(No Model.) 2 Sheets—Sheet 1.

H. B. GALE.

ELEVATOR CONTROLLING MECHANISM.

No. 598,505. Patented Feb. 8, 1898.

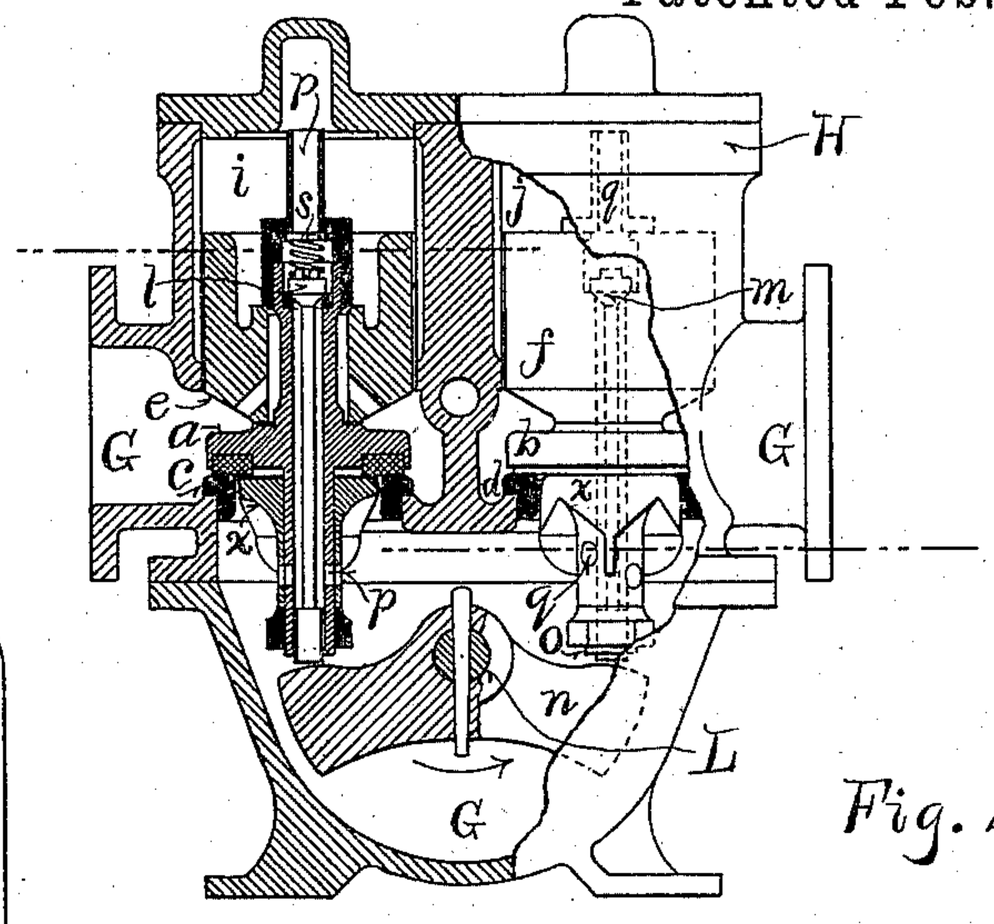


Fig. 2.

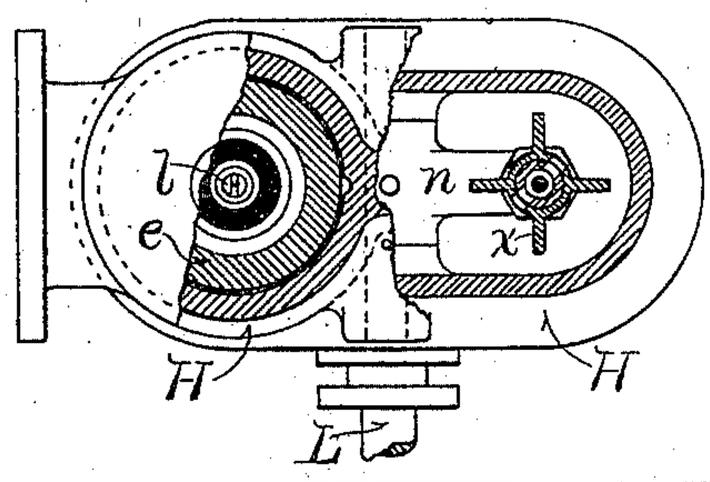


Fig. 3.

