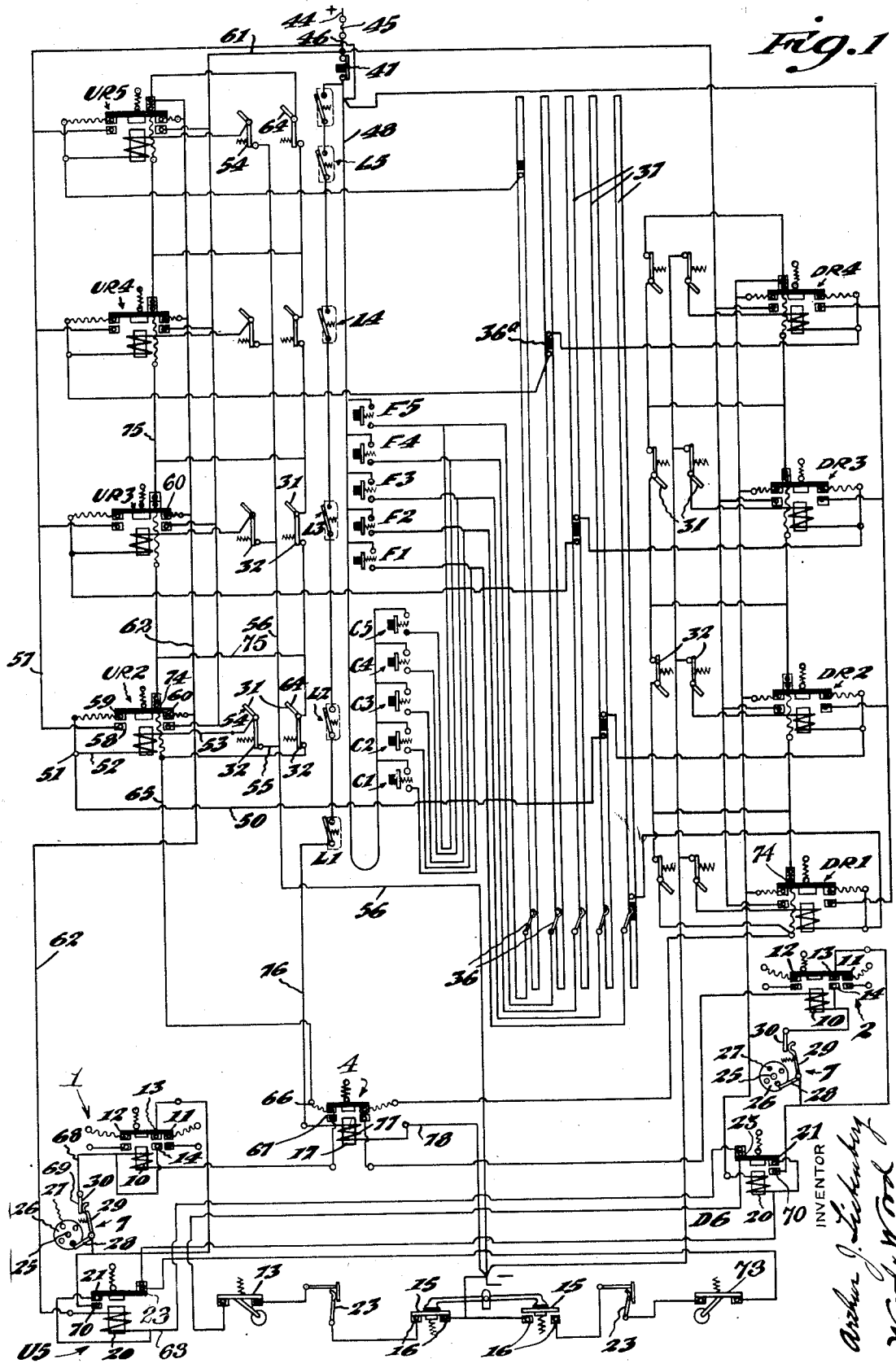
Oct. 3, 1933. A. J. LIEBENBERG 1,929,391

ELEVATOR CONTROLLER

Filed Sept. 28, 1929 5 Sheets-Sheet 1

Fig. 1

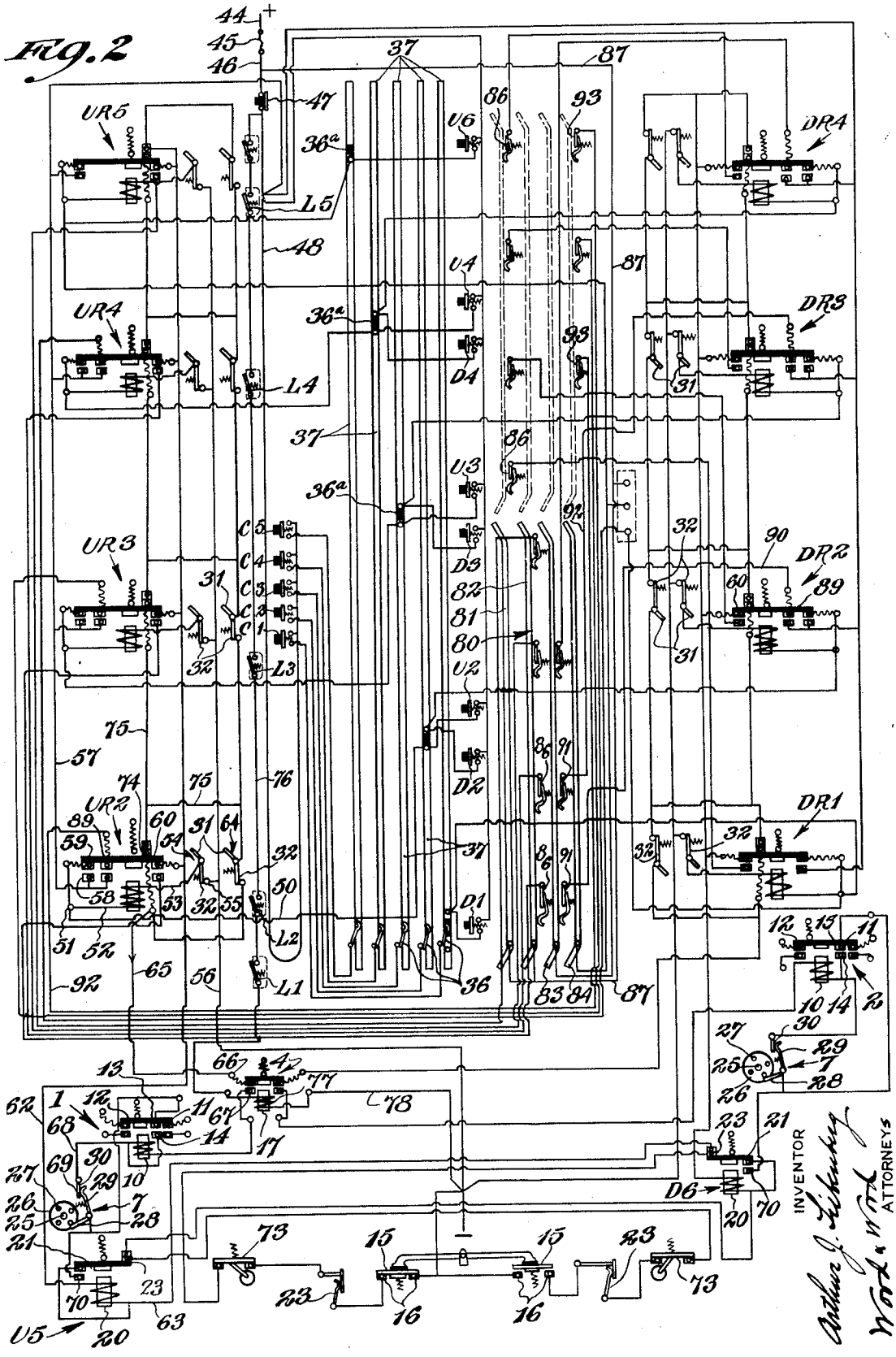


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ELEVATOR CONTROLLER

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Fig. 2



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ELEVATOR CONTROLLER

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Fig. 3.

