

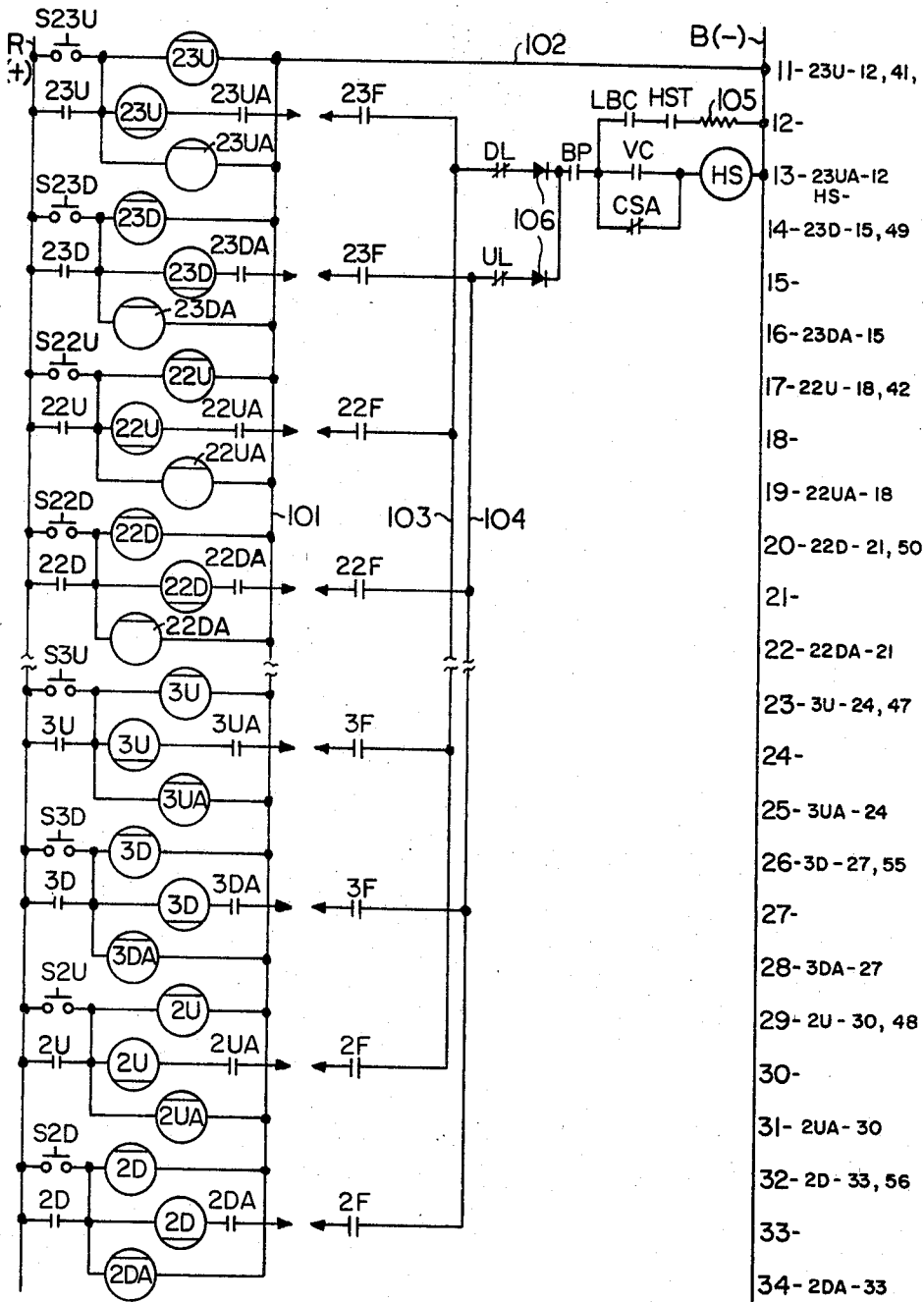
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P. F. DE LAMATER
ELEVATOR CONTROL HAVING CAR CALL LOCKOUT
OF HALL CALL STOPPING MEANS

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ELEVATOR CONTROL HAVING CAR CALL LOCKOUT OF HALL CALL STOPPING MEANS

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ABSTRACT OF THE DISCLOSURE

An elevator control for a plural car elevator system which prevents stops of cars in response to hall calls when a car within a given range of travel of the landing of the hall call is set to travel in the direction of the hall call and has a car call for the landing of the hall call. The range of travel between the landing and the car locking out its hall call is a distance less than the total travel from the upper to lower terminal and greater than the slowdown distance from the landing, e.g. three landings plus the slowdown distance to the landing.