Fig. 1.

Witnesses.
J. L. Saul.
A. W. Bayard.

Inventor
Horace B. Gale
By Fred G. Fisher, Atty.

(No Model.) 2 Sheets—Sheet 2.

H. B. GALE.

ELEVATOR CONTROLLING MECHANISM.

No. 598,505. Patented Feb. 8, 1898.

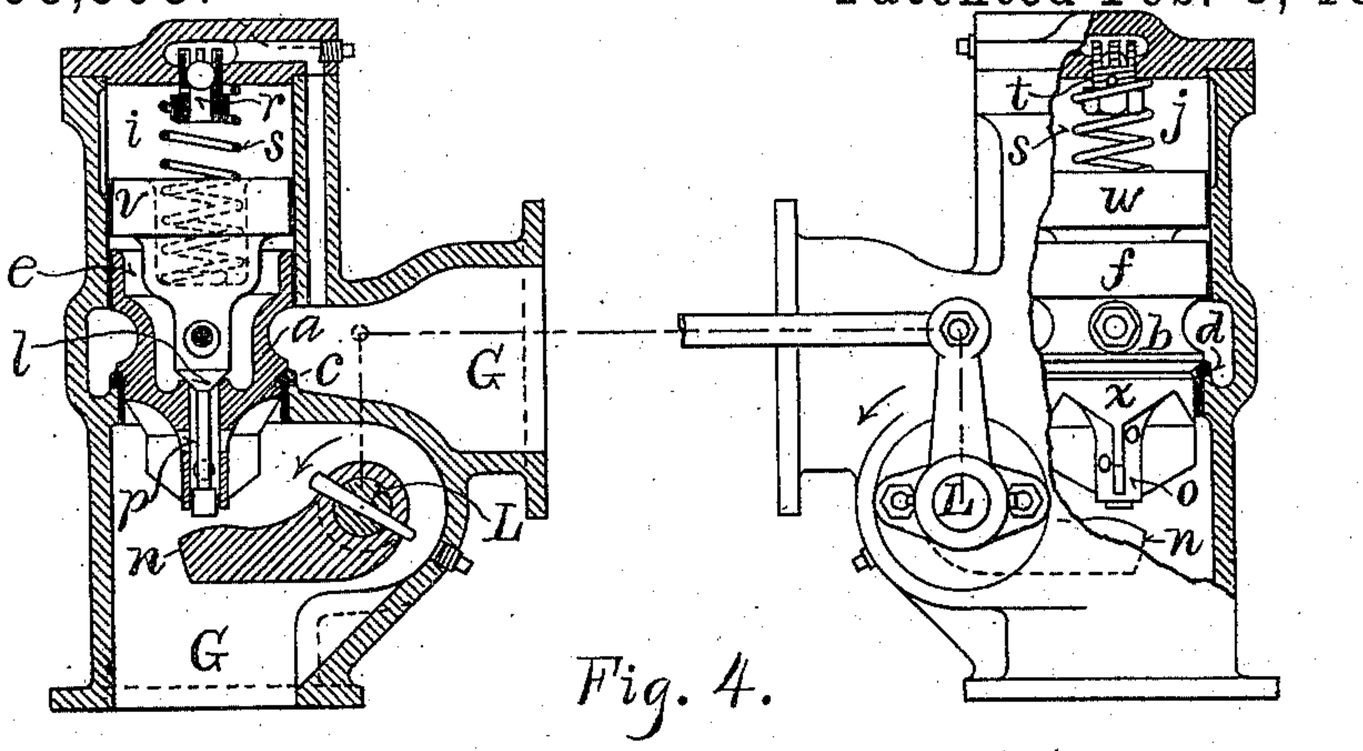


Fig. 4.

