No. 733,553. PATENTED JULY 14, 1903.

J. W. MOORE.

ELECTRIC CONTROLLER FOR HYDRAULIC ELEVATORS.

APPLICATION FILED DEC. 26, 1901.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

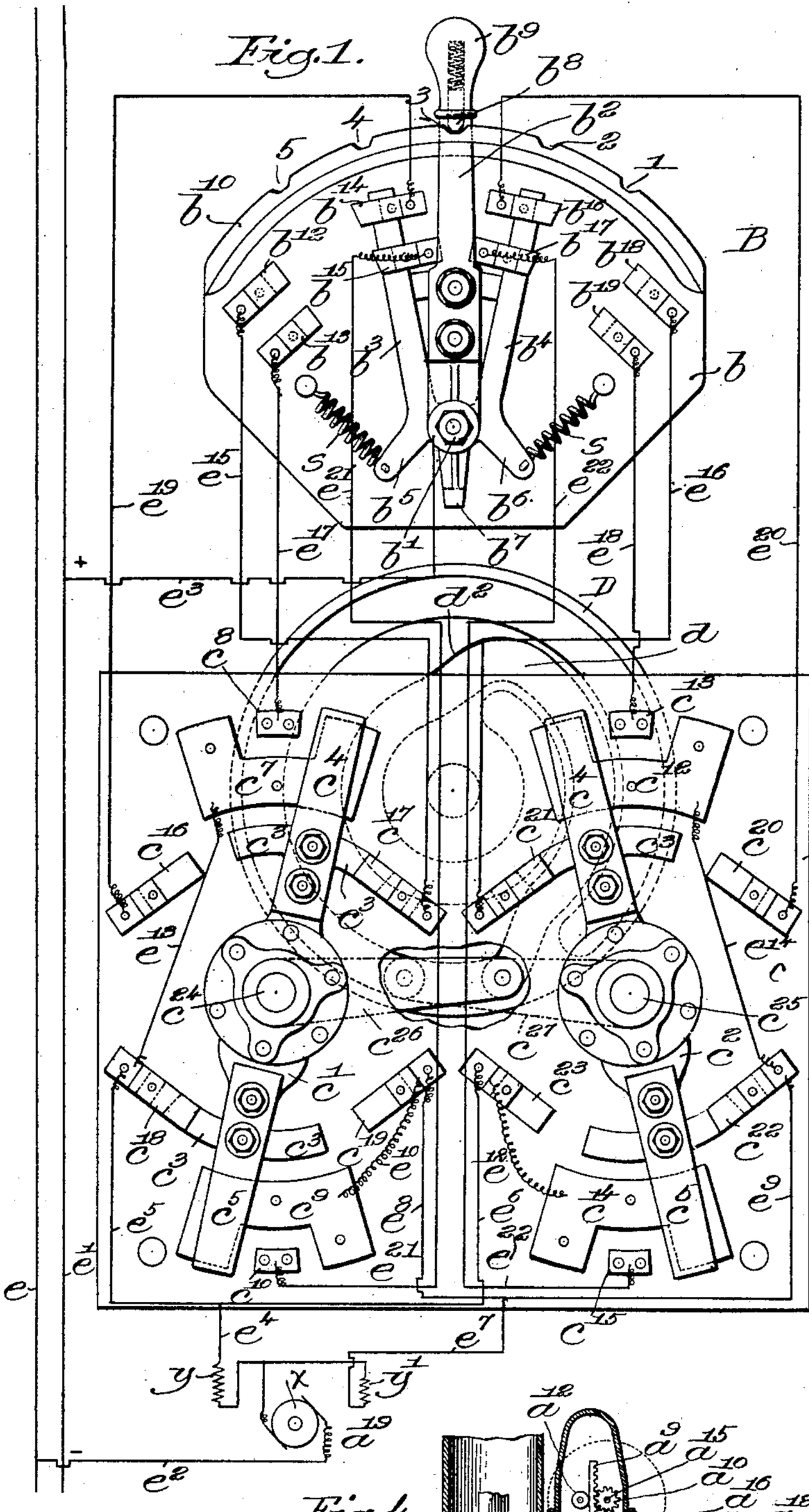
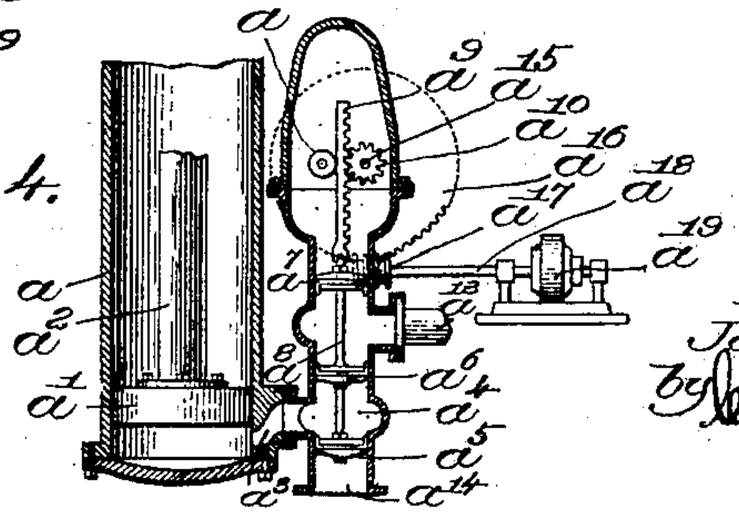


