

May 20, 1952

P. C. KEIPER ET AL
ELEVATOR CONTROL SYSTEM

2,597,586

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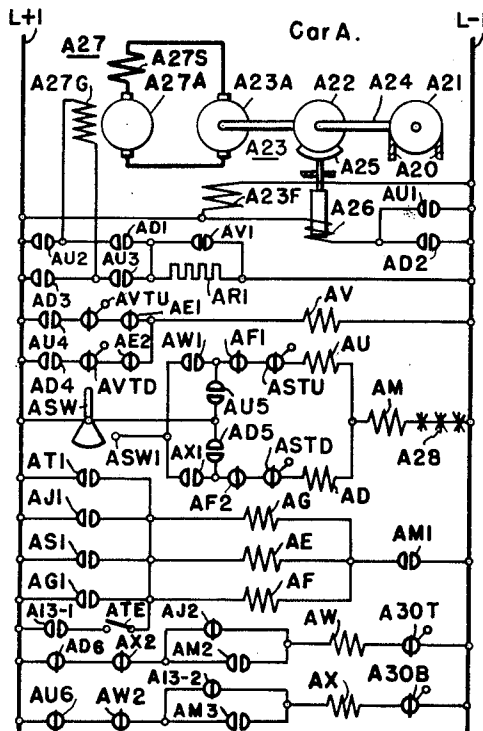


Fig. 1.

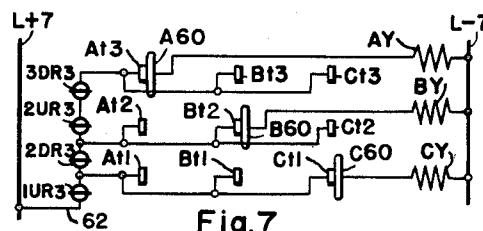


Fig. 7.

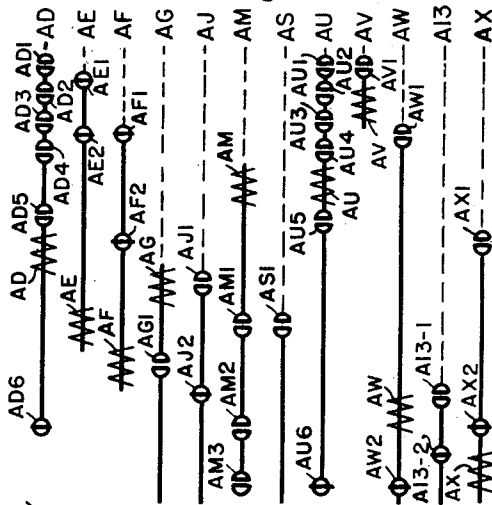


Fig. 1A.

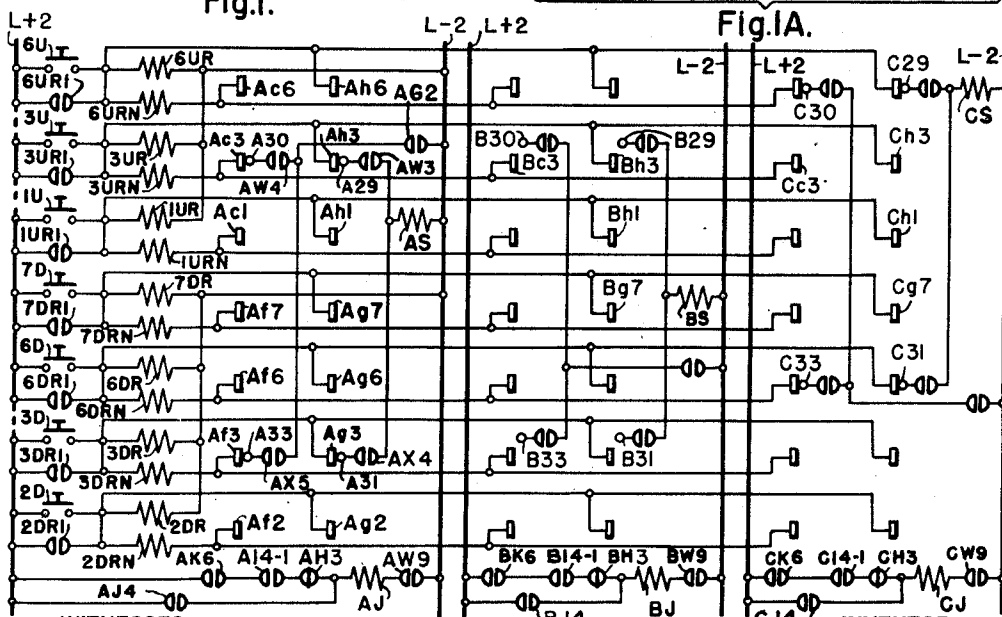


Fig. 2.

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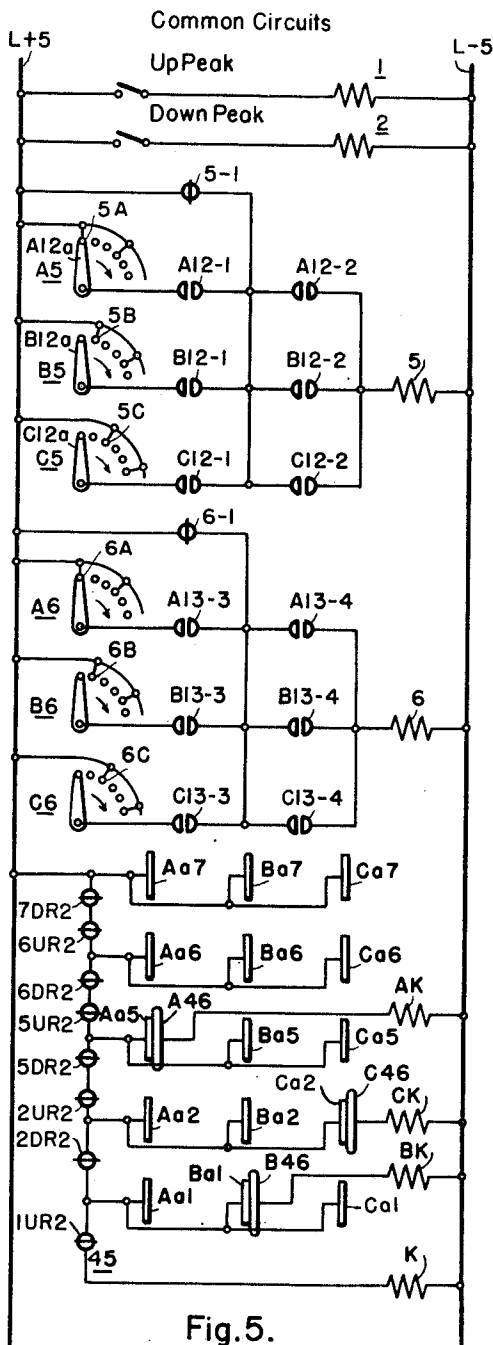
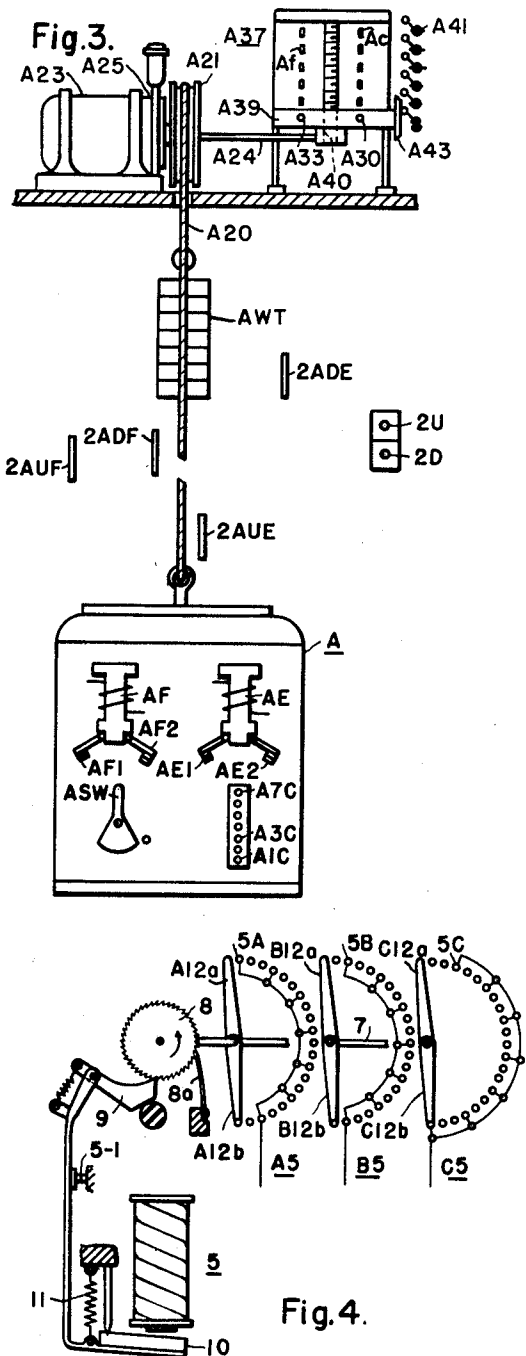
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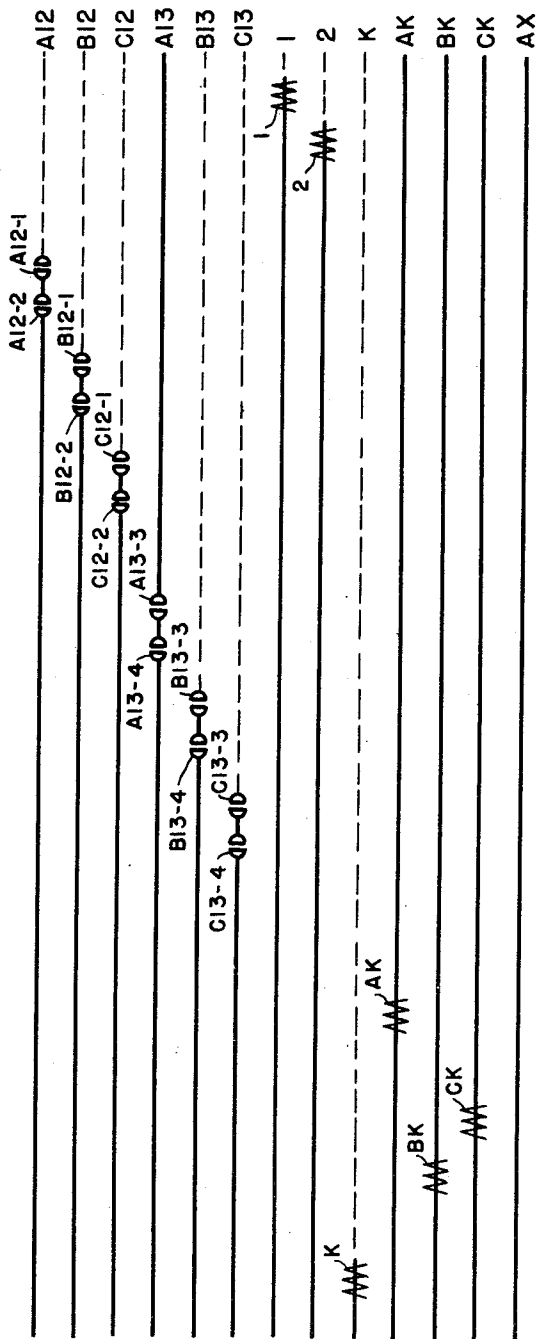
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5 Sheets-Sheet 3



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Fig. 5A.