This invention relates to controls for a group of elevators and more particularly to means for restricting the service to landings at which hall calls are registered and for which car calls are also registered to cars having such car calls.

Heretofore it has been known to inhibit the stops of cars in response to hall calls where other cars in the system have car calls for the corresponding landings of the hall calls. Such systems are shown in Williams Pat. No. 2,359,179 of Sept. 26, 1944 for "Elevator Control System" and in Keppler et al., Pat. No. 2,941,624 of June 21, 1960 for "Elevator Control System." In these prior art systems, the controls under certain circumstances cause a substantial deterioration in the service rendered by the system inasmuch as the delay in answering a registered hall call is substantially lengthened where the car in which a car call for the corresponding landing is registered is a great distance from the hall call and other cars are in immediate proximity to the landing of that hall call.

The present system has been utilized as an element of a system which tends to localize the response of elevators to calls in their immediate vicinity by establishing a spatial relationship between the calls and the cars which enables specific hall calls to be assigned to specific cars. Such assignment has been made in the overall system as disclosed in P. F. De Lamater patent application Ser. No. 565,551 for "Elevator Control" filed herewith as being based on a priority wherein the highest priority of call assignment is to an elevator car in proximity to a landing for which a hall call is registered which has a car call registered for that landing and an intermediate level of priority wherein a car is assigned a hall call in an active car service zone defined by the landings extending from the car in the direction the car is set to travel to the next preceding car set for travel in the same direction. A third level of priority is provided whereby a car having no assigned calls parks and responds to all calls in its vicinity. The parked car runs in either direction to calls for service away from the parking station which it accepts as assigned calls at the time of the registration. It also runs to calls which require reversal, that is, service toward the parking station on the lowest order of priority. The means affording the first order of service priority is the basis of the present invention.

In accordance with the above, one object of the present invention is to improve elevator controls.

A more specific object is to enable specific assignment of calls to cars on the basis of the proximity of the car to the call and the coincidence of car calls in that car for the landing of the hall call.

A further object is to expedite elevator service by eliminating unnecessary stops of cars without deteriorating the service to hall calls.

One feature of the invention resides in a control for a group of elevators wherein elevators normally commute the registered hall calls as they travel along the elevator hatchway and respond to registered hall calls as they are encountered, which is modified in its function to inhibit the response of cars to registered hall calls where another car is in proximity to the landing of the hall call, is traveling in the service direction of the hall call and has a car call registered for the landing of the hall call. The resultant lockout of cars not having car calls for the landing is further restricted such that the presence of additional car calls in the car which otherwise might inhibit the stop can indicate a potential service burden on the inhibiting car such that the inhibiting means is rendered ineffective.

The above and additional objects and features will be more fully understood from the following detailed description when read with reference to the accompanying drawings in which:

FIG. 1 is an across the line diagram of fragments of the hall call registering circuits for a multi-car elevator system and corresponding fragments of the hall call stopping and canceling circuit for an individual car in the system.

FIG. 2 is an across the line diagram of the auxiliary hall call relays common to the system and cooperating individual car circuits for a typical car which enter into the hall call lockout functions of the invention, together with a fragmentary car call registering, car call stopping and car call canceling circuit for an individual car in the system.

In one utilization of the system of this invention, it has been applied to a four car elevator system serving twenty-four landings. The control of this invention augments a control more completely disclosed in the aforementioned Paul F. De Lamater patent application for "Elevator Control" filed herewith and the disclosures of that application are incorporated herein by reference where necessary for a complete understanding of a typical application of this invention to an elevator control system. In the drawings, the controls individual to only one car and typical of each car are shown for a plurality of typical landings as they cooperate with controls common to all cars of the system through inter-couplings represented by arrowheaded leads in horizontal alignment at the interconnecting points.

The circuit diagrams are of across-the-line type to facilitate reading. As such, the operating coils and motors are separated from the contacts which they actuate. Location of the coils and contacts is signified by line number assigned to horizontal bands running across the drawings and indicated in a key in the right hand margin of the drawings. For example, FIG. 1 includes lines 11-34 and FIG. 2, lines 41-68. Each actuating coil or motor is indicated in the margin in horizontal alignment with its location in the drawing. Two forms of electromagnetic relays are illustrated. Relay HS at line 13 is represented by a circle in the drawings and is arranged to pull in its armature when the coil is energized and drop out the armature when the coil is deenergized. Other relays of the system typified by relay 23U at lines 11 and 12 have two coils, a latch coil represented by a circle with a chord across the upper portion as at line 11 and a reset coil represented by a circle with a chord across the lower por-

tion as at line 12. These dual coil relays are arranged such that energization of the latch coil alone or the reset coil alone will pull in the armature and actuate the relay contacts while deenergization of all coils drops out the armature. Further, if the latch coil is energized and the reset coil energized, the fluxes generated in the two coils oppose and cancel each other with the result that the armature remains dropped out.