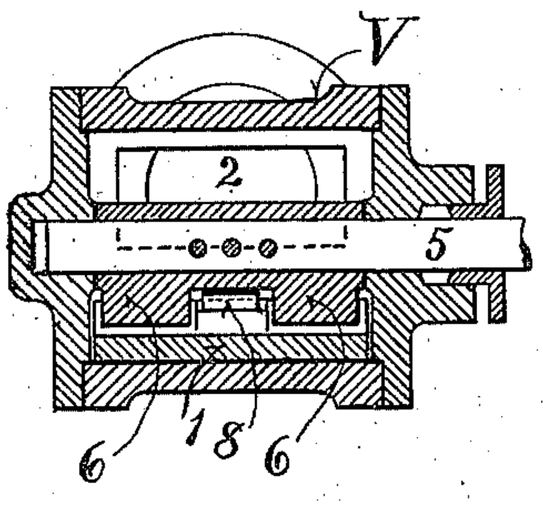
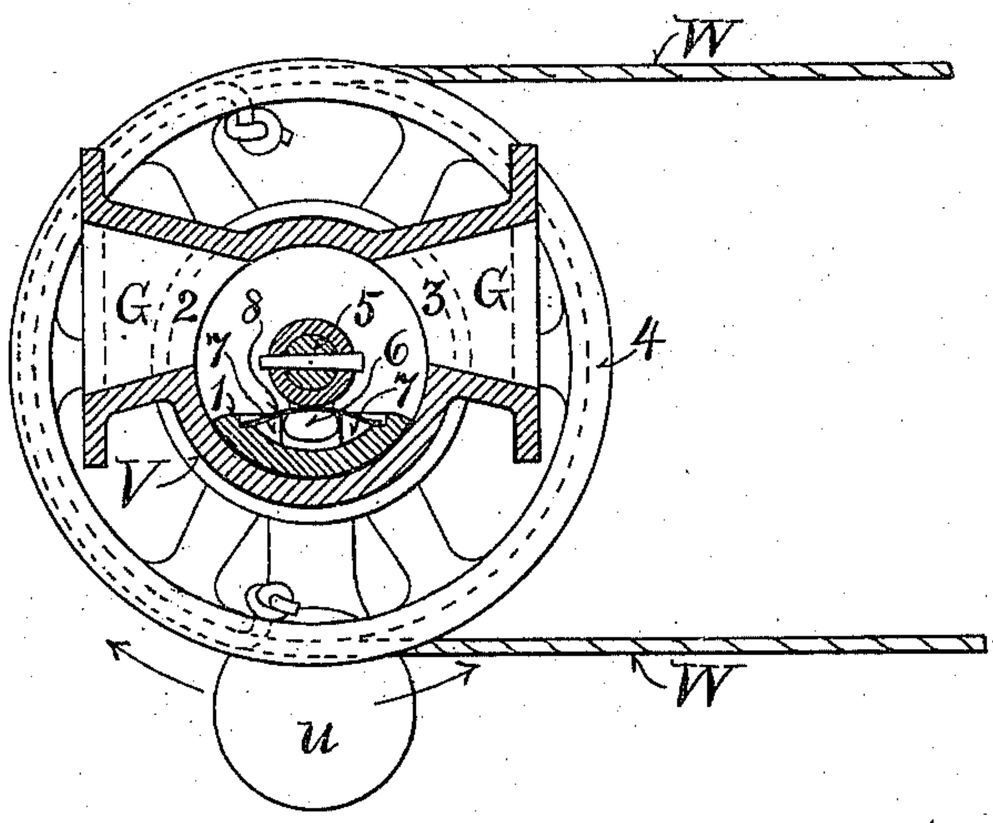


Fig. 5.



