(No Model.) 4 Sheets—Sheet 1.

A. SUNDH.

VALVE MECHANISM FOR HYDRAULIC ELEVATORS.

No. 454,410. Patented June 16, 1891.

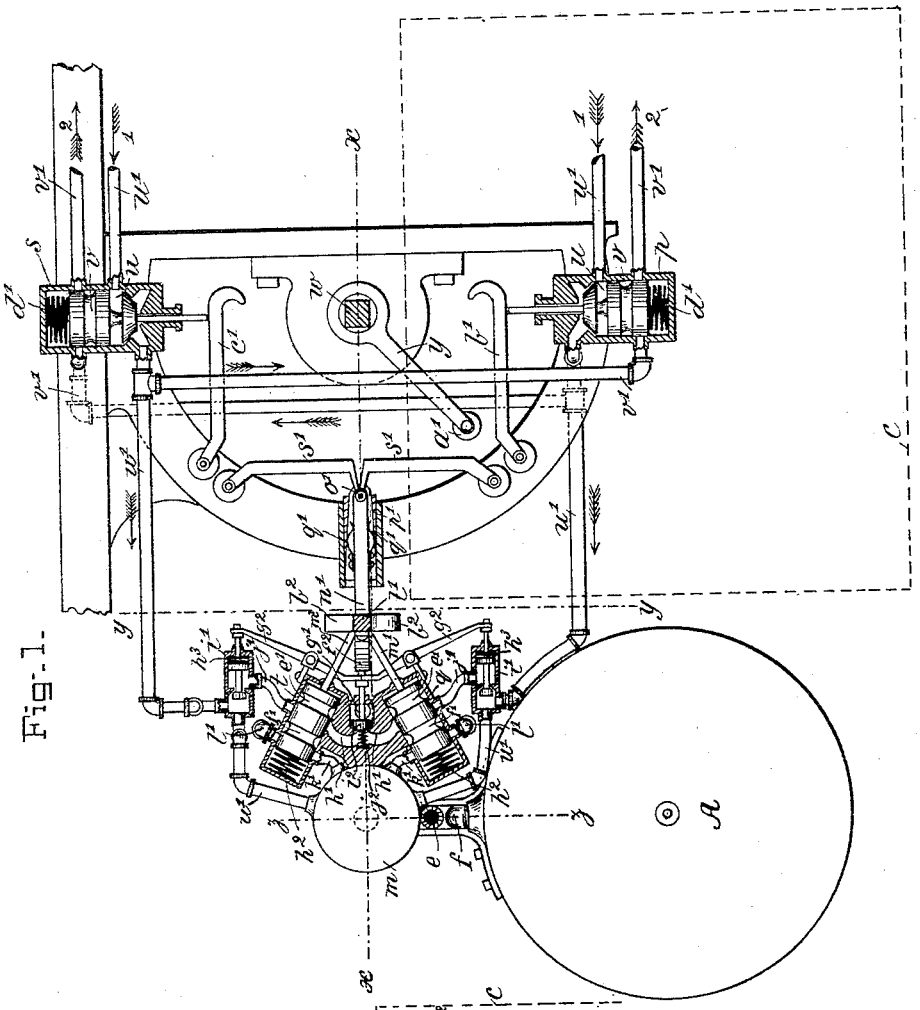

Fig. 1.

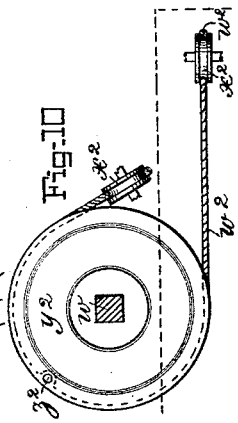

Fig. 10.

WITNESSES:
Ernst Lundgren
W. J. Morgan

INVENTOR:
August Sundh
By A. P. Thayer
atty.

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A. SUNDH.