The contacts controlled by the coils of the relays are shown in the drawings in the position they assume when the coils are deenergized and the armatures dropped out. Back contacts, those normally closed and opened by energizing the coil by which they are controlled, are shown closed in the drawing and bear the reference character of their actuating coil. They are associated with their actuating means by placing the number of the line on which they appear in the marginal key adjacent the reference character for that means and underlining that number. Thus in the case of relay 23C at line 57 of FIG. 2, the back contact at line 43 is represented in the key by "43." Front contacts, those normally opened and closed by the operation of the relay armature, also bear the reference character of the relay as the contact 23C at line 41 designated as "41" in the margin at line 57 opposite the reference character "23C." A list of the relays illustrated follows in which the relays have been arranged in alphabetical and numerical order according to their symbols, a functional description of the relays listed, and the location of the actuating coil indicated:

Symbol	Functional Description	Location
CCS	Car call stop	62
HS	Hall call stop	13
2D to 23D	Down hall calls 2nd to 23rd landings	33-14
2DA to 23DA	Auxiliary down hall calls 2nd to 23rd landings	34-16
2U to 23U	Up hall calls 2nd to 23rd landings	29-11
2UA to 23UA	Auxiliary up hall calls 2nd to 23rd landings	31-13

In addition, a number of contacts actuated by relays are shown wherein the relay coils are not illustrated in the present application. In general, these relays or their equivalents are known to those skilled in the art and further reference may be had to the aforementioned P. F. De Lamater patent application to illustrate the circuits for their control. The following table lists these relays alphabetically and offers a functional description of the relays:

Symbol:	Functional designation
BP	Bypass.
CSA	Car start auxiliary.
DCL	Door close limit.
DL	Down direction locking.
DRC	Direction reversal control.
HST	Hall stop timed.
LBC	Landing button control.
RH5	Fifth speed setting, rheostat
UL	lay.
VC	Up direction locking.
2F through 23F	Vernier crosshead. Second through twenty-third landing bridging.

Hall call buttons for the second, third, twenty-second and twenty-third landings which are typical of the landings in the system of the example are shown in FIG. 1 at lines 11-32 as push buttons having the prefix S, the landing designation and the service direction requested from the landing as the suffix U for up and D for down. These push buttons close contacts to register hall calls by energizing latch coils for corresponding call relays thereby completing a circuit from bus R through a latch coil to lead 101 and lead 102 extending to bus B. The buses R and B are respectively coupled to the positive and negative terminals of a suitable d.c. supply (not shown). The call relays each have a seal around their hall call buttons as contact 23U at 12 for the relay 23U

latch coil at 11. As is usual, each landing below the uppermost landing has an up hall call button and each landing above the lowermost landing has a down hall call button. The corresponding call relays are identified by their landing number and a suffix U for an up call and D for a down call.

The present system is arranged to increase the efficiency of operation of the group of cars by reducing the number of stops required by hall calls where a nearby car is set to travel in the direction required by the registered hall call and has a car call for the landing of the registered hall call, provided that nearby car is not otherwise so burdened that it is incapable of fulfilling the anticipated requirements represented by the registered call. Auxiliary relays 2UA to 23UA, 2DA to 23DA to the hall call relays 2U and 23U and 2D to 23D are provided to control this mode of operation. These relays have two coils, a latch coil illustrated in FIG. 1 which is energized with the hall call relay latch coil by the registration of a call and is sealed by the hall call relay seal around the call button, and a reset coil as illustrated in FIG. 2. The latch coil of the auxiliary hall call relay closes a contact in the reset coil circuit of the hall call relay provided the reset coil of the auxiliary hall call relay is not energized. Energization of the reset coil of the auxiliary call relay can occur either simultaneously with the energization of its latch coil, in which case the net flux in the relay is zero and the relay prevents completion of a hall call stop circuit common to all of the hall stop relays HS, illustrated for one car at line 13, and the hall call reset circuit until after the car has been stopped by its car call stop circuit. In this manner only cars with a car call for the landing will stop even though a hall call is registered at the landing.