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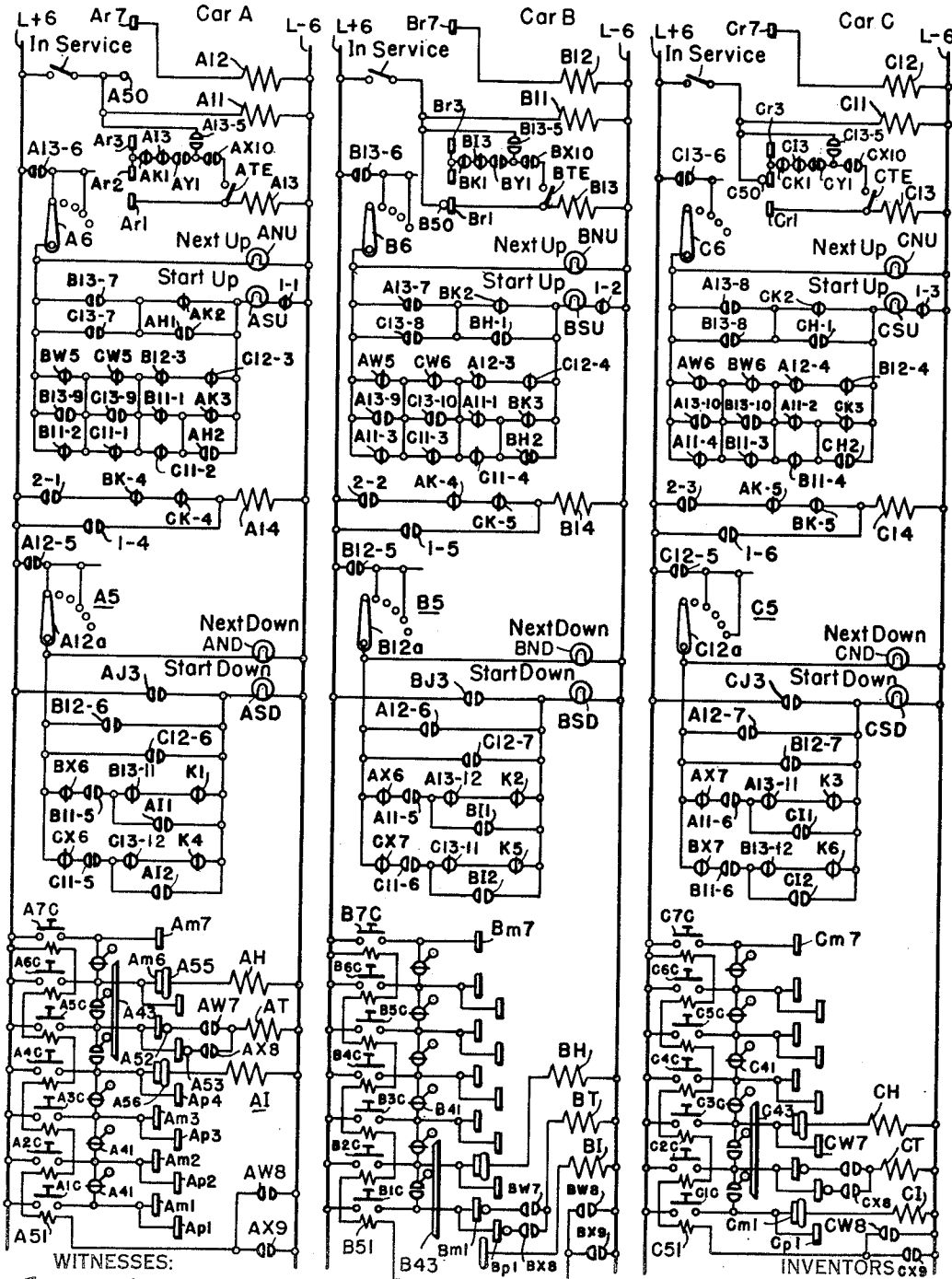
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5 Sheets-Sheet 4



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Fig. 6.

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5 Sheets--Sheet 5

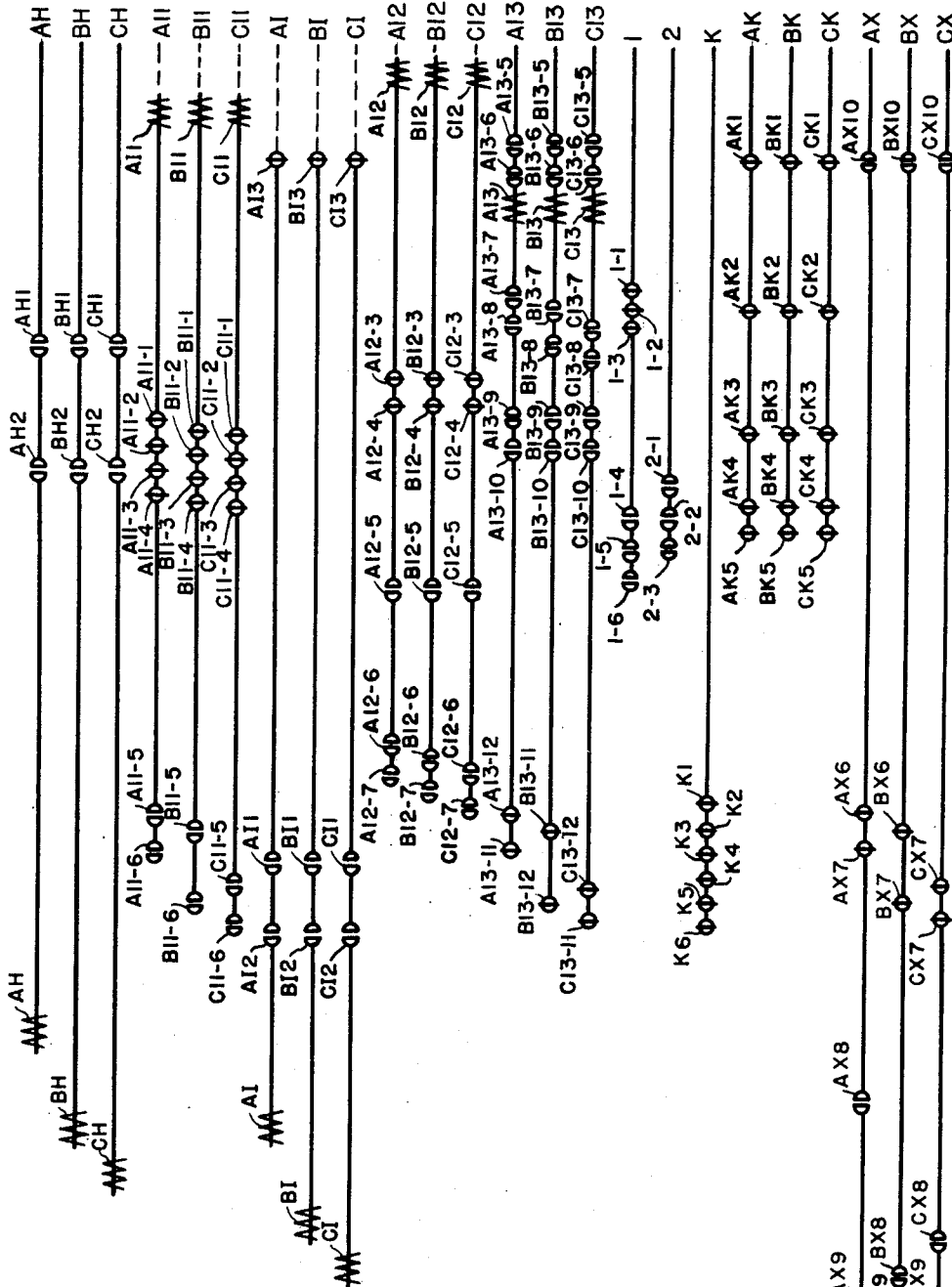


Fig.6A.

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ELEVATOR CONTROL SYSTEM

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Application February 3, 1950, Serial No. 142,322

31 Claims. (Cl. 187—29)

1

This invention relates to elevator control systems and it has particular relation to systems wherein elevator cars are arranged in banks and wherein dispatchers are provided for dispatching the elevator cars from terminal landings in orderly sequences.

Although certain aspects of the invention are suitable for single elevator cars, the invention is particularly desirable for elevator systems having a plurality of elevator cars arranged in a bank. The invention is especially suitable for a bank having three elevator cars wherein any one or two of the cars may be removed from service if so desired.

The elevator system illustrating the invention will be assumed to be installed in a building having a plurality of floors or landings to be served by the elevator cars. The elevator cars operate between terminal landings or floors from which they are dispatched or started in an orderly manner. If the elevator cars are of the automatic type, the start of each elevator car may be effected by operation of a suitable starting relay. However, it will be assumed for the purpose of discussion that each of the elevator cars is started by means of a car switch under the control of a car attendant.

Inasmuch as traffic conditions for most elevator installations vary during the day, it is desirable that each of the elevator installations be sufficiently flexible to provide optimum service for each of the traffic conditions. For example, in an office building traffic is predominantly in an up direction during certain periods of the day. In the morning, at the start of the start of the work day, passengers are traveling primarily from the lower terminal landing or street floor to various higher landings of the building. This may be termed an "up peak" period. During the "up peak" period, the elevator cars may be designed to operate high call reversal. As will be understood in the art, a car operating high call reversal proceeds from the lower terminal landing in an upward direction until it has reached the farthest or highest car or landing call in the up direction. When it has answered the highest call, the car reverses and returns towards the lower terminal landing. For "up peak" operation, the elevator cars may be permitted to start from the lower terminal landing as soon as the car is full.

During other periods of the day, passenger traffic predominantly is in a down direction. For example, in an office building at the close of the day, the traffic is predominantly from the upper

2

landings of the building toward the lower terminal landing. Such traffic may be referred to as "down peak" traffic.

If standard high call reversal operation is employed in a bank of elevator cars during a "down peak," the operation of the elevator cars may not be entirely satisfactory. For example, let it be assumed that in a ten story building, a down call is registered for the seventh floor or landing just as an elevator car is starting downwardly from the ninth floor. Under these conditions, a second car may start from the lower terminal landing to serve the down call at the seventh floor. However, when the down traveling car reaches the seventh floor, the resulting cancellation of the down call at the seventh floor results in a reversal of the elevator car which has started up from the lower terminal landing.

In accordance with the invention, the elevator cars of a bank operate on through trips between the terminal landings during the "down peak" period. However, an elevator car running on a through trip will be transferred to high call reversal operation if a landing call is registered in a predetermined direction behind or above the remaining cars in operation. This modified high call reversal operation tends to prevent unnecessary starts and reversals of an elevator car. By a call "behind" a car reference is made to a call which would require reversal of the elevator car if the elevator car is to serve the call.

During the remainder of the business day, the elevator cars may operate on a through trip basis. The first elevator car reaching either of the terminal landings is selected as the next car to leave such terminal landing. If all of the elevator cars are at one of the terminal landings, the cars are selected as the next cars to leave in a predetermined sequence.

When a first car is located at the lower terminal landing, and is selected as the next car to leave the lower terminal landing, it is started when any of the following conditions is fulfilled:

(1) A second car is at the lower terminal landing and a car call is registered in the first car.

(2) A second car is at the lower terminal landing and a landing call is registered.

(3) A second car is at the lower terminal landing and a third elevator car is approaching the lower terminal landing.

(4) The second and third cars are both conditioned for down travel and are below the upper terminal landing.

(5) All three elevator cars are at the lower terminal landing.

An elevator car located at the upper terminal landing is started when any of the following conditions is fulfilled:

(1) A second elevator car is at the upper terminal landing.

(2) A second elevator car is approaching the upper terminal landing and a car call is registered in the first elevator car.

(3) A second elevator car is approaching the upper terminal landing and a landing call is registered.

(4) A second elevator car is conditioned for travel towards the upper terminal landing and a car call is registered in the first elevator car.

When the elevator cars are operating during the off peak period, the foregoing dispatching conditions tend to separate the cars by approximately one-third of the round trip travel. If no car or landing call is registered, the dispatching action stops when two elevator cars arrive, at the lower terminal landing and one elevator car is at the upper terminal landing. Consequently, if any call is registered when the system is at rest, an elevator car serves the call within a reasonably short time.

Under certain conditions, as when all three elevator cars are away from the bottom terminal, it may be desirable to extend one of the terminal landings in order to decrease the travel of the elevator cars. For example, during the down peak operation, a resultant landing may be provided which includes a plurality of landings adjacent the lower terminal of the elevator cars. Thus, in accordance with the invention, a nine-floor building may have a resultant lower terminal landing which includes the first, second and third floors or landings. If a landing call is in existence behind an elevator car approaching the resultant lower terminal landing and if the elevator car has no car call registered for a floor in the resultant lower terminal landing, the elevator car would stop, would reverse, and would dispatch from the third floor. This materially reduces the time required for response to calls registered behind the elevator car while it is traveling down.

The invention further contemplates the removal of any one or two elevator cars of a three car bank from service. When one of the elevator cars is removed from service, the remaining two elevator cars operate in a two-car dispatching system. If a first one of the elevator cars is located at the lower terminal landing, it will be dispatched when any one of the following conditions is fulfilled:

(1) The second elevator car is traveling down.

(2) The second elevator car is at the lower terminal landing.

(3) The second car is at the upper terminal landing and a car call or a landing call is registered.

