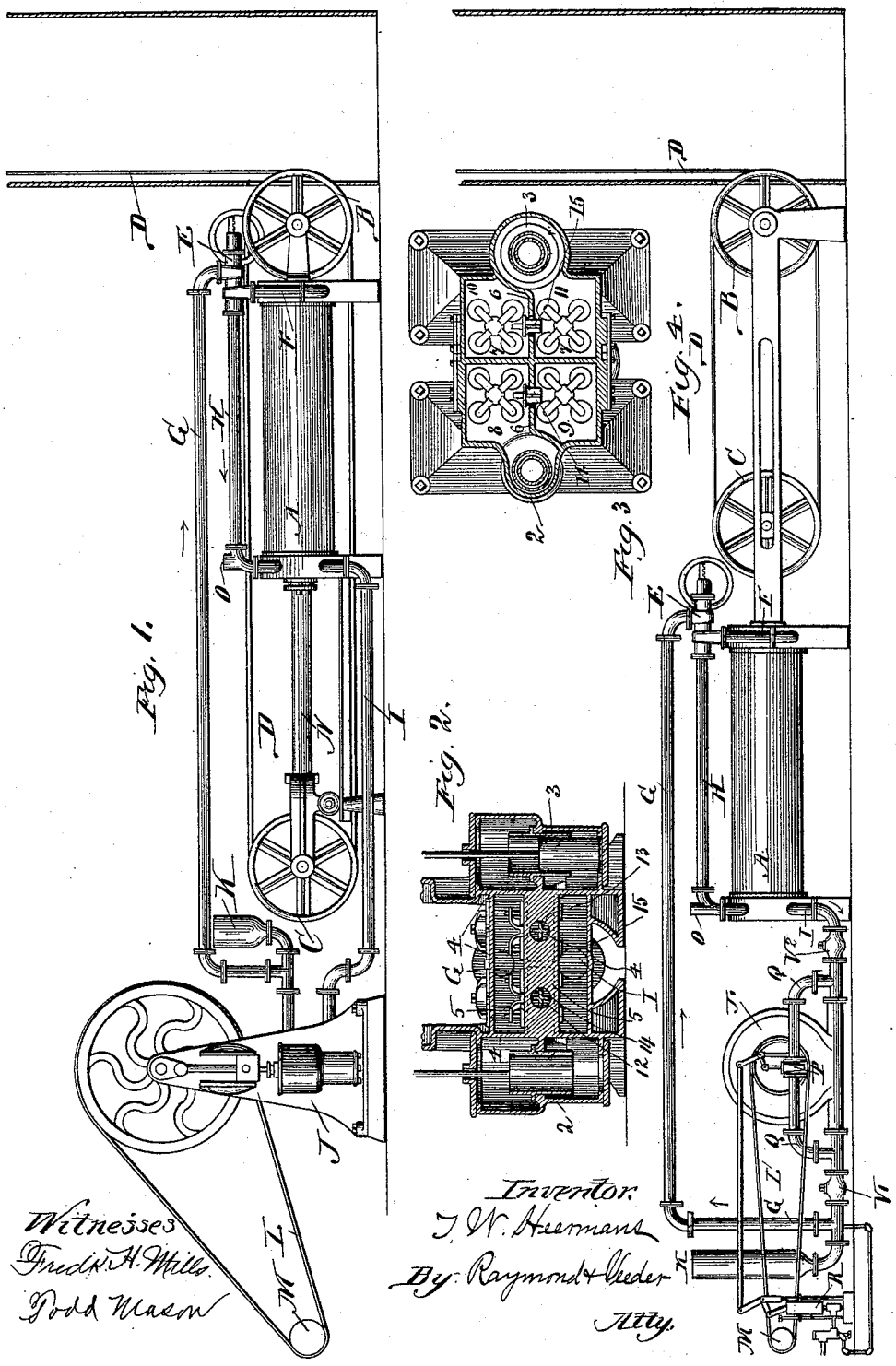
(No Model.) 2 Sheets—Sheet 1.

