March 12, 1963 J. R. DINNING ETAL 3,080,945

ELEVATOR CONTROLS

Filed Sept. 6, 1960

4 Sheets-Sheet 1

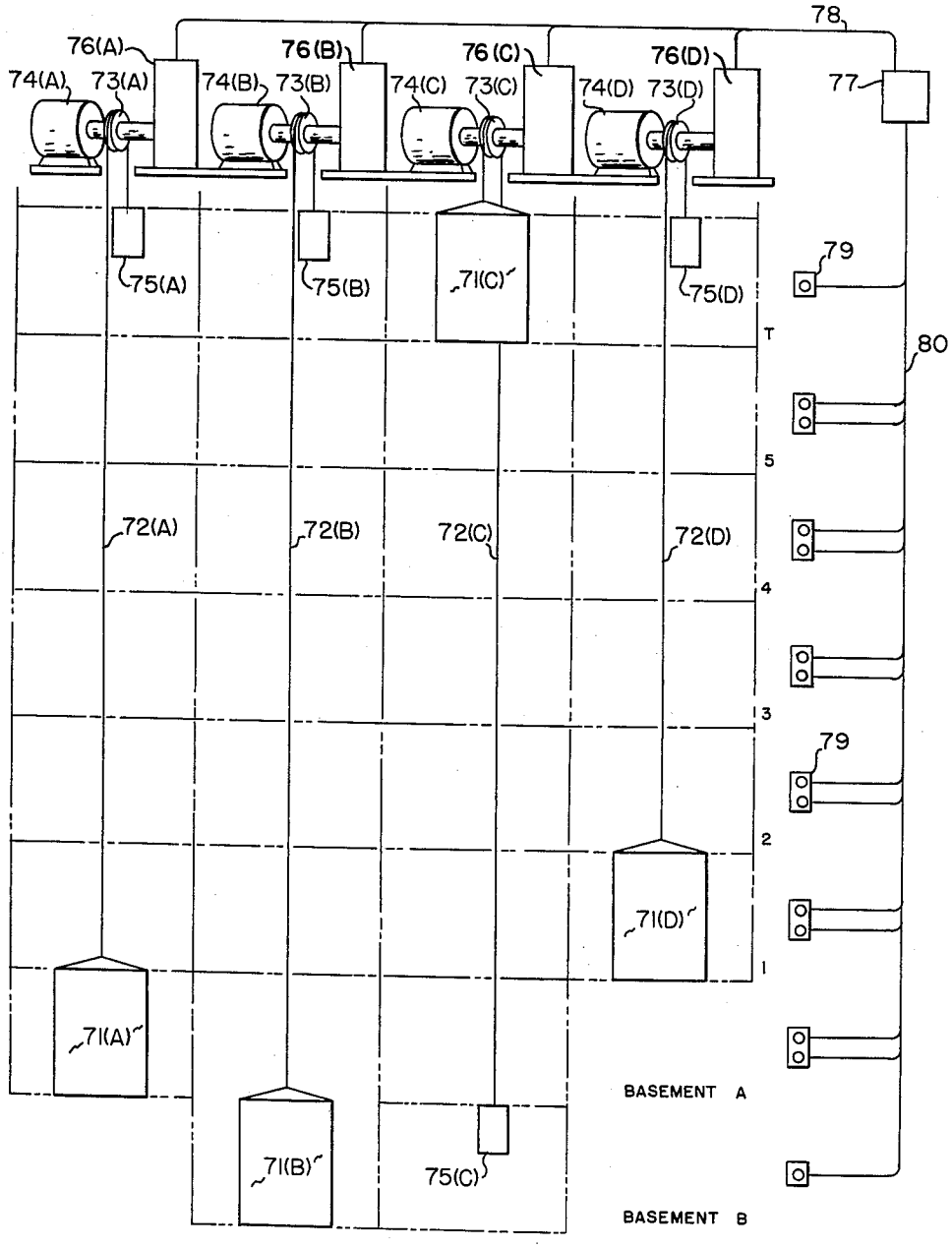


Fig. I

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ELEVATOR CONTROLS

Filed Sept. 6, 1960 4 Sheets-Sheet 2

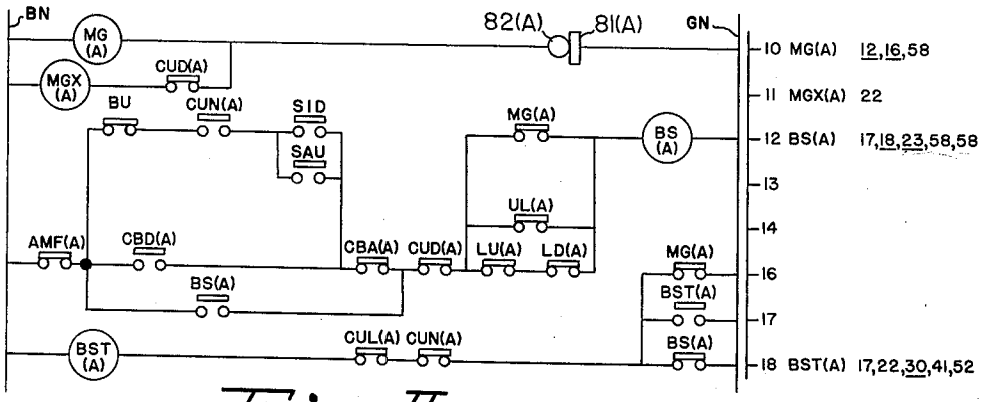


Fig. IIa

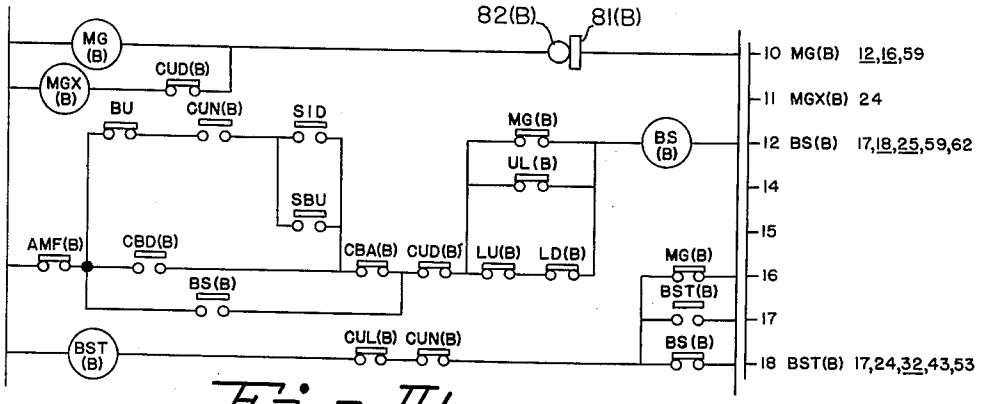


Fig. IIb

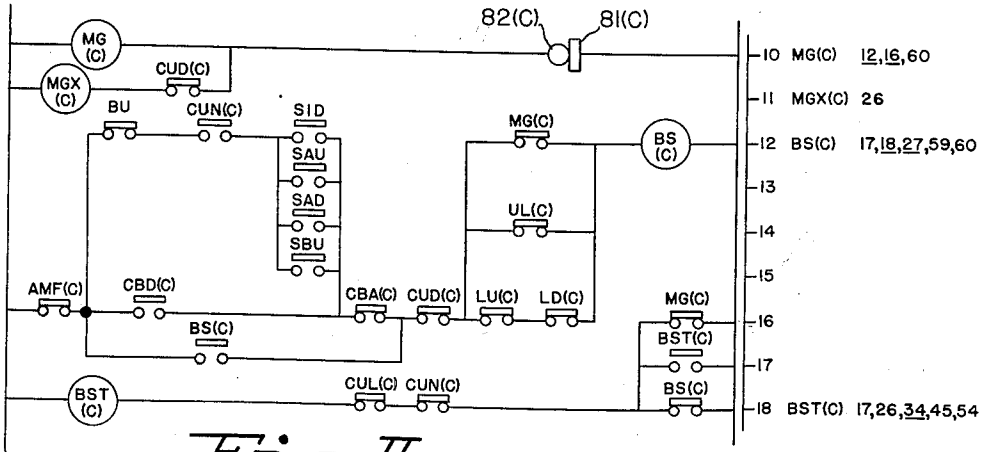


Fig. IIc

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ELEVATOR CONTROLS

Filed Sept. 6, 1960 4 Sheets-Sheet 3

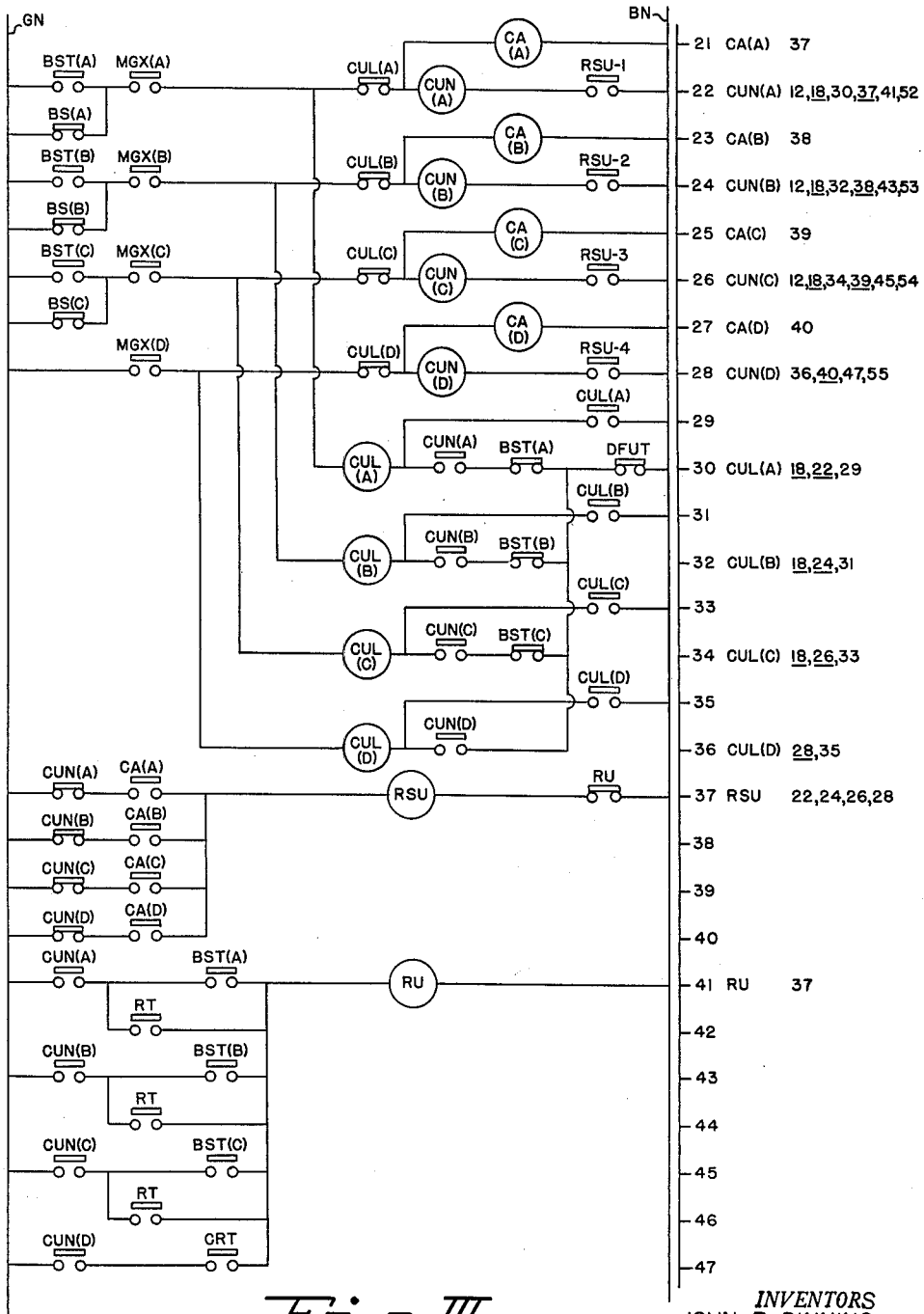


Fig. III

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ELEVATOR CONTROLS

Filed Sept. 6, 1960 4 Sheets-Sheet 4

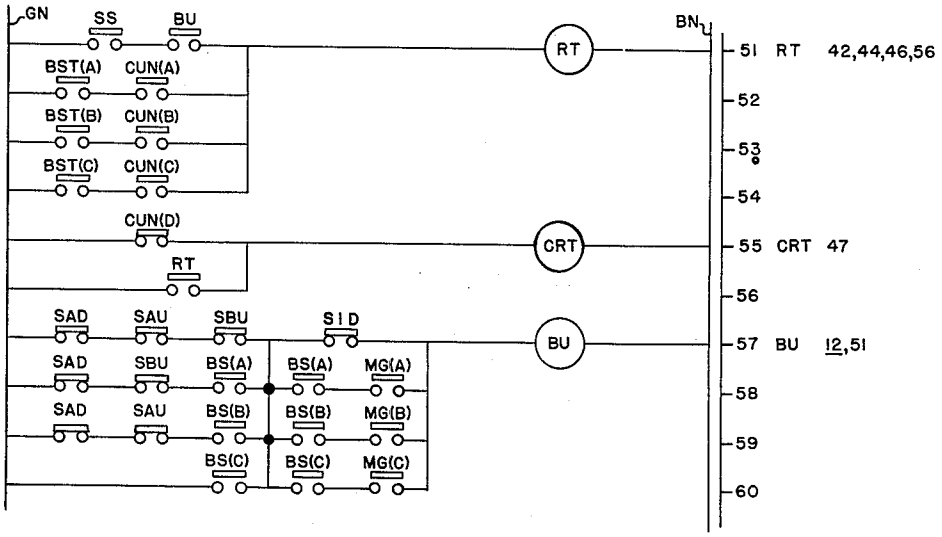


Fig. IV

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United States Patent Office

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3,080,945

ELEVATOR CONTROLS

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Filed Sept. 6, 1960, Ser. No. 54,240
21 Claims. (Cl. 187—29)

This invention relates to elevator system controls and particularly to controls for selecting cars which are to be started away from a landing.

Heretofore, elevator systems having a number of cars serving a plurality of landings have included means to stop cars at a landing and means to select cars for starting away from that landing. In many instances the landing, frequently termed a dispatching terminal, is not the extreme landing to which cars can travel, for example, there can be one or more landings below a lower dispatching terminal or above an upper dispatching terminal. Cars have been arranged to serve landings on one side of a dispatching terminal and have been selected for such service in the order they become available for travel from the terminal. Service to landings on the opposite side of the terminal, extension landings, has been subordinated to the service provided in the dispatching direction, to landings on the one side of the terminal, as by permitting only those cars not conditioned or selected for service in the dispatching direction to be conditioned for service to extension landings in response to calls for such service.

Prior systems have included landings served by less than all of the cars. Service to such landings has been sporadic since it was available only when a car capable of service was in condition to provide that service. For example, only two of a group of four cars might have openings at the fifth landing so that only those cars serve that landing. Calls at the fifth landing would therefore receive a reduced amount of service and where only one or two cars are operating because of a reduced demand on the system those calls might not be served at all if the operating cars have no openings at that landing.

