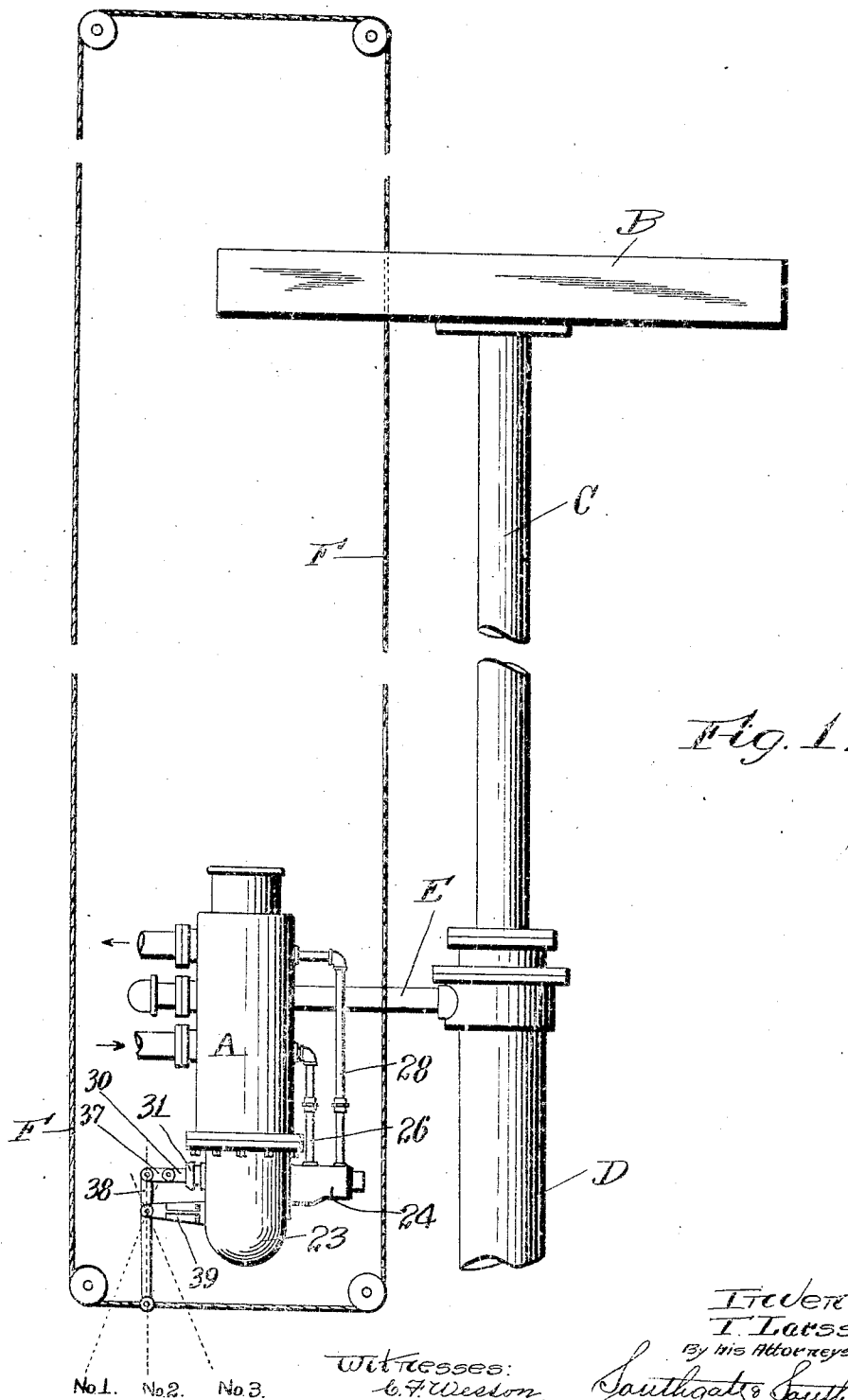


T. LARSSON.
ELEVATOR CONTROLLING MECHANISM.

APPLICATION FILED JUNE 29, 1903.

3 SHEETS—SHEET 1.



Witnesses:
C. F. Weston.
W. E. Ryan.

