No. 623,151. Patented Apr. 18, 1899.

F. E. HERDMAN.

SPEED REGULATING DEVICE FOR HYDRAULIC ELEVATORS.

(Application filed Oct. 6, 1898.)

(No Model.) 3 Sheets—Sheet 1.

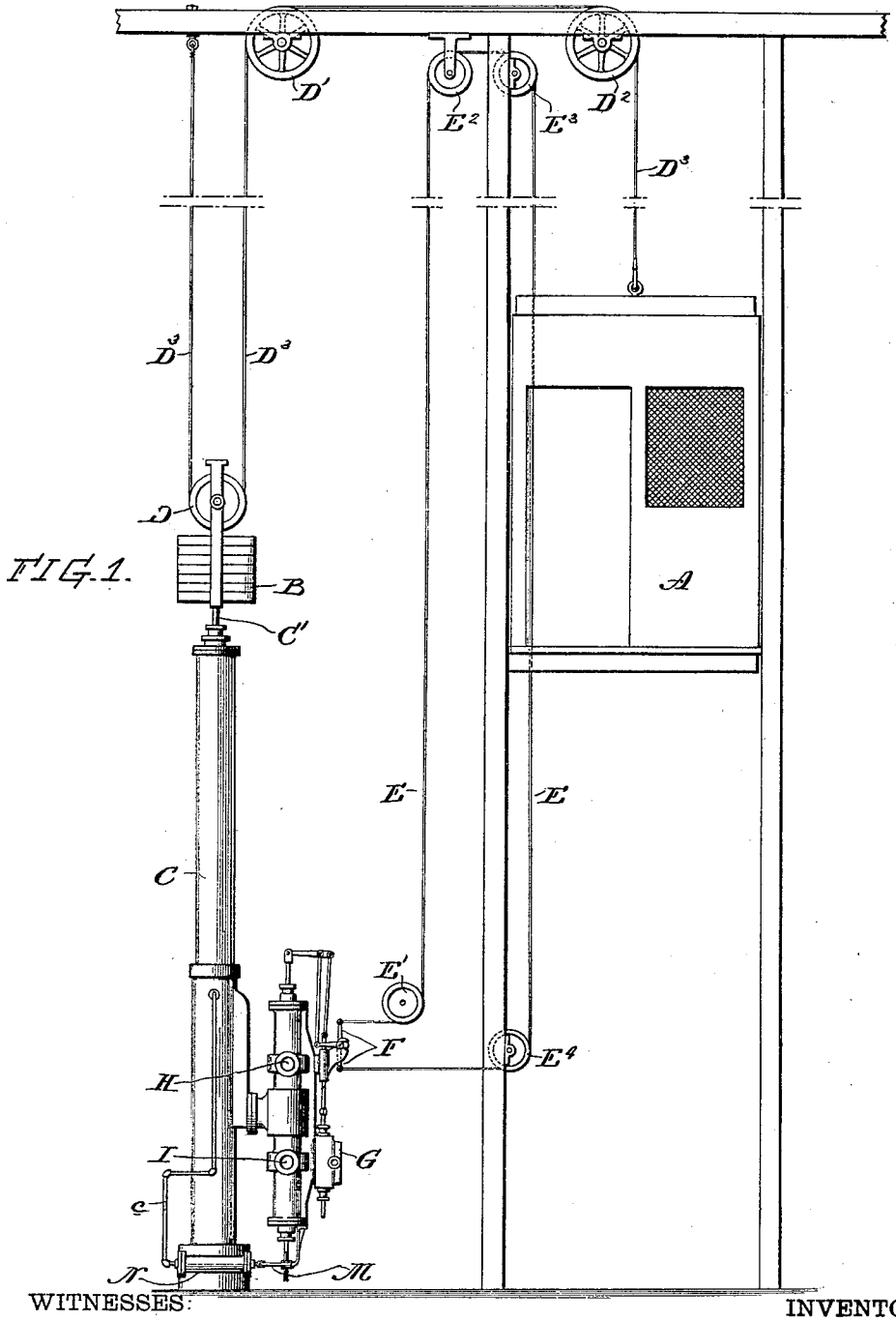


FIG. 1.