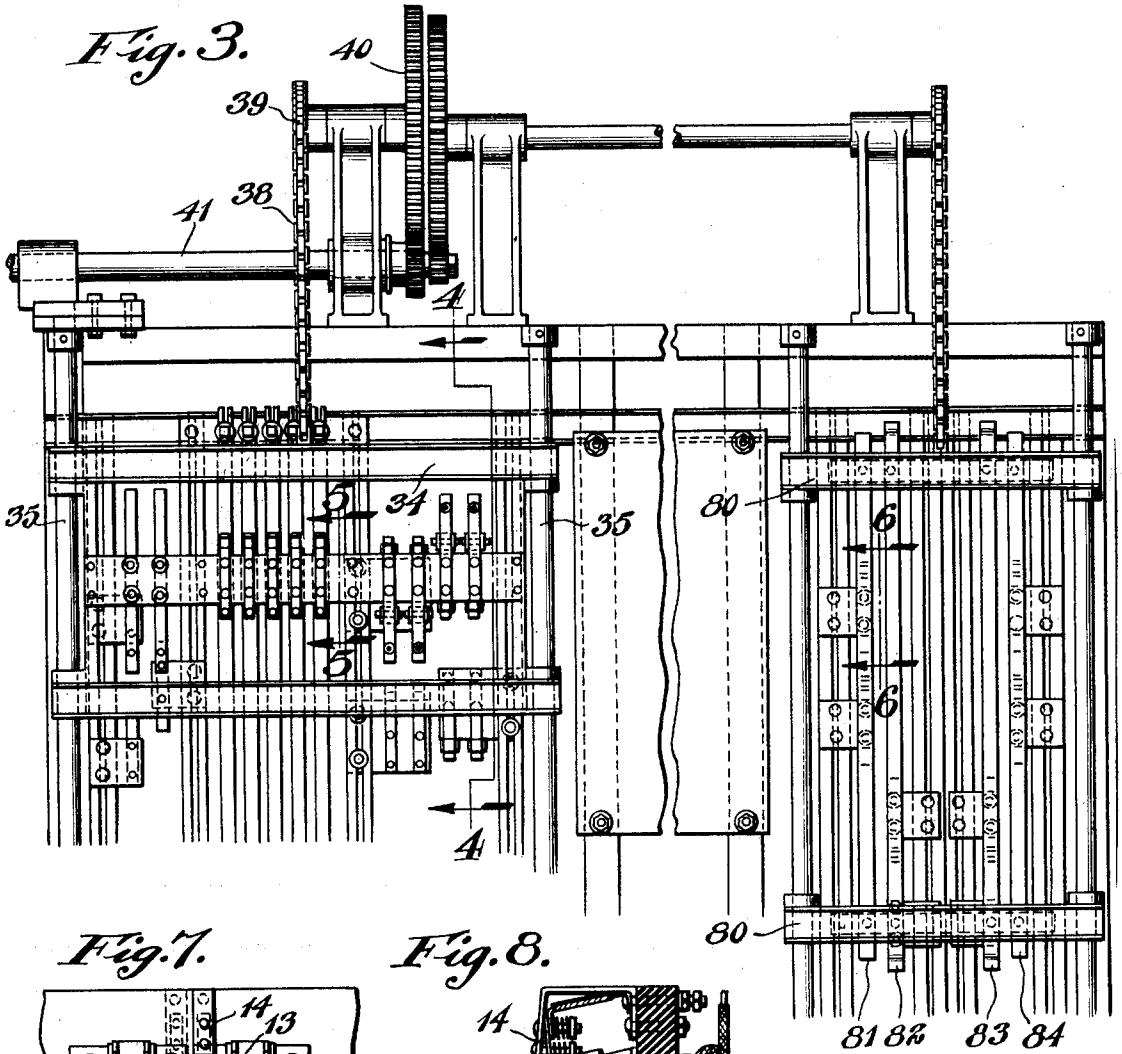


Fig. 7.

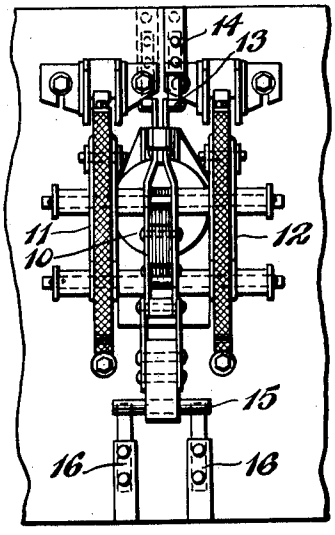


Fig. 8.

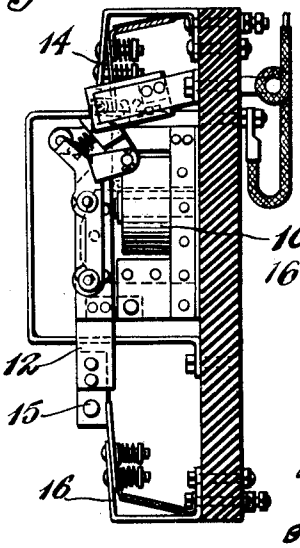
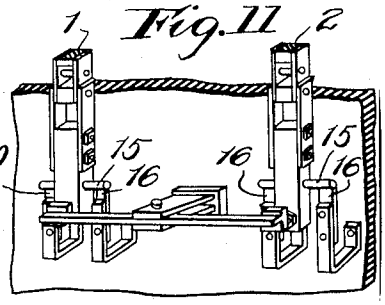


Fig. 11



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ELEVATOR CONTROLLER

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Fig. 4.

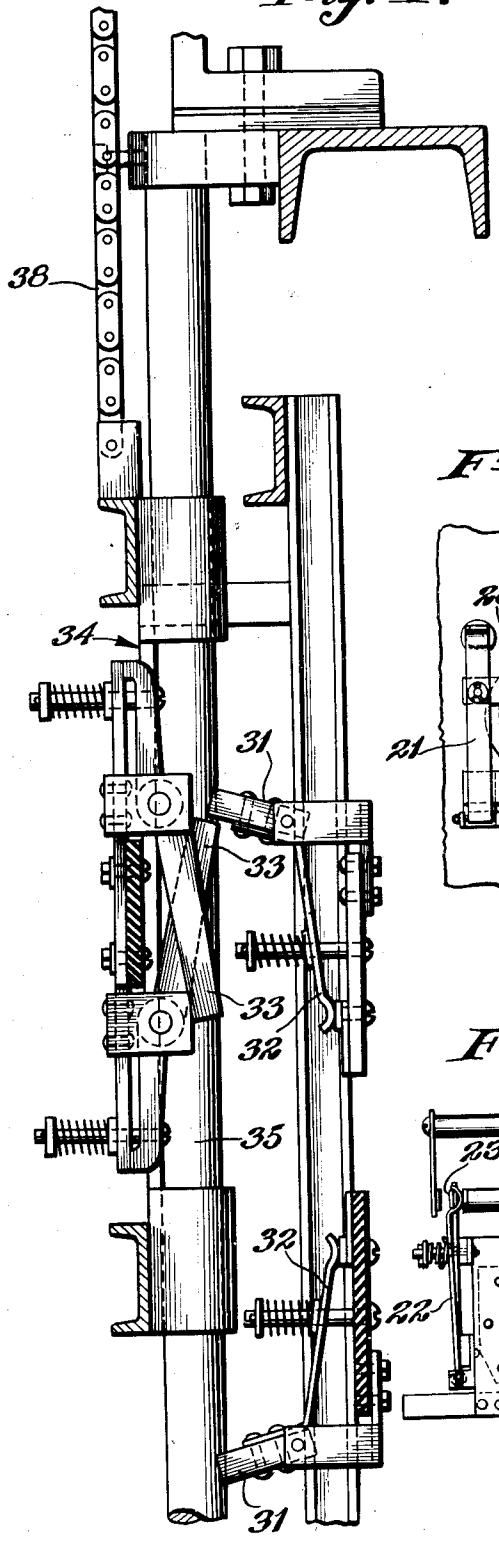


Fig. 5.

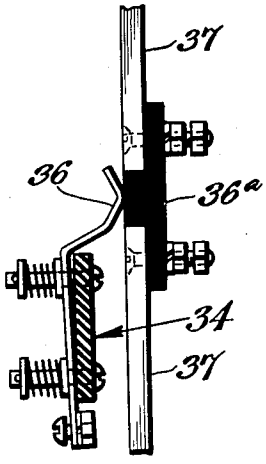


Fig. 9

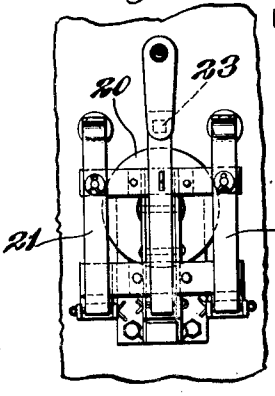


Fig. 6.