The present invention has for its objects the improvement of elevator service, the improvement of elevator controls, the avoidance of delayed service at landings served by less than all of the cars of a system, and the facilitation of service at extension landings beyond dispatching terminals.

In accordance with these objects one feature of this invention resides in repetitively selecting cars for service from a dispatching terminal, and rejecting those cars if they do not enter such service.

Another feature involves admitting a selected car to a condition or status from which it can render service from a dispatching terminal only if that car is capable of satisfying the service demand.

Another feature comprises releasing a selected car and selecting another only if another is available for selection and, advantageously, only if a call is in registration requiring elevator service.

In one illustrative embodiment of this invention it has been applied to the dispatch terminal car selection system disclosed in United States patent application Serial No. 808,290 which was filed March 30, 1959 in the name of Raymond A. Burgy and is entitled "Elevator Controls"

wherein a selecting mechanism such as a rotary selection switch hunts for a car to be selected when a vacancy occurs in the selection status if a car is available for selection and, upon selecting a car, enables that car to be assigned to extension landing service or dispatched service as the needs for such service arise. Frequently elevator systems are arranged with less than all of the cars serving all of the extension landings. In such systems including the present invention cars available at the dispatching terminal are selected and in response to calls for service to the extension landings are assigned to such service. However, if a selected car is not assigned to extension landing or dispatched service and another car is available for selection, the selected car is released after an interval and another car selected. In this manner all cars available for selection are given an opportunity to enter a service status so that a call serviceable by only a certain car or cars will be satisfied by having that car or one of those cars selected if available. Upon selection and before released from selection, the car enters the service status and in due course answers the call.

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

FIG. I is a schematic diagram of an elevator system to which the present invention has been applied;

FIGS. IIa, IIb, and IIc are across the line circuit diagrams of certain of the control circuits individual to the cars A, B and C respectively of FIG. I as utilized in this invention;

FIG. III is an across the line circuit diagram of the lower dispatch terminal selection and load car controls for the group of elevators of FIG. I; and

FIG. IV is an across the line circuit diagram of adjuncts to the selection circuits of FIG. III and the extension landing car assignment controls.

