F. C. FURLOW.

PUSH BUTTON CONTROLLED PLUNGER ELEVATOR SYSTEM.

APPLICATION FILED APR. 25, 1906.

907,985.

Patented Dec. 29, 1908.

3 SHEETS—SHEET 1.

Fig. 6.

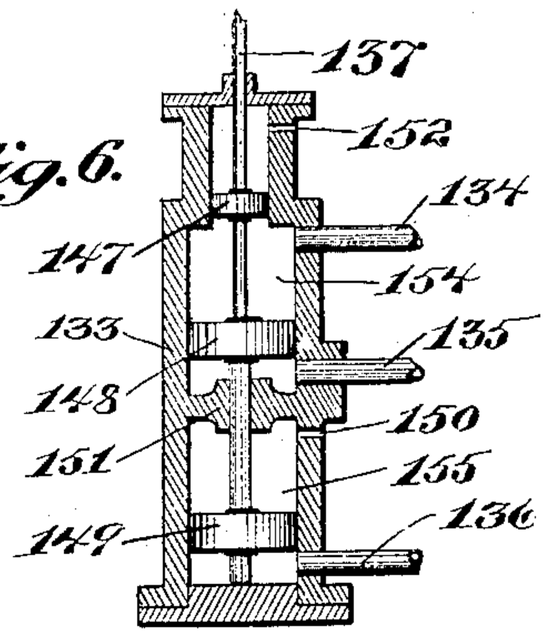

Fig. 7.

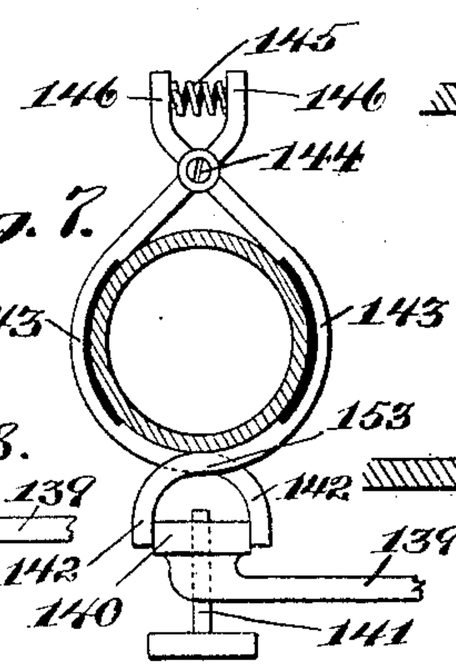

Fig. 8.

Fig. 1.

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3 SHEETS—SHEET 2.

Fig. 2.

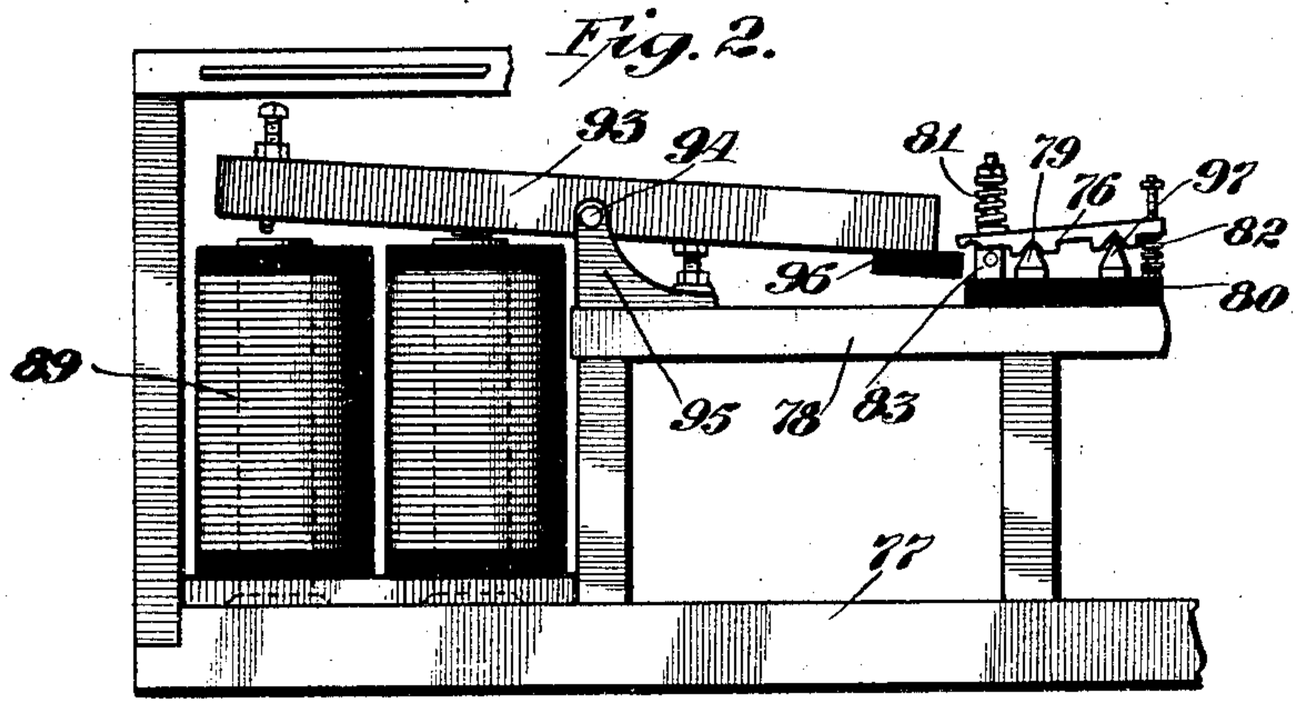


Fig. 3.