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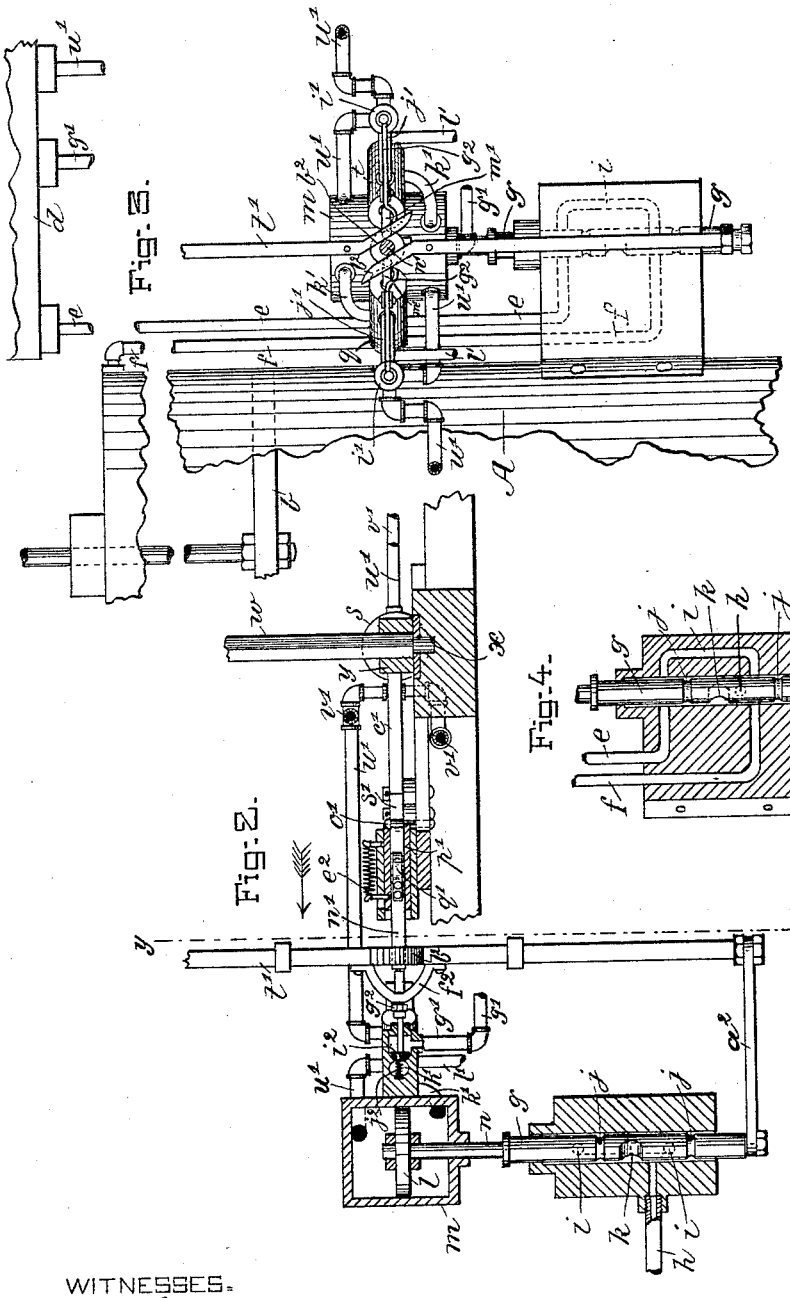

Fig. 3.

Fig. 2.

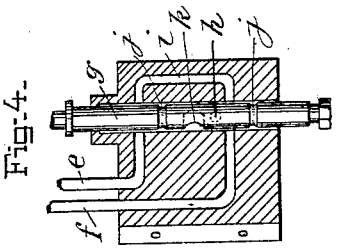

Fig. 4.

WITNESSES:
Ernst Lundgren
O. F. Lillengren

INVENTOR:
August Sundh
By A. P. Thayer
atty.

(No Model.) 4 Sheets—Sheet 3.

A. SUNDH.

VALVE MECHANISM FOR HYDRAULIC ELEVATORS.

