

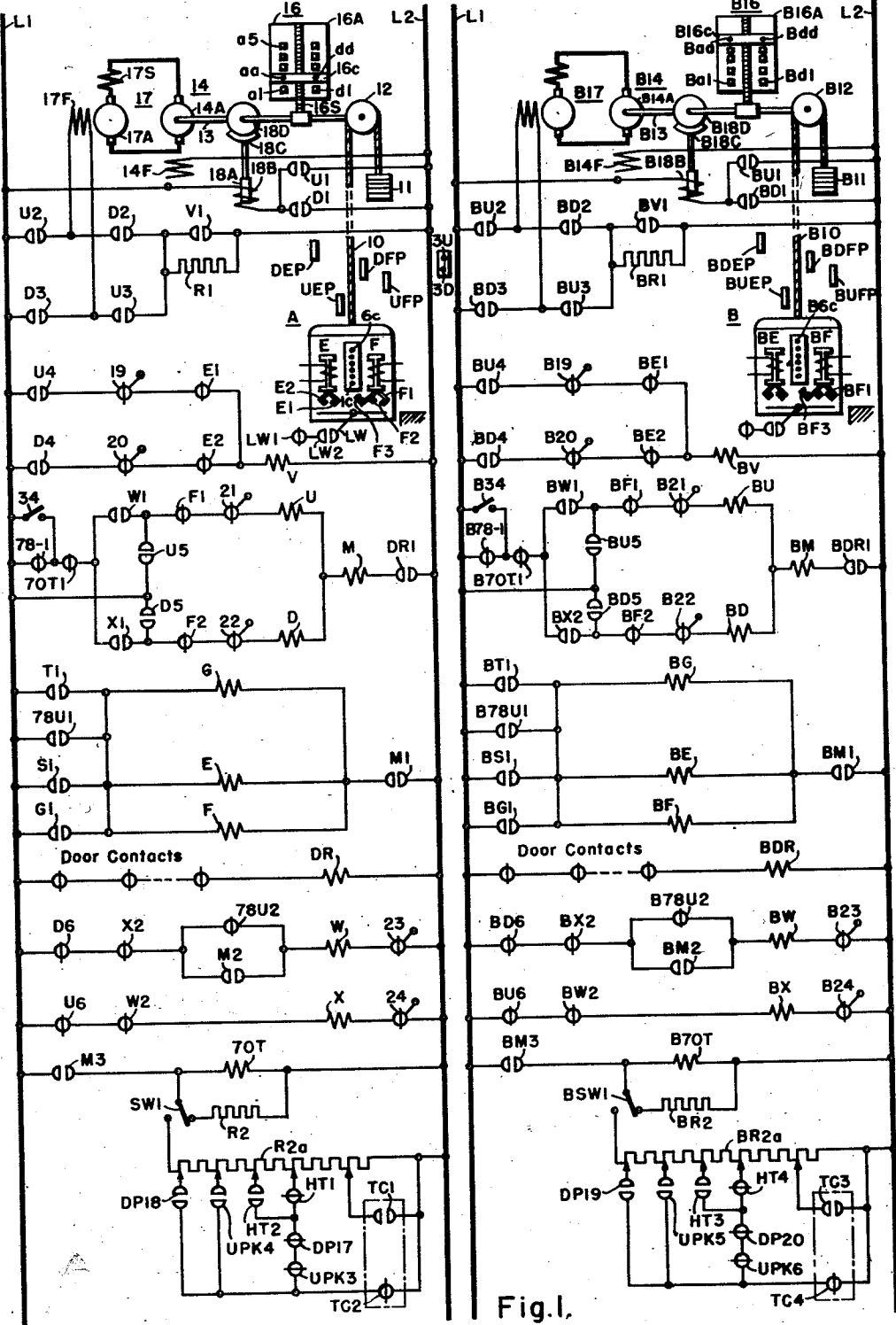
June 11, 1957

J. SUOZZO
ELEVATOR SYSTEMS

2,795,296

Filed July 20, 1954

8 Sheets-Sheet 1



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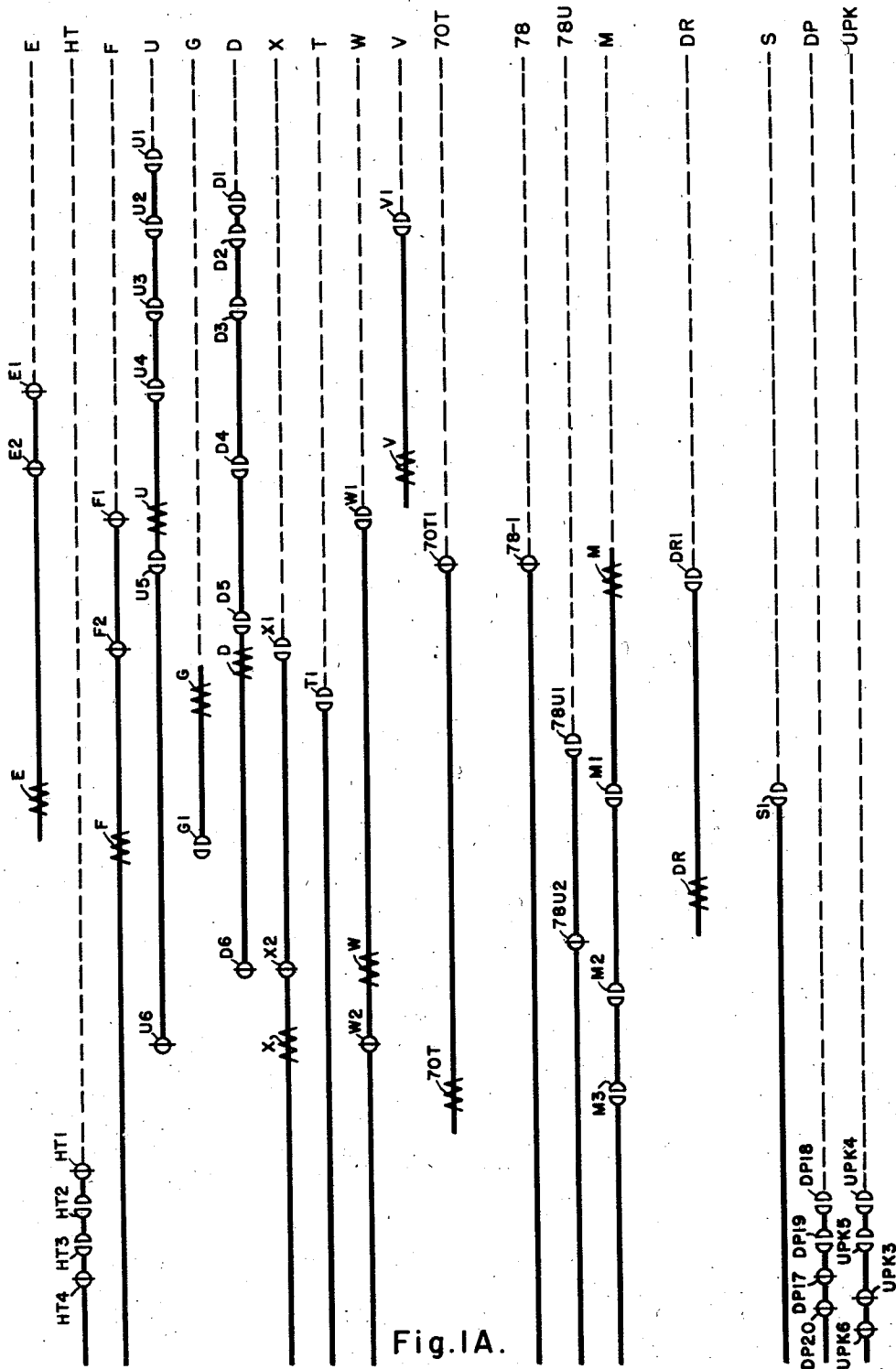


Fig. 1A.

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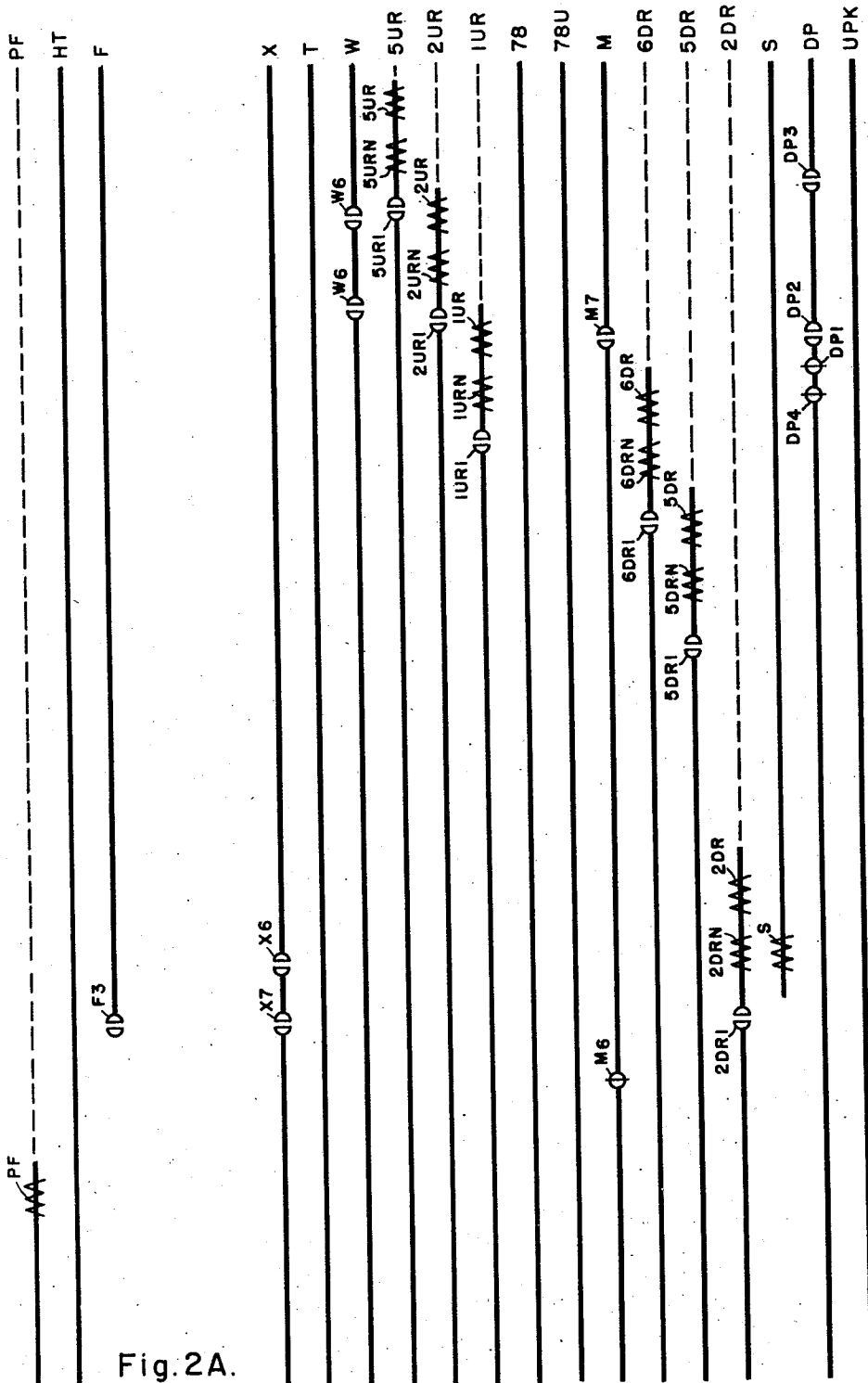
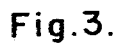


Fig. 2A.

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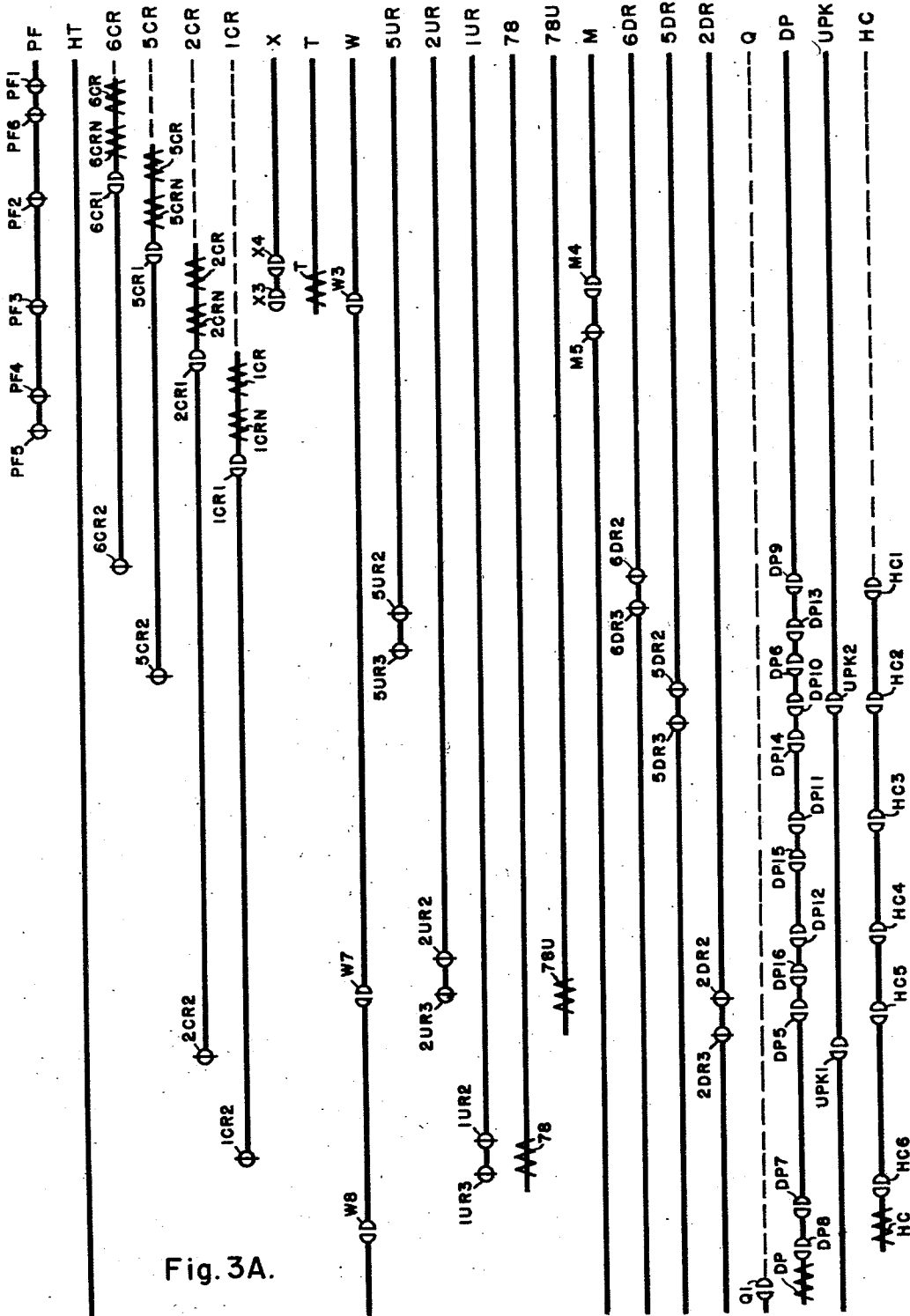


Fig. 3A.