If a first one of the two cars in a two-car dispatching system is located at the upper terminal landing, it will be dispatched when any of the following conditions is fulfilled:

(1) The second elevator car reaches the upper terminal landing.

(2) The second elevator car is traveling up in response to a landing call (if the second elevator car is traveling up in response to a car call, the first car remains at the upper terminal landing until the second car reaches the upper terminal landing).

(3) The second car is set for travel towards the upper terminal landing and a car call is registered in the first car.

It is, therefore, an object of the invention to provide an elevator system which dispatches a first car from a terminal landing when any of the following conditions is fulfilled:

(1) A second car is at the terminal landing and a car call is registered in the first car.

(2) A second car is at the terminal landing and a landing call is registered.

(3) A second car is at a terminal landing and a third car is approaching the terminal landing.

(4) A plurality of additional cars are approaching the terminal landing.

(5) At least three elevator cars are at the terminal landing.

It is a second object of the invention to provide an elevator system wherein a first car is dispatched from a terminal landing when any of the following conditions is fulfilled:

(1) A second elevator car is at the terminal landing.

(2) A second car is approaching the terminal landing and a car call is registered in the first car.

(3) A second elevator car is approaching the terminal landing and a landing call is registered.

(4) A car call is registered and a second elevator car is set for travel towards the terminal landing.

It is a third object of the invention to provide an elevator system wherein the first of the preceding objects applies to the lower terminal landing and the second applies to the upper terminal landing of the elevator system.

It is a fourth object of the invention to provide an elevator system wherein an elevator car operates on a through trip basis until a landing call is registered on a predetermined side of at least one additional elevator car, whereupon the first-named elevator car is transferred to farthest call reversal operation.

It is a fifth object of the invention to provide an elevator system wherein an elevator car may be reversed and dispatched from any of a plurality of landings adjacent a terminal landing in response to a landing call behind the elevator car.

It is a sixth object of the invention to provide an elevator system wherein a first car is dispatched from a terminal landing if a second car is approaching the terminal landing in response to a landing call but not if the second car is approaching the terminal landing in response to a car call.

Other objects of the invention will be apparent from the following description, taken in conjunction with the accompanying drawings, in which:

Figure 1 is a schematic view in straight-line form, with parts shown in perspective and parts broken away, showing operating circuits for an elevator car.

Fig. 1A is a schematic view of relays and contacts employed in the system of Fig. 1. The contacts and coils of the relays in Fig. 1A are in horizontal alignment with the corresponding contacts and coils in Fig. 1.

Fig. 2 is a schematic view in straight-line form of landing call and other circuits suitable for an elevator system.

Fig. 3 is a view in elevation, with parts broken away, of elevator apparatus which may be employed in the system of Fig. 1.

Fig. 4 is a schematic view of a stepping relay which may be employed in an elevator system embodying the invention.

Fig. 5 is a schematic view in straight-line form

showing certain control circuits for the elevator system embodying the invention.

Fig. 5A is a schematic view of relay contacts and coils employed in Fig. 5. If the two Figures 5 and 5A are placed in side-by-side relationship, the corresponding relays and coils are in substantially horizontal alignment.

Fig. 6 is a schematic view in straight-line form showing control circuits for an elevator system embodying the invention.

Fig. 6A is a schematic view of certain of the relay coils and relay contacts employed in Fig. 6. If these two figures are placed in side-by-side relationship, the corresponding coils and relays are substantially in horizontal alignment, and

Fig. 7 is a schematic view of a landing call below circuit which may be employed.

Although the invention could be employed for structures having any desired number of landings, it will be assumed for the purpose of illustration that three elevator cars are installed in a building having seven floors or landings. In the following discussion, the elevator cars will be designated as cars A, B and C. Each component associated with the car A will be identified by a suitable reference character preceded by the letter A. It will be understood that similar components are employed for the elevator cars B and C, but if the similar components are illustrated or referred to, they will be designated by the corresponding reference characters preceded by the letter B or C.

Inasmuch as the relays employed in the elevator systems may have a number of contacts, each of the sets of contacts will be identified by the reference character applied to the complete relay to which a numeral suffix is applied indicating the specific set of relay contacts. Thus the designation A13—3 indicates that reference is made to the set of contacts 3 of the relay 13 associated with the car A. The corresponding set of contacts for the car C would be identified by the designation C13—3. The relay contacts may be either "make" or "front" contacts which close when the relay is energized to complete a circuit, or the contacts may be "break" or "back" contacts which open when the relay is energized to interrupt an electrical circuit.

The following relays and switches will be referred to in the discussion:

SWITCHES AND RELAYS SPECIFIC TO CAR A

AU—Up switch
AD—Down switch
AV—Speed relay
AM—Running relay
AG—Inductor holding relay
AE—Inductor slowdown relay
AF—Inductor stopping relay
AT—Car call stopping relay
AJ—Reversing relay
AS—Landing call stopping relay
AW—Up relay
AX—Down relay
AK—Landing call above relay
AY—Landing call below relay
A11—In service relay
A12—Upper terminal relay
A13—Lower terminal relay
A14—High call reversal relay
AH—Car call above relay
AI—Car call below relay

RELAYS COMMON TO ALL CARS

1UR to 6UR—Landing up registering relays

2DR to 1DR—Landing down registering relays

1—"Up peak" relay

2—"Down peak" relay

5—Upper terminal "next" relay

6—Lower terminal "next" relay

K—Landing call relay.

Figure 1

A portion of the control circuits for one of the elevator cars is illustrated in Fig. 1. Since this portion is duplicated for each of the three elevator cars A, B, and C, it will suffice to illustrate and describe the portion for the car A.

The car A is secured to a flexible rope or cable A20 which passes around a sheave A21. The sheave, together with a brake drum A22 and the armature A23A of a direct-current motor are secured to a shaft A24 for rotation as a unit. A field winding A23F for the motor A23 is connected for energization across direct-current buses L+1, L-1. A brake shoe A25 is resiliently urged against the brake drum A22 and is released by energization of a brake coil A26. The brake coil is energized through contacts of an up switch AU or a down switch AD.

The motor armature A23A is connected in a series loop circuit with an armature A27A of a direct-current generator A27. A generator series field winding A27S may be connected in the series or loop circuit. It will be understood that the armature A27A of the generator is rotated at a constant rate by means of a motor, not shown. The motor and generator are parts of a conventional variable-voltage driving unit for the elevator car A.

The speed and direction of the elevator car A are determined by the magnitude and polarity of the energization of the main field winding A27G of the generator. This field winding may be connected across the buses L+1, L-1 through a reversing switch and a resistor AR1. The reversing switch is provided by make contacts AD1 and AD3 of the down switch which when closed energize the generator field with a polarity suitable for moving the elevator car in a down direction. When make contacts AU2 and AU3 are closed, the generator field is energized with proper polarity for up travel of the elevator car. In order to increase the speed of the elevator car, the resistor AR1 may be shunted by contacts of a speed relay AV.

The speed relay AV is connected for energization across the buses L+1, L-1 through contacts AU4 or AD4 of the up or down switch. Limit switches AVTU and AVTD are opened, respectively, when the elevator car is adjacent its upper and lower limits of travel. When once energized, the speed relay AV normally is deenergized by break contacts AE1 or AE2 of an inductor slowdown relay.

The up switch AU or the down switch AD is energized by operation of a car switch ASW located in the car A. When the car attendant rotates the car switch to energize the up or down switch, a car running relay AM also is energized. Suitable contacts are associated with the up and down switches for controlling the energization thereof and these will be referred to subsequently. Safety devices A28, such as car and landing door contacts, which are closed when the various doors are closed, may be provided to control energization of the up and down switches.

The slowdown and stopping of the elevator car at a desired landing are effected by means of

an inductor slowdown relay AE and an inductor stopping relay AF. When either of these relays is energized, it does not operate immediately its associated contacts. Operation of the contacts is effected when the elevator car reaches an inductor plate associated with the inductor relay. The association of inductor plates with the inductor relays is well understood in the art and will be discussed subsequently.

When the elevator car is running, the energization of the inductor relays is controlled by contacts AT1 of a car call stopping relay, contacts AJ1 of a reversing relay, contacts AS1 of a landing call stopping relay and contacts A13-1 of a lower terminal relay. When the inductor relays are once energized, a holding relay AG also is energized to establish a holding circuit for the inductor relays.

The direction of travel of the elevator car A is determined by the energization of an up relay AW or a down relay AX. These relays are so interlocked that only one can be energized at any time.

Figure 2

Fig. 2 illustrates the circuits employed for initiating a stopping operation of the elevator cars in response to a call from any of the floors or landings served by the elevator cars. Reversing relays AJ, BJ and CJ also are shown. In Fig. 2, the car A is assumed to be at the third landing, the car B is assumed to be between the third and sixth landings, and the car C is assumed to be at the sixth landing.

Up buttons are located at the lower terminal landing and at each of the intermediate landings. Inasmuch as similar circuits are associated with each of the up buttons, the circuits will be illustrated and described only for the landing buttons 1U, 3U and 6U which are located respectively at the first, third and sixth landings.

Down buttons 2D to 7D are located respectively at the intermediate landings and at the upper terminal landing. Since these buttons have similar circuits associated with them, the circuits will be illustrated and described only for the second, third and seventh landings. The circuits associated with the up and down buttons in Fig. 2 are conventional in the art.

In accordance with established practice, each of the elevator cars has a selector associated with it. The selector for the car A has a row of contact segments Ah1 to Ah6 which are engaged successively by a brush A29 as the elevator car A moves upwardly. Each of these contact segments is connected to the bus L+2 when a stop is to be made at the corresponding landing. It will be understood that one of the contact segments is associated with each of the landings at which a stop is to be made when an elevator car is traveling in the up direction.

A second similar row of contact segments Acl to Ac6 is provided for cancelling any landing call for a landing at which a stop is made while the car is traveling in an up direction. These contact segments are engaged successively by a brush A30.

A third row of contact segments Ag2 to Ag7 is associated with the down landing buttons 2D to 7D for the purpose of controlling the stopping of the car in response to registration of a down call at any of the landings. These contact segments are successively engaged by a brush A31. A row of cancelling contact segments Af2 to Af7 is associated with the down landing buttons for cancelling any call registered for a landing at

which the elevator car A stops during travel in a down direction. These contact segments are engaged successively by a brush A33.

Similar contact segments and brushes are provided for each of the selectors for the cars B and C and cooperate with the landing buttons in a similar manner.

Actuation of any of the up landing buttons is effective for energizing an associated one of the landing up registering relays 1UR to 6UR. For example, if the button 3U is actuated, the landing up registering relay 3UR is connected across the direct-current buses L+2, L-2. The registering relay closes its contacts 3UR1 to establish a holding circuit for itself around the button 3U and to connect the contact segments Ah3, Bh3 and Ch3 to the bus L+2. The first elevator car to near the third floor running up completes an energizing circuit for one of the landing call stopping relays AS, BS or CS to initiate a stopping operation of the associated car at the third floor. Shortly thereafter the associated cancelling contact segment Ac3 is connected to the bus L-2 to complete an energizing circuit for the cancelling coil 3URN. The coils 3URN and 3UR are wound in opposition to each other. Consequently, energization of the cancelling call 3URN cancels the call at the third floor.

In a similar manner, when the elevator car A is proceeding in a down direction, the landing call stopping relay AS is energized when the brush A31 reaches a "hot" g-segment. As the car comes to a stop, the brush A33 engages the corresponding f-segment to cancel the landing call for the landing at which the car A stops.

Inasmuch as the cars stop at the terminal landings, by operation of limit switches the segments Ah1, Bh1 and Ch1 for the lower terminal landing and Ag7, Bg7 and Cg7 for the upper terminal landing may be omitted if so desired.

Figure 3

Fig. 3 shows the structural relationships of the car A and associated equipment. It will be noted that the inductor relays AF and AE are mounted on the elevator car A. In addition, the car switch ASW is mounted on the car and push buttons A1C to A7C are provided on the car for registering car calls. The car A and a counterweight AWT are secured to the respective ends of the cable A20.

The inductor relay AE has make contacts AE1 and AE2 which are normally closed. If the coil of the inductor relay AE is energized, the contacts still remain closed until the inductor relay reaches one of its associated inductor plates AUE or ADE. If the inductor relay AE is adjacent one of the inductor plates ADE, a magnetic circuit is completed for the inductor relay and if the coil of the inductor relay is also energized, the contacts AE2 are opened. If the inductor relay AE is adjacent the inductor plate AUE and the coil is energized, the contacts AE1 are opened. In a similar manner, the inductor relay AF cooperates with the inductor plates AUF and ADF.