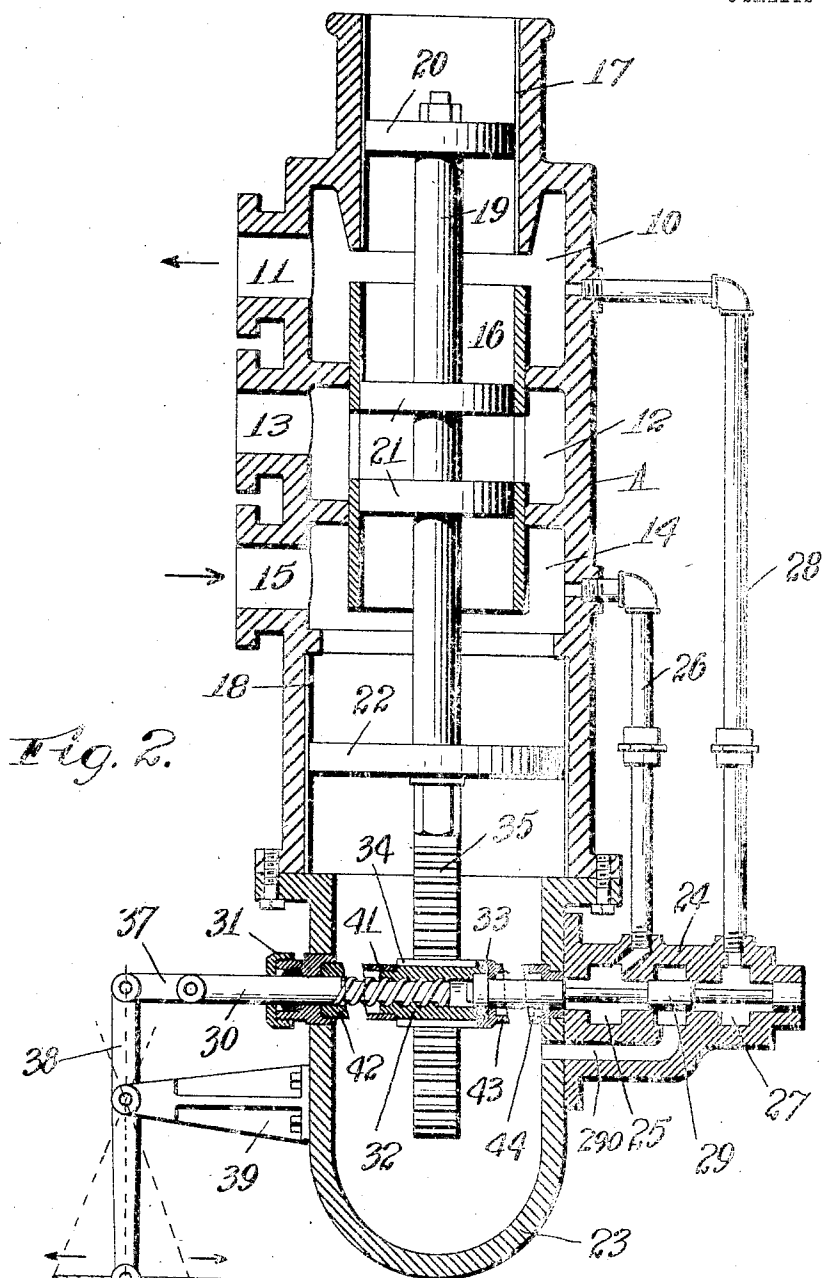
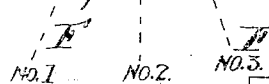
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3 SHEETS—SHEET 2.



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3 SHEETS—SHEET 3.

Fig. 5.