T. W. HEERMANS.

ELEVATOR.

No. 455,794. Patented July 14, 1891.



(No Model.) 2 Sheets—Sheet 2.

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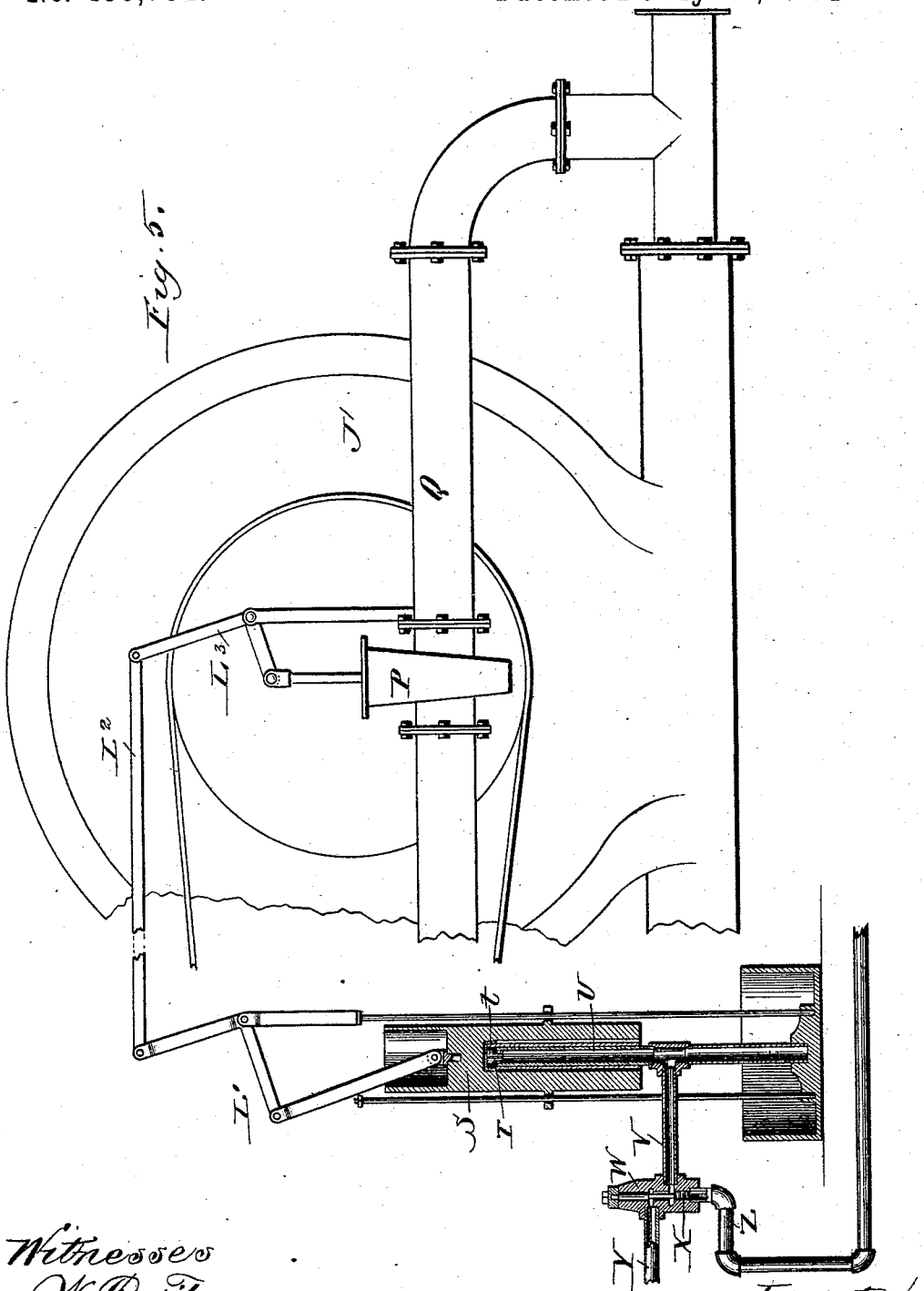
Fig. 5.