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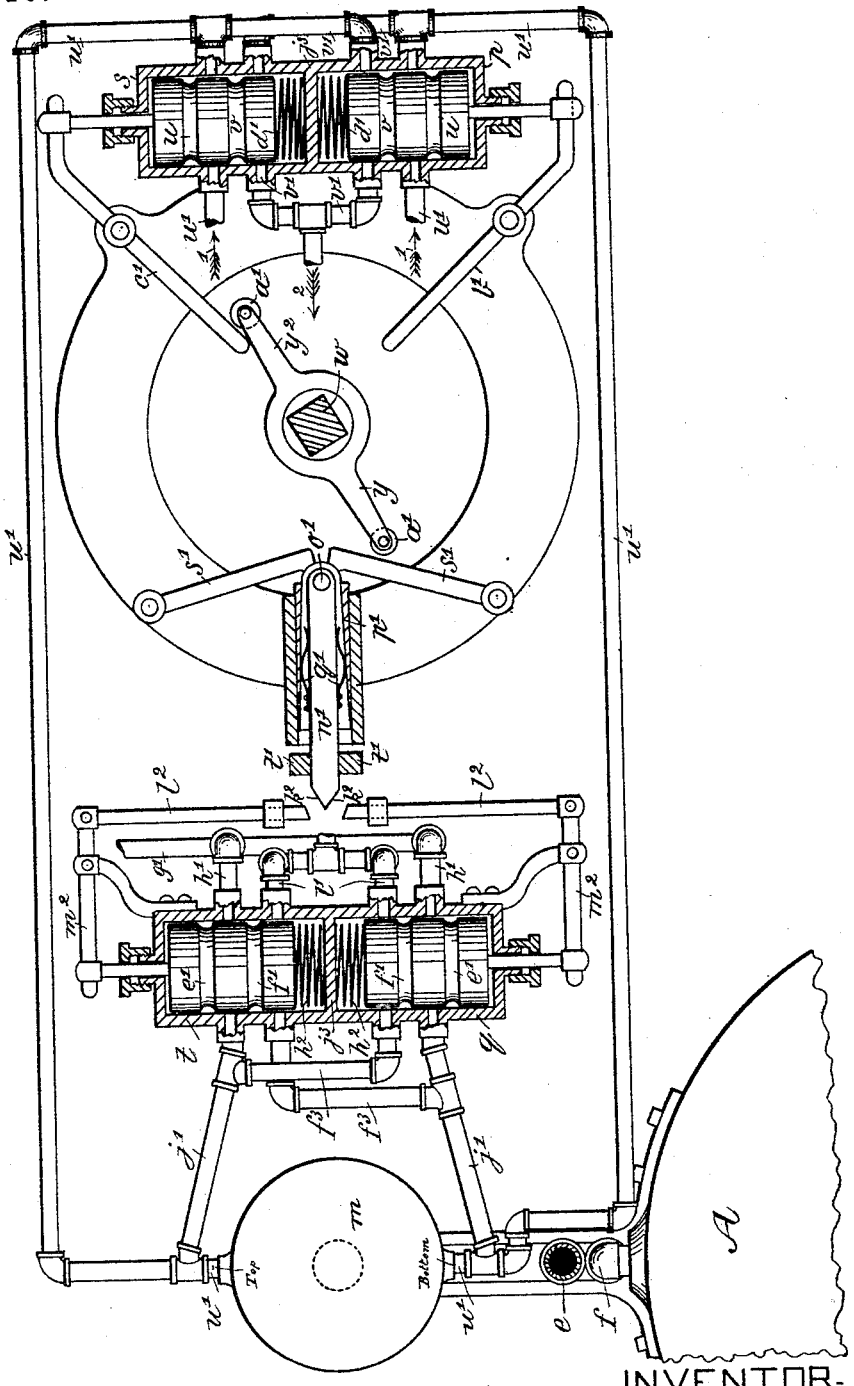
Fig. 5.



WITNESSES:
Ernst Lundgren
O. J. Gilmorgan

INVENTOR:
August Sundh
By A. P. Thayer
atty.

(No Model.) 4 Sheets—Sheet 4.

A. SUNDH.

VALVE MECHANISM FOR HYDRAULIC ELEVATORS.