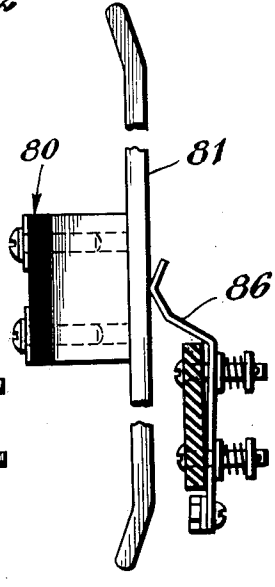
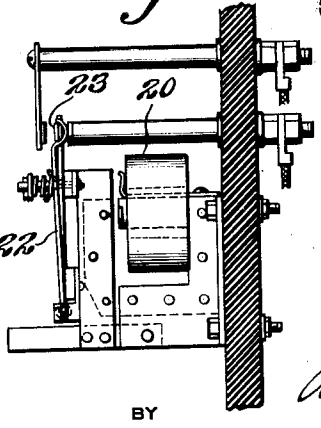


Fig. 10



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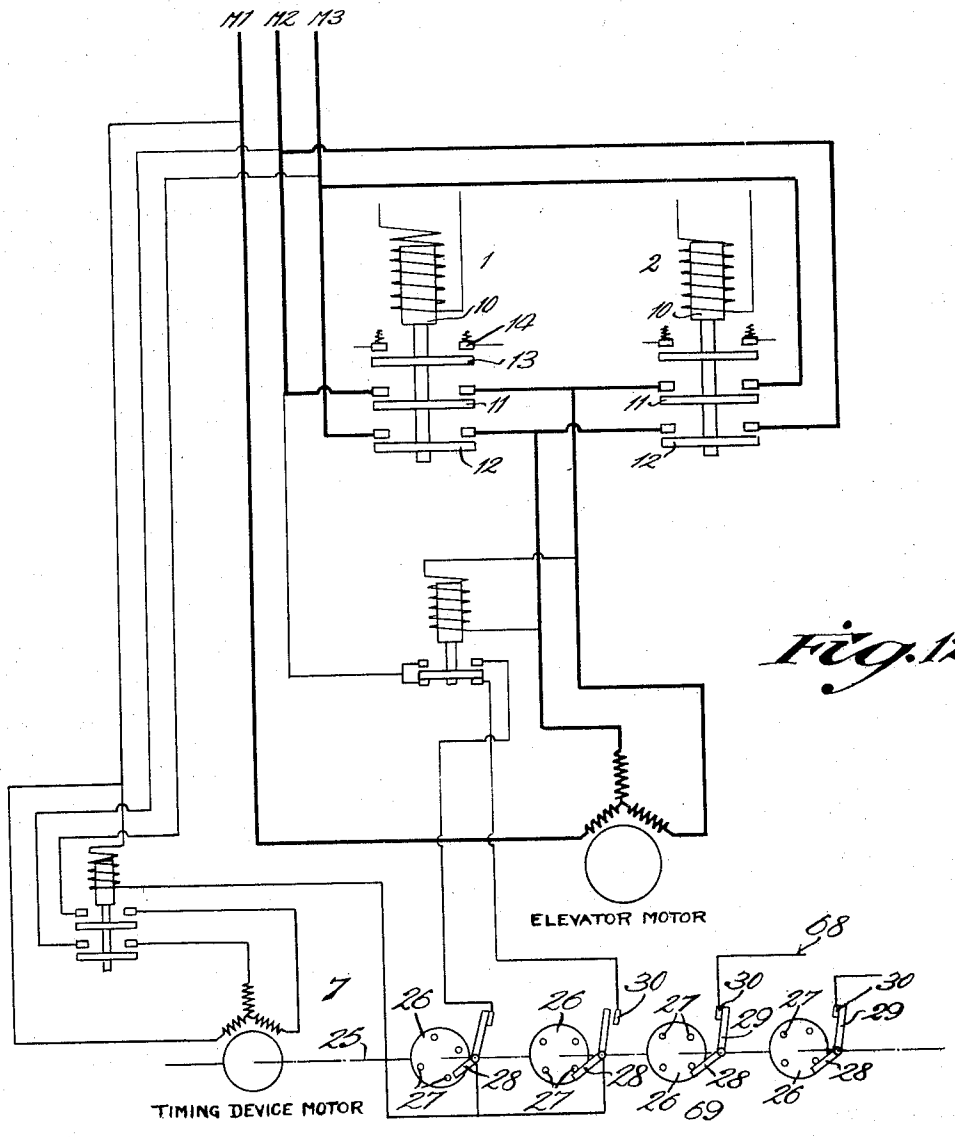


Fig. 12

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ATTORNEY

Patented Oct. 3, 1933 1,929,391

UNITED STATES PATENT OFFICE

1,929,391

ELEVATOR CONTROLLER

Arthur J. Liebenberg, Cincinnati, Ohio, assignor to The Warner Elevator Manufacturing Company, Cincinnati, Ohio, a corporation of Ohio

Application September 28, 1929
Serial No. 395,919

12 Claims. (Cl. 187—29)

The invention relates to push button, automatic elevator control, providing automatic starting and stopping of the car, and after started in one direction, stopping at all floors, in the successive order of floors responsive to calls and capable of being reached in continued direction of travel for collecting prospective passengers or discharging passengers enroute to its full direction limit of travel, or to such last floor in the direction order of travel from which a call has been registered.

It is an object of the invention to provide a push button elevator control for a more continued operation of the car in the direction started, to serve or render the car available for all floors, from the floor at which the car started and within and to the floor limit of car travel in such direction, upon the registration of the making of calls from such floors during the continuing direction control. The car stops at the floors having calls registered in the natural order of floors as reached, regardless of the order in which the calls were made and provided the call be made before the car reaches or passes the floor and before control reversal is effective after the last floor, in the floor order, has been served.

It is another object to provide uniform service for all floors with the least possible delay, avoiding short trips when there are long trip demands and vice versa, the manipulation of the car between certain floors against the exclusion of other floor demands, or the unwarranted passing or cutting out of floors for which service is waiting and which could be served in the trip, to increase the efficiency of the service, reduce operating costs and more adequately serve peak periods.

Another object of the invention is to provide a push button automatic elevator, either single button at and for each floor landing, or double button, direction selective, at and for each floor, each floor button for starting the car and rendering the car responsive to the button controls and for all floors for which floor buttons have been operated, available and serviceable in the traveling direction for which the car was started, stopping at the signaled floor in the natural order of floors, whereupon after all called floors in the continued direction of car travel have been answered, the direction of car travel will be automatically reversed to serve unanswered calls available in the opposite continued direction of travel.

Other objects and advantages will appear from the following description and reference in connection with the accompanying drawings, in which:

Figure 1 diagrammatically represents an elevator control system embodying the invention and operative by a single button at each floor landing.

Figure 2 is a diagrammatic view of a method incorporating double buttons, direction selective, at each floor landing.

Figure 3 is a detailed front elevation of the upper portion of the movable control device used in connection with the method employing double push buttons at each floor landing selective for up and down travel. Approximately one-half of the device is employed for the single floor button control.

Figure 4 is an enlarged section on line 4—4, Figure 3.

Figure 5 is an enlarged section on line 5—5, Figure 3.

Figure 6 is an enlarged section on line 6—6, Figure 3.

Figure 7 is a front elevation of one of the main electromagnetically operated switches for elevator motor starting and direction control.

Figure 8 is a side elevation thereof.

Figure 9 is a plan view of one of the magnetically operated floor switches, and

Figure 10 is a side elevation thereof.

Figure 11 is a detailed perspective view of the lower portion of the main contactors or elevator motor reversing switch for illustrating the mechanical interlock.

Figure 12 is a diagrammatic view showing the feed line circuits for the elevator hoisting motors, illustrating the same in connection with the conventional representation of a motor and its direction switches and including controlling circuits for a motor of a timing device as an element of the elevator control system.

