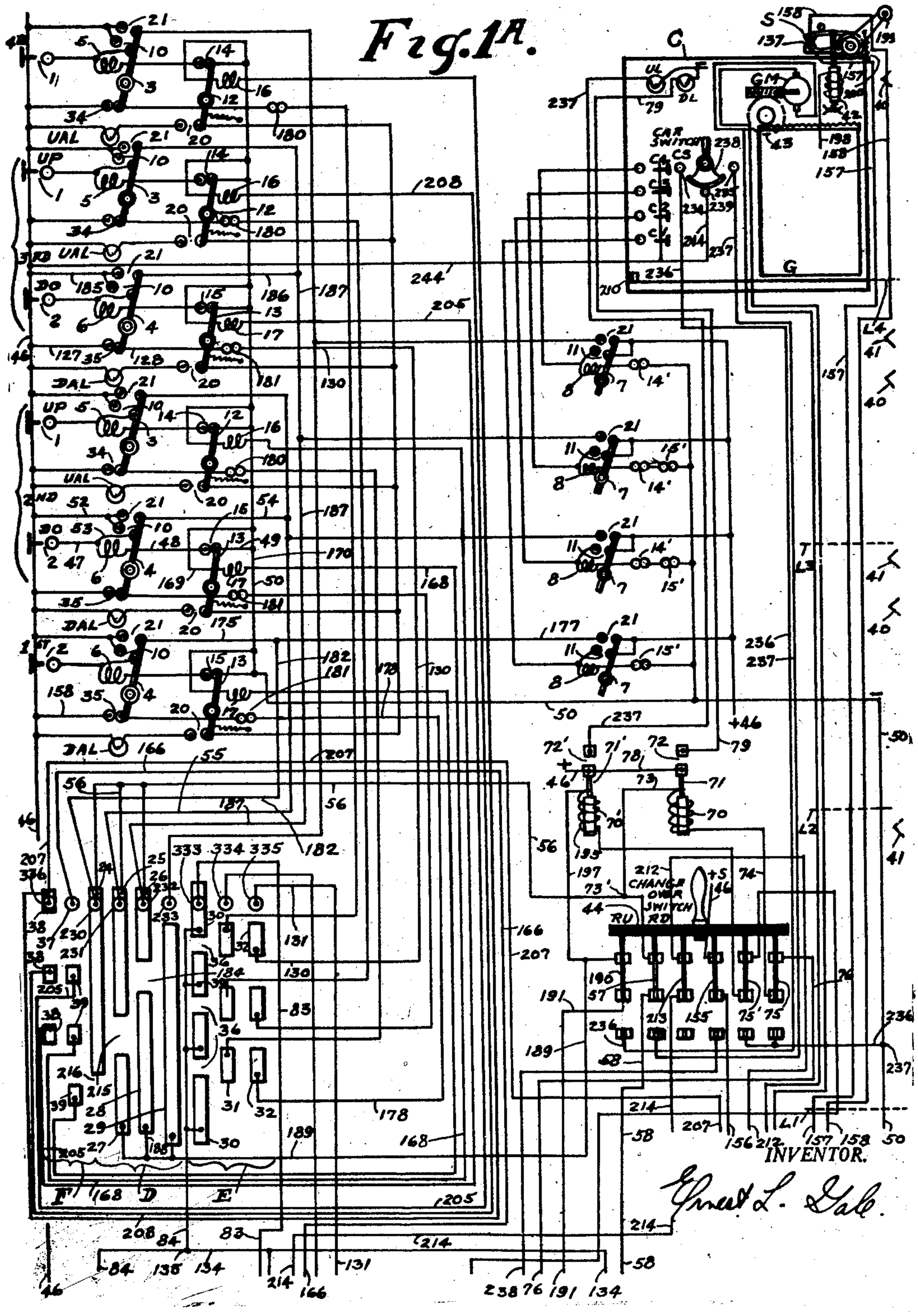
June 5, 1934. E. L. GALE 1,962,009

SYSTEM OF CONTROL FOR ELEVATORS

Filed July 31, 1930 3 Sheets-Sheet 1

Fig. 1A.



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SYSTEM OF CONTROL FOR ELEVATORS

Filed July 31, 1930 3 Sheets-Sheet 2

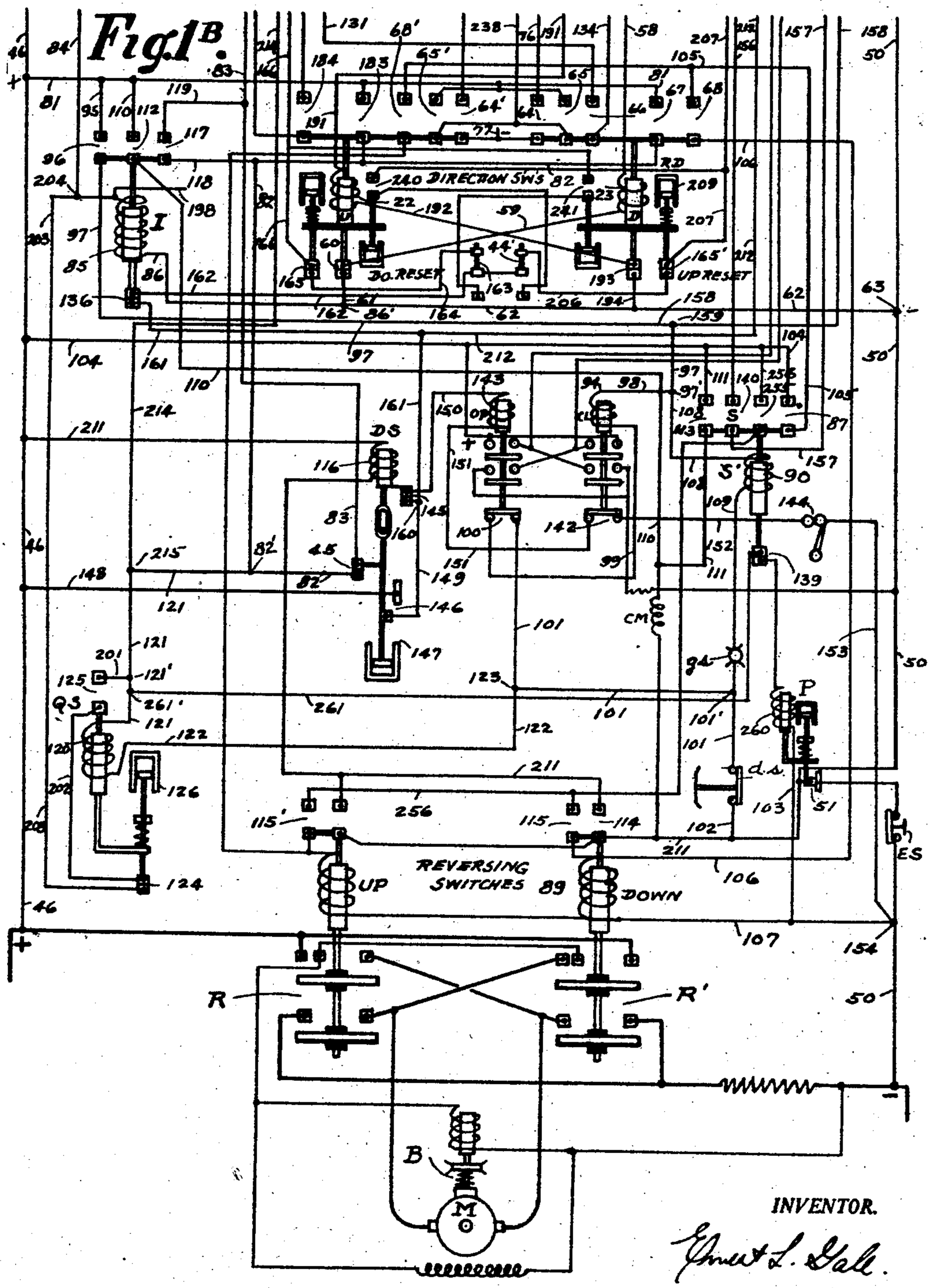

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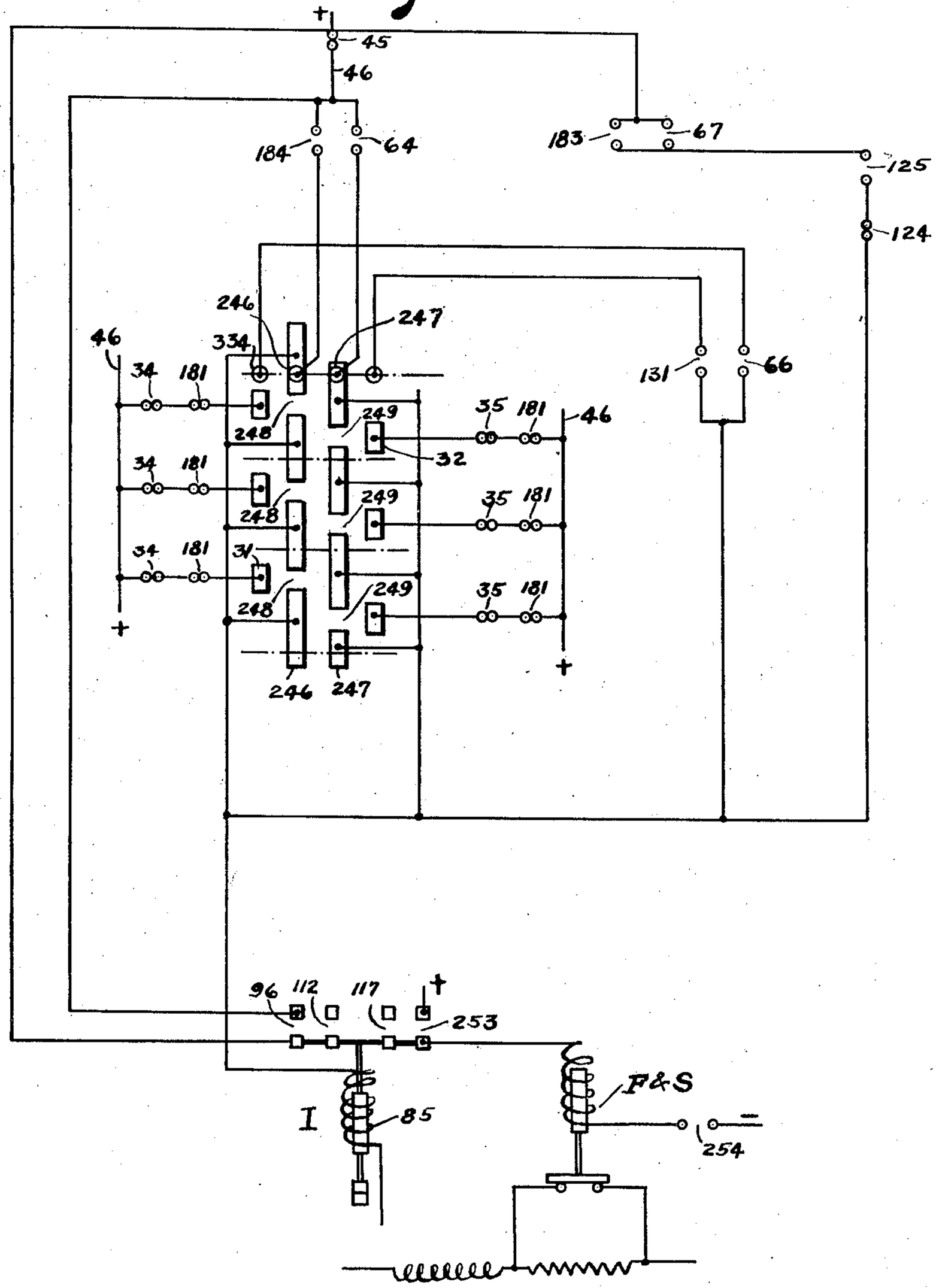
Fig. 2.



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UNITED STATES PATENT OFFICE

1,962,009

SYSTEM OF CONTROL FOR ELEVATORS

Ernest L. Gale, Yonkers, N. Y., assignor, by mesne assignments, to The Gurney Elevator Co., Honesdale, Pa., a corporation of Pennsylvania

Application July 31, 1930, Serial No. 472,003

42 Claims. (Cl. 187—29)

My invention relates to a system of control for elevators.

The objects of the invention reside in various features summarized as follows:—

First.—A push-button control system having up and down control means or push-button switches at each of the intermediate landings and one push-button at each end landing; also a single push-button switch for each landing, located within the car. Any push-button is effective by only a single push thereof to register a call by setting its floor-relay at any time regardless of the direction of car movement or position of the car at the time it is pushed. Actuation of either the up or down push-button for any landing can initiate movement of the car toward its landing from either direction and the car responds to a farthest actuated button regardless of whether it is an up or down button, before reversal of car movement is normally effective in response to actuated buttons in the other direction.

Second.—A selector mechanism having combined functions both to cause the car to run and to intercept or stop it at landings for which calls are registered and being in the form of a commutating machine. The commutating machine in principle consists of means which energize a car running circuit to cause the car to run said means operating to successively and momentarily open said running circuit as the car progresses in its travel and additional means are provided whereby the running circuit is either re-established by the first named means if a call is not registered for the landing corresponding to such point of opening, or is interrupted or broken if a call is registered.

The arrangement is such that the car will be caused to stop or to be intercepted successively at landings in their natural order, in response to registered calls from within the car and from the landings regardless of the order in which the calls are registered.

The car, when moving upwardly, is intercepted only by actuated up push-buttons, excepting in the event that a down button is the farthest-up actuated button and in such case, said down button causes the car to stop at its landing. The car when moving downwardly is intercepted only by down push-buttons, excepting in the event that an up button is the farthest-down actuated button, in which case, said up button causes the car to stop at its landing.