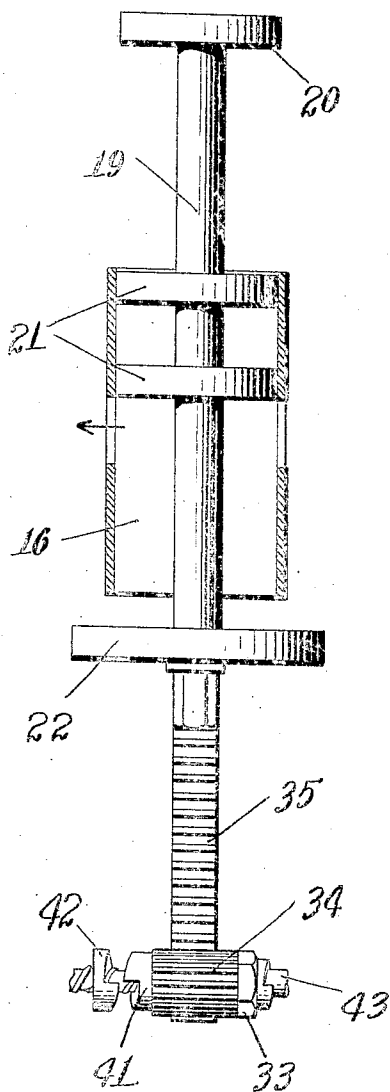
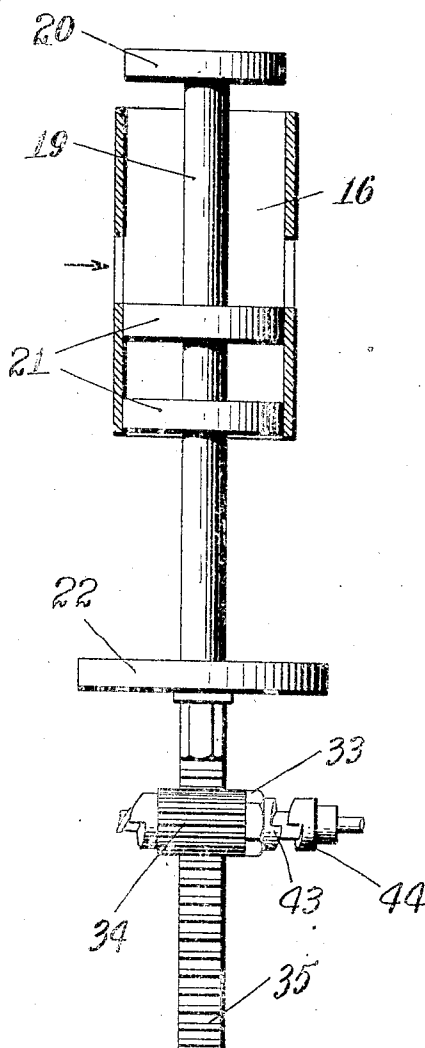
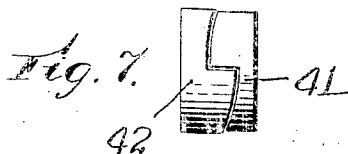
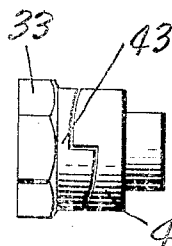


Fig. 6.



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UNITED STATES PATENT OFFICE.

THURE LARSSON, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO THE
STANDARD PLUNGER ELEVATOR COMPANY, OF WORCESTER, MASSA-
CHUSETTS, A CORPORATION OF NEW JERSEY.

ELEVATOR-CONTROLLING MECHANISM.

SPECIFICATION forming part of Letters Patent No. 786,653, dated April 4, 1905.

Application filed June 29, 1903. Serial No. 163,477.

To all whom it may concern:

Be it known that I, THURE LARSSON, a subject of the King of Sweden and Norway, residing at Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Elevator-Controlling Mechanism, of which the following is a specification.

This invention relates to an elevator-controlling mechanism which is operated from the elevator-car to start, stop, or reverse the elevator and to control its speed.

The especial object of this invention is to provide positive mechanical means for preventing a reckless or careless manipulation of the elevator-controlling device, thereby avoiding accidents due to too quick reversal from a travel in one direction to a travel in the opposite direction.

To these ends this invention consists of the elevator-controlling apparatus and of the combinations of parts therein, as hereinafter described, and more particularly pointed out in the claims at the end of this specification.

The accompanying three sheets of drawings illustrate the application of this invention to a plunger-elevator.

In said drawings, Figure 1 is a side view, partially broken away, of sufficient parts of a plunger-elevator to illustrate the application of my invention thereto. Fig. 2 is an enlarged detail view of the elevator-valve. Figs. 3 and 4 are detail views of the stop-collars or cams which limit the distance which the pilot-valve may be shifted by a single movement, thereby preventing accident from too rapid reversals of the elevator, said collars being shown in normal position. Fig. 5 shows the position of the parts when the elevator is going up at full speed. Fig. 6 shows the position of the parts when the elevator is going down at full speed. Fig. 7 is a detail view showing the stop-collars in engagement when the pilot-valve is shifted to its limit of travel in one direction, and Fig. 8 is a detail view showing the stop-collars in engagement when the pilot-valve is shifted to its limit of travel in the opposite direction.