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Fig. 4.

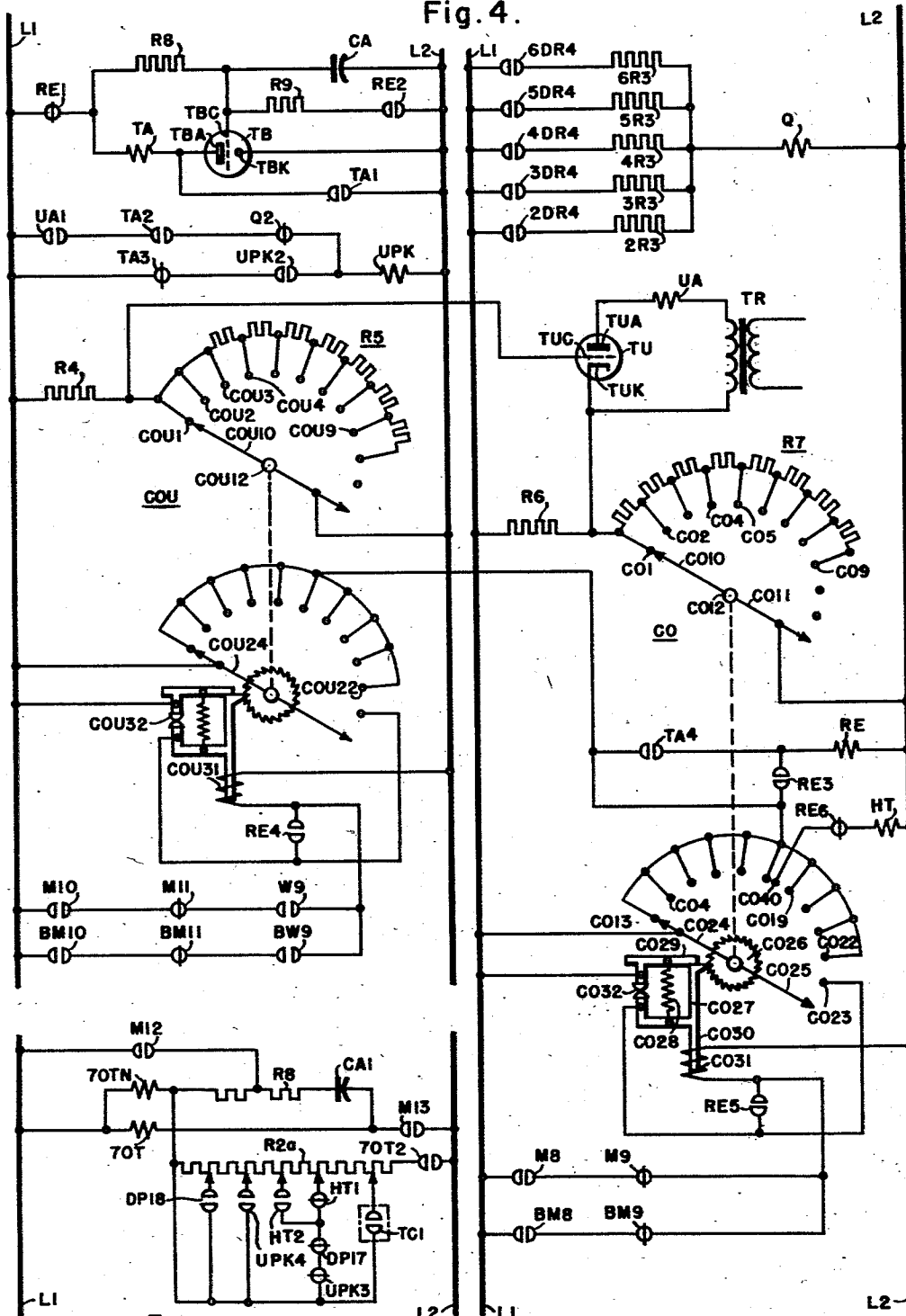


Fig.5.

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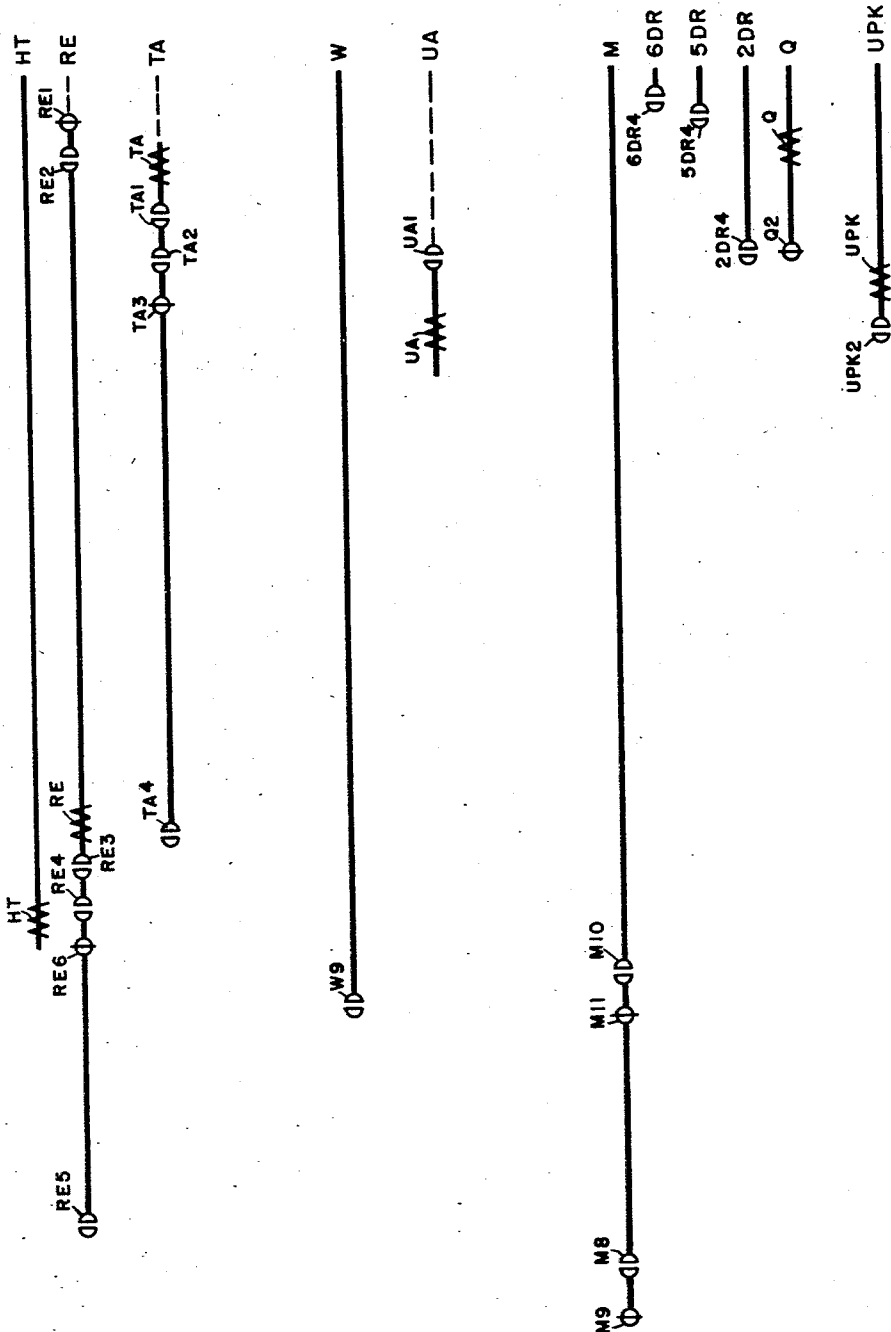


Fig. 4A.

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ELEVATOR SYSTEMS

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Application July 20, 1954, Serial No. 444,461

30 Claims. (Cl. 187—29)

This invention relates to elevator systems providing elevator service dependent on traffic demand and it has particular relation to elevator systems providing automatic control variations designed to assure continuous and efficient elevator service under various traffic demands and operating conditions.

Aspects of the invention may be employed either for elevator systems employing a single elevator car or for elevator systems employing multiple elevator cars. The elevator system to which the invention is applied may be of the attendant or non-attendant type as desired. However, the invention is particularly suitable for a bank of elevator cars designed for operation without attendants and will be described with particular reference to such a system.

An elevator system designed to carry passengers to provide efficient service throughout a day wherein the nature of the demand for service may vary appreciably. Thus, the elevator system may be required to provide efficient service during periods which are known as off-hour periods, up-peak periods, off-peak periods and down-peak periods. An off-hour period is one wherein the demand for elevator service is infrequent or intermittent and may occur during the night in an office building. During an up-peak period the elevator car is required to carry passengers predominantly in the up direction. Traffic during an off-peak period is substantially balanced in the two directions of travel. In the down-peak period traffic is predominantly in the down direction.

The problem of providing efficient elevator service is complicated further by improper actions by intending passengers. For example, during a down-peak period intending passengers at floors or landings served by the elevator system may register calls for up service even though they desire to travel in the down direction. Such improper registration of calls for service interferes with the orderly and efficient operation of the system.

In accordance with the invention, an elevator car traveling in a first direction is conditioned to reverse if it is loaded and has no further car calls registered requiring travel of the elevator car in such direction. Thus, during a down-peak period if intending passengers desiring to proceed in the down direction enter and fully load an elevator car set for up travel, the elevator car will reverse if it has no registered car calls requiring further travel in the up direction.

During a down-peak period the efficiency of the system is also increased by assigning only part of the elevator cars of a bank to answer registered calls for up service from the floors or landings. Since legitimate calls for up service during the down-peak period ordinarily are few in number, a single elevator car generally suffices to serve such calls.

The invention further contemplates the cancellation of a call for service in one direction when an elevator car set for travel in the other direction stops at the floor or landing at which the call is registered. For example, during a down-peak period if an elevator car set for down

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travel stops at a floor or landing at which a floor call for service in the up direction is registered, this call is cancelled. Since such calls frequently are improperly registered, the cancellation improves the efficiency of elevator service in the desired direction. However, to facilitate reregistration of the call for up service if the intending passenger actually desires to travel in the up direction and fails to enter the elevator car, the system permits reregistration of the call even while the elevator car is stopped at the floor or landing.

In a system designed for non-attendant operation a non-interference time is provided at each stop of an elevator car to permit loading and unloading of the car. This time may be varied in accordance with predetermined conditions such as the mode of operation for which the system is set.

A transfer of the elevator system between different modes of operation preferably is made dependent on a function of the stops made by the elevator cars employed in the system. Thus, if the number of stops made by the elevator cars while they are set for travel in the down direction exceed a predetermined number, the elevator system may be modified for down-peak operation. If the number of stops made by the elevator cars while they are set for up travel exceed a predetermined number, the system may be modified for up-peak operation.

Desirably, the transfer of the elevator system to a different mode of operation is dependent on the relationship of the stops made by the elevator cars while set for travel in one direction to other stops made by the elevator cars or to all stops made by the elevator cars. Thus, if the difference between stops made while the elevator cars are set for up travel and all stops made by the elevator cars exceeds a predetermined value, the system may be transferred to up-peak operation.

In a preferred embodiment of the invention, the transfer to a different mode of operation is dependent on the ratio of stops in one direction to all stops made by the elevator cars. Thus, if the ratio of the number of stops made by the elevator cars while set for travel in the up direction relative to the number of total stops made by the elevator cars exceeds a predetermined value, the elevator system may be transferred to up-peak operation. The transfer may be dependent on other factors. For example, if the number of registered down floor calls exceeds a predetermined value, the system may be prevented from being transferred to up-peak operation.

In some cases, an elevator system is provided with independently effective circuits. Failure of one of the independent effective circuits may seriously impair the operation of the system, and would be particularly objectionable for systems designed for operation without attendants. For example, in some elevator systems different sources of power are employed for car call circuits and for corridor or floor call circuits. If a source of power for the floor call circuits fails, the elevator cars would not respond to registered calls for service from the floors. Under such circumstances, the invention assigns the elevator cars to stop at predetermined floors. In a preferred embodiment of the invention the car call circuits are modified to stop each of the elevator cars at the assigned floors.

It is therefore an object of the invention to provide an improved and efficient elevator system.

It is a further object of the invention to provide an elevator system in which different modes of operation are provided for different peak periods and in which the operation is modified to provide reasonably uniform and efficient service for all actual and intending passengers at all times.

It is also an object of the invention to provide an elevator system wherein an elevator car if loaded while set

for travel in a first direction is assigned to reverse substantially if no registered car call requires further travel of the elevator car in such direction.

It is an additional object of the invention to provide an elevator system wherein a call for elevator service in a first direction from a floor or landing is cancelled in response to the stopping at such floor of an elevator car set for travel in a second direction.

It is a still further object of the invention to provide an elevator system wherein elevator cars are assigned to stop at predetermined floors in response to a predetermined condition.

It is another object of the invention to provide an elevator system having different modes of operation wherein the transfer between the modes of operation is dependent on functions of the stops made by the elevator cars.

It is a further object of the invention to provide an elevator system having a non-interference time which is adjustable in response to variations in system operation.

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 with circuits shown in straight-line form of a portion of an elevator system embodying the invention;

Figs. 2, 3 and 4 are schematic views with circuits shown in straight-line form of further portions of the elevator system illustrated in Fig. 1;

Figs. 1A, 2A, 3A and 4A, respectively, are key representations of relays and switches illustrated in Figs. 1, 2, 3 and 4. If Figs. 1A, 2A and 3A are horizontally aligned respectively with Figs. 1, 2, 3 and 4, it will be found that corresponding contacts and coils of relays and switches shown in the horizontally-aligned figures are substantially in horizontal alignment. In some instances wherein a group of similar relays are employed, only representative relays are shown in the key representations; and

Fig. 5 is a schematic view of a modified timing circuit.

In order to facilitate the orderly presentation of the invention, a number of conventions have been adopted. Although the invention may be incorporated in an elevator system having any desired number of elevator cars serving a structure having any desired number of floors or landings, it will be assumed that the invention is incorporated in an elevator system having two elevator cars serving a structure having six floors or landings. The elevator cars are designated by the reference characters A and B.

Because of the similarity of the circuits and components associated with the two elevator cars, components associated with the elevator car B will be identified by the same reference characters employed for the components associated with the elevator car A preceded by the letter B. For example, the resistors R8 and BR8 are associated respectively with the elevator cars A and B.