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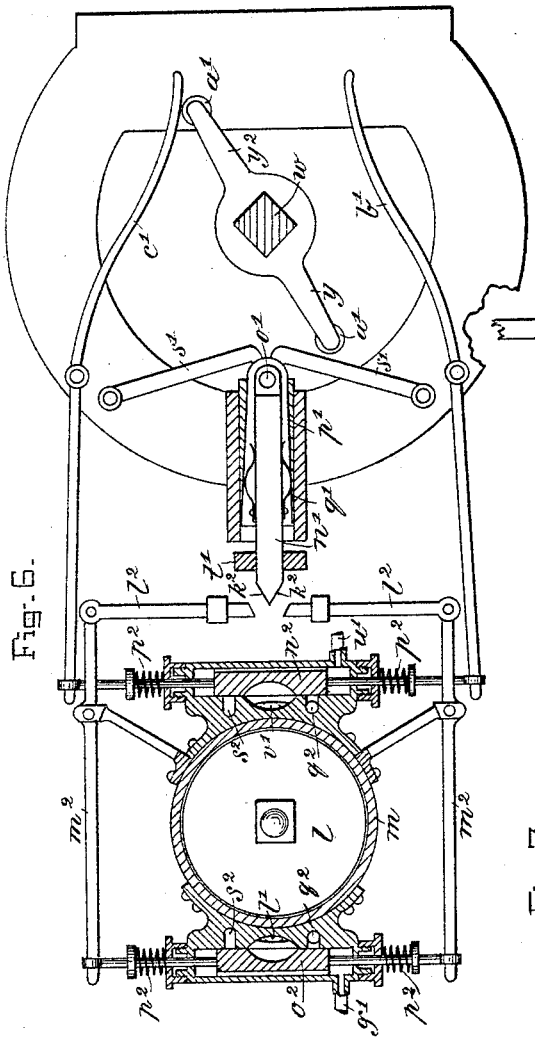

Fig. 6.

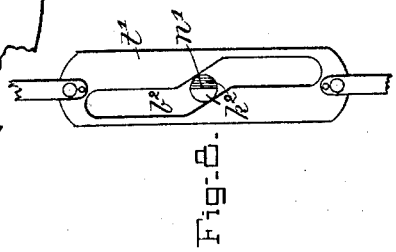

Fig. 8.

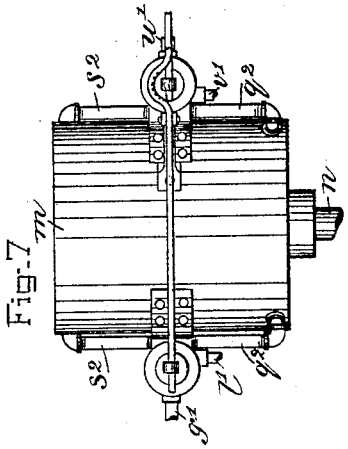

Fig. 7.

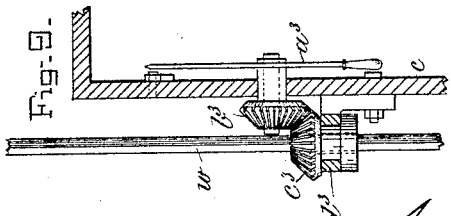

Fig. 9.

WITNESSES:

Ernst Lundgren

O. J. Morgan

INVENTOR:

August Sundh

By A. P. Thayer

Atty

UNITED STATES PATENT OFFICE.

AUGUST SUNDH, OF YONKERS, NEW YORK, ASSIGNOR OF ONE-HALF TO ERNEST BOENING, OF SAME PLACE.

VALVE MECHANISM FOR HYDRAULIC ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 454,410, dated June 16, 1891.

Application filed May 6, 1890. Serial No. 350,749. (No model.)

To all whom it may concern:

Be it known that I, AUGUST SUNDH, a citizen of Sweden, and a resident of Yonkers, in the county of Westchester and State of New York, have invented new and useful Improvements in Valve Mechanism for Hydraulic Elevators, of which the following is a specification.

My invention relates to means for working the distributing-valve which controls the inlet of the liquid from the accumulator to and the exhaust from the cylinder in which the car-actuating piston works; and it consists of an auxiliary piston and valve mechanism for working said distributing-valve by the power of the accumulator in lieu of the cord and other mechanism now employed for working said distributing-valve by the hand-power of the conductor directly applied.

The object is to provide more controllable and easier-working apparatus for large elevators than the present means now in use, all as hereinafter fully described, reference being made to the accompanying drawings, in which—

Figure 1 is a top view of the car-actuating cylinder and plan of the apparatus as I prefer to arrange it, partly in horizontal section, with the car indicated in dotted lines. Fig. 2 is a vertical section on line $x\,x$ of Fig. 1. Fig. 3 is a vertical section on line $y\,y$, and also shows part of the accumulator. Fig. 4 is a vertical section of the main valve in a plane at right angles to that of Fig. 2. Fig. 5 is a plan view, partly in horizontal section, showing a modified arrangement of the apparatus on a larger scale. Fig. 6 is partly a plan view and partly a horizontal section of a modified arrangement, in which it is shown that slide D-valves may be used to carry out my invention. Fig. 7 is a side elevation of part of the apparatus of Fig. 6. Fig. 8 is a modified form of the push-rod shifter in front elevation. Fig. 9 is a detail showing the conductor's hand-lever device for working the valve-shifting gear by the shaft suspended in the elevator-way. Fig. 10 is a modification showing the application of the ordinary conductor's rope for working the said valve-shifting gear.