Four inductor plates, a landing up button and a landing down button are provided for each of the intermediate landings. In Fig. 3, the inductor plates and buttons for the second floor are illustrated. When the car A approaches the second floor when traveling in the up direction and a stop is to be made at the second floor, the inductor plates 2AUE and 2AUF, respectively, cooperate with the inductor relays AE and AF to initiate slowdown and stopping of the elevator car. When the elevator car nears the second floor

when traveling in the down direction, the inductor plates 2ADE and 2ADF cooperate successively with the inductor relays AE and AF to initiate slowdown and stopping of the elevator car at the second landing. At the upper terminal landing, only one AUE and one AUF plate and one landing down button are required. At the lower terminal landing, only one ADE plate and one ADF plate and one landing up button are required.

The car A also has associated therewith a selector A37 which may be of any conventional construction. In the form illustrated, the selector has a plurality of rows of fixed contact segments. To simplify the illustration in Fig. 3, only two rows of contact segments A_f and A_c are shown, these corresponding to the rows illustrated in Fig. 2. It will be understood that in each of the rows one contact segment is provided for each desired landing. The brushes A33 and A30 are mounted on a carriage A39 which is threaded for reception of a screw A40. Rotation of the screw in accordance with travel of the elevator car is effected by means of suitable gearing which couples the screw A40 to the shaft A24. Consequently, as the car A moves, the brushes on the carriage A39 successively engage contact segments corresponding to the landings reached by the elevator car. In addition, certain mechanical switches A41 are provided which are successively engaged by a cam A43 secured to the carriage A39. The cam has a length sufficient to bridge three successive switches. As the carriage moves, the mechanical switches are successively opened by means of the cam. These mechanical switches are employed for purposes hereinafter set forth. In accordance with conventional practice, the motor A23 and the selector A37 are installed in a penthouse above the elevator hoistway.

Inasmuch as the equipment shown in Fig. 3, with the exception of the landing buttons 2U and 2D is duplicated for the cars B and C, the description of the equipment for the car A suffices for the equipment associated with the cars B and C.

Figure 4

In certain of the circuits hereinafter described, stepping relays are employed. Such stepping relays are well known in the art and a typical stepping relay is illustrated in Fig. 4.

In Fig. 4, a stepping relay 5 is illustrated which includes a shaft 7. This shaft is mounted for rotation in suitable bearings and has secured thereto a ratchet wheel 8. The ratchet wheel is advanced by means of a suitable pawl 9 which is biased against the teeth of the ratchet wheel. When the coil of the stepping relay 5 is energized, an armature 10 is attracted and such attraction moves the pawl 9 to the left as viewed in Fig. 4 against the bias of a spring 11. When the coil is deenergized, the spring 11 moves the pawl 9 to the right to rotate a shaft 7 through an angle corresponding to one tooth of the ratchet wheel. If the coil of the stepping relay is intermittently energized, the shaft 7 is intermittently advanced. The shaft 7 has associated therewith a pair of contact arms A12a and A12b which are displaced from each other about the axis of the shaft 7 by 180°. During rotation of the shaft 7, the contact arms in turn sweep over a semi-circular row A5 of contacts. Although only one contact is required for each of the elevator cars, conventional selector relays come equipped with rows containing a large number of individual contacts. In order to permit utilization of the

standard selector relays, the contacts in a row may be arranged in groups. Thus in Fig. 4 the first contact 5A of the row A5 and every third contact 5A thereafter are connected to a common conductor. These contacts are associated with the elevator car A. In a similar manner, the second contact 5B of a row and every third contact 5B thereafter are connected to a second conductor. The third contact 5C of a row and every third conductor thereafter are connected to a third conductor. Thus three groups of contacts are provided each associated with one of the elevator cars. Since two contact arms are provided, the contact arm A12a starts engaging the associated semi-circular row of contacts as the contact arm A12b completes its engagement therewith. A spring arm 8a prevents reverse rotation of the ratchet wheel. It will be understood that as many rows or banks of contacts and as many contact arms as desired may be associated with the contact arms of the stepping relay. In Fig. 4 rows A5, B5 and C5 are provided respectively for the three cars.

Figure 5

In Fig. 5, circuits are shown which are common to the three elevator cars. The up peak relay 1 is energized by means of a manually operated switch when it is desired to condition the elevator cars for up peak operation. The down peak relay 2 is energized by means of a manually operable switch when it is desired to condition the cars for down peak operation. Direct-current energy is available for the various relays from the direct-current buses L+5 and L-5.

At the upper terminal landing, it is desirable that only one elevator car at a time be selected as the next car to leave the terminal landing. Preferably, the elevator cars should leave the upper terminal landing in the order of their arrival thereat. The next car to leave the upper terminal landing is determined by "next" or stepping relay 5. The contacts 5A, 5B and 5C of the stepping relay are associated, respectively, with contacts of upper terminal relays A12, B12 and C12 of the three elevator cars.

In a similar manner, the next car to leave the lower terminal landing is determined by a stepping relay 6 which is similar in construction to the stepping relay 5. The contacts 6A, 6B and 6C of the "next" or stepping relay 6 are associated, respectively, with contacts of the lower terminal relays A13, B13 and C13 of the three elevator cars.

In Fig. 5, a landing call relay K is employed for the purpose of indicating the registration of a call by one of the landing buttons. To this end, a series circuit 45 is provided which includes break contacts of the registering relays for the landings. The series circuit 45 includes the landing call relay K and extends between the buses L+5, L-5. The circuit 45 may be traced as follows: L+5, 7DR2, 6UR2, 6DR2, 5UR2, 5DR2, 4UR2, 4DR2, 3UR2, 3DR2, 2UR2, 2DR2, 1UR2, K, L-5.

To conserve space, the registering relays for the third and fourth floors do not have their break contacts shown in Fig. 5. It will be understood that if any of the registering relays is energized, the break contacts therefor are opened to deenergize the landing call relay K.

The circuit 45 also has contact segments associated therewith for the purpose of indicating the position of any landing call with respect to the elevator cars. Thus the selector for the car

A has a row of contact segments Aa1 to Aa7 which have a brush A46 associated therewith. The brush A46 moves the contact segments for the various landings in accordance with movement of the car A. The brush A46 should be dimensioned to bridge two successive contact segments of its associated row of contact segments. Similar contact segments and brushes are provided for the cars B and C.

A landing call above relay AK is connected between the brush A46 and the bus L-5. Similarly, landing call above relays BK and CK are associated with the brushes B46 and C46.

The connections of the contact segments to the bus L+5 are controlled by the conditions of the break contacts located in the circuit 45.

The contact segments for each intermediate landing are connected to the circuit 45 at a point on the circuit 45 located between the break contacts for the up and down registering relays for the same landing. For example, the contact segments Aa6, Ba6 and Ca6 are connected to a point on the circuit 45 located between the break contacts 6UR2 and 6DR2. The contact segments for the upper terminal landing are connected directly to the bus L+5. The contact segments for the lower terminal landing are connected to a point on the circuit 45 located between the contacts 2DR2 and 1UR2.

Deenergization of any of the landing call above relays AK, BK or CK indicates that one or more landing calls have been registered for landings above the position of the elevator car associated with such relay.

Figure 6

Separate control circuits for each of the cars A, B and C are illustrated in Fig. 6. Although somewhat different contact arrangements are provided for certain components in Fig. 6, similar relays and lamps are employed for the three cars. Consequently, for the preliminary discussion of Fig. 6, it will suffice to discuss the relays and lamps for the car A alone. The cars A, B and C are assumed to be representatively at the sixth, first and second landings.

An in service relay A11 is provided for the car A. When the car A is in service, the relay A11 is energized from the direct-current buses L+6, L-6 through a manually-operable switch. When the elevator car A is to be removed from service, the switch is opened.

A row of contact segments including the segments Ar1, Ar2, Ar3 and Ar7 are provided on the selector for the car A for engagement by a brush A50. The contact segments Ar1, Ar2, Ar3 and Ar7 have positions on the selector corresponding to the first, second, third and seventh landings.

The contact segment Ar7 is connected through an upper terminal relay A12 to the bus L-6. When the elevator car A is at the upper terminal landing and is in service, the relay A12 is connected for energization from the direct-current buses L+6, L-6 through the brush A50.

The contact segment Ar1 is connected to the bus L-5 through the lower terminal relay A13. Consequently, when the elevator car A is at the lower terminal landing and is in service, the lower terminal relay A13 is energized through the brush A50. Under certain conditions, the lower terminal relay A13 may be energized when the brush A50 engages the contact segments Ar2 and Ar3 for the second and third floors. The conditions under which such energization occurs will be discussed below.

When the elevator car A is at the lower terminal landing and is selected as the next car to be dispatched from the lower terminal landing, a suitable signal is actuated, for an example, a lamp ANU is illuminated. This indicates to the car attendant that he should start loading his car. The elevator car A is started from the lower terminal landing by operation of a suitable signal such as by illumination of a lamp ASU. This lamp is connected for energization through various combinations of relay contacts which will be discussed below. As previously pointed out, the elevator cars may be operated high call reversal. Such operation is controlled for the car A by the high call reversal relay A14.

Similar provisions are made for starting the elevator car A downwardly from the upper terminal landing. To this end, a lamp AND is illuminated to indicate that the elevator car A is selected as the next car to leave the upper terminal landing. The lamp ASD is illuminated to dispatch the elevator car A from the upper terminal landing. The lamp ASD also may be illuminated when the car A reverses at a highest call. The illumination of the lamp ASD is controlled by various combinations of relay contacts which will be discussed below.

Car calls are registered by means of the car buttons A1C to A7C for the respective landings. These buttons, when actuated are retained in actuated condition by means of windings A51 which are energized through make contacts of the up or down relay AW or AX. When the elevator car reverses these contacts are both opened for a short time to release the car buttons. The car buttons include magnetic armatures for the windings and are spring-biased towards their opened condition. The car buttons have associated therewith two rows of contact segments Am1 to Am7 and Ap1 to Ap7. These contact segments are engaged successively respectively by brushes A52 and A53. The car call stopping relay AT is connected between the bus L-6 and the brushes A52 and A53 respectively through make contacts of the up and down relays AW and AX. During up travel of the elevator car, when the brush A52 reaches a "hot" contact segment, the car call stopping relay AT is energized to initiate a stopping operation of the elevator car. The brush A53 is effective in a similar manner during down travel of the elevator car. The contact segments for each landing served by the elevator car are connected through the associated car button to the bus L+6.

The mechanical switches A41 are employed with other apparatus for the purpose of indicating the position of a car call with respect to the elevator car. A separate mechanical switch A41 is located between each adjacent pair of the contact segments Am1 to Am7. As previously pointed out, these mechanical switches are opened successively by a cam A43 which is long enough to bridge three of the mechanical switches.

Energization of the car call above relay AH indicates the registration of a car call for a landing above the car. The relay AH is connected between the bus L-6 and a brush A55 which is long enough to bridge two adjacent ones of the contact segments Am1 to Am7. The brush A55 is spaced above the brush A52 by a distance corresponding to the spacing of the contact segments Am1 to Am7.

The car call below relay AI is connected be-

tween the bus L-6 and a brush A56 which also successively engages the contactor segments Am1 to Am7. The brush A56 is long enough to bridge two successive ones of the contact segments Am1 to Am7 and is spaced below the brush A52 by a distance equal to the spacing of contact segments.

The cam A43 opens the mechanical switches A41 on each side of the contact segment being engaged by the brush A52. This prevents energization of the car call above relay AH through any car call button for any landing below the position of the car. In addition, the opening of the mechanical switches prevents the energization of the car call below relay AI through any car call button for a landing above the car position.

Figure 7

The landing call below relay AY when energized indicates the absence of a landing call for a landing below the position of the car. It is associated with terminal extension landings, which in the illustrated embodiment comprise the second and third lands. If employed, this relay requires the car A when traveling down, to travel to the lowest landing for which a landing call is registered even though a terminal extension is provided.

The landing call below relays AY, BY and CY cooperate with a call below circuit 62 in the same manner. Consequently, a discussion of the relay AY and its operation for the car A will suffice.

The selector for the car A has a row of contact segments At1, At2 and At3 for the first, second and third landings which cooperate with a brush A60 capable of bridging two of the segments. The relay AY is connected between the brush A60 and the bus L-1.

The call below circuit 62 includes break contacts 1UR3, 2DR3, 2UR3 and 3DR3. The contacts 1UR3 are located between the contact segment At1 and the bus L+1. The contacts 2DR3 are located between the contact segments At1 and At2 and the contact segments 2UR3 and 3DR3 are located between the contact segments At2 and At3.