Fig. 4.



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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 2.

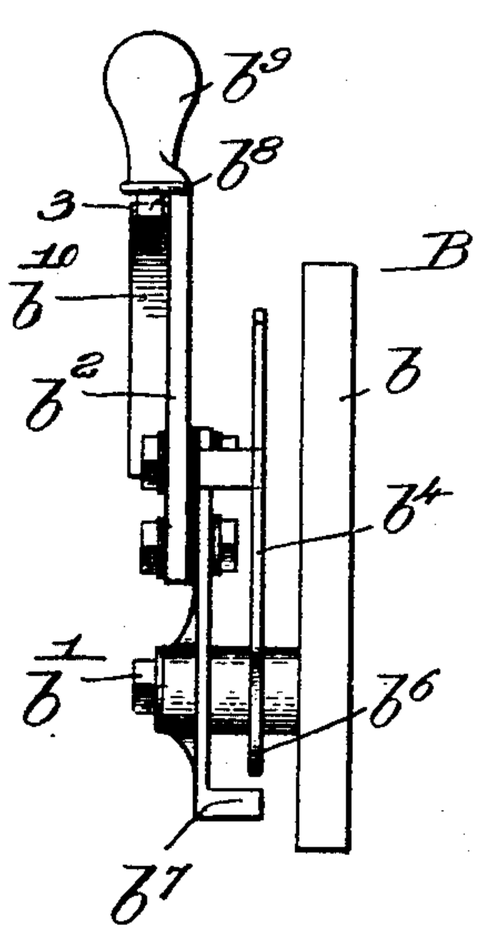


Fig. 3.