In the use of high-speed elevators accidents have sometimes been caused by too quick reversal of the direction of travel of the elevator-car, and even without causing serious accidents a too quick reversal of an elevator is undesirable, as it places abnormal strains upon the running-gear. A too quick reversal of motion is especially undesirable in a high-speed plunger-elevator plant. In the operation of a plunger-elevator the moving parts are necessarily comparatively bulky, and the inertia of the parts when operating at high speeds is sufficient to require the travel of the elevator-car through a distance of some feet before it can be safely brought to rest.

A plunger-elevator is controlled by the valve, which admits the water to and exhausts the water from the plunger-casing. The valves which have heretofore ordinarily been employed for this purpose have been constructed so that they may be shifted at a single movement from a wide-open position admitting water to the plunger-casing to a wide-open position for exhausting water therefrom, and vice versa. The sudden or unrestrained shifting of a main valve of a plunger-elevator system from its supply position to exhausting position, or vice versa, is liable to cause serious accident, or at least to strain the running gearing. For example, if a plunger-elevator is going up at full speed the inertia of the parts will require a travel of the car through a number of feet before the car can safely be brought to rest, and if during this interval of time the position of the main valve should be shifted so as to permit water to be exhausted from the piston-casing the car will continue to rise, causing the plunger to leave the water and sometimes air to be drawn in through the stuffing-box into the casing, and this unrestricted upward motion of the elevator, with its subsequent settling, entirely destroys reliability of operation. On the other hand, if the position of the valve be reversed when a plunger-elevator is descending quickly a heavy water-hammer and strain is caused, which is liable to injure the valves,

pump, or other parts of the system. To overcome these difficulties, I have invented a means for preventing improper reversals and have devised a system of control which will prevent the reckless or improper running of a hydraulic elevator and which will take the operation of the valve, so far as reversals are concerned, outside the complete control of the operator by being so constructed that too sudden reversals cannot be caused thereby. While this controlling-valve has been especially designed for use in connection with plunger-elevators, it is to be understood that the same may be employed with advantage for controlling substantially all classes of hydraulic elevators.

I have shown my invention applied as an improvement upon the elevator-valve which is shown, described, and claimed in United States application for patent, Serial No. 98,009, filed by me March 13, 1902.

Referring to the accompanying drawings for a detail description of my improvement, B designates an elevator-car carried by plunger C, which runs in the plunger-casing D. Connected to the plunger-casing D is a to-and-from pipe E.

F designates a standing controlling-rope which may be operated from the elevator-car. The moving controlling-rope F constitutes the movable element which may be shifted from the elevator-car to stop or start the elevator or limit its speed. It is to be understood, however, that I have illustrated my invention combined with the standing controlling-rope for the sake of simplicity merely, as in practice many different arrangements of standing or running controlling-ropes, take-up levers, or other devices are employed for connecting the car with the parts to be operated, and some of these forms of controllers I regard as more desirable than the standing controlling-rope shown.

The parts as thus far referred to correspond with the parts of the ordinary plunger-elevator plant.

The form of valve corresponds in its general features with the valve shown in my prior application for patent and is most clearly illustrated in Fig. 2. As shown in this figure, the valve-casing A is provided near its upper end with an exhaust-chamber 10, which may be connected by a passage 11 to a waste-pipe or other outlet. The valve-casing A is provided below the exhaust-chamber 10 with a central chamber 12, which is connected by a passage 13 to the to-and-from pipe E. Below the central chamber 12 the valve-casing A is provided with a pressure-chamber 14, which may be connected through a passage 15 to any suitable source of hydraulic pressure. Mounted in the casing A is a lining 16, provided with slots or openings near its middle, permitting connection between the central chamber 12 and pressure-chamber 14 or ex-