Relays and electromagnetic switches employed for the elevator system may have front or make contacts and back or break contacts. Front or make contacts of a relay are closed when the relay is energized and picked up. The contacts are open when the relay is deenergized and dropped out. Back or break contacts of a relay are closed when the relay is deenergized and dropped out. The back or break contacts are open when the relay is energized and picked up. The relays and switches are illustrated in their deenergized and dropped out conditions.

Each set of contacts of a relay or switch is designated by the reference characters employed for the relay or switch followed by a suitable numeral specific to the set of contacts. For example, the reference characters U1 and U3 designate the first and third sets of contacts respectively associated with the up switch U of the elevator car A.

In order to further facilitate the presentation of the invention, certain apparatus specific to car A and certain

apparatus common to all of the elevator cars are set forth as follows:

APPARATUS FOR CAR A

- 5 E—Inductor slowdown relay
- F—Inductor stopping relay
- V—Speed relay
- U—Up switch
- M—Running relay
- 10 D—Down switch
- G—Holding relay
- W—Up preference relay
- X—Down preference relay
- 70T—Non-interference relay
- 15 DR—Door relay
- HC—High car call reversal relay
- 1CR to 6CR—Car call registering relays
- T—Car call stopping relay
- 78U—Call-above relay
- 20 S—Floor call stopping relay
- 78—Call relay

APPARATUS COMMON TO ALL CARS

- 1UR to 5UR—Up floor call registering relays
- 25 2DR to 6DR—Down floor call registering relays
- HCM—Bank high call reversal relay
- TA—Timing relay
- PF—Power-fail relay
- DP—Down-peak relay
- 30 UPK—Up-peak relay
- Q—Quota relay
- UA—Stop-ratio relay
- RE—Reset relay

Figure 1

Fig. 1 shows the elevator cars A and B and certain control circuits associated therewith. The elevator car A (illustrated in the left column) will be assumed to be stopped at the second floor of the structure whereas the elevator car B (illustrated in the right column) will be assumed to be stopped at the fifth floor of the structure. With these exceptions, the circuits and mechanisms associated with the two elevator cars are similar and will be understood by reference to those associated with the elevator car A.

The elevator car A is connected by a rope or cable 10 to a counterweight 11. The rope 10 passes over a sheave 12, which is secured to a shaft 13 for rotation therewith. The shaft 13 is rotated by a motor 14 which may be of any conventional type. For present purposes it will be assumed that the motor 14 is a direct current motor having its armature 14A secured to the shaft 13 and having a field winding 14F which is permanently connected across two direction current buses L1 and L2 which supply direct current energy for the control circuits.

The elevator car A has therein a plurality of normally-open car-call push buttons 1c to 6c which are actuated for the purpose of registering calls respectively for the first to sixth floors as desired by passengers entering the elevator car.

To permit registration of calls for service by prespective passengers located at the various floors served by the elevator cars, push button stations are located at such floors. Such a station is shown in Fig. 1 for the third floor. It includes a normally-open up floor call push

button 3U which is pressed by a prospective passenger desiring elevator service in the up direction. A similar push button is located at each floor from which service in the up direction may be desired. The station also includes a normally-open push button 3D which is pressed

by a prospective passenger desiring elevator service in the down direction. A similar push button is located at each floor from which elevator service in the down direction may be desired. The numeral of the reference characters (as 3D or 3U) indicates the floor at which the push button is located.

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The elevator car A also has mounted thereon a slowdown inductor relay E and a stopping inductor F which may be of conventional construction. The slowdown relay E has two sets of break contacts E1 and E2 associated therewith. The relay has a normally incomplete magnetic circuit and energization of the winding of the relay alone does not affect the associated contacts. However, if the slowdown relay E reaches an inductor plate UEP located in the hoistway of the elevator car while the winding of the relay is energized, the contacts E1 open. In Fig. 1 the inductor plate UEP is assumed to be mounted in the hoistway to be reached by the slowdown relay E as the elevator car A nears the third floor. If the elevator car A is to stop at the third floor, the winding of the relay E is energized and when the relay reaches the inductor plate UEP for the third floor, the contacts E1 open to initiate a slowdown operation for the elevator car. It will be understood that a similar inductor plate is similarly associated with each of the floors at which the elevator car A may stop during up travel thereof.

During down travel of the elevator car A, the inductor relay E cooperates with down inductor plates DEP to initiate a slowdown of the elevator car as it approaches a floor at which the elevator car is intended to stop. For example, if the elevator car is to stop during down travel at the third floor, the winding of the inductor relay E is energized as the elevator car nears the third floor. When the inductor relay reaches the down inductor plate DEP for the third floor, the contacts E2 open to initiate a slowdown operation of the elevator car. It will be understood that a similar inductor plate DEP is provided for each of the floors at which the elevator car A is to stop during down travel thereof.

The stopping relay F similarly cooperates with inductor plates UFP and DFP for the purpose of bringing the elevator car to a stop as it reaches a floor at which it is to stop. Thus, if the elevator car A during up travel is to stop at the third floor, the winding of the stopping relay F is energized and as the inductor relay of stopping relay F reaches the stopping inductor plate UFP for the third floor, the contacts F1 open. These contacts in opening result in stopping of the elevator car at the third floor. A similar inductor plate is provided at each of the floors for which the elevator car A is to stop during up travel thereof.

If the elevator car A is to stop at the third floor during down travel thereof the winding of the stopping relay is energized and as the relay reaches the inductor plate DFP for the third floor, the contacts F2 open to produce a stopping operation of the elevator car at the third floor. At the same time, make contacts F3 close for a purpose pointed out below. It will be understood that a similar inductor plate is provided for each of the floors at which the elevator car A is to stop during down travel thereof.

When the elevator car is loaded to capacity a normally-open load switch LW is operated to open its break contacts LW1 and close its make contacts LW2.

Because of the large number of control circuits required, it is conventional practice to provide each elevator car with a floor selector 16. This selector includes a plurality of rows of contact segments mounted on the insulating panel 16A. Only two rows of contact segments a1 to a5, d1 to d5 are illustrated in Fig. 1. These contact segments are successively engaged during travel of the elevator car respectively by brushes aa and dd for the purpose of controlling the energizations of certain circuits. For example, if the elevator car A during down travel is to stop at the third floor in response to a car call, the brush aa engages the contact a3 shortly before the elevator car A reaches the third floor, to initiate a stopping operation thereof.

The brushes aa and dd are mounted on a brush carriage 16C which is mounted for movement in accordance with movement of the elevator car, but at a greatly reduced rate. In the embodiment of Fig. 1, it is assumed that the

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carriage 16C has threaded engagement with a screw 16S which is coupled to the shaft 13 through suitable gearing for rotation in accordance with movement of the elevator A. Consequently, as the elevator car A moves, the brushes mounted on the carriage 16C permit the energization of appropriate circuits at various points of travel of the elevator car.

Although the driving motor 14 may be energized in various ways, it will be assumed that the control of this motor is of the type commonly referred to as a variable voltage control. In such a control, a direct current generator 17 has its armature 17A connected in a loop with the armature 14A of the motor. A series field winding 17S for the generator also may be included in this loop. The generator has a main field winding 17F which is connected for energization from the buses L1 and L2 through a reversing switch. This reversing switch includes contacts U2 and U3 of an up switch. When these contacts are closed, the field winding is energized with proper polarity for up travel of the elevator car. On the other hand, when contacts D2 and D3 of a down switch are closed, the field winding is energized with proper polarity for down travel of the elevator car. The energization of the field windings is completed through a resistor R1 for slow speed operation of the elevator car or through make contacts V1 of a speed relay for full speed operation of the elevator car. If a direct-current exciter generator is mounted on the shaft 13, the terminals of the generator may be connected to the buses L1 and L2 for the purpose of supplying direct-current energy thereto.

The elevator car A is provided with a conventional spring-applied electromagnetically-released brake. This brake includes a brake drum 18D which is secured to the shaft 13 for rotation therewith. A brake shoe 18C normally is biased against the brake drum by means of a spring (not shown). The brake is released upon energization of a brake coil 18B which cooperates with a magnetic armature 18A secured to the shoe 18C. The coil 18B is connected to the buses L1 and L2 for energization either through make contacts U1 or through make contacts D1 of the up switch U or the down switch D.

The speed relay V is connected for energization from the buses L1 and L2 through either of two paths. One of these paths includes make contacts U4 of the up switch, a limit switch 19 and the break contacts E1 of the slowdown relay. The limit switch 19 is a cam-operated normally-closed switch which is opened as the elevator car nears its upper limit of travel.

The remaining path of energization comprises the make contacts D4 of the down switch, a limit switch 20 and the break contact E2 of the slowdown relay. The limit switch 20 may be cam operated. It is normally closed and is opened as the elevator car A nears its lower limit of travel.

As long as the elevator car A is running, the running relay M is energized. This relay can be energized only as long as the make contacts DR1 of a door relay DR are closed. These contacts are closed only as long as all of the hoistway doors and car doors for the car A are closed. Such safety provisions are well known in the art.

The running relay M initially can be energized only if the break contacts 78—1 are closed to indicate that a call for service has been registered and if the break contacts 70T1 are closed to indicate that sufficient time has elapsed since the last stop of elevator car A to permit discharge or entry of passengers. If operation of the elevator cars in the absence of a call for service is desired, the contacts 78—1 may be shunted by a manual switch 34.

Assuming that the foregoing contacts 70T1 and 78—1 associated with the running relay M are closed, the relay may be energized initially through either of two paths. One of these paths is as follows:

L1, 78—1, 70T1, W1, F1, 21, U, M, DR1, L2

Since the up switch U is energized through this path, it follows that the elevator car will be conditioned for up travel. The limit switch 21 is a normally-closed mechanically-operated switch which is opened as the elevator car A nears its upper limit of travel. When energized, the up switch U closes its make contacts U5 to establish a holding circuit around the contacts 70T1, 78—1 and W1.

The second path for initially energizing the running relay M may be traced as follows:

L1, 78—1, 70T1, X1, F2, 22, D, M, DR1, L2

Since the down switch D now is energized, it follows that the elevator car A is conditioned for down travel. The limit switch 22 is a mechanically-operated normally-closed switch which is opened as the elevator car A nears its lower limit of travel. When it picks up, the down switch D closes its make contacts D5 to establish a holding circuit around the contacts 70T1, 78—1 and X1.

The slowdown relay E, the inductor relay F, and a holding relay G are energized in parallel from the buses L1 and L2 through make contacts M1 of the running relay M. To complete an initial energizing circuit for these relays E, F and G, one of three conditions must be present. First, the make contacts T1 are closed to indicate that a car call is registered for a floor which the elevator car A is approaching. Second, the contacts 78U1 are closed to indicate that the elevator car A is approaching a landing or floor at which it is to reverse. Third, the make contacts S1 are closed to indicate that the elevator car A is conditioned to stop at a floor in answer to a registered floor call for such floor.

When the holding relay G is energized, it closes its make contacts G1 to establish with the make contact M1 a holding circuit for the inductor relays E and F.

The direction of travel of the elevator car A is determined initially by an up preference relay W and a down preference relay X. For the up preference relay W to be energized, the break contacts D6 must be closed (i. e. the down switch D is deenergized). The break contacts X2 must be closed (i. e. the down preference relay X is deenergized). The limit switch 23 also must be closed. This switch is normally closed and is opened as the elevator car A reaches its upper limit of travel, in this case, the sixth floor.

Energization of the up preference relay W also requires closure of at least one of two sets of contacts. These include the break contacts 78U2 which are closed when the elevator car A is not conditioned to reverse at an intermediate floor or landing. Make contacts M2 are closed as long as the elevator car A is running.

The down preference relay X is energized if the break contacts U6 are closed (i. e. the up switch U is deenergized), the break contacts W2 are closed (i. e. the up preference relay is deenergized) and the limit switch 24 is closed. This limit switch is normally closed and is opened as the elevator car A reaches the lower terminal floor.

As long as the elevator car A is running, the make contacts M3 are closed to energize the non-interference relay 70T. When the elevator car A stops, the contacts M3 open to deenergize the relay. However, the relay 70T has a substantial delay in drop out. This delay may be provided in any suitable manner as by connecting a resistor R2 across the relay coil through a switch SW1. The time delay in drop out is selected to be sufficient to permit discharge of passengers from the elevator car A or entry of passengers into the elevator car A after each stop. If an adjustable time delay is desired, the switch SW1 may be operated to connect a substitute adjustable resistor R2a across the relay. The adjustment of this resistor will be discussed below.

It will be recalled that the door relay DR is connected across the buses L1 and L2 through contacts operated by each door associated with the elevator car A. If any of the doors are open, the contacts associated therewith are also open to prevent energization of the door relay DR.

Figure 2

Figure 2 shows the floor call registration circuits for the elevator cars. The upper part of the figure illustrates up floor call registering circuits. These circuits are operated by normally-open push buttons 1U to 5U which are located respectively at the first to fifth floors. The push buttons have associated therewith up floor call registering relays 1UR to 5UR and cancelling coils 1URN to 5URN in a manner which will be clear from the discussion of the call registering relays and cancelling coils associated with the car call push buttons.

The up floor call registering relays 1UR to 5UR and their cancelling coils are associated with contact segments for each of the elevator cars in the bank. For example, a row of contact segments e1 to e5 is provided for the elevator car A and cooperate with a brush ee. A brush ff cooperates with a row of contact segments f1 to f5, for the elevator car A.

Let it be assumed that while the elevator car A is traveling up a prospective passenger waiting on the fifth floor presses the up floor call push button 5U to energize the up floor call registering relay 5UR. This relay closes its make contact 5UR1 to establish a holding circuit around the push button.

Since the elevator car is assumed to be traveling up, the make contacts W5 of the up preference relay W are closed. It will be assumed further that the break contacts DP1 of the down-peak relay DP are closed. As the elevator car A nears the fifth floor, the brush ee engages the contact segment e5 to complete the following circuit:

L11, 5UR1, e5, ee, W5, DP1, LW1, S, L21

The buses L11 and L22 represent a source of direct current. The energization of the floor call stopping relay S initiates the stop at the fifth floor. In response to movement of the car towards the fifth floor, the brush ff engages its contact segment f5. As the elevator car stops, the make contacts F3 close to complete the following cancelling circuit:

L11, 5UR1, 5URN, f5, ff, W6, F3, L21

This resets the up floor car registering relay 5UR. (If greater lead in cancelling is desired the contacts F3 could be replaced by make contacts of the relay E.) As the elevator car A comes to a stop, the brush ee preferably passes slightly above the contact segment e5. However, the brush ff remains in engagement with the contact segment f5 as long as the elevator car A remains at the fifth floor and closure of contacts M6 maintains the cancelling circuit. By inspection of Fig. 2, it will be observed that the contact segment e5 is connected to the corresponding contact segments for the other elevator cars in the bank (such as contact segment Be5 for the elevator car B). Similarly, the contact segment f5 is connected to corresponding contact segments (such as the contact segment Bf5) for the remaining cars of the bank. Consequently, operation of the push button 5U is effective to stop the first up traveling elevator car which reaches the fifth floor and which is conditioned to accept the call at the fifth floor.