Two methods of operation are herein provided, one employing a single push button at and for each floor or landing, effective for either up or down travel of the car, answering a call and stopping the car at the floor or floors from which the call or calls were made responsively as reached by the car in the direction in which the car is traveling. Any and all calls made above the station of the car in its travel up will be served as reached irrespective of the order in which the calls were made and likewise any calls made after the car is traveling up and above such station will be answered on the down travel of the car. For instance, if the car is on the first floor and calls from the second and fourth floors are made, the car will travel up stopping at second, thence after a station stopping period or interval of rest at the second floor and with the

floor doors and gates closed will proceed to the fourth floor. The person at the second floor will be required if he desires to go down on his call, to be a passenger up to the fourth floor, or allow the car to continue to the fourth floor and after the car leaves the second floor in traveling up again register his call to be answered on the down travel of car.

The second method employs double or sets of push buttons at and for each floor or landing, selective as "up" and "down" which are only answered correspondingly with the direction of car travel. In the first method if there is only one call made, the car will be started and stopped to answer the call, irrespective of whether the car is located above or below the floor from which the single call is registered, and for the first method will stop at any floor it reaches in its direction of travel from which calls are interveningly made, while in the second it will only answer those interveningly made corresponding to the direction of car travel.

In both methods, however, the car will answer all calls or up calls in its continued up direction of travel which it can reach and will not respond to calls or "up calls" from lower floors which it has passed, until the call for the uppermost floor has been answered. Once the car is started in a certain direction it will serve all the calls on floors it can reach in such direction and after all have been served it will operate in the opposite direction.

For convenience in manufacture and installation, the control devices are grouped into two divisions and each group mounted upon a panel board. One group, common to or the duplicate in both methods constitutes a set of main contactors, 1 and 2 comprising a pair of magnetically operated switch devices having mechanical and electrical interlock for elevator hoisting motor starting and direction circuit control; a third contactor as a magnetically operated switch device for motor accelerating and operating control of a timing device as a secondary part of an automatic motor control not particularly concerned in the present invention and therefore omitted herein to avoid complications; a fourth contactor 4 as a magnetically operated electric circuit controlling switch device having its magnet windings in series circuit connection with all doors or gates, necessitating door or gate closure before elevator control is effective; a pair of up and down direction maintaining contactors, U5 and D6, each as a magnetically operated electric circuit controlling switch for continuing car travel in a given direction to answer all the calls responsively within such direction of travel before direction of car travel can be reversed; and, a timing device 7, as an electric motor driven apparatus, effective for automatically starting the car after a determined interval and after answering or serving a call for continuing the travel of the car, for subsequent service.

The main contactors 1 and 2 are of duplicate structure, each as illustrated in Figures 7 and 8, comprising a magnet 10 actuating a pair of contact levers or arms 11 and 12 joined together to swing as a unit. The contact levers when the magnet is energized at their forward or upper end engage with stationary contacts for establishing and maintaining the hoisting motor circuit. The contact levers intermediate thereof, insulated therefrom and at their forward ends carry a contact bar 13 engaging with a stationary spring-pressed contact or plate 14. At the opposite ends of said contact levers 11 and 12 and intermediate thereof, a contact bar 15 is provided for contacting with a pair of stationary spring-pressed contact fingers 16—16 for an interlock circuit control, effective when the magnet is deenergized.

The main contactors 1 and 2 are also provided with a suitable mechanical interlock to prevent the simultaneous closing of both contactors, this principle being common and of general use for elevator reversing switches as shown in Figure 11, the free end of the armature lever carrying the contact bar 15, is arranged to engage with one end of a cross lever, the opposite end of said cross lever correspondingly being adapted to be engaged by the armature lever of the second main contactor or switch.

The contactor for motor accelerating and control of timing device is similar in construction to contactors or switches 1 and 2.

The contactor 4 or electro-magnetic switch, which may be designated as a door or gate contactor, operating only when all doors or gates of the system are closed, comprises a magnet 17 and a pair of contact levers actuated by the magnet when energized. The levers are joined as a unit and respectively engage with stationary contacts for closing control circuits for either up and down car travel or service.

The up and down direction maintaining contactors or switches U5 and D6 are of duplicate construction each incorporating a magnet 20, contact levers or arms 21, 22, joined as a unit and moving or actuated when the magnet is energized to engage respectively stationary contact. The arms 21, 22 intermediately thereof and insulated therefrom, carry a third contact arm 23 for engagement with a stationary contact but alternately or reversely from the arms 21, 22 so that when the arms 21, 22 close their contact, contact arm 23 is open and vice versa. Insofar as the present system is concerned for both of the switches U—5 and D—6, one of the contact arms of each, as for instance, arm 22, and stationary contact with which the magnet 20 is energized, may be omitted, and therefore not referred to in the present system of push button control. The switches, however, are the same as used in the system for the various floor switches, in which all of the three circuit make and break elements are utilized.

The timing device 7 is represented as an electric motor driven apparatus operating electric circuit controlling switches. It comprises a small electric motor mounted on the panel board having its armature shaft coupled to speed reduction gearing transmitting a driven shaft 25, the shaft 25 carrying a plurality of cams, in the form of disks 26 having a plurality of pins 27 extending laterally from one side of the disk, each pin in its order adapted to engage with and actuate an arm 28 suitably pivoted and carrying a contact finger 29 for contact or engagement with a stationary contact or contacts 30. The timing device controls a maintaining circuit to the elevator motor direction and starting switches to give the user time to open and close doors between the time of stopping and starting, and is arranged to close contacts for a maintaining circuit after a determined time limit and after elevator stopping, say about seven seconds, or interval required before the elevator continues in its travel in response to other push button calls in the same or reverse direction.

The structure of the electro-magnetically oper-

ated contactors or switches above referred to may follow any standard of construction conventional to elevator control practice, and as the present invention is primarily directed to a system or systems of control, the structural details of the various switches employed need not be specifically described to a full understanding of the methods and operation.

A second division or group of control devices, as a second panel board installation and particularly for the single push button, per floor, method, comprises a plurality of electro-magnetically operated switches or relays, designated as panel board floor switches or relays, in sets for each floor or landing served and relatively for up and down capacities, except for the uppermost and lowermost floors or opposite landing limits of car travel for which only a single switch or relay is required. These switches or relays for the floors of the system may be treated as up and down groups each effective upon pushing or closing its corresponding floor or car button. The switches or relays are all of duplicate construction and substantially the same as switches U5 and D6, having three movable contacts, two thereof alternate to the third in making and breaking their circuits.

In addition to the panel board floor switch, mechanically operated snap switches are provided, a set for down direction and a second set for up direction for each floor, excepting for the opposite car travel limit floors wherefor only the singular is required. The respective up and down sets of snap switches likewise are grouped and in superposed arrangement for those of each group corresponding to the floor or landing order or sequence adapted to be tripped or actuated in sequence by trip dogs or levers mounted upon and moving with a carriage in transmitted connection through gear reduction and cable connecting with the elevator car so as to correspondingly move in unison therewith.

Each snap switch as shown in Figure 4 comprises an arm 31 suitably pivoted upon a stationary support and carries a spring-pressed finger 32 normally in engagement with a stationary contact. The arm 31 with its contact finger is actuated by a spring-pressed dog or lever 33 mounted upon and moving with a carriage 34 sleeved and sliding upon a pair of spaced vertical rods 35, fixed to the panel board framing. Two sets of trip dogs or levers 33 are provided, one set effective in the down direction of travel of the carriage and the other in the up direction.

A plurality of brushes or flexible fingers 36, one for each floor or landing, is mounted in a suitable manner upon the carriage constantly in engagement respectively with stationary metallic strips 37, one for each floor or landing and of a length approximating the length of carriage travel. The strips 37 are arranged longitudinally parallel and adjustably secured at their opposite ends to the panel board framing.

The carriage 34 is connected to one end of a sprocket chain 38, engaged over a sprocket wheel 39 of reduction transmission gearing 40. The opposite end of the sprocket chain carries a counter weight (not shown). The reduction gearing is driven by a shaft 41 having a cable winding sheave fixed thereon, and the cable for the sheave connected with the elevator car so that the carriage moves in unison with the car, but in a reduced degree.

The strips 37 are proportional in length to the car travel and primarily govern the direction of car travel in conjunction with the floor relays for the floors to be answered in a given direction of travel before it is possible to reverse the direction of car travel. A separate strip is utilized for each floor and each is of sectional form consisting of a pair of metallic strip sections joined together and electrically divided by a section of insulation 36*a*, the section of insulation being located at a point for the respective floor stops of the carriage to be engaged by the corresponding finger 36 upon the carriage when the car is stationed at the floor for which the strip serves. The brush or finger 36 when engaged with the insulation section of its strip cuts out the push button control for such floor as long as the car is stationed at such floor.