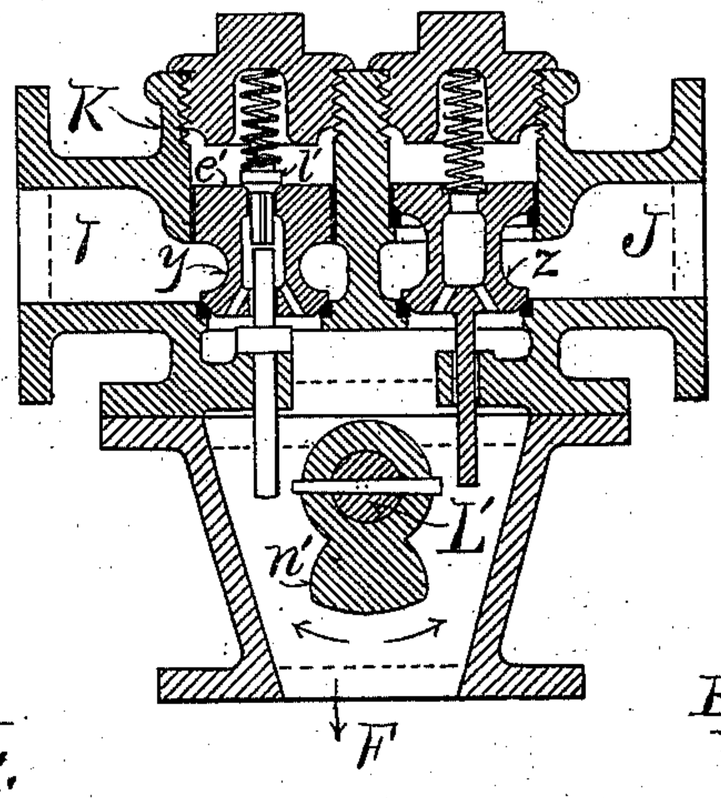


Fig. 6.

Witnesses.
J. A. Saul.
A. V. Bayard.

Inventor.
Horace B. Gale
By Fred'k P. Fish
Attorney.

UNITED STATES PATENT OFFICE.

HORACE B. GALE, OF SAN FRANCISCO, CALIFORNIA.

ELEVATOR CONTROLLING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 598,505, dated February 8, 1898.

Application filed February 24, 1896. Serial No. 580,441. (No model.)

To all whom it may concern:

Be it known that I, HORACE B. GALE, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Elevator Controlling Mechanism; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates especially to that class of elevator machinery in which the platform or car is moved, directly or through intervening mechanism, by a piston or ram propelled by the joint action of a liquid, as water, and an elastic fluid, as air or steam, though some of its features are applicable also to elevators propelled entirely by hydraulic pressure.

The devices herein claimed constitute an improvement upon those covered by United States Patent No. 510,638, granted to me December 12, 1893.

An essential part of the controlling mechanism consists of a pair of oppositely-acting check-valves arranged in the water-passages leading to the operating-cylinder, each valve being opened by a flow of water in one direction only and closed automatically against a reversed flow by the pressure of the liquid upon its back, and of mechanism by which the external force applied to either valve may be varied by an operator in the car for the purpose of opening and closing the valve. The main object of these devices is, as set forth in my previous specification just cited, to enable the operator to set the valves at will either to prevent any flow of water through the passage or to permit it to flow only in one or the other direction, as determined, thereby preventing any reverse movements of the elevator-car in starting. As a means of varying the closing force applied to each check-valve I employ a piston connected thereto and an auxiliary valve for regulating the fluid-pressure upon the piston.

In so far as described in the foregoing the main features of the present invention are the same as are set forth in my previous specification, No. 510,638.

Two alternative arrangements of the check-valves in the main water-passage are described in the specification cited—a parallel and a series arrangement.