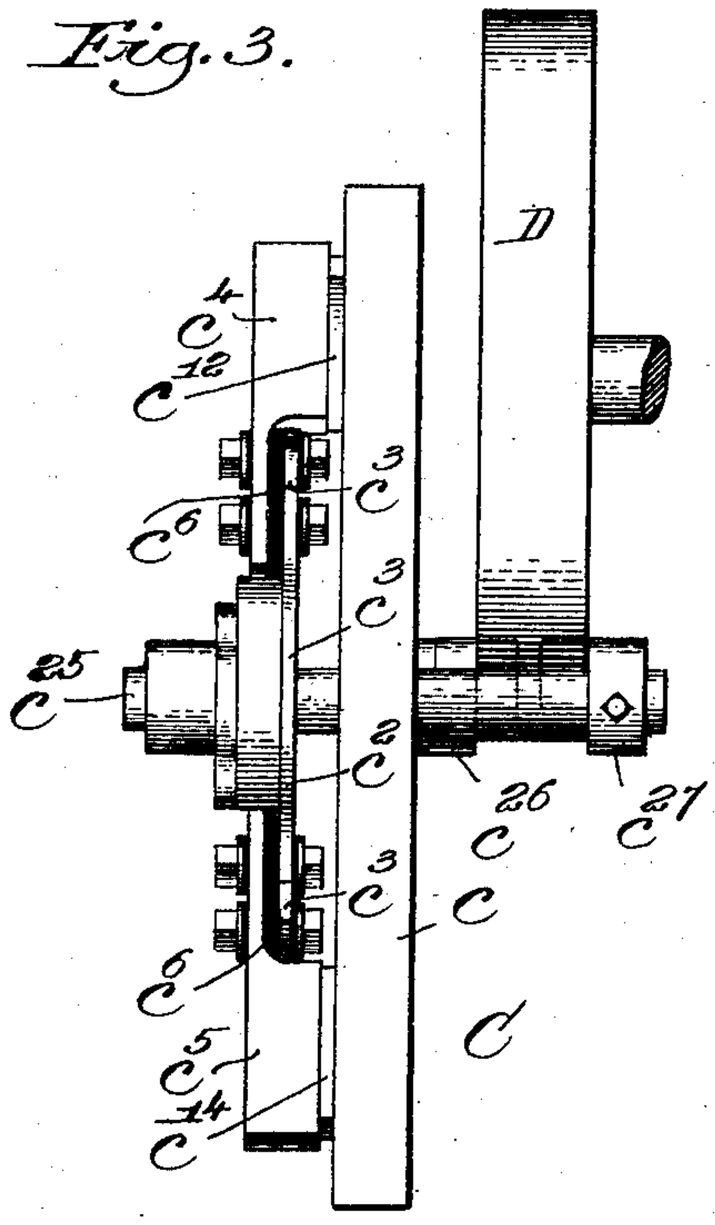
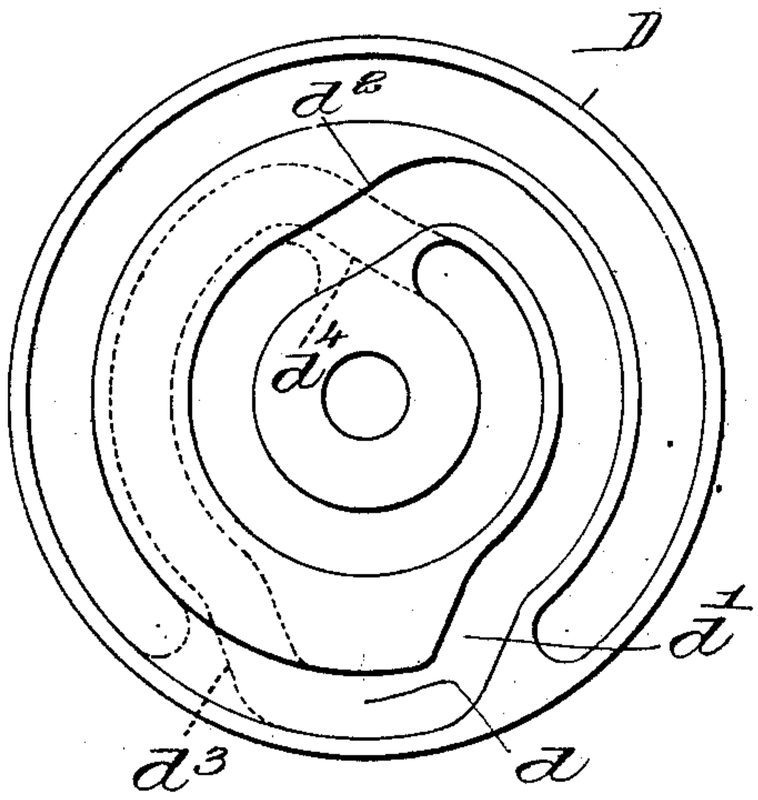


Fig. 5.



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No. 733,553. Patented July 14, 1903.

UNITED STATES PATENT OFFICE.

JOSEPH W. MOORE, OF NEWTON, MASSACHUSETTS.

ELECTRIC CONTROLLER FOR HYDRAULIC ELEVATORS.

SPECIFICATION forming part of Letters Patent No. 733,553, dated July 14, 1903.

Application filed December 26, 1901. Serial No. 87,249. (No model.)

To all whom it may concern:

Be it known that I, JOSEPH W. MOORE, a citizen of the United States, residing at Newton, county of Middlesex, State of Massachusetts, have invented an Improvement in Electric Controllers for Hydraulic Elevators, of which the following description, in connection with the accompanying drawings, is a specification, like characters on the drawings representing like parts.

Instead of the usual auxiliary or pilot valve for operating the main valve of the elevator I provide an electric controller operating directly on said main valve itself and capable of automatically controlling the valve, as well as being subject to control from the car.

My invention comprises, stated in general terms, a circuit-making device normally in position coöperating with a hand-lever to break the motor-circuit automatically when the hydraulic valve is in stopping position for the elevator, but upon circuit-closing movement of the hand-lever capable of being automatically shifted to a position without breaking the circuit for subsequent automatic stopping of the valve irrespective of the direction in which it is being moved. In its further embodiment I also provide electrical means under the control of the operator for starting, stopping, and reversing the direction of the motor at any point in the travel of the valve, and also preferably the arrangement is such that the operator can at will permit the automatic stopping mechanism above referred to to stop the motor when the valve is in its intermediate or stopping position or permit the motor to continue the movement of said valve on past said stopping position where it would otherwise be automatically stopped.

The constructional details of my invention will be more fully pointed out and the invention will be further defined in the following description and appended claims.