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(No Model.) 3 Sheets—Sheet 2.

FIG. 2.

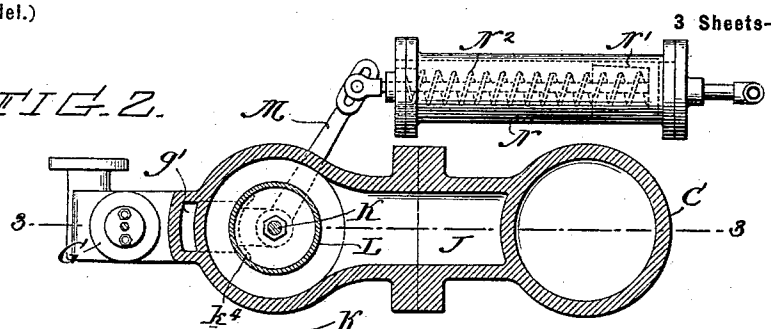
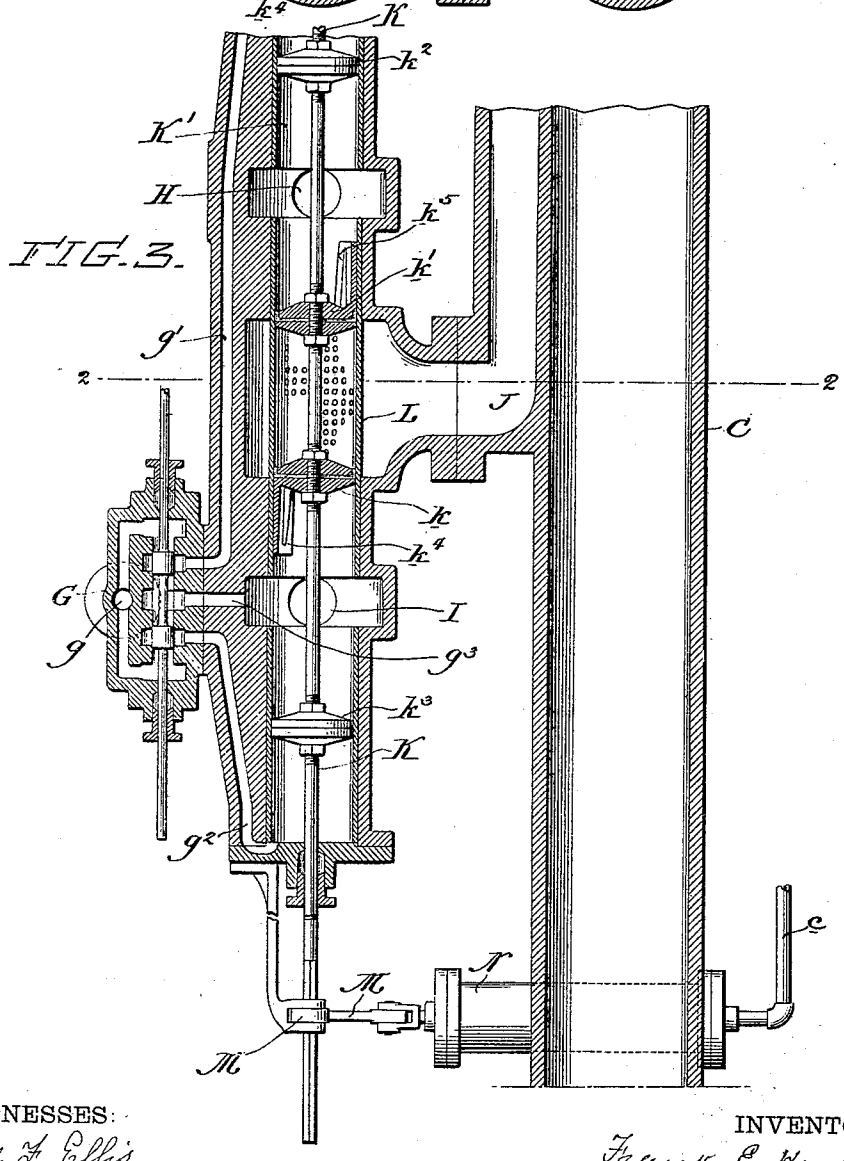


FIG. 3.