Third.—A dual system of control in which the landing and hall push-button switches have both a start and intercepting function in the matter of controlling the car, or on the other hand, the system can, by changing the position of a throw-over knife switch, be controlled by a car operator through control of a car switch within the car by means of which the car can be started, stopped and reversed at will and in which case the car and hall push-button switches retain their function to intercept the car, but their function to start the car is rendered inoperative, such start being solely under control of the car operator from within the car. The hall and car push-button switches are effective automatically to intercept the car while at the same time the operator holds the car switch in "on" or running position and a call cannot be defeated or skipped by so holding the car switch over.

With this arrangement, the operator has complete control of the car and can stop it at any point at will merely by returning the car switch to "off" position, and furthermore, he can at will, start the car from any point of stopping between the limits of car travel, in either direction.

Fourth.—An elevator control system complete within itself and omitting certain elements of the dual control system so that the push-buttons have a function only to stop the car but have no function to control its starts, nor the up and down indicating lights within the car, and an operator within the car has complete control of the car to start, stop and reverse it at will at any point within the limits of car travel.

Fifth.—A car gate and means comprising an electric motor to actuate same automatically to open position each time a stop is made at a landing in response to a push-button, but the gate remains closed if the car is stopped manually by an emergency stop button within the car. The car gate remains in open position when the car has stopped in response to the last call. However, until such last call is answered, the gate operating motor, as an incident to each stop of the car, is energized to cause automatic closure of the car gate as soon as the hoistway door is closed and such closure of the gate in each instance re-starts the car. If a hall passenger, who has registered a call, does not use the car, in which case the hoistway door will not be opened, the car gate motor will be energized to cause automatic closure of the car gate at the expiration of a pre-determined period of time to cause re-start of the car in response to remaining registered calls.

When on car switch operation, the car gate operating motor automatically opens the gate whenever the car is automatically intercepted in

response to registered calls made by the car or hall push-buttons, and whenever the car is stopped as by the car operator returning the car switch to "off" position. Furthermore, when on car switch operation, closure of the car gate by the gate operating motor, is under sole control of the car operator who by operation of the car switch to start the car in either direction, causes immediate closure of the car gate and closure of the latter initiates start of the car in the direction determined by the position of car switch, or if the car switch remains in "on" position during the stop period, the car gate is caused to be closed immediately as soon as the hoistway door is closed.

Sixth.—One "up" and one "down" light within the elevator car, operating one at a time in accordance with direction of car movement when the system is operating on the push-button alone, to give indication of the direction in which the car will proceed in response to unanswered calls. When on car switch operation, the "up" light goes on immediately as soon as a push-button for a landing above the car is pressed, and the "down" light goes on immediately as soon as a push-button for a landing below the car is pressed. When the "up" light becomes extinguished, this indicates to the car operator that the car has reached the farthest-up landing for which a call is registered and when the "down" light becomes extinguished, this indicates to the car operator that the car has reached the farthest-down landing for which a call is registered.

Seventh.—One "up" and one "down" light located at each intermediate landing and one light located at each end landing, controllable by the re-set relays for the floor-relays or call registering means, to flash momentarily, say for a period of 6 or 8 seconds, one at time in accordance with the direction of car travel and only at the landing stopped at, to give indication to the waiting hall passenger of the arrival of the car at the landing and the direction in which the car will proceed. In the event that the car has reached the farthest landing in one direction for which a call is registered, the two lights at said landing will go "on" or light up successively; that is, a few seconds apart, the first light to go "on", indicating the direction in which the car is moving in its approach to said landing, and the second light to go "on", in which case both lights glow at the same time, indicates that there is no registered call which will cause the car to proceed in the same direction as when approaching the landing, or in other words, it indicates that the car has reached the farthest landing in the direction indicated by the first light to go "on" and for which a call is registered.

Eighth.—A protective arrangment for the control system comprising a time switch which becomes effective to cut off all current supply to the control system, which in effect means among other things, that all registered calls are cancelled, if for example, the car does not start when a pre-determined time period has elapsed, in response to a registered call and which condition might be due to the car gate sticking and failing to close, or it may be due to a landing door being left in open position.

Ninth.—Three (3) sets of apparatus each with distinct functions, in the form of a commutating machine having fixed contact strips or segments and brushes, all three (3) sets arranged as a unitary structure, one (1) set functioning to control the running and intercepting circuits, the second set to control directional circuits for the car and indicating lights and the third set to control re-set floor-relays associated with the push-button control floor-relays which register calls.

Tenth.—A time-opening switch effective to maintain the re-set relay corresponding to the floor-relay which causes stop at its landing, energized during a substantial portion of the stopping period at a landing to prevent registration of a call during such period by pressure of the push-button which caused the stop at its associated landing and until re-start of the car is effected.

In the accompanying drawings Figs. 1A and 1B are to be read together, and illustrate in a diagrammatic manner, an elevator control system arranged in accordance with the present invention, and Fig. 2 illustrates diagrammatically a construction and arrangement of a commutating machine for a multi-speed elevator.

Referring now more particularly to Figs. 1A and 1B, and elevator car C is adapted for operation in any well known manner by a hoisting motor M provided with a usual electro-mechanical brake mechanism B.

The system herein described is arranged for the purpose of illustration for four landings L1, L2, L3 and L4 in which case there is one push-button at the upper and lower landings designated 1 and 2 respectively, and an up and down push-button 1 and 2 respectively, at each of the intermediate landings. Within the car there is one push-button for each landing, designated C1, C2, C3 and C4.

Up and down floor-relays of a well known type are designated 3 and 4 respectively, they being set by energization of their windings 5 and 6 respectively in response to actuation of their associated landing buttons, to register calls at any time regardless of direction of car movement and position of the car at the time they are actuated. An additional set of floor-relays 7 are set by energization of their windings 8 in response to actuation of their associated car buttons.

The push-buttons are required to be actuated only momentarily to set the floor relays to register calls and the floor-relays are maintained in actuated position to keep the calls registered until response of the car thereto by the provision of a self-holding circuit for each relay controlled by its self-holding contacts 10. A similar self-holding circuit controlled by self-holding contacts 11 is provided for each floor-relay 7. Re-set relays 12 and 13 control the re-set operation of the "up" and "down" floor-relays respectively, by open-circuiting their normally closed contacts 14 and 15 respectively, thus, to open the self-holding circuits for their associated floor-relay windings. Operating windings 16 and 17 are provided for the "up" and "down" re-set relays respectively.

The re-set relays 12 and 13 are each provided with an additional set of normally closed contacts 14′ and 15′ respectively, both sets in series being in the self-holding circuit of the associated car relay winding 7. This arrangement in effect means that the operation of either an "up" or "down" reset relay for a landing, in addition to setting its associated floor-relay, also re-sets an associated car relay 7. These additional contacts 14′ and 15′ are shown disassociated from the re-set relays as a matter of convenience in the arrangement of circuits.

Up and down lights, UAL and DAL respectively, at each intermediate landing and one at each

end landing are controlled by normally-open contacts 20 of their associated reset relays to indicate car arrival, and also the direction in which the car will re-start from the landing and also another indication hereinafter described.

Each of the floor-relays 3, 4 and 7, are provided with normally-open contacts 21. These contacts and associated circuits initiate start of the car by energization of the up and down direction switch windings 22 and 23, depending on the position of the car with respect to the landing for which the push-button is actuated and such relation as is well known is established by the directional selector embraced by the bracket D. The directional selector is in the form of a commutating machine and for a four landing system consists of four vertical rows of fixed segments or contact strips, one row for each landing. The segments 24, 25 and 26 may be termed "down" segments and the segments 27, 28 and 29 are "up" segments and a dead zone or segment 215, separates the "up" and "down" segments of each landing.

Brushes 230, 231, 232 and 233 are caused to travel in accordance with position of the car but at a reduced rate of movement, by any suitable and well known driving connection (not shown) with the car or hoisting mechanism.

The directional selector functions to direct current to the down direction switch winding 23 in response to actuation of either up or down landing push-buttons and to car buttons for landings below car position and to the up direction switch winding 22 in response to actuation of either up or down landing push-buttons and to car buttons for landings above car position. The directional selector together with the contacts 21 maintain direction for car movement through their control of the direction switch until the car has reached the farthest landing for which either an up or down button is pressed.

Coming now to the elements which will be termed combined car running and intercepting control elements, they comprise normally-closed or back-contacts 34 associated with each "up" floor-relay, and normally closed or back-contacts 35 associated with each "down" floor relay. Each car relay 7 for the intermediate landings is provided with two sets of these normally closed back-contacts, one set 180 in series with the up by-pass contacts 34 and the other set 181 in series with the down by-pass contacts 35 of the associated up and down floor-relays 3 and 4 respectively. The car relays 7 for the end landings are each provided with only a single set of these normally closed back-contacts, one set 180 for the fourth landing, in series with the associated back-contacts 34, and the other set 181 for the first landing, in series with the associated back-contacts 35.

These contacts, together with the commutating mechanism or floor selector embraced by the bracket E constitute what may be termed a combined car running and intercepting or stop control, so-called because they, within themselves, perform a double function; first—to energize a car running circuit to cause the car to run, and second,—to initiate the interception in response to registered calls for stop of the car.

This construction and arrangement clearly differentiates over other known systems which employ a primary circuit as the car running circuit, and a secondary system of circuits together with contact mechanism to energize such secondary circuits to initiate stops of the car, such secondary circuits having a function only to stop the car, but having no function to cause the car to start or run as in the present invention.

The floor stop selector E consists of three vertical rows of fixed segments or contact strips 30, 31, and 32 and traveling brushes 333, 334 and 335 to co-operate respectively with said rows of fixed segments. The segments 30 are relatively long and the segments 31 and 32 are relatively short. The arrangement is such, that with the car at any landing, the brush 333 is substantially midway between the end of the segment 30 corresponding to such landing and said brush and segment energize a circuit herein after to be described which causes the car to run. The brush 334 is an up brush and the brush 335 is a down brush, and these brushes are rendered alive one at a time in accordance with direction of car movement.

As the car progresses and reaches a point substantially midway between adjacent landings, the brush 333 is then at a dead zone or gap 36, which may be in the form of a filler-in or dead segment and the brushes 334 and 335 engage segments 31 and 32 respectively just prior to the brush 333 reaching the dead zone and until brush 333 engages an adjacent segment 30. The opening of the running circuit at the dead zone or segment is only momentary.

As a result of this arrangement, the brush 333 and segments 30 function successively and momentarily to open the car running circuit at the dead zones 36 and the running circuit at such times is maintained without interruption by a by-pass around said dead zone, including the brush 334 and a segment 31 or the brush 335 and a segment 32, (depending on the direction of movement of the car) and back-contacts 34 and 180 in series or the back-contacts 35 and 181 in series, (depending on the direction of movement of the car) of the floor-relays corresponding to the landing being approached if such relays are not operated prior to the brush 333 having passed the dead zone in which case the car running circuit is transferred from said by-pass elements back again to a brush 333 and the next segment 30 so that in effect the car will not be intercepted at landings if calls corresponding to direction of car movement are not registered. On the other hand the car will be automatically stopped or intercepted successively at landings for which calls are registered by hall buttons which correspond to direction of car movement and at any landings for which calls are registered by the car buttons because in such case the car running circuit is open as each dead zone 36 is reached and also at the by-pass around same for each of the landings for which such calls are registered.

Traveling brushes 336 and 37 co-operate respectively with two rows of segments 38 and 39 embraced by the bracket F to control circuits for the up and down re-set windings 16 and 17.

It will be observed from the description thus far given, that the three sets of elements, viz; the direction selector D, the start and stop floor selector E, and the re-set control mechanism F are in the form of a commutating machine which forms a unitary structure and their associated movable brushes may all be carried by a single brush carrier (not shown) to be movable together as a unit in accordance with movement of the car.

The commutating machine may be located remote from the car and its brushes actuated in

accordance with the position of the car by any well known type of driving mechanism (not shown).

With the present arrangement the selector mechanism E initiates the interception or stop of the car, before the car actually reaches what is termed the stopping distance from the landing or in other words, when the car is substantially midway adjacent landing and the actual stop is effected by an auxiliary means in the form of a normally closed stop switch S on the car through co-action with up and down peaked stop cams 40 and 41 respectively located in the hoistway, there being two of these cams for each intermediate landing and one for each end landing. Of course, if the selector mechanism is directly driven from the car by a chain, or tape and reel or in any other well known manner, the selector mechanism is at all times kept in synchronism with the car and in such case, the layout of the selector segments can be arranged so that the selector effects the actual stop of the car and in such case the stop switch S and co-operating stop cams are not needed.

However, if the selector is driven from some moving part of the machine remote from the car as is common practice, it cannot be relied upon to give a stop of desired accuracy and hence it becomes desirable to use the stop switch S and co-operating stop cams in which case the selector initiates the stop operation in response to registered calls, and the stop switch S is merely an auxiliary stop element to effect final and accurate stop. The stop switch may be of the retractive type having a winding 42 to retract same while the car is running, or the winding may be dispensed with, as for example, if the car speed is not in excess of about 150 feet-per-minute, which is about the maximum for which striking elements may be safely used, and in such case the stop cams will open-circuit the stop switch contacts but without effect unless the selector has first initiated certain preparatory operations which results in the switch S causing stop when actuated by a stop cam.

A car gate is designated G and a reversible electric motor GM located on the car is adapted to open and close the gate through any of the well known types of leverage or gearing such as 43 for example.

Electro-magnetically operable switches OP and CL control said gate motor, respectively to open and close the gate. A car gate switch is designated *gs*; and a single door switch *ds* in operative association with a cam on the car operates in a well known manner to act as a tell-tale as to whether the landing door is closed and locked and when in such condition the door switch is closed, but unlocking and opening of the door opens said switch.

