ELEVATOR SYSTEM HAVING ACCELERATED RESPONSE FOR PRIORITY FLOOR CALLS

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This page contains a diagram related to an elevator system with accelerated response for priority floor calls. The diagram includes various electrical components and connections, possibly illustrating the circuitry or operational flow of the system. The patent number is 2,565,632, and the date is August 28, 1951. The inventors are D. Santini and Arvid Nelson, with John Suozzo. The diagram is labeled FIG. 3.
FIG 4.
This invention relates to elevator systems and it has particular reference to elevator systems providing a normal service for normal floor calls from intending passengers and providing accelerated service for priority calls from intending passengers.

When an elevator system is installed and properly adjusted for predetermining traffic conditions, passengers are carried between the various floors served by the elevators as promptly as possible. Under certain conditions, particularly those resulting from a temporary change in the traffic conditions, certain priority floor calls may become evident from the following detailed description taken in conjunction with the accompanying drawings, of which:

1. This invention relates to elevator systems and it has particular reference to elevator systems providing a normal service for normal floor calls from intending passengers and providing accelerated service for priority calls from intending passengers.

2. Figure 1 is a diagrammatic representation of an elevator system embodying my invention. Figure 2 is a diagrammatic representation of the stationary contact segments and the moving brushes on a floor selector for one of the elevator cars embodied in Fig. 1, with the brushes disposed in the position they take when the car is stopped at the third floor.

3. Figs. 3, 4 and 5 collectively constitute a diagrammatic representation in straight-line style of the circuit connections for the two-car elevator system illustrated in Fig. 1. The figures should be assembled vertically in numerical order with Fig. 3 at the top.

4. Figs. 3A to 5A, inclusive, are key representations of the relays in Figs. 3 to 5, inclusive, illustrating the coils and contact members disposed in horizontal alignment with their positions in the straight-line circuits of Figs. 3 to 5. Figs. 3A to 5A should be placed beside the corresponding Figs. 3 to 5 to facilitate the location of the various coils and contacts.

5. Each relay coil or winding is identified by a relay reference character. Each set of relay contacts is identified by the proper relay reference character followed by a number representing the set of contacts. The relay contacts may be "make" or "break" contacts which are designed to interrupt a circuit when a relay having such contacts is energized. A relay also may have "front" or "make" contacts which are designed to complete or close a circuit when the relay is energized. Parts are illustrated in their de-energized conditions.

6. The elevator system may be provided with four cars A, B, C and D for serving seven floors. This number of cars and this number of floors have been selected for the purpose of simplifying the disclosure as much as possible, but it is to be understood that the invention may be used for any reasonable number of cars in a bank serving any reasonable number of floors. For example, the invention would be suitable for an installation of six cars serving thirty floors.

7. For the sake of simplicity, the similar apparatus individual to each car is given the same reference characters except that the apparatus for cars B, C or D is given the prefix B, C or D to indicate that it is for cars B, C or D instead of for car A.

8. The drawings show primarily cars A and C together with their associated circuits. It will be understood that the circuits for cars B and D are substantially similar to the circuits for the cars A and C.
Apparatus individual to car A

- **D**—down switch
- **E**—slow-down inductor relay
- **F**—stopping inductor relay
- **G**—inductor holding relay
- **H**—high car call relay
- **I**—high call reversing relay
- **K**—high floor call relay
- **X**—high priority floor call relay
- **P**—car running relay
- **R**—resistors
- **S**—floor call stopping relay
- **T**—car call stopping relay
- **U**—up direction switch
- **V**—high speed relay
- **W**—up direction preference relay

**DR**—door relay


**XRDR**—Interval holding relay common to all cars.

**Apparatus in Fig. 1 of the drawings**

Referring more particularly to Fig. 1 of the drawings, it will be observed that a car A is arranged to be supported in a hatchway by a cable 10 which passes over a sheave 11 to a counterweight 12. The sheave 11 is mounted for rotation by a shaft 13 driven by a motor 14. A brake 15 of the usual spring-operated, electromagnetically-released type is provided for stopping further rotation of the sheave 11 when the motor 14 is deenergized.

A floor selector 16, of any suitable type, is provided for connecting the various electrical circuits of the system in accordance with the position of the car A. The shaft 13 is extended to operate a brush carriage 17 on the floor selector 16 by mechanically rotating a screw-threaded shaft 18 on which the carriage is mounted. The carriage 17 is provided with a number of brushes which are disposed upon movement of the car, to successively engage stationary contacts arranged in rows on the selector in position to correspond to the floors of the buildings. For simplicity, only two brushes 32 and 33, and two rows of contact segments 35 and 32, disposed to be engaged by them are illustrated in Fig. 1, but it will be understood that in the system to be described hereinafter, as well as in practice, a much larger number of brushes and rows of contact segments is required. Other forms of selectors may be substituted for the selector shown, if desired.

A starting switch SW is mounted in the car to be operated by the attendant to start the car. When the car switch is rotated anticlockwise, it closes its contacts SW1 to start the car in the direction for which it is conditioned to operate. When the car switch is centered, it leaves the control system of the car in such condition that the car can be stopped by operation of hall buttons at the floor landings or stop buttons in the car. It is to be understood that the car may be operated by the car switch or that any suitable control means may be substituted for the car switch. The illustration of the car switch is used for simplicity in describing the system.