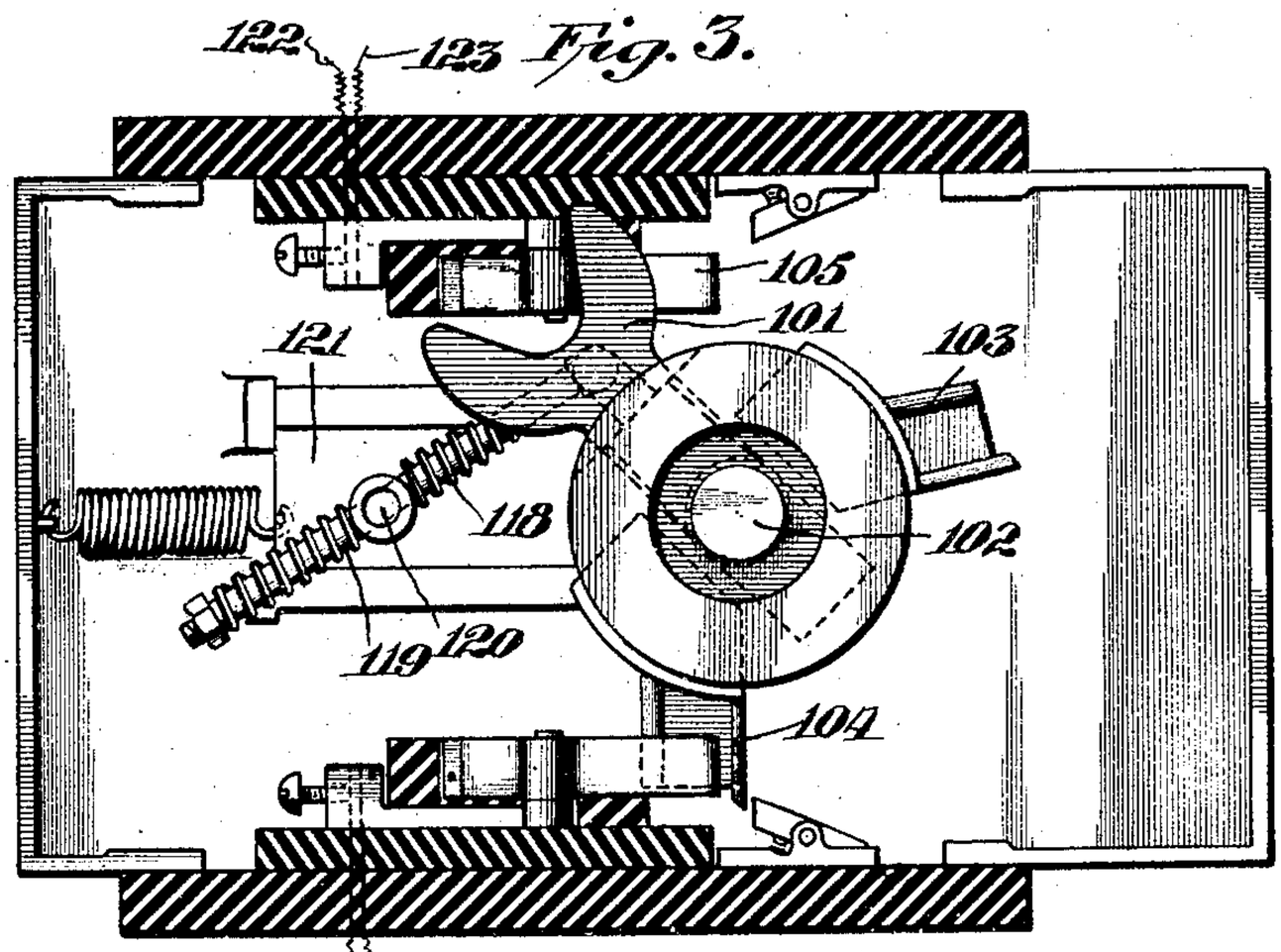
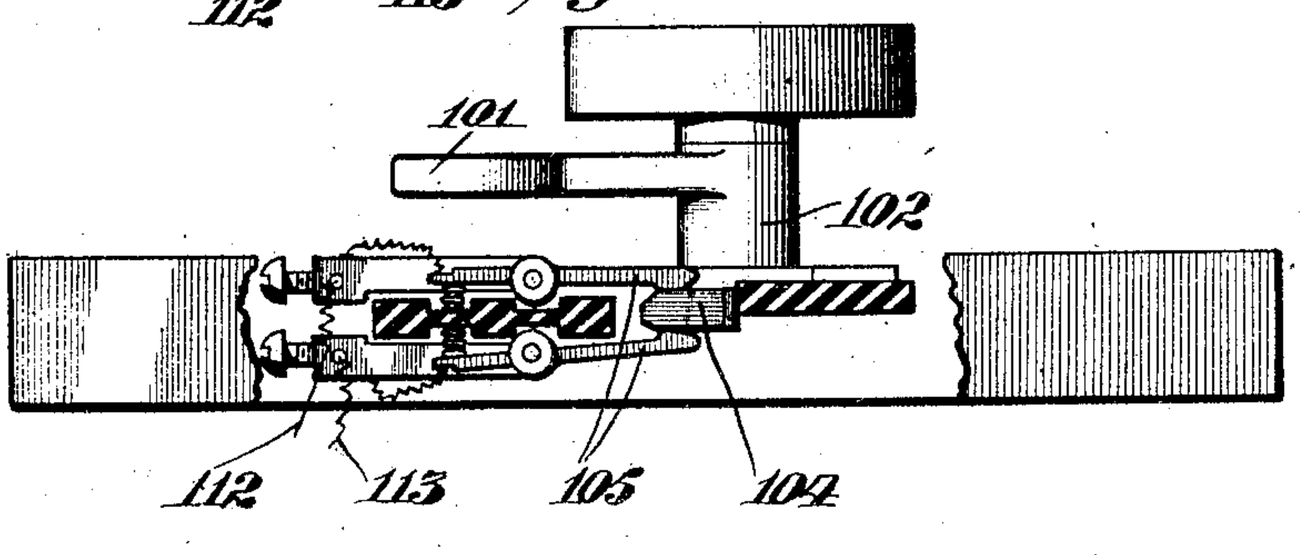