A represents the vertical cylinder, in which the piston b works for actuating the car c (partly shown in full lines in Fig. 9 and dotted lines in Figs. 1 and 10) in the usual manner through the instrumentality of liquid admitted to the upper end from the accumulator d through the pipes $e\,f$ and actuating the piston b and exhausted from it by the controlling-valve g, hereinafter called the "main valve," the pipe e forming the communication between the accumulator d and said main valve and the pipe f connecting said valve with the top of the cylinder. Communication is opened between pipes e and f to admit the fluid to cylinder A for forcing the piston down and raising the car through passage i, when the main valve g is raised so that the cavities j in it coincide with the terminals or ports of said passage i and the pipes e and f. This communication is closed and the exhaust is opened for the escape of the liquid from the cylinder to allow the piston to rise and the car to descend when the main valve is shifted, so that its cavity k opens port of pipe f to the exhaust-passage h. Said communication is also closed and the exhaust likewise to hold the car at rest when the main valve is shifted to the middle position, in which said main valve is represented in Figs. 2 and 3.

It is to be understood that the exhaust-passage h is in practice connected by a suitable pipe with the receiving-tank for the liquid, which is thereafter forced into the accumulator again in the well-known arrangement of hydraulic elevators. It is also to be understood that as thus far described the apparatus is all of the well-known construction. My invention comprises the following-described auxiliary hydraulic apparatus for thus actuating the said main valve to work the car. I employ a piston l in a cylinder m for working said valve by liquid from the accumulator duly admitted to and exhausted from said cylinder, said piston being represented in this example as connected directly to the upper end of the rod or stem of the valve; but it is to be understood that it may be connected to the lower end in the same manner, or it may be connected indirectly to either end by any approved form of intermediate apparatus.

It is to be noted that the piston l stands in

the median position of the cylinder m when the main valve is in its median position, and is to be shifted up or down, according as the car is to be raised or lowered, and is always to be brought to the median position to stop and hold the car at rest. To raise said piston and main valve for moving the car upward, the valve at p is used. To return said piston and main valve from the upward position to the middle and stop and hold the car on the upward run, the valve at t is used. To cause said piston and valve to shift from the middle position downward and cause the car to move downward, the valve at s is used, and to return the said piston and main valve from below upward and stop and hold the car on the downward run the valve at q is used. The valves p and s are ordinary balanced piston-valves, each having an inlet-passage u and exhaust-passage v, with corresponding inlet and exhaust pipes u' v'. The inlet-pipe u' of valve p connects with cylinder m at the lower end, and the corresponding pipe of valve s connects with said cylinder at the upper end, as best shown in Fig. 3. The exhaust-pipe v' of valve p exhausts from the upper end of cylinder m, and the corresponding pipe of valve s exhausts from the lower end of said cylinder, these exhaust-pipes being respectively connected with the inlet of the other valve between said valves and said cylinder, so that when the inlets of said other valves are closed and these are opened the liquid returns through the latter. The inlet-pipes u', leading to the valves, as indicated by the arrows 1, Figs. 1 and 5, are to be understood as connecting with the accumulator d, and the exhaust-pipes v', leading therefrom, as indicated by the arrows 2, are to be understood as connected with the receiving-tank, from which the exhaust-liquid is pumped into the accumulator, as usual. To operate these valves from the car by the conductor, I have provided a vertical shaft w to extend along up the elevator-way, either through the car c or just outside of it, and so connected with the conductor's hand-lever a^3, Fig. 9, that he has the means of turning it to right or left at will half a revolution, or thereabout, said shaft being suspended from its upper end, so that said conductor's lever or other device coupling said lever with the shaft may slide along the shaft with the car and be utilized at any point along the shaft for turning it. In this case said lever a^3 is connected with said shaft by the bevel-wheels b^3 and c^3, the former being fitted on the axis of said lever mounted in the side of the car, and the latter is carried in the bracket d^3 and slides along the shaft. The lower end of the shaft is suitably confined in a step x, and it carries an arm y, preferably having a friction-roller a' in the free end, which, taking effect on the push-lever b' or c', according as the shaft is turned one way or the other, opens one or the other of the valves, as is clearly represented in Fig. 1. The springs d' return the valves to their normal positions and close them when relieved of the action of arm y by the return of it to its normal position.