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(No Model.) 3 Sheets—Sheet 3.

FIG. 4.

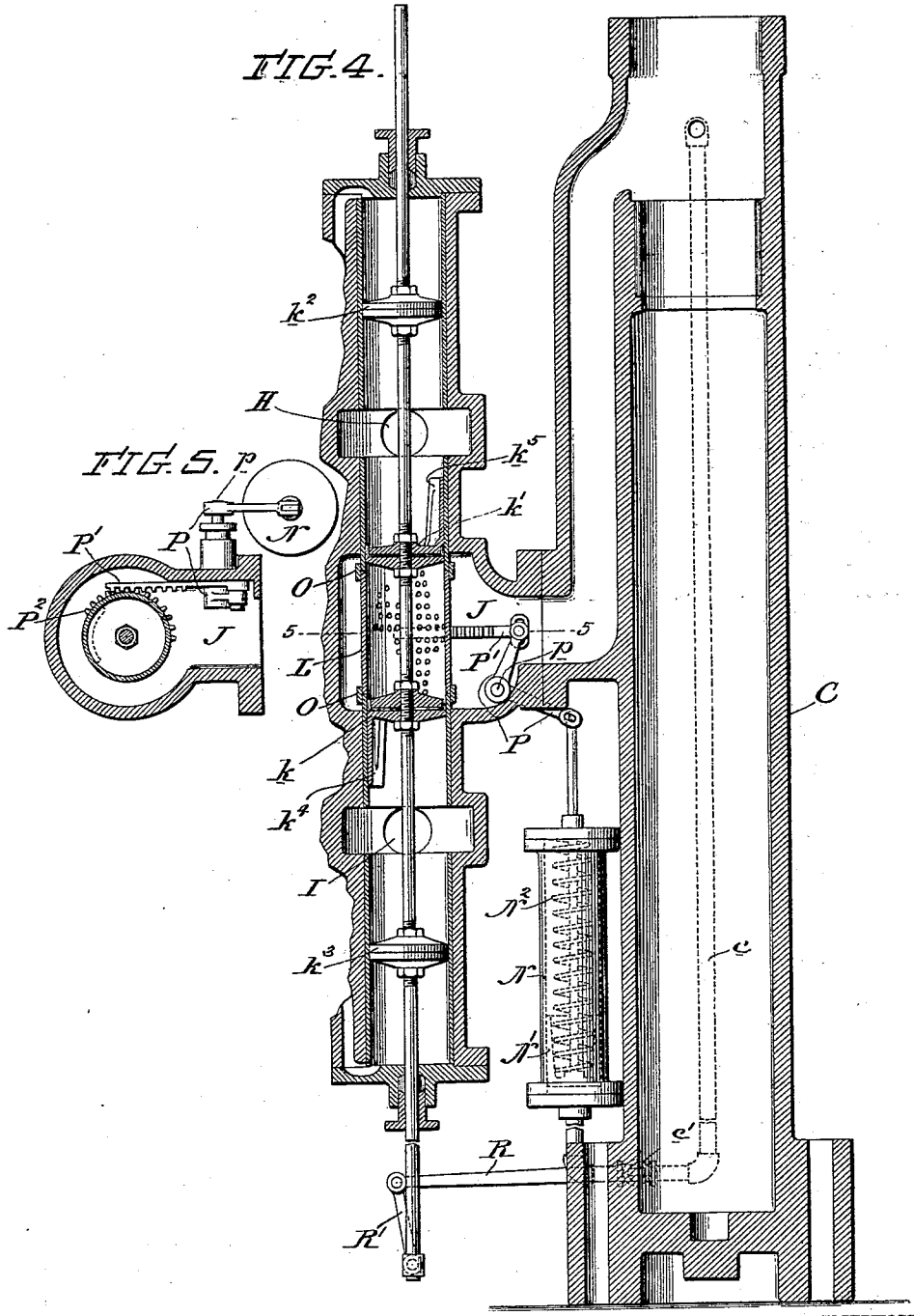


FIG. 5.