haust-chamber 10, according to the position of the valve-pistons. The casing A has a lining 17 fitted into the upper part thereof and a lining 18 fitted into the lower part thereof. Mounted in the casing A is a main-valve stem 19, which has a top piston 20 and the controlling-pistons 21. At its lower end the main-valve stem 19 is provided with a large operating-piston 22. Bolted onto the casing A is a bottom casing 23, and extending from the casing 23 is a pilot-valve casing 24, in which the pilot-valve is mounted, the axis of said pilot-valve being at right angles to the axis of the main valve—that is to say, as herein illustrated, the pilot-valve is movable transversely with respect to the main valve. The pilot-valve casing 24 is provided with an inlet-chamber 25, connected by a pipe 26 to the pressure-chamber 14. Near its other end the pilot-valve casing 24 is provided with a chamber 27, connected by a pipe 28 to the exhaust-chamber 10. The pilot-valve stem is provided with a central piston 29, which normally closes connection between the pressure-chamber 25 or exhaust-chamber 27, with a passage 290, which leads into the casing 23. When the piston 29 is moved to the right from its position illustrated in Fig. 2, a passage between the pressure-chamber 25 and casing 23 will be opened, and when the piston 29 is moved in the opposite direction from normal position a passage between the exhaust-chamber 27 and casing 23 will be opened. The pilot-valve is operated by a connection comprising two sections adjustably threaded together. One section 30 extends out through a stuffing-box 31 and is adjustably threaded into the second section 32. The second section 32 is provided with a recess for receiving a collar on the end of the pilot-valve stem, and the parts are pivotally connected by a cap 33, threaded onto the section 32. The nut or section 32 is provided with gear-teeth 34, which mesh with a rack 35, extending down from the main valve. This geared connection between the nut 32 and rack 35 permits an endwise travel of the nut 32, while the raising or lowering of the main valve turns the nut 32 through this geared connection. At its outer end the rod or section 30 is connected by a link 37 to a lever 38, pivoted in a bracket 39. At its lower end the lever 38 is connected to the controlling-rope F.

The parts of the valve thus far described are the same as in the application, Serial No. 98,009, before referred to. The piston 22 forms a motor means for moving the main valve, and the pilot-valve forms a mechanism for controlling the motor means.

In the operation of the parts when the lever 38 is shifted to position No. 1, indicated by dotted lines, pressure will be admitted to shift the main valve to the position illustrated in Fig. 5 to admit pressure to the casing D to cause the car to go up at full speed. When

the lever 38 is shifted to position indicated by dotted lines at No. 3, pressure will be exhausted from the casing 23, so that the unbalanced pressure between piston 22 and the smaller valve 21 will move the main valve to the position illustrated in Fig. 6 to exhaust from the casing D to cause the car to go down at full speed. When the lever 38 is moved part way either side of its central position at No. 2, proportionate movements will be imparted to the main valve, the pilot-valve being brought to closed position by the automatic centering or return motion caused by the rack, pinion, nut, and screw, and the elevator-car will move up or down at proportionate speed. When the lever 38 occupies or is moved back to its central position indicated by dotted lines at No. 2 in Fig. 1, the main valve will assume its closed position, as shown in Fig. 2.

If the mechanism hereinafter described were not used, and if the lever 38 should be at a position either side of its central position with the elevator-car going up or down, the lever 38 could be shifted to the other side of its central position, which would cause a quick and violent reverse of the main valve and of the movement of the car. For example, if the operating-lever were at the position No. 1 and the main valve in the position shown in Fig. 5 with the elevator going up at full speed, a careless and inexperienced operator could throw the operating-lever 38 through its central position to the extreme position on the other side—that is, to position No. 3—which could cause the main valve to move rapidly from its position shown in Fig. 5 to the position shown in Fig. 6, reversing the travel of the elevator from full speed in an upward direction to full speed in a downward direction. This would cause an extremely violent reverse, with the disadvantages heretofore pointed out. While this is an extreme of the reverse which could be obtained in the old constructions, it is obvious, of course, that any degree of reverse could be obtained, depending upon the movement imparted to the lever 38 from one side of its central position to the other side of its central position. To prevent movements of this character, except at the proper speed, I have invented a controlling apparatus, so that the operating-lever cannot be moved from one side of its central position through its central position to a position on the other side of its central position until the main valve has been brought to its central position.

All elevator-valves are designed so that if the operating-lever is simply moved from an operative position back to its inoperative or central position the main valve comes easily and gradually back to its central position, gradually stopping the movement of the elevator-car. The ports in the lining 16 and the throttling action obtained by the closing of the main