In the accompanying drawings, in which I have shown a preferred embodiment of my invention, Figure 1 represents, partly in front elevation and partly in diagram, the essential portions of my invention, said figure showing the car-controller, the automatic controller, and the wiring of the various parts with the motor. Figs. 2 and 3 are respectively side or edge elevations of the car-controller and the automatic controller, parts being broken away, with the side contacts and certain details omitted for clearness of illustration. Fig. 4 is a central sectional view showing the motor and connected parts of the hydraulic valve portion of an elevator. Fig. 5 is a detail showing the cam in front elevation.

Referring first to Fig. 4 in order that the general operation and purpose of my invention may be understood, it will be seen that a usual water-cylinder a, containing a piston a' and a piston-rod a^2 for lifting the elevator, is connected with a usual valve arrangement by a port a^3, said valve arrangement comprising a box a^4, containing valves a^5 a^6 and a balance-valve a^7, whose valve-rod a^8 is provided at its upper end with a rack a^9, held in engagement with a pinion a^{10} by a roll a^{12}. Water is supplied from a main or pump connection a^{13}, and the exhaust flows out at a^{14}. The toothed pinion a^{10} is fast on a shaft a^{15}, provided externally of the valve-box with a worm-wheel a^{16}, meshing with a worm a^{17} on the armature-shaft a^{18} of the motor a^{19}. The valve is shown in closed position, by which is meant the position when it maintains the piston a', and hence the elevator connected therewith, stationary at whatever elevation it may be, and the valve must move down from this position in order to start the elevator up, and when the latter is up the valve must move up from this position to start the elevator down, the valve being given these movements by the rotation of the worm-wheel a^{16} in one direction or the other, as the case may be, and my invention resides in providing positive electrical control for governing the movement of this worm-wheel both automatically and manually.

Referring now to Fig. 1, it will be seen that I have provided a car switch or controller B and an automatic switch or controller C, the latter usually being located at the motor. The controller B comprises a suitable base b, provided with a stud b', on which are loosely mounted a hand-lever b^2, and two independent contact makers or knives b^3 b^4, each being shown as provided at their lower ends with projections b^5 b^6 and held by springs s normally in the position shown in Fig. 1. The

lever b^2 has preferably at its lower end a laterally-projecting finger b^7 for coöperating with the projections b^5 b^6 in the manner described later on and is provided at its upper end with any suitable form of stop device, herein shown as a spring-actuated dog b^8 in the handle b^9, to coöperate with notches 1 to 5, formed in a rail or guide b^{10} of the switch or controller. On the base b are secured usual clips or contacts b^{12} to b^{19}. The automatic controller C is shown as consisting of a base c, on which are mounted two levers or contact-makers c' c^2, each consisting (see Fig. 3) of a central part c^3 and end parts c^4 c^5, all of conductive material and insulated from each other at c^6 to coöperate with end contacts c^7 to c^{15} and with side clips or contacts c^{16} to c^{23}. The levers c' c^2 are carried by the rock-shafts c^{24} c^{25}, respectively, and on these shafts, herein shown as behind the base c, are arms c^{26} c^{27}, having at their ends cam-rolls to travel in the path-cams of a cam D, fast on the pinion-shaft a^{15}. For convenience the path-cams for the levers c^{26} c^{27} are provided in the opposite faces of the cam D and are identical in arrangement for operation, as presently set forth. As herein shown, the wiring is as follows: From the mains e e', respectively, a conductor e^2 leads to one side of the armature x of the motor and a wire e^3 to the car-controller, being shown as connected with the stud b'. The field of the motor is reversely wound in two parts y y', the former being connected by a wire e^4 with the two parts of the automatic controller by branches e^5 e^6, leading, respectively, to the contacts c^{18} c^{23}, and the latter field-winding y' being connected by a wire e^7 and its branches e^8 e^9 with opposite contacts c^{19} c^{22} of the respective parts of the controller C. At the opposite terminals of these respective branches—*i. e.*, at the lower contacts c^{19} c^{23} and c^{18} c^{22}—connection is made to the lower end contacts c^9 c^{14} by wires e^{10} e^{12} and to the upper end contacts c^7 c^{12} by wires e^{13} e^{14}. As already stated, the parts are shown in the position which maintains the hydraulic valve in elevator-stopping position, and when it is desired to move the valve from this position by shifting the hand-lever b^2 to the right or to the left, according to the direction of valve movement desired, the circuit is completed through the contact b^{12} or b^{18} by a wire e^{15} or e^{16}, leading to the contact c^{17} or c^{21}, as the case may be, the motor-starting circuit being as follows: e^3 b^3 b^{12} e^{15} c^{17} c^3 c^{18} e^5 e^4 y a^{19} e^2 for one direction or e^3 b^4 b^{18} e^{16} c^{21} c^3 c^{22} e^9 e^7 y' a^{19} e^2, and when the valve has been started and the cam mechanism has at once shifted the corresponding contact-maker c' c^2 to its vertical or intermediate position, as herein shown, the circuit is then completed through the contacts c^7 c^8 or c^{12} c^{13}, which connect, respectively, by auxiliary circuit-wires e^{17} e^{18} with the contacts b^{13} b^{19}, the circuits being e^3 b^3 b^{13} e^{17} c^8 c^7 e^{13} c^{18} e^5 e^4 y a^{19} e^2 or e^3 b^4 b^{19} e^{18} c^{13} c^{12} e^{14} c^{22} e^9 e^7 y' a^{19} e^2. In this position the circuit-maker c' or c^2 may be moved for stopping either to the right or to the left by the automatic mechanism, according to the direction of the valve movement, and if either of them is moved to the opposite position from that herein shown it stops the valve-controlling mechanism with the contact-makers c^3 and contacts c^{16} c^{19} of one part or c^{20} c^{23} of the other part of the controller C coupled, so that through the wires e^{19} or e^{20}, which lead to the contacts b^{14} b^{16}, respectively, the valve movement may be reversed upon the movement of the hand-lever b^2 back to its position shown in Fig. 1. When c' or c^2 are moved to contacts c^{17} or c^{21}, the circuits are as already indicated in the preceding paragraph, and when moved to contacts c^{16} or c^{20} the circuits are broken at c^7 and c^8 or c^{12} and c^{13} and are completed as follows: e^3 b^3 b^{14} e^{19} c^{16} c^3 c^{19} e^8 e^7 y' a^{19} e^2 or e^3 b^4 b^{16} e^{20} c^{20} c^3 c^{23} e^{12} e^4 y a^{19} e^2.