Fig. 4.



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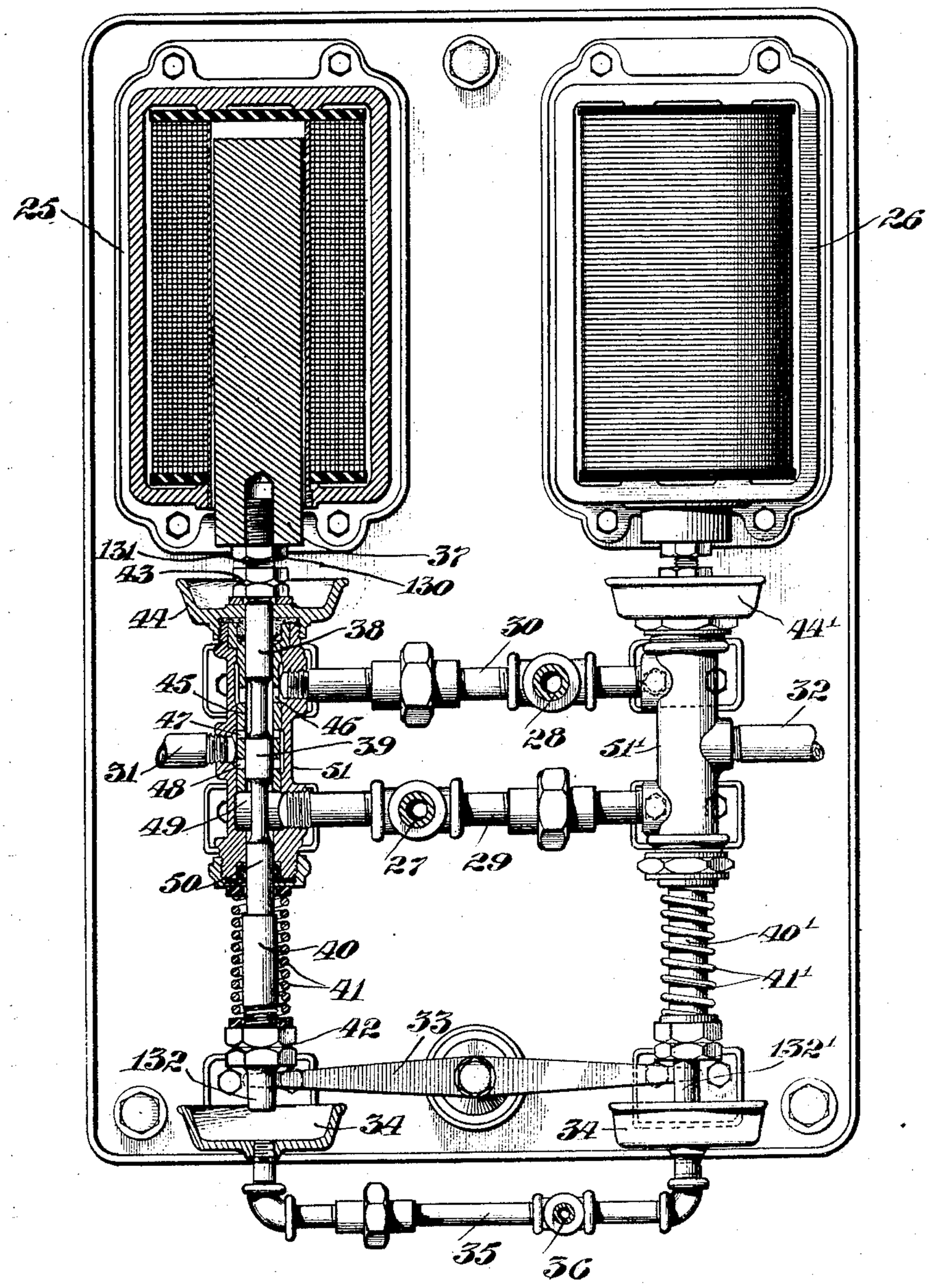
3 SHEETS—SHEET 3.

Fig. 5.



Attest:

Walter C. Strang

by

Inventor:

Floyd C. Furlow

C. M. Nissen

Atty

UNITED STATES PATENT OFFICE.

FLOYD C. FURLOW, OF MONTCLAIR, NEW JERSEY, ASSIGNOR TO OTIS ELEVATOR COMPANY, OF JERSEY CITY, NEW JERSEY, A CORPORATION OF NEW JERSEY.