An up hall call at the twenty-third landing registered by closing push button actuated contact S23U at 11 connects latch coil 23U and latch coil 23UA at 13 to leads 101 and 102, thereby completing circuits for those coils between the buses R and B. Contact 23U at line 12 is closed to hold this circuit around the push button and contact 23U at line 41 is closed to partially enable the reset coil 23UA. If the reset coil 23UA at 41 is not energized, energized latch coil 23UA at 13 closes its contact at 12 to enable the reset coil 23U at 12 by partially completing the hall call stopping and canceling circuits to the arrow-headed lead at 12.

It is to be recognized that moving elevators conventionally have an effective position as characterized by the setting of the car controls which is in advance of the actual position of the car in order to provide a slowdown distance as the car encounters a landing for which a call is registered. Thus a car running upward at full speed and located at the fifth landing has controls which effectively sense conditions three landings in advance of the car or the eighth landing. Ordinarily a car upon picking up a hall call or car call for a landing at its effective position, its slowdown distance in advance of its actual position, will initiate its stopping sequences and then cancel the call. The present system is concerned with locking out a range of landings in advance of the effective positions of the cars. Thus it relates locations in advance of each car as a first given distance along the travel of the car in advance of the landing of a call from which a stop of the car can be initiated for that landing and a second given distance in advance of the landing a greater distance than the first distance for inhibiting the hall call responsive means of cars. The first distance is the "slowdown distance" or "call acceptance zone" for the car. The second distance is the range in which a car with a car call can exclude other cars from the hall call.

The effective position of each car is signified in the control circuits by bridging relay contacts designated by the landing number and the suffix F. These relays (not shown) are arranged so that during the advance of the effective position of the elevator car along its path of travel and

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at the transition from one landing to the next adjacent landing, there is a continuity maintained through an overlap of the closed contacts. Thus as the car advances upward from the twenty-second floor, at which the contacts 22F at lines 18 and 21 are closed, to the twenty-third floor the contacts 23F at lines 12 and 15 are closed prior to the opening of the contacts 22F at 18 and 21. Immediately following the closure of contacts 23F, contacts 22F are opened. The direction of travel of the car is indicated by direction latching circuits. When the car is not set to go downward or is set to go upward, lead 103 is effective through back contact DL at 13 of the down direction locking relay, and, when the car is not set to go upward or is set to go downward, the back contact UL at 15 of the up direction locking relay is closed to enable lead 104. Each car as it advances along its path of travel, passes through a call acceptance zone defined by the interval a contact VC of a vernier crosshead relay (not shown) is closed. The location of the call acceptance zone with respect to a landing is dependent upon the speed at which the car is traveling at the time and is determined through the operation of the advance mechanism of the floor selector machine by techniques well known to those skilled in the art.

The assumed twenty-third floor up hall call is effective to actuate the hall stopping relay HS at 13 of the first ascending car which passes through the call acceptance zone for the twenty-third floor and closes contact VC at line 13, provided that car is not conditioned to bypass and therefore has its bypass relay contact BP at 13 closed. This circuit can be traced from bus R through contact 23U at 12, reset coil 23U, contact 23UA, and the arrow-headed lead all at 12 in the common circuit, to the arrow-headed lead for the individual car, and contact 23F at 12, thence to lead 103, back contact DL at 13 and contacts BP and VC at 13 to the coil HS and bus B. Coil HS pulls in and initiates the stopping circuit for the car. This de-energizes the car starting auxiliary relay CSA (not shown) to close its contact at line 14 shunting the vernier crosshead relay contact VC at 13 such that the advance of the car beyond the call acceptance zone and the opening of contact VC as the car approaches the twenty-third landing is ineffective to drop out the relay HS. The impedance offered by the car's hall stop relay coil HS limits the amount of current flowing through the reset coil 23U to a level generating insufficient flux to drop out the relay 23U. Hall stop relay HS energizes landing button control relay LBC (not shown) to close contact LBC and hall stop timed relay HST (not shown) to close contact HST both at 12 in series with resistor 105 whereby the impedance in series with reset coil 23U is reduced to a level permitting sufficient current to flow to drop out the relay whereby the hall call is reset.

Each car's stopping circuit functions similarly for up hall calls. Sneak circuits are prevented between the several hall call stop circuits by the blocking rectifiers 106 for both the up and down circuits. Down stops for the cars are similarly accomplished through the closed back contact UL at 15 and lead 104 when down hall calls are registered. For example, a down hall call at the twenty-third landing energizes relay 23D and is effective upon the hall stop relay of a car through that car's 23F contact at line 15 when the car is in the call acceptance zone for the twenty-third landing while above that landing and descending.