The circuits described above are arranged particularly for incorporation in an elevator system of the type disclosed in Raymond A. Burgy United States patent application Serial No. 808,290 which was filed March 30, 1959 for "Elevator Controls." In systems of that nature a plurality of cars serve a structure having a dispatching terminal with a plurality of landings spaced therefrom in a dispatching direction and one or more extension landings spaced from the dispatching terminal in a direction opposite the dispatching direction. Cars are selected for service from the dispatching terminal either in the dispatching direction or to the extension landings by a single selecting mechanism which automatically selects the cars and conditions them so that they can enter either the loading status for subsequent starting in the dispatching direction or can enter a status serving the extension landing. The present invention is concerned with the selection and assignment of cars which are available for selection either while approaching or stopped at a dispatching terminal for service therefrom and accordingly embodies in the illustrative disclosure a selecting mechanism which selects cars for service and travel in either direction from the dispatching terminal. However, it is to be understood that this aspect of the invention is merely illustrative and that the repetitive selection feature utilized herein to afford a continuous scan of the cars available for service to the extension landings from the dispatching terminal

can be applied to those systems wherein selection for service to extension landings is separate from selection for service in the dispatching direction. Further repetitive selection can be employed to advantage in selecting cars for service in the dispatching direction where certain landings are served by less than all the cars.

FIG. I represents a bank of four cars, A B, C and D. Throughout the specification and drawings, those elements individual to the cars have been identified therewith by the suffiix letter designating the car enclosed in parenthesis. FIGS. II*a*, II*b* and II*c* disclose certain of the circuits which are individual to and provided for each of the cars serving one or more extension landings. These circuits are for cars A, B and C only since car D provides no basement service and would have no basement service relay BS. FIG. III and FIG. IV disclose circuits which are common to the cars including certain of the relays functioning in the selection and dispatching sequence which are individual to the cars and therefore include the parenthetical suffix car designations to distinguish the elements for the several cars. Thus, relay CUN for car A at line **22** is the lower terminal selection relay for that car and bears the designation CUN(A). Thus the contacts CUN(A) shown throughout the drawings are the lower terminal selection relay contacts for car A.