It will be seen that when either of the valves p or s is opened liquid from the accumulator is admitted to one side of the piston l and exhausted from the other side by said valve, and when the piston l reaches the end of its up or down movement from the center position it remains in that position while the car continues to run, the valve p or s being allowed to close after having shifted the piston. Then for returning the piston l to the middle position and stopping and holding the car one or the other of the valves q t is brought into use to permit the escape of sufficient of the liquid in cylinder m to enable the piston to so return and to admit other liquid behind said piston and force the return of the piston to said middle position. When so returned to the middle position, the said valve q or t thus used is automatically closed. The main valve then stops, and with the other valves closed holds the said main valve in the middle position, which likewise stops and holds the car. These valves q t are also ordinary balanced piston-valves and have inlet-passages e' and exhaust-passages f'. The liquid from the accumulator flows to the inlet-passages, when open, through the pipe g' and branches h', and thence to the cylinder m through valves i' and inlet-pipes u', respectively, said valves i' being connected with the inlet-pipes u' and also connected with the inlet-passages e' by the branch pipes j'; but they may be dispensed with, as they are only employed as an additional means of security against leak and the consequent shifting of the car when it is to be held stationary. The exhaust-passages f' of these valves q t are also connected with the cylinder m by the pipes k', but at the ends opposite to those connected with their inlet-passages e', and they discharge into pipes l', through which the liquid returns to the receiving-tank. The valve q is to be opened to cause the piston l to rise from the lower position and stop the car on the downward run, and the valve t is to be opened to cause said piston to descend from the upper position and stop the car on the upward run. To open these valves by the same shaft w and arm y, by which the valves p s are opened, they are so placed that their stems m' nearly converge in the apex of a triangle of which they form the two sides, and in front of the end of the push-rod n', whose other end is pivoted at o' in the sliding box p', so as to vibrate laterally, and having springs q' to return it to the normal position. The box in which this push-rod is pivoted is so placed relatively to the levers s' and the arm y that in the range of said arm from one to the other of the push-levers b' c' for working valves p s it will slide push-rod n' forward to open one or the other of the valves q t, according as it is directed against the end of one or the other of the stems m' of said valves, which must be the

stem of valve t if the car is going up, or the stem of valve q if it is going down. The spring e^2 shifts the push-rod back. For so directing the push-rod the push-rod shifter t' is provided, said shifter being connected to the main valve n by the bar a^2, or it may be any other approved contrivance whereby said shifter may be made to shift up and down synchronously with said valve. It is located in the vertical line of the free end of the push-rod, and at b^2 it has reverse inclines, or it may be a cam-slot, as represented in Fig. 8, so arranged with relation to said push-rod that when valve g rises and opens pipes $e\,f$ and passage i to admit the liquid to cylinder A for working the car upward it will shift push-rod n' to the range of the stem of the valve t, ready for the conductor to open it by the shaft w, and stop the car on the upward run, and when valve g descends and opens the exhaust from cylinder A to let the car descend said shifter will shift push-rod n' over to the range of the stem of valve q, ready for the conductor to open said valve and stop the car on the downward run. The piston l and the main valve quickly return to the center position when either of these valves q or t is opened, and the shifter also, which releases the opened valve from the push-rod and its spring h^2, closes it. Then when the conductor shifts shaft w and arm y to open one of the valves p or s for starting the car again the push-rod carrying slide p' is released, and its spring e^2 returns it to the normal position, ready for operation again. The push-rod shifter is also made to close valves i' when it returns to the center position to afford additional security against shifting of the car by leakage through valves $q\,t$ when standing, said valves i' then constituting a second cut-off in the inlet-passages $u'\,j'$ to cylinder m. To accomplish this, said shifter is provided with the bow-cam f^2, which projects into the middle vertical plane between said valves and studs, with its greatest projection in the horizontal plane of said valves when the shifter is in the middle position, and said valves are coupled to the levers g^2, the free ends of which meet in front of the cam, so that when said cam comes to said middle position from either direction it forces them in the direction to close said valves, and when it moves away again, either up or down, it leaves the levers and valves free to permit the latter to be opened by the springs h^3. There is also another valve i^2 in the inlet $g'\,h'$ from the accumulator as a still further means of safety against shifting the car. It is located in the range of the cam f^2 and the free ends of levers g^2, so as to be closed by them when the push-rod shifter comes to the middle position, and is provided with a spring j^2 to open it when the cam shifts away from said middle position either up or down; but this valve and the valves i' may be omitted, if desired.

