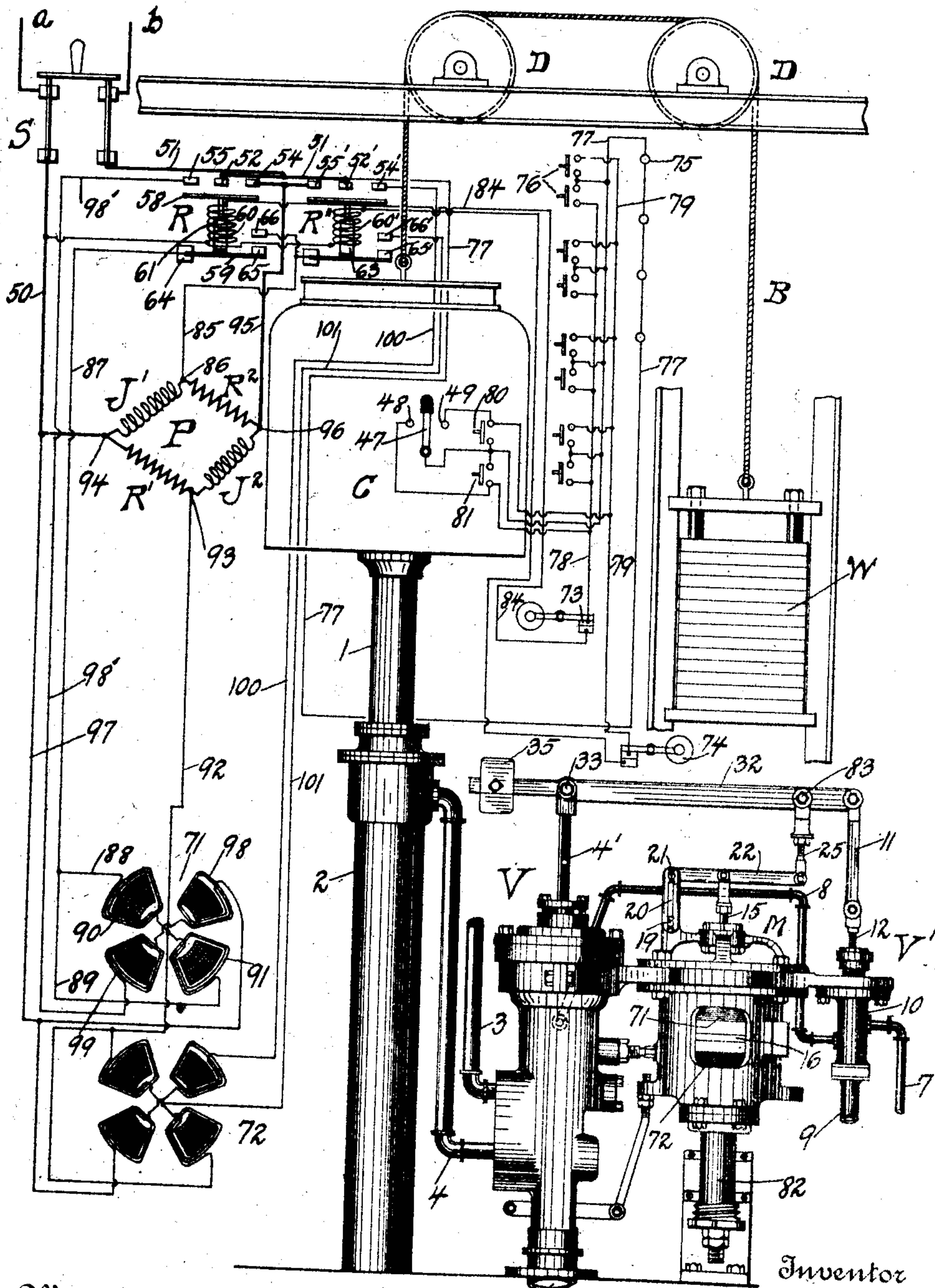


D. L. LINDQUIST.
 ALTERNATING CURRENT CONTROLLING APPARATUS FOR HYDRAULIC ELEVATORS.
 APPLICATION FILED JUNE 1, 1907.

976,130.