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UNITED STATES PATENT OFFICE.

FRANK E. HERDMAN, OF WINNETKA, ILLINOIS.

SPEED-REGULATING DEVICE FOR HYDRAULIC ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 623,151, dated April 18, 1899.

Application filed October 6, 1898. Serial No. 692,779. (No model.)

To all whom it may concern:

Be it known that I, FRANK E. HERDMAN, a citizen of the United States, residing at Winnetka, county of Cook, and State of Illinois, have invented a new and useful Improvement in Speed-Regulating Devices for Hydraulic Elevators, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to speed-regulating devices for elevators operated by fluid-pressure; and its general object is to provide a speed-governor which will maintain a uniform speed of the car or cage with varying loads.

In a hydraulic or other fluid-pressure-operated elevator not provided with speed-regulating devices the speed of the car will vary with the load on the car. For example, in the plunger type of machines, where the weight of the plunger lifts the load and the water-pressure lowers the load by lifting the plunger, if the load on the car be heavy the difference in weight between the load and the plunger will be slight, producing a correspondingly light pressure in the cylinder, and when the operating-valve is moved to connect the cylinder with the discharge the water will be exhausted but slowly, causing a correspondingly slow ascent of the car, and likewise under similar conditions of heavy load if the operating-valve be moved to connect the cylinder with the supply, the dead resisting weight of the plunger being light, the water will be forced into the cylinder with great velocity, causing the car to descend with great rapidity. In the same way with a light load on the car, the difference in weight between the load and plunger being considerable and the pressure in the cylinder being correspondingly great, the car will ascend rapidly and descend slowly.

In an application filed by me January 23, 1897, Serial No. 620,323, I have described a speed-regulating apparatus capable of use in connection with any fluid-pressure-operated elevator, but shown and described in its application to the plunger type of machine, this regulating apparatus comprising a regulating device or valve located at the supply and exhaust port controlled by the operating-valve and operatively connected with a piston in an auxiliary hydraulic cylinder in connection with the main elevator-cylinder, the piston being spring-pressed on one side and subject to the hydraulic pressure transmitted from the main cylinder on the other side. The extent to which the spring will be compressed against the action of the spring is in direct ratio with the pressure in the main cylinder, and to the extent that the spring is compressed the regulating device, by its connection with the piston before mentioned, will be moved proportionately to choke the exhaust-perforations and enlarge the supply-perforations in the supply and exhaust port controlled by the operating-valve. Thus if the load on the car be light and the pressure in the cylinder proportionately great the regulating device will be moved to widen the openings in the supply and exhaust port for the supply and narrow the openings for the exhaust, thus preventing excessive slowness of descent and excessive speed of ascent. If the load on the car be heavy and the pressure in the cylinder consequently light, the regulating-valve will be moved by the spring against the pressure of the water in the opposite direction, widening the openings for the exhaust and narrowing the openings for the supply, thus preventing excessive slowness of ascent and excessive speed of descent, and throughout intermediate variations of load and pressure the regulating device will be adjusted to vary the size of the supply and exhaust perforations accordingly and maintain a uniform speed of travel of the car in spite of variations of load.

My present invention embodies the same principle of varying the size of the openings for the supply and discharge proportionate to the load in the car and the pressure in the cylinder, but broadly differs from the invention of my prior application in that an additional regulating-valve is dispensed with and the operating-valve itself so constructed and connected that it is made to perform the dual function of controlling the travel of the car and regulating its speed. It differs more specifically in that the operating-valve is so constructed with reference to the perforated casing over which it travels that by a suitable connection between the valve or casing and the auxiliary-cylinder piston the valve or casing will by variations of pressure in the ele-

vator-cylinder be caused to turn on its axis, so that the valve in its movement from or toward its central position will open or close a greater or less proportion of supply or exhaust perforations dependent upon the pressure in the elevator-cylinder, as in my prior application. I am thus enabled by a reconstruction of the operating-valve and perforated casing to dispense with the additional device essential to the broad invention of my prior application.