In the system to which the present invention has been applied, the cars can be parked at random positions. When a car is parked at a landing, it has no direction set and up and down direction locking relay back contacts UL at 15 and DL at 13 are closed to enable that car to run to hall calls for adjacent landings and open its doors for hall calls at the parking landing. In accordance with the present invention another car having a car call for a landing for which a hall call is registered can inhibit the response to such hall call by the packed car if the other

car is traveling in the proper direction and within the range of the landing which is effective to actuate the inhibiting means. This is accomplished by inhibiting operation of the HS relay for the parked car whereby that car remains parked with its doors closed.

In the absence of an inhibiting function, the registration of a hall call at the parking landing initiates operation of the parked car to serve that call. In the event the car has been parked with its doors closed at the landing for which a hall call is registered, it is necessary to initiate the door opening sequence before canceling the call. Under these circumstances relay HS is energized by the registration of the call to close a contact of the HS relay and energize relay HST. Relay HST insures that the motor generator set for the car is started (by means not shown) if the set is shut down and closes a contact in the call canceling circuit at 12 as described above. However, the landing button control relay LBC does not become energized until the door opening is initiated for a parked car and therefore contact LBC at 12 remains open until the car is conditioned to open its doors. This sequence retains the registration of the hall call until the doors are started open.

The circuits in the upper portion of FIG. 2 represent four typical floors, the auxiliary hall call relays shown on the right hand side of the drawings as common to all cars, and in alignment therewith on the left hand side of the drawings, the typical energizing circuit for those coils as provided by each of the cars. This system is arranged to energize the auxiliary hall call relay for a hall call if there is a car within three landings of the hall call traveling in the direction of service required by the hall call, provided that car has a car call for the landing of the hall call, provided that car is not so loaded or otherwise conditioned to bypass, and provided that car has no car calls for the next two succeeding landings beyond the landing in question. In order to provide these controls, the auxiliary hall call relay reset coils are segregated into a group of up hall call relays and a group of down hall relays.

In the assumed up hall call at the twenty-third floor, relay 23UA would have been held in a dropped out position and thereby had its contact 23UA at line 12 open in the hall call stopping circuit if another ascending car had a car call for the twenty-third landing, was within three landings of the twenty-third landing, and was capable of serving that landing. Assume that a second car had been ascending so that its up direction locking relay contact UL at 42 was closed and was not set to bypass so that its bypass relay contact BP at 57 was closed to connect bus R to lead 107. Under these circumstances, the lead 108 is activated in that car's up auxiliary hall call reset circuit through the blocking rectifier 109. If the car were at the twentieth, twenty-first or twenty-second landing, its contact 20F at 43, 21F at 42 or 22F at 41 would be closed to complete a circuit to the cross connections 111 comprising a series of back contacts of car call relays in the illustrated example for certain landings above the current car position. In the example the car calls are effective as hall call stop inhibitors for three landings ahead of the effective car position. The circuit of back contact cross connections 111 are made up from the junction for indicating effective car position through the back contact of the car call relay for the fourth landing beyond the effective car position in the direction of car travel to the junction of the next car position. Thus if the car were at the twentieth landing so that its contact 20F was closed, and had no car call for the top landing to open back contact TC at 42 for the twenty-fourth landing, a circuit would be provided between lead 108 and the cross connection circuit 111 through contact TC at 42 and rectifier 112 to the closed contact 23C for the car call at the twenty-third landing of that car at line 41.

The arrowheaded lead on the left of FIG. 2 is cross

coupled to the arrowheaded lead on the right common to all cars at line 41. The registered up landing call at the twenty-third landing which closed contact 23U at line 41 would thereby complete a circuit to the reset coil 23UA and bus B. With reset coil 23UA energized, latch coil 23UA at line 13 would be ineffective to close its contact at line 12 and the common function of the hall call stopping circuit would be disabled for all cars. As a result, only those cars having car calls for the twenty-third landing could be stopped at that landing. The car call circuits are illustrated in the lower portion of FIG. 2 from line 57 through 68.

