the diaphragm is also provided with a knife edge to act on the said lever as will be described.

The auxiliary valve referred to, in one instance, is constructed to control the admission of fluid to the piston cylinder so as to cause the fluid to act upon the said piston in a direction to open the main valve of the regulator, when the fluid pressure equals or exceeds a predetermined point, in which instance, the main valve of the latter is included in the by-pass for the pump. The auxiliary valve referred to, may also be constructed as will be hereinafter described to cause the fluid to move the piston in opposite directions to positively open and close the main valve of the regulator according to the fluid pressure in the tank. In this latter instance, the regulator controls the admission of steam to the steam chamber of the pump. These and other features of my invention will be pointed out in the claims at the end of this specification.

Figure 1 represents in elevation and section a pump regulator valve embodying my invention and provided with an auxiliary valve constructed so as to enable the regulator to be used on a pump driven by electricity, and

Fig. 2 is a sectional detail showing the form of the auxiliary valve employed when the regulator is used in connection with a pump operated by steam.

The valve fitting A provided with the inlet port or pipe $a$ and the outlet port or pipe $a'$ and having the double valve seats $a^2$ $a^3$ with which co-operates the main valve $a^4$, is and may be of any usual or desired construction. The main valve $a^4$ has its valve stem $a^5$ extended through a suitable stuffing box $a^6$ in the top plate $a^7$ of the fitting, and through a stuffing box $a^8$ and head $a^9$ of the cylinder A', provided with a piston $a^{10}$ to which the opposite end of the valve rod $a^5$ is connected.

The cylinder A' has secured to or forming part of it a valve chamber or chest $b$, communicating with the cylinder A', as herein shown, through the ports $b'$ $b^2$, the said valve chest being further provided as shown in Fig. 1 with ports $b^3$ $b^4$ communicating with an exhaust port or passage $b^5$. The valve chest $b$, as shown in Fig. 1, has located within it a valve stem $b^6$, shown as provided with two disk valves $b^7$ $b^8$ controlling the port $b'$ and like disk valves $b^9$ $b^{10}$ controlling the port $b^2$, as will be described. Between the ports $b'$ $b^2$, the valve chest $b$ has communicating with it a fluid inlet port or passage $b^{12}$ also connected to a diaphragm-containing-chamber B above the diaphragm $c$ located therein. The diaphragm $c$ acts on a stem, rod or projection $c'$, which is herein shown as firmly secured to the said diaphragm and which is extended through the lower part or wall of the said chamber, and for the best results is made V-shaped at its end to form a knife edge, which co-operates with the bearing plate or piece $c^2$, herein-represented as dove-tailed into the lever $c^3$ provided with the usual weight $c^4$, and in accordance with my invention, fulcrumed on the knife edge $c^5$ on an upright $c^6$, represented as erected from the top plate $a^7$ of the fitting A. The knife edge $c^5$ preferably engages a hardened piece or surface $c^7$ represented as dove-tailed into the lever $c^3$. The bearing surfaces $c^2$ $c^7$ are and preferably will be made of hardened steel.

The valve stem $b^6$ of the auxiliary valve is extended through a suitable stuffing box $d$ and is directly connected to the lever $c^3$ to be actuated thereby, it being herein shown as secured to the said lever by the screw $d'$. The diaphragm-containing-chamber B is provided with a fluid inlet pipe $d^2$, which in practice is connected to the tank or vessel containing the fluid employed to actuate the elevator. The regulator, when constructed as above described, is designed to be used to control the action of a pump, when the latter is driven by an electric motor, and in this instance, the fitting A is included in the by-pass for the pump, the inlet port or pipe $a$ being connected to one end of the pump cylinder and the outlet pipe or port $a'$ being connected to the other end of the said pump cylinder. When thus used, the main valve $a^4$ is normally seated and the by-pass passage is closed, the parts of the regulator being in the position shown in Fig. 1, and the pressure of the fluid employed to operate the elevator being below the predetermined point. If now, the pressure of the fluid employed to actuate the elevator should reach the predetermined point, which may, for instance, be set at one hundred pounds in the case of the closed tank system, the fluid in the chamber B acts upon the diaphragm $c$ and depresses the short end or arm of the weighted lever $c^3$, thereby raising the long arm of the said lever upward and moving the stem $b^6$ of the auxiliary valve in substantially the same direction indicated by arrow 20, so as to cut off communication between the inlet port or passage $b^{12}$ and the port $b'$, and establish communication between the valve chest and the port $b^2$, so that the fluid from the diaphragm-containing-chamber B passes through the passage $b^{12}$ into the valve chest $b$ and then past the valve $b^9$ and into the cylinder A' below its piston $a^{10}$, thereby moving the piston $a^{10}$ in the direction indicated by arrow 20 and lifting the main valve $a^4$ from its seat, thus establishing communication between the pipe or port $a$ and the pipe or port $a'$, and permitting the pump to be operated without exerting strain upon the motor, the pump in this instance being cut off from the fluid-containing-tank by the usual check valve, not herein shown.