Patented Nov. 15, 1910.



Witnesses:
 James G. Bethell.
 Ernest L. Gale, Jr.

Inventor
 David L. Lindquist
 By C. M. Nieren Attorney

UNITED STATES PATENT OFFICE.

DAVID L. LINDQUIST, OF YONKERS, NEW YORK, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

ALTERNATING-CURRENT CONTROLLING APPARATUS FOR HYDRAULIC ELEVATORS.

976,130.

Specification of Letters Patent.

Patented Nov. 15, 1910.

Application filed June 1, 1907. Serial No. 376,863.

To all whom it may concern:

Be it known that I, DAVID L. LINDQUIST, a subject of the King of Sweden, residing at Yonkers, in the county of Westchester and State of New York, have invented a new and useful Improvement in Alternating-Current Controlling Apparatus for Hydraulic Elevators, of which the following is a specification.

My invention relates to alternating current-controlling means for hydraulic elevator apparatus, and is particularly adapted to control the operation of valve mechanism of plunger elevators of the direct-acting type.

One of the objects of my invention is to provide simple and efficient means for controlling a hydraulic elevator by means of alternating current.

Another object of my invention is the adaptation of single phase current to the control of valve mechanism of hydraulic elevators particularly of the plunger type.

A further object of the invention is the provision of an automatic push-button alternating current controlling system for a hydraulic elevator.

Other objects of the invention will appear hereinafter, the novel combinations of elements being pointed out in the claims.

The accompanying drawing illustrates an application of my invention, and includes the circuits and connections of an automatic push-button system to change single alternating current to multiphase current to more efficiently operate electro-magnets of valve mechanism to in turn control a plunger elevator of the direct-acting type.

Obviously, those skilled in the art may make various changes in the details and arrangement of parts without departing from the spirit and scope of my invention and I desire therefore not to be limited to the precise construction herein disclosed.

In the accompanying drawing the car C is supported on the upper end of the plunger 1 which moves up and down in the hydraulic cylinder 2. A counterweight W is connected to the top of the car C by the cable or rope B which passes over the sheaves D mounted on an overhead fixed beam. The weight W may be proportioned with respect to the car plunger and live load as desired, but permitting the car to always descend by reason

of unbalanced load, the buoyancy of the plunger being preferably compensated for by the counterweight cables.

V designates a differential main or motor valve and V' a pilot valve, for controlling the admission to and exhaust from the cylinder 2 of the motor fluid.

The parts thus far described are of well known construction, it being understood that main valve apparatus of any construction may be used if desired, but I prefer to use the particular arrangement of valve apparatus, as shown, controlled by an alternating current magnet M, this, however, being the invention of Frederick W. Newell, and embodied in his application for patent Ser. No. 365,968, filed April 2, 1907, alternating current electro-magnetic valve apparatus.

The valve apparatus considered as a whole consists essentially of the main valve device V, the pilot valve device V', the alternating current magnet M and intermediate connections. The magnet is in reality double in that it comprises two windings 71, 72, with an intermediate armature 16 suitably centered normally as for instance by a spring in the tube 82. This armature 16 is connected by the rod 15 to the lever 22 which is pivoted at 21 to the link 20, this link being in turn pivoted to the supporting frame of the entire valve apparatus. The lever 22 is connected by the link 23 to the lever 32 which is fulcrumed at 33 to the main valve stem 4' and is connected at one end to the link 11 and carries a balancing weight 35 at its other end. The link 11 connects the lever 32 to the pilot valve stem 12. Now when the winding 71 receives current to effect the upward movement of the lever 32 on its fulcrum 33 the pilot valve is moved upwardly in its cylinder 10 and the fluid in the motor of the main valve device is permitted to flow through the pipe 8 to the exhaust port 9 of the pilot valve device V'. The main valve will then be moved upwardly and the motor fluid permitted to pass from the elevator cylinder through the pipe 4 to the exhaust port 5. The car will then descend. When the main valve is thus moved upwardly the lever 32 is moved on the fulcrum 33 to recenter the pilot valve.