PUSH-BUTTON-CONTROLLED PLUNGER-ELEVATOR SYSTEM.

No. 907,985. Specification of Letters Patent. Patented Dec. 29, 1908.

Application filed April 25, 1906. Serial No. 313,540.

To all whom it may concern:

Be it known that I, FLOYD C. FURLOW, a citizen of the United States, residing at Montclair, in the county of Essex and State of New Jersey, have invented a new and useful Improvement in Push-Button-Controlled Plunger-Elevator Systems, of which the following is a specification.

My invention relates to hydraulic elevators, and one of its objects is the provision of an improved automatic push-button electric system of control for hydraulic elevators.

A further object of the present invention is the provision of brake apparatus associated directly with a plunger and operated by a hydraulic motor independently of the controlling valve apparatus.

More particularly it is one of the objects of this invention to provide in combination with a push-button controlled plunger elevator system, brake apparatus associated directly with the plunger and operated by a hydraulic motor independently of the operation of the change-valve apparatus.

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

In the accompanying drawings, Figure 1 represents more or less diagrammatically a plunger elevator system and brake apparatus for the plunger; Fig. 2 is an elevational view of one of the floor relays; Fig. 3 represents a sectional view of an intermediate limit switch; Fig. 4 represents a plan view of Fig. 3 with a portion broken away to show the operation of the electric switch; Fig. 5 represents an elevational view, partly in section, of the electro-magnetic valve controlling apparatus; Fig. 6 shows valve mechanism for the brake; and Figs. 7 and 8 are detail views of the brake apparatus.

Referring to Fig. 1, C designates an elevator car which is attached to and supported by the plunger P, the latter being adapted to move up and down in the cylinder 1 in the well known manner. To the top of the car C is secured the counterweight rope 2, which passes upwardly over the sheave S to the counterweight W in the usual manner.

V designates an automatic limit stop-valve which is automatically operated at the upper and lower limits of travel of the car by the latter striking against the stop buttons or balls B, and moving the rope R in one direction or the other. The rope R is passed one or more times around the sheave 4, so that when said rope is moved, the sheave 4 will be turned to operate said gear mechanism connected to the pinion 7, which in turn actuates the rack 8 to move the valve 68 in the proper direction to effect a cutting off of the supply or exhaust and thus stop the car. A rope 5 is connected to the sheave 4 at one end, and to its other end is connected a weight 6 so that when the car is moved away from its limit of travel the automatic valve V will be restored to its normal position as shown in Fig. 1.

The apparatus thus far referred to is of well known construction and is here set forth merely by way of illustration, and any other mechanism than that illustrated may be used if desired. That is, I do not desire to be limited to any particular type of hydraulic elevator as my invention is adapted to any hydraulic elevators in which motor fluid in the form of liquid or gas must be controlled.

9 and 10 designate respectively, the supply controlling valve and the exhaust controlling valve, the operation of each of which is controlled by the electro-magnetic valve apparatus 11 shown in enlarged view in Fig. 5. The valves 9 and 10 comprise differential pistons and are normally held by pressure from constant supply pipes 56 and 56′ in the positions shown in Fig. 1. In addition to these valves there is also the automatic stop valve V which is connected to the cylinder head H by means of the pipe 3. The valves 9 and 10 are connected to the upper and lower portions of the stop valve V. The function of the stop valve V is to automatically shut off the flow of water to and from the cylinder 1 when the car approaches either terminal, and it is controlled directly and automatically by the movement of the car in the hatchway, thus making a positive stop in case of derangement of the electrical apparatus.

The main controlling valves 9 and 10 are both normally closed thus cutting off the ingress of water to, or the egress of water from the elevator cylinder 1. When either of the fields of the solenoids controlling the auxiliary or pilot valves 51 or 51′ are excited, the core of the solenoid is lifted with the result that the two-way valve 9 or 10 connected thereto, is opened to permit the passage of water to or from the cylinder, depending

upon whether the car is to go up or to go down. The operating valve remains open and the car continues in motion until the circuit carrying the current to the solenoids is broken by means of one of the floor switches 13, 14, or 15. These switches are used for shifting the current to either the up or down pilot valve, and also for breaking the circuit controlling the electrical apparatus used in connection with the floor at which the switch is located.

The floor switches each comprise a forked arm 101, which is mounted on a pivot 102 in the hatchway. In Fig. 3 is shown an intermediate limit switch which comprises two blades 103 and 104, one of which is always in engagement with the spring clips 105 as more clearly shown in Fig. 4. Preferably some arrangement is made for holding one of the blades in circuit-closing position, as, for example, a spring 118, mounted on a rod 119, which is pivoted at 120 to a spring-operated slide 121. Any other suitable device may be used, however, for holding the blade 103 or 104 in its circuit-closing position.

As will be seen in Fig. 4, the arms 105 are spring pressed and mounted so as to be insulated from each other, and have connected to their inner ends the wires 112 and 113, or the wires 122 and 123, as shown in Fig. 3. Secured to the car C is cam 16 which carries a laterally projecting pin 100. This pin is adapted to engage the fork or butterfly 101 of the intermediate switch, as that designated 14, and thus reverse the contact blades. This pin 100 may also be depended upon for operating the top and bottom floor switches 13 and 15, but I may operate the latter by means of the cam 16 striking against an arm carrying a roller at its outer end and being fixed to the shaft which carries the switch blade at its other end. When the switches 13 and 15 are thus operated, their knives are pulled out of contact with the clips thereby breaking the circuit. When this occurs the core of the solenoid and stem of the auxiliary valve return to their normal position by gravity, causing the two-way valve to immediately close and effect a stopping of the car.