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UNITED STATES PATENT OFFICE.

THADDEUS W. HEERMANS, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE CRANE ELEVATOR COMPANY, OF ILLINOIS.

ELEVATOR.

SPECIFICATION forming part of Letters Patent No. 455,794, dated July 14, 1891.

Application filed February 27, 1891. Serial No. 383,026. (No model.)

To all whom it may concern:

Be it known that I, THADDEUS W. HEERMANS, residing at Chicago, in the county of Cook and State of Illinois, and a citizen of the United States, have invented certain new and useful Improvements in Elevators, of which the following is a specification, reference being had to the accompanying drawings.

The hydraulic elevators most in use derive their water-supply from a tank or other reservoir placed in an elevated position about the building or structure in which the elevator is situated, the purpose of this construction being to secure constancy of the water-supply and facility in the management, together with quickness in starting and stopping the car, the movements of the elevator being controlled entirely by the valve which regulates the admission and exhaust of the water to and from the elevator-cylinder. A disadvantage of this form of elevator is that the pressure and quantity of water used in making an ascent of the elevator is constant and sufficient to raise the maximum load for which the elevator is designed, whether a large or small load is actually carried, thus entailing a great waste of power.

It is the object of my present invention to secure the same facility of control which is obtained by the storage-tank system by retaining the control of the movements of the elevator through a single operating-valve which regulates the admission and exhaust of fluid to and from the elevator-cylinder, while at the same time I economize power by pumping direct to the elevator-cylinder under a pressure which shall depend upon the size of the load to be lifted, and shall be only sufficient for the work to be done.

A further object of my invention is to produce an elevator apparatus which shall conveniently permit the use of separate pumps for each elevator where a number are used together, which pumps may all be driven from a single source of power, if desired.

A further purpose of my invention is to simplify the apparatus by dispensing with all independent storage-tanks, whether large or small, by using the elevator-cylinder as a storage-tank, effecting the operation of the elevator by a simple transfer of the water or other power-transmitting liquid from one end to the other of the elevator-cylinder.

In the drawings, Figure 1 is a side elevation of so much of an elevator apparatus as is necessary to illustrate my invention. Figs. 2 and 3 are vertical and horizontal sections, respectively, of the pump shown in Fig. 1 as a part of the elevator apparatus. Fig. 4 is a side elevation of a portion of an elevator apparatus, showing my invention as carried out in an apparatus containing some modifications in constructional detail. Fig. 5 is a view, on an enlarged scale, partly in section, of the pump and connected devices forming a part of the apparatus illustrated in Fig. 4.

A, Fig. 1, is the elevator-cylinder. Fixed sheaves B and movable sheaves C, connected to the piston in the usual manner, are provided. The rope or cable D passes around said sheaves and is then led to the elevator shaft or well, as usual.

E is the control-valve, which is constructed and operated from the elevator in any well-known manner. It is connected to the pipe F, leading to the elevator-cylinder, as well as to the inlet-pipe G and the exhaust-pipe H. The exhaust-pipe H leads to the opposite end of the elevator-cylinder A from that into which the pipe F enters. For convenience of designation I shall call the end of the cylinder into which the exhaust-pipe H leads the "exhaust end" of the cylinder, and the end into which the pipe F enters the "pressure end" of the cylinder. From the exhaust end of the cylinder the pipe I leads to the inlet or suction of the pump J. The pipe G is connected to the outlet of the pump J, and through it water is delivered under pressure to the cylinder A through the control-valve. Connected to the pipe G at any convenient point is an air-chamber K for preventing any shocks from the pulsation of the water within the pipes. The pump is, under ordinary circumstances, intended to run continuously, and, as illustrated in Fig. 1, is driven by a belt L from a pulley M, of which there may be a series arranged on a line-shaft. The speed at which the elevator will run is of