A cam magnet CM functions to move the door switch bodily with the cam and so retract the latter so as to prevent possible engagement of the well known door lock elements (not shown) as the car passes landings not stopped at; a change-over knife switch is designated 44, and when in position as shown, the system operates as a usual push-button control intercepting system without an operator on the car and the push-buttons function both to start and to intercept the car and to control indicating lights within the car, and by throwing the switch over to its other position, the function of the push-buttons to control start of the car is rendered ineffective but they retain their function to intercept or stop the car and to control said lights within the car and the matter of starting, stopping and reversing the car at will is given over to the car switch CS; an electro-magnetically operable switch I is responsive to the selector E and other elements to start and initiate stop of the car; and electro-magnetically operable time switch QS is what may be termed a quick re-start switch, so called because it functions to cause closure of the car gate as soon as a landing door is closed and closure of the gate re-starts the car immediately. On the other hand an additional electro-magnetically operable time switch DS is provided which allows for reasonable delay of a passenger in the matter of opening the landing door but if at the expiration of about 8 or 10 seconds, say for example, which may be termed the stopping period, the landing door had not been opened, said switch recloses its time-closing contacts 45 to cause closure of the car gate which causes re-start of the car; that is, if there is an unanswered call registered at some other landing.

The time switch DS obviously prevents hold-up of the car at any landing at which an intending passenger registers a call but does not use the car, or does not open the landing door prior to the reasonable period allowed for such purpose; an electro-magnetically operable switch S' is responsive to the switch I to start the car and to stop the car in response to actuation of the stop switch S subsequently to the initiation of the stop by said switch I, and it is controlled by certain interlocking circuits hereinafter described to prevent start of the car until the car gate is closed, and the hoistway door closed and locked; an electro-magnetically operable switch P is what may be termed a protective switch so called by reason of its function to open circuit at its time-opening contacts a certain circuit which in effect cancels all registered calls and cuts off the current supply from the entire control system in the event that the car fails to start after a period of about 30 seconds in response to a registered call which failure may be due to the car gate sticking in open position, or to a hoistway door being left in open position; an emergency switch to be located within the car is designated ES; up and down indicating lights in the car are designated U1 and DL respectively, and at each intermediate landing is one up and one down car arrival light UAL and DAL respectively and one at each end landing. The lights UAL and DAL may be located within the push-button box or separate therefrom in a convenient location for observation by the passengers at the landings. There is also one light at the lower terminal landing, designated DAL, and one at the upper terminal landing designated UAL; up and down electro-magnetically operable reversing switches to control hoisting motor M are designated R and R' respectively.

Having thus described the various elements, their operation will now be described.

With the elements in the position as shown, the car is at rest at the fourth landing, the car gate is in open position, the door contacts *ds* are closed indicating that the door at the fourth landing is closed and locked, there are no calls registered and the change-over switch is in position to render the system effective so that the car can be started and intercepted by the push-button system of circuits, and the control of the car by car switch operation is rendered ineffective.

Assume now that an intending passenger at the second landing desires to go down and ac-

cordingly actuates the down push-button 2 at said landing and during travel of the car downwardly and sometime before it is substantially midway between the second and first landing, a passenger at the first landing actuates the button thereat. The down floor-relay switch 4 operates in response to actuation of the push-button at the second landing and so registers the call and by so doing opens its back-contacts 35 to condition the system to cause interception of the car at the landing, and closes its top contacts 21 to cause closure of the down direction switch D thus establishing direction for car movement. Top contacts 10 are also closed to complete a self-holding circuit for the floor-relay winding 6 which in effect keeps the call registered independently of the push-button until response of the car thereto.

A circuit completed by the down push-button 2 at the second landing may be traced as follows:— mains from any suitable source of supply are designated + and —, from + wire to wire 46, down push-button 2 for second landing, floor-relay winding 6, wire 48, through normally closed re-set contacts 15, wire 49 and thence to the line by way of a common return wire 50 which includes the time-opening contacts 51 of the protective switch P.

The self-holding circuit for the floor-relay winding may be traced from the feed wire 46, wire 52, self-holding contacts 10, wire 53, thence through relay winding 6 to the line by the circuit just traced above.

Starting contacts 21 complete a circuit for the winding 23 of the down direction switch D which may be traced as follows:— from feed wire 46, wire 52, contacts 31, wires 354 and 355, which connect with the traveling brush 231 of the directional selector, through the down segment 25 for the second landing, wire 56 through the change-over switch by way of the blade 57, wire 58, through winding 23, wire 59, back-contacts 60 of the up direction switch, wires 61 and 62 to a junction 63 with the wire 50 which connects with the line by way of the protective contacts 51.

The down direction switch will now operate to close-circuit the top contacts designated 64, 65, 66, 67, 241 and 68 and to open the time opening contacts 165' and contacts 193. The contacts 64 complete a circuit for a winding 70 of a relay 71 which closes its contacts 72 to complete a circuit for the down indicating light DL within the car. A circuit 73 for the winding 70 is in parallel with the direction switch winding 23, it branching from the wire 56 at junction 73', thence through the winding 70, wire 74, to wire 76 by way of the knife switch 75, contacts 64 and wire 77 to be connected with the minus wire 50.

A circuit for the down light DL may be traced from a + wire 46, wire 78, contacts 72, wire 79, light DL to the line.

The contacts 67 complete a circuit for the winding 85 of the switch I which may be traced as follows:—wire 81 which branches from the feed wire 46, contacts 67, wire 82 through time-closing contacts 45, wire 83, to brush 333 of the selector E, segment 30 corresponding to the fourth landing, thence by a wire 84 to which all segments 30 are connected in parallel, through winding 85 of switch I, wire 86 to a junction 86' with wire 62 which connects with the line.

At this point it will be mentioned that the down reversing switch winding 89 cannot be energized to start the car downwardly unless and until the hoistway door is closed and locked and the car gate closed, and suitable interlocking circuits are provided to accomplish such safe guard. In carrying out this arrangement, contacts 87 of switch S', in series with the directional contacts 68 to control a circuit for the winding 89 of the down reversing switch, cannot be closed until the door switch *ds* and car gate switch *gs* are closed, said switches *ds* and *sg* being in series with an operating winding 90 of switch S'. The door-switch *ds* being closed, and also the top contacts 96, 112 and 117 of switch I, a circuit is now completed for the winding 94 of the switch CL which now closes to cause rotation of the gate motor GM in a direction to close the car gate and it is preferable and so arranged, that current is kept onto the motor while the car is running in which case the motor GM simply becomes stalled when the gate is in closed position against a suitable stop member 210.

A circuit for the winding 94 may be traced as follows:—wires 46, 81 and 95, contacts 96 of switch I, wires 97 and 98, winding 94 of switch CL, wire 99, through interlocking contacts 100 of switch *Op*, wire 101, door-switch *ds*, wire 102, to a junction 103 with wire 50, then to the minus line by way of the protective contacts 51 and emergency switch *es*.

The switch CL directs current to the armature of the gate operating motor in a manner well known which needs no detailed description, to cause same to rotate in a direction to close the car gate.

When the car gate is in closed position, it closes the car gate switch *gs* and thus a circuit is completed for the winding 90 of switch S'.

Contacts 87 of switch S' close to complete a circuit for the winding 89 of the down reversing switch as follows:—wires 46 and 104, contacts 87, wire 105, contacts 68 of the down direction switch D, wire 106, through winding 89 of the down reversing switch and thence by wire 107 to the line.

The down reversing switch R' will now close to cause release of the brake and to cause operation of the hoisting motor to operate the car downwardly in a well known manner which needs no detailed description.

The winding 90 of switch S' is connected in parallel with the winding 94 of switch CL by a wire 108 which branches from the wire 97 at junction 97', through winding 90, wire 109 which includes the car gate switch *gs*, to junction 101' with wire 101 and so on to the line by way of the door switch *ds* wire 102 to junction 103 and wire 50.

It will be observed now that the contacts 96 of the switch I close an initial feed for the windings 90 and 94 in parallel, and the switch S' closes its contacts 140 to complete a holding circuit for said windings and said holding circuit is controlled by the automatic stop switch S on the car. Hence the windings 90 and 94 in parallel, are controlled by parallel circuits one of which is controlled by the master switch I and the other by the automatic stop switch S. The holding circuit may be traced as follows:—from a plus wire 46 beginning at the knife switch 44 through knife switch blade 155, wire 156, contacts 140, wire 157, contacts 137 of stop switch S on car, wire 158 and then forms a junction at 159 with the initial feed wire 97, and extends from thereon through the windings 90 and 94 in parallel in a manner as traced hereinbefore.

The cam magnet CM is controlled by parallel wires 110 and 111 controlled by contacts 112 and 113 of the switches I and S' respectively.

When the down reversing switch closes, it closes auxiliary contacts 114. Closure of contacts 114 completes a circuit for the winding 116 of the time-switch DS by way of wires 46 and 211 and switch DS operates to open circuit at its contacts 45, the original feed for the winding 85 of the master switch I but the latter is now self-holding by way of its self-holding contacts 117 which by-pass the contacts 45 by way of wires 118 and 119.

A circuit for the winding 120 of the switch QS, branches from the feed wire 82 for the winding 85 of switch I at a junction 82' and extends then by wire 121, through winding 120, wire 122 to a junction 123 wire 101 and thence to wire 50 to minus line by way of the door-switch *ds*. The switch QS now operates to open-circuit the contacts 124 and to close-circuit the contacts 125, the contacts 124 being time-opening or in other words their opening is delayed by the action of a dash pot 126 which permits such opening in about 2 or 3 seconds.

It will be observed at this time that the circuit for the winding 120 of the quick-re-start switch QS is subject to the control of the door switch *ds* which means that said winding is de-energized whenever the landing door is unlocked which results in closure of the back-contacts 124 and opening of the top contacts 125, the purpose being described hereinafter.

From the description thus far given it will be observed that the switch I is in effect, a master switch so called because it operates in response to registered calls to initiate start of the car and also to initiate stop of the car at landings successively in their natural order regardless of the order in which the calls are registered.

We now have the car moving downwardly with all the brushes of the three commutating units D, E and F moving in synchronism with the car, and when the car is midway between the fourth and third landing, the feed for the winding 85 of the master switch I is opened momentarily at a dead zone 36 but is maintained without interruption by a by-pass circuit (because there is no down call registered at the third landing) around said dead zone by way of the down brush 335 segment 32 back contacts 35 of the third landing down floor-relay switch 4, and the feed is transferred back again to the brush 333 and an adjacent segment 30. By so maintaining energization of the winding 85 of the master switch I, the car will be kept running and will not stop at the third landing because there was no down call registered for said landing and the car will continue to the second landing. However, if the third landing down button had been actuated prior to the brush 333 passing said dead zone, the winding 85 will in such case be de-energized to cause opening of the switch I to initiate stop at the third landing, because the feed for said winding is open at both the dead zone and also at said by-pass-contacts 35 the latter being opened in response to manual actuation of the third landing down push-button.

The by-pass circuit around the dead zone 36 for the winding 85 as completed when the car is midway between the fourth and third landing may be traced as follows:—from wire 46, wire 127, back-contacts 35 of the third landing down floor-relay 4, wire 128, normally closed back-contacts 181 (which are associated with the floor-relay 7 responsive to the third landing car button, but are shown dis-associated from said relay for convenience), wire 130, a down segment 32 corresponding to the third landing, down brush 335, wire 131, contacts 66 of the down direction switch D, wire 134, junction 135 with wire 84 and the circuit thus far traced completes the by-pass and then extends by wire 84, through winding 85, wires 86, 62, and so on to the line in a manner as traced hereinbefore. The brush 333 and a segment 30 will not maintain the circuit for the winding 85 energized and in effect continue movement of the car downwardly and when the car is midway between the third and second landing the brush 333 engages a dead zone 36, and the by-pass circuit corresponding to the second landing around said dead zone, is open-circuited at the back-contacts 35 of the down floor-relay corresponding to the second landing said contacts being open-circuited as the result of the actuation of the down push-button at the second landing. The winding 35 is de-energized as a result of its self-holding circuit being open-circuited at the by-pass contacts 35 for the second landing, and the switch I will now open-circuit its top contacts 96, 112 and 117 and close its back contacts 136.

Opening of switch I in response to a registered call, in effect initiates stop of the car because of its opening at contacts 96, one of the parallel feeds for the winding 90, and the other parallel feed or holding circuit for said winding controlled by the stop switch S now controls the car etc., and when the car reaches the stopping distance from the landing the down cam 41 actuates said switch S to open said other parallel feed to de-energize the winding 90 and also the winding 94 in parallel therewith, and in this manner cause stop of the car by opening switch S' and causing the automatic opening of the car gate. The winding 42 of the stop switch S is connected in a circuit 198 in parallel with the winding 85 of the switch I, to be energized and de-energized simultaneously therewith. The winding 42 is energized to retract the stop switch with its contacts remaining closed so that its roller 199 will not engage the stop cam at landings not stopped at and when it is de-energized the switch is rocked by a spring 200 while at the same time its contacts remain closed, so that the roller 199 will be in position for engagement by the stop cam when the stopping distance is reached.

With the winding 94 of switch CL de-energized, the latter opens to discontinue the holding action of the gate motor GM, and the contacts 142 of switch CL close.

When the down reversing switch R' opens, it opens the contacts 114 to de-energize the winding 116 of the time switch DS and its contacts 145 close quickly but the closing of the contacts 45 and the opening of contacts 146 is delayed by a dash pot 147, and the latter contacts open a fractional part of a second prior to the lapse of the 8 or 10 second stop period as controlled by the re-start contacts 45. The contacts 145 and 146 now being closed complete a circuit for the winding 143 to cause operation of the reversing switch OP to control the gate motor GM automatically to open the car gate. The circuit may be traced as follows:—wire 46, wire 148, time-opening contacts 146, wire 149, contacts 145, wire 150, winding 143, wire 151, contacts 142, wire 152, gate limit switch 144, wire 153, to junction 154 with wire 50.

The switch OP closes to cause rotation of the gate motor GM in a direction to cause opening of the car gate and a limit switch 144 is adapted to de-energize said winding 143 to stop the gate motor when the gate reaches full open position.

The winding CM of the door lock mechanism is de-energized by opening of the contacts 113 of switch S' and said mechanism is thus conditioned so that the door-switch *ds* will be open-circuited only if and when the landing door is opened.