As the car A approaches the terminal extension landings while traveling down, the brush A60 engages the contact segment At3 for the third landing. If no landing call is registered for a landing below the third landing, the relay AY will be energized to close its make contacts AY1 (Fig. 6) through the following circuit (Fig. 7): L+1, 1UR3, 2DR3, 2UR3, 3DR3, At3, A60, AY, L-1. The elevator car A while traveling down does not reverse above the lower terminal landing as long as the make contacts AY1 are open.

OPERATION—CAR A STARTS FROM LOWER TERMINAL LANDING

In discussing the operation of the elevator cars, it will be assumed that the car A has been selected as the next car to leave the lower terminal landing and that the selected car has received its start signal.

When the car A previously reached the lower terminal landing, the lower limit switch A30B opened to deenergize the down relay AX (Fig. 1). The down relay consequently opened its contacts AX1 to prevent re-energization of the down switch AD and closed its break contacts AX2 to energize the up relay AW. The up relay AW closed its make contacts AW1 to prepare the up switch AU for subsequent energization and opened its break contacts AW2 to prevent ener-

gization of the down relay. It will be understood further that the upper limit switch AVTU, ASTU and A30T are closed whereas the lower limit switches AVTD, ASTD and A30B are open.

The car attendant rotates his car switch ASW (Fig. 1) in a counterclockwise direction to complete the following circuit: L+1, ASW, ASW1, AW1, AF1, ASTU, AU, AM, A28, L-1.

Upon energization, the running relay AM closes make contacts AM1 to prepare the inductor relays for subsequent energization. In addition, the make contacts AM2 close to establish a holding circuit around the contacts AJ2 of the reversing relay.

As a result of the energization of the up switch AU, make contacts AU1 close to energize the brake coil and the brake is accordingly released. The contacts AU2 and AU3 close to energize the generator field for up travel of the elevator car. Consequently, the elevator car starts to move up from the lower terminal landing. The make contacts AU4 close to energize the speed relay AV. The speed relay closes its contacts AV1 to shunt the resistor AR1. The elevator car now accelerates rapidly to its full running speed. The make contacts AU5 close to establish a holding circuit around the car switch ASW and the contacts AW1 of the up relay. Finally, the break contacts AU6 open to prevent energization of the down relay AX.

With the car A running up, it will be assumed that an up call is registered for the third landing by operation of the landing button 3U (Fig. 2). Also a car call is registered for the sixth floor by operation of the car call button A6C (Fig. 6).

As the car approaches the third floor, the brush A29 finally completes the following circuit: L+2, 3UR1, A23, A29, AW3, AS, L-2.

Upon energization, the landing call stopping relay AS closes its contacts AS1 (Fig. 1) to energize the relays AG, AE and AF. The relay AG closes its contacts AG1 to establish a holding circuit around the contacts AS1.

Although the windings of the inductor relays AE and AF are energized, nothing happens until the inductor relay AE reaches the inductor plate AUE (Fig. 3) for the third floor. At such time, the contacts AE1 open to deenergize the speed relay AV (Fig. 1). The speed relay opens its contacts AV1 to introduce the resistor AR1 in series with the generator field winding A27G. The elevator car now slows to its landing speed.

As the slow up-travel of the elevator car continues, the inductor stopping relay AF reaches the inductor plate AUF (Fig. 3) for the third floor and the contacts AF1 open to deenergize the up switch AU (Fig. 1) and the running relay AM. The relay AM opens its contacts AM1 to deenergize the windings of the relays AG, AE and AF. The contacts of these relays consequently return to the positions illustrated. The contacts AM2 open but have no immediate effect upon the operation of the system.

The deenergization of the up switch AU results in opening of the contacts AU1 to deenergize the brake coil. Consequently, the brake is applied to stop the elevator car at the third landing. In addition, the contacts AU2 and AU3 open to deenergize the generator field winding. The contacts AU4 and AU5 open but have no immediate effect upon the operation of the system. The contacts AU6 close but have no immediate effect on the system for the reason that the contacts AW2 remain open.

It will be assumed that the entering passenger

at the third landing also desires to go to the sixth landing. Upon rotation of the car switch ASW by the car attendant to engage its associated contact and upon closure of the car and hoistway doors, the up switch AU and the car running relay AM again are energized and produce up travel of the elevator car in the manner previously described.

As the elevator car nears the sixth floor, the brush A52 (Fig. 6) finally engages the contact segment Am6 to complete the following circuit: L+6, A6C, Am6, A52, AW7, AT, L-S.

The car call stopping relay, upon energization, closes its contacts AT1 (Fig. 1) to energize the relays AG, AE and AF. These relays initiate the slowdown and stopping of the elevator car at the sixth landing in the manner previously described for the third landing. From the preceding discussion it will be understood that the car attendant may manually open the car call button after the call is answered. However, in the preferred embodiment the brush A52 leaves the contact segment AM6 as the car stops and the car call button is subsequently reset by opening of the contacts AW3 as discussed below.

After he has discharged his passengers, the car attendant again manipulates the car switch ASW to reenergize the up switch AU and the car running relay AM. The car proceeds in the up direction in a manner previously described. As the car nears the upper terminal landing, the inductor relay AE (or the upper limit switch AVTU) opens its contacts to interrupt the energization of the speed relay AV. Such deenergization results in slowdown of the elevator car in the manner previously described. The upper limit switch ASTU opens to deenergize the up switch AU and the car running relay AM. Such deenergization results in stopping of the elevator car at the upper terminal landing in the manner previously described.

As the elevator car reaches the upper terminal landing the limit switch A30T opens to deenergize the up relay AW. This relay, upon deenergization, closes its break contacts to energize the lower relay AX. However, for a short time the contacts AW8 and AX9 are open to reset any operated car call buttons.

CAR A RETURNS TO LOWER TERMINAL LANDING

It will be assumed next that the car A at the upper terminal landing has been selected as the next car to leave the upper terminal landing, that it has received a start signal, that a car call has been registered for the second landing and that a landing call has been registered for the third landing.

When the car reached the upper terminal landing, the upper limit switch A30T opened to deenergize the up relay AW. This relay, upon deenergization, opened its make contacts AW1 to prevent energization of the up switch AU and closed its break contacts AW2 to complete an energizing circuit for the down relay AX. The energization of the relay AX resulted in closure of the contacts AX1 to permit energization of the down switch AD and in opening of the contacts AX2 to prevent energization of the up relay AW.

Upon actuation of the car switch ASW by the car attendant, the following circuit is established: L+1, ASW, AX1, AF2, ASTD, AD, AM, A23, L-1.

The energization of the car running relay AM

results in closure of the contacts AM1, AM2 and AM3 for the purposes previously set forth.

The energization of the down switch AD results in closure of the make contacts AD2. This releases the elevator brake. Also contacts AD1 and AD3 close to connect the generator field for energization with proper polarity for down travel of the elevator car. The car now starts to proceed in a down direction. Contacts AD4 close to energize the speed relay AV. The relay AV establishes a shunt around the resistor AR1 to produce full speed operation of the elevator car in the down direction.

Closure of the make contacts AD5 establishes a holding circuit around the car switch ASW and the closing contacts AX1 of the holding relay. Contacts AD6 open to prevent energization of the up relay AW.

As the elevator car nears the third landing, the brush A31 (Fig. 2) finally engages the contact segment Ag3 to establish the following energizing circuit: L+2, 3DR1, Ag3, A31, AX4, AS, L-2. The contacts AS1 (Fig. 1) consequently close to energize the windings of the relays AG, AE and AF. The relay AG completes its holding circuit for the inductor relay windings.

As the inductor relay AE reaches the inductor plate ADE (Fig. 3) for the third floor, it opens its contacts AE2 to deenergize the speed relay. As previously pointed out, such deenergization results in a decrease in the speed of the elevator car.

When the inductor relay AF reaches the inductor plate ADF for the third floor, contacts AF2 open to deenergize the up switch AD (Fig. 1) and the car running relay AM. The car running relay AM operates as before to open its contacts AM1, AM2 and AM3. However, the relay AX remains energized as long as the break contacts of the relay A13 are closed.

The deenergization of the down switch AD results in the opening of the contacts AD2 to apply the brake, and opening of the contacts AD1 and AD3 to deenergize the generator field. Consequently, the car stops at the third landing. The opening of the contacts AD4 and AD5 and the closing of the contacts AD6 have no immediate effects on the operation of the system.

During the initiation of a stop of the elevator car at the third landing, the brush A33 engages the contact segment A/3 to complete the following energizing circuit: L+2, 3DR1, 3DRN, A/3, A33, AX5, AG2, L-2. The energization of the canceling coil 3DRN cancels the call for the third landing.

When the car attendant again is ready to proceed downwardly, he again operates his car switch ASW to reenergize the switch AD and the car running relay AM. These operate in a manner previously described to move the elevator car in a down direction.

As the elevator car nears the second floor, the brush A53 (Fig. 6) engages the contact segment Ap2 for a time sufficient to complete the following circuit: L+6, A2C, Ap2, A53, AX8, AT, L-6. The car call stopping relay AT closes its contacts AT1 for a time sufficient (Fig. 1) to energize the relays AG, AE and AF. These operate to stop the elevator car at the second landing in the manner discussed with reference to the stop at the third landing.

When the car attendant is ready to proceed to the lower terminal landing, he again operates his car switch to start the car downwardly in the manner previously described. As the elevator car nears the lower terminal landing, the slow-

til the car C leaves the upper terminal landing. Under these conditions, the stepping relay completes the following circuit for the next down lamp for the elevator car C (see Fig. 6): L+6, C12-5, C5, CND, L-6. The car attendant for the elevator car C now is informed that his car has been selected as the next car to leave the upper terminal landing and may start to load his car. The stepping switch 5 operates in a similar manner to select the car A or the car B as the next car to leave the upper terminal. If two or more elevator cars are at the upper terminal simultaneously, the stepping relay 5 steps until it reaches the first position capable of maintaining the energization of the stepping relay. The elevator car corresponding to such position then is selected as the next elevator car to leave the upper terminal landing.

The selection of the next elevator car to leave the lower terminal landing is accomplished in a similar manner by the stepping relay 6. This stepping relay selects one of the next up lamps ANU, BNU or CNU for illumination. The lower terminal relays A13, B13 and C13 cooperate with the stepping relay 6 in the same manner by which the relays A12, B12 and C12 cooperate with the stepping relay 5. It will be understood that each of the lower terminal relays A13, B13 and C13 is energized when its associated elevator car is at the lower terminal landing.

The start up relays are controlled by combinations of relay contacts which are dependent for each elevator car on the positions and directions of travel of the elevator cars. Let it be assumed that the elevator car C is at the lower terminal landing and that it has been selected as the next car to leave the lower terminal landing. The system is assumed to be on off peak or down peak operation. Under these circumstances, the elevator car will receive a start signal under any of the following conditions:

(1) Either car A or car B subsequently reaches the lower terminal landing and a landing call is registered. Under these circumstances, one of the sets of contacts A13-8 or B13-8 is closed. Furthermore, the contacts CK2 are closed because of the existence of a landing call for a landing above the position of the car C. One of the two following circuits is, therefore, established for the start up lamp CSU:

(a) L+6, C13-6, C6, A13-8, CK2, CSU, 1-3, L-6.

or

(b) L+6, C13-6, C6, B13-8, CK2, CSU, 1-3, L-6.

(2) Either car A or car B subsequently reaches the lower terminal landing and a car call is registered in the car C. Again either of the sets of contacts A13-8 or B13-8 is closed and the make contacts CH1 are closed. The latter contacts are closed because of the presence of a car call for a landing above the position of the car C. Consequently, one of the two following circuits is established for the start up lamp CSU:

(a) L+6, C13-6, C6, A13-8, CH1, CSU, 1-3, L-6

or

(b) L+6, C13-6, C6, B13-8, CH1, CSU, 1-3, L-6.

(3) The elevator car B subsequently reaches the lower terminal landing and the elevator car A is approaching the lower terminal landing. The presence of the car B at the lower terminal

landing results in energization of the lower terminal relay B13 which closes its contacts B13-10. Inasmuch as the elevator car A is approaching the lower terminal landing, the up relay AW for the elevator car A is deenergized and its break contacts AW6 are closed. Furthermore, the elevator car A has left the upper terminal landing and the break contacts A12-4 of the upper terminal relay for the elevator car A are closed. Inasmuch as the elevator car B also is away from the upper terminal landing, the contacts B12-4 are closed to complete the following circuit: (a) L+6, C13-6, C6, AW6, B13-10, A12-4, B12-4, CSU, 1-3, L-6. Had the elevator car A reached the lower terminal landing while the elevator car B was approaching the same landing, a circuit somewhat similar to the immediately preceding circuit would be established as follows: (B) L+6, C13-6, C6, A13-10, BW6, A12-4, B12-4, CSU, 1-3, L-6.