Car buttons 2c, etc. (one for each floor) are mounted in the car, so that the attendant may, by operating them, cause the car to stop automatically at any floor. The direction of operation of the car is controlled by relays W and X as will be described in connection with Fig. 3.

Hall buttons are mounted at the floor landings, in order that waiting passengers may cause the cars to stop thereat. An up button and a down button are provided at each floor intermediate the terminals. A down button is disposed at the top terminal and an up button at the bottom terminal. Fig. 1 illustrates only the up hall call button 25 and the down hall call button 2D for the second floor.

In order to automatically effect accurate stopping of car A at the floors in response to operation of the stopping buttons 20, etc., in the car, or by operation of the hall call buttons 2U, 2D, etc., at the floor, a slow-down inductor relay E and a stopping inductor relay F are mounted on the car in position to cooperate with suitable inductor plates of iron or other magnetic material mounted in the hatchway adjacent to each floor.

Only the up plates UP1 and UP2 and the down plate DP1 and DP2 for the second floors are illustrated. Similar plates are provided for each floor, except that the top terminal has only up plates and the bottom terminal only down plates.

The inductor relays E and F, when their coils are energized, have normally incomplete magnetic circuits which are successively completed by the inductor plates as the car approaches a floor at which a stop is to be made. These relays are so designed that energization of their operating coils will not produce operation of their contacts until the relay is brought opposite its inductor plate, thereby completing the relay magnetic circuit. Upon operation of the relay contacts (such as E1 or E2) they remain in operated condition until the relay operating coil is deenergized, even though the inductor relay moves away from the position opposite the inductor plate which completed its magnetic circuit. The plates should be so spaced in the hatchway as to provide desirable distances for slowdown and stopping of the cars at all floors. Other methods of controlling slowing down and stopping of the car may be used if so desired.

The cars and their control apparatus may be designed for operation, under certain conditions, as a high call reversal system in which the cars stop for up calls on their up trips but automatically stop and reverse at the highest down call when there is no service required above that highest down call. Such operation is well understood in the art. If the car attendant desires, for any reason, to go above the highest down call while on an up trip he can so by passing a car call button 6e, etc., for a floor above to cause the car to keep on up to such floor.

Suitable switching means, represented by the switch 19, may be provided on the cars or elsewhere to condition each elevator car to be dis-
patched at each terminal, or for operation as a high call reversal elevator.

A push-button switch 27 is provided in car A to permit the attendant to by-pass the calls ahead of his car when it is loaded or whenever the attendant desires to operate the car straight through.

**Apparatus in Fig. 2**

Fig. 2 illustrates an enlarged view of the floor selector 16 of Fig. 1. In this figure, the various stationary contact segments are represented by rectangles and most of the contacting brushes by small circles. The brush carriage 17 is shown by dotted lines in the position it occupies when the associated car is stopped at the third floor.

The contact segments 21 to 23 on the floor selector are disposed to be successively engaged by the brush 30 to control the high car call relay 2 and by the brush 31 for completing stop circuits set up by the call push buttons in the car for a direction stop. The brush 30 should be long enough to reach adjacent brushes.

The contact segments 22 to 26 and the brush 22 are for connecting the circuits of the stop buttons 22, etc., at the floor landings for up stops. The up contact segments 22 to 30 and the brush 33 are provided for connecting circuits for controlling down calls reaching the up hall call buttons 22, etc. The up contact segments 21 to 26 and the brush 34 connect circuits for the high call relay to be described later. The contact segments 22 to 30 and the brush 31 connect circuits for priority high down floor calls to be described later. The down cancel cancel contact segments 22, etc., and brush 41, the down floor call contact segments 22, etc., and brush 42 and the down car call contact segments 22, etc., and brush 43 are provided for connecting circuits for the down direction in the same manner as described for the up direction.

On the right-hand side of the floor selector, a series of switches 52 to 55 are illustrated as disposed to be operated by a cam 49 on the carriage 17 as it moves from its floor to floor position, for the purpose of controlling a high car call circuit.

The start signal for each car should be given only after the car has reached the dispatching floor. Arrival of each car at each dispatching floor completes a circuit for starting purposes through a suitable contact segment. Thus a segment FS is engaged by its brush 46 when the car A reaches the upper dispatching floor.

**Apparatus in Fig. 3**

Referring particularly to Fig. 3 of the drawings, it will be observed that control circuits are shown on the left-hand side which are individual to car A. At the right-hand side, the circuits shown are individual to car C. Similar circuits are employed for all of the cars A, B, C and D.

As shown, the motor 14 is provided with an armature 14A which is mechanically connected to the shaft 13 for driving the sheave 11. The brake 15 is provided with a winding 20 which is energized on energization of the motor 14. The motor 14 includes the usual shunt-type main field winding 14F, which is connected for energization across the direct-current supply conductors L–3 and L+3. The armature 14A is connected for energization by a loop circuit 22 to a generator G which is provided with an armature 14B.

In order to control the direction and magnitude of the voltage generated by the generator armature 14A, a separately-excited main field winding GF is provided for the generator G. A field resistor RI is included in the circuit of the field winding GF to provide speed control for the motor 14. The generator G is provided with suitable means such as a series field winding GS for correcting the speed regulation of motor 14.

The master switch 5W located in car A is here shown connected to control the energization of the operating windings of an up reversing switch U and a down reversing switch D. The reversing contacts U and D are provided with contact resistors U2, U3 and D1, D3 for connecting the generator field winding GF to the conductors L–3 and L+3 in accordance with the direction in which it is desired to operate the car. When either the up or the down reversing switch U or D is energized, the car running relay M is also energized to condition certain circuits for operation. The common portion of the circuits of the reversing switches U and D and the running relay M includes the usual safety devices indicated diagrammatically at 52. These safety devices may include consoles only when the landing and elevator car doors are closed.