When the master switch I operates to initiate stop of the car, its back-contacts 136 close and when the down re-set brush 37 is on the second landing re-set segment 39 which does not take place until the second landing selector brush 231 is at the dead zone 215 (such relativity being important and necessary), a circuit is thus completed for the down re-set winding 17 for the second landing which results in opening the normally closed contacts 15 and 15', of the re-set relay 13 to open the self-holding circuits for their associated floor-relays 4 and 7 to re-set relay and also car relay 7 if it had been set. Since the time-opening contacts 146 do not start to open until final stop of the car is effected, and because of the fact that these contacts do not open until a fractional part of a second prior to the reclosure of the re-start contacts 45, the re-set winding 17 will be maintained energized throughout the entire period beginning when the brush 37 is on segment 39 (which takes place about the time when the stop switch S effects stop) and extending throughout the entire stopping period as controlled by the switch DS and ending when re-start of the car is initiated, or at any rate when the contacts 146 open so that the current supply for the re-set winding does not remain on indefinitely. By so maintaining the re-set winding 17 energized, it maintains its contacts 15 and 15' open-circuited and so prevents registration of a call by actuation of the second landing down button subsequently to the stop already having been initiated by a call already registered and until restart of the car is initiated and by so preventing registration of a call a possible false stop of the car is prevented.

The contacts 20 of the second landing down re-set relay 13 are closed throughout the entire stop period above mentioned to complete an energizing circuit for the down car arrival light DAL at the second landing which light indicates to the intending passenger at the landing the arrival of the car and the direction in which the car traveled in its approach to the landing and since only one light is on as distinguished from the two going on, indicates that the car will re-start in a down direction. The light DL within the car remains on during stop at the second landing and it also indicates by being on, that the car will re-start in the downward direction. Obviously if both lights are off within the car, that would indicate to the intending passenger that the car is controllable to travel in either direction from the second landing. However, since a call is registered at the first landing, the light DL remains "on" until the car reaches said landing, and is then extinguished because the car has reached the farthest landing down for which a call is registered.

Of course it is obvious that if the landing door is closed prior to the lapse of the period controlled by the time-switch DS, in which case the car start is initiated immediately by the quick start switch QS by energizing the winding 85 of the switch I, the latter will operate to open its back-contacts 136 and so open the energizing circuit for the second landing down re-set winding 17 to permit closure of the re-set relay contacts 15 and 15', and so condition the energizing circuits for the second landing down relay winding 6 and also the car relay winding 8 to enable said relays to function in response to their associated landing and car push-buttons to register a call. Under such condition, the re-set relay 13 will open its contacts 20 to cause the light DAL to go "out".

The energizing circuit for the winding 17 of the second landing re-set relay may be traced as follows:—the same as heretofore traced for the winding 143 of the switch OP to a junction 160 with wire 149 and branching therefrom by way of wire 161, back-contacts 136 of switch I, wire 162, blade 163 of a knife switch 44' which is to form a part of the knife switch 44 but shown separated therefrom for convenience, wire 164, time-opening back-contacts 165 of direction switch U, wire 166, down re-set brush 37 now in engagement with the down re-set segment 39 for the second landing, wire 168, re-set winding 17, wire 169 which forms a junction with the common return wire 50.

Assume now that the passenger at the second landing opens and recloses the door at the second landing and having boarded the car actuates the car button corresponding to the first landing thus to register a call by causing operation of the first landing car relay 7. We now have parallel feeds to the down direction switch winding 23, by way of parallel wires 175 and 177 connecting with brush 230 by way of wire 182. Operation of the car relay 7 opens the back-contacts 181 thereof shown in series with the back-contacts 35 of the first landing floor-relay which have already been opened because of a registered call from the push-button at the first landing. Since the contacts 35 and 181 are in series in a by-pass circuit 178 connecting with the first landing down segment 32, it is obvious that the opening of either set of contacts in response to actuation of their associated push-buttons for the first landing causes automatic stop of the car at the landing corresponding thereto.

The door switch *ds* is open-circuited by opening the door to open the circuit for the winding 120 of the quick re-start switch QS causing the latter to close its back-contacts 124 and open its top contacts 125. As soon as the landing door is closed and assuming further that this is all accomplished some seconds prior to the lapse of the time period allowed for re-start of the car by the other time switch DS, the winding 120 of the switch QS is energized by such closure of the landing door. The contacts 125 close quickly but the opening of the contacts 124 is delayed for about 2 seconds or so, and these two sets of contacts now complete an energizing circuit for the winding 85 of switch I which circuit is independent of the restart contacts 45 of the time switch DS. The circuit for the winding 85 as now completed by the quick re-start switch may be traced as follows:—the circuit is a by-pass around the re-start contacts 45 of switch DS and around the selector brush and segments 333 and 30 as follows:—branching from the wire 82 at the junction 82', wire 121 to junction 121', wire 201, contacts 125, wire 202, contacts 124, wire 203 to a junction 204 with wire 84 and through the winding 85 in a manner as traced hereinbefore. The winding 85 now being energized and with the down direction switch D remaining in closed position during stop at the second landing by reason of the feed established for its winding 23 from the first landing floor-relay contacts 21 as a result of the first landing push-button having been actuated as before mentioned, the switch I will now

close to cause automatic closure of the car gate and consequent re-start of the car in a down direction in the same manner as already described in detail.

It will be mentioned however that the 2 seconds allowed for the opening of the contacts 124 of switch QS allows sufficient time for the winding 85 to be energized thereby to close its self-holding contacts 117 and the subsequent opening of the contacts 124 divorces the winding 85 from such feed so that the control of the holding circuit for said winding is under control of the associated selector mechanism E and the call registering means.

The car is now moving downwardly from the second landing and when it is substantially midway between the second and first landing, brush 333 is at a dead zone 36 and since the by-pass circuit 178 around said dead zone is now open-circuited at the back-contacts 35 and also at the back-contacts 181, (either set, because the two sets are in series opening said by-pass circuit) the winding 85 of the master switch I is under such condition, open-circuited to cause opening of the switch I to initiate stop of the car which is finally effected by actuation of the switch S on the car and the car will be brought to a state of rest at the first landing and the car gate will be automatically opened in a manner as described hereinbefore and if all calls have been answered, the gate will remain in open position and will close in response to the first call registered.

Substantially at the time when the stop switch S engages the stop cam, the first landing directional selector brush 230 reaches a dead zone 216 on the first landing directional segment 24 which results in cutting off the supply of current from wires 175, 177, 182, 56, 58, etc. to the down direction switch winding 23 and the down direction switch will open. Since the winding 70 of relay 71 is in parallel with the winding 23, it will now be de-energized and as a result the relay 71 will open its contacts 72 and the light DL within the car will be extinguished.

If, during dispatch of the car downwardly in response to the second landing down push-button, the push-button at the first landing is actuated before stop is effected at the second landing, and assuming that the intending passenger at the second landing did not use the car, that is to say, he did not open the hoist-way door, the result is that the call is cancelled and the winding 120 of the switch QS remains energized by the circuit heretofore traced for it, thereby maintaining the quick restart contacts 124 of switch QS open so that the winding 85 of switch I does not receive its supply from such source to cause switch I to restart the car and under such condition the car will be restarted automatically at the expiration of about an 8 or 10 second stopping period by closure of the time-closing contacts 45 of switch DS which complete an energizing circuit such as hereinbefore traced for the winding 85 of switch I which operates in a manner as hereinbefore described to cause automatic closure of the car gate and consequent restart of the car which in this case is downwardly because of the call already having been registered at the first landing.

With this arrangement, if the intending passenger does not open the landing door, the car will remain at said landing only for a pre-determined period of time as controlled by the time switch DS and will be automatically re-started at the expiration of said period in response to a remaining call or calls.

The starting contacts 21 of both the up and down floor-relays for each intermediate landing are connected in parallel with their associated directional selector brushes 31, 32 for their associated landing which means that either the up or down push-button for each of said landings will control a circuit for the up direction switch winding 22 to initiate movement of the car upwardly if the car is below said landing, or will control a circuit for the down direction switch winding 23 to initiate movement of the car downwardly if the car is above said landing. For example:—assume that an intending passenger at the third landing, desiring to go down, accordingly actuated the third landing down button to register a call by setting the third landing down floor-relay 4 after the car had passed said landing and before stop of the car at said first landing. Under such condition the up direction switch winding 22 cannot receive current supply in response to the setting of the third landing down button for which a call is registered which landing, under condition as assumed, is the first landing, because its circuit is open at the back-contacts 193 of the direction switch D.

When the car reaches the first landing the down direction switch opens its top contacts and closes its back-contacts 193 to energize the up direction switch winding 22 to cause closure of the up direction switch. The stop at the first landing is completed and the car gate is automatically opened, and assuming that the first landing door has been opened and again closed and locked all within the 8 or 10 second stop period allowed by the time-switch DS the automatic closure of the car gate and start of the car upwardly will be initiated by the master switch I whose winding 85 will be energized by way of the time switch contacts 124 and 125 of switch QS and the direction switch contacts 183 which means that the car will re-start as soon as the first landing door is closed and without waiting for the lapse of the 8 or 10 second stopping period as controlled by the time switch DS.

With the car under dispatch upwardly under control of the down push-button at the third landing, the automatic stop at said landing under such condition is effected by opening of the up direction switch contacts 183 to de-energize the winding 85 of the master switch I and so initiate stop of the car, etc. in a manner as hereinbefore explained it being obvious and understood of course that the up direction switch winding circuit is opened when the third landing directional selector brush 232 engages the dead zone 184 which takes place substantially at a time when the car is at the stopping distance from the landing.

With the car moving upwardly under control of the down third landing button, the third landing by-pass circuit is opened at the back-contacts 35 of the floor-relay 4 for said landing, but without effect because with the car going upwardly only the up brush 334 and associated segments 31 are rendered effective as for example by closure of the up direction switch contacts 184 and with only the down button pressed these elements are without avail to cause stop of the car at the third landing but as described above, in such case, the stop is effected at such landing by opening of the up direction switch contacts 183.

If the push-button 1 at the fourth landing is

actuated prior to the car reaching the stopping distance of the third landing or in other words before the up direction switch opens, the car will not make the stop at the third landing in response to the down call thereat but will continue on and be automatically stopped at the fourth landing. This is so because closure of the fourth landing floor-relay contacts 21 establishes a feed circuit for the winding 22 of the direction switch U which keeps the switch closed until the car reaches the fourth landing and by so doing, prevents its contacts 183 from opening to cause stop at the third landing. A circuit for the up direction switch winding 22 as completed by registration of the call by closure of the third landing floor-relay 4 after the car when going down had passed the third landing may be traced as follows:—wire 46, wire 185, contacts 21, wire 186, wire 187, directional selector brush 232, which is in engagement with the up directional selector segment 28 when the car is below the third landing, wire 188 to a common up wire 189, through change-over switch 44 by way of blade 190, wire 191, through direction switch winding 22, wire 192, back-contacts 193 of down direction switch, wire 194, wires 62 and 50 etc. to the line.

The up light UL within the car is on when the car is under dispatch upwardly and until it reaches the farthest-up landing for which a call is registered this being so because the winding 195 of the relay 196 which controls the light UL is connected in a circuit 197 in parallel with the circuit just traced for the winding 22 of the up direction switch.

Let it be assumed now, that the third landing push-button hereinbefore referred to as dispatching the car upwardly is the farthest up actuated button. The car is automatically stopped at said landing in response to said button, the up light within the car is extinguished and both the up and down re-set windings 16 and 17 will be energized to actuate both re-set switches to open their top contacts 14 and 15 respectively and also their top contacts 14′ and 15′ in series with the car floor-relay 7 for the third landing.

With this arrangement and only a condition that the car is at the farthest landing for which a call is registered and regardless of whether it is an up or down call, or both, both the up and down floor-relays will have their holding circuits opened as will also the car relay 7 and this will insure re-set of all 3 relays for such landing.

Since the third or farthest-up landing for which an actuated push-button or buttons is now reached in which case both re-set relays 12 and 13 become effective to re-set their associated floor-relays 3 and 4 and also the car relay 7, said re-set relays will close-circuit their contacts 20 to complete energizing circuits for both lights UAL and DAL at the landing and the lights will flash and indicate to the intending passenger the arrival of the car and also the fact that the car has reached the farthest landing in one direction for which a call is registered and if one should go out and the other remain on, this would indicate that the car will restart in the direction indicated by the one remaining on and a light within the car will also give such indication, but if both landing lights are on and both lights within the car are out or extinguished that indicates that there are no calls registered either above or below the car. For example,—if prior to the passenger at the third landing taking possession of the car as by pressing a car button, an intending passenger at the fourth landing should be first to register a call, the up light UL within the car will be caused immediately to go " on " to indicate that the car will move upwardly and indication of this will also be given at the landing because in such case the down light DAL will go out or be extinguished because the circuit for the re-set winding 17 will be opened at the up direction switch contacts 165 to cause the contacts 20 to open, and the up light will remain " on ", that is, until the switch I operates to re-start the car and thus opens its back-contacts 136 which break the common feed to both re-set windings and causes opening of the re-set contacts 20 to extinguish the light UAL.

Both lights ultimately will go out when the time-opening switch contacts 146 open, by opening the feed for the re-set windings at that point, in which case it is obvious, no one had taken possession of the car during the stopping period as controlled by the time switch DS.

At this point, it will be mentioned that when the last call is responded to, the re-set winding or windings will not remain energized indefinitely but only during the period taken by the time-opening contacts 146 of switch DS to open, which is approximately about 8 or 10 seconds say for example. With the car at the farthest point of dispatch both direction switches then close their back-contacts 165 and 165′ so that with the back-contacts 136 of switch I closed and also the time-contacts 146, an energizing circuit is completed for the up and down re-set winding 16 and 17 by way of the wires 46, 148, contacts 146, wires 149, wire 161, contact 136, wire 162, to a double pole knife switch wherefrom parallel circuits extend, one to the down re-set winding 17 by way of wire 164, contacts 165, wire 166, brush 230, segment 39, wire 205 and the other to the up-reset winding 16 by way of wire 206, contacts 165′, wire 207, brush 336, segment 38, and wire 208. In order to insure a sufficient period of time for this re-set operation, even though a call below the car had been registered to cause closure of the down direction switch D when the car reached the farthest-up point of dispatch and the up direction switch opened, the re-set contacts 165′ are controlled by a dash pot 209 which delays their opening and hence such a quick closure of the direction switch cannot interfere with the intended reset operation because the contacts 165′ under such condition will remain closed for a second or so after the down direction switch closes.