During a down-peak period, break contacts DP1 and DP4 are open to prevent the elevator cars from answering up-floor calls. Such calls are canceled by any down traveling elevator car which stops at the floors. For example, make contacts DP2 and M7 shunt the make contacts W6 to permit cancellation of an up floor call by any elevator car which stops at the appropriate floor regardless of the direction of travel of the elevator car. If one of the elevator cars, such as the elevator car B, is to answer up-floor calls during the down-peak period, the switch B26 may be closed and the switches 27 and B27 may be opened. It should be noted that if an up-floor call is canceled by an elevator car set for down travel, the call may be reregistered while the elevator car is at the floor of the canceled call. For example, contacts

W6 and M7 for the elevator car A are open under such conditions to prevent cancellation of the reregistered calls. Break contacts M6 are designed to open slightly before make contacts M7 close.

The up-floor call registering circuits for all of the intermediate floors are similar. Consequently, such circuits are illustrated in Fig. 2 only for the second and fifth floors.

Since the elevator car A does not stop during up travel at the lower terminal or first floor, a contact segment in the *e* row is not required. With this exception, the call registering circuits for the first floor are similar to those described for the fifth floor.

The lower part of Fig. 2 illustrates the down floor call registering circuit for the elevator cars. Down floor calls are registered by operation of normally-open push buttons 2D to 6D which have associated therewith down-floor call registering relays 2DR to 6DR and canceling coils 2DRN to 6DRN. Each push button cooperates with its call registering relay and its canceling coil in the manner discussed with reference to the up-floor call push buttons.

For the elevator car A, a row of contact segments *g2* to *g5* cooperates with a brush *gg* and a row of contact segments *h2* to *h6* cooperates with a brush *hh*. Let it be assumed that the elevator car A while traveling down is approaching the fifth floor at which a down-floor call has been registered by operation of the push button 5D. Such operation results in energization of the down-floor call registering relay 5DR to close the make contacts 5DR1. Since the elevator car is traveling down, the make contacts X6 and X7 are closed.

As the elevator car A nears the fifth floor, the brush *gg* engages the contact segment *g5* to complete the following circuit:

L11, 5DR1, *g5*, *gg*, X6, LW1, S, L21

The energization of the floor call stop relay S initiates a stopping operation of the elevator car A at the fifth floor. As the elevator car continues its approach, a brush *hh* engages the contact segment *h5*. The stopping of the elevator car A results in closure of the make contacts F3 to complete the following cancelling circuit:

L11, 5DR1, 5DRN, *h5*, *hh*, X7, F3, L21

The energization of the cancelling coil resets the call registering relay 5DR. Preferably, as the elevator car A comes to a stop, the brush *gg* passes slightly below the associated contact segment *g5*, but the brush *hh* remains in engagement with the associated contact segment *h5*. Inasmuch as break contacts M6 are closed while the elevator car is stopped, the down-floor call cannot be registered until the elevator car starts away from the floor.

The contact segment *g5* is connected to corresponding contact segments (such as the contact segment *Bg5*) of the remaining cars. Similarly, the contact segment *h5* is connected to the corresponding contact segments (such as the contact segment *Bh5*) for the remaining cars. Consequently, the first elevator car to approach the fifth floor while traveling down will answer a call registered by the call registering relay 5DR.

The down-floor call registering circuits for all of the intermediate floors are similar and may be traced readily in Fig. 2. The down-floor call registering relays for the upper terminal or sixth floor also may be similar. However, since the elevator car A does not stop at the sixth floor during down travel, the contact segment in the *g* row may be omitted for the sixth floor.

It is the practice in certain elevator systems to employ different sources of electrical energy for the floor call circuits and for the remainder of the system. For example, the buses L1, L2 may be energized from an exciter generator mounted on the shaft 13 of Fig. 1, whereas the buses L11, L21 of Fig. 2 may be energized through a rectifier from the alternating-current supply for the build-

ing housing the elevator system, and such a power supply is represented by the rectangle 28.

A failure of the floor call circuits, such as a failure of the rectifier, is most undesirable, particularly in systems designed for operation without attendants. In accordance with the invention, such a failure is accompanied by dropout of the power-fail relay PF. As explained below in greater detail, the dropout of the relay PF assigns each of the elevator cars to stop at specified floors. For example, the elevator car A may be assigned to stop at floors 1, 2, 3, 6 and the elevator car B may be assigned to stop at floors 1, 4, 5 and 6 to provide continuous service for intending passengers waiting for service at the floors.

Figure 3

Figure 3 shows the call registration circuits for the elevator cars. Car call registration circuits are illustrated for the elevator cars A and B in the upper part of Fig. 3. Fig. 3 also shows the call-above relay 78U, the call relay 78, the high car call reversal relay Hc and the down-peak relay DP.

It will be recalled that the elevator car A is provided with a plurality of push buttons 1c to 6c for the purpose of registering car calls. Each of these push buttons has associated therewith a car call registering relay 1CR to 6CR respectively. Inasmuch as the relays and circuits for the intermediate floors are similar, they are not shown for the third and fourth floors. The push buttons and call registration relays cooperate with four rows of contact segments located on the floor selector for the elevator car A. The contact segments *a1* to *a5* cooperate with the brush *aa* for the purpose of initiating a stopping operation of the elevator car during down travel of the elevator car respectively at the first to fifth floors. The contact segments *b2* to *b6* cooperate with a brush *bb* for the purpose of initiating a stopping operation of the elevator car during up travel of the elevator car respectively at the second to sixth floors. A brush *cc* cooperates with a row of contact segments *c1* to *c6* for the purpose of canceling registered car calls as they are answered during down travel and up travel of the elevator car. It will be understood that for each contact segment, the numeral of the reference character designates the floor with which the contact segment is associated. Thus, the reference character *a1* designates the contact segment for the first floor in the *a* row.

By reference to Fig. 3, it will be observed that when the car call push button 5c is pressed, the car call registering relay 5CR is connected therethrough across the buses L1 and L2. This relay closes its make contacts 5CR1 to establish a holding circuit around the push button. The contact segments *a5* and *b5* are connected through this set of contacts to the bus L1.

If the elevator car A is set for down travel, the make contacts X4 are closed. And if the elevator car is approaching the fifth floor, the make contacts M4 of the running relay also are closed. Consequently, as the elevator car nears the fifth floor, the brush *aa* engages the contact segment *a5* to complete the following circuit for the car call stopping relay T:

L1, 5CR1, *a5*, *aa*, X4, T, M4, L2

The energization of the relay T initiates a stopping operation of the elevator car A at the fifth floor.

As the elevator car A continues its approach toward the fifth floor, the contact segment *c5* is engaged by the brush *cc*. As the elevator car comes to a stop, the break contacts M5 of the running relay close to complete the following canceling circuit:

L1, 5CR1, 5CRN, *c5*, *cc*, M5, L2

The operating coil of the registering relay 5CR and the canceling coil 5CRN are wound in opposition on a common core. Consequently, energization of the canceling coil 5CRN cancels the effect of the operating coil and resets the registering relay 5CR. Preferably, as the

elevator car stops at the fifth floor, the brush *aa* passes slightly below the associated contact segment *a5*, however, the brush *cc* remains in engagement with the associated contact segment *c5* as long as the elevator car A remains at the floor.

Next it will be assumed that the same call is registered for the fifth floor as the elevator car A travels up towards the fifth floor. Under these circumstances, the make contact W3 of the up preference relay are closed. As the elevator car A nears the fifth floor, the brush *bb* engages the contact segment *b5* to complete the following circuit:

L1, 5CR1, *b5*, *bb*, W3, T, M4, L2

The energization of the car call stopping relay T results in the initiation of a stopping operation for the fifth floor. As the elevator car A continues to approach the fifth floor, the brush *cc* engages the contact segment *c5* to complete the following circuit:

L, 5CR1, 5CRN, *c5*, *cc*, W4, M5, L2

The energization of the canceling coil 5CRN resets the call registering relay 5CR. During the stopping operation, the brush *bb* preferably passes slightly above the associated contact segment *b5*, whereas the brush *cc* remains in engagement with the associated contact segment *c5* as long as the elevator car A is at the fifth floor.

The car call registering circuits for all of the intermediate floors are similar to those described for the fifth floor. For this reason and to conserve space, the intermediate floor circuits are illustrated in Fig. 3 only for the second and fifth floors.

The car call registering circuits for the upper terminal (sixth floor) may be similar to those employed for the intermediate floors. However, since the elevator car A stops at the sixth floor only during up travel, a contact segment for the sixth floor need not be provided in the *a* row. By reference to Fig. 2*a*, it will be noted that only contact segments *b6* and *c6* are provided for the sixth floor. Contact *b6*, however, is connected directly to line L1 as the car always stops at the sixth floor if it reaches such a floor.

The car call registering circuits for the lower terminal or first floor may be similar to those provided for the intermediate floors. Since the elevator car stops at the first floor only during down travel, a contact segment for the first floor need not be provided in the *b* row. For this reason, in the car call registering circuits only contact segment *a1* and *c1* are illustrated for the first floor. By reference to Fig. 2*a*, it will be noted that contact segment *a1* is connected directly to line L1. This provides for a permanent stop at the first floor.

Under certain conditions, it may be advisable to assign each of the elevator cars to stop at certain floors. For example, if the floor or corridor call circuits become ineffective, as because of power failure, the power-fail relay PF closes its break contacts PF3 to establish with the manual switch 25 an energizing circuit for the car call registering relay 2CR. This assigns the elevator car A to stop at the second floor. Contacts PF6 close to provide a circuit for the energization of relay 6CR which assigns the car to run to the sixth floor. If stops only during down travel are desired in response to closure of the contacts PF3, the switch 25 may be opened. Contacts PF3, segment *d6*, brush *dd*, and contacts X3 now are connected in series across the button 2*c* when the car is at the sixth floor, and assign the elevator car A to stop at the second floor during down travel. In a similar manner, closure of contacts PF1 and PF2 assign the elevator car B to stop at the sixth and fifth floors.

In Fig. 3*a*, call circuit 30 is provided which has two functions. This circuit energizes a call relay 78 when no call is registered in the elevator by the car call push buttons for the elevator car A or by any floor call push button. In addition, the call circuit 30 energizes the

call above relay 78U as the elevator car during up travel nears an intermediate floor at which the elevator car is to reverse.

The call-above circuit 30 includes break contacts for all of the floor call registering relays and for all of the elevator A car call registering relays arranged in the order of the floors. This circuit may be traced as follows:

L1, 6CR2, 6DR2, 5UR2, 5CR2, 5DR2, 4UR2, 4CR2, 4DR2, 3UR2, 3CR2, 3DR2, 2UR2, 2DR2, 2CR2, 1CR2, 1UR2, 78, L2

By inspection of this circuit, it will be observed that as long as a call is registered by the car call push buttons for the elevator car A or by the floor call push button the relay 78 is deenergized.

The call circuit 30 has associated therewith a row of contact segments *k1* to *k5* which are engaged successively by the brush *kk* as the elevator car A moves. The contact segments are so located relative to the call circuit 30 that each contact segment is placed below all break contacts of the call circuit which require travel of the elevator car A above such contact segment. Thus, the contact segment *k5* is connected to the call circuit between the contacts 5UR2 and 5CR2. The contact segment *k4* is connected between the contacts 4UR2 and 4CR2. The location of the remaining contact segments similarly may be ascertained by reference to Fig. 3. It will be noted that the relay 78U is connected between the brush *kk* and the bus L2 through make contacts W7 of the up preference relay W, and through one of three paths. These three paths are represented by make contacts DP, contacts UPK1 and a manual switch 31.

In certain cases, it is desirable to prevent registered calls from affecting the call circuit 30. For example, it may be desirable under some conditions to prevent registered floor calls from affecting the operation of the relay 78U and 78. To this end, make contacts DP9 to DP16 when their associated manual switches are closed shunt the contacts of the up-floor call registering relays for floors above the second floor. As a further example, make contacts of the high car-call reversal relay HC are provided for the purpose of shunting the break contacts of the up- and down-floor call relays. When the relay HC is energized, the contacts HC1 to HC5 close to shunt respectively the contacts of the floor-call registering relays for floors above the first floor.

The high car-call reversal relay HC is energized if the elevator car A is set for up travel (contacts W8 close), the elevator car is loaded (contacts LW2 are closed) and the system is on down-peak operation (contacts DP7 are closed). If the manual switch 32 is closed, pickup of the relay completes a self-holding circuit through the contacts W8 and HC6.

The down-peak relay DP is energized if the manual switch 33 is closed or if make contacts Q1 of the quota relay Q are closed.

Figure 4

As shown in Fig. 4, the quota relay Q is connected for energization between buses L1 and L2 through a parallel circuit having a separate arm for each of the floors above the lower terminal floor which is served by the elevator cars. In the present case, five arms are employed. Each of the arms includes make contacts of a separate one of the down-floor call registering relays and a resistor. For example, the arm corresponding to the second floor includes the make contacts 2DR4 and a resistor 2R3. The resistors and relays are so related that the relay Q picks up only when energized through at least a predetermined number of the resistors. For present purposes, it will be assumed that the quota relay picks up only when energized through at least three of the arms of the parallel circuit.

The remainder of Fig. 4 is directed to circuits for measuring the ratio of stops made by the elevator cars while set for travel in the up direction to all stops made

by the elevator cars and to circuits for controlling the up-peak relay UPK.

If the ratio of the number of stops made by the elevator cars while set for travel in the up direction of the total number of stops made by the elevator cars exceeds a predetermined value, the stop ratio relay UA is energized and picks up. It will be noted that the relay UA is connected in series with the secondary winding of a transformer TR across the cathode TUK and anode TUA electrodes of an electronic tube TU. The tube TU also has a control electrode TUC. The tube TU may be of the cold cathode type or of the high-vacuum hot-electrode type. However, for present purposes it will be assumed that the tube TU is a gaseous discharge tube of the hot cathode type commonly known as a thyratron. The primary winding of the transformer TR may be energized from any suitable alternating-current source of energy.

The anode current flowing through the tube TU is controlled from a bridge circuit which includes resistors R4, R5, R6 and R7. The resistors R4 and R6 are equal fixed resistors whereas the resistors R5 and R7 are adjustable resistors. The value of the resistance in the resistor R5 is dependent on the number of stops made by the elevator cars while set for up travel. The value of the resistance in the resistor R7 is dependent on the total number of stops made by the elevator cars. It will be noted that the resistor R4 and the effective value of the resistor R5 are connected in series across the buses L1 and L2. The resistor R6 and the effective value of the resistor R7 also are connected across the buses L1 and L2. The control electrode TUC of the tube TU is connected to a point intermediate the resistors R4 and R5, whereas the cathode electrode TUK is connected to a point intermediate the resistors R6 and R7.