In the particular embodiment of my invention herein shown I have arranged the automatic mechanism so that it immediately shifts the contact-maker c' or c^2 (according to the direction of valve movement) whenever the valve is started, and hence as this action at once breaks the reversing-circuit, which I have just explained, it becomes necessary to provide another circuit for the new intermediate position of the circuit-breaker c' or c^2, and this provision is made by the auxiliary circuit-wires e^{21} e^{22}, which connect, respectively, the contacts b^{15} c^{10} and b^{17} e^{15}, the circuits then being e^3 b^3 b^{15} e^{21} c^{10} c^9 e^{10} c^{19} e^8 e^7 y' a^{19} e^2 or e^3 b^4 b^{17} e^{22} c^{15} c^{14} e^{12} c^{23} e^6 e^4 y a^{19} e^2.

The operation of my apparatus is as follows: Let it be supposed that the elevator is at the bottom of its travel and the valve is in the position shown in Fig. 4, the electrical parts being in the position shown in Fig. 1. If now it is desired to start the elevator upwardly, the car-lever b^2 is moved to the left, so as to engage the knife b^3 with the contacts b^{12} b^{13}, thereby completing the circuit through the wire e^{15} and parts c^{17} c^3 c^{18} e^5 e^4 and motor, thereby rotating the armature-shaft a^{18} in the direction to lower the valve a^5 a^6. As soon as the armature-shaft begins to rotate, and consequently the cam D correspondingly rotates, the arm c^{26} is raised by the throw d' of the path d, so as to shift the contact-maker c' into its intermediate or vertical position, Fig. 1. This serves to shift the circuit from the wire e^{15} to the wire e^{17}, so that then the circuit is made from the contact b^{13} by means of the wire e^{17} and parts c^8 c^4 c^7 e^{13} c^{18} e^5 e^4 and field y. This change does not break the circuit nor alter the direction of rotation of the armature, but simply places the contact-maker c' in an intermediate position, so that it may be thereafter shifted either to the right or the left. The armature-shaft continues to rotate in the same direction until the valve has reached its lowermost limit of travel, whereupon the throw d^2 of the cam D lifts the arm c^{26} still farther, so as to cause the contact-maker c' to break the circuit at the contacts c^8 c^7 and to contact with c^{16} c^{19}, thereby stopping the