(4) The elevator cars A and B both are approaching the lower terminal landing. Under these conditions, the up relays for both of the cars A and B are deenergized and the break contacts AW6 and BW6 are closed. The upper terminal relays for these cars are deenergized and the break contacts A12-4 and B12-4 are closed to complete the following circuit: L+6, C13-6, C6, AW6, BW6, A12-4, B12-4, CSU, 1-3, L-6.

(5) The elevator cars A and B also are at the lower terminal landing. The lower terminal relays for the cars A and B are both energized to close their make contacts A13-10 and B13-10. The upper terminal relays for the same cars are both deenergized and have the break contacts A12-4 and B12-4 closed to establish the following circuit: L+6, C13-6, C6, A13-10, B13-10, A12-4, B12-4, CSU, 1-3, L-6.

When any of the elevator cars is removed from service, the associated terminal relays A12 and A13 or B12 and B13 or C12 and C13 and their associated in service relay A11, B11 or C11 are deenergized. It will be assumed that the elevator car A is removed from service and that the remaining elevator cars B and C operate as a two-car bank. The assumption that the elevator car C is at the lower terminal landing is continued. Under these circumstances, the elevator car C receives a start up signal under any of the following conditions:

(1) The elevator car B is traveling down. The upper terminal relays A12 and B12 are both deenergized and their contacts A12-4 and B12-4 are closed. The up relay for the down traveling car B is deenergized and the contacts BW6 are closed. Consequently, the following circuit is established for the start up lamp: L+6, C13-6, C6, A11-4, BW6, A12-4, B12-4, CSU, 1-3, L-6.

(2) Both elevator cars are at the lower terminal landing. The lower terminal relay for the car B is energized to close its contacts B13-10. Consequently, the following circuit is established: L+6, C13-6, C6, A11-4, B13-10, A12-4, B12-4, CSU, 1-3, L-6.

(3) Car B is at the upper terminal landing and a car call is registered in the car C or a landing call is registered. Inasmuch as the elevator car B is at the upper terminal landing, its up relay is deenergized and the break contacts BW6 are closed. If a car call is registered in the car C, the make contacts CH2 of the car call above relay CH are closed. If a landing call is registered, the break contacts CK3 of the landing call above relay CK are closed. Consequently, depending on whether a car call or a

down inductor relay (or the lower limit switch AVTD) opens to deenergize the speed relay AV and the car slows to a landing speed. The stopping inductor relay (or the limit switch ASTD) opens to deenergize the down switch AD and the car running relay AM. These cooperate to stop the elevator car at the lower terminal landing in the manner previously described. The lower limit switch A30B opens to deenergize the down relay AX. This relay opens its contacts AX1 to prevent energization of the down switch AD. Also, break contacts AX2 close to complete an energizing circuit for the up relay AW. The car now is set for up travel. The contacts AW8 and AX9 again are both opened for a time sufficient to permit resetting of the car call buttons.

DISPATCHER OPERATION

It will be assumed initially that all three elevator cars are in service. This means that the in service relays A11, B11 and C11 (Fig. 6) all are energized by closure of the in service switches.

If the up peak and down peak switches (Fig. 5) are both open, the up peak and down peak relays 1 and 2 are deenergized and the elevator cars provide off peak service.

If the up peak relay is energized by closure of its associated up peak switch, it opens its break contacts 1-1, 1-2 and 1-3 and it closes its make contacts 1-4, 1-5 and 1-6 (Fig. 6).

The opening of the contacts 1-1, 1-2 and 1-3 removes the start up lamps of the elevator cars from service. Consequently, each of the elevator cars is loaded by its car attendant and the car attendant leaves the lower terminal landing as soon as his elevator car is full.

Closure of the contacts 1-4, 1-5 and 1-6 energizes the high call reversal control relays A14, B14, and C14. Energization of these relays places the system on standard high call reversal operation. Each of the elevator cars during an up trip will proceed to the highest car call or the highest landing call, whichever is higher. At the highest of such calls, each elevator car reverses and returns to the lower terminal landing.

The reversing operation of the elevator cars will be understood by a brief discussion of the operation of the reversing relay AJ (Fig. 2). Inasmuch as the contacts A14-1 are closed, the reversing relay is subject to control by the up relay AW, the car call above relay AH and the landing call above relay AK. If the car is traveling up, the contacts AW9 of the up contact are closed. As long as a car call exists for a landing above the position of the elevator car A, the break contacts AH3 are opened and the reversing relay AJ cannot be energized. As long as a landing call exists for a landing above the position of the elevator car A, the make contacts AK6 are open and the relay AJ cannot be energized. However, as soon as the elevator car A reaches the highest call for service therefrom, the following circuit is completed: L+2, AK6, A14-1, AH3, AJ, AW9, L-2.

The reversing relay promptly closes its contacts AJ4 to establish a holding circuit around the contacts AK6, A14-1 and AH3. Contacts AJ1 (Fig. 1) close to energize the relays AG, AE and AF to assure stopping of the elevator car at the next landing reached thereby. Contacts AJ2 open and as soon as the parallel contacts AM2 open, the up relay AW is deenergized. The deenergization of the up relay AW results in energization of the down relay AX. This conditions the elevator car A for down travel. In addition,

the contacts AJ3 (Fig. 6) to close to illuminate the start down lamp ASD. This informs the car attendant that he is returning to the lower terminal landing. It will be understood that the contacts AW8 and AX9, Fig. 6, are both open for a brief time to reset car call buttons before the car starts down.

Let it be assumed next that the up peak relay 1 is deenergized and that the down peak relay 2 is energized by closure of its associated down peak switch (see Fig. 5). The energization of the down peak relay results in closure of the make contacts 2-1, 2-2 and 2-3 (Fig. 6). This places the system on modified high call reversal. Each elevator car will operate high call reversal only if a landing call exists for a landing behind or above the remaining two elevator cars. For example, the energization circuit for the high call reversal control relay A14 includes the break contacts BK4 and CK4 for the elevator cars B and C. By reference to Fig. 5, it will be observed that if no landing call exists for a landing above the position of the car B, the landing call above relay BK is energized and the break contacts BK4 (Fig. 6) are open to prevent energization of the high call reversal control relay A14. Similarly, by reference to Fig. 5, it will be observed that if no landing call exists for a landing above the position of the elevator car C, the landing call above relay CK is energized and the contacts CK4 (Fig. 6) are open to prevent energization of the high call reversal control relay. Under either of these conditions, the contacts A14-1 (Fig. 2) of the relay A14 are opened and prevent energization of the reversing relay AJ. Consequently, the car A does not reverse at an intermediate landing but proceeds to the upper terminal landing.

If a landing call exists for a landing above both of the cars B and C, the break contacts BK4 and CK4 (Fig. 6) are both closed and the high call reversal control relay A14 is energized to close its contacts A14-1 (Fig. 2). This permits the elevator car A to operate high call reversal. Such operation will be clear from the preceding discussion.

In a similar manner, the high call reversal control relay B14 (Fig. 6) is controlled by break contacts AK4 and CK5 for the cars A and C. Also, the high call reversal control relay C14 is controlled by break contacts AK5 and BK5 for the elevator cars A and B. Consequently, when the system is conditioned for down peak operation, each elevator car operates high call reversal only if a landing call exists for a landing above the positions of the remaining two elevator cars.

The selection of an elevator car as the next car to leave a terminal landing now will be discussed. Let it be assumed that the elevator car C reaches the upper terminal landing. Under such conditions, the brush C50 (Fig. 6) engages the contact segment Cr7 to energize the upper terminal relay C12. This relay closes its make contacts C12-1, C12-2 (Fig. 5) to complete the following energizing circuit for the stepping relay 5: L+5, 5-1, C12-2, 5, L-5. It will be understood that the break contacts 5-1 of the stepping relay contacts are opened each time the stepping relay is energized. Consequently, the stepping relay notches forward one step at a time until the contact arm C12a completes the following circuit for the stepping relays: L+5, C5, C12-1, C12-2, 5, L-5.

The stepping relay now remains energized un-

landing call is registered, one of the following circuits is completed:

(a) L+6, C13-6, C6, A11-4, BW6, A11-2, CH2, CSU, 1-3, L-6.

or

(b) L+6, C13-6, C6, A11-4, BW6, A11-2, CK3, CSU, 1-3, L-6.

If the car B were removed from the service in place of the car A, similar circuits would be established for the start up lamp CSU. It is believed that these circuits may be traced on the drawings as the result of the foregoing discussion.

It will be understood that similar combinations of relay contacts are effective for illuminating the start up lamp BSU or the start up lamp ASU of the cars B and A in a similar manner. Inasmuch as the contacts are clearly labeled in Fig. 6, it is believed that the corresponding circuits for the cars A and B may be traced readily as a result of the detailed discussion of the operation of the start up lamp CSU.

The operation of the start down lamps now will be considered. It will be assumed that the car C is at the upper terminal landing and that it has been selected as the next car to leave the upper terminal landing. It is assumed further that all three elevator cars are in service.

(1) If the elevator car A subsequently arrives at the upper terminal landing, it energizes its up terminal relay A12 to complete the following circuit for the start down lamp CSD: L+6, C12-5, C5, A12-7, CSD, L-6.

(2) If the car B subsequently arrives at the upper terminal landing, the following energizing circuit is similarly established: L+6, C12-5, C5, B12-7, CSD, L-6.

(3) (a) If the elevator car B is set for up travel, the down relay BX is deenergized and the break contacts BX7 are closed. If the elevator car B has left the lower terminal landing, the lower terminal relay B13 is deenergized and the break contacts B13-12 are closed. If a landing call has been registered, the landing call relay K is deenergized and the break contacts K6 are closed to establish the following circuits: L+6, C12-5, C5, BX7, B11-6, B13-12, K6, CSD, L-6.

(b) If the car A instead of the car B had been running up, the following circuit would be similarly established: L+6, C12-5, C5, AX7, A11-6, A13-11, K3, CSD, L-6.

(4) (a) If the elevator car B is at the lower terminal landing or is set for up travel, the down relay BX is deenergized and the break contacts BX7 are closed. Under these circumstances, if a car call is registered in the elevator car C, the car call below relay CI is energized to establish the following circuit: L+6, C12-5, C5, BX7, B11-6, C12, CSD, L-6.

(b) Had the car A instead of the car B been at the lower terminal landing or set for up travel when a car call was registered in the car C, the following circuit would have been similarly established: L+6, C12-5, C5, AX7, A11-6, C11, CSD, L-6.

It will be recalled that the start down lamp CSD also is illuminated if the elevator car C when traveling up reverses at one of the intermediate landings.

Let it be assumed next that one of the elevator cars, such as the car A, is removed from service. The start down lamp for the car C

when the car C is at the upper terminal landing is illuminated in the same manner discussed above except that the car A is no longer effective for dispatching the elevator car C. It should be noted that when the car A is removed from service, the contacts A11-6 are opened by the deenergization of the in service relay to prevent completion of a circuit therethrough for the start lamp of the elevator car C.

It should be noted that when the elevator car B is traveling up for a landing call, the car C is promptly dispatched. However, if the elevator car B is traveling up in response only to a car call in the elevator car B, the car C is not dispatched from the upper terminal landing until the arrival of the elevator car B thereat. If no landing call is registered, it is clear that no intending passenger is awaiting service at a landing and there is no need for prompt dispatch of the elevator car C.

The start down lamps for the cars A and B are illuminated in a manner similar to that described for the elevator car C. Since the various contacts are clearly labeled in Fig. 6, it is believed that the circuits for the start lamps ASD and BSD may be traced on the drawing in conformance with the discussion for the elevator car C.

Under some circumstances, it may be desirable to extend one of the terminal landings to include a plurality of landings adjacent the terminal landing. For example, in an installation which has unusually heavy traffic in a down direction during a down peak period from the higher landings, it may be desirable to reverse a down traveling elevator car at a landing above the lower terminal landing if complete travel of the elevator car to the lower terminal landing is not required. A terminal extension may be provided selectively in the elevator system herein described by operation of a manual switch ATE, BTE or CTE (Fig. 6) for each of the elevator cars. Under certain conditions, this switch connects the contact segments Ar2, etc., for landing adjacent the lower terminal landing to the contact segment Ar1 for the lower terminal landing. Under these circumstances, the contact segment Ar2, etc., operate as part of a resultant terminal landing and any of the contact segments so connected is effective for stopping and reversing the associated down traveling elevator car if further travel of the elevator car in a down direction is not required. As many contact segments as desired may be connected to the contact segment Ar1. However, in the embodiment herein illustrated, two segments Ar2 and Ar3 are arranged for connection to the contact segment Ar1.