The contacts 21 of both the up and down floor-relays 3 and 4 and also those for the car relay 7 for any one of the intermediate landings, are connected in multiple with the directional selector brush of the associated landing and obviously this means that actuation of a push-button within the car or of either the up or down push-buttons at each of said intermediate landings, will cause energization of the up direction switch winding 22 if the car is below said landings or will cause energization of the down direction switch winding 23 if the car is above said landings and of course the directional selector mechanism serves as a tell-tale means for car position and determines as to whether the car is above or below landings for which calls are registered and therefore governs the matter of giving direction for car movement in response to calls through control of the direction switch windings 22 and 23 and the circuits of these windings are suitably interlocked in a well known manner at the two sets of back-contacts 60 and 193 so that

the direction switches are operable to close only one at a time.

It will be observed that the winding 120 of the switch QS is subject to the control of the direction switch contacts and also the door switch *ds*. A direction switch once closed remains closed until the car reaches the farthest landing for which a button is pressed and regardless of the number of stops at intermediate landings before reversal is normally effective and this means that said winding 120 will be de-energized only if the landing door is opened whenever stop is made at such intermediate landings.

However, keeping in mind that when such farthest landing is reached, the feed for said winding is cut off at the direction switch and may then be quickly re-established by the direction switch for reverse direction of travel as in the event of a call in such direction having been registered prior to the car reaching said farthest point of dispatch, and since de-energization of said winding would permit closure of the contacts 124 to provide a direct feed for the winding 85 of switch I which would in effect cause closure of the latter and result in a false operation, it becomes necessary to prevent such de-energization of said winding 120 at such times. According to the present arrangement, said winding 120 will be maintained energized by the time-opening contacts 146 of switch DS during the period of possible quick reversal operation at the direction switches and hence the switch QS will keep its contacts 124 open-circuited throughout such period and until ample time has been given for the passenger at the landing to open the landing door which of course effects de-energization of said winding 120 or if the door is not opened within the pre-determined time period allowed by the switch DS, the latter by opening its contacts 146 de-energizes said winding.

The circuit for said winding 120 may be traced as follows:—wires 46 and 148, contacts 146, wires 149 and 161, wire 212, through change-over switch by way of blade 213, wire 214 to a junction 215 with wire 121, through winding 120 and so on to the main by way of wires 122 and 101, door-switch *ds*, wire 102 to wire 50 including the protective contacts 51 and the emergency switch ES to the line.

From the description thus far given it will be obvious that a down button for a landing above the car is effective to initiate movement of the car upwardly and if prior to the car reaching the stopping distance of said landing, there is no call registered for a landing or landings above said landing, said down button is effective to stop the car at its landing and said stop is effective by opening of the up direction switch, and the car in moving upwardly will be intercepted at any landings below said first named landing, only in response to actuated up buttons and to any actuated car buttons for such landings. However, if prior to the car reaching the intercepting zones relative to said landings, a call is registered by either an up or down button for a landing or landings above or by car buttons, the car will not stop at said first named landing but will continue on upwardly until the farthest-up landing is reached for which either an up or down button is actuated, being intercepted only by actuated up buttons at landings below said farthest-up landing.

It is obvious from the description just given, that an up button for a landing below the car is effective to initiate movement of the car downwardly, but will stop the car at its landing only if such up button is the farthest-down actuated button and during movement of the car downwardly toward said landing it will be intercepted only by actuated down buttons and by car buttons.

An operating winding 260 for the protective switch P is connected in parallel with the winding 85 of the master switch I by way of a wire 261 connecting at a junction 261' with wire 121, and is in series with back-contacts 139 of the auxiliary stop switch S'.

Since the car gate switch *gs* and the door switch *ds* are in series with the operating winding 90 of the switch S' the latter will operate in response to a call to open said back-contacts 139 to prevent energization of the winding 260 so long as the car gate and door are closed as intended normally. However if when a call is registered, the gate should stick and therefore be ineffective to close the gate switch, or if the door has not been closed and locked, the winding 90 cannot receive current because of either the gate switch or the door switch being open-circuited and consequently the winding 260 receives its supply of current by way of contacts 139 and if such open-circuited condition obtains for a period of about 30 seconds or so subsequently to the closing of the switch I in response to a registered call, the switch P at the expiration of said period opens its time-opening contacts 51 thereof to open-circuit the wire 50 at said point and in effect cancel any call or calls which are registered and in fact open-circuit practically the entire system because of the elements having wires terminating at the wire 50 which is a common return wire connecting with the line.

We come now to the operation of the system when car switch control is desired in which case there is an operator in the car.

For car switch control, the change-over switch 44 located in any convenient place generally on a control panel, is thrown from the upper position to the lower position.

Doing so, in effect renders the car starting and directional function of the car and hall push-button contacts 21 through their control of the direction switches U and D ineffective, by open-circuiting the up and down feed wires 189 and 56 leading from the directional selector to the up and down direction switch windings 22 and 23 respectively, at the knife blades 190 and 57 respectively, and transfers control of said windings to up and down car switch contacts 234 and 235 by way of wires 236 and 237 and the knife switch blades 190 and 57 in their lower position. The hall and car push-buttons in this manner are rendered ineffective to govern direction of the car and to control its starts, but their control of the lights UL and DL remains effective, and the car switch through its control of the direction switches can cause the car to start, stop and reverse at any point within the limits of car travel. The push-buttons however, at the landings and within the car retain their function to intercept the car at landings successively and in their natural order, regardless of the order in which they are actuated. The car stop and intercepting control selector E together with the back-contacts 34, 35, 180 and 181 of the floor-relays and the circuits associated with said contacts and selector are unaffected by throwing the change-over switch over and hence they function as before and in conjunction with the car switch to control the master switch I to cause the car to

run and also to be intercepted at landings for which buttons are actuated, and the arrangement is such that the buttons intercept the car without the operator having to move the car switch from on to off position, it being remembered that the operator, simply by normal operation of the car switch has complete control of the car so that if he does center the car switch the car stops in response to such operation at any point of travel.

It will be remembered that with the system operating on push-button operation for both dispatch and interception of the car, the up and down lights UL and DL within the car are effective to go on only one at a time depending on direction of car movement because of the interlocking arrangement of the contacts 64 and 64' of the down and up direction switches. The contacts 64 control the relay winding 70 and the contacts 64' control the relay winding 70' and since the direction switches close only one at a time it naturally follows that only one winding 70 nd 70' at a time can be energized and consequently it is possible for only one light to go on and such arrangement is desirable as it results in indicating the direction in which car may restart. However, when the system is controlled by the car switch under control of a car operator the lights are controlled in a manner so that the up light goes on immediately regardless of direction of car movement in response to actuation of either and up or down button for any landings above car position and also in response to car buttons for such landings, and the down light goes on immediately regardless of the direction of car movement in response to actuation of either an up or down button for any landings below car position and also in response to car buttons for such landings. When the car reaches the farthest-up landing for which either an up or down call or both are registered, or for which a call is registered from the car, the up light will go out, indicating to the car operator that the car has reached the farthest-up landing for which a call is registered.

When the car reaches the farthest-down landing for which either an up or down call or both are registered or for which a call is registered from a button within the car, the down light will go out, indicating to the car operator that the car has reached the farthest-down landing for which a call is registered. By throwing the knife-switch 44 over to its lower position, the windings 70 and 70' are divorced from control by the direction switch contacts 64 and 64' which permitted the lights to operate only one at a time and they are connected through the knife switch blades 75 and 75' directly to a common return wire 236 connecting at a junction 237 with the wire 50 which arrangement permits energization of both windings at the same time as above described, regardless of the direction of car movement. Of course it is obvious from the description already given that the contacts 21 and associated circuits together with the directional selector D retain their function to control said lights UL and DL. By throwing the knife switch over the holding circuit including the wires 156, 157, 158, etc. for the winding 90 of the switch S' is divorced from the direct feed wire 46 and is conditioned to be subject to the control of the direction switch contacts 65 and 65' so that in effect it is subject to manual control to be open-circuited by centering the car switch. In operation, assume that the car is at rest at the first landing and a passenger at the third landing desires to go down and accordingly actuates the third landing down button to register the car. The third landing floor-relay closes its contacts 21 to complete an energizing circuit for the winding 70' of the relay 71' which operates to close its contacts 72' to complete a circuit 237 for the light UL within the car.

The up light goes "on" thus to indicate a call from a landing above the car and the operator accordingly moves the car switch segment 238 to engage the up contact 234 and the common contact 239, and thereby complete the circuit for the up direction switch winding 22. The up direction switch will now close and cause energization of the winding 85 of the master switch I which closes to cause automatic closure of the car gate and consequent start of the car upwardly. The master switch I when its operation is initiated by closure of a direction switch under control of the car switch, functions to cause closure of the car gate and start of the car and also to intercept the car in response to registered calls from the landing or within the car, and to effect automatic opening of the car gate when stop is effected in response to said calls, in exactly the same manner as has already been described in detail hereinbefore for push-button dispatch of the car.

It is obvious that since the holding circuits for the winding 85 of the master switch I and also the winding 90 of the switch S are controlled by the direction switch contacts 183, 67, 65 and 65' respectively and the direction switches being directly under control of the car switch, the operator can by centering the car switch cause opening of a direction switch to de-energize said windings to cause stop of the car at any desired point and the car gate will be automatically opened. Let it be assumed now with the car moving upwardly that a passenger at the second landing registers a call by actuating the second landing up button before the up brush 334 passes the dead zone for said landing.

When the brush 334 reaches said dead zone the feed for winding 85 is cut off at that point, and the by-pass around said dead zone being open-circuited at the back-contacts 34 of the second landing up floor-relay results in opening the switch I to open-circuit at its contacts 96 one parallel feed for the winding 90 of switch S' to initiate stop of the car and at the same time the stop switch winding 42 is de-energized to cause the stop switch S on the car to assume a position to engage the up stop cam 40 at the second landing. The other parallel feed for the winding 90 is now by way of the direction switch contacts 65', connecting with the plus wire 81, wire 238, to wire 156 by way of knife switch blade 155, self-holding contacts 140, wire 157, contacts 137 of the stop switch S on the car, wires 158 and 108, through the winding 90 and so on as hereinbefore described. This self-holding circuit is now under control of the stop switch S on the car and is opened when the stop switch engages the up stop cam at the second landing. Since the holding circuit for the winding 85 of switch I is controlled by the holding contacts 117, and the direction switch contacts 183 in series and the self-holding circuit for the winding 90 of switch S' is also controlled by the direction switch contacts 65', means in affect that said switches I and S operate in response to registered calls from the landings and within the car to cause automatic stop of the car and automatic opening of the car gate, without the operator having to move

the car switch from its on position which means that such operation is effective without opening the direction switches, but on the other hand movement of the car switch to off position to open a direction switch causes said switches I and S to function immediately to stop the car and open the car gate.

Hence if the car operator holds the car switch in its on position when the car is brought to a stop in response to a registered call, the opening of the hoistway door to cause opening of the door switch *ds* causes de-energization of the winding 120 of the time-switch QS so that as soon as the hoistway door is closed said winding is again energized to close its contacts 125, and start the opening of the time-opening contact 124 and said two sets of contacts complete an initial energizing circuit for the winding 85 of the master switch I to cause its operation to cause closure of the car gate with consequent re-start of the car (all accomplished in a manner as hereinbefore described), in a direction dependent on the position of the car switch.

Thus the car switch can remain in on position when the car is intercepted at landings in response to registered calls and in said case automatic closure of the car gate and re-start of the car is effective immediately by closure of the landing door. However, the car will remain at rest so long as the car switch is in off position. By moving the car switch to on position the car gate will be immediately closed by the gate motor and the car is started by closure of said gate. The switch QS is conditioned as stated hereinbefore by opening and closing the landing door to cause immediate re-start of the car as soon as the car switch is moved to on position. Such immediate re-start is rendered effective by the switch QS without first having to open a landing door, as in the event of the operator stopping the car by car switch operation between or at landings.

Such operation, by opening the circuit for the winding 120 at the direction switch contacts 67 and 183 conditions the system to cause re-start as soon as the car switch is moved to on position. This is so because the by-pass feed around said contacts 67 and 183 for the winding 120 of the switch QS by way of the contacts 146, wires 149 and 212, switch blade 213, wire 214, etc. is now open-circuited at said switch blade 213 so that the only feed for said winding is now by way of the direction switch contacts and is consequently under manual control of the car switch.

At this point it will be observed that since the direction switches are under control of the manual car switch and not under control of the automatic directional selector, the lack of this automatic control of said direction switches means in effect that the car when moving upwardly will not be automatically intercepted at the farthest-up landing for which a call is registered if it is a down call and the car when moving downwardly will not be automatically intercepted at the farthest-down landing for which a call is registered if it is an up call. However the car need not necessarily always travel to the limits to insure that all passengers who have registered calls are picked up and that proper re-set of the floor-relays is effective because with the present arrangement, the up and down lights UL and DL within the car indicate to the car operator by going out that the car has reached a farthest-up or farthest-down landing respectively for which a call is registered and the operator upon observing such signal or indication may stop the car manually at the landing by centering the car switch.

Hence the car when moving upwardly stops only in response to up calls and when moving downwardly stops only in reponse to down calls and if the farthest-up call is a down call, the stop at such landing is manual as by the car switch, and in response to the up light going out, and if the farthest-down call is an up call, the stop at such landing is manual as by the car switch and in response to the down light going out.