My invention also relates to an auxiliary device the object of which is to shut off the connection between the elevator-cylinder and the auxiliary pressure-cylinder during the operation of the elevator mechanism, thereby preventing any changes in the adjustment of the speed-governing mechanism due to pulsation or otherwise when the car is in motion.

In the drawings, Figure 1 is a side elevation of car, operating-cylinder, operating-valve, speed-regulating mechanism, and connections. Fig. 2 is a plan, partly in section, showing a part of the elevator-cylinder, pressure-cylinder, and connection of the latter with the operating-valve. Fig. 3 is a side elevation, partly in section, of same. Fig. 4 is a side elevation, partly in section, showing a modification wherein the pressure-cylinder is connected with the perforated diaphragm in the port connecting the operating-valve chamber with the operating-cylinder. Fig. 5 is a plan section showing the connection between the pressure-cylinder and diaphragm.

A is the car or cage; B, the counterbalancing-weights; C, the operating-cylinder; C′, the plunger therein; D D′ D^2, the pulleys around which passes the lifting-cable D^3, secured at one end to the car and at the other end to the beam on which pulleys D′ and D^2 are mounted; E, the operating-cable passing around sheaves E′, E^2, E^3, and E^4 and attached at its ends to the rock-shaft F, which by the system of levers usual in hydraulic elevators is connected with pilot-valve G.

H is the inlet or supply port, connecting through the operating-valve chamber K′, perforated bushing L, and port J with the elevator or operating cylinder C.

K is the operating-valve in chamber K′.

I is the outlet-port.

k k' are the valve-heads on the valve K. (Shown in Figs. 3 and 5 at its central position.) This valve is controlled and moved by means of the piston-heads k^2 and k^3, which are brought in connection with water through the medium of valve G, having the inlet-port g and the passage g', leading to the operating-valve chamber on one side of the piston-head k^2, and the passage g^2, leading to the one side of the piston-head k^3, while the passage g^3 leads to the exhaust. This valve G is under the control of the operator, as before described, and by moving it connection may be made between the operating-cylinder and either the inlet or discharge port.

The valve K works in the bushing L, which has perforations in it at the enlargement of the valve-casing, constituting the port J. These perforations are so arranged that as the valve-piston moves to connect the operating-cylinder with either supply or discharge it cuts in the perforations gradually. It will be noticed that there are separate perforations for the supply and the exhaust.

To the piston k is connected a shoe k^4, extending downward, and to the piston k' a shoe k^5, extending upward. These shoes are of such length that when the valve is thrown to its full extent in either direction the shoe will be of equal length to the perforations.

To one end of the valve-stem, passing through and extending beyond the stuffing-box of the valve-chamber, a lever M is feathered, the other end of this lever being slotted and engaging a pin connecting the forked ends of the piston-rod of piston N′ in the auxiliary pressure-cylinder N. The cylinder N is connected with the operating-cylinder C by the pipe c. In this cylinder N is the spring N^2, opposing the pressure from the operating-cylinder.

It is obvious that with variations of pressure in the operating-cylinder, due to variations in load on the car, the piston N′ will be forced against the action of spring N^2 to an extent dependent upon the amount of hydraulic pressure, and by the connection before described the valve will be rotated.