valve and the simultaneous throttling as the pilot-valve closes gives that action in the form of valve shown. By the mechanism which I have invented and which is hereinafter described it is impossible to move the operating-lever 38 through its central position until the gradual closing movement of the main valve has easily brought the elevator to a stop, and it is thus impossible to cause a violent reverse or a violent movement of the main valve through its central position, no matter how careless the operator may be and no matter how he manipulates the operating connections. This desirable result is accomplished by a controlling apparatus which will prevent a movement of the operating-lever through its central position unless and until the main valve is in or reaches its central position. This mechanism in the specific embodiment of the invention shown in the drawings consists of a spiral or helical cam 41, arranged on the left-hand side of the nut 32 and opposed to a spiral or helical cam 42, secured to the stuffing-box, and of a spiral or helical cam 43, arranged on the cap 33 of the nut 32 and opposed to a spiral or helical cam 44, secured in the casing 23. The helices of these cams are formed to have the same pitch as the screw 30 and nut 32, and the cams are relatively set, as shown in Figs. 3 and 4, these two figures representing the position of the cams when the main valve is in its central or closed position and when the operating-lever 38 is in its central position, No. 2. When the parts are in this normal position, the operator can move the pilot-valve from its central position in either direction to the extremes of its travel—that is, up to either position No. 1 or No. 3—the extreme movement of the pilot-valve being a pitch of said screw 30 or the distance said screw 30 will be moved by one revolution of the nut 32.

Suppose the operator should move the lever 38 half-way from position No. 2 to position No. 1. This will move the pilot-valve half-way to the right and will cause the main valve to move half-way up. This movement of the main valve will turn the pinion 34 and nut 32 a half-turn, which will restore the pilot-valve to normal central position, the lever 38 remaining at the half-way position between No. 2 and No. 1. This will bring the cams to the relative normal horizontal position shown in Figs. 3 and 4; but as cams 41 and 43 have been turned half-way around the distance that the cam 41 can now be moved into the cam 42 or the distance the cam 43 can be moved into the cam 44 will only be one-half of a pitch. The operator can now at any time move the lever 38 still farther toward position No. 1 to increase the speed of the car; but from the intermediate position assumed the operator can only move the lever 38 back to central position and cannot pass the central position until the high point of

cam 41 is turned back to clear the high point of cam 42, which only takes place when the main valve returns to its closed or central position and restores the cams 41 and 43 to the axial position shown in Figs. 3 and 4. Thus the operator cannot throw the operating-lever 38 past the central position until the main valve returns to its closed or central position, which action must take place properly. If the operating-lever 38 should be moved half-way to the right, substantially the same action will take place, except that the cams 41 and 43 would be revolved a half-turn in the opposite direction when the main valve reaches its half-way position toward the bottom of the casing to allow the exhaust, whereby the operating-lever 38 cannot be moved back past central position until the high point of the cam 43 is turned past the high point of the cam 44. The same action takes place no matter what degree the operating-lever is moved from its central position in either direction, as the partial revolution of the cams 41 and 43 is proportional to the movement of the operating-lever 38—that is to say, if the lever 38 is moved toward position No. 1 to any extent up to a full movement thereof to cause the elevator to ascend at any degree of speed it is locked from being moved past its central position by cams 41 and 42 until the main valve comes back to its central position, or if said lever 38 is moved toward position No. 3 to any extent up to a full movement thereof to allow the elevator to descend at any speed it is locked from being moved back past its central position by cams 43 and 44 until the main valve comes back to its central position. This prevents a careless operator from reversing the motion of the car violently, as the main valve must come back easily to its central position by reason of the throttling thereof, it being impossible to throw the main valve across the central position to alter the gradual centering of the main valve. In short, when the main valve is in its closed position the operator can move the operating-lever 38 to any position; but so soon as it is moved in either direction from its central position and the main valve consequently started from its central or closed position the operating-lever, although it is free to be moved back to its central position, cannot be moved back through its central position until the main valve has returned to its central position. In other words, when the main valve is not in its central position the movement of the operating-lever is restricted to one side of its central position while the main valve is allowing a flow in either direction until the main valve is restored to closed position.

In the ordinary operation with a competent operator who does not try to reverse the car while it is in motion the parts herein described do not come into operation; but they form important safeguards to guard against

careless operators and to eliminate so far as is possible the factor of volition and to make the mechanism practically interlocking.

While this construction is of use in any class of elevators employing pilot-valves, it is of particular advantage in hydraulic plunger-elevators, because, as before described, if the motion of the car is violently reversed when going up the plunger is apt to bound, while if the car is violently reversed when descending a water-hammer or blow is caused which is apt to injure or derange the mechanism. These accidents are avoided by the mechanism before described.