The operator in the car can pre-register calls for stops as the passengers call their floors when they board the car and the car will stop successively at landings for which calls are registered, regardless of the order in which calls are registered. As to the re-set operation of the floor-relays, it may be desirable for some types of service, that is, where inter-floor travel is not heavy and where passengers are in the practice of boarding an up going car when they have registered a down call in which case the up going car stopped in response to an up call by a passenger going up, or boarding a down going car when they have registered an up call in which case the down going car stopped in response to a down call by a passenger going down, to re-set both the up and down floor-relays for such landing whenever the car stops thereat. Hence if such an arrangement is desired, the re-set circuits can remain as heretofore described, that is, controlled by the back-contact 165 and 165′ of the up and down direction switches in which case the operator will center the car switch as an incident to each stop in response to the push-buttons, so that in effect both sets of back-contacts will be closed to re-set both floor-relays for the landing stopped at and also the car relay, all accomplished in a manner as described hereinbefore.

However, if the operator keeps the car switch on when stop is effected in response to registered calls, only calls corresponding to direction of car movement and also calls registered from within the car will be cancelled, and by centering the car switch, which he may do in response to the UL or DL signals as when one goes out, both the up and down relays and the car relay will be reset.

However, if at any time it may be desired to re-set only up floor-relays when the car is going up and only down floor-relays when the car is going down, even though the car switch is centered or remains in on position when stop is effected in response to registered calls, such result is accomplished by throwing over the knife switch 44′ which in effect divorces the up re-set wire 207 from the back-contacts 165′ and conditions said wire to be energized from the top time-opening contacts 240 of the up direction switch U and divorces the down re-set wire 166 from the back-contacts 165 and conditions said wire to be energized from the top time-opening contacts 241 of the down direction switch D.

When the car has reached the farthest landing in one direction for which a call is registered as indicated by the light UL or DL going out, the operator observes that he need go no further in the one direction and accordingly stops the car to take on the waiting passenger and then re-starts the car in a reverse direction by reverse operation of the car switch.

In such case, both floor-relays and the car relay corresponding to the landing at which the car operator reverses car movement will be re-set and this is so because obviously both sets of contacts 241 and 240 controlled by the direction switches U and D will be closed one set corresponding to the direction of travel when stop is effected and the other to the reverse direction of car movement and for this arrangement the back-contacts 136 of switch I, which are in the common feed 161 and 162 to both sets of said re-set contacts may be arranged to be time-opening by providing a dash pot 242 as in dotted lines, which will allow said feed circuit to remain closed at said contacts 136 for a second or so after the switch I has operated in response to the operator starting the car in the reverse direction and this time period allows sufficient time for the re-set operation to become effective for the floor-relay for such farthest landing at which reversal is effected and which corresponds to the reverse movement of the car.

By movement of the car switch segment to engage contacts 239 and 234 an energizing circuit for the up direction switch winding 22 is completed as follows:—from + wire 46, wire 244, through car switch by way of contacts 239, segment 238, contacts 234, wire 236, to wire 191 by way of switch blade 190 and so on through the winding 22 by way of wires hereinbefore traced as when said winding is controlled by the floor-relay contacts 21.

Closing of the up direction switch will cause automatic closure of the car gate and consequent start of the car in exactly the same manner as has been described for start of the car, etc. in response to push-button operation, it being observed that for car switch control, that is, when closure of a direction switch is effected by the car switch operation, the car running and intercepting selector E together with the associated circuits and push-button controlled contacts 34, 35, 180 and 181, all function as hereinbefore described to cause the car to run and also to intercept it at landings successively in their natural order regardless of the order in which the calls are registered and the intercepting operation is effective without the car operator having to move the car switch to off position although he may at his option do so when the car has stopped in response to a call or at any other time. Furthermore, the operator has complete control of the car, since by manipulating the car switch in a normal manner, the car can be started, stopped and reversed at will at any point within the limits of car travel. Furthermore, the lights within the car operating as they do indicate when the farthest landing up and the farthest landing down has been reached for which either an up or down call is registered so that the car need not necessarily always travel to the terminal landings to insure that all passengers have been picked up. The use of a usual annunciator within the car which is usually employed to indicate each individual landing for which a call is registered, is eliminated with its accompanying expense.

Of course it will be obvious, that by the mere omission of the directional selector D, also the top contacts 21 of the floor-relays and the circuits controlled by said elements up to the point as for example, where such circuits terminate into the two wires 189 and 56, all of which have to do with the matter of controlling the direction switches together with the lights UL and DL from the push-buttons to initiate start of the car and to maintain direction of car movement until a farthest point of dispatch is reached, and omitting also the lights UL and DL and associated relays 71 and 71', there remains the complete and operative system such as is particularly useful in the class of service having an operator within the car to control its starts and the push-buttons as well as the car switch control its stop and while the system in its entirety, that is, with the push-buttons having start as well as intercepting functions, may of course be used even though there be an operator within the car, its cost is considerably greater of course than the system with the elements omitted and the car switch control permits of a more flexible operation as to the matter of stopping and reversing at any desired point and this is so because for push-button dispatch, a closed direction switch remains closed until the car has reached the farthest landing in the direction of car movement for which either an up or down button, or a car button is actuated, and consequently reversal of car movement at will is not effective as it is with car switch control.

It will be understood therefore that the present invention by the process involving mere omission of elements, anticipates in effect, four distinct types of elevator control systems, each having a particular use for a particular class of elevator service already recognized,—first,—a plain intercepting control system in which the push-buttons within the car and at landings control the start as well as interception of the car, and also the indicating lights within the car, with the car switch, and change-over switch omitted, such a system having use in apartment houses for control of passengers themselves; second,—another system being used in apartment houses and known in the trade as a dual control system embodying the above push-button control system in which case the change-over switch for one position renders said push-button system effective to start as well as intercept the car and also to control the lights UL and DL and for another position renders the starting function of said buttons ineffective so that the buttons have functions only to intercept the car and to control the said lights and conditions said system so that start stop and reversal of the car is controllable at will by a car switch; third,—the office building type; a system complete within itself with the omission of the elements above enumerated in which case the car and hall push-buttons have a function only to intercept the car at landings but have no control over its starts, and an operator within the car by means of a car switch controls start, stop and reversal of the car at will. As a matter of fact said third system includes only those elements which function while the car is on car switch control as already described, excepting those having to do with the control of the lights UL and DL within the car such as the directional selector D, contacts 21, and associated circuits, etc., and these elements together with the lights and change-over switch are omitted and their functions are sacrificed.

However, if desired, the contacts 21 may be adapted for use to control a system of circuits for an annunciator within the car which is not as expensive as the use of a directional selector D to control the lights UL and DL and in such case the annunciator drop for any landing may be automatically re-set by its associated re-set relay already at hand. However, where a dual control system is desirable, the matter of providing these lights involves very small expense as com-

pared with that of an annunciator system, and the means for controlling the lights, viz—the directional selector D, push-button controlled contacts 21, etc. are already at hand and necessary for the push-button dispatch of the car. When on car switch operation it is desirable to indicate to the operator when the farthest-up and farthest-down landings are reached for which calls are registered and since the car stops automatically in response to calls which correspond to the direction of car movement, from the landings and the car such indication is all that is necessary in order that the operator may stop the car by the car switch operation if the farthest calls do not correspond to direction of car movement.

However, a further and obvious omission of elements which will suggest itself to elevator engineers to adapt the said car switch system for use for service identified as department store control wherein the car will stop automatically at each landing, involves the matter of omitting the car and hall push-button and floor-relays, re-set relays, etc. and associated circuits and also the two vertical rows of segments 31 and 32 which span the dead zones of the retained row of segment 30. Obviously the omission of these elements or in other words the call registering means, results in automatic stop being initiated as each dead zone is reached even though the operator keeps the car switch in on position but the operator has complete control of the car and can stop and reverse it at will.

The said lights give the necessary indication and the cost of installing them is considerably less than the cost of installing an annunciator system which it has been customary to use heretofore in conjunction with a dual control system.

For a multi-speed push-button control system, the car running and intercepting selector E as illustrated in Fig. 2 to control the master switch I is arranged somewhat differently than as shown in Fig. 1B which is for a single speed control.

In Fig. 2 there is an up and down row of relatively long segments 246 and 247 respectively and associated traveling brushes 246′ and 247′ with the necessary dead zones 248 and 249 respectively provided as the slow-down zones and the up row of relatively short segments 31 and down row of relatively short segments 32 control the by-pass around the dead zones for the winding 85 of the master switch I by way of the respective push-button controlled back-contacts 34, 35 and 181 as in Fig. 1B. The master switch I in addition to controlling the elements as in Fig. 1, is provided with an additional set of contacts 253 in series with normally open contacts 254 controlled by the last arm on an accelerating magnet (not shown), to control the operation of a fast and slow speed switch F and S in a well known manner such for example as is described in my copending application, Serial Number 236,740 filed November 30th, 1927.

The up and down brushes 246′ and 247′ and their associated row of segments 246 and 247 are rendered effective one row at a time by subjecting them to the control of contacts 184 and 64 controlled by the direction switches U and D of Fig. 1.

Obviously the master switch I as controlled by the selector arrangement illustrated in Fig. 2, in addition to performing the functions described for it in connection with Fig. 1B, has the added function of controlling the slow-down switches F and S to cause automatic slow-down, etc. in response to calls registered from within the car and at landings regardless of whether the system is operated by push-button dispatch or car switch.

When this multi-speed selector is used, the car is automatically slowed-down in response to a farthest-up actuated button if it is a down button, and in response to a farthest-down actuated button if it is an up button, by opening of a direction switch through its control by the directional selector and in such case the contacts 255 of the switch S′ of Fig. 1B to be used only in conjunction with the multi-speed arrangement, control a self-holding by-pass circuit 256 by way of contacts 115 and 115′ for the reversing switch windings 89 and 89′, (see Fig. 1B) around the direction switch contacts 68 and 68′ so that a closed reversing switch will not be de-energized when a direction switch opens to slow down the car, but will be maintained closed by said by-pass circuit 256 until the stopping point is reached and the switch S′ opened by the stop switch S on the car.

The Fig. 2 arrangement for multi-speed car operation with the call registering means omitted and considered in conjunction with certain accessory elements of Fig. 1B, provides a mode of operation for car switch control whereby the car operator need move the car switch to on position only momentarily to start the car from a landing and immediately return the car switch to off position in which case the car will continue on toward the next landing at slow speed independently of manual operation because of the self-holding circuit provided for the windings of the reversing switches as illustrated in Fig. 1B, and when a dead zone for such next landing is reached, the by-pass control elements being omitted means that the interception of the car will be initiated by de-energizing the winding 85 of the master switch I which results subsequently in automatic opening of the car gate, and automatic stop of the car at said landing. Such continuation of car movement only at slow speed is effected by return of said car switch to off position, the direction switch contacts 184 or 64 which are closed to start the car being again opened so that the switch I is thereby opened to prevent fast speed operation and the system is under the control of a reversing switch having a held circuit which is subject to be opened when the stopping point is reached, by the stop switch S on the car.

From what has been said it is obvious that the selector E and associated circuits have use with any of the four types of systems herein specifically mentioned and identified. Furthermore while the invention discloses elements which constitute a dual control elevator system, it can be by omission of elements converted to meet the requirements of three other classes of service identified as the office building type, the department store type, and the apartment house type.

Various modifications in construction and arrangement of parts will suggest themselves to those skilled in the art and I wish therefore not to be limited to precise details and arrangements as herein described.

What I claim is:—

1. An elevator control system comprising in combination a car, a car running circuit, a manual switch within the car, an additional manual switch, and a car actuated commutating machine having means cooperating with said first named manual switch to control said circuit to start the car from each landing and also having additional

means cooperating with said additional manual switch to control said circuit to cause automatic stop of the car at a pre-determined point.

2. An elevator control system comprising in combination a car, a car running circuit, a manual switch within the car, a plurality of up control means, one for each of a plurality of landings, a plurality of down control means, one for each of said landings, a car actuated commutating machine having means operable jointly with said manual switch within the car to control said car running circuit to start the car from each of said landings, and having additional means effective at intercepting points to momentarily transfer control of the car running circuit to said up and down control means corresponding to said points, and means effective so that only up control means control said car running circuit when such transfer is effected when the car is going up and only said down control means control said car running circuit when such transfer is effected when the car is going down.

3. An elevator control system comprising in combination a car, a car running circuit, a manual switch within the car, a plurality of push-button control means, one for each of a plurality of landings, a commutating machine having conductor strips and co-operating conductor means to engage same in accordance with car position said strip and conductor means effective jointly with said manual switch to control said car running circuit, and additional conductor strips each in a circuit including its associated push-button control means, said conductor means co-operating with the first and second named conductor strips alternately so that as each intercepting point is reached said car running circuit is transferred to control by a corresponding push-button control means so that if it is not operated to register a call it maintains energization of said car running circuit to prevent interception of the car at the landing corresponding thereto, and if in call registering position such transfer of said car running circuit de-energizes same to intercept the car at the landing.

4. An elevator control system comprising in combination a car, a car running circuit, a manual switch within the car, a plurality of push-button control switches, one for each of a plurality of landings, and a commutating machine having conductor strips separated by dead points defining car intercepting zones, and conductor means successively to engage said strips operating jointly with said manual switch to control said car running circuit, and other conductor strips each in a circuit including its associated push-button control switch, said conductor means operating conjointly with the first and second mentioned conductor strips to sequentially include said second mentioned conductor strips in and to sequentially exclude said first mentioned conductor strips from said car running circuit at each of the intercepting zones to transfer control of said car running circuit to a push-button switch corresponding to said point, so that push-button switches which are not operated maintain energization of the car running circuit to prevent interception of the car at their landings and push-button switches which are operated to register calls form a break in said car running circuit to de-energize same to intercept the car at their landings.