In order to explain the operation of the bridge circuit, let it be assumed that the tube TU fires when the control electrode TUC becomes positive relative to the cathode electrode TUK. It will be assumed further that at the start of a measuring period the effective values of the resistors R5 and R7 are equal, that each stop of an elevator car increases the effective value of the resistor R7 by 10,000 ohms, and that each stop of an elevator car while set for travel in the up direction increases the effective value of the resistor R5 by 20,000 ohms. The bus L1 is assumed to be a positive bus and the bus L2 is assumed to be a negative bus.

If an elevator car makes a stop while set for travel in the down direction, the value of the resistor R7 is increased by 10,000 ohms. Since this increases the negative bias on the control electrode TUC, the tube TU does not fire. If an elevator car now makes a stop while set for travel in the up direction, an additional 10,000 ohms is added to the effective value of the resistor R7 which now has a total effective value of 20,000 ohms. However, the up stop also increases the effective value of the resistor R5 by 20,000 ohms under the assumed conditions, and the bridge consequently is balanced. Since the control electrode TUC and the cathode electrode TUK are at the same potential relative to each other, the tube TU does not fire under the assumed conditions.

If an elevator car again makes a stop while set for travel in the up direction, the effective value of the resistor R7 becomes 30,000 ohms, whereas the effective value of the resistor R5 becomes 40,000 ohms. Consequently, under the assumed condition, the bridge is unbalanced and a positive bias is applied to the control electrode TUC which results in firing of the tube TU. The relay UA thereupon picks up. Under these assumed conditions, the tube fires when the ratio of the stops made by the elevator cars while set for travel in the up direction to the total stops made by the elevator cars exceeds one half.

If each stop made by an elevator car while set for travel in the up direction were to increase the effective

resistance of the resistor R5 by 30,000 ohms, it follows that the tube TU would fire whenever the ratio of the stops made by the elevator cars while set for travel in the up direction to the total stops made by the elevator cars exceeded one third.

The adjustment of the resistor R7 in accordance with stops made by the elevator cars is controlled by a stepping switch CO which has a semi-circular row of contacts CO1 to CO9 connected to taps on the resistor R7. The contacts are engaged by one of two brushes CO10 and CO11, which are displaced from each other 180° about a shaft CO12. The brushes are connected to the bus L2.

The stepping switch also has a second semi-circular row or bank contacts CO13 to CO23 which are engaged by one of two brushes CO24 and CO25, displaced from each other by 180° about the shaft CO12. The brushes CO24 and CO23 are connected to the bus L1. The contacts CO13 to CO22 are connected to the bus L2 through a reset relay RE and either make contacts TA4 or make contacts RE3.

In order to step the shaft CO12, a ratchet wheel CO26 is secured thereto and a pawl CO27 is positioned to engage the ratchet wheel. This pawl is biased upwardly by means of a spring CO28 to a position wherein the pawl CO27 engages a stop CO29.

The pawl CO27 has a magnetic core CO30 associated with a solenoid CO31. The solenoid is connected for energization across the buses L1 and L2 through a parallel circuit having a separate arm for each of the elevator cars employed in the bank. For purposes of illustration, cars A and B have been illustrated. Consequently, two arms are illustrated in Fig. 4. One of the arms includes make contacts M8 and break contacts M9 of the running relay for the elevator car A. The other arm includes the corresponding make contacts BM8 and brake contacts BM9 for the running relay associated with the elevator car B. When the elevator car A is running, the make contacts M8 are closed and the break contacts M9 are opened. As the elevator stops at a floor, the make contacts M8 open and the break contacts M9 close. However, the break contacts M9 are designed to close slightly before the make contacts M8 open. Consequently, for each stopping of the elevator car A, a pulse of current is supplied to the solenoid CO31 to attract the associated magnetic core CO30 across the bias of the spring CO28. Upon completion of the pulse, the spring CO28 urges the pawl CO27 against the stop CO29. During such movement, the pawl advances the shaft CO12 one step. Each step of the shaft CO12 corresponds to the angular distance between successive contacts CO1 to CO9 and CO13 to CO23.

For resetting purposes, the solenoid CO31 is connected across the buses L1 and L2 through make contacts RE5 of the reset relay and self-stepping contacts CO32 of the stepping switch. By inspection of Fig. 4, it will be observed that the contacts CO32 are biased to their closed conditions by the spring CO28 and opened when the pawl CO27 is moved down by the solenoid CO31. Consequently, as long as the contacts RE5 remain closed, the stepping switch steps rapidly in a clockwise direction as viewed in Fig. 4. Such stepping switches are well known in the art. It will be noted that the contact CO23 is connected to the bus L1 through the self-stepping contacts CO32.

The stepping switch COU associated with the register R5 is identical to the stepping switch CO with the exception that make contacts of the up-preference relays are added to make the stepping switch COU respond only to stops of the elevator cars which are set for travel in the up direction. Components of the stepping switch COU which are similar to those of the stepping switch CO are identified by similar reference characters except that the prefix COU rather than CO is employed.

As clearly shown in Fig. 4, the solenoid COU31 is

connected across the buses L1 and L2 through a parallel circuit having a separate arm for each of the elevator cars. Thus, for the elevator car A the solenoid COU31 is connected across the buses L1—L2 through make contacts M10, break contacts M11 and make contacts W9. The contacts M10 and M11 operate in the same manner as the contacts M8 and M9 associated with the stepping switch CO. However, because of the presence of the make contacts W9 and similar contacts BW9 for the elevator car B, the solenoid COU31 is energized once for each stop of an elevator car while set for travel in the up direction.

It will be noted that the contacts COU1, COU2 and COU3 are connected directly to each other and have no resistance therebetween. This is for the purpose of preventing operation of the relay UA unless at least three stops have been made of elevator cars set for travel in the up direction. The number of such stops required before the relay UA is permitted to operate may be controlled by the number of contacts which are connected directly to each other. If desired, the first resistance step (that between the contacts COU3 and COU4) may be made slightly larger than the remaining resistance steps to assure the desired operation.

The stepping switches are reset at predetermined intervals. Such intervals are measured by an electronic tube TB which has its anode electrode TBA and its cathode electrode TBK connected across the buses L1 and L2 through a timing relay TA and break contacts RE1 of the reset relay. The break contacts RE1 also are connected in series with a resistor R8 and a capacitor CA across the buses L1 and L2. The tube TB has a control electrode TBC which is connected to a point between the resistor R8 and the capacitor CA. A resistor R9 is connected through make contacts RE2 across the capacitor CA. The tube TB may be of any desired type such as a hot cathode, high vacuum tube or a thyratron. For present purposes, it will be assumed that the tube is a cold cathode gaseous discharge tube.

When the break contacts RE1 close, the capacitor CA starts to charge. After the lapse of a predetermined interval, the charge across the capacitor CA becomes sufficient to initiate a discharge in the tube TB. When the tube fires, the resultant anode current results in pickup of the timing relay TA, and this relay closes its make contacts to establish with the break contacts RE1 a self-holding circuit. When the reset relay RE picks up, it opens its break contacts RE1 to deenergize the timing relay TA and closes its make contacts RE2 to establish a discharge circuit for the capacitor CA.

Closure of the make contacts TA2 of the timing relay prepares the up-peak relay UPK for energization. Such energization can be effected only if the break contacts Q2 are closed to indicate that the down floor calls registered in the system are below a predetermined number. In addition, make contacts UA1 of the stop ratio relay must be closed to indicate that the ratio of the up stops to the total stops is above a predetermined value. When the up-peak relay picks up, it closes its make contacts UPK2 to complete with the break contacts TA3 a holding circuit for the up-peak relay. The break contacts TA3 are designed to close as the relay TA drops out slightly before the make contacts TA2 open.

It is believed desirable at this point to describe a cycle of operations of the circuits shown in Fig. 4. Let it be assumed that the components are in the conditions illustrated in Fig. 4, and that the break contacts RE1 have just reclosed to start the charging of the capacitor CA. It will be assumed further that the resistors R5 and R7 are proportioned to pick up the relay UA when the ratio of up stops to total stops is three-fourths or more.

As the capacitor CA charges, it will be assumed that the elevator car A successively stops while set for down travel at the third floor and that the elevator car B suc-

cessively stops for up travel at the second, fourth and fifth floors.

As the elevator car A stops at the third floor, the make contacts M8 of the running relay close and the break contacts M9 open. However, it will be recalled that there is a brief time during which both of these sets of contacts are closed and the solenoid CO31 consequently is briefly energized. In response to such energization the solenoid attracts the magnetic core CO31 against the bias of the spring CO28. Since the solenoid CO31 immediately is deenergized, the spring CO28 moves the pawl CO27 upwardly to advance the shaft CO12 and the associated brushes through one step and the brushes respectively engage the contacts CO2 and CO14. During the stepping operation, the self-stepping contacts CO32 open and reclose without affecting the operation of the system.

It will be assumed that the advance of the brush CO10 increases the effective value of the resistor R7 to 10,000 ohms. This places a negative bias on the tube TU and the stop ratio relay UA consequently remains dropped out.

During the foregoing operation of the stepping switch CO, the make contacts M10 close and the break contacts M11 open. However, since the elevator car A is set for travel in the down direction, the make contacts W9 are open and the solenoid COU31 remains deenergized.

If the elevator car B stops successfully at the second, fourth and fifth floors, the make contacts BM8 and the break contacts BM9 supply three successive pulses of energy to the solenoid CO31 for the purpose of advancing the stepping switch CO three additional steps. The brush CO10 now engages the contact CO5, and it will be assumed that each step introduces 10,000 ohms of the resistor R7 to give a total effective value of 40,000 ohms.

Inasmuch as the elevator car B is set for up travel, the make contacts BW9 of its up-preference relay are closed. Consequently, if the elevator car A stops successively at the second, fourth and fifth floors, the make contacts BM10 and the break contacts BM11 coact to supply three successive pulses of current to the solenoid COU31. This advances the shaft COU12 three steps to bring the brush COU10 into engagement with the contact segment COU4.

It will be assumed that the amount of resistance between the contacts COU3 and COU4 is 41,000 ohms. Since the effective value of the resistor R5 is 41,000 ohms as compared to an effective value of 40,000 ohms for the resistor R7, the bridge is unbalanced in a direction supplying a positive pulse to the control electrode of the tube TU and this tube consequently discharges to pick up the relay UA. The relay UA is preferably a somewhat sluggish relay to prevent response of the relay to brief stepping operations of the stepping switches.

It will be assumed next that at this stage the capacitor CA has charged to a value sufficient to fire the tube TB and pick up the relay TA. The relay TA closes its make contacts TA1 to establish with the break contacts RE1 a self-holding circuit. In addition, make contacts TA2 close. Since less than three down floor calls are assumed to be registered, the break contacts Q2 also are closed and since the make contacts UA1 are closed, the up-peak relay UPK is energized. This relay closes its make contacts UPK2. However, since the break contacts TA3 are open, a self-holding circuit for the up-peak relay is not yet established.

The timing relay TA also closes its make contacts TA4 to establish with the stepping switches an energizing circuit for the reset relay RE. The reset relay opens its break contacts RE1 to deenergize the timing relay TA. In addition, make contacts RE2 close to establish with the resistor R9 a discharge circuit for the capacitor CA. Closure of make contacts RE3 establishes with the stepping switches a self-holding circuit for the resetting relay. Closure of the make contacts RE5 completes with the self-stepping contacts CO32 a self-stepping circuit for the

solenoid CO31. Consequently, the relay CO rapidly steps in a clockwise direction until the brush CO24 engages the contact CO23 to maintain energization of the solenoid CO31. As the brush CO24 leaves the contact segment CO22, it is no longer effective for completing a self-holding circuit for the relay RE. In a similar manner, closure of the make contacts RE4 establishes a self-stepping circuit for the stepping switch COU and this resets until the brush COU24 leaves the contact COU22. Since the arms CO24 and COU24 have passed respectively the contacts CO22 and COU22, the reset relay RE is now deenergized. The make contact RE5 opens to deenergize the solenoid CO31 and this permits the spring CO28 to advance the shaft CO12 one step to bring the brush CO23 into engagement with the contact segment CO13. In a similar manner the opening of the make contacts RE4 advances the shaft COU12 one step.

It will be recalled that the opening of the break contacts RE1 resulted in dropout of the timing relay TA. This relay closed its break contacts TA3 in advance of opening of the make contacts TA2 in order to establish with the contacts UPK2 a self-holding circuit for the up-peak relay UPK. Opening of the make contacts TA4 had no immediate effect on the operation of the system.

Returning to the effect of the dropout of the reset relay RE, this relay opens its make contacts RE2 to interrupt the discharge circuit for the capacitor CA and closes its break contacts RE1 to start another timing operation.

In the foregoing discussion it is clear that the circuits of Fig. 4 measure a ratio of up stops to total stops of the elevator cars for each interval determined by the timing relay TA, and if the ratio for any interval exceeds a predetermined value and if the down floor calls at the same time are below a predetermined value, the up-peak relay UPK is energized.

OPERATION

In order to assure a full understanding of the invention, certain typical operations of the elevator system now will be considered. First, it will be assumed that the elevator cars are parked at the lower terminal floor and that a passenger enters the elevator car at the lower terminal floor for the purpose of proceeding to the fifth floor.

The doors of the elevator cars may be of the manually-opened spring-closed type or may be of conventional power-operated design. Upon entering the elevator car A, the passenger presses the car call push button 5c (Fig. 3) to energize the associated car call registering relay 5CR. This relay closes its make contacts 5CR1 to establish a holding circuit around the push button. The relay also opens its break contacts 5CR2 (Fig. 3) to deenergize the relays 78U and 78. Inasmuch as the elevator car A is at the lower terminal floor, it will be understood that the up preference relay W is energized and picked up.

Inasmuch as the relay 78 is now dropped out, the contacts 78—1 (Fig. 1) are closed. It will be assumed also that the elevator car A has remained at the lower terminal floor for a time sufficient to result in closure of the break contacts 70T1. Consequently, upon closure of the doors, the door relay DR closes its make contacts DR1 to complete the following circuit:

L1, 78—1, 70T1, W1, F1, 21, U, M, DR1, L2

Upon energization, the up switch U closes its make contacts U1 to release the elevator brake. Contacts U2 and U3 close to energize the generator field winding 17F with proper polarity for up travel of the elevator car. Contacts U4 close to complete the following energizing circuit for the speed relay V:

L1, U4, 19, E1, V, L2

The speed relay closes its make contact V1 to shunt the resistor R1 and conditions the elevator car for full speed operation.

Continuing with the operation of the up switch U, the

energized up switch closes its make contacts U5 to establish a holding circuit around the contacts 70T1, 78—1 and W1. Break contacts U6 open to prevent energization therethrough of the down preference relay X.

The elevator car A now accelerates in the up direction for the purpose of carrying the passenger to the fifth floor.