A high-speed relay V is provided for short-circuiting the resistor RI disposed in series circuit relation with the generator field winding GF for applying the maximum voltage to that winding when the car is operating at a high speed. This relay is controlled by contacts U4 and D4 of the switches U and D on starting and by contacts E1, E2, of the slow-down inductor relay E when stopping. An upper and a lower mechanical limit switch VTU and VT D, are provided for interrupting the circuit of the high-speed relay V when the car reaches a proper slow-down point in advance of the upper and lower terminals, respectively, and an upper and a lower stopping limit switch STU and STD, are provided for opening the circuits of the reversing switches U and D at the terminal limits, in accordance with the usual practice.

An up direction preference relay W and a down direction preference relay X are provided for controlling the direction of operation of the car and performing certain functions in connection therewith. The operating windings of these relays are controlled by a top limit switch SW of a bottom limit switch 30B and the high-call reversal relays. Each of the limit switches 30T and 30B is arranged to be opened when car A arrives at the corresponding terminal, thereby interrupting the circuit of the direction preference relay W or X corresponding to the direction of operation of the car. Also when the high call reversal relays operate while the car is between terminals, the relays W and X are operated to reverse the direction switches. Hence the car attendant does not need to do anything except close or open the car switch SW and operate the car call buttons.

The energizing coils for the slow-down inductor switch E and the stopping inductor switch F, are illustrated in this figure as arranged to be energized on operation of the contacts SI of a hall call stopping relay S, the contacts TI of a car call stopping relay T or the contacts J1 of a high call reversing relay J. (The operating coils for relays S and T are illustrated in Fig. 4 and the energizing coil for relay J is illustrated in Fig. 5 and will be described in connection therewith.)

An inductor holding relay G is provided for maintaining the inductor relays in energized condition during a decelerating or stopping operation.
The car buttons 2c, etc., described in connection with Fig. 1, are illustrated with their holding coils 2oc, etc., and circuit in the upper part of Fig. 4, in connection with the high car call relay H and the stopping relay T. The coils 2oc, etc., are energized when the car starts in either direction to hold in the car buttons 2c, 3c, etc., as they are operated, until the direction of the car is reversed, so that the momentary operation of a car button by the attendant will cause it to remain in operated condition until the car is reversed. Energy for the various control operations is derived from direct-current conductors or buses L-1, L-4, L-5, L-6, L-3 which may be extensions of the conductors L+3, L-3.

The high car call relay H is used to prevent relay J (Fig. 5) from reversing the car at the highest registered down floor call when a stop call for a floor above is registered on the stop buttons in the car. It is connected by brush 30 to the row of contact segments 62, etc., on the floor selector 18, so that it will be energized when ever a stop call is registered on any of the stop buttons in car A for a floor above the car. The switches 52, 55, inclusive, operated by the cam 49, are shown as disposed in the circuits of the car buttons to prevent energization of the relay H by operated stop buttons in car A for floors below that car. The cam 49 has a length sufficient to bridge two of the switches.

The car stopping relay T is connected to the up brush 31 engaging the row of contact segments 62, etc., and to the down brush 43 engaging the row of contact segments 62, etc.; so that, when a call is registered on a car button and the car approaches the energized contact segment corresponding thereto, relay T will be energized to stop the car by energizing the inductor relays P and E.

The floor or hall buttons 2U, 3D, etc., described in connection with Fig. 1, are shown with their circuits in the lower part of Fig. 4. Associated with each floor button is a call registering or storing relay by means of which the momentary pressing of the buttons will set up or register a stop call which will hold itself for the direction of the registered call. The call registering relays are connected as 2UR or 3UR for the up direction and as 2UR, 3UR and 6UR for the up direction. For simplicity, the up direction registering relays and floor buttons for only the second, third and sixth floors are shown, as the up buttons and registering relays for the other floors will be readily understood.

The down call registering relays, when energized, close circuits to the row of contact segments 62, etc., and the up registering relays, when energized, close circuits to the row of contact segments 62, etc., on the floor selector so that the contact segment for a floor for which a call is registered is energized as long as the call exists. A car stopping relay S is shown as connected to the down brush 42 engaging segment g2, etc., and to an up brush 32 engaging segment b2, etc. When the car approaches a floor in a down direction for which a down call is registered, the corresponding brush engages the energized contact segment for that floor and thereby causes the relay S to be energized, which, in turn, energizes the inductor relays P and E of that car to effect the stopping of that car at that floor.

The up cancellation coils are designated as 2URN, etc., connected to the up segments of the car, and the down cancellation coils as 2DRN, etc., connected to the down segments of the car, of all of the cars. The brush 33 moves over the segments c2, etc., of the car A, and the brush 41 (or C41) moves over the segments f2, etc., of car C2, etc., they energize the cancellation coil for any floor at which a car stops to answer a stop call.

Contacts of the relays M, W and X shown are for controlling the connections of various circuits. It is believed that such contacts may be traced readily on the drawings and that their purposes will be apparent from the discussion herein presented.

The high floor call relay K is provided for holding the highest collocated floor call relay XX and the priority service relay HCDC together with the operating circuits therefor.