5. An elevator control system comprising in combination a car, a car running circuit, a manual switch within the car, and a commutating machine having a single row of conductor strips regardless of the number of landings served and a brush successively to engage said strip in accordance with car position effective jointly with said manual switch to control said circuit to start the car from each of a plurality of landings and provided with a series of dead zones or intercepting zones, a normally closed by-pass around the dead zones to maintain the running circuit energized, and means for opening said by-pass whereby when said dead zones are engaged by said brush, said running circuit is opened to automatically stop the car at landings successively in their natural order.

6. An elevator control system comprising in combination a car, a car running circuit including a plurality of breaks defining car intercepting zones, a manual switch within the car, circuit controlling means operable jointly with said manual switch to control said running circuit to start the car from each of a plurality of landings, said circuit controlling means automatically opening said car running circuit momentarily when the car reaches points in its travel corresponding to each intercepting zone, a plurality of control means, one for each of a plurality of landings, said circuit controlling means having conductor strips and a brush common to said strips successively to engage same in accordance with car position, a normally closed car running bypass circuit around each of the breaks of the car running circuit, each of the said conductor strips being sequentially insertable in said car running bypass circuit with an associated control means at times when the positions of the car coincide with said intercepting zones and means controlled by the control means of the several landings to maintain the car running circuit energized by means of the respective car running bypass circuits through intercepting zones the associated landing controls of which are not in call-registering position, and to open the car running by-pass circuits of intercepting zones, the associated landing controls of which are in call-registering position, to cause interception of the car thereat.

7. An elevator control system comprising in combination a car, a car running circuit, a manual switch within the car, a plurality of push-button control switches, one for each of a plurality of landings, and a commutating machine having two sets of conductor strips and co-operative conductor means, the strips of the two sets being arranged in alternate order to be engaged successively by said conductor means in accordance with position of the car, one set operable jointly with said manual switch to control said car running circuit to start the car from each of said landings, and the other set being in circuit with said push-button control switches, said conductor means by its movement relative to said strips operating to successively transfer control of said car running circuit to said push-button control switches so that push-button switches which are not operated prior to or at the time such transfer is effective at their associated intercepting points, maintain said car running circuit momentarily to prevent interception of the car at their landings, and push-button switches which are operated prior to or at the time such transfer is effective from a break in said car running circuit at those points which results at the time such transfers are effective in de-energizing said car running circuit to intercept the

car at their landings successively in the natural order regardless of the order in which said push-button switches are operated.

8. An elevator control system comprising in combination a car, a car running circuit, a manual switch within the car, a plurality of control means, one for each of a plurality of landings, a commutating machine having spaced conductor strips and a brush successively to engage same in accordance with position of the car, the spaces between said conductor strips defining breaks in the car running circuit for interception of car operation, said strips and brush operating jointly with said manual switch within the car to control said running circuit, and operating independently of the manual switch when the brush is between spaced strips to open said running circuit at each intercepting point, and means electrically connectable in the car running circuit and conditioned by each of said control means when not in actuated position, to energize said running circuit when it is opened by said brush traversing a break in the car running circuit at intercepting points corresponding to such control means, said control means when in actuated or stop registering position conditioning said last named means to de-energize last mentioned means to maintain the car running circuit open and thus cause interception of the car at their landings successively when said commutating machine opens said car running circuits at the intercepting points corresponding to said actuated control means.

9. an elevator control system comprising in combination a car, a car running circuit, a plurality of control means one for each of a plurality of landings each control means having start and stop contacts, a commutating machine having conductor strips, conductor means successively to engage said strips in accordance with car position, certain of said strips operating jointly with said start contacts to control said running circuit to start the car and other of said strips each in a circuit with said stop contacts of its corresponding control means, the strips operatively associated with the start contacts being spaced to provide dead zones for intercepting the car at points in its travel corresponding to the said landings, and the strips in contact with said stop contacts being disposed with respect to the first mentioned strips to provide bypasses for said conductor means around the dead zones separating said first mentioned conductor strips and normally functioning when in circuit with said conductor strips to maintain continuity of the car running circuit, said conductor means operating at each of the intercepting points to transfer control of said car running circuit from the first mentioned conductor strips and start contacts of the control means to control by the second mentioned conductor strips and the stop contacts of said control means, the stop contacts of the control means being normally closed to complete the bypass circuits whereby to maintain energization of the car running circuit through interception zones corresponding to the landings the control means of which are in normal position to prevent interception of the car at their respective landings, and so that control means which are in call registering position form a break in the bypass circuit at such points to maintain the car running circuit open through such bypass to thereby de-energize the car running circuit to intercept the car at their landings successively in the natural order of the landings regardless of the order in which the control means are actuated.

10. An elevator control system comprising in combination a car, a car running circuit, up and down direction switches, a plurality of control means, one for each of a plurality of landings, each control means having start and stop control contacts, a directional selector in the form of a commutating machine to control circuits responsive to said start contacts to cause operation of said direction switches to establish direction for car movement, an additional selector in the form of a commutating machine operable jointly with said directional switches to control said car running circuit to start the car in a direction as determined by said direction switches, said additional selector effective at intercepting points to transfer control of said car running circuit to be controlled only by said stop contacts so that control means which are not in call registering position maintain energization of the car running circuit by way of their respective stop contacts to prevent interception of the car at their landings, and control means which are in call registering position form a break in the car running circuit at their respective stop contacts so that by such transfer of the car running circuit at their respective landings, the said circuit is de-energized to intercept the car at landings successively in their natural order regardless of the order in which the control means are actuated.

11. An elevator control system comprising in combination a car, a car running circuit open-circuited at a plurality of points corresponding to floor landings and defining car intercepting zones, a plurality of control means one for each of a plurality of landings each control means having start and stop control contacts, a directional selector having for each intermediate landing one up and one down conductor strip the two for each landing forming one row with as many of such rows as there are intermediate landings, directional circuits through said selector responsive to said start contacts to condition the car running circuit for directional car movement, an additional selector having two sets of conductor strips one set of said conductor strips operating jointly with the start contacts to complete the car running circuit upon actuation of any of said landing controls, the other set of said strips being electrically connected to said stop contacts and arranged jointly therewith to normally establish bypass circuits around the open-circuited points of the car running circuit to maintain the car in operation through the interception zones corresponding to landings the controls of which are in normal or unactuated position, the stop contacts of said landing controls being normally closed to complete said bypass circuits and arranged to be opened when said controls are actuated to thereby open the bypass circuits around the open circuit points of the car running circuit corresponding thereto, to thereby insure deenergization of the car running circuit to intercept the car, said two sets of conductor strips being arranged in separate rows, and brushes operated in accordance with the position of the car arranged to contact the strips of each row.

12. An elevator control system comprising in combination a car, a car running circuit, a plurality of push-button controlled floor-relays each having a set of start contacts and a set of stop contacts, a directional selector in the form of a commutating machine having for each intermediate landing one up and one down conductor

strip said two strips for each landing forming one row and each row having a co-operative brush, an additional selector having two sets of conductor strips said two sets of conductor strips being arranged relatively in alternate order to be engaged successively by a co-operative brush, the conductor strips of one set operating jointly with said start contacts to control start of the car, and the conductors for said other set operating jointly with said stop contacts to control said running circuit both to prevent interception of the car and to cause interception of the car at their associated landings, and said brush by its movement to successively engage conductor strip of said two sets in alternate order thereby transfers control of said car running circuit to said stop contacts so that floor-relays which are not in call registering position have closed stop contacts which maintain energization of the car running circuit to prevent interception of the car at their landings and floor-relays which are in call registering position have open-circuited stop contacts which form a break in said car running circuit at such points so that such transfer of the control of the running circuit causes de-energization thereof and consequent interception of the car at those landings for which calls are registered, in the natural order of landings regardless of the order in which the calls are registered.

13. An elevator control system comprising in combination a car, a car running circuit, a manual start switch, selectively operable control means one for each of a plurality of landings effective to register calls at any time regardless of direction of car movement at the time they are actuated, a commutating machine remote from the car having two sets of conductor strips arranged in alternate order to be successively engaged by a conductor means controllable in accordance with position of the car, the conductors of one set each effective jointly with said manual switch to complete said car running circuit to cause start of the car from its associated landing, the conductors of the other set each in a car running circuit including its associated selective control means, and said conductor means operable by its movement when the car reaches each intercepting point to transfer control of said car running circuit momentarily without interrupting the continuity thereof to control by a selective control means which corresponds to the particular point at which such transfer occurs, by first engaging a conductor strip of said second set and then disengaging a conductor strip of said first set.

14. An elevator control system comprising in combination a car, a plurality of push-button controlled floor-relays each having a set of start and a set of stop contacts, each set of stop contacts being normally closed and being open-circuited when their associated floor-relays are in call registering position, a directional selector in the form of a commutating machine having for each intermediate landing one up and one down conductor strip in longitudinal alignment, a plurality of brushes one co-operating with each row, an intercepting selector having two sets of conductor strips the conductors of the two sets being arranged alternately for successive engagement by a co-operating brush, up and down directional switches having operating windings controllable by said start contacts and said directional selector to establish direction for car movement, the farthest actuated of said start contacts in the direction in which car movement is directed maintaining a direction switch closed before reversal of car movement is effective in response to registered calls for landings in the reverse direction, and a car running circuit controlled jointly by said direction switches and by one of said two sets of conductor strips of said intercepting selector, and each conductor strip of the other set being in a car running circuit with associated stop contacts, said brush which co-operates with said two sets of conductor strips by its successive engagement with same, operating to transfer control of said car running circuit successively to said stop contacts so that stop contacts of those floor-relays not in call registering position maintain energization of said car running circuit to prevent interception of the car at their landings and stop contacts of those floor-relays which are in call registering position are open-circuited to thus form a break in said car running circuit at those points, so that said transfer of said car running circuit when the car is at intercepting points corresponding to said breaks, results in interception of the car at their landings successively in their natural order regardless of the order in which the floor-relays are actuated.

15. An elevator control system comprising in combination a car, a plurality of push-button controlled floor-relays each having means effective to start the car, a re-set relay for each of said floor-relays, a directional selector in the form of a commutating machine having for each intermediate landing one up and one down conductor strip, the two strips corresponding to each landing being arranged in separate rows, and a co-operating brush for the strips of each row, directional circuits responsive to said relays and controlled by said directional selector to maintain directional car movement until the car reaches the farthest landing for which a car is registered, an intercepting selector having two sets of conductor strips the conductors of the two sets being arranged alternately for successive engagement by co-operating brush mechanism, the strips of one set being connected to the strips of said directional selector, a car running holding circuit controllable by said floor-relays jointly with the strips of the other set of said intercepting selector to control dispatch of the car and to intercept it at landings successively in their natural order regardless of the order in which said floor-relays are actuated to register calls, and a relay reset selector including additional conductor strips each of which is connected to the winding of a floor reset relay and a co-operating brush to engage same successively, means to actuate all of said brushes in accordance with car position, and circuits controlled by said additional conductor strips and brush to control said re-set relays to reset actuated floor relays after the car has executed the course initiated thereby.

16. An elevator control system comprising in combination a car, a plurality of push-button controlled floor-relays each having means effective to start the car, directional circuits responsive to said relays to maintain direction of car movement until the car reaches a farthest landing for which a call is registered, a car running circuit having a series of breaks corresponding in number to the landings served, and two sets of conductor strips and co-operating brushes, one set of strips controlling the continuity of such directional circuits, and the other set of conductor strips controlling the down direction circuits to energize the car running circuit to cause start of

the car from each landing, the said strips both sets under the action of said brushes operating to close said breaks successively and by so doing transfer control of said car running circuit to said floor-relays one at a time in successive order.

17. An elevator control system comprising in combination a car, a plurality of floor-relays, one for each of a plurality of landings each having a set of car start contacts and a set of stop contacts said stop contacts being normally closed and being open-circuited by operation of the associated relay to call registering position, a commutating machine have two sets of spaced conductor strips arranged in alternate order, separate co-operative conductor means successively engaging the respective sets of conductor strips and actuated in accordance with the position of the car, a car running circuit controllable by said floor relays and commutating machine, means to electrically connect one set of said conductor strips with said start contacts to control said car running circuit to start the car toward a landing for which start contacts are actuated, and car running by-pass circuits each including a conductor strip of the other set and connected to be controlled by associated stop contacts said last mentioned strips being disposed with respect to said first mentioned strips to bypass the car running circuit around the spaces therebetween so that the car is not stopped at landings for which calls are not registered and the car is stopped at landings for which calls are registered successively in their natural order regardless of the order in which the calls are registered.

18. An elevator control system comprising in combination a car, a car running circuit, a plurality of landings each having call registering means comprising start contacts and two sets of stop contacts, one set for up stop and one set for down stop, said stop contacts being normally closed and being open-circuited by actuation of said call registering means to register a call by closing said start contacts, a commutating machine having two sets of conductor strips arranged in alternate order for successive engagement by co-operative conductor means actuated in accordance with position of the car, one set of conductor strips operating jointly with said start contacts to control said car running circuit to start the car from landings, and the other set being in a car running circuit controlled by associated two sets of stop contacts, said brush by its successive engagement with said conductor strips operating to successively transfer control of said car running circuit to said two sets of stop contacts corresponding to each point at which such transfer is effective, and means to render said up stop contacts ineffective to control said running circuit when movement of the car is downwardly and to render said down stop contacts ineffective when movement of the car is upwardly.

19. An elevator control system comprising in combination a car, a manual control switch, a car running circuit having self-holding means, a time-switch, said manual control switch and time switch controlling said running circuit initially to energize same to start the car, said time switch opening with delayed movement thereby to transfer control of the running circuit to said self-holding means and selectively operable manual control means to control said self-holding circuit to intercept the car at landings in their natural order regardless of the order in which said means are operated.

20. An elevator control system comprising in combination a car, a car switch, a car running circuit having holding means, a second switch, said car switch and second switch controlling said car running circuit initially to energize same to start the car from each landing, said second switch being self-opening and such opening being delayed until said holding means is effective, thereby to transfer control of the running circuit to said holding means under control of said car switch so that the latter controls said self-holding circuit to de-energize the same at will and selective means controllable manually from within the car and from each of a plurality of landings to control said holding circuit to intercept the car at landings successively in their natural order regardless of the order in which said selective means are actuated.