In Fig. 5 I represent a modified arrangement of the valves $p\,s$ and $q\,t$, the valves i' and i^2 being omitted. They are connected for the operation of the liquid on the piston of cylinder m in just the same way, the principal difference being that the valves of each pair $p\,s$ and $q\,t$ are arranged in the opposite ends of a duplex cylinder, having a partition j^3 at the middle, and instead of the push-rod n' acting directly against the stems of the valves $q\,t$ it is made to operate them by its bevel sides k^2 being forced against the ends of rods l^2, coupled to the stems of said valves by the levers m^2, and the valves $p\,s$ are so placed relatively to the shaft w that a separate arm y^2 is employed for working them. The inlets of these valves $q\,t$ are connected to inlet-passages u' by branches j', about the same as in Figs. 1 and 3, but without the extra stop-valves i', as before stated; but in this case I prefer to arrange the exhaust the same as with the valves $p\,s$. Thus the exhaust-passage f' of valve q exhausts from the upper end of cylinder m, and the corresponding exhaust-passage of valve t exhausts from the lower end of said cylinder, these exhaust-passages being respectively connected with the inlet of the other valve between the said valves and said cylinder by the pipes f^3.

In Figs. 6 and 7 it will be seen that I may also use ordinary D slide-valves, as n^2, for shifting the main valve either up or down for working the car in either direction, according as it is shifted one way or the other by the arm of the shaft w, and valve o^2 for shifting the piston back from either end of cylinder m to the middle for stopping and holding said valve in the middle position, according as it is worked in either direction by the push-rod n' through rods l^2 and levers m^2, substantially the same as the valves $q\,t$ are operated. These valves are provided with springs p^2 to return them to the middle position for closing both the inlet and exhaust passages. u' represents the inlet-pipe to the valve n^2, the same as to the valves p, s, and g', the inlet to valve o^2, the same as to valves $g\,t$, and the exhaust-pipes may be similarly designated v' and l'. s^2 represents the passages from these valves to the upper end of cylinder m, and q^2 the passages to the lower end. While I prefer for some purposes to employ the shaft w, as I have represented it, for working this valve-gear, I am not limited to it, for the rope w^2, commonly employed for working the main valve, may be used, if desired, by arranging it in the guide-pulleys x^2 and around a pulley y^2 on shaft w, as I have represented it in Fig. 10, said rope being preferably fastened to the pulley, as at z^2, to prevent slipping.

I claim—

1. The combination, with the main valve controlling the car in an elevator, of the main-valve-actuating piston, one or more valves in the control of the conductor's valve-shifter and controlling said valve-actuating piston for opening said main valve in either direction, and one or more valves, also in the con-

trol of the conductor's valve-shifter and controlling said valve-actuating piston, for closing said main valve in either direction and holding it closed, substantially as described.

2. The combination, with the main valve controlling the car in an elevator, of the main-valve-actuating piston, one or more valves in the control of the conductor's valve-shifter and controlling said valve-actuating piston for opening said main valve in either direction independently of and while the devices for closing said main valve remain in the normal conditions, and one or more valves, also in the control of the conductor's valve-shifter and controlling said valve-actuating piston, for closing said main valve in either direction independently of and while the devices for opening said main valve remain in the normal conditions, substantially as described.

3. The combination, with the main valve controlling the car in an elevator, of the main-valve-actuating piston, one or more valves in the control of the conductor's valve-shifter and controlling said valve-actuating piston, for opening said main valve in either direction, one or more valves, also in the control of the conductor's valve-shifter and controlling said valve-actuating piston, for closing said main valve in either direction and holding it closed, and springs which close said auxiliary piston-valves when relieved of the action of the conductor's valve-shifter, substantially as described.