It will be recalled that the running relay M also was energized. As a result of its energization, the running relay closes its make contacts to prepare the relays G, E and F for subsequent energization. The make contacts M2 close to maintain the energization of the up preference relay despite subsequent opening of the break contacts 78U2. Make contacts M3 close to energize the non-interference relay 70T. The non-interference relay opens its break contacts 70T but such opening has no immediate effect on the operation of the system.

Referring to Fig. 3, the running relay M closes its make contacts M4 and opens its break contacts M5 and M6. Such contact operations have no immediate effect on the operation of the system.

Assume first that the switch 31 (Fig. 3) is closed. As the elevator car nears the fifth floor, the brush *kk* engages the contact segment *k5* which is positioned above the break contacts 5DR2. Consequently, the call-above relay 78U is energized through the circuit:

L1, 6DR2, 6CR2, 5UR2, *k5*, *kk*, W7, 31, 78U, L2

The relay 78U closes its make contacts 78U1 (Fig. 1), and opens its break contacts 78U2. This would initiate a reversal of the elevator car at the fifth floor by a sequence to be discussed below. For present purposes, it will be assumed that the switch 31 and that the relay 78U remains deenergized.

The approach of the elevator car A towards the fifth floor brings the brush *bb* (Fig. 3) into engagement with the contact segment *b5* to energize the car call stopping relay T through the circuit

L1, 5CR1, *b5*, *bb*, W3, T, M4, L2

The car call stopping relay closes its make contacts T (Fig. 1) to energize through the contact M1 the three relays G, E and F in parallel. The relay G closes its make contacts G1 to establish a holding circuit around the contacts T1.

The energization of the inductor slow down and stopping relays E and F prepares these relays for subsequent operation. As the elevator car A nears the fifth floor, the inductor slow down relay E reaches the inductor plate UEP for the fifth floor which completes a magnetic circuit resulting in the opening of the normally-closed contacts E1. Such opening deenergizes the speed relay V. As a result of the deenergization of the speed relay V, make contacts V1 open to introduce the resistor R1 in series with the generator field winding 17F. The resulting decrease in the output of the generator slows the elevator car A to a landing speed.

As the elevator car A slowly approaches the fifth floor, the stopping relay F reaches the inductor plate UFP for the fifth floor. This completes a magnetic circuit which results in opening of the normally-closed contacts F1. In opening, the contacts F1 deenergizes the up switch U and the running relay M.

The up switch U now opens its make contacts U1 to apply the elevator brake. Contacts U2 and U3 open to deenergize the generator field winding and the elevator car now stops accurately at the fifth floor. Opening of the make contacts U4 and U5 and closure of the break contacts U6 have no immediate effect on the operation of the system.

The running relay M opens its make contacts M1 to deenergize the relays G, E and F. The relay G opens its make contacts G1. Opening of the make contacts M2 has no immediate effect on the system operation. Make contacts M3 open to deenergize the noninter-

ference relay 70T. This relay now starts to time out and provides time for passengers to enter or leave the elevator car.

Referring to Fig. 3, it should be noted that as the elevator car A continues its approach toward the fifth floor, the brush *cc* engages the contact segment *c5*. When the running relay drops out to close its break contacts M5, the following canceling circuit is completed:

L1, 5CR1, 5CRN, c5, cc, M5, L2

Consequently, the car call registering relay 5CR is reset. As the car comes to a stop, the brush *bb* passes slightly above the associated contact segment *b5*.

The resetting of the call registering relay 5CR opens the make contacts 5CR1. In addition, the break contacts 5CR2 (Fig. 3) reclose to complete an energizing circuit for the call relay 78.

The call relay 78 as a result of its energization opens its break contacts 78—1 (Fig. 1). Consequently, when the non-interference relay 70T times out and recloses its break contacts 70T1, the up switch U and the running relay M cannot be energized until a call is registered from one of the floors or in the elevator car A to close the contact 78—1.

Next it will be assumed that as the elevator car A was leaving the first floor in the preceding example, a prospective passenger at the second floor registered an up floor call by operation of the up floor call push button 2U (Fig. 2). Such operation energizes the up floor call registering relay 2UR which closes its contact 2UR1 to establish a holding circuit around the push button. In addition, the registering relay opens its break contacts 2UR2 in the call circuit 30 (Fig. 3) and similar contacts, such as the contact 2UR3, in the call circuits for the remaining elevator cars in the bank. Since the registration of the car call for the fifth floor in the elevator car A has deenergized the relays 78U and 78, opening of the contacts 2UR2 has no effect thereon. However, the opening of the contacts may effect the remaining elevator cars of the system. For example, the opening of the break contacts 2UR3 deenergizes the relay 78 for the car B and permits operation of such elevator car.

As the elevator car A nears the second floor, the brush *ee* engages the contact segment *e2* to establish the circuit

L11, 2UR1, e2, ee, W5, DP1, LW1, S, L21

The resultant energization of the floor call stopping relay S results in closure of the make contacts S1 (Fig. 1) to energize the relays G, E and F. These cooperate to stop the elevator car A at the second floor by a sequence which will be clear from the preceding discussion of the stopping of the elevator car at the fifth floor. As the elevator car stops, the engagement of the brush *ff* with the contact segment *f2* and the closure of the break contacts F3 completes the following canceling circuit:

L11, 2UR1, 2URN, f2, ff, W6, F3, L21

This resets the up floor call registering relay 2UR in the manner previously described. As a result of this resetting, the relay opens its contacts 2UR1 and recloses its break contacts 2UR2 (Fig. 3). Inasmuch as the contacts 5CR2 remain open, the reclosure of the contacts 2UR2 has no immediate effect on the system. However, the relay also recloses its break contacts 2UR3. If no other call is registered affecting the elevator car B, the reclosure of the contacts 2UR3 results in energization of the call relay B78.

Next it will be assumed that a prospective passenger at the fourth floor registers a down floor call by operation of the push button 4D (Fig. 2) after the elevator car A reached the fifth floor. The resultant energization of the down floor registering relay 4DR closes the make contacts 4DR1 to establish a holding circuit around the push button. Closure of make contacts 4DR4 (Fig. 4) does not energize the quota relay sufficiently to cause it to pick up.

In addition, the registering relay 4DR opens its break contacts 4DR2 (Fig. 3) and similar contacts for the remaining cars, such as the contacts 4DR3 for the elevator car B. The opening of the break contacts 4DR2 deenergizes the call relay 78. This relay recloses its break contacts 87—1. It will be assumed that the elevator car A has remained at the fifth floor for time sufficient to permit reclosure of the break contacts 70T1 of the non-interference relay. Consequently, the up switch U and the running relay M are energized in the manner previously described to move the car upwardly to the upper terminal floor. As the elevator car A nears the upper terminal floor, the brush *bb* (Fig. 3) engages the segment *b6* to complete the following energizing circuit:

L1, b6, bb, W3, T, M4, L2

The relay T closes its make contacts T1 (Fig. 1) to energize the relays G, E and F. These relays initiate a stopping operation of the elevator car A at the sixth floor in a manner which will be clear from the earlier discussion of the stopping of the elevator car at the fifth floor. As it reaches the sixth floor, the elevator car A opens its limit switch 23 (Fig. 1) to deenergize the up preference relay W. Since this relay closes its break contacts W2 and the break contacts U6 close as the car stops, an energizing circuit is completed for the down preference relay X through the limit switch 24. The deenergization of the up preference relay and the energization of the down preference relay condition the elevator car A for down travel.

After the expiration of time sufficient to permit the non-interference relay 70T to time out, the break contacts 70T1 close to complete the following circuit:

L1, 70T1, 78—1, X1, F2, 22, D, M, DR1, L2

The relay D upon energization closes its make contact D1 to release the elevator brake. Contacts D2 and D3 close to energize the generator field with proper polarity for down travel. Contacts D4 close to complete through the limit switch 20 and the contacts E2, an energizing circuit for the speed relay V. This relay closes its make contacts V1 to shunt the resistor R1. The elevator car A now accelerates to its full speed in the down direction.

Closure of the make contacts D5 establishes a holding circuit around the contacts 70T1, 78—1, and X1. Opening of the break contacts D6 has no immediate effect on the operation of the system. The running relay M upon energization operates its contacts in the manner previously described.

As the elevator car A nears the fourth floor, the brush *gg* engages the contact segment *g4* (Fig. 2) to complete the following energizing circuit:

L11, 4DR1, g4, gg, X6, LW1, S, L21

As a result of its energization, the floor call stopping relay S closes its make contact to energize the relays G, E and F. The relay G closes its make contact to establish a holding circuit around the contacts S1. The continued movement of the elevator car A brings the inductor slow down relay adjacent the plate DEP for the fourth floor and completes a magnetic circuit resulting in opening of the contacts E2. Such opening results in deenergization of the speed relay V and this relay opens its make contact V1 to introduce the resistor R1 in series with the generator field winding. The decrease in energization of the field winding slows the elevator car to a landing speed. The continued movement of the elevator car A at a slow speed brings the inductor stopping relay F adjacent the inductor plate DFP to open the contacts F2 and close the make contacts F3 (Fig. 2b). Such opening of the contacts F2 deenergizes the down switch D and the running relay M. The down switch D opens its make contacts D1 to apply the elevator brake. Contacts D2 and D3 open to deenergize the generator field winding and the elevator car stops accurately at the

fourth floor. Opening of make contacts D4 and D5 and closure of break contacts D6 have no immediate effect on the operation of the system.

During the stopping operation the brush *hh* (Fig. 2) engages the contact segment *h4* to complete the following canceling circuit:

L11, 4DR1, 4DRN, *h4*, *hh*, X7, F3, L21

In resetting, the relay 4DR opens its holding contacts 4DR1. In addition, the relay recloses its break contact 4DR2 (Fig. 3) and corresponding contacts in the call circuits for the remaining elevator cars of the bank. If no other call is registered affecting the call circuit 30, the call relay 78 is energized and prevents further operation of the elevator car A. Contacts 4DR4 (Fig. 4) open to deenergize completely the quota relay Q.

It will be assumed that the passenger at the fourth floor enters the elevator car and operates the push button 1c (Fig. 3) to initiate movement of the elevator car to the first floor. The resultant energization of the car call registering relay 1CR closes the holding contacts 1CR1 and opens the break contacts 1CR2 (Fig. 3). Opening of the contacts 1CR2 deenergizes the call relay 78 and this relay closes its break contacts 78-1 (Fig. 1) to permit further movement of the elevator car. If sufficient time has elapsed for the noninterference relay 70T to drop out, the break contacts 70T1 close. If the doors also are closed, an energizing circuit again is completed for the down switch D and the running relay M. These cooperate in the manner previously discussed to move the elevator towards the first floor.

As the elevator car A nears the first floor, the brush *aa* (Fig. 3a) engages the contact segment *a1* to complete an energizing circuit for the car call stopping relay T. This relay closes its make contacts T1 to energize the relays G, E and F through the contacts M1. The energized relays E and F cooperate in the manner previously described to stop the elevator car A at the first floor. As the elevator car stops, the brush *cc* engages the contact segment *c1* to complete the following canceling circuit:

L1, 1CR1, 1CRN, *c1*, *cc*, M5, L2

In resetting, the relay 1CR opens its holding contacts 1CR1, and closes its break contacts 1CR2 (Fig. 3) to complete an energizing circuit for the call relay 78. The relay 78 opens its break contacts 78-1 (Fig. 1) to prevent further operation of the elevator car A until a call is registered requiring such operation.

As it reaches the lower terminal floor, the elevator car A opens the limit switch 24 to deenergize the down preference relay. This relay closes its break contacts X2 to complete an energizing circuit for the up preference relay W as the elevator car stops at the lower terminal floor. The deenergization of the down preference relay X and the energization of the up preference relay W conditions the elevator car A for up travel.

Next it will be assumed that a failure occurs in the power supply 28 (Fig. 2) for the floor call circuits. As a result of such failure, the power fail relay PF drops out and closes its break contacts PF1 and PF2 (Fig. 3). Closure of the break contacts PF1 completes an energizing circuit for the car call registering relay B6CR for the sixth floor. In an analogous manner, closure of the break contacts PF2 completes with the switch B25 an energizing circuit for the car call relay B5CR for the fifth floor. The elevator car B now is assigned to stop at the fifth and sixth floors during each of its trips. If the switch B25 were open, closure of the break contacts PF2 would complete an energizing circuit for the car call registering relay B5CR only when the make contacts BX3 were closed to indicate that the elevator car B was set for down travel and the car was at the top terminal as indicated by the closure of the selector contacts B*d6* and B*dd*. Under such circumstances, the elevator car B

would be assigned to stop at the fifth floor only while travelling in the down direction.

At the same time, the power fail relay closes its break contacts PF3 to complete with the switch 25 an energizing circuit for the car call registering relay 2CR. Contacts PF6 close to establish a pick up circuit for relay 6CR. Consequently, the elevator car A now is assigned to stop at the second floor and sixth on each of its trips. If the switch 25 were open, the contacts PF3 would be effective to energize the car call relay 2CR only if the elevator car A is set for down travel and is at the sixth floor. Under such circumstances, the assignment of the elevator car A to stop at the second floor would be effective only during down travel of the elevator car. Closure of the break contacts PF4 and PF5 energize, respectively, the car call registering relay 1CR and B1CR to assign the elevator cars A and B to stop at the first floor.

In the foregoing manner, failure of the power supply 28 results in the assignment of each of the elevator cars to stop at specified floors. This assures reasonably satisfactory service for intending passengers at the various floors despite the failure of the floor call circuits.

Assume next that down floor calls are registered at the second, third and fourth floors. The sequence for registering such calls will be understood from the foregoing discussion. As the result of such call registrations, the quota relay Q (Fig. 4) is energized through the resistors 2R3, 3R3 and 4R3. Such energization is sufficient to pick up the quota relay which opens its break contacts Q2 without immediately affecting the operation of the system. The relay additionally closes its make contacts Q1 (Fig. 3) to energize the down-peak relay DP.

As a result of its energization, the down-peak relay DP opens its break contacts DP1 to prevent the elevator car A from answering up floor calls.

In addition, the make contacts DP2 close. To illustrate the effect of the closure of the make contacts DP2, let it be assumed that at the time the down-peak relay operates, the elevator car A is approaching the fifth floor in the down direction to answer a car call for the fifth floor and that an up floor call is also registered for the fifth floor. The sequence for registering such calls has been discussed above. Inasmuch as an up call has been registered for the fifth floor, the car registering relay 5UR is energized.

As the elevator car A approaches the fifth floor, it stops in response to the registered car call by a sequence which will be clear from the preceding description. It will be recalled that during the stopping of the elevator car, the inductor relay F operates to close the make contacts F3. This now completes the following canceling circuit for the up floor call at the fifth floor:

L11, 5UR1, 5URN, *f5*, *ff*, DP2, 27, M7, F3, L21

Consequently, the stopping elevator car cancels the up floor call at the fifth floor even though it is not in condition to serve such call. As the elevator car A completes its stopping at the fifth floor, the break contacts M6 close. However, since the make contacts M7 and W6 are both open, the canceling circuit for the fifth floor registering relay 5UR is interrupted and an up floor call may be reregistered for the fifth floor despite the presence of the elevator car A at the fifth floor. Consequently, if an intending passenger really desires to proceed upwardly from the fifth floor, he may promptly reregister his call.