course governed by the amount of liquid supplied to the elevator-cylinder A, and this will be a fixed quantity so long as the pump is run at the regular speed, whether the load upon the elevator be small or great. The pressure under which water is delivered from the pump, and consequently the work performed by the pump, is proportional to the load lifted. In order to permit the pump to work continuously, whether the elevator be ascending or not, it is provided with a by-pass, which is automatically opened when the closure of the control-valve causes the pressure against the delivery of the pump to exceed the amount necessary to lift the largest load for which the elevator is designed, and the opening of said by-pass permits the pump to run unloaded, the only power consumed being the comparatively slight pressure required to cause the pulsation of the water back and forth within the pump. The construction of said by-pass is, for the sake of completeness, illustrated in detail in Figs. 2 and 3, though it forms no part of the present invention, but is the subject-matter of an application filed by me in the United States Patent Office January 31, 1891, and serially numbered 379,765.

The pump has two water-cylinders 2 and 3, and the valve-chambers are located in the frame between said cylinders. The valves are contained within a chamber formed by the walls 4 4, which chamber is subdivided by two horizontal partitions 5 5 into three compartments, the lower of which is open to the inlet or suction pipe I and the upper of which is connected to the outlet-pipe G. The middle compartment is again subdivided by the vertical partitions 6 7 (seen in Fig. 3) into four valve-chambers 8, 9, 10, and 11, respectively. The valve-chambers 8 and 9 communicate with the upper and lower ends, respectively, of the cylinder 2, and the chambers 10 and 11 communicate with the upper and lower ends of the cylinder 3, as indicated in Fig. 3. Within the partition-wall 6 are made openings 12 and 13, into which are fitted valves 14 and 15. It is evident that when said valves 14 and 15 are opened, instead of water being delivered by the pump there will simply be a pulsation of the liquid back and forth between the valve-chambers 8 and 9 and between the valve-chambers 10 and 11, while the closure of the valves will cause the pump to operate in the usual manner. The operation of the valves 14 and 15 is automatically effected by any of the ordinary pressure-relief valves, or by such a pressure-relief valve as is represented in section in Fig. 5. Said valve is herein shown in connection with the by-pass valve and pump, illustrated in Fig. 4, but is equally applicable to the pump shown in Figs. 4 and 5, and will be hereinafter more fully described. As the action of said relief or pressure-regulating valve is the same, whether attached to one or the other of the by-pass valves, it is here illustrated in connection with one form only. The relief or pressure regulating valve does not form a part of the present invention, but is the subject-matter of a pending application filed by me August 19, 1890, and serially numbered 362,424.

The operation of the apparatus is as follows: If it is desired to ascend, the control-valve E is moved so as to place the delivery-pipe G in communication with the pressure end of the cylinder A, whereupon the pressure will fall in the pipe G to the working limit, the by-pass will close, and the elevator will rise at a speed determined by the speed of the pump J. If now the control-valve E be closed, the pressure rising in the pipe G will cause the pressure-regulating valve to act, so as to open the by-pass valves 14 and 15, thereby causing the pump to cease operating, although it continues in motion. When the control-valve is opened to the exhaust-pipe H, the water passes through the latter from the pressure end to the exhaust end of the cylinder A, the exhaust end becoming filled as the pressure end is emptied. In order to allow for the space taken up by the piston-rod N, there should be an extra space allowed between the piston and the cylinder-head at the exhaust end of the cylinder above that allowed at the pressure end when the piston is at the extremes of its travels. In order to allow for the fluctuation of the water-level, an air-vent O is provided, either in the exhaust-pipe H or some other point communicating with the upper portion at the exhaust end of the cylinder.

In the apparatus illustrated in Fig. 4 a rotary pump J′ is substituted for the pump J, and a by-pass valve P is located in the pipe Q, which connects the discharge and suction sides of the pump J′.