An inverted mode of operation is afforded for down landing calls. Consider a down hall call for the third landing which energizes latch coil 3D at line 26 and latch coil 3DA at line 28, and further visualize a non-bypassing car below the seventh landing and above the third landing having a car call for the third landing. Such a car would have its auxiliary down hall call relay reset circuit enabled for the third landing to energize the auxiliary down hall call relay reset coil 3DA at line 55. Thus if the car were not set to bypass, its bypass relay contact BP at 57 would be closed to couple lead 107 to bus R, and if the car were set for down travel, its down direction locking relay contact DL at 51 would be closed through blocking rectifier 113 to the common lead 114 of the car's auxiliary down hall call relay energizing circuit. If the car were at the sixth landing, contact 6F at 53 would be closed to couple lead 114 to the cross connections comprising the series of back contacts 115. If, further, the car had no car calls within the range of the two landings beyond the landing in question, that is no car call for the second or first landing so that its contacts 2C at 53 and 1C at 54 were closed, it would energize the reset coil 3DA through its contact 3C at 55 and the common down hall call contact 3D at 55.

The hall call stop inhibiting circuit is thus effective to prevent duplicate stops in rapid succession where a first car picks up the hall call for a landing and a second closely following car stops at the same landing for its individually registered car call. This inhibition is subject to the constraints that the second car must not be so burdened either with its present loading or anticipated loading that the concentration of all of the traffic present at the one landing in that car would result in a deterioration of service. Thus the car having the car call registered cannot be bypassing as would be the case if it were overloaded and it cannot have additional car calls registered closely adjacent and beyond the landing in question. If the car having the car call and approaching the landing in question meets these constraints, and is within the spatial limits dictated by the circuit, three landings in the example, it ordinarily will both promptly and adequately serve the landing call and car call with a single stop, thereby permitting other cars to proceed to other service in the building without the impediment of an extraneous stop.

The range of effectiveness of the car call lockout of hall stops can be adjusted by the choice of the car call back contacts in the cross connecting circuits 111 and 115. A range of three landings ahead is provided as for example in the up hall call circuit such that a car at the nineteenth landing having its contact 19F at 44 closed, is inhibited from affecting circuits ahead if its twenty-third landing car call is registered to open back contact 23C at 43. This is the fourth landing ahead of the nineteenth landing. In a similar fashion, a car at the second floor and set to ascend so that it has contacts UL at 42 and 2S at 47 closed, is effective for any car call up to the fifth landing provided no additional car call for two landings ahead of the call in question is registered. Thus a car call for the third landing would close contact 3C and energize relay 3UA reset coil. A car call for the fourth landing would close contact 4C

at 46 and energize relay 4UA reset coil unless there was also a car call registered for the sixth landing to open back contact 6C at 46. The inversion of this relationship is readily apparent from the review of the auxiliary down hall call relay reset circuits of 49-56 in FIG. 2.

Before considering the response of a car which has appropriated the assignment of a hall call by virtue of its car call, a review of the car call circuits at 57-68 is in order. A car call is registered by depressing a call button in the car on a control panel (not shown). Ordinarily each car has a car call button for each landing it is capable of serving as typified by the car call buttons actuating contacts in the car call circuits and designated by the prefix C and the number designation of the landing. For example, the car call button for the fourth landing C4 at 63 when depressed completes a circuit from lead 116 to latch coil 4C at 63, leads 117 and 118 and bus B. If a circuit is complete from bus R to lead 116 at this time, relay 4C pulls in to close its seal contact at 64 around button C4 and remains energized until the car responds to a call or until the car is reversed.

The circuit between bus R and lead 116 is ordinarily through direction control relay contact DRC at 58. During a normal run, both while the car is running and during its stops, contact DRC at 58 is closed. As the car is slowed to stop and reverse its direction at the end of a normal run, the direction locking relay for the direction in which the car is traveling is dropped (by means not shown). This drops direction control relay DRC to open contact DCR at 58 while the car speed setting is above the fifth speed stop and back contact RH5 at 59 is open. DRC remains dropped until the car is started from the stop. Thus, all car call registering circuits are deenergized during slowdown at the end of a run by disconnecting lead 116 from bus B. Subsequent to the drop of relay DRC the hoist motor control of the car is transferred from its fifth speed setting to the fourth speed setting to drop fifth rheostat relay RH5 and close its back contact at 59. While the car is stopped at the landing back contact RH5 connects bus B to lead 116 whereby car calls can again be registered.