The metallic section of the strip at one side or above the insulation section governs up directions of car travel and the metallic strip section at the opposite side or below the insulation, down car travel. The metallic section lengths vary except for the strip representative for the intermediate floor if its station location is at the middle point of the full car travel or elevator hatchway. The lower sections of the group of strips electrically connect with their respective floor relays of the up group, while the upper section electrically connects to the respective floor relays of the down group.

Each finger 36 connects with its respective car push button and also floor push button, and the brushes or fingers 36 for the several floors being in an aligned row upon the carriage, it will be recognized that when one brush is on the insulation section of its strip, the other brushes will be on either an up or down section of its strip depending upon the station location of the car. Therefore, assume that the car is stationed at the second floor, brushes 36 for the floors above the second will be on the up sections of their respective strips, and the brushes for the floor or floors below the second will be on the down section or sections. Closing any push button, floor or car, above the second floor will energize its respective floor relay of the up group, and correspondingly closing any button below the second floor, the floor relay of the down group.

The system is diagrammatically disclosed in connection with five floor landings or stations each having a single push button, and in an order from bottom to top are designated as floor push button F1, F2, F3, F4, F5, and likewise for each landing is a door or gate switch, operated by closing and opening the door, these switches designated L1, L2, L3, L4, L5.

The car is provided with a push button for each floor landing designated as car push buttons C1, C2, C3, C4, C5. As illustrated the car is at rest, level with the first floor landing. In such position of the car, the carriage 34 correspondingly is in its first floor station with the brush 36 for the first floor landing upon the insulation section of its strip 37, while the other brushes 36 for the respective floors are all on the lower sections of their respective strip for up direction. Pressing any or all of the floor buttons or car buttons for the floor landings above the first will energize the appropriate floor relays, designated UR2, UR3, UR4, and UR5 of the up group which will energize the direction switch U5 starting the car upward. The order in which the buttons are pressed is immaterial as all calls will be answered in the order as reached or can be reached in the up direction of car travel. The car will, after stopping at each landing to be served, travel to the uppermost landing called before the direc-

tion control can be changed. The car having once started in the up direction will answer all calls made while the car is moving in such direction and made before the car direction is reversed. This is due to the differential lengths of the sections of the strip 37 for up and down direction control. It will be recognized that with the car standing at the first floor landing, brush 36 for the first floor landing is on the insulation section of its strip, while the brushes 36 for the several upper floor landings are each upon relatively different lengths of strip sections for car up travel, so that the car up direction is governed by the lengths of the sections of the strips at one side, the insulation sections thereof contemplated for governing up travel of the car. In a like manner the strip sections at the opposite side of the insulation sections thereof are contemplated for governing down travel of the car.

With the car traveling in the up direction or before direction control switch U5 is cut out, a push button above the station of the car is pressed. The direction cannot be reversed until such upper floor landing was reached. The same condition prevails for down travel of the car. With the car stationed at the first floor landing or while traveling upward, the floor button F5 is pressed the car will travel to the fifth floor landing although it will stop at any floor landing that it may reach in its up travel should the button therefor be pressed before the car moves past the floor, otherwise it will be taken care of and served on the down travel of the car. Should, however, only a single floor be called, the car can be started in the appropriate direction to reach and automatically stop at the floor called, and from thence controlled by the passenger through the car switch buttons for either up or down travel. With the car traveling in an up direction, by pressing any of the floor landing buttons above the car, such upper floor landings must be served before the car direction can be reversed, the reversal being either automatically effected by pressing the floor landing buttons for the floors below the car, or by the car push buttons. If no buttons are pressed the car will stop and remain at the floor landing highest in order that it has served, and should a subsequent call be for a floor landing above such station of the car, it will travel upward. Should a call come from a floor below the car, the direction will be reversed, for in such instance direction switch D6 would be energized, cutting out direction switch U5, and the down floor landings would be in order.

Every floor button pressed is effective irrespective of the order in which it was pressed, although it will only be served in its floor order and direction of car travel or location of the car at the time the call was made, and will be served whenever reached by the car in either its up or down travel, and therefore may be referred to as "pick-up" or collective.

In the diagram, the devices are shown in their idle position with the car at rest. Assume that the floor relay UR2 is energized by pressing floor button F2 closing a circuit as follows: From the supply source plus side 44, through fuse 45, wire 46, stop button or switch 47, wire 48 connecting in parallel with one terminal of all the floor buttons 52, etc., thence through the opposite terminal of the floor button F2 to the appropriate carriage brush 36 for second floor landing direction control, and with the car at the first floor landing the brush 36 is in contact with the lower up direction section of the second floor strip 37. This strip section connects by wire 50 to a terminal 51 of the floor up direction relay UR2, from terminal 51 by wire 52 through the windings of the magnet of said relay, by wire 53 to the movable arm 31 and contact finger 32 of the floor up direction snap switch 54. The snap switch 54 is normally closed and positively opened, mechanically, by the appropriate dog 33 on the carriage 34 as the car reaches the second floor station; and from the snap switch 54 through the stationary contact thereof, by wire 55 to negative feed line 56.

A similar circuit can be traced for each of the floor relays of the up group, each having one terminal of its magnet winding in connection with a lower up direction section of its floor strip so that each floor relay of the up group may be energized when the floor and car push buttons therefor are pressed. No up direction floor relay is required for the first floor landing and likewise no down direction floor relay for the uppermost or fifth floor landing.

The wiring for the car buttons is substantially the same as for the floor buttons, the wire 48 or a movable connection therewith connected with one terminal of each of the car buttons, while the opposite terminals are connected to their respective brushes 36 corresponding to the floor landing the particular brush is to serve. The operative result of floor and car buttons is analogous.

As the function of the car and floor button, generally, is but momentary, provision is made to hold in the floor relays when energized through closing of push button and not release with the release of the button, thus automatically register or reserve the call to be served when the car reaches the floor landing. The car upon reaching the level of the floor landing, through the mechanical operation of the floor snap switch actuated by the carriage 34, breaks the circuit to the floor relay.

When floor relay UR2 pulls in or is active it establishes its own maintaining circuit, as follows: A wire 57 connects with wire 48 leading to the plus side of feed line, and to one terminal or stationary contact 58 engaged by the movable switch arm 59 of the relay, the arm connecting electrically with the terminal 51 at one side of the relay magnet windings. The circuit thence follows as previously described for the push button, through snap switch 54 to negative side of feed line.

Wire 57 is common to all of the relays of the up group connecting therewith in the same manner as detailed for floor relay UR2.

The floor relays being independent of one another are individually effected upon closing of their respective floor or car button, and with the car at the lowermost or first floor landing it is only possible to energize the floor relays of the up group as their delegated brushes 36, except for the first floor landing which is on the insulation section, are on the lower up direction sections of the longitudinal stationary strips.

Pulling or closing relay UR2, or in fact either one of floor relays of the up group, establishes another circuit by a second switch arm 60 moving in unison with switch arm 59, for energizing the up direction maintaining contactor U5, which when once energized, remains so, until all calls registered and unanswered in the up direction of car travel are served.

The closing of the second switch arm 60 of either or all of the floor relays of the up group

establishes a circuit for the magnet of the up direction maintaining switch or contactor U5 as follows: Starting at the plus lead 44, fuse 45, by wire 61 connecting with the stationary contacts of all the floor relays of the up group, engaged by the second switch arms 60, through the arm 60, by wire 62 to and through magnet coil 20 of the up direction maintaining switch U5. Thence by wire 63 having in series therewith the interlock switch contacts of down direction maintaining switch D6 and of the main contactor or switch 2 to the negative feed line.

It is understood that the main direction switch 2 and the down direction maintaining switch D3 are open, thus establishing the interlock switch connections controlled thereby for the opposite direction control, and as this is merely a safety feature incorporated in the control included wherever possible in elevator control systems, these graphically need not be traced in detail. Note, however, that when switches 2 and D6 are closed the circuits to the magnet of up direction maintaining switch U5 cannot be completed and vice versa when U5 is closed circuit to the magnet of switch D6 cannot be completed.