The current used for controlling the electro-magnetic apparatus may be taken from the electric light wires in a building with resistance, as for example, a suitable number of lamps inserted to reduce the potential. Obviously, any other source of electric current may be used if desired, as for example, electric batteries, or a dynamo, or an alternating current generator.

Referring now to the wiring for controlling the pilot valve mechanism 11 and the trip switches 12, it will be explained how the push buttons when operated, are automatically thrown out or short circuited as soon as one of the trip switches 12 has been actuated. It will then be seen that as soon as a push button at a landing, or one of the push bottons in the car, has been operated, the operator is given exclusive control of the car, and it will go to the landing to which it has been sent or called unless the safety switch 24 in the car is operated, in which case the car would be immediately stopped.

It should be noted that an up or "call" push button is provided at each floor, and that in addition thereto, there is also a down or return button at each floor. These sets of push buttons are designated 17, 18, and 19 in Fig. 1. The up or "call" button brings the car to the floor where operated, while the down or return button, which is wired in parallel with the basement "call" button 19, enables a person, after using the elevator, to return it to the first floor if desired. The car is also provided with a set of push buttons numbered to correspond with the several floors, each button being wired in parallel with the corresponding floor "call" button. On each door leading into the elevator shaft is a door switch as indicated at 20, 21, and 22. These switches are all in the same circuit, and in this circuit, which also passes through the car, is a stop button or safety switch 24, which enables the passenger to break the circuit at will, thus stopping the car at any desired position in the elevator well or hatchway, or at any time.

The operation of the construction thus far described will be understood from the following explanation: Assuming that the car is at an intermediate floor and that the push button 71 at the top floor be operated so as to close the circuit from the + main through one blade of the main line switch 72 and thence by way of wire 73, door contacts 22, 21, and 20, wire 74, safety switch 24 in the car, wire 75 to the trip switches 12. These trip switches are in such a position normally, that the circuit will continue through the stationary contact strips 83 and connecting wires 84, to the wire 85, and thence the circuit continues to wire 86, push button 71, wire 87, wire 88, electro-magnet 89, wire 90, switch 13, which at this time is in a closed position, wire 91, solenoid 25, wire 92, and finally through the other blade of the main line switch 72 to the — main. It will be noticed that this circuit passes through both the lowermost electro-magnet 89 and the electro-magnet 25.

One of the trip switches is shown in elevation in Fig. 2, and comprises a support 77 on which are mounted the electro-magnet 89 and the table 78. The latter carries a bracket 95 on which is pivoted at 94 an armature 93, the outer end of which carries a piece of insulation 96. On the right-hand end of the table 78 as viewed in Fig. 2, is secured a block of insulation 80 which carries

contacts 83, 79, and 97, and also supports a spring 82 which acts on one end of the circuit-closing bar 76. With the other end of this bar is associated a spring 81 which acts to move the inner end of the bar 76 so as to electrically connect the contacts 83 and 79. The spring 82 at this time acts upwardly at the other end of the bar 76 to move the same out of engagement with the contact 97. The electrical connections of the wiring with these contacts will be clear from an inspection of Fig. 1.

When the electro-magnet 89 is energized and the armature 93 is actuated, the block of insulation 96 is moved upwardly and strikes against the inner end of the circuit-closing bar 76, and disengages the same from the contact 79. This operation, however, effects the engagement of the bar 76 with the contact 97, but the contact 83 is still in electrical connection with said bar 76. All of the push buttons 17, 18, and 19 at the landings, and the push buttons 23 in the car will be short-circuited so that even if they were operated after the car has been started in motion, they could have no effect whatever until after the car had reached the floor to which it has been sent or called and the relay shown in Fig. 2, automatically restored to its normal position, as shown in said figure. The holding circuit of the electro-magnets 89 and 25 excluding the push buttons, may be traced from the + main to and through the wire 73, door contacts 22, 21, and 20, wire 74, safety button 24 in the car, wire 75, contact 83, bar 76, contact 97, wire 98, wire 99, lowermost magnet 89, wire 90, switch 13, wire 91, magnet 25, and wire 92 to the — main.

It will be noticed that a separate relay is used for each floor, that is, if there are three floors as shown, there should be three relays. A separate magnet is of course used for each switch, the coils of each of such magnets taking their current from the same trip switch that the magnet governs, and are connected with the floor button so that the circuit through any magnet may be closed by operating the corresponding floor push-button connected with the same. The current then passes on through the corresponding floor to one of the solenoids operating the auxiliary or pilot valves, and thence to the return wire as traced above.