In practice the cams are usually eased off—that is, a little radial play is allowed between the high surfaces—to accommodate the lap which is usually given to the main valve and its ports. It is also to be observed that the helical stop-faces as thus arranged furnish a positive means for restoring the pilot-valve to normal position after it has been shifted to either limit of its travel—that is to say, in the operation of the construction when the pilot-valve is not thrown to its full limit of travel the screw-threaded connection will serve to restore the pilot-valve to normal position; but when either set of stop-faces 41 and 42 or 43 and 44 is brought into engagement the stop-face 42 or the stop-face 44, as the case may be, will form a stationary cam-section, and hence more positive means for returning the pilot-valve than the screw-threaded connection, which is of a floating or bodily-movable character.

I am aware that changes may be made in practicing my invention by those who are skilled in the art and that many different types of elevator-controllers may be designed and applied to widely-different types of elevators for preventing sudden reversals according to this invention without departing from the scope thereof as expressed in the claims. I do not wish, therefore, to be limited to the construction I have herein shown and described; but

What I do claim, and desire to secure by Letters Patent of the United States, is—

1. In a valve mechanism, the combination with the main valve and the pilot-valve, of means for preventing a reverse except when the former is in a determined position.

2. The combination with the main valve and the pilot-valve, of means for preventing the latter from being moved for a reverse except when the former is in a determined position.

3. The combination with the main valve and the pilot-valve, of means for preventing the latter from being moved for a reverse except when the former is in central position.

4. The combination of a main-valve mechanism, a pilot-valve mechanism, operating connections for the pilot-valve, and means constructed and arranged to limit the movement of the operating connections by the position

of the main valve to prevent a reverse until the main valve comes back to its central or closed position.

5. The combination of a main-valve mechanism, a pilot-valve mechanism, operating connections for the pilot-valve, and means constructed and arranged to limit the movement of the connections by the position of the main valve to prevent a movement of the same through central position until the main valve comes back to its central or closed position.

6. The combination of a main-valve mechanism, a pilot-valve mechanism, operating connections for the pilot-valve, and means constructed and arranged to restrict the movement of the operating connections to one side of central position while the main valve is allowing a flow.

7. The combination of a main-valve mechanism, a pilot-valve mechanism, operating connections for the pilot-valve, and means constructed and arranged to restrict the movement of the operating connections to one side of central position while the main valve is allowing a flow in either direction.

8. The combination of a main-valve mechanism, a pilot-valve mechanism, operating connections for the pilot-valve, and means constructed and arranged to restrict the movement of the operating connections to one side of central position while the main valve is allowing a flow and until the main valve is restored to closed position.

9. The combination of a main-valve mechanism, a pilot-valve mechanism, operating connections for the pilot-valve, and means constructed and arranged to restrict the movement of the operating connections to one side of central position while the main valve is allowing a flow in either direction and until the main valve is restored to closed position.

10. The combination of a main-valve mechanism, a pilot-valve mechanism, operating connections for the pilot-valve, and means constructed and arranged to prevent the operating connections from being moved back through central position until the main valve is returned to the central position, whenever the operating connections have been moved in either direction from central position, and the main valve has started from its central or closed position, but still to permit the operating connections to be free to be moved to any point between central position and extreme position on the side of the central position from where they were first moved.

11. The combination of a main-valve mechanism, a pilot-valve mechanism, operating connections for the pilot-valve, and means constructed and arranged to permit the pilot-valve to be moved to either side of its central position when the main valve is closed, but to prevent the operating connections from being moved back through their central position until the main valve has moved to its central

position, whenever the pilot-valve has been moved to one side and the main valve moved from its normal position.

12. The combination of a main-valve mechanism, a pilot-valve mechanism, and an interlocking cam mechanism operated by the movement of the main valve to prevent a reversing movement except when the main valve is in central position.

13. The combination of a main-valve mechanism, motor means for moving the main valve, controlling mechanism for the motor means, operating connections for the controlling mechanism, and means for preventing the operating connections causing a reversal of the main valve until the main valve is in or until it reaches its closed position.

14. The combination of the main valve, the pilot-valve, operating connections to the pilot-valve, a nut and screw in said connections for restoring the pilot-valve to closed position, means for operating the nut and screw from the main valve, and an interlocking cam mechanism arranged on said nut and a stationary part to prevent a reversing movement of the operating connections except when the main valve is in central position.

15. The combination of a main valve, a pilot-valve, operating connections to the pilot-valve, a nut and screw for restoring the pilot-valve to closed position, operating-gearing to said nut and screw from the main valve, a helical cam arranged on said nut, and a stationary cam arranged on a stationary part.