The magnet for the elevator motor and brake of contactor or switch 1 is energized through the following circuit: Starting with wire 61 through the closed second switch arm 60 of either of the floor relays of the up group, by wire 62 which connects with the second switch arms 60 of all the relays of the up group and loops to connect in series with all of the second snap switches 64 for each floor landing. A similar snap switch 64 is utilized for each floor landing excepting for the first floor landing and respectively are disposed adjacent the corresponding floor snap switches 54 of duplicate construction therewith, and in a superposed arrangement in the order of the floor landings for which they serve. The snap switches 54 and 64 as a set for each floor are simultaneously actuated by the carriage 34 as they are reached in the up travel of the carriage, and non-operative with the down travel of the carriage 34. The snap switches normally are closed. The circuit continues from the lowermost snap switch 64 of the series by wire 65, which also connects with a third switch arm of the second floor up direction relay UR2, as the lowermost of the up group, to the contact 66 of the contactor 4, stationary contact 67 of said switch or contactor 4 to one side of the magnet coil of switch 1, continuing from the opposite side of the winding of magnet 10 of main direction switch 1, by wire 68, to the switch 69 of the timing device 7.

As soon as the magnet 10 is energized pulling in the switch arms of switch 1, the circuit for the magnet 10 is maintained through the contacts 13, 14 of the switch 1, short circuiting or strapping out the switch 69 of the timing device to a stationary contact 70 of up direction maintaining relay U5 and a switch arm 21 thereof, thence to the negative feed line.

In the partial circuit line between the switch arm 21 and negative feed line, interlock switch contacts 15, 16 of the main direction switch 2, interlock switch of the down direction maintaining switch D6 and an up limit hatchway switch 73 are interposed in series circuit connection therewith.

When the floor relay UR2 pulls in it breaks contact of the normally closed third switch arm 74 located in the center of the magnet. The switch arm 74 when closed engages with a stationary contact connecting by a wire 75 to the third switch arm 74 of the next floor relay in order, the third switch arms 74 of all of the relays of the up group being in series circuit connection when all the railways are inactive. The stationary contact for the third switch arm also connects to the wire 65, to shunt or divert a partial circuit about a floor snap switch 64 of the corresponding floor for which the relay serves, so as to complete the circuit through the third switch arm of the relay when the snap switch 64 is broken.

When the snap switch 64 of a particular floor is broken or opened by the carriage 34, its corresponding floor snap switch 54, up direction, is opened, cutting out the corresponding floor relay, as say UR2, so that the partial circuit controlled by either the second floor snap switch 64 or alternately, third switch arm 74 of floor relay UR2 for the main direction switch 1 would be through the second switch arms 60 of any of the other relays of the up group which are active by the looped wire 62, closed snap switches 64 of the up group, cross wire 75, third switch arm or relay UR2 to magnet of switch 1, provided the floor gate magnet switch 4 was active, which results when all floor doors or gates are closed.

The magnetically operated switch or contactor 4 is connected in series with all gate and door switches, and when the magnet for switch 4 is energized a pair of switch arms are closed for completing partial circuits for the magnets of the main direction switches 1 and 2.

The circuit for the magnet of switch 4 is as follows: Plus side of feed line 44, fuse 45, wire 46, stop button 47, wire 48, wire 76 connecting with wire 48 and in series with all of the floor or gate switches to magnet winding 77 of switch 4, thence by wire 78 to negative feed line.

For an example, pressing the second floor landing button F2, and the consequent operation of the second floor relay UR2, or in fact upon pressing any of the floor buttons above the first floor at which the car is stationed, and provided floor doors and car gate are closed for functioning switch 4, and the switch 69 of the timing device 7 is closed, the system is in condition for up travel of the car. The direction maintaining switch U5 will remain closed so long as any floor relays of the up group are active, and only those above the floor station of the car at such time, any button below will be served by the appropriate relay of the down group. As soon as the carriage 34 reaches its second floor station it will trip snap switches 54, 64, snap switch 54 breaking the circuit to the magnet of second floor relay UR2 and snap switch 64 the circuit to the main direction switch 1, stopping the car at the second floor landing. Then opening the car gate or second floor hatch door breaks the circuit to switch 4 which remains so as long as the door and gate are open. If no calls have been made for any of the floors above the second, a passenger at his selection upon closing door and gate can through the car buttons control the car for either up or down direction of travel. Further, with the car idle at the second floor landing the first floor button could also be made effective for car down control should such call be made before any further up call.

Control can be had in either direction whenever the direction maintaining relays U5 and D6 are out and the first in action has preference over the other.

The direction maintaining switches U5 and D6 when active are however only responsive relatively to the floor landing buttons above and below the station of the car, due to the brush engagement with either up or down direction section of the strips 37. For instance with the car stationed, in a five floor control, at the third floor landing, third floor button is ineffective as the brush for that floor landing is upon the insulation section of the third floor strip, push buttons F4 and F5 would function respectively, relays UR4 and UR5 while push buttons for the first and second floors would be effective for functioning floor relays DR1 and DR2 respectively of the down group. If a call from either one of the first and second floor buttons preceded a call or calls for the fourth and fifth floors, the car would travel first to the floors from which calls were made below the third and then respond for the up calls, and vice versa.

When the circuit controlled by the third switch arm 74 of a floor relay is closed due to the relay dropping out, switch 1 or 2 does not again pull in until the switch 69 of the timing device is closed. The timing device is arranged to close contacts in about seven seconds, allowing the passenger time to open and close doors between time of starting and stopping.

It is the ability to intercept the car in its direction of travel that expedites service. Persons going or desiring to go in the same direction do not have to wait until one person is through with the car before getting elevator service.

The control devices for the down direction are operated substantially the same as those described for up direction. Direction maintaining switch D6 performs the same function as switch D5, but is only responsive to the floor relays of the down group DR1, DR2, DR3, DR4, and therefore the circuit reference made for the parts of the up direction responds equally for the similar parts for down direction control, so that the circuits need not be traced in detail herein, like reference characters being employed in the drawings therefor, except wherein distinction is made to designate the group or for direction control to which the parts belong. The snap switches for the down direction operate only by down direction of carriage travel and therefore are set alternate from the snap switch for up direction.

The stop button switch 47 usually is installed in the car necessitating a moving circuit line, adapting the car to be stopped or elevator service cut out when required, and upon opening the stop button switch, the circuit to the entire system is cut out.

The second method as diagrammatically illustrated in Figure 2, provides selective or separate up and down push buttons at each of the intermediate floor landings, and a single button at the top and at the bottom floor landings, as an up button for the top landing and a down button for the bottom landing. The floor button and floor relay circuits for the second method are not made as for the first method through the traveling brushes and longitudinal strips. The car button circuits however remain the same. The push buttons for the several floors for the "up" control are designated U—2, U—3, U—4, U—6, and for the "down" calls D—1, D—2, D—3, D—4.

The floor relays for both up and down groups are each provided with an additional contact arm and stationary contact therefor, so that each floor relay has three normally open contact arms and one normally closed contact arm.

The second method also provides a floor selecting device as a second carriage 80 driven from the same drive shaft as carriage 34, excepting that its gear reduction is twice as great, operating the second carriage at half the speed of the first carriage. Four longitudinal contact shoes 81, 82, 83, and 84 are mounted upon the second carriage, each having an active length of one-half the total travel of the first carriage. The shoes slide over respective stationary contact fingers in their up and down travel.

Each floor button when pressed, except for the buttons at which the car is stationed, will complete the circuit to the magnet of its corresponding floor relay, from plus side feed line 44, fuse 45, wire 46, stop button switch 47, wire 48, floor push button, wire 50, wire 52, magnet, wire 53, snap switch 54, wire 55 to negative feed line. Each floor magnet maintains its own circuit substantially as previously described for the first method, when closed by its push button.

Sets of floor snap switches actuated by the carriage 34 for respectively breaking circuit control of floor relays and main direction switches 1 and 2 are substantially as previously described. Likewise the shunting function of the normally closed switch arm of the floor relays.

The floor relays each through its appropriate switch arm 60, does not, when closed, complete a partial circuit to a direction maintaining switch, as in the first method. Its stationary contact, instead of connecting directly to the plus feed line, in turn connects with a stationary contact of a group of contacts for engagement by a respective shoe of the second carriage 80, in a five floor installation, as exemplified by the diagram Figure 2.