The car call stopping and resetting circuits are directly controlled through the floor selector machine for the individual elevators. Contacts 119 represent segments in a vertical column on the floor selector machine located at levels corresponding to the landings served by the car. These contacts are commutated by a brush 121 carried by a crosshead on the floor selector machine and advanced to correspond to the effective position of the car. A car call stopping signal is issued to the controls for the car through the energization of relay CCS at 62 when the effective position of the car is determined by the floor selector crosshead position as it locates the brush 121 on the floor selector contacts 119 to engage a contact for a landing for which a car call is registered. In the case of a car call for the fourth landing, the segment 119 at line 64 is shown engaged by the brush 121 so that the approaching car when in its call acceptance zone as defined by the closure of contact VC at 63 completes a circuit from bus R through contact DRC at 58, lead 116, contact 4C at 64, reset coil 4C at 64, segment 119 and brush 121 of 64, contact VC at 163 and coil CCS at 62 to bus B. When relay CCS is energized, it deenergizes the car start and running circuits to drop the relay CSA and close back contact CSA at 62 such that the opening of the contact VC at 63 as the car advances toward the landing at which it is to stop is ineffective to deenergize a relay CCS. As in the case of the hall call stopping circuit, the impedance of the coil CCS limits the current through the reset coil of the car call relay to a level which is insufficient to generate the flux necessary to overcome the latching flux. Hence, the car call relay remains energized at this time.

As the car enters its leveling door open zone, eight inches from the landing, the car door operator is ener-

gized and the door is started open. When the door is two inches from fully closed position and moving in an opening direction, the door close limit relay DCL is energized to close its contact at 61 thereby shunting relay CCS with resistance 122 to reduce the impedance in the circuit to reset coil 4C to a level developing adequate flux to overcome the latch flux and drop the car call relay.

Returning now to the consideration of a coincident car call and hall call for a landing under conditions inhibiting the hall call stopping circuit, the energized auxiliary hall call relay reset coil by retaining the auxiliary hall call relay armature dropped out prevents the competition of the hall call stop circuit and hall call reset circuit by retaining its contact as contact 23UA at line 12 open. Thus the advance of any car along its path of travel to the call acceptance zone for the twenty-third up hall call is of no effect and unless the car has a car call registered, it either actuates a highest call circuit (not shown) and reverses or it continues past the twenty-third landing to the top landing.

That car which is ascending which has a car call registered for the twenty-third landing and which is within three landings of the twenty-third landing will, as it reaches the call acceptance zone for the twenty-third landing, actuate its car call stopping relay CCS at line 62 in the manner described. It therefore is stopped through the car call stopping controls, initiates its door opening and then cancels the car call dropping out relay 23C to open its contact at line 41. The opening of contact 23C deenergizes the reset coil 23UA permitting the latch coil 23UA at 13 to be effective in closing its contact at line 12. The registered up hall call at the twenty-third landing is then canceled since the car is not set for down travel and has its back contact DL at 13 closed, is not bypassing and has its contact BP at 13 closed, is located at the twenty-third landing so that its contact 23F at 12 is closed, is not running so that its starting and running relay back contact CSA at 14 is closed and thereby offers a complete circuit for the hall stop relay HS through reset coil 23U. With HS energized, relays LBC and HST are energized to close their contacts at line 12 thereby reducing the impedance in series with reset coil 23AU sufficiently to permit reset of the up hall call for that landing.

It should be noted that both hall calls and car calls are normally cancelled as they are answered. Accordingly, a car proceeding along the hatchway should have no car calls registered behind it in normal usage. If through inadvertence, car calls are registered behind the car, they are not canceled until the car is set to reverse. As a result, in the lockout circuits for the hall calls as controlled by car calls, a false hall call lockout can be achieved through the misuse of the car call registering means. Where such misuse is prevalent, it can be avoided by polarizing the cross connecting chain of back contacts 111 for the car call circuits in the auxiliary up hall call relay reset controls individual to the car. This polarization can be by inserting a rectifier poled as the rectifier 112 in series with each of the car call relay back contacts between the junction to the bridging relay contacts 21F and 22F. Thus a rectifier poled as rectifier 112 can be included in series with back contact TC between the junction of that contact to the contact 21F at line 42 and the junction from that contact to the bridging contact 20F at 43. In the down circuit this polarization can be reversed to achieve the same result.

From the above description, it is seen that the controls of this invention avoid duplicate stops for landing calls closely adjacent a car having a car call registered for the corresponding landing and traveling in the service direction of the landing call. The system responds to car calls and landing calls in a conventional manner except in those instances where the proximity of cars and the coincidence of requests for service at a landing exist. Thus, each of the car call and hall call stopping means are responsive while the car is in a call acceptance zone a predetermined

distance ahead of the landing which is determined as a function of the speed of the car and thus the slowdown distance required to bring the car to a stop from its operating speed at a position level with the landing. As in conventional elevator practice, the car which is the slowdown distance in advance of the landing is considered to be effectively present at the landing. When a car is located at an effective distance in advance of the slowdown distance for the landing and has a car call registered for that landing, it is also effective to inhibit response of other cars to hall calls for that landing in that service direction. In the example, the second distance is a range of three landings from the effective position of the car in advance of the call. Thus the actual distance of the car in advance of the call can be considered to be slowdown distance plus a range of three landings in advance of that call.