My present improvements relate especially to the case in which the main check-valves are placed in series, and consist in a certain design and arrangement of these valves and the controlling mechanism, auxiliary valves and pistons, and in certain attachments which are added to improve the operation of the device and promote economy in the use of the working fluid.

The main objects of the present improvements are to give the operator a more direct and positive control of the main valves, permitting more perfect regulation of the speed of the car, to diminish friction and other resistances to the movement of the controlling-valves, to insure a gradual and easy closing of the same, and to provide improved means for automatically stopping the car at the upper and lower limits of its travel.

In the accompanying drawings, Figure 1 is a diagram illustrating the application of my improvements to the operating mechanism of an elevator. Fig. 2 represents a partial vertical section and partial elevation of the main and auxiliary valves; Fig. 3, a partial horizontal section and partial plan view of the same; Fig. 4, a vertical section and elevation illustrating a variation in the arrangement of the main valves and certain attachments to the auxiliary valves; Fig. 5, two vertical cross-sections of the automatic stop-valve, and Fig. 6 a vertical section illustrating the valves controlling the admission and exhaust of the elastic working fluid.

The same letters and figures indicate corresponding parts in all the views.

Referring to Fig. 1, A indicates the operating-cylinder; B, the piston-rod, carrying at its outer end the sheaves C, around which are passed the ropes D, by means of which the car E is raised and lowered. F indicates a receiver containing a portion of water or other liquid used in working the elevator and connected with the operating-cylinder A through the water-passage G, of which the casing of the main water-valves H forms a part. I indicates the supply-pipe for steam, air, or other elastic working fluid, J the exhaust-pipe, and K the casing of the admission and exhaust valves connected to the top of the receiver. The operating-cylinder here shown is of the horizontal single-acting type, having its outer end open to air; but this type is chosen merely as an illustration, all the devices herein

claimed being equally applicable to vertical cylinders and to cylinders in which the end opposite the receiver connection is closed and the adjacent side of the piston subjected to the pressure of air or steam or of water under the pressure of air or steam, according to any suitable method of operating such cylinders known in the art. The movable body upon which the fluid-pressure acts to raise or lower the car is herein referred to as a "piston," it being understood that the improvements apply as well to elevators in which the car is propelled by a plunger or ram.

The receiver in Fig. 1 is provided with deflecting-plates *g* at the top and bottom and with a float *h*, made of wood sheathed with copper or of other suitable material, which rises and falls with the fluctuation of the water-surface, being guided by the vertical guide-bar *k*. These devices are intended especially for use when steam is employed as a working fluid, and their object is to diminish the agitation of the water in the receiver and to confine the heat imparted to it by the steam mostly to the upper surface. This promotes economy in the use of the steam and by keeping the water in the operating-cylinder A comparatively cool prevents the formation of bubbles therein, and thus improves the action of the controlling mechanism. The deflectors *g* and the float *h* are not absolutely necessary, and any or all of them may be omitted.

Figs. 2 and 3 illustrate a good construction of the water-valves embodying my improvements therein. *a* and *b* indicate the main check-valves, which are of the puppet type, resting upon the seats *c* and *d*, the valves being so arranged in the casing H that a pressure of the water in the passage G in the direction from *a* to *b* tends to lift the valve *b*, while a pressure in the contrary direction would tend to lift the valve *a*. As each valve is thus capable of being opened by a pressure or tendency to flow in one direction only, while the other can be opened by a tendency in the contrary direction only, the pair in series effectually close the passage against a flow in either direction except when external means, controlled by the operator in the elevator-car, are employed to raise either one of the check-valves, leaving the water then free to flow in the direction permitted by the other.

In my earlier specification already cited the means illustrated for thus raising either check-valve independently (shown in Fig. 4 of said specification) consisted of a pair of pistons connected to the valves, respectively, and an auxiliary valve by which a working fluid could be admitted to act upon either piston, so as to lift the connected valve against the pressure of the liquid upon its back. This method is effective in so far as the mere opening and closing of the valves are concerned, but does not render possible without additional complications such a partial and variable opening as is desirable in order to secure the most perfect control and regulation of speed in rapid elevators for passenger-service.