motor, and consequently the valve, but permitting the elevator to continue its upward movement. If the operator wishes to stop the elevator at any point in its upward course, he simply restores the hand-lever b^2 to its intermediate position, thereby reversing the rotation of the armature-shaft and connected parts by completing a circuit from the contact b^{14} by the wire e^{19}, contact c^{16}, part c^3, contact c^{19}, and wires e^8 e^7 to the field-winding y'. This causes the valve to move upwardly, the contact-maker c' being meanwhile shifted back to its intermediate position by the throw d^2 of the cam, which shifts the circuit from the contact b^{14} to the contact b^{15} and through the wire e^{21} and parts c^{10} c^5 c^9 e^{10} to the same wire e^8 as before, and as soon as the valve arrives at its intermediate position, as shown in Fig. 4, for cutting off the water-supply the arm c^{26} is moved downwardly by the throw d' of the cam, thereby breaking contact at c^9 c^{10} and stopping the motor automatically. If now the operator wishes to lower the elevator, he shifts the hand-lever to the right, Fig. 1, thereby completing a circuit from the contact b^{18} through the contact-maker c^2 in the position shown in the drawings to the armature-winding y' of the motor, and at once the throw d^3 of the cam shifts the contact-maker c^2 to its intermediate position, thereby shifting the circuit from the contact b^{18} to the contact b^{19}, wire e^{18}, contacts c^{13} c^{12}, and wire e^{14} again into the same circuit with the winding y', and when the valve has reached its uppermost limit the throw d^4 of the cam shifts the contact-maker c^2 still farther to the right, thereby breaking the circuit at c^{13} c^{12} and stopping the further movement of the valve. Similarly as before, if now the operator wishes to stop the elevator at any point he restores the hand-lever b^2 to the position shown in Fig. 1, thereby moving the knife b^4 into engagement with the contacts b^{16} b^{17} and completing a reversing-circuit through the contact b^{16}, wire e^{20}, and parts c^{20} c^3 c^{23}, wires e^6 e^4, and field-winding y, and at once the reverse rotation of the cam D shifts the contact-maker c^2 back to its intermediate position by means of the throw d^4, and subsequently by means of the throw d^3 shifts it still farther to the left, breaking the circuit and stopping the valve in its closed or intermediate position, as shown in Fig. 4.

From the above description it will be seen that by a movement of the hand-lever to one side or the other the valve is caused to move up or down and is automatically stopped in closed position in going from open position and is automatically stopped in open position in going from closed position.

It will be noted that during the travel of the valve I maintain the circuit-breaker c' or c^2, as the case may be, in its intermediate or vertical position. This is an important feature of my invention. This is the preferred means which I employ for permitting the automatic stopping of the motor in whichever direction it is running and at the same time for putting the parts in operative circuit for being thereafter started in a reverse direction by the manual lever.

When, for example, the circuit-maker c' is in its intermediate position, it thereby completes the circuit through the contacts c^8 c^7 when the hand-lever is thrown to the left for moving the valve down, and it completes the circuit through the contacts c^9 c^{10} when the hand-lever is in its intermediate position for moving the valve up toward its stopping position, and it so remains until the valve reaches its lowermost position or its stopping position, as the case may be, whereupon in both instances the cam shifts the contact-maker c' so as to break the circuit at the end contacts, said cam shifting the contact-maker over to the left when the valve is at the bottom, and thereby leaving the parts in the proper circuit for subsequently starting the valve up, and said cam shifting the contact-maker over to the right when the valve is at the middle or stopping position. This leaves the parts in circuit for starting the valve back downwardly again; but as the valve is in its intermediate or stopping position (shown in Fig. 1) and may require to be moved either up or down I have so arranged the parts that when the contact-maker c' is left in circuit, just described, for starting the valve down the other contact-maker c^2 will then be in circuit for starting the valve up, it being understood that current is thrown into one circuit or the other, as desired, according to the direction in which the hand-lever b^2 is thrown.

Thus far I have explained how my apparatus operates to move the valve either upwardly or downwardly and stop it automatically at the limit of its movement and how it operates to move it from either one of these positions in the opposite direction and stop it automatically when it arrives at its intermediate position for stopping or cutting off the flow of water. If, however, the operator wishes to reverse the travel of the elevator without stopping the valve at its intermediate position, or, in other words, if he wishes to prevent the valve from being automatically stopped in the position shown in Fig. 4, he simply moves the hand-lever from one extreme position to the other. For example, if the valve is moving down and the knife b^3 is therefore in contact with the contacts b^{12} b^{13} and the operator wishes to reverse the movement of the valve and at the same time prevent its being automatically stopped when it arrives in stopping or intermediate position, he simply throws the hand-lever b^2 over past the center to the right, so as to bring the knife b^4 into contact with the contacts b^{18} b^{19}. When now the throw d' operates on the arm c^{26}, it acts to break contact at c^9 c^{10} the same as before; but in this case this does not serve to stop the valve, for the reason that although it breaks that circuit the same field-winding

y' and wire e^7 are included in circuit with the contact b^{19} through the wire e^{18}, contacts c^{13} c^4 c^{12}, wires e^{14} and e^9, which continues the rotation of the motor without stopping until the valve is manually stopped or until it reaches its extreme upward limit and is stopped automatically.