When the auxiliary valve stem $b^6$ is raised as just described and the port $b'$ cut off from the fluid inlet port or passage $b^{12}$ by the valve $b^8$, communication is established between the port $b'$ and the port $b^3$ connecting the upper portion of the valve chest with the exhaust passage $b^5$, and at the same time, the valve $b^{10}$ is moved so as to cut off communication between the port $b^2$ and the exhaust passage $b^5$. As the piston $a^{10}$ is moved in the direction of arrow 20, the fluid in the cylinder A' above the said piston is forced through the port $b$ past the valve $b^7$ into the upper portion of the valve chest, thence through the port $b^3$ into the exhaust passage $b^5$.

When the fluid in the tank or vessel falls below a predetermined amount, the pressure is reduced upon the diaphragm $c$ and is overcome by the weight $c^4$, which moves the long arm of the lever $c^3$ in a direction opposite to that indicated by arrow 20, that is, in the direction indicated by arrow 21, thereby moving the auxiliary valve stem downward into the position shown in Fig. 1, so as to cut off communication between the fluid inlet passage $b^{12}$ and the port $b^2$ and establish communication between the passage $b^{12}$ and the port $b'$, and at the same time establish communication between the port $b^2$ and the exhaust port $b^5$, the valve $b^{10}$ being moved so as to open the communication between the port $b^2$ and the exhaust passage $b^5$, while the valve $b^7$ is closed to cut off communication between the port $b'$ and the port $b^3$.

By pivoting the weighted lever $c^3$ on the

knife edge $c^5$ and acting upon the short arm of the said lever by the knife edge $c^2$ on the diaphragm stem $c'$, the said lever and its connected auxiliary valve are rendered very sensitive and respond to slight changes in fluid pressure upon the diaphragm $c$, thereby rendering the action of the main valve $a^4$ responsive to slight changes in pressure of the actuating fluid.