Upon the deenergization of the magnet the armature 16 centers itself and this causes

the lever 32 to be moved downwardly on 33 as a fulcrum and the pilot valve is opened to the supply port 7. This causes the closing of the main valve and the recentering of the pilot valve. The car will therefore stop.

Assuming that the parts are again in normal position, as shown, and that the car is stationary, let the lower solenoid 72 receive current. Then the pilot valve will be moved downwardly to permit the supply fluid to pass from the supply pipe 7, through the connecting pipe 8, to the motor of the main valve device and the main valve will thereupon permit the supply fluid to pass from the supply pipe 3 to the cylinder 2 to lift the car. When the main valve is fully open the pilot valve has again recentered itself and when the magnet is deenergized the pilot opens to the exhaust port 9 to cause the main valve to close and stop the car.

The system of circuits and connections for controlling the electro-magnet will now be described. A main line switch S serves to connect the conductors a and b leading from a source of single-phase alternating current supply, to the conductors 50 and 51, respectively.

R and R'' designate single-phase electro-magnetic reversing switches. Inasmuch as these are similar only one will be described. Arranged in the solenoid 60 is the loose core or plunger 61 which carries on its upper end a bridge member 58 for electrically connecting the contacts 55, 52, and 54 when lifted into engagement therewith. Normally the core or plunger 61 rests on a conducting leaf spring 59 secured to the fixed block 64 and carrying the contact 65. When the solenoid 60 receives sufficient current to lift its core the spring 59 will be released and will automatically move the contact 65 into engagement with the contact 66. It will therefore be seen that after the solenoid lifts its core the contacts 65 and 66 will be held in engagement with each other independently of the solenoid; this feature is embodied in my copending application Ser. No. 353,205, filed January 21, 1907, controlling devices for alternating current motors.

In order to change the single phase current from the mains into multiphase current suitable for operating the electro-magnet I employ a phase-splitting device preferably like that embodied in my copending application Ser. No. 357,044, filed February 12, 1907, alternating current controlling means. Generally, it comprises two resistance elements R' , R'' , and two inductance elements J' , J'' connected in bridge form and so arranged with respect to the other circuits as to perform its function.

In the car C are up and down push-buttons 80 and 81, and a simple electric switch

47 which may be used in place of said push buttons.

76 are the floor push-buttons, 75 the door contacts and 73, 74 the limit switches.

If the push-button switch 81 or one of the lower push-button switches 76, is operated, or if the car switch lever 47 is moved into engagement with the contact 48 a circuit will be closed from the main a through the solenoid 61 and thence by conductor 84 to and through limit switch 73, conductor 78, the switch operated, conductor 77, door contacts 75, conductor 51 and finally to the other main b through the switch S. The switch R will therefore be operated to effect the electrical connection of the contacts 55, 52 and 54 and the engagement of the contacts 65 and 66 with each other. Contact 66 is in permanent connection with phase-splitting device P at the point 86 between the inductance J' and resistance R'' by means of the conductor 85; and when the switch R is operated the point 86 is connected by conductors 87, 88 and 89, to the individual coils 90, 91 and thence by the conductor 92 to the point 93 between the resistance R' and inductance J'' . Substantially at the same time the bridging member 58 in engagement with the contact 52 connects the point 96 through the conductors 95 and 51 to the main b . The opposite point 94 is connected by the conductor 50 through the switch S to the main a . As to the points 94 and 96, therefore, the phase-splitting device is connected directly across the mains a and b . It will also be observed that the main a is connected by the conductor 97 to the individual coil 98 and that the main b is connected through conductor 51, contact 52, bridge member 58, contact 55 and conductor 98' to the individual coil 99. The coils 98 and 99 being in series with each other will therefore be connected across the mains a and b while the other coils 90 and 91 will be connected to the phase-splitting device.