The system to be considered herein comprises a lower dispatching terminal, a plurality of landings above the lower dispatching terminal and two extension landings below the lower dispatching terminal designated basements A and B. Each car is shown to offer a different form of service with respect to the extension landings, car A serving only basement A, car C serving both the basements A and B, car B serving only basement B and car D serving none of the basements. It will be understood that the invention is applicable to a bank of elevators containing any number of cars and serving a number of landings including any combination of extension landings, such as a single extension landing served by only two of the cars or, for example, five extension landings, some of which are served by each of the cars.

The elements individually associated with car A include a car **71** suspended by hoisting cables **72** trained over a traction sheave **73** driven by a lifting motor **74** which may be of any convenient type but ordinarily is arranged for variable voltage control as in the well-known Ward-Leonard type system. Coupled to the opposite end of the lifting cable **72** is a counterweight **75**. A floor selector **76** is associated with the car to establish appropriate circuits for the car's position at any instant. This floor selector can be of the commutating type including a two coordinate system of contacts on a panel where contacts for given functions are oriented in vertical lanes and the several contacts of the circuits performing different functions for each landing are generally aligned in rows transverse of those lanes. A crosshead (not shown) sustaining a number of commutating brushes is mounted to be carried along the contacts parallel to the lanes either in synchronism with the car or suitably in advance of the running car and in synchronism with the stopped car depending on the nature of the selecting machine and controls. While the contacts of the floor selector illustrated in the circuits to be described are mechanically commutated by a crosshead which is advanced with respect to the car while the car is running, it is to be appreciated that controls employing other forms of mechanical commutators well known to the art can be adapted to this invention and that other forms of selector devices, such as relay type selectors, also lend themselves to utilization of the features of this invention.

Each of the cars A through D have individual controls including the floor selectors **76**(A) through **76**(D) and supplemental equipment apart from those floor selectors. All of the car controls are integrated into a system insuring an interrelated operation of the cars by means of a group supervisory control schematically represented by the rectangle **77** interlinked to the floor selectors by the cable **78**. The group supervisory control **77** can include means for establishing various programs of operation in accordance with manual selecting devices, clock controlled devices or means sensing conditions in the elevator system, such as the demand imposed thereon or the service provided thereby. It can also include dispatch timers or devices which dispatch cars on other than a time basis for certain aspects of the invention and means for generally controlling the operating pattern of individual cars in the group, even to the extent of removing cars from service or introducing cars into service.

Car A is shown with a travel from basement A to top landing T. Cars B and C have a travel from basement B to top landing T, car C having openings at each landing between those limits while car B has an opening at each landing except the A basement. Car D serves the lower dispatching terminal, landing No. 1, and the landings above through the top landing T. Each car is provided with conventional reversal circuits which are effective at the respective limits of travel to reverse the car and condition it for starting in the opposite direction after a suitable interval for load transfer. A load transfer interval is provided at each landing to which the cars can travel and provide service. At the dispatching terminal the cars frequently are retained an interval in excess of the load transfer interval and in the example are released only in response to certain conditions such as a dispatch signal issued to a car held in load status after the expiration of a dispatch interval or in response to a basement service assignment.

The invention will be considered as applied to an automatic elevator system wherein no attendants are required on the cars and the passengers direct car operation by indicating their demands for service from hall call registering means **79** located at each of the several landings and including down hall call means at the top through the next to the bottom landings, the basement A and up hall call registering means at the bottom, basement B, through the landing adjacent the top landing. These call registering means can be common to all cars in the bank and are schematically represented as interconnected to the several cars through the group supervisory control rectangle **77**, by means of cabling **80**. Passengers within the cars indicate their desired destinations by the registration of calls upon call registering means therein (not shown) which can be individual to the several landings served by the cars.

In order to facilitate an understanding of the circuits illustrated in FIGS. II through IV, an alphabetical listing for the symbols of the relays and contacts utilized is presented below, together with a short description of those relays and the location, if shown, of their actuating coils. These relays and all other circuit elements are shown in across-the-line diagrams. The relay contacts therefore are often located remote from the actuating coils. In order to correlate the location of the actuating coils and contacts, a marginal key has been employed with each of the circuit diagrams. With this key, each diagram has been divided into horizontal bands which are identified with line numbers in the right-hand margin. Relay symbols are located in the margin to the right of the line numbers and in horizontal alignment with the coil position. The location of each contact actuated by a relay coil is set forth to the right of the relay symbol in the key by the numeral of the line upon which it appears. The numerals designating the location of back contacts, those which are normally closed when the relay is deenergized and are open when it is energized, are underlined in the key to distinguish them from front contacts, those which are closed upon their actuating coil being energized. Thus, the lower terminal selection relay actuating coil for car A, CUN(A), appearing on line **22**, has front contacts at lines **12**, **30**, **41** and **52** and back contacts at lines **18** and **37**, as signified by the numerals

in the margin of FIG. III at line 22. The relay and switch symbols illustrated are as follows:

Symbol	Name	Location
AMF(A) to (C)	Above lower terminal—cars (A) to (C)	
BS(A) to (C)	Basement service—cars (A) to (C)	12
BST(A) to (C)	Basement service timer—cars (A) to (C)	18
BU	Basement assignment	57
CA(A) to (D)	Car available—cars (A) to (D)	21 to 27
CBA(A) to (C)	Car call above—cars (A) to (C)	
CBD(A) to (C)	Car call below—cars (A) to (C)	
CRT	Common reselection timer	55
CUD(A) to (C)	Up dispatch—cars (A) to (C)	
CUL(A) to (D)	Up load—cars (A) to (D)	30 to 36
CUN(A) to (D)	Lower terminal selection—cars (A) to (D).	22 to 28
DF	Down generator field	
DFUT	Up load car control timer	
LD(A) to (C)	Down leveling—cars (A) to (C)	
LU(A) to (C)	Up leveling—cars (A) (C)	
MG(A) to (C)	Bottom dispatching terminal—cars (A) to (C).	10
MGX(A) to (C)	Bottom dispatching termial—cars (A) to (C).	11
RSU	Lower terminal selector	37
RT	Reselecting timer	51
RU	Lower terminal selection control	41
SAD	Basement A down call	
SAU	Basement A up call	
SBU	Basement B up call	
SS	Landing call	
S1D	First landing down call	
UL(A) to (C)	Up direction holding—cars (A) to (C)	

FIGS. II*a*, II*b* and II*c* are of the same general form and therefore have been assigned indentical line numbers for circuits performing similar functions for cars A, B and C. Separate illustration of the individual car circuits has been dictated by the difference in basement service afforded by these cars and thus the differences in the basement call circuits actuating the individual basement service relays BS.