The stationary contact for the switch arm 60 of the floor relay UR2 of the up group connects by a wire to the stationary contact 86 of the floor sector mechanism. The next floor relay in order of the relays for the intermediate floors has its switch arm 60 connected to a second stationary contact 86 for the up group. The contacts 86 are arranged, spaced apart, in a vertical row and floor order and within the lower half of the second carriage travel and contacted by the shoe 82. The shoe 82 has a wire 87 connected thereto leading to the plus feed line.

A like set of stationary contacts 86 are provided for the floor relays of the intermediate floors of the down group, except that they are located within the upper half of the second carriage travel, and engaged by the shoe 81. For a five floor installation four stationary contacts 86 are provided for the up group, none being required for the top floor and likewise four for the down group, omitting the bottom floor.

The third normally open switch arm 89 of the floor relays of both groups and only for the intermediate floors thereof, each has the arm 89 respectively connected to a stationary contact engageable by a respective third or fourth contact shoe of the second carriage. For instance, third switch arm 89 of floor relay DR2 of the down group connects by a wire 90 to the stationary contact 91 of a vertical row of stationary contacts for the down group, located within the lower half of second carriage travel and engageable by the third shoe 83. The contacts 91 respectively are in horizontal alignment with

contacts 86 of the up group for corresponding floors.

The third switch arm 89 of the floor relay UR2 of the up group connects by a wire 92 to a stationary contact 93 of a vertical row of stationary contacts located in the upper half of carriage travel and aligned with, respectively, corresponding floor contact 86 of the down group, and engageable by the shoe 84. Contact shoe 84 for the stationary contacts of the down group connects with the plus side of the magnet winding of the bottom floor relay of the down group, while the contact shoe 83 connects to a corresponding side of the magnet winding of the top floor relay of up group, conversely to shoe 84.

The operation of the floor relays and various devices is substantially as described for the first method for answering all calls available in the direction that the car has been started. As selective direction floor buttons are employed provision is made for registering as made, whether for up or down direction, although some may have preference over others, governed by the station of the car. The service always follows in the natural order of the floors, regardless of the order in which the calls were made, and available in the particular continuous direction of car travel. If the car is started up it will answer the up calls then available, before answering down calls, and the car must travel to its full floor limit before it can be reversed. For instance the car starting in an up direction from the third floor must travel to the top floor before its direction of travel can be reversed to answer down calls, and then continue to the bottom floor before up calls can again be served. The circuit to either of the direction maintaining switches U5 or D6 once established remains so until all calls registered and available in the continued direction of car travel are served, and the car reaches the floor limit of travel for that direction. It is therefore apparent in the double system that the car must travel to one of the floor limits, before it can be reversed to answer the calls from buttons corresponding to the direction in which the car has already traveled.

The closing of relay U5 with the car, say at the bottom landing, causes the car to run to the up limit of travel. When the car is at the top landing down relay becomes effective for stopping the car. During the time the car is traveling to the top floor to answer down calls, any of the up buttons pressed, provided the car has not passed the floor will be served. The service order depends upon whether the calls made are in the trip direction of the car, and the floors therefore have not been passed, if not the car proceeds to the floor limit, reverses and travels to the opposite limit.

The position of the traveling shoes 81, 82 govern which of the direction maintaining switches U5 or D6 may be made effective. When the shoes are in their lower half of travel, shoe 82 completes the circuit to the switch U5 through the active relays of the up group, the shoe 81 likewise being in the lower half is out of reach of its stationary contacts located in the upper half, so that the circuit to the direction maintaining switch D6 cannot be completed. The switch U5 will remain closed if any of the relays of both groups are active until the shoe 82 disengages the uppermost stationary contact 86, whereupon the shoe 81 becomes effective, to complete the circuit to direction maintaining switch D6 and responsive to relays of the down group.

When the traveling shoes 83, 84 are in the lower half of travel, a magnet energizing circuit for the top floor relay of the up group, responsive to throwing in any of the intermediate floor relays of the down group is effective, necessitating car up travel to top floor landing and then down to answer and serve the down calls. Conversely when the shoes are in the upper half of travel shoe 84 is in engagement with the stationary contacts in partial circuit respectively with the intermediate floor relay of the up group and shoe 83 is ineffective.

If only calls in a corresponding direction are made, the car will start and travel in such direction, serve the calls in their regular floor order and then continue and stop at the last floor in the floor order from which a call has been made. Therefore, assume the car is at rest at the first floor landing, floor buttons U2 and U4 have been pressed the car will be started and travel up, serving said floors, and stop at the fourth floor landing. Should down calls below the fourth floor follow, the car will start and travel down.

In both systems a car once started in a direction it will respond to all calls available in that direction to the floor limit of travel, if the calls are instituted within the corresponding directional control. This is of particular advantage during peak periods, establishing universal service to all floors, eliminates short trips when there are long trip demands, transporting a larger number of persons within a shorter period, and an operation of the elevator efficiently with regard for signals.

In Figure 12, the feed circuits for the elevator motor controlled by the direction switches 1 and 2 are disclosed, the figure likewise including circuits for starting and stopping the motor of the timing device 7. The timing device is effective with each starting and stopping of the elevator motor to give the user of the elevator time to open and close the doors between the time of starting and stopping. It provides for a circuit control in connection with the elevator motor control and also for its own electric motor control as for starting and stopping of the timing motor after a control for the elevator motor has been effected to reset the cam discs for a subsequent circuit controlling operation. As for example, assume that the feed circuit to the elevator motor has been completed for starting after the time lapse for door operation, the timing mechanism having functioned for an elevator motor starting control, the timing motor is again operated to reset the cam discs for a subsequent circuit controlling operation to either cut out or in certain circuits controlled by the cam operated switches. As the method of control and circuit arrangement for a motor driven timing device may follow any well recognized practice, no detailed description of all of the parts and elements of the timing mechanism is made herein. It is also obvious that other types of timing devices may be employed in connection with the present system of elevator control.

Having described my invention, I claim:

1. An electric elevator comprising, a plurality of relays, two for each of the intermediate floors and one for each of the top and bottom floors, said relays organized in groups for relatively opposite car travel direction control, with the relay for the top floor a member of one group and the relay for the bottom floor a member of the second group, the relays of one group effective for stopping the car at the floors corresponding thereto

in one direction of car travel and those of the second group in the opposite direction of car travel, a relay controlling circuit, the relays of each group each when operated remains in operated position until the controlling circuit therefor is cut off by the car reaching the floor corresponding thereto and stopping the car at the floor and a pair of alternately operative direction control maintaining switches each responsive to an operated relay of one group and remaining in operated position as long as a floor relay of its group remains in operated position, a pair of stationary contacts in continuous arrangement corresponding to each floor, one in circuit connection with a floor relay of one group and the second with a floor relay of a second group, and a contact carrier moving in relation with the elevator car having a brush for each pair of stationary contacts for governing the controlling circuit between the push button and relays for giving preference to relays of one group corresponding to the first operated relay and available in a continuous direction of car travel over those in a control for an opposite direction of car travel.

2. An electric elevator system comprising, a plurality of relays, two for each of the intermediate floors and one for each of the top and bottom floors, said relays organized in groups for relatively opposite car travel direction control, with the relay for the top floor a member of one group and the relay for the bottom floor a member of the second group, the relays of one group effective for stopping the car at the floors corresponding thereto in one direction of car travel and those of the second group in the opposite direction of car travel, a relay controlling circuit, the relays of each group each when operated remains in operated position until the controlling circuit therefor is cut off by the car reaching the floor corresponding thereto and stopping the car at the floor, a pair of alternately operative direction control maintaining switches each responsive to an operated relay of one group and remaining in operated position as long as a floor relay of its group remains in operated position, a car actuating and stopping switch responsive to the relays of one group and the direction control maintaining switch therefor, stopping the car at the floors corresponding to the operated relays of one group in the natural order of floors regardless of the order in which the relays are operated and a second car actuating and stop switch responsive to the relays of the second group for a similar car stopping control, a pair of stationary contacts in continuous arrangement corresponding to each floor, one in circuit connection with a floor relay of one group and the second with a floor relay of a second group, and a contact carrier moving in relation with the elevator car having a brush for each pair of stationary contacts for governing the controlling circuit between the push button and relays for giving preference to relays of one group corresponding to the first operated relay and available in a continuous direction of car travel over those in a control for an opposite direction of car travel.