The switch R when closed affects only the winding 71 of the electro-magnet, one set of coils of the other 72 being open-circuited at contact 54' connected to the conductor 100 and the other being open-circuited at contact 66' connected to the conductor 101. When the switch R'' is closed by the manipulation of the up push-button 80 in the car or an up push-button at one of the landings, then the circuits of the windings 72 will be closed and as before explained when the winding 71 receives current to lift the armature 16 the main valve will be opened to exhaust to permit the car to descend, whereas when the winding 72 receives current the main valve will be opened to supply to cause the car to ascend.

In the system shown the manual switch operated must be kept in closed position while the car is moving and when the switch

is opened the car will stop. For the sake of simplicity and by way of illustration merely I have shown one of the least complicated arrangements of push-button circuits but any other automatic push-button system of control may be used if desired.

It should be noted that by the employment of a multiphase magnet, the valves may be operated very quickly to secure a quick starting of the elevator car; and furthermore, where only single-phase current is available the valves may still be effectively operated in an electric elevator control system by the interposition of a phase-splitting device to change single-phase current to multi-phase current for operating the valve magnet.

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

1. The combination with a hydraulic elevator and valve apparatus to control the flow of motor fluid thereto and therefrom, of a double multiphase alternating current electromagnet having two sets of windings for actuating said valve apparatus, a phase-splitting device to change single-phase to multiphase current, and a system of circuits and switches to select one of said two sets of windings of the multiphase magnet for receiving multiphase current to effect the operation of the valve apparatus.

2. The combination with an elevator car, hydraulic moving apparatus, and controlling mechanism, of a multiphase electromagnet having two sets of windings, an armature normally intermediate said sets of windings, connections between said armature and said controlling mechanism, a phase-splitting device intermediate a source of single-phase alternating current supply and said electromagnet, and a selective system of circuits and connections to predetermine the direction of movement of said armature.

3. The combination with a plunger elevator comprising a car, plunger, hydraulic cylinder and controlling valve apparatus, of an electromagnet having two sets of polyphase windings, an armature connected to said valve apparatus, and an automatic switch system of circuits and connections to effect the flow of electric current through said windings and the operation of the arma-

ture and valve apparatus to cause the car to move up or down.

4. The combination with a plunger elevator comprising a car, plunger, hydraulic cylinder and controlling valve apparatus, of a doubly wound electromagnet, an armature for said electromagnet and connected to said valve apparatus, and an automatic push-button system of circuits and connections to effect the energization of said electromagnet to move the armature in a predetermined direction to operate the valve apparatus.

5. The combination with an elevator car, a plunger connected thereto, a hydraulic cylinder for said plunger, and valve apparatus for controlling the flow of motor fluid to or from said cylinder, of an electro-responsive device having two sets of polyphase windings and an armature connected to said valve apparatus, a phase-splitting device between conductors from a source of single phase alternating current supply and said sets of windings, reversing switches, and up and down electric switches at the landings and in the car connected to said reversing switches to effect the variation of the latter to complete circuits through a corresponding set of said windings, and a magnet for the valve apparatus.

6. The combination with an elevator car, plunger, cylinder, and controlling valve apparatus, of an electromagnet, an armature connected to said controlling apparatus and movable in two directions by said electromagnet to effect the opening or closing of the valves, a phase-splitting device for changing single phase current from the source of electric current to multiphase current for said electromagnet, and a push-button system of circuits and connections for effecting the energization of said electromagnet and predetermining the direction of movement of said armature and the corresponding up or down movement of the car.

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

DAVID L. LINDQUIST.

Witnesses:

CHAS. M. NISSEN,
ALFRED C. BECHET.