The rotation of the valve occurs while the car is being loaded or unloaded, and hence while the elevator is stationary. The perforations are so arranged that when the valve is turned a different proportion of the supply and exhaust perforations will be in the line of movement of the respective shoes. For example, the supply-perforations are so arranged that when the pressure in the cylinder N is at its maximum, which is the case when the load is lightest, the operating-valve is shifted so that the supply-perforations are entirely free from the path of travel of the shoe k^5, attached to piston k', and so that a large proportion of the discharge-perforations are in the path of shoe k^4 on piston k. If the operating-valve is moved to connect the elevator-cylinder with the supply, the passage of shoe k^5 over the bushing at the supply and exhaust port will close none of the perforations, giving the port its full opening, the excess in weight of counterbalance over the car being at the maximum, and consequently the maximum opening of the port being necessary to insure the desired speed of descent. If under the same conditions of load the operating-valve is moved to connect the elevator-cylinder with the exhaust, the excess of weight counterbalancing the car being at its maximum, and thus inducing maximum rapidity of discharge, the passage of shoe k^4 over the bushing at the supply and exhaust port will close a consid-

erable proportion of the perforations, choking the outlet to the extent necessary to limit the speed to the desired extent of ascent.

When the pressure in the cylinder N is at its minimum, which is the case when the load is heaviest, the operating-valve is shifted so that the discharge-perforations are entirely free from the path of the shoe k^4 and so that a large proportion of the supply-perforations are in the path of shoe k^5. If the operating-valve is moved to connect the elevator-cylinder with the supply, the passage of shoe k^5 over the bushing at the supply and exhaust port will close a large proportion of the perforations, choking the port and restricting the speed of descent. If under the same conditions of load the operating-valve is moved to connect the elevator-cylinder with the exhaust, the passage of shoe k^4 over the bushing will close none of the perforations, giving the port its full opening, this being necessary to insure the desired speed of ascent. So with intermediate variations between maximum and minimum loads, the supply and exhaust perforations are choked proportionately, giving a uniform speed of ascent and descent whatever the load may be.

The relations of perforations and shoes would be so arranged as to maintain a desirable minimum opening in either the supply or discharge and so proportion the amount of perforations cut out or cut into the port as to give the best results.

Instead of shifting the operating-valve I can, as before stated, connect the spring-pressed piston of the pressure-cylinder with the bushing, so as to shift the bushing, the result being precisely the same as if the valve were shifted. This modification is shown in Figs. 4 and 5. The bushing is so made that it can revolve in bearings O. A bell-crank P, pivoted at p, is connected at one end by means of rack P′ and pinion P^2 with the bushing, while the other end is connected with the piston-rod of piston N′ in pressure-cylinder N.

The pistons k and k' can be so located that when the valve is in its central position they are entirely free from the bushing containing the perforations, and in consequence it can be shifted through the medium of the cylinder K with the least possible exertion, as the shifting would occur when the load had been placed on or taken off the cylinder and when the valve is in its central position. As soon as the valve operates to connect the supply or discharge with the operating-cylinder the packing on piston or the packing on piston k' passes onto this bushing, and the friction between this packing and the bushing tends to steady the bushing similar to the effect of a dash-pot.

It is obvious that the details of construction herein shown may be varied within wide limits without departing from the invention, and I wish it to be understood that where the shoes or their equivalent are used their number is unimportant, as two or more shoes may be placed on each piston to equalize the side pressure or to give a controlling movement with the most accurate and economical operation of the cylinder N, the perforations of course being located accordingly, and the results of the several shoes and the rearrangement of perforations being obviously the same as one unit of perforations and one shoe.

It will be understood from the foregoing description that in the specific embodiment of my invention illustrated and described the pressure in the cylinder varies with the load, which in the normal operation of the elevator is changed only while the elevator is at rest. Consequently the pressure in the cylinder is changed and the resultant adjustment of the automatic device controlled by the cylinder-pressure is effected while the car is at rest and remains unchanged during starting, running, and stopping. Strictly speaking, however, there is a tendency to a temporary rise or fall of this pressure immediately following the quick opening of the supply and exhaust port, and there exists the same tendency consequent upon the quick closure of the port, and other causes may produce slight variations in pressure during the travel of the car. I have provided, therefore, a device for controlling the action or preventing changes in the adjustment of the automatic devices when the car is not at rest or during starting, running, and stopping. To this end I have placed a cock c' in the pipe connections c between the operating and pressure cylinder. I have shown the cock as connected by a lever R and link R′ with the end of the stem of the operating-valve. When the operating-valve is central, the cock is open, and when the valve is moved in either direction from the center the cock by the connection mentioned is either closed or choked down to a minute opening, as may be desired, dependent upon the particular conditions confronting the constructor. By this arrangement when the car is brought to rest at a landing the opening of the cock leaves the pressure-cylinder free to be shifted to adjustability to any change in load, and when the car is started the closing of the cock will effectually prevent any changes during the motion of the car.