3. An electric elevator system comprising an elevator car, a plurality of relays, two for each of the intermediate floors and one for each of the top and bottom floors, said relays organized in groups for relative opposite car travel direction control, the relay for the top floor a member of one group and the relay for the bottom floor a member of the second group, the relays of one group effective for stopping the car at the floors corresponding thereto in one direction of car travel and those of the second group in the opposite direction of car travel, a relay controlling circuit, the relays of each group each when operated remains in operated position until normalized by the car reaching the floor corresponding thereto, a pair of alternately operated direction control maintaining switches each responsive to an operated relay of one group and remains in operated position until all of the operated relays of its group have been normalized and means for each floor actuated by the car upon reaching each of the floors for normalizing an operated relay corresponding to the floor, stopping the car and reconditioning the system for restarting the car in a continued direction to respond to the operated relays in the floor order regardless of the order in which the relays were operated, a pair of stationary contacts in continuous arrangement corresponding to each floor, one in circuit connection with a floor relay of one group and the second with a floor relay of a second group, and a contact carrier moving in relation with the elevator car having a brush for each pair of stationary contacts for governing the controlling circuit between the push button and relays for giving preference to relays of one group corresponding to the first operated relay and available in a continuous direction of car travel over those in a control for an opposite direction of car travel.

4. An electric elevator system comprising, an elevator car, floor relays organized in groups for relative opposite direction car travel control, each relay of each group responsive for a floor and when operated remains in operated position until normalized by the car reaching the floor in an appropriate direction of car travel for which the relay is responsive, a direction maintaining switch, one for each group of relays responsive to all of the relays of the group and when operated retains its operated position as long as there is a relay of its group in operated position, adapting when the car has once started in a certain direction to continue that direction and answer all calls for floors available in that direction for which relays of one group have been operated, and a carrier relatively traveling with the car carrying brushes one corresponding to each floor and a pair of stationary conductors corresponding to each floor for carrier brush engagement for rendering the relays of one group corresponding to the floors responded to and passed by the car in a continued direction of car travel ineffective for car control and conversely rendering the relays of the second group for those floors effective for response in reverse continued direction of car travel.

5. An electric elevator system comprising, an elevator car, floor relays organized in groups for relative opposite direction car travel control, each relay of each group responsive for a floor and when operated remains in operated position until normalized by the car reaching the floor in an appropriate direction of car travel for which the relay is responsive, a direction maintaining switch, one for each group of relays responsive to all of the relays of the group and when operated retains its operated position as long as there is a relay of its group in operated position, adapting when the car has once started in a certain direction to continue that direction and answer all calls for floor available in that direction for which relays of one group have been operated, and a carrier relatively traveling with the car carrying brushes one corresponding to

each floor and a pair of stationary conductors corresponding to each floor for carrier brush engagement for rendering the relay of one group corresponding to the floors responded to and passed by the car in a continued direction of car travel ineffective for car control and conversely rendering the relay of the second group for those floors effective for response in reverse continued direction of car travel, and means for normalizing each operated relay, each with the approach of the car to the floor for which the relay corresponds for stopping car at the floor and reconditioning the system for restarting car to respond to operated relays in the floor order regardless of the order in which the relays were operated.

6. A control system for elevators, comprising "up" and "down" floor relays, one set for each of the intermediate floors served, and a single relay respectively for relative alternate car direction control for the top and bottom floors, said relays selectively energized for a car control to respond to an operated floor push button and a traveling switch device in circuit alternately with either of said relays for each floor and for corresponding relay control of all floors available in a continuous direction of car travel after starting in one direction before a reversal of the car travel can be effected, said switch device constituting a pair of stationary conductors corresponding to each floor and a carrier moving relatively with the car having a brush corresponding to each floor for engagement with the corresponding pair of stationary conductors.

7. A control system for elevators, comprising "up" and "down" floor relays, one set for each of the intermediate floors served, and a single relay respectively for relative alternate car direction control for the top and bottom floors, said relays selectively energized for a car control to respond to an operated floor push button and a traveling switch device in circuit alternately with either of said relays for each floor and for corresponding relay control of all floors available in a continuous direction of car travel after starting in one direction before a reversal of the car travel can be effected, said switch device constituting a pair of stationary conductors corresponding to each floor and a carrier moving relatively with the car having a brush corresponding to each floor for engagement with the corresponding pair of stationary conductors and switch devices in circuit each with a respective relay operated by the car upon reaching the floor called for deenergizing its relay.

8. A control system for elevators, comprising "up" and "down" floor relays, one set for each of the intermediate floors served, a single relay respectively for relative alternate car direction control for the top and bottom floors, said relays selectively energized for a car control to respond to an operated floor push button, a traveling switch device in circuit alternately with either of said relays for each floor for corresponding relay control of all floors available in a continuous direction of car travel after starting in one direction before a reversal of the car travel can be effected, said switch device constituting a pair of stationary conductors corresponding to each floor and a carrier moving relatively with the car having a brush corresponding to each floor for engagement with the corresponding pair of stationary conductors, a switch device in the hatchway one for each relay normally in circuit therewith operated by the car upon reaching the floor called for deenergizing the relay, and a second switch device in the hatchway, one for each relay normally and combining therewith for control of a motor control suited for stopping the car upon arrival of the car at the floor for which call has been made.

9. A control system for elevators, comprising a relay respectively for each floor for dispatching a car in one direction, a relay respectively for each floor for dispatching the car in an opposite direction, said relays selectively energized for a car control to respond to an operated floor push button and a traveling switch device in circuit alternately with the relays of each floor and of the corresponding relays for the floors ahead in a direction in which the car must travel under the control of the first operated relay, before the relays for a reverse car direction control are effected for direction control, said switch device constituting a pair of stationary conductors corresponding to each floor and a carrier moving relatively with the car having a brush corresponding to each floor for engagement with the corresponding pair of stationary conductors.

10. An elevator control system, comprising "up" and "down" direction relays, one or the other of which is energized depending upon the direction the car has to travel to respond to an operated push button, "up" and "down" motor drive control switch devices in circuit controlled by the corresponding direction relays, and a traveling switch device having motion which is in copy of the car travel for governing the operation of the corresponding relays for floors ahead in the direction of car travel to respond to all floors available in one direction before car travel is reversed, said switch device constituting a pair of stationary conductors corresponding to each floor and a carrier moving relatively with the car having a brush corresponding to each floor for engagement with the corresponding pair of stationary conductors.

11. An automatic electric control system for elevators, comprising, a plurality of relays, two for each of the intermediate floors, and one for each of the top and bottom floors, said relays organized in groups for relatively opposite car travel direction control, with the relay for the top floor a member of one group and the relay for the bottom floor a member of the second group, the relays of one group effective for starting, direction, and stopping control of the car in one direction of travel and those of a second group for opposite direction of car travel, push button operated and controlling circuits for said relays, the relays when push button operated remain in operated position until the controlling circuit thereof is cut off by the car reaching the floor corresponding thereto, mechanically operated switches for opening the controlling circuit of said relays, a switch device having a contact carrier, one contact for each floor, traveling correspondingly with the travel of the car, stationary contacts for each traveling contact, each of a length approximately corresponding to the full direction of travel of the carrier, said stationary contacts sub-divided for alternate circuit control to the relays of a corresponding floor to give preference to calls for the first direction over calls for the opposite direction, and a pair of alternately operated direction control maintaining switches each responsive to an operated relay of one group and remaining in operated

position as long as a floor relay of its group remains in operated position.

12. An automatic electric control system for elevators, comprising, a plurality of relays, two for each of the intermediate floors, and one for each of the top and bottom floors, said relays organized in groups for relatively opposite car travel direction control, with the relay for the top floor a member of one group and the relay for the bottom floor a member of the second group, the relays of one group effective for starting, direction, and stopping control of the car in one direction of travel and those of a second group for opposite direction of car travel, push button operated and controlling circuits for said relays, the relays when push button operated remain in operated position until the controlling circuit thereof is cut off by the car reaching the floor corresponding thereto, mechanically operated switches for opening the controlling circuit of said relays, a switch device having a contact carrier, one contact for each floor, traveling correspondingly with the travel of the car, stationary contacts for each traveling contact, each of a length approximately corresponding to the full direction of travel of the carrier, said stationary contacts sub-divided for alternate circuit control to the relays of a corresponding floor to give preference to calls for the first direction over calls for the opposite direction, said carrier also serving to trip said mechanically operated switches for car stopping control, and a pair of alternately operated direction control maintaining switches each responsive to an operated relay of one group and remaining in operated position as long as a floor relay of its group remains in operated position.

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