The circuits disclosed in FIGS. II through IV are only fragmentary in nature and are intended to be incorporated with conventional elevator car control circuits and elevator system control circuits as noted above. They are all supplied from suitable sources of alternating current (not shown) connected across the main leads GN and BN. When combined with conventional controls, these circuits enable the selection of cars for travel from a dispatching floor on a repetitive basis wherein a car is selected so that it can be assigned to a condition providing service, and if not assigned within a given interval, is rejected from selection provided another car is available and another car is selected. This form of selection is particularly desirable where the service afforded by the cars differs such that a selected car may be incapable of serving a call currently registered due to limits placed on its travel while another car which might also be available for selection could serve that registered call. In such circumstances, after a suitable interval in the selection status, the car incapable of providing the service, is released from selection and another car selected. This hunting process continues until a car is selected which can serve a registered demand at which time that car is assigned service to that demand and is permitted to provide that service.

In the detailed disclosure the repetitive selection process has been disclosed with regard to operation to extension landings beyond the dispatching terminal particularly a pair of basement landings. However, it is to be appreciated that in some instances, landings displaced from a dispatching terminal in a dispatching direction are served by less than all of the elevator cars controlled by the dispatcher and, in such instances, reselection can be incorporated in the system with advantage to assure that service to the landings which are served by only a limited number of the elevator cars is obtained. Further, with respect to basement service to a multiplicity of basements, the control can be supplemented by a number of features including those which preclude the assignment of more than one car at a time to the extension landing service unless a call for service is registered for one of the extension landings behind the current extension floor serving car in which case an additional car is permitted to enter service for the extension floor and such other adjuncts as reversal at intermediate extension floors where no calls for service beyond those intermediate floors is in registration. Such adjuncts to basement service are disclosed in the application of John R. Dinning, Serial No. 831,736, filed August 5, 1959 and entitled "Elevator Control."

Bottom dispatch terminal relays MG and MGX at **10** and **11** are energized when the car is located effectively at the lower dispatching terminal as indicated by the travel of its crosshead to a position on the floor selector corresponding to the lower dispatching terminal to bring its brush **81** into engagement with floor selector contact segment **82**. Relays MG and MGX function in the selection and dispatching sequences of the system as will be described more fully below. Relay MG remains energized so long as the car remains effectively at the lower dispatching floor. However, relay MGX is energized only until the car receives its up dispatching signal at which time back contact CUD at **11** opens to deenergize MGX.

Basement service relay BS at **12** is energized for a car when that car accepts a basement service assignment. This relay can be energized only while a car is below the landing next above the lower dispatch terminal since at all times the car is above that position its AMF relay is energized to open back contacts at **16** and disable the BS energizing circuit. The energization circuit for BS is enabled only when no car call is registered above the car to open back contact CBA at **16**, only when the car has not been issued an up dispatch signal to open its back contact CUD at **16** and only when it is (*a*) not at the lower dispatch terminal to open its back contact MG at **12**, (*b*) not set for travel upward to open its up load relay back contact UL at **14** (*c*) or not leveling into a landing to open its up or down leveling relay back contacts LU or LD at **16**.

When standing at any landing, back contacts LU and LD are closed. When the car is descending below the lower dispatch terminal, back contacts UL at **14** are closed. When it is at any of the basements, back contact MG at **12** is closed. Therefore, a call can be registered for basement service while a car is at the lower dispatching terminal to energize relay BS and that relay will be maintained energized while the car descends from the terminal while it is stopped at the basements, while it ascends from the basements toward the lower dispatching terminal and until it begins to level into the lower terminal landing while ascending. BS is reset when a car levels into the lower dispatching landing when ascending from a basement since back contacts MG at **12**, UL at **14** and LU at **16** are open simultaneously.

When the car is below the next landing above the lower dispatch terminal, a car call for a landing below will energize its BS relay by closing contact CBD at **16** of car call below relay CBD (not shown). Landing calls, those common to two cars in the system shown, are also effective to energize the basement service relay of the car when it is selected and its lower terminal selection relay CUN is energized to close contact CUN at **12** provided another car is not assigned basement service to open basement assignment relay back contact BU at **12**. As shown in FIG. II a car A which serves basement A only can have its basement service relay BS(A) energized if the other prerequisites are met by registration of a down call at the lower dispatching terminal to close contact S1D at **12** or by registration of an up call at the A basement to close contact SAU at **13**. Car B serving the B basement only will have its relay BS(B) energized by a down call at the lower dispatching terminal to close contact S1D at **12** in its circuit of FIG. II*b* or by an up call at the B basement to close contact SBU at **15**. Car C serves basements A and B and traffic therebetween.

FIG. IIc illustrates the BS(C) relay circuit wherein a down call at either the lower dispatching terminal or the A basement will close contacts S1D at 12 or SAD at 14 and an up call at the A or B basements will close contacts SAU at 13 or SBU at 15 if the other prerequisites prevail.

The system is arranged to cancel landing calls as they are answered. Basement service relay BS is utilized to avoid duplication of service and should be maintained energized in a multibasement system to bar other cars from certain basement service requirements until the car returns to the lower dispatching terminal. A seal circuit for holding BS energized is shown at 17 for each of these relays.

Basement service timer BST at 18 times the interval that the car is available for assignment to basement service following its selection and the opening of back contact CUN at 18. BST has its energizing circuit enabled when the car is away from the lower dispatching terminal to close back contact MG at 16 or closed basement service relay contact BS at 18. BST is a slow dropout timer. Once energized it seals itself in by contact BST at 17 until the car is selected. After a car is selected and BST drops, its energizing circuit is held open until it loses selection without entering up load status or until it is released from up load status and permits back contact CUL at 18 to close. Relay BST drops out a suitable interval after its energizing coil has been deenergized, for example, in about one and one-half seconds. In the case of car A its dropout opens its contacts at 17, 22, 41 and 52 and closes a contact at 30. BST contact at 17 opens the seal circuit for BST around contacts MG and BS. The function of the remaining BST contacts will be discussed below.

Car available relays CA shown in FIG. III, are energized when a car is available for service from the lower dispatching terminal. In the case of cars which serve no extension landing such as car D, their car available relays CA(D), lower terminal selection relay CUN(D), and up load relay CUL(D) are energized through contacts MGX(D) at 28. Relays CA(D) and CUN(D) are also energized through back contact CUL(D) at 28. In the case of cars capable of serving extension landings, the car available relay such as that for car A, CA(A) is energized as the car effectively arrives at the lower dispatch terminal through contact BST(A) at 22 of the energized basement service timer, MGX(A) at 22 of the lower dispatching terminal relay and CUL(A) at 22 of the up load relay for that car. Car available relay enables a lower terminal rotary selector RSU by closing contacts in the energizing circuit for that selector at lines 37 through 40. Thus the arrival of car A closes contact CA(A) at 37 to complete a circuit through CUN(A), CA(A), coil RSU and contact RU assuming no other car has been selected at the lower dispatching terminal.