Returning to the operation of the down-peak relay, this relay further closes its make contacts DP3 and opens its break contacts DP4 for the purpose of conditioning the elevator car B to ignore up floor calls and to cancel an up floor call at any floor at which it stops while set for travel in the down direction. If it is desired to condition the elevator car B to respond to up floor calls during the down-peak period, the switches 27 and B27 may be opened and the switch B26 may be closed. This conditions the elevator car B to respond to up floor calls in the normal manner.

Alternatively, assume that the switches B26, B27 and 27 all are closed. Each car stopping at a floor while set for down travel cancels a registered up call for such floor. However, the elevator car B, when set for up travel, can answer an up floor call for any floor which it approaches.

Turning now to Fig. 3, it will be noted that the pick up of the down-peak relay also closes make contacts DP5 and DP6 to condition the elevator cars A and B to reverse at the farthest floor in the up direction for which a car call or a down-floor call is registered. If the elevator car is to ignore up-floor calls, make contacts DP9 to DP16 of the down-peak relay may be employed to shunt contacts of the up-floor call registering relays as indicated in Fig. 3. The operation of the relay 78U to reverse the elevator car at an intermediate floor has been previously discussed.

Let it be assumed next that the elevator system is conditioned for down-peak operation, and that down-floor calls are registered for the third and sixth floors in the manner previously discussed. The car A is assumed to leave the first floor with a passenger who has registered a car call for the third floor. The car answers the car call in the manner previously set forth, and it will be assumed that passengers enter the car and fully load the car at the third floor. Inasmuch as the car is fully loaded, the switch LW1 (Fig. 2) is open to prevent the elevator car from responding to floor calls if it is otherwise conditioned to so respond. In addition, the switch contacts LW2 (Fig. 3) close to complete with the make contacts W8 and the down-peak relay contacts DP7 an energizing circuit for the high car call reversal relay HC. This relay closes its make contacts HC1 to HC5 for the purpose of shunting the contacts of the floor call registering relay in the circuit 30 for floors above the first floor. Inasmuch as the contacts W7 and DP5 are both closed, the elevator car A now is conditioned to reverse at the third floor even though a floor call is registered for the sixth floor. If the switch 32 is closed, a holding circuit for the high car call reversal relay is also completed through the make contacts HC6.

Let it be assumed next that the elevator car B makes stops while set for travel in the up direction at the second, fourth and fifth floors, and that the elevator car A makes a stop at the third floor while set for down travel within the interval measured by the timing relay TA. As pointed out in the discussion of Fig. 4, this results in energization of the up-peak relay UPK. This relay closes its make contacts UPK1 (Fig. 3) to condition the elevator car A to reverse at the farthest floor when travelling in the up direction at which a down floor call or a car call is registered, provided that an up-floor call is not registered for such farthest floor and provided that an up-floor call is not registered for a floor above such farthest floor. Closure of make contacts UPK2 similarly conditions the elevator car B. The operation of the relays 78U and B78U previously has been discussed. The relay UPK remains energized until the ratio of up stops to total stops of the elevator cars within any interval drops below the predetermined value (contacts UA1 and TA3, Fig. 4, both are open) or until a quota of down floor calls are registered at the end of an interval (contacts Q2 and TA3, both are open).

NON-INTERFERENCE TIME

The operation of the elevator system heretofore discussed assumes that a constant non-interference time is employed. It will be recalled that such a non-interference time is obtained if the switch SW1 is in the position illustrated in Fig. 1. However, the efficiency of the elevator system may be increased if the non-interference time is adjusted to different values under different operating conditions of the system. To provide such adjustment of the non-interference time, the switch SW1 is manually operated to connect the resistor R2a across the non-interference relay 70T. The time of drop-out of the

relay now is determined by the effective value of the resistor R2a.

The resistor R2a has its effective value of resistance adjusted to provide the most desirable non-interference time for each condition of operation of the system. Thus, during down-peak operations, a substantial non-interference time is desirable, particularly during travel of the elevator car in the down direction. The value of non-interference time under these conditions is determined by closure of make contacts DP18 of the down-peak relay. Such closure shunts a large portion of the resistor R2a, as clearly illustrated in Fig. 1. The value of the portion shunted may be adjusted by means of an adjustable tap on the resistor. If this value of non-interference time is desired only during down travel of an elevator car, make contacts (not shown) of the down preference relay X may be included in series with the make contacts DP18. For the present purpose, it will be assumed that the non-interference time is effective for both directions of car travel.

During up-peak operations of the elevator system, a smaller portion of the resistor R2a is shunted by closure of the make contacts UPK4 of the up-peak relay. Consequently, a smaller value of non-interference time is provided for up-peak operations of the system.

During off-hours operation of the elevator system, a still shorter non-interference time may suffice. Such a short time is provided by shunting a small portion of the resistor R2a through make contacts TC1 which are closed when the system is in off-hours operation. For present purposes, it will be assumed that the contacts TC1 represent the make contacts of a time switch which are closed during the off-hour period of operation of the elevator system. Break contacts TC2 of the time switch are open when contacts TC1 are closed.

During off-peak operation of the elevator system, an intermediate value of non-interference time is suitable. Such non-interference time is provided by shunting a portion of the resistor R2a through a path including in series the break contacts DP17 of the down-peak relay, the break contacts UPK3 of the up-peak relay and break contacts HT1 of a heavy traffic relay. If the traffic demand during the off-peak period increases it may be desirable to increase the non-interference time. In Fig. 1 such increase is obtained as a result of operation of the heavy traffic relay HT which opens its break contacts HT1 and closes its make contacts HT2 to shunt a larger portion of the resistor R2a.

It may be desirable to adjust other non-interference times in accordance with the traffic demands. For example, during the up-peak operation an increase in efficiency may be obtained by employing a non-interference time which decreases with the number of stops during up travel of the elevator cars. Such a variation may be obtained by means of a heavy traffic relay similar to that discussed for the off-peak operation.

The heavy traffic relay may be operated in any suitable manner, for example it may be responsive to the number of calls registered by the elevator system. However, in a preferred embodiment of the invention the heavy traffic relay is dependent on the number of stops made by the elevator cars.

For illustrative purposes, the heavy traffic relay HT is shown in Fig. 4 associated with the stepping switch CO. The heavy traffic relay HT is connected between the bus L2 and a contact segment CO40 through break contacts RE6 of the reset relay RE. The contact segment CO40 is positioned to be engaged by the brush CO24 after the brush has been advanced a predetermined number of steps from its reset position. The heavy traffic relay HT has a non-interference time in drop out slightly greater than the time required for one cycle of the operation of the stepping switch. It will be recalled that such a cycle is determined by the timing relay TA.

As shown in Fig. 4, the contact segment CO40 is posi-

tioned to be engaged by the brush CO24 if the elevator cars make 5 stops. If the brush engages the contact segment CO40 before the timing relay TA operates to energize the reset relay RE, the heavy traffic relay HT is energized and picks up through the break contacts RE6. If the brush CO40 thereafter steps beyond the contact segment CO40, the relay HT starts to time out. Upon expiration of the time measured by the timing relay TA, the reset relay RE is energized and opens its break contacts RE6 to start a timing out operation of the relay HT (if the relay has not already started to time out). In addition, the stepping switch promptly resets for another cycle of operation. If the elevator cars make 5 additional stops before the heavy traffic relay HT times out, this relay is again energized. Consequently, as long as the elevator cars make stops at a predetermined rate, the heavy traffic relay HT remains picked up.

In Fig. 5 a modified construction is illustrated for the circuits associated with the non-interference relay 70T. Circuits only for the elevator car B are shown in this figure. As shown in Fig. 5, a neutralizing coil 70TN is wound around the operating winding for the relay 70T and is connected for energization in a direction producing a magnetomotive force which opposes that for the operating winding 70T. The neutralizing coil 70TN is connected across the buses L1 and L2 through the resistor R2a and make contacts 70T2 of the non-interference relay. Consequently, the magnitude of the current flowing through the neutralizing coil depends on the resistance value of the resistor R2a. The effective resistance of the resistor R2a is controlled by the same contacts illustrated in Fig. 1. However, in Fig. 1 an increase in effective resistance of the resistor 2a decreases the time delay, whereas in Fig. 5 an increase in the effective resistance increases the time delay.

Upon inspection of Fig. 5, it will be noted that the neutralizing coil also is connected across the operating winding of the relay 70T through a resistor R8 and a capacitor CA1. A tap on the resistor R8 is connected to the bus L1 through make contacts M12 of the running relay M. The non-interference relay 70T has its operating winding connected for energization across the buses through the make contacts M13 of the running relay.

When the elevator car starts, the make contacts M12 and M13 close to energize the non-interference relay 70T and to charge the capacitor CA1 through a portion of the resistor R8. In addition, make contacts 70T2 close to establish an energizing circuit for the neutralizing coil 70TN. As previously pointed out, the value of the neutralizing current flowing through the coil 70TN depends on the effective resistance of the resistor R2a.

When the elevator car stops the make contacts M12 and M13 open. The time of drop out of the non-interference relay 70T then is determined by the charge in the capacitor CA1 and by the value of the steady neutralizing current passing through the neutralizing coil 70TN. Consequently, the lower the effective resistance of the resistor R2a the larger the neutralizing current through the neutralizing coil and the shorter the non-interference time. The contacts of the relays in Fig. 5 are connected to produce the desired time values and the circuits associating them with the resistor R2a may be followed readily on the drawing.

Although the invention has been described to certain specific embodiments thereof, numerous modifications falling within the spirit and scope are possible. For these reasons, the foregoing description and drawings are to be construed in an illustrative rather than in a limiting sense.

I claim as my invention:

1. In an elevator system, a structure having a plurality of landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move and stop the elevator car at selected landings, said

control means comprising, landing call means operable for registering calls for elevator service from each of said landings, car call means operable for registering calls for landings desired by the load within the elevator car, means cooperating with the motive means in response to registration of calls by said call means for moving the elevator car and stopping the elevator car at each of the landings for which a call is registered by the call means, and modifying means responsive to a predetermined elevator car loading for conditioning the elevator car when travelling in a first direction to stop and reverse substantially at the farthest landing in said first direction for which a call is registered by the car call means even though a call is registered by the landing call means for a landing displaced in the first direction from said farthest landing.

2. In an elevator system, a structure having a plurality of landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move and stop the elevator car at selected landings, said control means comprising first landing call means operable for registering calls for elevator service in a first direction from each of said landings, second landing call means operable for registering calls for elevator service in a second direction from each of said landings, car call means operable for registering calls for landings desired by the load within the elevator car, means cooperating with the motive means in response to registration of calls by said call means for moving the elevator car and stopping the elevator car at each of the landings approached by the elevator car for which a call is registered by the call means which may be served by the elevator car in the direction of travel for which the elevator car is set, and modifying means responsive to a predetermined load in the elevator car for conditioning the elevator car when travelling in a first direction to stop and reverse substantially at the farthest landing in said first direction for which a call is registered by the car call means even though calls are registered by the first and second landing call means for a landing displaced in the first direction from said farthest landing.

3. In an elevator system, a structure having a plurality of landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move and stop the elevator car at selected landings, said control means comprising first landing call means operable for registering calls for elevator service in a first direction from each of said landings, second landing call means operable for registering calls for elevator service in a second direction from each of said landings, car call means operable for registering calls for landings desired by the load within the elevator car, means cooperating with the motive means in response to registration of calls by said call means for moving the elevator car and stopping the elevator car at each of the landings approached by the elevator car for which a call is registered by the call means which may be served by the elevator car in the direction of travel for which the elevator car is set, and modifying means responsive to a predetermined condition for assigning the elevator car while set for travel in the first direction to reset registered first and second landing call means for each of said landings at which the elevator car stops.

4. In an elevator system, a structure having a plurality of landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move and stop the elevator car at selected landings, said control means comprising first landing call means operable for registering calls for elevator service in a first direc-

tion from each of said landings, second landing call means operable for registering calls for elevator service in a second direction from each of said landings, car call means operable for registering calls for landings desired by the load within the elevator car, means cooperating with the motive means in response to registration of calls by said call means for moving the elevator car and stopping the elevator car at each of the landings approached by the elevator car for which a call is registered by the call means which may be served by the elevator car in the direction of travel for which the elevator car is set, and modifying means responsive to a predetermined condition for assigning the elevator car while set for travel in the first direction to reset registered first and second landing call means for each of said landings at which the elevator car stops, the second landing call means at each of said landings being operable to register a call while the elevator car is stopped at the associated landing and the elevator car is set for travel in the first direction.

5. In an elevator system, a structure having a plurality of landings including a pair of terminal landings and a plurality of intermediate landings located between the terminal landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move and stop the elevator car at selected landings, said control means comprising landing call means operable for registering calls for elevator service from each of said intermediate landings, means cooperating with the motive means in response to registration of calls by said call means for moving the elevator car and stopping the elevator car at each of the landings for which a call is registered by the call means, and modifying means responsive to an ineffective condition of the call means wherein the call means cannot be operated to stop the elevator car at the associated landings for assigning the elevator car to stop at a plurality of said intermediate landings.

6. In an elevator system, a structure having a plurality of landings including a pair of terminal landings and a plurality of intermediate landings located between the terminal landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move and stop the elevator car at selected landings, said control means comprising first landing call means operable for registering calls for elevator service in a first direction from each of said intermediate landings, second landing call means operable for registering calls for elevator service in a second direction from each of said intermediate landings, car call means operable for registering calls for landings desired by the load within the elevator car, means cooperating with the motive means in response to registration of calls by said call means for moving the elevator car and stopping the elevator car at each of the landings approached by the elevator car for which a call is registered by the call means which may be served by the elevator car in the direction of travel for which the elevator car is set, and modifying means responsive to a predetermined condition of the landing call means wherein the call means cannot be operated to stop the elevator car at the associated landings for assigning the elevator car to stop at a plurality of said intermediate landings.

7. In an elevator system, a structure having a plurality of landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move and stop the elevator car at selected landings, said control means comprising first landing call means operable for registering calls for elevator service in a first direction from each of said landings, second landing call means operable for registering calls for elevator service in a second direction from each of said landings, car call

means operable for registering calls for landings desired by the load within the elevator car, means cooperating with the motive means in response to registration of calls by said call means for moving the elevator car and stopping the elevator car at each of the landings approached by the elevator car for which a call is registered by the call means which may be served by the elevator car in the direction of travel for which the elevator car is set, said landing call means having a first source of power, said car call means having a second source of power, and means responsive to failure of the first source of power for operating the car call means to stop the elevator car at predetermined landings.