The high floor call relay K of car A is provided for controlling the operation of the high call reversing relays and car in accordance with the existence or non-existence of registered normal floor calls above it. In order to set a reversal of a car at a normal call, it is necessary to energize its relay K.

The circuit 39 includes back contacts 2DR3 to 1DR2 of the down call registering relays arranged in series relation according to the natural sequence of the floors and it is connected at floor points with the contact segment d1, etc. Consequently, the relay K for car A will not be energized as long as a down call exists at any floor above the floor of the contact segment on which the brush 39 rests, but as soon as the brush reaches a segment with no stored down calls above it, a circuit for the relay is completed and it is energized.

The high call reversing relay J is provided for preparing the circuits of car A that it will reverse direction of operation of the car at the floor corresponding to the highest registered down call when a circuit is completed to energize the relay.

The relay J stops the car by closing its contacts J1 in the circuit of the inductor relays P and E (Fig. 3) and it then reverses the stopped car by energizing its contacts J2 in the circuit of the up direction preference relay W (Fig. 3).

When a down floor call has remained unanswered for more than a predetermined time, it becomes a priority call. Such priority calls are determined by down floor calling relays 2DT to 1DT which are common to all of the cars. These relays are connected between the buses L-5, L-5, respectively, through break contacts 2DR3 to 1DR3 of the down call registering relays.

The timing relays 2DT to 1DT may be of any suitable construction for measuring a predetermined time. In the specific embodiment of Fig. 5, each of the timing relays has a time delay in drop out which is determined by a resistor RT which is connected thereacross. If desired, the resistors RT may be adjustable to permit individual adjustment of the time delay for each of the timing relays. If desired, different time delays may be provided for different floors of the system.

It will be understood that when no down floor calls are registered, all of the timing relays 2DT to 1DT are energized. Should a down floor call at one of the floors, such as the 5th floor, be registered, the break contacts 5DR3 open to inter-
rupt the energization of the timing relay 5DT. This relay promptly starts to time out and at the end of the time delay determined by its associated resistor RT the relay 5DT drops out. However, should the contacts 5DR8 reclose before the expiration of the time delay required for dropout of the timing relay 5DT, the relay is promptly re-energized and does not drop out.

The timing relays 2DT to 7DT have make contacts 2DT1 to 7DT1, respectively, which are associated with the contact segments e1 to e7 of the selector for the purpose of controlling the energization of the high priority floor call relay KX. The contacts 2DT1 to 7DT1 are connected in a series circuit 50X successively in accordance with the floors represented thereby between the contact segment e1 and the bus L+5. The contact segments e1 to e7 are connected at floor points on the circuit 50X in a manner analogous to the connection of the contact segments d1 to d7 to the circuit 50. Thus the contact segment e2 is connected to the circuit 50X between the contacts 2DT1 and 3DT1. The contact segment e1 is connected directly to the bus L+5. It should be noted that the circuit 50X employs make contacts of the relays 2DT to 7DT whereas the circuit 50 employs break contacts of the relays 2DR to 7DR.

The high priority floor call relay KX has one terminal connected to the bus L—5. The remaining terminal is connected through make contacts W6 of the up direction preference relay W to the brush 40. It will be recalled that as the elevator car moves, the brush 40 successively engages the contact segments e1 to e7 of the selector. The circuit 50X is similarly associated with the selectors of all of the cars.

The relay KX has contacts KX1 which cooperate with other contacts for the purpose of controlling the high call reversing relay J. The contacts KX3 are effective for energizing the relay J only if certain other additional contacts are closed including the contacts HCD2 of the priority service relay HCD which is common to all of the cars. The contacts HCD2 are closed for the purpose of expediting service to a priority down floor call only if none of the cars is positioned above the highest priority down floor call. Since the operation of the relay J depends in part on the dispatcher for the upper dispatching floor, a brief discussion of the dispatcher now will be presented.

The dispatcher for the upper dispatching floor includes a pair of contacts XD1—1. These contacts are timing contacts which are closed momentarily at the expiration of each dispatching interval. Closure of the contacts XD1—1 completes an energizing circuit for the interval holding relay XRAD across the buses L+5, L—5. Upon energization, the relay XRAD completes the following holding circuit therefor:

\[ \text{L}+5, \text{XRAD, XRAD—2, KX2, BKX2, CKX2, DKX2, L—5} \]

It should be noted that this holding circuit is established only if the highest priority floor call relays KX, BKX, CKX, DKX for all of the cars are de-energized. Consequently, if a car set for up travel is positioned above the highest priority down floor call, a holding circuit cannot be established for the relay XRAD.

Upon energization, the relay XRAD closes its make contacts XRAD1 to control in part the energization of the priority service relay HCD. The complete energizing circuit for this relay is as follows:

\[ \text{CL}+5, \text{HCD, KX1, BKX1, CKX1, DKX1, SD1, BSD1, CSD1, DSD1, XRAD, CL—5} \]

If an up traveling car is above the highest priority down floor call, one of the sets of contacts KK1 to DKX1 will be open to prevent energization of the relay HCD. However, if the relay HCD once is energized, it establishes a holding circuit around the contacts KK1 to DKX1 through the make contacts HCD1.

Energization of the relay HCD also is impossible if one of the cars has received a start signal from the dispatcher. Under these conditions, one of the sets of contacts SD, BSD, CSD and DSD would be open to prevent energization of the relay HCD. This is desirable for the reason that the car set for down travel is in position at the upper dispatching floor to provide reasonably prompt service for any priority down floor call.