While specific mechanisms for indicating the capability of a car to serve coincident car and hall calls for a given landing has been shown, a specific inhibiting means have been utilized to prevent hall call response lockout where the car service requirements exceed a certain threshold, other types of devices sensing the service imposed upon the car might be substituted to inhibit the car call lockout of hall call service without departing from the spirit of the invention. Further, the range of travel over which the lockout feature is effective can be altered within reasonable limits provided the feature of reasonable proximity of the car to the call is maintained to insure prompt response to the call.

In view of the various modifications which can be applied to this invention, it is to be understood that the detailed description is to be read as illustrative thereof and not as limiting its spirit and scope.

Having described the invention, I claim:

1. An elevator system comprising a plurality of cars serving an upper and a lower terminal landing and a plurality of intermediate landings, car call means for each car to register calls for landings served by said car, hall call means common to a plurality of said cars for each of a plurality of said landings to register calls for said landings served by said cars, means responsive to a hall call means registered for a landing and the presence of a car at the slowdown distance in advance of and for said landing of said hall call means for stopping said car at said landing, means responsive to a car call means registered for a car for a landing and the presence of said car at the slowdown distance in advance of said landing of said car call means for stopping said car at said landing, means for each of a plurality of said landings for sensing the presence of a car within a given range of travel in advance of said landing and having a car call registered for said landing, said range of travel extending from said landing slowdown distance for a plurality of landings less than the number of said intermediate landings, and means responsive to the response by said sensing means for said landing for inhibiting said hall call stopping means for said landing whereby other cars of said system are rendered non-responsive to said hall call when a car within said range of travel has a car call for the landing of said hall call.

2. A combination according to claim 1 including means responsive to the registration of a car call in said car having the coincident car call for a landing separated from said car by said landing of said coincident car and hall calls for disabling said inhibiting means whereby other cars of said system are rendered responsive to said hall call.

3. A combination according to a claim 2 wherein said separated landing is within a predetermined range of landings of said landing of said coincident car and hall calls.

4. A combination according to claim 1 wherein said hall call registering means is for service in a given direc-

11

tion of travel from said landing, and means enabling said inhibiting means only when said car having a registered car call for the landing for which a hall call is registered is set to travel in said given direction.

5. A combination according to claim 1 including individual means for cars for causing said cars to bypass hall calls, and wherein said inhibiting means is effective only when said bypass means for the car having said coincident car call is ineffective.

6. A combination according to claim 1 including means individual to cars for ascertaining the imposition of a predetermined service burden upon said individual cars, and wherein said inhibiting means is effective only when said service burden means ascertains less than said predetermined service burden upon said car having said coincident car call.

7. A hall call circuit for an elevator system having a plurality of cars comprising, hall call registering means at each of a plurality of landings, hall call storage means for each landing actuated by said registering means for said landing, hall call stopping means for each landing partially enabled by said storage means for said landing, second enabling means for each hall call stopping means and responsive to the registration of a hall call for said landing, reset means for each of said second enabling means, car call registering means for each landing for each car serving said landing, and means to actuate said reset means whereby said second enabling means disables said stopping means for said landing in response to the coincidence of a hall call and a car call registered for said landing.

8. A combination according to claim 7 including means to sense the presence of said car having a registered

12

car call for said landing of a registered hall call within a given range of travel of said landing, and means to enable said reset means only when said means senses that said car having said car call registered for said landing is located within said given range of travel of said landing.

9. A combination according to claim 8 including means to define the slowdown distance over which a car is decelerated to stop at a landing, and wherein said range of travel is a given number of landings plus the slowdown distance for said car.

10. A combination according to claim 7 including means to disable said reset means in response to the registration for the car having said coincident car call of a car call which is for a landing separated from the car by the landing of said coincident car and landing calls.

11. A combination according to claim 7 wherein said hall call registering means, said hall call storage means, said hall call stopping means, said second enabling means, and said reset means are all for a given travel direction; said combination including means to enable said reset means for a landing only while said car having said car call for said landing is set for said given travel direction.

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