It is obvious that my invention instead of being arranged to control the supply and exhaust port for the cylinder is equally capable of being arranged to control separately the supply-port and discharge-port which are in connection with the elevator-cylinder through the operating-valve chamber.

While I have described my invention as applied to the plunger type of hydraulic elevator, it is obvious that it is capable of application to any other type of hydraulic elevator or to any fluid-pressure-operated elevator.

Having now fully described my invention, what I claim, and desire to protect by Letters Patent, is—

1. In a fluid-pressure-operated elevator, in

combination, an elevator-cylinder, a port communicating with said cylinder, a combined operating and speed-regulating valve controlling said port, means manually controlled from the car for operating said valve to open and close said port, and automatic devices connected with the elevator mechanism to regulate the extent of opening of said port by said valve.

2. In a fluid-pressure-operated elevator, in combination, an elevator-cylinder, a port communicating with said cylinder, a combined operating and speed-regulating valve controlling said port, means manually controlled from said car for operating said valve to open and close said port, a pressure device controlled by the pressure in the elevator-cylinder, and automatic devices connected with and actuated by said pressure device to regulate the extent of opening of said port by said valve.

3. In a fluid-pressure-operated elevator, in combination, an elevator-cylinder, a port of irregular contour communicating with the cylinder, a combined operating and speed-regulating valve adapted to open and close and regulate the size of said port by moving over different portions thereof, means manually controlled from the car for operating said valve, and automatic devices connected with the elevator mechanism, constructed and adapted to change the relative positions of said port and valve, and cause said valve to move over different portions of said port.

4. In a fluid-pressure-operated elevator, in combination, an elevator-cylinder, a port of irregular contour communicating with the cylinder, a combined operating and speed-regulating valve adapted to open and close said port and regulate the size of said port by moving over different portions thereof, means manually controlled from the car for operating said valve, a pressure device controlled by the pressure in the elevator-cylinder, and automatic devices connected with said pressure device and constructed and adapted to change the relative positions of said port and valve and cause said valve to move over different portions of said port.

5. In a fluid-pressure-operated elevator, in combination, an elevator-cylinder, a port of irregular contour communicating with the cylinder, a valve adapted to open and close said port, an extension on said valve adapted to regulate the size of said port by moving over different portions thereof, means manually controlled from the car for operating said valve, and automatic devices connected with the elevator mechanism, constructed and adapted to change the relative positions of said port and extension and cause said extension to move over different portions of said port.

6. In a fluid-pressure-operated elevator, in combination, an elevator-cylinder, a port of irregular contour communicating with the cylinder, a valve adapted to open and close said port, an extension on said valve adapted to regulate the size of said port by moving over different portions thereof, means manually controlled from the car for operating said valve, a pressure device controlled by the pressure in the elevator-cylinder, and automatic devices connected with and actuated by said pressure device and constructed and adapted to change the relative positions of said port and extension and cause said extension to move over different portions of said port.

7. In a fluid-pressure-operated elevator, in combination, an elevator-cylinder, a port communicating with said cylinder, a combined operating and speed-regulating valve controlling said port, means manually controlled from the car for operating said valve to open and close said port, and automatic devices connected with and actuated by the elevator mechanism and connected with and actuating said valve to regulate the extent of opening of said port by said valve.