Although the contacts SD1 to DSD1 may be manually operated whenever a car has received its start signal, preferably these contacts are automatically operated by a conventional dispatcher. Various dispatchers are well known in the art, but it will be assumed that the dispatcher employed herein is that shown in the Williams et al. patent 2,084,337 and that the dispatcher of the Williams et al. system is connected for non-rotational operation.

A portion of the dispatcher described in the aforesaid Williams et al. patent is shown in Fig. 5. It will be noted that the start down relay SD corresponds to the relay (1SD) of the Williams et al. patent. This relay is energized through the contact segment FST which corresponds to the Williams et al. contact segment (1FST). The reference characters of the Williams et al. patent are shown in parentheses in Fig. 5.

In the Williams patent, the start down relays for the various cars are identified by the reference characters 1SD, 2SD, etc. It will be understood that one of these relays is provided for each of the cars A, B, C and D of the present invention and that these relays when energized open their respective break contacts SD1, BSD1, CSD1 and DSD1. Further, no concern will be expressed concerning the operation of the dispatcher may be obtained by reference to the aforesaid Williams et al. patent.

Summarizing the operation of the high call reversing relay J, it should be noted that this relay can not be energized unless the car A is traveling upwardly (contacts W7 of the up direction preference relay are closed). Furthermore, the relay J can not be energized if a car call exists for a floor above the position of the car (contacts HI of the high car call relay are then open).

If the switch HC is closed and if the contacts HI and W7 are closed, the high call reversing relay J is energized by closure of the make contacts KF of the high floor call relay. Consequently, the car operates high call reversal on the circuit 50.

If the contacts KX3 and HCD2 are closed, a priority down floor call is in existence and no car is in position to provide reasonably prompt service for the priority call. However, as a result of energization of the relay J the car stops and reverses at the highest priority down floor call to provide accelerated service therefor.

**Basic operation, car A**

Although the car A may be connected to operate high call reversal, it will be assumed for the
purpose of discussion that it and the remaining cars operate on a through trip basis. The cars take passengers from the ground or reference floor. Moreover, they normally answer all floor calls at all floors. They are dispatched at intervals on arrival at the ground or reference floor and on arrival at the upper terminal floor. Assuming that the car A is at the ground floor with its doors open to receive passengers, the up direction preference relay W (Fig. 3) will be energized. This is true for the reason that arrival of the car at the ground or reference floor activates the limit switch 36B which is opened to deenergize the down direction preference relay X. Closure of the back contacts X2 of the relay X establishes an energizing circuit for the up direction preference relay W across the supply conductors L+3, L-3 through the back contacts D9 of the down switch and the closed contacts of the upper limit switch 36T. If the car is prepared for upward travel, closure of the car switch SW completes an energizing circuit for the up direction switch U and the car running relay M. This circuit may be traced from the supply conductor L+3 through the switch SW, front contacts W1 of the up direction preference relay, back contact F1 of the stopping inductor relay, closed contacts of the limit switch STU, the winding of the up switch U, the winding of the car running relay M and the safety devices 28 to the supply conductor L-3. Energization of the up switch U results in establishment of a holding circuit therefor around the car switch through the front contacts U5 of the switch.

The switch U also closes its contacts U1 to release the brake 15 and closes its contacts U2, U3 to energize the field windings GF with proper polarity to initiate movement of the car A in an up direction. It will be recalled that closure of the contacts U2, U3 energizes the field winding GF through the resistor R1.

The high speed relay V is energized in response to closure of the contact U4 of the up switch through the limit switch VTU and the back contacts EI of the slowdown inductor relay. This results in closure of the contacts V1 to shunt the resistor R1 and conditions the car A for high speed operation.

Car A runs up at full speed and stops for all up floor calls and all up call cars. It will be recalled that an up floor call results in energization of the car call stopping relay S (Fig. 4) to close the contacts S1 (Fig. 3). Furthermore, a car call results in energization of the car call stopping relay T (Fig. 4) to close the contacts T1 (Fig. 3). Closure of either of the contacts S1 or T1 energizes the slow-down inductor relay winding E, the stopping inductor relay winding F and the inductor holding relay G which closes its contacts C1 to maintain the windings energized. While these windings are energized, if the car A passes an up plate UEP (Fig. 1), contacts EI (Fig. 3) are opened to deenergize the high speed relay V. This results in the slowing down of the car A. As the car A passes the up plate UFP (Fig. 1), the stopping relay F picks up to open its contacts F1 and consequently deenergizes the up switch U and the car running relay M. The resulting opening of the up switch contacts U2 and U3 deenergizes the field winding GF and the opening of the contact U1 results in application of the brake to stop the car A at the desired floor. The deenergization of the car running relay M results in opening of the contacts M1 and deenergizes the slow-down inductor relay E, the stopping inductor relay F and the inductor holding relay G. After the car A has stopped for an up call, it is restarted in the manner previously discussed.

When the car A arrives at the upper terminal floor, the car call stopping relay T (Fig. 4) is energized from the contact segments a1 of the associated floor selector. Energization of the car call stopping relay T results in the stopping of the car at the seventh floor in the manner previously discussed. Arrival of the car A at the seventh floor results in opening of the limit switch 30T (Fig. 3) to deenergize the up direction preference relay W. This relay consequently closes the back contacts W2 to energize the down direction preference relay X (the back contacts U6 and the lower limit switch 36B are closed). This conditions the car A for a return to the reference or ground floor.