16. The combination of a main valve, a pilot-valve, operating connections to the pilot-valve, a nut and screw for restoring the pilot-valve to closed position, operating-gearing to said nut and screw from the main valve, and oppositely-disposed helical cams arranged on said nut and stationary parts.

17. In a hydraulic elevator-valve, the combination of a main valve, a pilot-valve movable transversely with respect to the main valve, a connection for operating the pilot-valve comprising a section to be shifted from an elevator-car, and a second section or nut threaded thereon, a gear-and-rack connection between the nut and main valve, said gear-and-rack connection being arranged to permit an endwise travel of the nut, and to cause the rotation of the nut to restore the same to normal position when the main valve has been shifted, and stops for limiting the movement of the nut comprising helical stop-faces carried by the nut and cooperating stationary helical stop-faces.

18. In a hydraulic elevator-valve, the combination of a main valve, a pilot-valve movable transversely with respect to the main valve, an operating connection for the pilot-valve comprising sections threaded together, connections for sliding or shifting one of said sections longitudinally from an elevator-car, a gear-and-rack connection between the other

of said sections and a main valve, said gear-
and-rack connection being arranged to per-
mit a longitudinal movement, and to rotate
one of said sections to cause the screw-thread
5 to restore said section to normal position
when the main valve has been shifted, and
stops for limiting the extent to which the pil-
ot-valve may be shifted comprising helical
10 faces corresponding in pitch with the screw-
threaded connection and carried by the rotary
section and stationary parts respectively.

19. The combination of a main valve, a pil-
ot-valve, operating connections for the pilot-
valve, a nut and screw for restoring the pilot-
15 valve to closed position, operating connections
from the main valve to the nut and screw, a
helical cam arranged on said nut, and a helical
cam arranged on a stationary part, the pitch
of said cams equaling the pitch of said screw.

20. The combination of a main valve, a pil-
ot-valve, operating connections for the pilot-
valve, a nut and screw for restoring the pilot-
valve to closed position, means for operating
25 the nut and screw from the main valve, oppo-
sately-disposed helical cams on said nut, and
cooperating helical cams on stationary parts,
the pitch of said cams equaling the pitch of
said screw, whereby a reversing movement of
30 said operating connections to the pilot-valve
is prevented except when the main valve is in
central position.

21. The combination of a main-valve mech-
anism, a pilot-valve mechanism, an operating-
lever for the pilot-valve, and means arranged
35 to limit the movement of the lever by the po-
sition of the main valve to prevent a move-
ment of the same through its central position
until the main valve comes back to its central
or closed position.

40 22. The combination of a main-valve mech-
anism, a pilot-valve mechanism, an operating-
lever for the pilot-valve, and means construct-
ed to restrict the movement of the operating-
lever to one side of its central position while
45 the main valve is allowing a flow.

23. The combination of a main-valve mech-
anism, a pilot-valve mechanism, an operating-
lever for the pilot-valve, and means construct-
ed to restrict the movement of the operating-
50 lever to one side of its central position while
the main valve is allowing a flow in either di-
rection.

24. The combination of a main-valve mech-
anism, a pilot-valve mechanism, an operating-
lever for the pilot-valve, and means construct-
55 ed to restrict the movement of the operating-
lever to one side of its central position while
the main valve is allowing a flow and until
the main valve is restored to closed position.

25. The combination of a main-valve mech-
anism, a pilot-valve mechanism, an operating-
60 lever for the pilot-valve, and means construct-
ed to restrict the movement of the operating-
lever to one side of its central position while
the main valve is allowing a flow in either di-
65 rection and until the main valve is restored
to closed position.

26. The combination of a main-valve mech-
anism, a pilot-valve mechanism, operating
connections for the pilot-valve, and a cam
70 mechanism for preventing a reverse except
when the main valve is in central position,
said cam mechanism forming an auxiliary re-
storing means for the pilot-valve.

27. The combination of a main-valve mech-
anism, a pilot-valve mechanism, operating
connections for the pilot-valve, and a double
interlocking spiral cam mechanism for pre-
venting a reverse except when the main valve
is in central position, said cam mechanism
80 forming an auxiliary restoring means for the
pilot-valve.

In testimony whereof I have hereunto set
my hand in the presence of two subscribing
witnesses.

THURE LARSSON.

Witnesses:

LOUIS W. SOUTHGATE,
PHILIP W. SOUTHGATE.