21. An elevator control system comprising in combination a car, a car switch, a car running circuit having holding means, a second switch controllable by the car switch to be closed when the car switch is in off position and to be open-circuited when the car switch is on position, said second switch being in said car running circuit with said car switch to energize same to start the car from each of a plurality of landings and effective when open-circuited to make transfer control of the car to said holding means, a commutating machine having conductor strips, and a brush actuated in accordance with car position, said machine constructed and arranged to control said self-holding car running circuit so that during movement of the car between any two adjacent landings, said self-holding circuit is transferred from control by said car switch alone to control jointly by said car switch and a control means corresponding to the landing being approached and is transferred back again to be subject to control by said car switch alone prior to the car reaching said landing so that if during such transfer period said corresponding control means is in call registering position it forms a break in said self-holding circuit to intercept the car at its landing and if it is not in call registering position it maintains said self-holding circuit energized throughout said transfer period and until its control is transferred back again to control by said car switch in which case the car will continue on without stopping at said landing to the next intercepting point under control of said car switch which by movement to off position opens said car running circuit to stop the car at any point of car travel at will.

22. An elevator control system comprising in combination a car, a car running circuit having self holding means, a car switch to energize said car running circuit and said circuit holding means to maintain said running circuit for conditioning the same to control direction of car movement, a plurality of control means, one for each of a plurality of landings and means in said maintained circuit comprising conductor strips and a brush successively to engage same in accordance with car position, each conductor strip being electrically connected in the car-running circuit with an associated control means, and means for connecting said strips successively in the car-running circuit in response to the movement of the car, whereby said self-holding car-running circuit is controlled jointly by said car switch and the control means.

23. An elevator control system comprising in combination a car, a car running circuit, a plu-

rality of control means one for each of a plurality of landings, a car gate, circuit controlling mechanism actuated by the opening and closing of said gate, hoistway doors and circuit controlling mechanism actuated thereby, circuit controlling means conditioned by said hoist-way doors and said car gate being in closed position for maintaining the car running circuit intact, means conditioned by intercepting the car at a landing for opening the car gate, and conditioned by opening and closing the hoistway door at said landing to reclose said car gate, to control said car running circuit to cause restart of the car as soon as the door is closed, in response to a call or calls registered prior to or during any stopping period and means effective independently of such door operation, to restart the car in response to such unanswered registered call or calls at the expiration of a stopping period of predetermined duration.

24. An elevator control system comprising in combination a car, a plurality of call registering means, one for each of a plurality of landings, a car gate, hoistway doors and circuit controlling mechanism actuable thereby, motive means to open and close said car gate, means conditional on opening and closing a door for the landing which the car is stopped at to open-circuit and close-circuit said circuit-controlling mechanism, to control said motive means to close the car gate as soon as the door is closed, and means independent of said door operation, effective to control said motive means to close the car gate at the expiration of a stopping period of pre-determined duration.

25. An elevator control system comprising in combination a car, a plurality of call registering means, one for each of a plurality of landings, a car gate, hoistway door and circuit controlling mechanism actuable thereby, motive means to open and close said car gate, means conditional on opening and closing a door for the landing which the car is stopped at to open-circuit and close-circuit said circuit-controlling mechanism, to control said motive means to close the car gate as soon as the door is closed, and means independent of said door operation, effective to control said motive means to close the car gate at the expiration of a stopping period of pre-determined duration, said closure of the gate in either instance being effective only if a registered call remains unanswered.

26. An elevator control system comprising in combination a car, a plurality of call registering means, one for each of a plurality of landings, a car gate, hoistway doors and circuit controlling mechanism actuable thereby, motive means to open and close said car gate, means conditional on stopping the car at a landing in response to a registered call, to control said motive means to open said car gate, means conditional on opening and closing the landing door corresponding to the landing stopped at to thus open and close-circuit said circuit-controlling mechanism, effective to control said motive means to close the car gate as soon as the door is closed, means operable independently of said door operation, effective to control said motive means to close said car gate at the expiration of a stopping period of predetermined duration, said closure of the car gate in either instance being effective only if a registered call remains unanswered, and said closure of the car gate being repeated as an incident to each stop to cause in each instance restart of the car until all calls are answered in which case the car gate remains open but subject to be closed immediately in response to a first call to be registered.

27. An elevator control system comprising in combination a car, a manual switch within the car having an on position, also a stop position to stop the car, a plurality of control means, one for each of a plurality of landings effective to intercept the car at landings independently of the manual switch being moved from said on position, a car gate, motive means to open and close said car gate, means responsive to said manual switch in on position to control said motive means to close said gate, and means responsive to stopping of the car whether effected by movement of said manual switch to stop position, or in response to an actuated control means, to control said motive means to open said car gate.

28. An elevator control system comprising in combination a car, a manual switch within the car having running position, also a stop position to stop the car, a plurality of control means, one for each of a plurality of landings effective to intercept the car at their landings independently of the manual switch being moved from said running position, a car gate, motive means to open and close said gate, means responsive to said manual switch when in running position to control said motive means to close said car gate, and means responsive to stopping of the car in response to said control means and independently of moving the car switch from its running position to control said motive means to open the car gate.

29. An elevator control system comprising in combination a car, control means for each of a plurality of landings having combined starting and intercepting functions and effective to register calls at any time regardless of direction of car movement at the time they are actuated, a car gate, motive means to open and close said car gate, hoistway doors and circuit-controlling means actuated thereby, means responsive to the first of said control means to be actuated to control said motive means to close the car gate, said closure of the car gate causing start of the car toward a landing for which said call is registered, means conditional on stopping the car in response to a registered call to control said motive means to open said car gate, means effective if there is an unanswered call when said stop is made and on condition that said door-actuated circuit-controlling mechanism is opened and reclosed as an incident to said stop, and before expiration of a pre-determined stop period, to control said motive means to close said gate immediately as soon as the door is closed and the closure of the gate immediately restarts the car, and additional means effective only if a call is registered but independently of said operation of the door actuated circuit-controlling mechanism, to control said motive means to close said car gate at the expiration of a stopping period of pre-determined duration and said closure of the car gate restarts the car from landings stopped at until all registered calls are answered.

30. An elevator control system comprising in combination a car, control means for each of a plurality of landings having combined starting and intercepting functions, the farthest actuated control means in the direction of car movement determining the farthest point of car movement in said direction and reversal of car movement being effective at such point in response to a registered call or calls for landings in a reverse

direction, a car gate, motive means for opening and closing said car gate, hoistway doors and circuit-controlling means actuated thereby, hoisting motor and brake control means, means responsive to the first actuated of said control means to control said motive means to close said car gate, closure of the car gate effective to control said hoisting motor and brake control means to cause start of the car toward the landing corresponding to said actuated control means, means conditional on stopping the car in response to a registered call to control said motive means to open said car gate, means effective on condition that an additional call or calls remain unanswered when said stop is made and on condition that said door-actuated circuit-controlling mechanism is opened and reclosed when said stop is made, to control said motive means to close the car gate immediately as soon as the hoisting door is closed, and said closure of the car gate starts the car without delay toward the landing corresponding to said unanswered call or calls, and additional means effective only on condition that a call remains unanswered whenever a stop is made, but independently of said operation of the door-actuated circuit-controlling mechanism, to control said motive means to close said car gate at the expiration of a stopping period of pre-determined duration, and said closure of the car gate restarts the car.

31. An elevator control system comprising in combination a car, control means for each of a plurality of landings having combined dispatch and intercepting functions, a car gate normally in open position when all calls are answered, motive means to open and close said car gate, means conditional on opening and reclosing a hoistway door as an incident to each stop of the car at landings to control said motive means to close said car gate without delay as soon as the landing door is reclosed and closure of the car gate in each instance restarts the car.

32. An elevator control system comprising in combination a car, control means for each of a plurality of landings having combined dispatch and intercepting functions, a car gate, motive means to open and close the car gate, means conditional on opening and reclosing a hoistway door as an incident to each stop of the car at landings and on condition that a call is registered, to control said motive means to close said car gate without delay as soon as the hoistway door is reclosed and closure of the car gate in each instance restarts the car immediately and means effective in the absence of such door-operation as an incident to each stop at landings, and only on condition that a call is registered to control said motive means to close the car gate at the expiration of a time period of predetermined duration.

33. An elevator control system comprising in combination a car, a car switch, a car running circuit including a winding and holding contacts for said winding, a pair of normally closed contacts in parallel with said holding contacts, both sets of contacts in series with the car switch so that said running circuit is initially energized by said car switch and said normally closed contacts in series, the latter being opened but not until said holding contacts close, in response to movement of the car switch to on position so that said car running circuit is energized by way of said car switch and said self-holding contacts in series to the exclusion of said normally closed contacts which remain open until the car switch is moved to off position.

34. An elevator control system comprising in combination a car, a car switch, hoistway doors, a car running circuit including a winding and holding contacts for said winding, a circuit-controller controllable to be closed either by opening a hoistway door or by movement of said car switch to stop position and controllable to be opened by closure of the hoistway door only on condition that the car switch is in on position, said opening of the circuit controller being delayed, the said holding contacts and said circuit-controller being in parallel with each other and in series with said car switch in said car running circuit so that the latter is energized initially by said car switch and said circuit-controller in series to start the car, and opening of said circuit-controller contacts transfers control of the running circuit to said self-holding contacts and the car switch in series.

35. An elevator control system comprising in combination a car, a car switch, hoistway doors, a car running circuit including a winding and holding contacts for said winding, a circuit-controller controllable to be closed either by opening a hoistway door or by movement of said car switch to stop position and controllable to be opened by closure of the hoistway door only on condition that the car switch is in on position, said opening of the circuit controller being delayed, the said holding contacts and said circuit controller being in parallel with each other and in series with said car switch in said car running circuit so that the latter is energized initially by said car switch and said circuit controller in series to start the car, and opening of said circuit-controller contacts transfers control of the running circuit to said self-holding contacts and the car switch in series, and selectively operable means to control said holding car running circuit while so controlled by said car switch and self-holding contacts, to intercept the car at landings in their natural order regardless of the order in which said selective means are actuated.

36. An elevator control system comprising in combination a car, a push-button controlled call registering means, a re-set relay, and a switch mechanism rendered effective by intercepting the car at a landing to energize said re-set relay to reset said call registering means simultaneously with said intercepting operation, said switch having a delayed opening so that it maintains said re-set relay energized throughout a stopping period to prevent the call registering means from assuming call registering position throughout said period.

37. In an intercepting dual control elevator system, the combination with the car, a car gate, motive means to open and close said car gate, a plurality of control means one for each of a plurality of landings having combined dispatch and intercepting functions, a car switch, and a change-over switch effective for one position to render said control means effective to control said motive means for the car gate, and effective for another position to render said control means ineffective to control said car gate and to render said car switch effective to control said car gate.

38. In an intercepting dual control elevator system the combination with the car, a car gate, motive means to open and close said car gate, a plurality of control means one for each of a plurality of landings having combined dispatch and intercepting functions, a car switch, and a

change-over switch effective for one position to render said control means effective to control said motive means for the car gate, and effective for another position to render said control means ineffective to control said car gate and to render said car switch effective to control said car gate, and closure of the car gate causes start of the car.

39. In an intercepting dual control elevator system, the combination with the car, a car gate, motive means to open and close the car gate, a plurality of control means one for each of a plurality of landings having combined dispatch and intercepting functions, means conditioned by each stop of the car at landings in response to their control means to control said motive means to open said car gate, means to control said motive means to close the car gate to start the car in response to a registered call, a car switch, and a change-over switch effective for one position to render said gate closing control means responsive to said control means to cause closure of the gate and consequent start of the car, and effective for another position to render said gate closing control means ineffective to cause closure of the gate and start of the car in response to actuated control means and to render said car switch effective to control said gate closing control means to cause closure of the gate and consequent start of the car and said control means remaining effective to intercept the car.

40. In an intercepting dual control system, the combination with the car, a plurality of control means one for each of a plurality of landings having combined dispatch and intercepting functions, a car gate, motive means to open and close the car gate, gate opening control means conditioned by stop operation of the car at any landing in response to its actuated control means to cause said motive means to open said gate, gate closing control means to cause said motive means to close said car gate to initiate start of the car in response to a first actuated one of said control means, and effective thereafter as an incident to each stop and until all registered calls are answered, to close said car gate to re-start the car, a car switch, and a change-over switch, effective for one position to render said gate closing control means so responsive to said control means and effective for another position to render said gate closing control means non-responsive to said control means and to render said car switch effective to control said gate closing control means, and said gate opening control means being effective regardless of whether stop of the car is effected in response to actuated control means or in response to operation of said car switch.

41. An elevator control system comprising in combination a car, a car switch, a car running circuit including a winding having holding contacts, additional contacts normally closed and responsive to movement of the car switch to on position to be opened with delayed movement, said holding contacts and normally closed contacts being in parallel with each other and in series with said car switch to control said car running circuit, so that said car running circuit is initially energized by said car switch and normally closed contacts in series, and said normally closed contacts by so opening transfers control of said car running circuit to said holding contacts and said car switch in series, a plurality of control means one for each of a plurality of landings, said holding circuit including brush mechanism alternately to engage first one of a series of parallel connected conductor strips and then one of a series of conductor strips each in circuit with its associated control means so that said brush mechanism by its movement conditions said held running circuit to be controlled alternately by said car switch alone and by said car switch in series with a control means.

42. An elevator control system comprising in combination a car, a car running holding circuit, and means in said holding circuit comprising brush mechanism to engage alternately with conductor strips forming two sets, the conductors of one set being connected in parallel and each of the conductors of the other set being in series with an associated push-button control means which if it is not in call registering position maintains said holding circuit energized to prevent interception of the car at its landing and if it is in call registering position, it forms a break in said holding circuit to cause interception of the car at its landing.

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