4. The combination, with the main valve controlling the car in an elevator, of the main-valve-actuating piston, one or more valves in the control of the conductor's valve-shifter and controlling said valve-actuating piston for closing said main valve in either direction independently of and while the devices for opening said main valve remain in the normal conditions, and one or more valves, also in the control of the conductor's valve-shifter and controlling said valve-actuating piston, for opening said main valve in either direction independently of and while the devices for closing said main valve remain in the normal conditions, substantially as described.

5. The combination, with the main valve, main-valve-shifting piston, and the valve or valves for actuating said piston to close the main valve, of the push-rod adapted to actuate said valve or valves to close the main valve from either direction, the conductor's valve-shifter adapted to actuate said push-rod alike in either of its directions of movement, and the push-rod shifter connected with and actuated by the valve-rod and adapted to direct said push-rod to so actuate said valve or valves to close the main valve from either direction, substantially as described.

6. The combination, with the conductor's valve-shifter and the main valve, piston for actuating said main valve, and valve or valves for controlling said piston, of the sliding and vibrating push-rod and the push-rod shifter connected to and moving synchronously with the main valve and having the reverse inclines respectively arranged with and acting on the opposite sides of the said vibrating and sliding push-rod, substantially as described.

7. The combination, with the main-valve-shifting piston and the conductor's valve-shifter, of the independent valves p s, each connected by inlet and exhaust passages with the opposite ends of the cylinder of said main-valve-shifting piston, respectively, for actuating it in opposite directions, said valves independently operative by said conductor's valve-shifter and having springs independently closing them, substantially as described.

8. The combination, with the main-valve-shifting piston and its cylinder and with the conductor's valve-shifter, of the independent valves p s, normally maintained in position to prevent the escape of the water from said cylinder, each connected by inlet and exhaust passages with the opposite ends of the cylinder of said main-valve-shifting piston for working the piston in opposite directions, respectively, said valves independently operative for being opened by said conductor's valve-shifter acting directly on them and having springs independently closing them, substantially as described.

9. The combination, with the main-valve-shifting piston and its cylinder and with the conductor's valve-shifter, push-rod, and push-rod shifter, of the independent valves q t, normally maintained in position to prevent the escape of the water from said cylinder, each connected by inlet and exhaust passages with the opposite ends of the cylinder of said main-valve-shifting piston for working the piston in opposite directions, respectively, said valves independently operative for being opened by said conductor's valve-shifter, subject to the control of the push-rod shifter, and having springs independently closing them, substantially as described.

10. The combination, with the main-valve-shifting piston and the conductor's valve-shifter, of the independent valves q t, each connected by inlet and exhaust passages with the opposite ends of the cylinder of said main-valve-shifting piston for working the piston in opposite directions, respectively, and the auxiliary stop-valves i' in the inlet-passages of the cylinder of said main-valve-shifting piston, and the closer of said stop-valves coupled with and actuated by the rod of the said main-valve-actuating piston, substantially as described.

11. The combination, with the main-valve-shifting piston and the conductor's valve-shifter, of the independent valves p s, each connected by inlet and exhaust passages with the opposite ends of the cylinder of said main-valve-shifting piston for working the piston in opposite directions, respectively, also the valves q t, each similarly connected with said cylinder for working the piston in opposite directions, respectively, and the auxiliary

valves i' in the inlet-passages to said cylinder for opening the main valve and coupled with and actuated by the rod of the said main-valve-actuating piston, substantially as described.

12. The combination, with the main-valve-shifting piston and the conductor's valve-shifter, of the independent valves q t, each connected by inlet and exhaust passages with the opposite ends of the cylinder of said main-valve-shifting piston for working the piston in opposite directions, respectively, and the auxiliary stop-valve i^2 in the inlet-passage to said valves q t, and the closer of said stop-valve connected with and actuated by the rod of the said main-valve-actuating piston, substantially as described.

13. The combination, with the main-valve-shifting piston, of the independent valves p s, respectively connected by inlet and exhaust passages with the opposite ends of the cylinder of said main-valve-shifting piston for actuating it in opposite directions, valves q t, also respectively connected by inlet and exhaust passages with the opposite ends of said cylinder for working said pistons in opposite directions, the conductor's valve-shifter, and the levers controlled by said shifter for working said valves, said levers and shifter adapted to open one or the other of valves q t intermediately to opening valves p s, substantially as described.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 19th day of April, 1890.

AUGUST SUNDH.

Witnesses:
W. J. MORGAN,
A. P. THAYER.