Referring now to Fig. 5, it will be seen that when the core 37 of the magnet 25 is lifted, the pistons 38, 39, and 50 are lifted at the same time against the action of the spring 41 which is placed between the lower end of the auxiliary pilot valve casing 51 and the adjusting nuts 42. The valve 39 may be adjusted upwardly or downwardly by means of the nuts 43, and the core 37 may be moved upwardly or downwardly by loosening the nut 130 and turning the stem 131 the required amount. The auxiliary valve casing 51 and 51′ are exactly alike so that the section of only one of them is shown. A pivoted lever 33 whose ends pass through slots in the lowermost portions of the valve stems 131 and 131′ positively prevent both of the auxiliary valves from being operated at the same time. For instance, if it should happen by reason of a derangement of the wiring, that both of the magnets 25 and 26 should be operated at the same time, both of the pilot valves would be open and the motor fluid would simply pass from the supply valve 9 to the exhaust valve 10 without doing any work and thus be a total loss. The locking lever 33 however, prevents both pilot valves from being operated at the same time, and therefore the car can be operated upwardly or downwardly as desired and with certainty. Such inter-connecting means for preventing the operation of both pilot valves at the same time may be varied as desired, the locking lever being here shown merely by way of illustration. So also drip cups 34 connected together by pipe 36 and to an exhaust pipe 36, may also be added if desired, or any changes in the details and arrangement of parts may be made by those skilled in the art without departing from the principles of my invention.

Assuming again that the electro-magnet 25 has been energized, and the core 37 together with the parts connected thereto lifted, the valve 39 will be moved to such a position as to close connection between the pipe 31 and the exhaust port 28, and establish communication between the supply port 27 through the pipe 29, chamber 49, and openings 48 with the pipe 31. The motor fluid can now pass through the pipe 31 to the chamber 54 and act on the piston 55 to move it downwardly against the action of the motor fluid in the chamber 57 connected with the constant pressure supply pipe 56. It will be noticed that the pistons 55 and 58 are of different dimensions, the latter being smaller, and both being secured to the valve stem 59 which carries at its lower portion the piston valve 60 and the piston 61. The latter is adapted to move in the chamber 63 and is retarded in its upward direction by the check valve 62 so that the valve 60 will close slowly but may be moved in the opposite direction to open said valve quickly. This has the effect of letting the supply pressure from the pipe 52 into the plunger cylinder 1 quickly and thus obtaining a quick start of the elevator car. In order however, to prevent the car from stopping too suddenly, the valve 60 should be closed slowly and this may be accomplished by restricting the flow of air into the chamber 63 through the check valve 62 in any well known manner. The electro-magnet 25 having been operated to allow the pressure supply from

the pipe 27 to effect the downward movement of the piston 55 by its differential action, the valve 60 will be moved downwardly quickly and the main supply fluid flow from the pipe 52 past the valve 60, and thence through the pipe 64, port 65, chamber 70, and connecting pipe 3, to the plunger cylinder 1, or to the piston cylinder in case a hydraulic elevator system is employed, in which case the car is suspended.

The valve 9 having been opened and the supply pressure communicated to the plunger P, the car will be moved upwardly until it arrives at its designated intermediate landing, when the pin 100 will operate the switch 14 to effect a deënergization of the magnet 25 and the consequent closure of the pilot valve 51. The supply pressure from the pipe 56 will now effect a return of the valve 60 to a closed position slowly and the fluid in the chamber 54 will be exhausted through pipe 31, openings 47, (in Fig. 5) chamber 45, openings 46, pipe 30, to the exhaust port 28, the piston 60 being retarded by an adjustable opening in the check valve 62, as heretofore explained.

If the car should go to its uppermost landing it would operate the switch 13 and thus stop the car in the same manner, and if the car should go beyond this point for any reason whatever, the stop ball B would be struck and the drum or sheave 4 turned by means of the rope R to move the valve 68 upwardly and close communication between the valve 9 and the pipe 3. It will be noticed that the stop valve V comprises balanced pistons 67, 68, and 69, so that the fluid pressure acting thereon will have no tendency to move the same. Inasmuch as the communication between the supply pipe 52 and pipe 3, to the cylinder 1 is thus closed by the stop valve, and the valve 10 is closed, the elevator car will come to a positive stop at its uppermost limit of travel. The path of the current for the floor switch 13, 14, or 15, to the up or down auxiliary pilot valve magnets 25 or 26, depends entirely upon which line the contact blades of the intermediate floor switch are connected with, this in turn depending upon the location of the car. Thus, when the car passes the intermediate floor switch on its upward movement, it sets it to next direct the current to the exhaust or down valve magnet, and when it passes a floor switch on its downward movement, it sets it to next direct the current to the supply or up valve magnet. At any intermediate position both circuits are broken, so that at each passage of the car the floor switch is thrown out before being reversed. When the floor switch through which the current is flowing is thus thrown out, the current is cut off from the controlling magnet 89, and from the auxiliary pilot valve magnet 25 or 26, thus causing the main valve 9 to close and stop the car. The return movement of the armature of the controlling magnet 89, when the current is cut off, allows the trip switch in the magnet box to return to its normal position again connecting up the series of automatic switches ready for the next movement.

It should be noted that after the operator at a landing or in a car, has once pushed a button, it is unnecessary to hold said button in circuit closing position, for as soon as the magnet controlling the trip switch has been operated, the push button circuit is entirely thrown out of operation, that is, it is short-circuited as hereinbefore explained. It will also be seen that since the push button circuit is made inoperative after the car has once been set in motion, it is impossible for any one else to get control of the car until it has reached the desired floor and come to a full stop. If two buttons are pushed at practically the same time, the car will respond to the first call, although the two calls may be but the fractional part of a second apart.

It should furthermore be noted that the system herein disclosed has a high degree of safety, and it can readily be seen that an accident, so far as a confusion of calls is concerned, is impossible, for as soon as the car reaches a floor and the door is opened, it is impossible to start again from any floor or from within the car, until all the doors leading to the elevator well are in a closed position and the door contact switches 20, 21, and 22, are also closed. In connection with this system, any approved door lock which securely locks the door until the car is level with the floor landing may be used if desired.