My present improvement consists, chiefly, in providing positive mechanical connections by which either main water-valve may be lifted directly by the operator in the car without transmitting the motion through auxiliary valves and pistons, the latter being preferably retained, however, but used merely as a means of varying the pressure on the back of the main valves.

As a means of lifting the main valves I prefer to use an oscillating lever *n*, inclosed inside the water-passage G and carried by a spindle L, which passes through the casing H and is operated from the outside by suitable mechanism controlled from the elevator-car. When the spindle is turned slightly in the direction of the arrow, the oscillating lever *n* is brought to bear on the end of the hollow valve-stem *o*, and any further motion in the same direction will positively raise the valve *b*. When the valve *b* is thus positively opened, a tendency of the water to flow through the passage G in the direction from *b* to *a*, Fig. 2, will lift the valve *a*, and the water can thus flow freely from the receiver into the operating-cylinder; but a tendency to flow in the contrary direction cannot lift the valve *a*. Therefore the water can flow only in the direction determined upon. Thus when the water-valves are set in the direction required to raise the elevator-car it will not start until the opening of the admission-valve at the top of the receiver F has brought the pressure therein up to an amount sufficient to propel the water in the desired direction. In like manner when the spindle L is turned in the direction opposite to the arrow the lever *n* raises the valve *a*, leaving the water free to flow in the contrary way, as permitted by the valve *b*, or so as to lower the car. When the lever *n* is in its middle position, as shown, both the check-valves are closed and the car is held stationary.

The pressure of the water on the backs of the puppet-valves *a* and *b* would ordinarily be too great to allow them to be easily lifted by direct mechanism unless means were used to equalize or approximately equalize the pressure on the opposite sides of the valves. This may be done by the use of double-seated puppet-valves, such as illustrated in Fig. 6 at *z*; but it is difficult to obtain a sufficiently perfect balance with this type of puppet-valve to enable large water-valves to be easily opened by hand, though this type answers well for the smaller valves used to control the steam or air. The special means which I prefer for balancing the water-valves consists of the two loosely-fitting pistons *e* and *f*, connected to the valves *a* and *b*, respectively, and separating the inclosed chambers *i* and *j* from the main water-passage with the two small relief-valves *l* and *m*, closing the auxiliary passages *p* and *q*, which pass through the main valves and connect the chambers *i* and *j* with the water-

spaces underneath. The stems of the relief-valves *l* and *m* work inside the hollow stems of the main valves and project very slightly at the bottom, so that the small relief-valve is always opened by the oscillating lever *n* just before the corresponding main valve is lifted.

As the pistons *e* and *f* are not tight-fitting, the leakage around them when the valves are closed keeps the pressure in the chambers *i* and *j* equal to the pressure in the main passage above the valves *a* and *b*, respectively; but when the lever *n* is turned, for example, in the direction of the arrow, so as to lift the valve *b*, the relief-valve *m* is first raised from its seat and the water which leaks into the chamber *j* around the piston *f* is allowed to escape through the auxiliary passage *q* into the space beneath the main valve. The pressure in the chamber *j* is thus relieved, being equalized or nearly equalized with the pressure underneath the valve *b*, so the latter may be raised by a further movement of the lever *n* without appreciable resistance. The water, flowing through the main passage G in the direction from *b* to *a*, will then lift the valve *a* and its relief-valve *l*, the latter remaining seated on the main valve and acting simply as if a part of it. If during this action the water in the chamber *i* were allowed to escape only by leakage around the piston *e*, the opening of the valve *a* might take place too slowly. Accordingly I sometimes provide small auxiliary check-valves *r* and *t*, opening outwardly from the chambers *i* and *j* each into the main passage on the near side of the corresponding main valve, as shown in Fig. 4. Whenever the pressure under either main valve is greater than the pressure above it, the main valve will be lifted and the water in the chamber above it will escape through the small auxiliary check-valve. The latter may be a ball, as shown, or any other common type of check-valve.