At the expiration of the predetermined dispatching interval, the car A receives a dispatching signal. When the operator is ready to start the car in a downward direction, he closes the car switch SW to energize the down switch D and the car running relay M. The energizing circuit may be traced from the supply conductor L-3 through the car switch SW, front contacts X1 of the down direction preference relay, back contacts P2 of the stopping inductor relay, closed contacts of the bottom limit switch STD, the winding of the down switch D, the car running relay M and the safety devices 23 to the supply conductor L-3. Contacts D9 of the down switch D close to establish a holding circuits around the car switch. In addition, the down switch D closes its contacts D2 to release the brake 15 and closes its contacts D1 and D3 to energize the field winding GF and start the car A on its down trip. Closure of the contacts D4 of the down switch energizes the high speed relay V to shunt the resistor E1 and condition the car A for high speed operation.

As the car A moves toward the ground or reference floor, car calls result in energization of the car call stopping relay T (Fig. 4) to stop the car A at the desired floor. Furthermore, down floor calls energize the floor call stopping relay S (Fig. 4) of the car A to stop the car at the desired floor in order to accept passengers desiring transportation to a lower floor. The relays T and S operate by closure of their contacts T1 and S1 to energize the windings of the inductor relays to stop the car A at the desired floor. After completion of the desired stop, the car A may be started in a conventional manner to proceed towards the ground or reference floor. As car A approaches the ground floor, the car call stopping relay T is energized by energization of the contact segment a1 (Fig. 4) by the brush D8. The relay T closes its contacts T1 to energize the inductor relay windings for the purpose of stopping the car A at the ground or reference floor in a conventional manner. Also in approaching the ground floor, the down direction preference relay X (Fig. 3) is deenergized in response to opening of the bottom limit switch 30B. In opening, the down direction preference relay X conditions the up direction preference relay W for energization.

Priority operation, car A responds to priority down floor call

Car A is assumed to be at the lower terminal floor conditioned for up travel when an intend-
ing passenger on the 5th floor presses the down floor button to energize the down call storing relay 5DR. The relay 5DR closes its make contacts 6DR1 to establish a self-holding circuit. Contacts 6DR2 open to deenergize the high floor call relay K. Finally, the down call storing relay 6DR opens its break contacts 6DR3 to interrupt the energization of the down floor call timing relay 6DT. The timing relay 6DT now starts to time out.

At this point, it is assumed that car A is started upward in a manner which will be clear from the preceding discussion. As the car leaves the lower terminal floor, its up direction preference relay W, up direction switch U, car running relay M, high speed relay V, and the high priority floor call relay KX all are energized. It will be understood that the timing relays 2DT, 3DT, 4DT, 6DT and 7DT all are energized but that the timing relay 5DT is timing out. Also, it will be recalled that the down call storing relay 5DR is energized.

As the car A passes the second floor, a down floor call is registered at the 6th floor to energize the down call storing relay 6DR. This relay closes its make contacts 6DR1 to establish a self-holding circuit. The relay also opens its break contacts 6DR2 but such opening has no immediate effect on the system. Finally, the relay 6DR opens its break contacts 6DR3 to interrupt the energization of the down floor call timing relay 6DT. The timing relay 6DT now starts to time out.

It will be understood that if the switch HC were closed, the car under normal conditions would stop and reverse at the highest down call, in this case the 6th floor. If the switch were open, the car would operate normally on a through trip basis to the upper dispatching floor. It may be assumed for present purposes that the switch HC is closed.

As the car A passes, the third floor, the down floor call timing relay 6DT times out and opens its make contacts 6DT1. Such opening deenergizes the high priority floor call relay KX.

The relay KX upon being deenergized closes its break contacts KX1 and KX1 and opens its make contacts KX3. This operation of the relay KX has no immediate effect on the operation of the system.

As the car A continues its upward travel, the dispatcher timer closes its contacts XT1-1 to energize the interval holding relay XRD. If all of the cars are below the 5th floor, the break contacts KX2, BEK1, CKX2 and DKK2 all are closed and the following holding circuit is established for the relay XRD:

L-5, XRZ, XRZ2, KXZ, BEK2, CKX2, DKK2, L-8

As a result of energization of the relay XRZ the make contacts XRZ-1 close. Since all of the cars are assumed to be below the 5th floor, the following energizing circuit is established for the priority service relay HCD:

CL-5, HCD, KX1, BEK1, CKX1, DKK1, SDI, BSL1, CSD1, DSD1, XRZ, CL-5

Upon energization, the relay HCD closes its make contacts HCD1 to establish a holding circuit around the contacts KX1, BEK1, CKX1 and DKK1. Also make contacts HCD2 close but have no immediate effect on the system for the reason that the contacts KX3 are opened. Break contacts HCD4 and HCD5 open to prevent energization of the relays K and CK.

It will be recalled that if one of the cars such as the car B had been at the upper dispatching floor and had received its start signal, the contacts BS61 would have been open to prevent energization of the priority service relay HCD. The car B on its down travel would have provided reasonably prompt service for the intending passengers at the 6th and 5th floors.

When the car A arrives within stopping distance of the 5th floor, its brush 48 engages the contact segment e8 to complete the following energizing circuit for the high priority floor call relay

L-5, 6DT1, 6DT2, e8, 40, W6, KX, L-5

The relay KX now closes its make contacts KX3 to complete the following energizing circuit for the high call reversing relay

L-5, J, M1, HCD2, KX3, W7, L-5

Upon energization, the relay J closes its contacts J3 to establish a holding circuit around the contacts HCD2 and KX3.