The valve can be stopped manually at any point whatever in its travel simply by moving the hand-lever so as to bring one or the other of the knives b^3 b^4, as the case may be, into an intermediate position. For example, if the valve is moving down the hand-lever is shifted from notch 5 to notch 4 or if the valve is going up the hand-lever is shifted from notch 1 to notch 2. The importance of this capability of my invention is that it permits the operator to control with the utmost nicety the speed of the elevator by enabling him to stop the valve at any point for the passage of any degree of flow of water desired.

I prefer the particular arrangement of car-controller shown, as it enables me to make contact, as just explained, by the knives b^3 with the contacts b^{14} b^{15} and also by the knife b^4 with the contacts b^{18} b^{19}, and also it introduces a desirable element of safety, because should either of these knives get stuck in its outermost position, so that its spring s would not cause it to follow the lever when the latter was shifted back to its middle position, the end b^7 of the lever would strike the projection b^5 of the knife and compel it to move back into proper position. Also if the operator should accidentally lose the lever b^2 the springs s would automatically shift it back to its middle position, thereby automatically shifting the circuits of the armature into position to stop the elevator by bringing the valve to its intermediate or stopping position.

While I have shown and described my invention as specifically applied to a hydraulic device, it will be understood that this valve-controlling mechanism may be employed for controlling the flow of any fluid.

I regard my invention as fundamentally new in a number of particulars, more definitely referred to in the following claims, and accordingly I wish it understood that I am not limited to the particular mechanism described, as I am aware that many variations therefrom may be resorted to within the spirit and scope of my invention.

Having described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. In an apparatus of the kind described, a valve, a port controlled thereby, and means for operating said valve, including electrical mechanism for moving said valve from one open position toward its opposite open position, automatic stopping mechanism for stopping said valve when it arrives at closed position, and manually-controlled means for permitting said automatic mechanism to stop the valve or not at the will of the operator.

2. In an apparatus of the kind described, a valve, a port controlled thereby, and means for operating said valve, including electrical mechanism for moving said valve, automatic electrical means for stopping said valve when it arrives at open position, and manually-controlled stopping mechanism for stopping the valve at any point in its travel.

3. In an apparatus of the kind described, a valve, a port controlled thereby, electrical mechanism for moving said valve, manually-controlled stopping mechanism for stopping the valve at any point in its travel, and automatic electrical means for stopping said valve when it arrives at closed position.

4. In an apparatus of the kind described, a valve, a port controlled thereby, and means for operating said valve, comprising a plurality of electrical circuits for moving the valve, a circuit-changing device, means for starting the valve with said circuit-changing device in one of said circuits, and automatic means for shifting said device therefrom to another circuit for continuing the movement of the valve when started, and automatic means for breaking said second circuit when the valve has reached a predetermined point of movement.

5. In an apparatus of the kind described, a valve, a port controlled thereby, and means for operating said valve, comprising a circuit-changing device, means for starting the valve with said circuit-changing device in one of said circuits, and automatic means for shifting said device therefrom to another circuit for continuing the movement of the valve when started, automatic means for shifting said circuit-changer from said second circuit when the valve has reached a limit of travel, and shifting it into a circuit for subsequently starting the valve in an opposite direction.

6. In an apparatus of the kind described, a valve, a port controlled thereby, and means for operating said valve, comprising an opening-circuit, a closing-circuit, auxiliary circuits for each of said circuits, a circuit-changer, means for starting the valve with said circuit-changer in one of said first-mentioned circuits, automatic means for shifting said changer into circuit with the adjacent auxiliary circuit for continuing the movement of the valve when started, and automatic means for shifting said changer out of said circuit and into the other of said first-mentioned circuits when the valve has reached its open position or closed position, as the case may be.

7. In an apparatus of the kind described, a valve, a port controlled thereby, and means for operating said valve, comprising electrical circuits and apparatus for moving the valve in opposite directions, and automatic mechanism for placing said circuits and apparatus in position for starting the valve in either direction when between its end or open positions.

8. In an apparatus of the kind described, a valve, a port controlled thereby, and means

for operating said valve, comprising electrical circuits and apparatus for moving the valve in opposite directions, and automatic mechanism for placing said circuits and apparatus in position for starting the valve toward its closed position when in an open position.

9. In an apparatus of the kind described, a valve, a port controlled thereby, and means for operating said valve, comprising electrical circuits and apparatus for moving the valve in opposite directions, automatic mechanism for placing said circuits and apparatus in position for starting the valve toward its closed position when in an open position, and means for stopping the valve at any point in its travel.

10. In an apparatus of the kind described, a valve, a port controlled thereby, and means for operating said valve, comprising electrical circuits and apparatus for moving the valve in opposite directions, means for stopping and starting the valve at any point in its travel, and automatic mechanism for placing said circuits and apparatus in position for starting the valve in either direction required.