The operation of the by-pass valve P is governed by the pressure-regulator R. (Shown at the left of Fig. 4 and in detail in Fig. 5.) Said pressure-regulator consists of a movable cylinder S, within which is fitted a piston T. Through the piston is a small opening *t*, which communicates with the hollow piston-rod U. The latter is connected by a pipe V to a valve W. Within said valve W is fitted a piston-valve X, and the exhaust-pipe Y and inlet-pipe Z communicate with the upper and lower ends, respectively, of the cylindrical chamber within which the piston-valve is fitted.

The valve X, as illustrated in Fig. 5, is simply a piston fitted in the cylindrical chamber of the valve-casing W, so as to move freely therein. It may be made water-tight in any ordinary manner, as by rings or a series of fine grooves, the latter being preferable, in order to allow the piston to move without friction. The piston X acts as a valve in opening or closing communication of the passages Y Z, respectively, with the passage V.

The pipe Z is connected to the discharge outlet or pipe of the pump J′, so that the pressure underneath the valve X is equal to that existing at the discharge of the pump or at the pressure end of the cylinder A.

The operation of the pressure-regulator is as follows: When the pressure in the inlet-pipe G exceeds the normal working limit, the valve X rises, thereby opening communication between the pipes Z and V and allowing the fluid to enter the cylinder S through the hollow piston-rod U and the opening *t* in the piston. The cylinder S is thereby raised and this motion is communicated to the by-pass valve P by suitable connections—as, for example, the levers L′, L^2, and L^3. This relieves the pump of all pressure, the water simply circulating through the pipe Q, the check-valves V′, situated in the delivery-pipe beyond the junction of the by-pass pipe Q therewith, (*vide* Fig. 4,) closing, so that there is no backflow through the pump. As an extra precaution a second check-valve V^2 may be inserted in the suction-pipe; but it is not essential to the working of the apparatus.

By the construction herein described the by-pass is automatically opened whenever the pressure in the delivery-pipe of the pump outside of the control-valve rises above the normal, in consequence of the closure of the control-valve and the continued action of the pump, the pressure in the pump being thereby entirely relieved until such time as the elevator is again put in motion by the opening of communication between the delivery of the pump and the pressure end of the elevator-cylinder. In order to maintain the pressure in the delivery-pipe of the pump and so hold the by-pass open, notwithstanding the relief of pressure within the pump-cylinder by the opening of the by-pass, the by-pass passage is connected to the pump so that there is a valve between the delivery-pipe and the point at the delivery side of the pump into which the by-pass passage opens, said valve cutting off the connection between the delivery-pipe and the by-pass passage, so that the lowering of pressure in the pump does not lower the pressure in the delivery-pipe. In the case of a reciprocating pump the valve or valves from the delivery side of the pump may act as such cut-off valve. In the case of a rotary pump I interpose a check-valve, such as V′, for this purpose.

What I claim as new, and desire to secure by Letters Patent, is—

1. The combination, with the cylinder of a hydraulic elevator, of a pump connected thereto, a control-valve in said connection, and a by-pass passage connecting the suction and delivery sides of said pump and containing a valve controlled by the pressure in the delivery-pipe outside the control-valve, and a valve between the junction of the by-pass with the delivery side of the pump and the control-valve, substantially as described.

2. The combination, with the cylinder of a hydraulic elevator, of a pump connected thereto, a control-valve in said connection, and a by-pass passage connecting the suction and delivery sides of said pump and containing a valve controlled by the pressure in the delivery-pipe outside the control-valve, a valve between the junction of the by-pass with the delivery side of the pump and the control-valve, a pipe connecting the exhaust of said control-valve with the other end of said elevator-cylinder, and a pipe connecting the exhaust end of said cylinder and the suction of said pump, substantially as described.

3. The combination, with the cylinder of a hydraulic elevator, of a rotary pump connected directly thereto, a control-valve in said connection, a by-pass pipe connecting the suction and outlet of said rotary pump, provided with a by-pass valve controlled by the fluid-pressure in the delivery-pipe outside the control-valve, and a check-valve interposed in the delivery-pipe of said pump beyond the junction of the by-pass pipe therewith, substantially as described.

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