The relay KX also opens its contacts KX2 to deenergize the relay XRZ. Contacts KX1 open but are bypassed by the contacts HCD1 of the priority service relay.

Since the relay XRZ is deenergized, it opens its contacts XRZ2 but such opening has no immediate effect on the system. Also contacts XRZ1 open to deenergize the priority service relay HCD.

In addition to establishing a self-holding circuit through the contacts J3, the high call reversing relay J closes its contacts J1 (Fig. 3) to energize the windings of the slow-down inductor relay E, the stopping inductor relay F and the inductor holding relay G. In addition, the reversing relay opens its break contacts J2 but such opening has no immediate effect upon the operation of the system.

The inductor holding relay G closes its make contacts G1 to establish a holding circuit for the relays G, E and F.

When the car passes the up plate UEP for the 5th floor, a high speed circuit is completed for the slow-down inductor relay E and this relay opens its contacts E1 to deenergize the high speed relay V. This results in the opening of the contacts V1 and the slowing down of the car A.

As the car A passes the up plate UFP for the 5th floor, the stopping inductor relay F opens its contacts F1 to deenergize the up switch U and the car running relay M. The resulting opening of the up switch contacts U3 and U3 deenergizes the field winding GF and the opening of the contact U3 results in application of the brake to stop the car A at the 5th floor.

The deenergization of the car running relay M results in opening of the contacts M1 to deenergize the windings of the slow-down inductor relay E the stopping inductor relay F and the inductor holding relay G. Also the contacts M2 open. Since the break contacts J2 of the high call reversing relay J are now open, the opening of the contacts M2 deenergizes the up direction preference relay W. The up direction preference relay W opens its make contacts W1 and closes its break contacts W2. The latter contacts complete an energizing circuit for the down direction preference relay X. The relay X closes its
contacts X1 to prepare the car for down travel. Also the relay opens the break contacts X2 to prevent energization of the up direction preference relay W.

The up direction preference relay upon deenergization also opens its contacts W5 and W6 (Fig. 5) to remove the relays K and KX from service. In addition, contacts W1 open to deenergize the high call reversing relay J.

In response to the stopping of the car A at the 5th floor, the following floor calling circuit is completed

L-4, 5DR1, 5DR2, /5, 41, X6, Q2, L-4

The relay G may have a slight time delay in drop out to ensure cancellation of the floor call. The down call storing relay 5DR is now reset or deenergized and opens its holding contacts 5DR1. This relay also recloses its break contacts 5DR1 and 5DR1. The reclosure of the contacts 5DR2 has no immediate effect on the system. The reclosure of the contacts 5DR2 reenergizes the down floor call timing relay BDT. Those mentioned relay G thereupon closes its make contacts 5DT1 but the reclosure has no immediate effect on the operation of the system.

Since the elevator car A now is stopped at the 5th floor, the car attendant opens his doors to receive passengers. When the attendant recloses his doors and manipulates his car switch SW, the car proceeds in a down direction by a sequence of operations which will be clear from the preceding discussion.

As the car proceeds downwardly, it picks up all down floor calls and responds to all call cars as they are reached by the car according to travel to the lower terminal floor. It should be noted that because of the presence of the priority down floor call, the car A reversed at the 5th floor despite the presence of a nonpriority down floor call at the 6th floor.

Although the invention has been described with reference to certain specific embodiments thereof, numerous modifications following within the spirit and scope of the invention are possible.

We claim as our invention:

1. An elevator system, a structure having a plurality of floors, a plurality of elevator cars, means mounting the elevator cars for movement between said floors, call means for each of said floors, control means responsive to operation of any of said call means for stopping the first available one of the elevator cars at the associated floor, means for dispatching the elevator cars in a first direction from predetermined dispatching positions successively in accordance with a predetermined plan, and means responsive to failure of any of said elevator cars to be available for dispatching in accordance with said plan for conditioning an elevator car approaching its dispatching position in a second direction opposite to said first direction to stop and reverse at a floor displaced in the first direction from the last-named dispatching position, said last-named means comprising selective means preventing the last-named elevator car from reversing at a floor between the elevator car at the time of such failure and its dispatching position at which a call has been registered for travel in the first direction for less than a predetermined time.

2. A system as claimed in claim 1 wherein the conditioned elevator car is the leading elevator car approaching its dispatching position at the time of said failure.

3. In an elevator system, a structure having a plurality of floors, a plurality of elevator cars, means mounting the elevator cars for movement between said floors, control means responsive to operation of any of said call means for stopping the first available one of the elevator cars at the associated floor, means for dispatching the elevator cars in a first direction from predetermined dispatching positions successively in accordance with a predetermined plan, and means responsive to failure of any of said elevator cars to be available for dispatching in accordance with said plan for conditioning an elevator car approaching its dispatching position in a second direction opposite to said first direction to stop and reverse at a floor displaced in the first direction from the last-named dispatching position, said last-named means comprising selective means preventing the last-named elevator car from reversing at a floor displaced in the first direction from the last-named dispatching position, said last-named means comprising selective means effective in response to operation of certain of said call means for the first direction for floors intermediate the last-named floor and the dispatching position of the last-named floor without answer for less than a predetermined time and to operation of certain of the last-named call means without answer for more than said predetermined time for stopping and reversing the conditioned elevator car only at one of the last-named floors having call means operated and unanswered for more than the predetermined time.