RSU is a stepping switch which successively closes contacts RSU–1 through RSU–4 at lines 22 through 28 to enable in succession the lower dispatch terminal selection relays CUN for the several cars. When the CUN circuit for a car which is present at the lower dispatching terminal is completed by the rotary dispatch selector closing contact RSU for that car, the relay becomes energized to open its contact in the rotary dispatch selector circuit 37 through 40 and close its contact in the lower terminal selection control relay circuit RU at lines 41 through 47. RU, upon becoming energized through contacts CUN and BST of the car, opens its back contact at line 37 to assure that no other car can be selected while that car is selected at the lower dispatch terminal and basement service timer BST is pulled in. Thus assume that car A had arrived to close its contact CA(A) and energize RSU so that it stepped until it closed contact RSU–1 at line 22 to energize relay CUN(A). CUN(A) would open its back contact at 37 to deenergize rotary dispatch selector and maintain that selector in a state to hold contact RSU–1 closed. If another car were present at the lower dispatching terminal, such as car B, to close CA(B), RSU is maintained deenergized through open contact RU inasmuch as the lower terminal selection control relay RU is energized through contact CUN(A) and BSTA(A) at line 41.

If no car is in the up load status, that is conditioned to receive loads for travel upward and to be dispatched next, the selected car can enter up load status. Contact CUN(A) at line 18 of FIG. IIa deenergizes basement service timer BST(A) and after the expiration of a suitable dropout interval, relay BST(A) permits its contacts at 22 and 41 to open and its contact at 30 to close. Upon closure of that contact, closed contact CUN(A) at 30 completes a circuit for the up load relay of car A through contacts BS(A), MGX(A), coil CUL(A), contact CUN(A) provided the car has not energized its basement selection relay BS at this time to open contact BS(A) at 23 and provided the up load status has been vacant for an interval sufficient to permit up load control timer DFUT to time out and close its back contact at 30. Similarly, cars B, C and D can be advanced into the up load status by the successive operation of relays CA, CUN, and CUL for the individual cars and timers BST and DFUT.

Reselection timer RT at 51 of FIG. IV releases cars from selection at the lower terminal if they are not advanced from that selection into either up load status or basement service within a given interval defined by the dropout of timer RT following the dropout of timer BST. When RT is pulled in no shift in selection can occur. RT is energized when no call is registered to which a car can respond. This avoids needless operation of the car selecting mechanism. Thus if no landing call above the lower dispatching terminal is registered, relay SS (not shown) is energized and contact SS at 51 is closed. If a car is assigned to all of the basement calls which are registered relay BU is energized to close contact BU at 51 and complete with contact SS the circuit for RT. Thus RT is effective to prevent release of a selected car and selection of another if no landing call above the main terminal is registered and if no landing call for basement service is registered. Even if a basement call is registered RT will be maintained energized if a car is assigned to serve it. RT is energized upon a car entering up next status, while that car's basement selection timer has its contact BST at 52 through 54 closed, through the circuit BST and CUN at those lines. If a call is registered to open SS or BU at 51, the dropout of basement service timer BST for a car opens contact BST to open the energizing circuit for reselection timer RT. Similarly, the advance of a selected car into up load status while a landing call is registered or basement assignment relay BU is deenergized initiates the dropout interval for RT. This interval can conveniently be set to about a second and one-half. When RT drops out, it deenergizes up dispatch control relay RU at 41 by opening its contact at 42, 44 or 46 to open the shunt circuit around the then opened basement service timer contact BST at 41, 43 or 45. With RU deenergized, its contact at 37 closes to energize rotary selector RSU enabling that selector to open its contact for the current selected car to release its selection and close a next succeeding contact, thereby searching through the successive cars for another car available for selection.

In the illustrated example one car, car D, was assumed to provide no service to the extension landings. Accordingly, it would be undesirable to select car D and maintain that selection if a basement call were the only call in registration. Supplemental reselection timer CRT at 55 releases for selection a selected car which offers no extension floor service. That timer is energized through back contact CUN(D) for car D until car D has its lower terminal selection relay energized to open contact CUN(D) at 55. Timer CRT has a dropout interval approximately equal to the sum of the dropout intervals of basement selection timer BST and reselection timer RT.

Three seconds after the selection of car D through the operation of relay CUN(D), relay CRT drops out to open its contact at 47 in the energizing circuit for up dispatch control relay RU, thereby deenergizing that relay to enable it to initiate searching by rotary dispatch selector RSU.

Basement assignment relay BU at 57 is energized when no car is required for basement service as indicated by the call mechanisms at the landings and thus common to the cars. It is also energized when cars capable of providing the service required by registered basement calls are assigned to basement service. Registration of a landing call for basement service will deenergize relay BU until a car is assigned to that service.

BU enables or bars assignment of cars to basement service in response to landing calls through its back contacts at line 12 in the individual car basement service relay circuits. Energization of BU opens contact BU at 12 to prevent basement service while the drop of BU to close its contact at 12 enables the BS circuit of the selected car so that that circuit will be completed if the basement landing call can be served by that car. If the basement landing call can be served BS is energized and after a suitable interval the car door is closed and the car starts downward. If it cannot be served the reselection timer times out, the selected car is released from selection and another car available for selection is selected. If this newly selected car can serve the call its BS relay is energized and it provides the service, otherwise it too is released from selection and selection is repeated.

The absence of a landing call for basement service completes an energizing circuit at 57 for relay BU at 57 through down land signal contacts S1D and SAD for the lower terminal and A basement respectively and through up landing signal contacts SAU and SBU for the A and B basements respectively. Any basement service landing call will open this circuit to drop relay BU if no car capable of serving the call is in basement service to complete a circuit around the open contact.

Registration of a down landing call at the lower dispatching terminal opens contact S1D. If no car is at the lower dispatching terminal, with its MG relay energized to close contact MG at 58, 59 or 60, and conditioned for basement service, with its BS contact in series therewith closed, BU will be dropped out. Upon assignment of a car to basement service BU will again pull in since its energizing circuit will be complete through BS and MG and no other car will be assigned even after the car leaves the terminal since the conditioning of the first car for basement service will cause cancellation of the call and closing of contact S1D.