I have thus far described the action of the regulator when used in connection with a pump driven by an electric motor, but I do not desire to limit my invention to this particular use, as it is equally well-adapted, with a slight change in the construction of the auxiliary valve as will now be described, to be used in connection with a pump driven by steam. It will be noticed that when the main valve $a^4$ is employed to control the by-pass for the pump, the said main valve is opened when the pressure of the fluid employed to actuate the lever equals or exceeds the predetermined point. When the regulator is employed in connection with a pump driven by steam, the action of the main valve is the reverse of that described, namely, the said valve is closed when the fluid pressure equals or exceeds the predetermined amount, so as to render the pump inoperative at such time. To accomplish this result with the regulator herein shown, the auxiliary valve stem is provided with but two valves which are arranged on the said stem in such manner as to open one port as $b'$ and close the other port as $b^2$ when the pressure of the fluid equals or exceeds the predetermined point. This construction is shown in Fig. 2 and the operation of the auxiliary valve shown in Fig. 2 may be briefly described as follows:—As shown in Fig. 2, the valves on the auxiliary stem, which may be supposed to be the valves $b^8$ $b^9$, are located so as to connect the port $b'$ with the fluid inlet $b^{12}$ and to close the port $b^2$, the main valve $a^4$ being at such time closed and held to its seat by the fluid pressure which equals the predetermined amount. If now the pressure upon the diaphragm $c$ is relieved, as by the starting of the elevator, the lever $c^3$ is moved downward by its weight $c^4$ in the direction indicated by arrow 21, so as to establish communication between the port or passage $b^{12}$ and the port $b^2$, at the same time cutting off the port $b'$ from the fluid inlet $b^{12}$ and establishing communication between the port $b'$ and the exhaust passage $b^5$ through the port $b^3$. The fluid admitted into the cylinder A′ below the piston $a^{10}$ moves the said piston in the direction indicated by the arrow 21 and opens the main valve $a^4$, the fluid in the cylinder A′ above the valve $a^{10}$ being forced out through the port $b'$ into the valve chest above the valve $b^8$ and through the port $b^3$ into the exhaust passage $b^5$. When the pressure of the fluid has again reached the predetermined amount, the weighted lever $c^3$ is moved upward and the auxiliary valve stem is moved in the direction indicated by arrow 20 so as to establish communication between the port or passage $b^{12}$ and the port $b'$, and connecting the port or passage $b^2$ with the exhaust passage $b^5$. In this case, the fluid passes into the cylinder A′ through the port $b'$ and forces the piston $a^{10}$ downward so as to close the main valve $a^4$.

The movements of the lever $c^3$ and of the auxiliary valves, are limited by the stops $e$ $e'$. In order to positively open the main valve $a^4$ in case the same remains seated by accident or from sticking of the valve, the fitting A is provided with a movable rod $e^2$ adapted to be forced into engagement with the under side of the main valve to lift it from its seat.

Instead of the particular form of diaphragm herein shown, I may employ any other well-known equivalent form, such, for instance, as a piston movable in a cylinder and having its piston rod constituting the stem $c'$.

I claim—

1. In a pump regulator, the combination with a main valve, a piston connected thereto, a cylinder for said piston, a valve chest communicating with said cylinder, a fluid inlet for said valve chest communicating with a diaphragm-containing-chamber, a diaphragm in said chamber actuated by the same fluid which acts on the said piston, a stem or rod actuated by said diaphragm, an auxiliary valve in the said valve chest controlling the admission of the diaphragm actuating fluid into the said valve chest, and a lever acted upon by the said diaphragm stem and to which the stem of the said auxiliary valve is directly connected to move in substantially the same direction in which the said lever is moved, substantially as described.

2. In a pump regulator, a fitting provided with a valve seat, a main valve located in said fitting, an actuating piston for said main valve, a cylinder for said piston provided with ports $b'$ $b^2$, a valve chest communicating with the said cylinder through said ports, a valve stem provided with valves co-operating with said ports, a fluid inlet passage communicating with the said valve chest between the said ports, a diaphragm chamber into which the fluid which actuates the said piston is admitted, a diaphragm in said chamber acted upon by the same fluid which actuates the said piston, a stem or rod actuated by the said diaphragm, and a pivoted lever acted upon by said stem and to which the auxiliary valve stem is directly connected to move in substantially the same direction in which the said lever is moved, substantially as described.

3. In a pump regulator, a fitting provided with a valve seat, a main valve located in said fitting, an actuating piston for said main valve, a cylinder for said piston provided with ports $b'$ $b^2$, a valve chest communicating with said cylinder through said ports and provided with exhaust ports $b^3$ $b^4$, a valve stem provided with valves $b^7$ $b^8$ controlling the ports $b'$ $b^3$ and with valves $b^9$ $b^{10}$ controlling the ports $b^2$ $b^4$, a valve inlet passage communicating with the

said valve chest between the ports $b'$ $b^2$, a diaphragm chamber with which the said valve inlet passage is connected, a diaphragm in said chamber, a stem or rod actuated by said diaphragm, and a pivoted lever acted upon by said stem and to which the auxiliary valve stem is connected, substantially as described.

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

WILLIAM B. MASON.

Witnesses:

JAS. H. CHURCHILL,

J. MURPHY.