4. A system as claimed in claim 4 wherein the conditioned elevator car is the leading elevator car approaching its dispatching position.

5. A system as claimed in claim 4 wherein the control means is effective upon reversal of said conditioned elevator car for stopping the reversed car successively at floors approached by the reversed car for which call means have been operated for said second direction.

6. A system as claimed in claim 1 wherein if priority calls for the second direction exist for a plurality of floors between the elevator cars at the time of said failure and the dispatching positions of the respective cars, said selective means permits stopping and reversal of one of the elevator cars only after the elevator-car-to-be-reversed has reached the priority call nearest to the dispatching position of the last-named elevator car.
8. A system as claimed in claim 7 wherein the elevator-car-to-be-reversed is the leading one of the elevator cars approaching the dispatching positions in said first direction.

9. In an elevator system, a structure having a plurality of floors, an elevator car, means mounting the elevator car for movement between said floors, call means for each of the floors, control means responsive to operation of any said call means for stopping the elevator car at the associated floor, means for dispatching the elevator car in a first direction from a predetermined dispatching position at intervals determined by a predetermined plan, and means responsive to failure of said dispatching means to complete a dispatching operation upon the expiration of one of said intervals for conditioning the elevator car if traveling towards the dispatching position in a first direction to stop and reverse at a call intermediate the elevator car at the time of such failure and the dispatching position for a second direction opposite to the first direction, said last-named means comprising selective means capable of effecting said reversal only at a call for the second direction which has remained unanswered for more than a predetermined time.

10. A system as claimed in claim 9 wherein said selective means in response to the existence of a plurality of elevator cars at the time of said failure and the dispatching position for the second direction which have remained unanswered for more than the predetermined time permits reversal of the car only at the one of said calls which is nearest to the dispatching position.

11. In an elevator system, a structure having a plurality of floors, an elevator car, means mounting the elevator car for movement between said floors, call means for each of the floors, control means responsive to operation of any of said call means for stopping the elevator car at the associated floor, means for dispatching the elevator car in a first direction from a predetermined dispatching position at intervals determined by a predetermined plan, and means responsive to failure of said dispatching means to complete a dispatching operation upon the expiration of one of said intervals for conditioning the elevator car if traveling towards the dispatching position in a first direction to stop and reverse at a call intermediate the elevator car at the time of such failure and the dispatching position for the second direction opposite to the first direction, said last-named means comprising selective means responsive to the presence of both priority and nonpriority calls intermediate the elevator car at the time of said failure and the dispatching position for the second direction for preventing reversal of the elevator car at a nonpriority call.

12. In an elevator system, a structure having a plurality of floors, an elevator car, means mounting the elevator car for movement between said floors, call means for each of the floors, control means responsive to operation of any of said call means for stopping the elevator car at the associated floor, means for dispatching the elevator car in a first direction from a predetermined dispatching position at intervals determined by a predetermined plan, a high priority-call reversal circuit normally ineffective for controlling the elevator car, and means responsive to failure of the dispatching means to complete a dispatching operation upon the expiration of one of said intervals for transferring the elevator car to control by the high priority-call reversal circuit.

13. In an elevator system, a structure having a plurality of floors, a plurality of elevator cars, means mounting the elevator cars for movement between said floors, call means for each of said floors, control means responsive to operation of any of said call means for stopping the first available one of the elevator cars at the associated floor, means for dispatching the elevator cars in a first direction from predetermined dispatching positions successively in accordance with a predetermined plan, timing means for each floor for measuring the time during which a call for service in a second direction opposite to the first direction remains unanswered, a priority-call reversal circuit responsive to said timing means for designating the floor nearest to the dispatching positions at which a call for service in the second direction has remained unanswered for more than a predetermined time, and means responsive to failure of any one of the elevator cars to be in dispatching position at the time a car is to be dispatched in conformance with said plan for transferring the cars to control by said priority-call circuit, said last-named means comprising means cooperating with the control means for stopping and reversing the first available one of the elevator cars traveling in the first direction at said designated floor.

14. A system as claimed in claim 13 in combination with means responsive to the absence of a priority call above the leading elevator car traveling in the first direction for preventing said transferring of the cars.

15. A system as claimed in claim 13 in combination with means responsive to arrival of an elevator car in the dispatching position subsequent to said transferring for cancelling said transferring of the car.

16. A system as claimed in claim 13 in combination with means responsive to the answering of all priority calls for the second direction above one of the elevator cars traveling in the first direction after said transferring for cancelling the transfer of said last-named elevator car.

17. A system as defined in claim 18 wherein said service means is effective for reversing an up-traveling car which stops in response to an operated one of the down-call means.

18. A system as defined in claim 18 wherein the service means is responsive to an operated down-call means for stopping an up-traveling
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19. A system as defined in claim 18 wherein the service means is responsive to operation of a plurality of down-call means for floors ahead of an up-traveling car for stopping the last-named elevator car at the floor of the highest of the plurality of down-call means.

20. A system as defined in claim 21 wherein the service means is responsive to an operated down-call means for stopping an up-traveling car only if the last-named call means has remained unanswered for more than a predetermined time, in combination with means responsive to the presence of an up-traveling car above the floor of the highest down-call means which has remained unanswered for more than said predetermined time for preventing stopping of an up-traveling car in response to said last-named call means.

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