An up landing call from basement A can be served by cars A and C so that the first of those cars to be selected at the lower terminal will have its BS relay energized and will bar response of the other car to that call. The call opens contacts SAU at 57 and 59 and closes contacts SAU at 13 of FIGS. II*a* and II*c*. If neither of cars A or C is assigned basement service to close contacts BS(A) at 58 or BS(C) at 60 BU will be deenergized. Assume car D has been selected at the lower dispatch terminal and car B is in the up load status with its CUL(B) relay energized. Car D cannot enter the basement service since it is not arranged for such service and cannot enter the up load status occupied by car B. A suitable interval after selection and the opening of CUN(D) at 55 CRT times out to close its contact at 47. Time out is assured since the basement call deenergized BU to open the holding circuit for RT at 51 and contact RT at 56 is open.

With CUN(D) and CRT closed at 47 relay RU is energized to open its contact at 37 and hold car D selected. However, when CRT times out to open this circuit contact RU at 37 closes and selector RSU steps opening contact RSU–4 at 23 and closing contact RSU–1 at 22 or RSU–3 at 26 assuming car A or C is at the lower terminal to close contact CA(A) at 37 or CA(C) at 39. If no unselected car is available RSU will not advance and car D will remain selected until one becomes available.

Assuming car A is available, when RSU–1 closes it is selected by energizing CUN(A) at 22 to close contact CUN(A) at 12 and complete an energizing circuit for BS(A) from lead BN through AMF at 16, BU and CUN(A) at 12, SAU at 13, CBA(A) at 16 (assuming no car call above in car A), CUD(A), LU(A) and LD(A) at 16 and BS(A) to lead GN. BS(A) then closes its contact at 17 to seal itself in, opens its contact at 18 to bar reenergization of BST(A) as car A relinquishes selection, opens a contact at 23 to release car A from selection when BST(A) times out and opens its contact at 22, and closes two contacts at 58 to reenergize relay BU and lockout the selection of another basement serving car for that call.

Similarly, an up landing call at the B basement results in basement service by car B or C by deenergizing BU until one of those cars assumes that service by being selected through operation of its CUN relay.

If a basement service call is registered which cannot be served by car A it will retain its basement service assignment and if available another car will be assigned. Assume an up call is registered at the B basement to energize relay SBU and open contacts SBU at 57 and 58. This deenergizes relay BU despite the closed BS(A) contact for car A and initiates the repetitive selection process by opening contact BU at 51 deenergizing timer RT. The selector hunts for a car to satisfy the demand and energize relay BU. Since car B is in up load status it cannot be selected when RSU–2 at 24 is closed because contact CUL(B) at 24 is open. When RSU–3 at 26 is closed car C is selected, if it is available, and has its relay CUN(C) energized. The call also closed contact SBU at 15 so that upon selection of car C and the closure of contacts BU and CUN(C) at 12 relay BS(C) is energized to assign car C to basement service, close contact BS(C) at 60 and reenergize BU. Had car C been assigned basement service as by registration of a car call to close CBD(C) at 16 the registration of the call at the B basement would have no effect on relay BU since contact BS(C) at 60 would be closed to by pass the open SBU contacts at 57 and 58.

Only car C serves both the A and B basements hence only car C will be assigned basement service by a down landing call at the A basement. That call opens contact SAD at 57, 58 and 59 to drop BU and closes contact SAD at 14 in FIG. II*c*. When, through selection by the CUN relays and release of selection by timing out of BST and RT or CRT, the selection cycle is repeated to hunt for and select car C that car energizes its BS relay and reenergizes BU.

It is desirable to utilize basement service assigned cars to the maximum. Thus when a car is assigned to basement service by a car call or by the assignment process effected through selection and registration of a basement landing call, and that car is capable of serving a basement landing call no other car is assigned and repetitive selection does not occur since relay BU remains energized.

Assume car C has a car call for a basement registered while it is standing at the lower dispatch landing and a basement landing call such as an up call at basement B is registered. If car C is not barred from basement service by a car call above to open CBA(C) at 16 or an up dispatch signal to open CUD(C) at 16 its BS relay is energized from lead BN through AMF(C), CBD(C), CBA(C), CUD(C), LU(C) and LD(C) all at 16, and BS(C) at 12 to lead GN. This closes contacts BS(C) at 59 and 60 so that BU cannot be dropped by a landing call for basement service since the opening of any of contacts SAD, SAU or SBU at 57 is rendered ineffective by the closing of contact BS(C) at 60 and the opening of contact S1D at 57 has no effect since it is shunted by

BS(C) and MG(C) at 60. Therefore BU remains energized so that in the absence of a landing call for service above the lower dispatching terminal to open contact SS at 51, contact BU at 51 maintains reselection timer RT energized and the rotary selector circuit open at contact RU at 37.

This invention is not to be restricted to the particular form or mode of operation of basement service relays BS and basement assignment relay BU since these relays are employed to illustrate but one application of the invention. For example, where only a single basement is involved the relay BS can be reset as the car arrives at that basement instead of being maintained until the car returns to the lower dispatching terminal as illustrated. In multiple basement installations the retention of BS in an energized state until the car returns to the terminal insures full utilization of cars capable of serving several basements. Thus car C might be serving the B basement when an up landing call at the A basement is registered which it could serve. With BS(C) energized the registration of a call opening SAU at 57 has no effect on BU since closed contact BS(C) at 60 shunts that contact. This avoids initiation of repetitive selection, since reselection timer RT is not deenergized by opening contact BU at 51 and another car is not needlessly assigned to basement service.

In recapitulation of the invention, it involves the selection of cars available for travel from a dispatching terminal or parking landing in an orderly manner which avoids unnecessary car travel while providing prompt service to all landings. The invention is of particular advantage in systems where certain landings are served by less than all of the cars in the elevator group. It embodies a selection apparatus which selects cars for assignment to a condition preparatory for travel from the landing. A selected car is retained in selected status with its CUN relay energized for a minimum interval if it is not assigned to the travel state, either basement service assignment wherein its BS relay is energized or up load status with its CUL relay energized in the example, and then if a need for service exists as indicated by an open SS or BU contact at 51 and another car is available for selection, the selected car is released from selection and another available car is selected. Deenergization of BU is indicative of a basement call which cannot be answered by the selected car. Opening of contact SS indicates a landing call which any of the cars can serve. This repetitive selection can be combined advantageously with assignment equipment which assigns a car to travel only if it is capable of serving the registered call for service so that in the hunting car selection a car capable of the required service is ultimately selected and then assigned to travel to satisfy that service.

This invention has been disclosed as applied to a particular system of control for a bank of elevators and as a particular combination of circuits however it is to be understood that it lends itself to many modifications and to application in other systems. Accordingly this disclosure is to be read as illustrative of the invention and not in a limiting sense.