One advantage gained by the use of the auxiliary check-valves *r* and *t* is that when they are employed the leakage around the pistons *e* and *f* may be made less than would otherwise be necessary. When either main valve is allowed to close, the water can enter the chamber above it only by leakage around the piston, and by making this leakage sufficiently slow a too sudden closing of the valve and abrupt stoppage of the elevator by carelessness on the part of the attendant is rendered impossible. The pistons *e* and *f* act also as guides for the main valves *a* and *b*.

In Fig. 2 the piston *e* is fitted loosely on the stem of the valve *a*, so as to have a very slight vertical motion between stops thereon, and is provided with small passages through it, as shown. By this means the piston *e* is made to act itself as a check-valve, permitting the liquid to flow out of the chamber *i* when it rests upon its lower stop and closing against its upper stop to prevent the entrance of water into the chamber *i* when the pressure therein is less than in the main passage G above the valve *a*, as when the latter is being closed. The pistons *e* and *f*, Fig. 2, by this construction accomplish the same purpose as the check-valves *r* and *t* in Fig. 4.

The speed of closing of the main valves may be still further limited when it is desired to do so by attaching to the relief or pressure-equalizing valves *l* and *m* the dash-pistons *v* and *w*. (Shown in Fig. 4.) Sometimes also the relief-valves are provided with springs *s* to assist in closing them and the main valves; but neither the springs, the dash-pistons, nor the auxiliary check-valves are absolutely essential and any or all of them may be omitted.

The faces of the main valves may be either metallic surfaces beveled and ground to fit metallic seats, as shown in Fig. 4, or flat faces of softer material, as shown in Fig. 2.

To make it easier to graduate the opening and closing of the valves with nicety and to prevent wear of the valve-faces by the water, I prefer to make the main valves with projecting rings *x*, which may be notched, as shown, and which shut off the flow of water gradually as either valve is lowered and before it reaches its seat.

It is not necessary that the two check-valves should be included in the same casing. They may be made, when preferred, with individual casings and placed in separate parts of the water-passage, as indicated in Fig. 4. In such cases other parts of the apparatus, such as the automatic stop-valve, may be placed between the two controlling-valves, the operating-spindles of the latter being connected on the outside. When the two puppet-valves *a* and *b* are applied to control the flow of water respectively into and out of the cylinder of a plain hydraulic elevator, I prefer the plan of having separate casings like those of Fig. 4.

The special design of the valves for controlling the passage of the air or steam into and out of the top of the receiver F is not essential to the present invention, and any suitable valves known in the art may be used for this purpose. The admission and exhaust valves *y* and *z* (shown in Fig. 6) are similar in general construction to the main water-valves in Fig. 2, except that the exhaust-valve *z* is of the double-seated puppet type and does not require a relief-valve. The oscillating lever *n'* in Fig. 6 is allowed considerably more lost motion than that in Fig. 2 in order that the opening and closing of the admission and exhaust valves for the steam or air may occur when the water-valves are nearly wide open, thus preventing unnecessary throttling of the water and promoting economy in the use of the elastic fluid.

The special arrangement of the mechanical connections between the valves and the elevator-car is not essential, and any suitable transmitting devices known in the art may be used by which the spindles L' and L can

be operated simultaneously. As shown in Fig. 1, the spindle L of the water-valves is operated by the forked lever R, driven by means of the rollers Q from the wheel P. The latter and the wheel U on the spindle L′ of the admission and exhaust valves are oscillated by the handle M in the elevator-car through the transmitting-ropes N, wheels O and S, and the chains T and T′.