Assuming that the car is at its uppermost landing, and the floor switch 14 is in the position shown in Fig. 3, so as to electrically connect the wires 112 and 113, let it be desired to call the car to the floor below. In this case the push button 116 is operated, whereupon a circuit will be established from the + main to and through the wire 73, door contacts 22, 21, and 20, wire 74, safety switch 24 in the car, wire 75, contacts 83 and connecting wires 84, wire 85, wire 86, push button 116 which has been operated, wire 137, wire 117, magnet 89, (second in the series), wire 114, wire 113, switch blade 104 and spring pressed contacts 105, wire 112, wire 115, down magnet 26, and wire 92 to the — main. Pilot valve 51′ will thereupon be operated and the middle trip switch operated to short circuit the push buttons at the landings and the push buttons 23 in the car. Pilot valve 51′ having been opened, the fluid under pressure will flow through the pipe 32 to the chamber 54′ of the valve 10 and effect a movement of the valve 60′ to its open position. The valve 9 at this time is in the position shown in Fig. 1, and so also at stop valve V. The opening of the valve

60′ establishes connection between the cylinder 1 and the exhaust pipe 53. The car may therefore descend in a well known manner until the pin 100 strikes the fork or butterfly 101 to disconnect the wires 112 and 113 and thus effect a deënergization of the magnet 26. The pilot valve 51′ will thereupon be closed by reason of gravity acting on its moving parts, and the constant pressure supply from the pipe 56′ will effect a return of the valve 60′ slowly to its normal or closed position, thus stopping the car at the desired landing. If the car arrives at the lowermost landing, it will operate the switch 15 which also cuts off current from the magnet 26 and effects the stopping of the car in the same manner. If the lower stop button B is actuated, the valve 68 will be moved downwardly to automatically cut off the exhaust flow from the cylinder 1 to the exhaust pipe 53, and thus stop the car. It will be noticed that the valve 10 is also provided with a small check valve 62′ so that the valve 60′ may be opened quickly, and therefore the car will be allowed to start downwardly quickly, and to close slowly so that the car will stop gradually.

It is one of the especial objects of my invention, however, to provide means for positively holding the car in a desired position, as at a landing, so that there may be no settling and consequent derangement of the circuits and connections of the push-button system. This I deem a valuable feature of my invention as I have found electric push-button plunger elevator systems impracticable by reason of the movement of the car away from the landing due to leakage of the motor fluid from the plunger cylinder and the consequent irregular stopping of the car near other landings. I have in this instance illustrated the brake apparatus disclosed and claimed in my Patent No. 810,404, granted January 23, 1906, for an improvement in retarding devices for plunger elevators, but I wish it to be understood that I do not desire to be limited to any particular brake apparatus but that any holding means may be used, consonant with the claims hereto appended. Furthermore, so far as this particular feature of my invention is concerned, any other system of automatic push-button control than that illustrated may be used in combination with brake apparatus for the plunger.

Referring to Figs. 1, 6, 7, and 8, it will be seen that a hydraulic motor 133 is connected by means of the pipes 135 and 136 with the pipes 31 and 32, respectively. The motor 133 is secured to the cylinder head H as by means of a bracket 132, and the piston rod 137 is connected by the link 138 to the brake lever 139. Rigidly mounted on the cylinder head H is an inwardly extending bearing 141 on which is pivoted the cam 140. The brake or gripping device comprises two brake shoes 143, 143, which are pivoted to a fixed support at 144 and between their extensions 146, 146, is mounted a spring 145 to automatically move the shoes out of engagement with the plunger when the brake-applying device is released. The other ends of the shoes 143, 143, are also provided with extended portions 142, 142, to form jaws which cross each other at 153. The cam 140 being pivoted between these jaws is adapted to engage therewith to positively apply the brake shoes to the plunger when the motor 133 moves the brake-lever 139 to substantially horizontal position as indicated in Fig. 1.

The motor shown in section in Fig. 6 comprises three pistons 147, 148, and 149, the first-named being of smaller area than the latter two which are of substantially the same area. A partition 151 divides the cylinder into two chambers 154 and 155, the pistons 147 and 148 moving in the former, and the piston 149 moving in the latter.

Assuming that a push-button is operated to start the car upwardly, the pilot valve 51 is operated to admit fluid under pressure to the pipe 31 as heretofore explained. This fluid pressure will be transmitted through the pipe 135 to the chamber 154 beneath the piston 148, as well as to the chamber 54 above the piston 55. A constant fluid pressure acts through the pipe 134 to produce a differential action on the pistons 147 and 148 tending to move the same downwardly. When the fluid pressure is exerted on the under side of the piston 148 from the pipe 135, the piston-rod 137 will be forced upwardly to rotate the brake-lever 139 sufficiently to release the brake and permit the spring 145 to move the brake shoes out of engagement with the plunger. At substantially the same time the valve 9 is opened and pressure exerted on the plunger to move the car upwardly. Any suction produced by the piston 149 during this operation will have no effect as the exhaust port in the valve 51′ is open at this time. To allow free movement of the pistons, air vents 150 and 152 are provided for the chambers 155 and 154, respectively, above the pistons 149 and 147.