8. In a fluid-pressure-operated elevator, in combination, an elevator-cylinder, a port communicating with the cylinder, a combined operating and speed-regulating valve capable of a rotary and longitudinal movement, means manually controlled from said car for moving said valve longitudinally to open and close said port, and automatic devices connected with the elevator mechanism for imparting a rotary movement to said valve to vary the size of said port.

9. In a fluid-pressure-operated elevator, in combination, an elevator-cylinder, a port communicating with the cylinder, a valve adapted to open and close said port, an extension on said valve adapted to regulate the size of said port, and means manually controlled from said car, and automatic devices connected with the elevator mechanism for operating said valve.

10. In a fluid-pressure-operated elevator, in combination, an elevator-cylinder, a valve-chamber, supply and discharge passages in said chamber for admitting supply to and exhausting from the elevator-cylinder, a combined operating and speed-governing valve adapted to close said passages when in its inoperative position, and to open to the elevator-cylinder said supply-passage by a movement in one direction and said discharge-passage by a movement in the opposite direction, means manually controlled from the car for operating said valve, and automatic devices connected with the elevator mechanism to regulate the extent of opening of both the supply and discharge passages by said valve.

11. In a fluid-pressure-operated elevator, in combination, an elevator-cylinder, a valve-chamber, supply and discharge passages in said chamber for admitting supply to and exhausting from the elevator-cylinder, a combined operating and speed-governing valve adapted to close said passage when in its inoperative position and to open to the eleva-

tor-cylinder said supply-passage by a movement in one direction and said discharge-passage by a movement in the opposite direction, means manually controlled from the car for operating said valve, a pressure device controlled by the pressure in the elevator-cylinder, and automatic devices connected with and actuated by said pressure device to regulate the extent of opening of both the supply and discharge passages by said valve.

12. In a fluid-pressure-operated elevator, in combination, an elevator-cylinder, a valve-chamber, ports of irregular contour in said valve-chamber, one controlling the supply to, and the other the discharge from, said cylinder, a combined operating and speed-governing valve controlling said ports, a pressure device controlled by the pressure in the elevator-cylinder, automatic devices connected with and actuated by said pressure device and constructed and adapted to simultaneously change the relative positions of both of said ports and valve and cause said valve, when operated, to move over different portions of either of said ports, and means manually controlled from the car for operating said valve.

13. In a fluid-pressure-operated elevator, in combination, an elevator-cylinder, a port communicating with said cylinder, a combined operating and speed-regulating valve controlling said port, means manually controlled from said car for operating said valve to open and close said port, a pressure device, a pipe connecting the same with the elevator-cylinder and through which the said pressure device is controlled by the pressure in the elevator-cylinder, automatic devices connected with and actuated by said pressure device to regulate the extent of opening of said port by said valve, a valve in said pipe, and a connection between the pipe-valve and the main valve whereby during the shifting of the main valve to open said port, said pipe-valve is moved toward its closed position.

14. In a fluid-pressure-operated elevator, in combination, an elevator-cylinder, a port communicating with said cylinder, a combined operating and speed-regulating valve controlling said port, means manually controlled from the car for operating said valve to open and close said port, automatic devices connected with the elevator mechanism to regulate the extent of opening of said port by said valve, said automatic devices being thrown into action during the closure of said port by said valve, and means for controlling the action of the automatic devices while said port is not closed by said valve.

15. In a fluid-pressure-operated elevator, in combination, an elevator-cylinder, a port communicating with said cylinder, a combined operating and speed-regulating valve controlling said port, means manually controlled from said car for operating said valve to open and close said port, a pressure device controlled by the pressure in the elevator-cylinder, and automatic devices connected with and actuated by said pressure device to regulate the extent of opening of said port by said valve, said automatic devices being thrown into action during the closure of said port by said valve, and means for controlling the action of the automatic devices while said port is not closed by said valve.

In testimony of which invention I have hereunto set my hand, at Bay View, Michigan, on this 30th day of August, 1898.

FRANK E. HERDMAN.

Witnesses:
CHILLION L. SMITH,
EDWIN E. ALLEN.