In Fig. 1, V indicates the casing of the automatic stop-valve, which is shown in section in Fig. 5. Its office is to stop the car at the upper and lower limits of its movement in case the attendant fails to close the main controlling-valves. The valve consists of a sliding plate 1, fitting the inside surface of the cylindrical casing V, in which are two ports 2 and 3, communicating with the main water-passage G. The valve is driven by the wheel 4 on the spindle 5 through the projecting lug 6, which engages the lugs 7, and it may be held to its seat by a light spring 8, though the latter is not necessary.

To explain the operation of the automatic stop-valve, suppose the main piston-rod B in Fig. 1 to be moving outward, raising the elevator-car. When the piston approaches its extreme outer position, corresponding to the extreme upper limit of the car's movement, the lug X, carried by the piston-rod, engages the tappet Y on the rope W and turns the wheel 4 in a right-handed direction until the valve-plate 1 covers the port 2, thus cutting off the flow of water through the passage G from the receiver into the operating-cylinder and stopping the upward motion of the car. As long as the main controlling-valves remain set to raise the car the pressure of the water on the inside of the plate 1 keeps the stop-valve tightly closed; but whenever the controlling-valves are set to lower the car the pressure of the water on the valve-plate 1 is reversed, and it is moved slightly away from its seat, permitting the water to flow out of the operating-cylinder and the car to descend. As soon as the downward movement begins the lug X releases the tappet Y and the weight *u* swings the stop-valve back to its middle position. When the car reaches the lower limit, the lug X engages the tappet Z, and the wheel 4 is turned in the opposite direction, so as to close the port 3. In the latter position the stop-valve prevents any further flow of water out of the operating-cylinder, which would tend to lower the car, but the loose or yielding connection between the spindle 5 and the valve-plate 1 permits the water to start freely back whenever the controlling-valves are set for going up.

Where it is convenient to do so, the lug X may be attached to the car instead of the piston-rod, the rope W being arranged to correspond, and any equivalent devices known in the art by which motion can be transmitted from the main elevator mechanism to the automatic stop-valve may be substituted for the rope and tappets, which are shown merely for illustration.

Without limiting my claims strictly to the specific forms of each element of the combinations shown and described, what I claim, and desire to secure by Letters Patent, is—

1. In an elevator controlling mechanism, the combination of a pair of oppositely-acting puppet check-valves in the water-passages leading to the operating-cylinder, a positive mechanism controlled from the elevator-car by which either check-valve is moved from its seat independently, a piston connected to each of said valves and capable of slight movement between stops on the stem thereof for the purpose described, an inclosed chamber on one side of each piston, an auxiliary passage through each main valve connecting the said chamber with the water-space on the opposite side of the valve, and a relief-valve controlling each of the said auxiliary passages, by means of which the pressure on opposite sides of the corresponding main valve is approximately equalized before the latter is opened.

2. In an elevator controlling mechanism, the combination of two oppositely-acting puppet check-valves in the water-passages leading to the operating-cylinder, a mechanism controlled from the elevator-car by which either check-valve is moved from its seat independently, a piston connected to each of said valves, an inclosed chamber on one side of each piston, an auxiliary passage through each main valve connecting the said chamber with the water-space on the opposite side of the valve, a pressure-equalizing valve controlling each of said auxiliary passages, and a dash-piston by which the movement of the said pressure-equalizing valve is regulated, substantially as set forth.

3. In an elevator controlling mechanism, the combination of two oppositely-acting puppet-valves in the water-passages leading to the operating-cylinder, a mechanism controlled from the elevator-car by which each of the said valves is moved from its seat independently, a piston connected to each of said valves, an inclosed chamber on one side of each piston, an auxiliary passage through each main valve connecting the said chamber with the water-space on the other side of the valve, a pressure-equalizing valve controlling each of said auxiliary passages, and auxiliary check-valves communicating between each of the said inclosed chambers and the main water-passage on the near side of the corresponding main valve, substantially as set forth.

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

HORACE B. GALE.

Witnesses:
D. W. WELLS,
EDWARD M. COPE.