When the car approaches the designated landing and the pilot valve 51 is closed, the pressure in the pipe 135 is consequently cut off and the exhaust port in said valve opened. This results in the constant fluid pressure from the pipe 134 by differential action on the piston 148, moving the piston-rod 137, link 138, lever 139, and cam 140 to their normal positions. In other words, when the push-button system tends to automatically stop the car at the predetermined landing, the cam 140 will be actuated to positively apply the brake to the plunger to retard the motion of the plunger in assisting to stop the car and also hold the car stationary adjacent the desired floor or substantially level

therewith, until it is desired to again operate the car.

When a push-button is operated to allow the car to descend, the pilot valve 51′ will be operated and fluid pressure exerted from the pipe 27 through the pipe 32 to the chamber 54′ as before explained, and also through the pipe 126 to the chamber 155 beneath the piston 149. The piston rod 137 will thus be moved upwardly to release the brake apparatus at substantially the same time that the valve 10 is operated to open the cylinder exhaust, and when the car approaches the desired floor and the exhaust valve 10 is gradually closed, the brake will be gradually and positively applied to retard the plunger and hold the car stationary after coming to a stop.

Obviously various modifications in the details and arrangement of parts may be made by those skilled in the art without departing from the principles of my invention, and I desire therefore not to be limited to the precise construction herein disclosed.

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

1. In a hydraulic elevator, the combination with a plunger and change-valve apparatus, of a retarding device, a fluid pressure motor for operating said retarding device independently of said change-valve apparatus, and a single device for controlling both the change-valve apparatus and the said motor.

2. In a hydraulic elevator, the combination with a plunger and change-valve apparatus, of a retarding device, a fluid pressure motor for operating said retarding device, and a plurality of pilot valves each controlling the operation of both the motor and the change-valve apparatus.

3. In an elevator, the combination with a car, of a plunger connected thereto, controlling apparatus, a push-button electric system for operating said controlling apparatus, and mechanically operated means applied to the plunger for positively holding the car stationary, the means being dependent for its operation upon the said push-button electric system.

4. In an elevator, the combination with a car, of a plunger connected thereto, controlling apparatus, a push-button controlled electric system for operating said controlling apparatus, and means mechanically connected to said controlling apparatus and associated with said plunger for holding the car in fixed position.

5. The combination with a car, a plunger and operating apparatus, of hydro-mechanical brake mechanism associated with said plunger, and electric circuits and connections to automatically control said operating apparatus and said brake mechanism to cause said car to start from any position and stop at a predetermined position.

6. In an elevator, the combination with a car, a plunger, a cylinder and valve apparatus, of an automatic push-button controlled system of electric circuits and connections for effecting an automatic stop of said car at a predetermined landing, and a hydraulic brake connected to said valve apparatus and associated with the plunger to positively retard the motion of the car and plunger and hold the same substantially stationary at a landing.

7. In a hydraulic elevator, the combination with a car and a plunger, of a retarding device for such plunger, and hydraulic means controlled from the car or from a landing for releasing said retarding device.

8. In a hydraulic elevator, the combination with a car and a plunger, of a retarding device for such plunger, and hydraulic means within the control of the passenger in the car or at a landing for releasing and applying such retarding device.

9. In a hydraulic elevator, the combination with a plunger and a car, of a retarding device for the plunger, and automatically controlled hydraulic means for starting and stopping said car and for releasing and applying said retarding device.

10. In a hydraulic elevator, the combination with a plunger, of a car attached to the plunger, valve apparatus, a retarding device for the plunger, a hydraulic actuating appliance for said retarding device, and electro-mechanical means for controlling said valve apparatus and said actuating appliances.

11. In a hydraulic elevator, the combination with a plunger, of reversing valve mechanism for controlling the movement of said plunger, a retarding device for the plunger, a hydraulic motor for operating said retarding device, and electro-mechanical means for effecting the operation of said reversing valve apparatus and of said motor.

12. In a hydraulic elevator, the combination with a plunger and a car, of a retarding device for the plunger, a hydraulic motor for operating said retarding device, and electro-mechanical means for controlling the starting, stopping and the reversing of the movement of the car and substantially at the same time the operation of said motor.

13. In a hydraulic elevator, the combination with a plunger and a car, of a hydraulically operated gripping device for said plunger, and electric means for controlling the application and release of said gripping device.

14. In a hydraulic elevator, the combination with a plunger and a car, of a brake for said plunger, means for controlling the movement of the car, a hydraulic motor for actuating said brake, and electro-mechanical apparatus for effecting the operation of said

controlling means and also the operation of said motor to release and apply the brake.

15. In a hydraulic elevator, the combination with a plunger and a car, of a brake for the plunger, a hydraulic motor for operating said brake, reversing valve mechanism for controlling the movements of the car and plunger, pilot valve apparatus for controlling said reversing valve mechanism and said motor, and electric appliances for operating said pilot valve apparatus.

16. In a hydraulic elevator, the combination with a plunger and a car, of a cylinder for said plunger, means for controlling the flow of fluid to or from said cylinder, a brake for the plunger, a hydraulic motor for operating said brake, pilot mechanism connected to said controlling means and to said motor, and electro-magnetic appliances for controlling said pilot mechanism.

17. In a hydraulic elevator, the combination with a plunger and a car, of pivoted braking jaws for the plunger, resilient means for releasing said braking jaws from the plunger, a cam coacting with said jaws to positively apply the same to the plunger, a motor for actuating said cam, and automatic electro-mechanical appliances for effecting the operation of said motor.

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

FLOYD C. FURLOW.

Witnesses:
W. W. LIGHTHIPE,
W. H. BRADY.