11. In an apparatus of the kind described, a manual controller, an automatic controller, a motor operated in connection therewith, a plurality of circuits therefor, movement of said manual controller to one position completing a circuit through said automatic controller for starting said motor in one direction, said automatic controller then shifting from said circuit to an adjacent circuit for continuing without break the operation of the motor, said automatic controller being provided with coöperating parts and circuits placing it, when thus shifted, also in position for reversing the current in said motor upon the shifting of the manual lever therefor.

12. In an apparatus of the kind described, a manual controller, an automatic controller, a motor operated in connection therewith, said automatic controller comprising two independent contact-makers, a plurality of circuits for coöperating with each contact-maker and with the motor and manual controller, each contact-maker having two main positions in which it can complete circuits respectively for running the motor in opposite directions, and each contact-maker having a third position in which it can complete a circuit for running the motor in either direction.

13. In an apparatus of the kind described, a manual controller, an automatic controller, a motor operated in connection therewith, said automatic controller comprising two independent contact-makers, a plurality of circuits for coöperating with each contact-maker and with the motor and manual controller, each contact-maker having two main positions in which it can complete circuits for running the motor in opposite directions, and each contact-maker having a third position to which it can be shifted from either of its main positions without interrupting the current, and from which it can be shifted to either of its main positions for breaking the circuit.

14. In an apparatus of the kind described, a manual controller, an automatic controller, a motor operated in connection therewith, said automatic controller comprising two independent contact-makers, a plurality of circuits for coöperating with each contact-maker and with the motor and manual controller, said automatic controller having means for automatically shifting said contact-makers at predetermined points in the operation of said motor for controlling the rotation and the direction of rotation of said motor, according to the position of said manual controller.

15. In an apparatus of the kind described, a motor, an automatic controller therefor, a manual controller and circuits for said parts, said automatic controller including a centrally-pivoted circuit-maker, two pairs of contacts therefor, operating respectively through said circuit-maker to complete circuits for running said motor in opposite directions, and other contacts, respectively in position to be simultaneously included by said circuit-maker in said two circuits, the shifting of said manual controller closing one or the other of said circuits, as desired.

16. In an apparatus of the kind described, a motor, an automatic controller therefor, a manual controller, and circuits for said parts, said automatic controller including two centrally-pivoted circuit-makers, each having two pairs of contacts therefor, operating respectively through said circuit-makers to complete circuits for running said motor in opposite directions, and other contacts, respectively in position to be simultaneously included by the adjacent circuit-maker in said two circuits thereof, the closing of said several circuits depending upon the position of the manual controller.

17. In an apparatus of the kind described, a motor, an automatic controller therefor, a manual controller, and circuits for said parts, said automatic controller including two centrally-pivoted circuit-makers, each having two pairs of contacts therefor, operating respectively through said circuit-makers to complete circuits for running said motor in opposite directions, and other contacts, respectively in position to be simultaneously included by the adjacent circuit-maker in said two circuits thereof, the closing of said several circuits depending upon the position of the manual controller, said automatic controller having means for automatically placing said two circuit-makers simultaneously in circuits thereof for running the motor in opposite directions.

18. In an apparatus of the kind described, a manual controller, an automatic controller, a motor operated in connection therewith, said automatic controller comprising two independent contact-makers, a plurality of circuits for coöperating with each contact-maker

and with the motor and manual controller, said manual controller having two knives or contact-making devices, one for the circuits of each of said automatic contact-makers, and an operating-handle for said two knives provided with means for independently moving said knives to the various positions required for their respective circuits.

19. In an apparatus of the kind described, a manual controller, an automatic controller, a motor operated in connection therewith, said automatic controller comprising two independent contact-makers, a plurality of circuits for coöperating with each contact-maker and with the motor and manual controller, said manual controller comprising an operating-handle and two independently-movable knives, one thereof being always held yieldingly in contact with said handle for permitting one knife to remain in circuit-closing position while the handle is shifting the other knife.

20. In an apparatus of the kind described, a manual controller, an automatic controller, a motor operated in connection therewith, said automatic controller comprising two independent contact-makers, a plurality of circuits for coöperating with each contact-maker and with the motor and manual controller, said manual controller comprising an operating-handle and two independently-movable knives, one thereof being always held yieldingly in contact with said handle for permitting one knife to remain in circuit-closing position while the handle is shifting the other knife, said handle having a safety device for compelling each knife to move with it from one position of said knife to another.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

JOSEPH W. MOORE.

Witnesses:
GEO. H. MAXWELL,
WILHELMINA C. HENSER.