The connection of the contact segments Ar2 and Ar3 to the contact segment Ar1 is controlled by break contacts AK1 of the landing call above relay and break contacts A13 of the car call below relay and make contacts AY1 of the landing call below relay AY. In addition, a further control is exercised by make contacts AX10 of the down relay AX. Consequently, if the switch ATE is closed, if the elevator car A is traveling downwardly (make contacts AX10 are closed), if no car call exists for a landing below the elevator car A (break contacts A13 are closed), if a landing call exists for a landing above the elevator car A (break contacts AK1 are closed), and if there is no landing call for a landing below the car (contacts AY1 are closed), the contact segments Ar2 and Ar3 are connected to the contact

segment Ar1. When the down traveling elevator car A reaches the first of these connected contact segments, the brush A50 completes an energizing circuit for the lower terminal relay A13 which may be traced as follows: L+6, in service switch, A50, Ar3 or Ar2, AK1, A13, AY1, AX10, ATE, A13, L-6.

Upon energization, the lower terminal relay A13 closes its contacts A13-5 to establish a holding circuit around the brush A50, the contact segment Ar2 or Ar3, the contacts AK1 and the contacts A13.

By reference to Fig. 1, it will be observed that energization of the lower terminal relay A13 results in a stopping operation of the elevator car. The switch ATE is a two-pole switch which is effective in part for controlling the connection of the contacts A13-1 to the relays AG, AE and AF. If the switch ATE is closed and the lower terminal relay A13 is energized, an energizing circuit for the relays AG, AE and AF of the down traveling elevator car is completed through the contacts A13-1 and the switch ATE. The relays AG, AE and AF cooperate to stop the elevator car at the next floor reached by the elevator car. This will be assumed to be the third floor corresponding to the contact segment Ar3 of Fig. 6.

The energization of the lower terminal relay A13 also opens the break contacts A13-2 (Fig. 1). As the car stops, the contacts AM3 open to deenergize the down relay AX. Upon deenergization, the down relay AX closes its break contacts AX2 to energize the up relay AW. The elevator car now is conditioned for travel in an up direction. Under these conditions, the second and third landings in effect form an extension of the lower terminal landing and operate in the same manner to stop, reverse and start the elevator car A.

THROUGH TRIP OPERATION

In order to make certain that the operation of the elevator system is fully understood, a number of typical operating conditions will be discussed. For the first operating condition, it is assumed that the system is arranged for off peak operation. This means that the up peak and down peak relays 1 and 2 are deenergized. It is assumed further that the terminal extension switch ATE is open. The elevator car C initially is at the lower terminal landing and the stepping switch 6 has stepped to a position wherein the next up lamp CNU (Fig. 6) is illuminated through the circuit: L+6, C13-6, C5, CNU, L-6.

The elevator car A is at the upper terminal landing and the elevator car B is running down. For the assumed conditions, the in service relays A11, B11 and C11 are energized. The lower terminal relay C13 also is energized. The up relay CW and the down relays BX and AX are energized. The upper terminal relay A12 is energized. Inasmuch as it is assumed that no landing call is registered, the landing call above relays AK, BK and CK and the landing call relay K all are energized.

The elevator car A now leaves the upper terminal landing and the brush A50 (Fig. 6) consequently leaves the contact segment Ar7 to deenergize the upper terminal relay A12. The upper terminal relay A12 now completes the following energizing circuit for the start lamp of the elevator car C: L+6, C13-6, C5, AW6, BW6, A12-4, B12-4, CSU, 1-3, L-6.

In response to his start lamp, the car attendant starts the elevator car C from the lower terminal landing by the procedure above set

forth. As the elevator car leaves the lower terminal landing, the brush C50 leaves the contact segment Cr1 to deenergize the lower terminal relay C13. As a result of such deenergization, the contacts C13-6 open to deenergize the lamps CNU and CSU.

Next it will be assumed that the elevator cars C and B both are at the lower terminal landing and that the stepping switch 6 has operated to select the elevator car C as the next car to leave the lower terminal landing. The elevator car A is at the upper terminal landing. The in service relays A11, B11, C11, the lower terminal relays B13 and C13, the upper terminal relay A12, the down relay AX and the up relays BW and CW, are all energized. Inasmuch as it is assumed that no landing call is registered, the landing call above relays AK, BK and CK and the landing call relay K all are energized.

If the elevator car A leaves the upper terminal landing, the brush A50 (Fig. 6) leaves the contact segment Ar7 to deenergize the upper terminal relay A12. The deenergization of the upper terminal relay completes the following circuit for the start lamp of the elevator car C: L+6, C13-6, C6, AW6, B13-10, A12-4, B12-4, CSU, 1-3, L-6.

Upon receipt of his starting signal, the car attendant starts the elevator car C in an up direction by the procedure previously set forth. As the brush C50 leaves the contact segment Cr1, the lower terminal relay C13 is deenergized to extinguish the lamps CNU and CSU. Inasmuch as the elevator car B remains at the lower terminal landing, the stepping relay 6 steps to a position wherein the elevator car B is selected as the next car to leave the lower terminal landing. Consequently, the following circuit is established for the lamp BNU: L+6, B13-6, B6, BNU, L-6.

DOWN PEAK OPERATION

It is assumed next that the down peak switch is actuated to energize the down peak relay 2. It is assumed that the elevator car A is at the lower terminal landing and the elevator car C is traveling down. The elevator car B has just left the lower terminal landing and the elevator car A has been selected as the next car to leave the lower terminal landing. The down peak relay 2, the in service relays A11, B11 and C11, the up relays AW and BW, the down relay CX, the landing call above relays AK, BK and CK, the landing call relay K, the lower terminal relay A13, and the lamp ANU, are energized.

At this juncture, a down call is registered from the second landing to energize the down call registering relay 2DR (Fig. 2). The down call registering relay closes its make contacts 2DR1 to establish a self-holding circuit. Also, this relay opens its break contacts 2DR2 (Fig. 5) to deenergize the landing call above relay AK and the landing call relay K. Inasmuch as the elevator cars B and C both are assumed to be above the second landing, the call for the second landing does not affect the energization of the landing call above relays BK and CK.

At a time when all of the elevator cars are below the sixth landing, a down call is registered at the sixth landing. Such registration energizes the registering relay 6DR (Fig. 2) which closes its make contacts 6DR1 to establish a self-holding circuit. Also, the relay opens its break contacts 6DR2 (Fig. 5) to deenergize the landing call above relays BK and CK. Consequently, the following circuit is established for the high call

25

26

reversal control relay A14 (Fig. 6): L+6, 2—1 BK-4, CK-4, A14, L-6.

The relay A14 closes its make contacts A14-1 (Fig. 2) to prepare the reversing relay AJ for subsequent energization. The elevator car A now is conditioned to operate high call reversal because of the presence of the sixth landing down call behind or above the elevator cars B and C.

The elevator car C now arrives at the lower terminal landing and energizes the lower terminal relay C13. Such energization completes the following circuit for the start lamp ASU: L+6, A13-6, A6, C13-7, AK2, ASU, I-1, L-6.

The car attendant for the elevator car A now starts his car by a procedure similar to that discussed previously. As the car A leaves the lower terminal landing, the brush A50 leaves the contact segment A1 to deenergize the lower terminal relay A13. This, in turn, opens its contacts A13-6 to extinguish the lamps ANU and ASU. Since the elevator car C now is at the lower terminal landing, the stepping relay 6 steps until it completes a circuit for the lamp CNU. This means that the elevator car C is selected as the next car to leave the lower terminal landing.

It will be recalled that the high call reversal control relay A14 is energized. It is assumed that no car calls are registered for the elevator car A and the car call above relay AH is deenergized. This means that the contacts AH3 (Fig. 2) associated with the reversing relay AJ are closed.

As the elevator car proceeds upwardly, the brush A46 finally reaches the contactor segment Aa6 and the landing call above relay AK (Fig. 5) is energized. When reenergized, the relay AK closes its make contacts AK6 (Fig. 2) to complete an energizing circuit for the reversing relay AJ. This relay initiates the stopping and reversing of the elevator car A at the sixth landing by a procedure which has been discussed previously. The elevator car A now returns to the lower terminal landing in a conventional manner.

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

We claim as our invention:

1. In an elevator system for a structure having terminal landings and a plurality of intermediate landings between the terminal landings, a plurality of elevator cars operable between the terminal landings for serving the landings, call registering means for registering calls for the landings, control means for stopping each of the elevator cars at landings having calls registered by the call registering means, and farthest call reversing means cooperating with the control means in response to registration of a call for one of the landings on a predetermined side of certain of the elevator cars for stopping and reversing at least one of the elevator cars at the farthest landing in a predetermined direction of travel of the elevator cars for which a call is registered by the call registering means, said farthest call registering means if the registered calls are not on said predetermined side of certain of the elevator cars being ineffective for reversing an elevator car.

2. A system as claimed in claim 1 wherein the call registering means comprises up call registering means and down call registering means for each of the intermediate landings.

3. The system as claimed in claim 1 in com-

ination with selectively-operable means for rendering the farthest call reversing means effective to reverse a car at the farthest landing in a predetermined direction of travel of the car for which a call is registered regardless of the position of the last-named call relative to the remainder of the cars.

4. In an elevator system for a structure having terminal landings and a plurality of intermediate landings between the terminal landings, three elevator cars operable between the terminal landings for serving the landings, call registering means for registering calls for each of the landings, control means for each of the elevator cars cooperating with the call registering means for stopping the elevator cars at landings having calls registered by the call registering means, and farthest call reversing means cooperating with the control means and the call registering means in response to registration of a call for a landing displaced in a predetermined direction from two of said cars for transferring the remaining car for farthest call reversal operation, said farthest call reversing means being ineffective to transfer said remaining car for high call reversal operation if the registered call is displaced in said predetermined direction from only one of the other cars.

5. A system as claimed in claim 4 in combination with selectively-operable means for rendering the farthest call reversing means effective to transfer said remaining car regardless of the position of the other cars.

6. In an elevator system for a structure having first and second terminal landings and a plurality of intermediate landings between the terminal landings, an elevator car operable in first and second directions between the terminal landings for serving the landings, call registering means for registering calls for either of said directions of travel for each of the intermediate landings, control means for said elevator car normally operable during a trip in said first direction for moving the car to the first terminal landing and reversing the car at the first terminal landing for movement in said second direction away from the first terminal landing to answer calls registered by the registering means, and means responsive to registration of at least one call in either of said directions by the call registering means for a landing between the second terminal landing and the car when traveling in said first direction for stopping and reversing the elevator car at one of said intermediate landings which becomes in effect an advanced terminal landing.

7. A system as claimed in claim 6 in combination with means responsive to operation of the call registering means for an intermediate landing between the advanced terminal landing and the first terminal landing for preventing said stopping and reversing of the elevator car at an advanced terminal landing at least until the elevator car has responded to said operated second call registering means.

8. An elevator system as claimed in claim 6 wherein the first and second terminal landings are respectively lower and upper terminal landings, and the first and second directions are respectively down and up directions, said advanced terminal landing comprising any of a plurality of landings immediately above the lower terminal landing which is first reached by the elevator car following said registration of a call.

9. In an elevator system for a structure hav-

ing first and second terminal landings and a plurality of intermediate landings between the terminal landings, a plurality of elevator cars each operable in first and second directions between the terminal landings for serving the landings, call registering means for registering calls for either of said directions of travel for each of the intermediate landings, control means for each of the elevator cars normally operable during a trip in said first direction for moving the associated car to the first terminal landing and reversing the associated car at the first terminal landing for movement in said second direction away from the first terminal landing to answer calls registered by the registering means, and means cooperating with said control means for each of the elevator cars in response to registration of at least one call in either of said directions by the call registering means for a landing between the second terminal landing and one of the cars when traveling in said first direction for stopping and reversing the last-named elevator car at one of said intermediate landings which becomes in effect an advanced terminal landing.

10. A system as claimed in claim 9 in combination with a dispatcher for dispatching elevator cars from the first terminal landing, said dispatcher being effective for dispatching one of the elevator cars from the advanced terminal landing instead of from the first terminal landing if the last-named car reverses at the advanced terminal landing.