Having described the invention, we claim:

1. An elevator system including a plurality of cars serving a plurality of landings including a dispatching terminal, a plurality of landings displaced in a dispatching direction from said terminal, a landing displaced from said terminal in a second direction opposite said dispatching direction, means for registering demands for service by said cars, means responsive to the availability of a car for service from said terminal, means to select a car available for service from said terminal, means responsive to the presence of a selected car for preventing selection of another car, means to condition a selected car for service in said second direction in response to a call for such service, means to condition a selected car for service in said dispatching direction a given interval after selection in response to the absence of another car so conditioned, and means responsive to the expiration of an interval greater than said given interval following selection of a car, to the registration of a demand for service, and to the availability of another car for selection to disable said selection preventing means.

2. An elevator system including a plurality of cars serving a plurality of landings including a dispatching terminal, a plurality of landings displaced in a dispatching direction from said terminal, a landing displaced from said terminal in a second direction opposite said dispatching direction, means for registering demands for service by said cars, means responsive to the availability of a car for service from said terminal, means to select a car available for srevice from said terminal, means responsive to the presence of a selected car for preventing selection of another car, means to condition a selected car for service in said second direction in response to a call for such service, means to condition a selected car for service in said dispatching direction a given interval after selection in response to the absence of another car so conditioned, means to release a selected car from selection when said car is conditioned for service from said terminal, and means responsive to the expiration of an interval greater than said given interval following selection of a car, to the registration of a demand for service, and to the availability of another car for selection to disable said selection preventing means.

3. An elevator system including a plurality of cars serving a plurality of landings including a dispatching terminal, a plurality of landings displaced in a dispatching direction from said terminal, an extension landing displaced from said terminal in a second direction opposite said dispatching direction and served by less than all of said cars, means for registering demands for service by said cars, means responsive to the availability of a car for service from said terminal, means to select a car available for service from said terminal, means responsive to the presence of a selected car for preventing selection of another car, means to condition a selected car capable of service to said extension landing for service to that landing in response to a call for such service, means to condition a selected car for service in said dispatching direction in response to the absence of another car so conditioned, means to release a conditioned car from selection, and means responsive to the expiration of an interval following selection of a car to disable said selection preventing means.

4. An elevator system including a plurality of cars serving a plurality of landings including a dispatching terminal, a plurality of landings displaced in a dispatching direction from said terminal, a landing displaced from said terminal in a second direction opposite said dispatching direction, means for registering demands for service by said cars, means responsive to the availability of a car for service from said terminal, means to select a car available for service from said terminal, means responsive to the presence of a selected car for preventing selection of another car, means to condition a selected car for service in said second direction in response to a call for such service, means to condition a selected car for service in said dispatching direction in response to the absence of another car so conditioned, and means responsive to the expiration of an interval following the registration of a call which said selected car is incapable of serving to disable said selection preventing means.

5. An elevator system including a plurality of cars serving a plurality of landings including a dispatching terminal, means for registering calls for service, means to stop cars at said dispatching terminal, means for selecting cars at said dispatching terminal to be conditioned for travel therefrom, certain of said cars serving landings which are not served by all of the cars in the system, means to condition a car which has been selected for travel from said dispatching terminal in response to a call it is

capable of serving, and means for selecting another car available for travel from said terminal when the selected car is not conditioned for starting in response to predetermined condition.

6. A system according to claim 5 wherein said predetermined condition is the registration of a call.

7. A system according to claim 5 wherein said predetermined condition is the registration of a call which a car conditioned for travel is incapable of serving.

8. A system according to claim 5 wherein said predetermined condition is the registration of a call which the selected car is incapable of serving.

9. A system according to claim 5 wherein said predetermined condition is the expiration of an interval initiated upon the selection of the car.

10. An elevator system comprising a plurality of cars serving a plurality of landings, a car selector for selecting a car available for service from a landing, means for conditioning a selected car for service from said landing, means to release a conditioned car from selection, and means responsive to a predetermined condition in said system to release from selection a car which is not conditioned.

11. A system according to claim 10 wherein said predetermined condition is the expiration of a given interval following the selection of the selected car.

12. A system according to claim 10 wherein said predetermined condition is the registration of a call for service.

13. A system according to claim 10 wherein said predetermined condition is the availability of another car for service from said landing.

14. A system according to claim 10 wherein said predetermined condition is the availability of another car for service from said landing and the expiration of a given interval following selection of a car.

15. A system according to claim 10 wherein said predetermined condition is the availability of another car for service from said landing and the registration of a call for service.

16. A system according to claim 10 wherein said predetermined condition is the concurrence of the availability of another car for service from said landing, the expiration of a given interval following the selection of a car, and the registration of a call for service.

17. A system according to claim 10 wherein said predetermined condition is a call for service which said selected car is incapable of serving.

18. An elevator system comprising a plurality of cars serving a plurality of landings, a selector for selecting cars available for service from a given landing, a selector control for enabling said selector in response to the absence of a selected car, means for conditioning a car for service from said given landing, means for releasing from selection a car which has been conditioned for service, a timer for measuring the interval a car is selected, and means for actuating said selector control in response to the operation of said timer whereby a selected car which has not been conditioned is released from selection.

19. An elevator system comprising a plurality of cars serving a plurality of landings, a selector for selecting cars available for service from a given landing, a selector control for enabling said selector in response to the absence of a selected car, means for conditioning a car for service from said given landing, means for releasing from selection a car which has been conditioned for service, means for registering calls for service by said cars, means responsive to a call for service which the selected car can satisfy, a timer for measuring an interval from the response of said call responsive means and the selection of the selected car whichever occurred later, and means for actuating said selection control in response to the operation of said timer whereby said selected car is released from selection.

20. An elevator system comprising a plurality of cars serving a plurality of landings, a selector for selecting cars available for service from a given landing, a selector control for enabling said selector in response to the absence of a selected car, means for conditioning a car for service from said given landing, means for releasing from selection a car which has been conditioned for service, means for registering calls for service by said cars, means responsive to a call for service which the selected car cannot satisfy, a timer for measuring an interval from the response of said call responsive means and the selection of the selected car whichever occurred later, and means for actuating said selection control in response to the operation of said timer whereby said selected car is released from selection.

21. An elevator system comprising a plurality of cars serving a plurality of landings, a car selector for selecting and maintaining selected at any given moment but one car from those available for service from a landing, means for conditioning a selected car for service from said landing, means to release a conditioned car from selection upon the conditioning of said car, and means responsive to a predetermined condition in said system to initiate selection of an unselected car by said selector for service from said landing while another car is selected by said selector.

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