11. In an elevator system for a structure having a pair of terminal landings and a plurality of intermediate landings between the terminal landings, three elevator cars movable between the terminal landings for serving the landings, and a dispatcher for dispatching said elevator cars, said dispatcher comprising means responsive to the presence of two of said cars at a first one of the terminal landings and travel of a third one of said cars away from a second one of the terminal landings for dispatching one of the cars from said first one of the terminal landings.

12. In an elevator system for a structure having upper and lower terminal landings and having landings intermediate the terminal landings, three elevator cars movable between the terminal landing for serving the landings, control means operable for moving each of the cars between the terminal landings, and a dispatcher for maintaining two of the cars located at the lower terminal landing and a third one of the cars located at the upper terminal landing when no demand for service exists on the system, said control means being operable for moving the third car away from the upper terminal landing, said dispatcher including means responsive to downward travel of the third elevator car and to the presence of said two cars at the lower terminal landing for dispatching one of the two cars at the lower terminal landing towards the upper terminal landing, car call registering means for each of the cars operable within the cars for registering landings desired by car passengers, said dispatcher including means responsive to registration of a car call in one of the cars when located at the lower terminal landing and to the presence of a second car at the lower terminal landing for dispatching the car having a registered car call.

13. In an elevator system, a structure including an upper terminal landing, a lower terminal

landing and a plurality of intermediate landings, a plurality of elevator cars mounted for movement between the landings, call registering means for registering calls for each of the landings, control means normally operable for moving each of the cars between the terminal landings on through trips, said control means cooperating with the call registering means for stopping the cars during such through trips at desired landings for which calls have been registered, and a dispatcher responsive to the presence of two of the elevator cars at the lower terminal landing and to the registration of a call for one of the intermediate landings for dispatching one of the elevator cars at the lower terminal landing, said dispatcher being ineffective for dispatching one of the elevator cars located at the lower landing in response only to the presence of two of the elevator cars at the lower terminal landing.

14. In an elevator system for a structure having first and second spaced terminal landings and a plurality of intermediate landings between the terminal landings, three elevator cars movable between the terminal landing for serving the landings, and a dispatcher comprising means responsive to the presence of a first one of the elevator cars at the first terminal landing and to the movement of second and third ones of the elevator cars towards the first terminal landing for dispatching the first one of the elevator cars from the first terminal landing, the movement of the second one of the elevator cars towards the first terminal landing while the third one of the elevator cars is at the second terminal landing being insufficient alone to dispatch the first one of the elevator cars.

15. In an elevator system for a structure having terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars operable in first and second directions between the landings for serving the landings, call registering means for registering elevator calls from each of the intermediate landings, control means for each of the elevator cars, each of the control means being operable for moving the associated elevator car between said landings, and a dispatcher responsive to the presence of a plurality of said elevator cars at one of the terminal landings and to a predetermined operation of said call registering means for dispatching the car which first arrived at said last-named terminal landing.

16. A system as claimed in claim 15 wherein said call registering means is located at each of the intermediate landings for operation by intending passengers.

17. In an elevator system for a structure having terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars operable in first and second directions between the landings for serving the landings, call registering means operable from the intermediate landings for registering elevator calls from each of the intermediate landings, control means for each of the elevator cars, each of the control means being operable for moving the associated elevator car between said landings, and a dispatcher responsive to the combination of the approach of one of the elevator cars to one of the terminal landings, the presence of another of the elevator cars at the last-named terminal landing, and a predetermined operation of the call registering means for dispatching said last-named elevator car from the last-named terminal landing.

18. A system as claimed in claim 17 in combination with car call registering means operable within each of the elevator cars for registering calls desired by car passengers, a car call registered in a first one of the cars when located at one of the terminal landings being ineffective to dispatch the last-named car until a second approaching one of the elevator cars substantially reaches the last-named terminal landing.

19. In an elevator system for a structure having first and second terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars each operable in first and second directions respectively towards the first and second terminal landings for serving the landings, call registering means for registering calls for the landings, control means for each of the elevator cars for stopping the elevator cars at landings having calls registered by the call registering means, farthest call reversing means cooperating with the control means in response to registration of a call for one of the landings displaced in the first direction from certain of the elevator cars for stopping and reversing at least one of the elevator cars when traveling in the first direction at the farthest landing for which a call is registered by the call registering means, said farthest call reversing means if the registered calls are displaced in the second direction from certain of the elevator cars being ineffective for reversing an elevator car, means cooperating with the control means for stopping and reversing each of the elevator cars when traveling in the second direction at the second terminal landing, and means responsive to registration of at least one call by the call registering means for a landing between one of the cars traveling in the second direction and the first terminal landing for stopping and reversing the last-named elevator car at an intermediate landing which in effect becomes temporarily an advanced second terminal landing.

20. A system as claimed in claim 19 wherein said plurality of elevator cars comprises three cars, said directions are up and down directions, said call registering means includes an up call registering means and a down call registering means at each of the intermediate landings, said control means normally operating to stop each of the elevator cars at each call registered by the up call registering means and reached by the car during up travel of the car, and said control means normally operating to stop each of the elevator cars at each call registered by the down call registering means and reached by the car during down travel of the elevator car.

21. A system as claimed in claim 20 in combination with car call registering means for registering car passenger calls for the landings, said control means comprising means cooperating with the car call registering means for stopping the car at landings for which calls are registered by the car call registering means as the landings are reached, and means responsive to registration of a car call for the second terminal landing for preventing the elevator car in which the car call is registered from reversing at an advanced second terminal landing.

22. In an elevator system for a structure having first and second terminal landings and a plurality of landings intermediate the terminal landings, at least three elevator cars each operable in first and second directions respectively towards the first and second terminal landings for serving the landings, call registering means for registering calls for the landings, control

means for each of the elevator cars for stopping the elevator cars at landings having calls registered by the call registering means, and a dispatcher for dispatching the elevator cars from one of the terminal landings in the order of the arrival of the cars at the last-named terminal landing, said dispatcher including means for dispatching successive cars from the last-named terminal at an interval dependent only on the position of the elevator cars, the movement of the elevator cars and the registration of calls by the call registering means.

23. In an elevator system for a structure having first and second terminal landings and a plurality of landings intermediate the terminal landings, at least three elevator cars each operable in first and second directions respectively towards the first and second terminal landings for serving the landings, call registering means for registering calls for the landings, control means for each of the elevator cars for stopping the elevator cars at landings having calls registered by the call registering means, the call registering means comprising landing call registering means located at each of the landings and car call registering means disposed in each of the elevator cars, and a dispatcher comprising dispatching means which operates to dispatch one of the elevator cars designated as the selected car from the first terminal landing in response to fulfillment of any of the following conditions:

- A. the selected car and certain of the other cars are at the first terminal landing and at least one car call is registered in the selected car;
- B. the selected car and at least a second one of the cars are at the first terminal landing and at least one call is registered by the landing call registering means;
- C. the selected car is at the first terminal landing and at least two of the remaining elevator cars are approaching the first terminal landing.

24. In an elevator system for a structure having first and second terminal landings and a plurality of landings intermediate the terminal landings, at least three elevator cars each operable in first and second directions respectively towards the first and second terminal landings for serving the landings, call registering means for registering calls for the landings, control means for each of the elevator cars for stopping the elevator cars at landings having calls registered by the call registering means, and a dispatcher comprising dispatching means which operates to dispatch one of the elevator cars designated as the selected car from the first terminal landing in response to fulfillment of any of the following conditions:

- A. the selected car and a second one of the cars are at the first terminal landing and a third one of the elevator cars is traveling towards the first terminal landing;
- B. the selected car is at the first terminal landing and at least two others of the elevator cars are traveling towards the first terminal landing.

25. A system as claimed in claim 24 wherein the call registering means comprises landing call registering means located at each of the landings and car call registering means disposed in each of the elevator cars, said dispatching means also operating to dispatch the selected car in

31

response to fulfillment of any of the following conditions:

- C. the selected car and at least a second one of the remaining cars are at the first terminal landing and at least a certain minimum number of car calls, at least one, is registered in the selected car;
- D. the selected car and at least a second one of the cars are at the first terminal landing and at least a certain minimum number of calls, at least one call, is registered by the landing call registering means.

26. A system as claimed in claim 25 wherein the dispatching means also operates to dispatch the selected car in response to fulfillment of the following condition:

- E. the selected car and at least two additional elevator cars are at the first terminal landing.

27. A system as claimed in claim 25 in combination with a dispatcher comprising dispatching means which operates to dispatch the selected car from the second terminal landing in response to fulfillment of any of the following conditions:

- a. the selected car and at least one additional elevator car are located at the second terminal landing;
- b. the selected car is at the second terminal landing, at least an additional one of the elevator cars is approaching the second terminal landing, and at least a certain minimum number of car calls is registered in the selected car;
- c. the selected car is at the second terminal landing, at least an additional one of the elevator cars is approaching the second terminal landing and at least a certain minimum number of calls is registered by the landing call registering means;
- d. the selected car is at the second terminal landing, at least one car call is registered in the selected car and a second one of the elevator cars is prepared for travel towards the second terminal landing.

28. In an elevator system for a structure having first and second terminal landings and a plurality of landings intermediate the terminal landings, at least three elevator cars each operable in first and second directions respectively towards the first and second terminal landings for serving the landings, call registering means for registering calls for the landings, control means for each of the elevator cars for stopping the elevator cars at landings having calls registered by the call registering means, the call registering means comprising landing call registering means located at each of the landings and car call registering means disposed in each of the elevator cars, and a dispatcher comprising dispatching means which dispatches one of the elevator cars designated as the selected car from the second terminal landing in response to fulfillment of any of the following conditions:

- a. the selected car and at least one additional elevator car are located at the second terminal landing;
- b. the selected car is at the second terminal landing, at least an additional one of the elevator cars is approaching the second terminal landing, and at least one car call is registered in the selected car;
- c. the selected car is at the second terminal

32

landing, at least an additional one of the elevator cars is approaching the second terminal landing and at least one call is registered by the landing call registering means;

- d. the selected car is at the second terminal landing, at least one car call is registered in the selected car and a second one of the elevator cars is prepared for travel towards the second terminal landing.

29. In an elevator system for a structure having first and second terminal landings and a plurality of landings intermediate the terminal landings, first and second elevator cars each operable in first and second directions respectively towards the first and second terminal landings for serving the landings, call registering means for registering calls for the landings, control means for each of the elevator cars for stopping the elevator cars at landings having calls registered by the call registering means, said call registering means comprising landing call registering means located at the intermediate landings and car call registering means in each of the elevator cars for registering calls desired by car passengers, and a dispatcher comprising dispatching means which operates to dispatch the first elevator car from the first terminal landing in response to fulfillment of any of the following conditions:

- A. the first elevator car is at the first terminal landing and the second elevator car is approaching the first terminal landing;
- B. both of the elevator cars are at the first terminal landing;
- C. the first elevator car is at the first terminal landing and at least one car call is registered therein;
- D. the first elevator car is at the first terminal landing and at least one call is registered by the landing call registering means.

30. A system as claimed in claim 29 in combination with a dispatcher comprising dispatching means which dispatches the first elevator car from the second terminal landing in response to fulfillment of any of the following conditions:

- a. the first elevator car is at the second terminal landing, the second elevator car is prepared to travel toward the second terminal landing and at least one car call is registered in the first elevator car;
- b. both of the cars are at the second terminal landing;
- c. the first elevator car is at the second terminal landing, the second elevator car is approaching the second terminal landing and at least one call is registered by the landing call registering means.

31. In an elevator system for a structure having first and second terminal landings and a plurality of landings intermediate the terminal landings, first and second elevator cars each operable in first and second directions respectively towards the first and second terminal landings for serving the landings, call registering means for registering calls for the landings, control means for each of the elevator cars for stopping the elevator cars at landings having calls registered by the call registering means, said call registering means comprising landing call registering means located at the intermediate landings and car call registering means in each of the elevator cars for registering calls desired by car passengers, and a dispatcher comprising dis-

33

patching means which operates to dispatch the first elevator car from the first terminal landing in response to fulfillment of any of the following conditions:

- a. the first elevator car is at the first terminal landing, the second elevator car is prepared to travel towards the first terminal landing, and at least one car call is registered in the first elevator car; 5
- b. both of the cars are at the second terminal landing; 10

34

- c. the first elevator car is at the first terminal landing, the second elevator car is approaching the first terminal landing and at least one call is registered by the landing call registering means.

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No references cited.