8. In an elevator system, a structure having a plurality of landings including a pair of terminal landings and a plurality of intermediate landings located between the terminal landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move and stop the elevator car at selected landings, said control means comprising first landing call means operable for registering calls for elevator service in a first direction from each of said intermediate landings, second landing call means operable for registering calls for elevator service in a second direction from each of said intermediate landings, car call means operable for registering calls for intermediate landings desired by the load within the elevator car, means cooperating with the motive means in response to registration of calls by said call means for moving the elevator car and stopping the elevator car at each of the landings approached by the elevator car for which a call is registered by the call means which may be served by the elevator car in the direction of travel for which the elevator car is set, and modifying means responsive to a predetermined condition of the landing call means wherein the call means cannot be operated to stop the elevator car at the associated landings for assigning the elevator car to stop at a plurality of said intermediate landings during travel of the elevator car in only one direction.

9. In an elevator system, a structure having a plurality of landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move and stop the elevator car at selected landings, said control means comprising means selectively operable in cooperation with the motive means for moving the elevator car and stopping the elevator car at preselected floors in accordance with any of a plurality of modes of operation, and means responsive to a predetermined relationship between a first function of the number of stops made by the elevator car and a second function of the number of stops made by the elevator car for varying the mode of operation of the elevator car.

10. In an elevator system, a structure having a plurality of landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move and stop the elevator car at selected landings, said control means comprising means selectively operable in cooperation with the motive means for moving the elevator car and stopping the elevator car at preselected floors in accordance with any of a plurality of modes of operation, and means responsive to the ratio of stops of the elevator car in a first direction to total stops of the elevator car in a predetermined interval for transferring the elevator car from one of the modes to another of the modes of operation.

11. In an elevator system, a structure having a plurality of landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means

to move and stop the elevator car at selected landings, said control means comprising first landing call means operable for registering calls for elevator service in a first direction from each of said landings, second landing call means operable for registering calls for elevator service in a second direction from each of said landings, car call means operable for registering calls for landings desired by the load within the elevator car, means cooperating with the motive means in response to registration of calls by said call means for moving the elevator car and stopping the elevator car at each of the landings approached by the elevator car for which a call is registered by the call means which may be served by the elevator car in the direction of travel for which the elevator car is set, expediting means operable for expediting elevator car service in the first direction, means for measuring a first quantity representing the stops made by the elevator car while set for travel in the first direction, means for measuring a second quantity representing at least in part the stops made by the elevator car in the second direction, and means responsive to a predetermined relation between said quantities for operating said expediting means.

12. In an elevator system, a structure having a plurality of landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move and stop the elevator car at selected landings, said control means comprising first landing call means operable for registering calls for elevator service in a first direction from each of said landings, second landing call means operable for registering calls for elevator service in a second direction from each of said landings, car call means operable for registering calls for landings desired by the load within the elevator car, means cooperating with the motive means in response to registration of calls by said call means for moving the elevator car and stopping the elevator car at each of the landings approached by the elevator car for which a call is registered by the call means which may be served by the elevator car in the direction of travel for which the elevator car is set, expediting means operable for expediting elevator car service in the first direction, means for measuring a first quantity representing the stops made by the elevator car while set for travel in the first direction, means for measuring a second quantity representing at least in part the stops made by the elevator car in the second direction, means responsive to a predetermined relation between said quantities for operating said expediting means, and means responsive to a predetermined registration of calls by the second landing call means for blocking said operation of the expediting means.

13. In an elevator system, a structure having a plurality of landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move and stop the elevator car at selected landings, said control means comprising first landing call means operable for registering calls for elevator service in a first direction from each of said landings, second landing call means operable for registering calls for elevator service in a second direction from each of said landings, car call means operable for registering calls for landings desired by the load within the elevator car, means cooperating with the motive means in response to registration of calls by said call means for moving the elevator car and stopping the elevator car at each of the landings approached by the elevator car for which a call is registered by the call means which may be served by the elevator car in the direction of travel for which the elevator car is set, modifying means responsive to a predetermined relationship between a first function of the number of stops made by the elevator car and a second function of the number of stops made by the elevator car for

varying the mode of operation of the elevator car, and means responsive to a predetermined registration of calls by the second landing call means for blocking said variation of the mode of operation.

14. In an elevator system, a structure having a plurality of landings, a plurality of elevator cars, means mounting each of the elevator cars for movement relative to the structure to serve the landings, motive means for moving each of the elevator cars, and control means cooperating with the motive means to move and stop the elevator cars at selected landings, said control means comprising landing call means common to said elevator cars and operable for registering calls for elevator service from each of said landings, car call means for each of the elevator cars operable for registering calls for landings desired by the loads within the elevator cars, means cooperating with the motive means in response to registration of calls by said call means for moving each of the elevator cars and for stopping each of the elevator cars at each of the landings approached by such elevator car for which a call is registered by the car call means of such approaching elevator car and at each of the landings approached by such elevator car for which a call is registered by the landing call means for service in the direction of approach of such elevator car, and modifying means individual to each of the elevator cars, each of the modifying means being effective in response to a predetermined elevator car loading for the associated elevator car to assign such associated elevator car when traveling in a first direction to stop and reverse at the farthest landing in said first direction for which a call is registered by the car call means for such associated elevator car even though a call is registered by the landing call means for a landing displaced in the first direction from said farthest landing.

15. In an elevator system, a structure having a plurality of landings, a plurality of elevator cars, means mounting each of the elevator cars for movement relative to the structure to serve the landings, motive means for moving each of the elevator cars, and control means cooperating with the motive means to move and stop the elevator cars at selected landings, said control means comprising first landing call means common to said elevator cars and operable for registering calls for elevator service in a first direction from each of the landings, second landing call means common to the elevator cars and operable for registering calls for elevator service in a second direction from each of said landings, car call means for each of the elevator cars operable for registering calls for landings desired by the loads within the elevator cars, means cooperating with the motive means in response to registration of calls by said call means for moving each of the elevator cars and for stopping each of the elevator cars at each of the landings approached by such elevator car for which a call is registered by the car call means of such approaching elevator car and at each of the landings approached by such elevator car for which a call is registered by the landing call means for service in the direction of approach of such elevator car, and modifying means individual to each of the elevator cars, each of the modifying means being effective in response to a predetermined load for the associated elevator car to assign such associated elevator car when traveling in a first direction to stop and reverse at the farthest landing in said first direction for which a call is registered by the car call means for such associated elevator car even though a call is registered by the first and second landing call means for a landing displaced in the first direction from said farthest landing.

16. In an elevator system, a structure having a plurality of landings, a plurality of elevator cars, means mounting each of the elevator cars for movement relative to the structure to serve the landings, motive means for moving each of the elevator cars, and control means cooperating with the motive means to move and stop the elevator cars at selected landings, said control means

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comprising first landing call means common to said elevator cars and operable for registering calls for elevator service in a first direction from each of the landings, second landing call means common to the elevator cars and operable for registering calls for elevator service in a second direction from each of said landings, car call means for each of the elevator cars operable for registering calls for landings desired by the loads within the elevator cars, means cooperating with the motive means in response to registration of calls by said call means for moving each of the elevator cars and for stopping each of the elevator cars at each of the landings approached by such elevator car for which a call is registered by the car call means of such approaching elevator car and at each of the landings approached by such elevator car for which a call is registered by the landing call means for service in the direction of approach of such elevator car, and modifying means responsive to a predetermined condition for assigning each of the elevator cars stopping while set for travel in the second direction to reset operated first and second landing call means at each of the landings at which such stopping takes place.

17. In an elevator system, a structure having a plurality of landings, a plurality of elevator cars, means mounting each of the elevator cars for movement relative to the structure to serve the landings, motive means for moving each of the elevator cars, and control means cooperating with the motive means to move and stop the elevator cars at selected landings, said control means comprising first landing call means common to said elevator cars and operable for registering calls for elevator service in a first direction from each of the landings, second landing call means common to the elevator cars and operable for registering calls for elevator service in a second direction from each of said landings, car call means for each of the elevator cars operable for registering calls for landings desired by the loads within the elevator cars, means cooperating with the motive means in response to registration of calls by said call means for moving each of the elevator cars and for stopping each of the elevator cars at each of the landings approached by such elevator car for which a call is registered by the car call means of such approaching elevator car and at each of the landings approached by such elevator car for which a call is registered by the landing call means for service in the direction of approach of such elevator car, and modifying means responsive to a predetermined condition for assigning each of the elevator cars stopping while set for travel in the second direction to reset operated first and second landing call means at each of the landings at which such stopping takes place, the second landing call means at each of the landings at which such stopping and resetting takes place being operable for registering a call while the stopping elevator car is at such landing.

18. In an elevator system, a structure having a plurality of landings, a plurality of elevator cars, means mounting each of the elevator cars for movement relative to the structure to serve the landings, motive means for moving each of the elevator cars, and control means cooperating with the motive means to move and stop the elevator cars at selected landings, said control means comprising landing call means common to said elevator cars and operable for registering calls for elevator service from each of said landings, and means responsive to an ineffective condition of the landing call means for assigning one of said elevator cars to stop at part of said landings and for assigning another of said elevator cars to stop at other of said landings.

19. In an elevator system, a structure having a plurality of landings, a plurality of elevator cars, means mounting each of the elevator cars for movement relative to the structure to serve the landings, motive means for moving each of the elevator cars, and control means cooperating with the motive means to move and stop

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the elevator cars at selected landings, said control means comprising first landing call means common to said elevator cars and operable for registering calls for elevator service in a first direction from each of the landings, second landing call means common to the elevator cars and operable for registering calls for elevator service in a second direction from each of said landings, car call means for each of the elevator cars operable for registering calls for landings desired by the loads within the elevator cars, means cooperating with the motive means in response to registration of calls by said call means for moving each of the elevator cars and for stopping each of the elevator cars at each of the landings approached by such elevator car for which a call is registered by the car call means of such approaching elevator car and at each of the landings approached by such elevator car for which a call is registered by the landing call means for service in the direction of approach of such elevator car, said landing call means having a first source of power and said car call means having a second source of power, and means responsive to failure of the first source of power for operating the car call means to stop each of the elevator cars at a different group of said landings.

20. In an elevator system, a structure having a plurality of landings, a plurality of elevator cars, means mounting each of the elevator cars for movement relative to the structure to serve the landings, motive means for moving each of the elevator cars, and control means cooperating with the motive means to move and stop the elevator cars at selected landings, said control means comprising first landing call means common to said elevator cars and operable for registering calls for elevator service in a first direction from each of the landings, second landing call means common to the elevator cars and operable for registering calls for elevator service in a second direction from each of said landings, car call means for each of the elevator cars operable for registering calls for landings desired by the loads within the elevator cars, means cooperating with the motive means in response to registration of calls by said call means for moving each of the elevator cars and for stopping each of the elevator cars at each of the landings approached by such elevator car for which a call is registered by the car call means of such approaching elevator car and at each of the landings approached by such elevator car for which a call is registered by the landing call means for service in the direction of approach of such elevator car, said landing call means having a first source of power and said car call means having a second source of power, and means responsive to failure of the first source of power for operating the call means to stop each of the elevator cars during travel in only one of said directions at a different group of said landings.

21. In an elevator system, a structure having a plurality of landings, a plurality of elevator cars, means mounting each of the elevator cars for movement relative to the structure to serve the landings, motive means for moving each of the elevator cars, and control means cooperating with the motive means to move and stop the elevator cars at selected landings, said control means being operable for transferring the elevator cars from a first to a second mode of operation, and means responsive to a predetermined relationship between a first function of the stops made by the elevator cars and a second function of the stops made by the elevator cars for operating the control means to vary the mode of operation of the elevator cars.

22. In an elevator system, a structure having a plurality of landings, a plurality of elevator cars, means mounting each of the elevator cars for movement relative to the structure to serve the landings, motive means for moving each of the elevator cars, and control means cooperating with the motive means to move and stop the elevator cars at selected landings, said control means comprising first landing call means common to said elevator cars and

operable for registering calls for elevator service in a first direction from each of the landings, second landing call means common to the elevator cars and operable for registering calls for elevator service in a second direction from each of said landings, car call means for each of the elevator cars operable for registering calls for landings desired by the loads within the elevator cars, means cooperating with the motive means in response to registration of calls by said call means for moving each of the elevator cars and for stopping each of the elevator cars at each of the landings approached by such elevator car for which a call is registered by the car call means of such approaching elevator car and at each of the landings approached by such elevator car for which a call is registered by the landing call means for service in the direction of approach of such elevator car, expediting means operable for expediting elevator service in the first direction, means responsive to a certain ratio of the number of stops made by the elevator cars while set for travel in the first direction to the total stops made by the elevator cars in a predetermined interval for operating the expediting means.

23. In an elevator system, a structure having a plurality of landings, a plurality of elevator cars, means mounting each of the elevator cars for movement relative to the structure to serve the landings, motive means for moving each of the elevator cars, and control means cooperating with the motive means to move and stop the elevator cars at selected landings, said control means comprising first landing call means common to said elevator cars and operable for registering calls for elevator service in a first direction from each of the landings, second landing call means common to the elevator cars and operable for registering calls for elevator service in a second direction from each of said landings, car call means for each of the elevator cars operable for registering calls for landings desired by the loads within the elevator cars, means cooperating with the motive means in response to registration of calls by said call means for moving each of the elevator cars and for stopping each of the elevator cars at each of the landings approached by such elevator car for which a call is registered by the car call means of such approaching elevator car and at each of the landings approached by such elevator car for which a call is registered by the landing call means for service in the direction of approach of such elevator car, expediting means operable for expediting elevator service in the first direction, means responsive to a certain ratio of the number of stops made by the elevator cars while set for travel in the first direction to the total stops made by the elevator cars in a predetermined interval for operating the expediting means, and means responsive to the number of calls registered by the second landing call means for blocking operation of the expediting means.

24. In an elevator system, a structure having a plurality of landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move the elevator car and to stop the elevator car at selected landings in accordance with any of a plurality of modes of operation, said control means comprising means responsive to the lapse of a substantial time while the elevator car is stopped at any of said landings for starting the elevator car, and means for selecting a different magnitude of said substantial time for each of said modes of operation.

25. An elevator system as claimed in claim 24 wherein said modes include at least two modes selected from a group comprising an off-peak mode for providing substantially balanced elevator service in two directions of travel, an up-peak mode for providing elevator service predominantly in an up direction and a down peak mode for providing elevator service predominantly in a down direction.

26. In an elevator system, a structure having a plurality of landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move the elevator car and to stop the elevator car at selected landings, said control means comprising means responsive to the lapse of a substantial time while the elevator car is stopped at any of said landings for starting the elevator car, and means for altering the magnitude of such substantial times at periods of the day.

27. In an elevator system, a structure having a plurality of landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move the elevator car and to stop the elevator car at selected landings, said control means comprising means responsive to the lapse of a substantial time while the elevator car is stopped at any of said landings for starting the elevator car, and means responsive to the demand for elevator service for varying the magnitude of such substantial time.

28. In an elevator system, a structure having a plurality of landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move the elevator car and to stop the elevator car at selected landings, said control means comprising means responsive to the lapse of a substantial time while the elevator car is stopped at any of said landings for starting the elevator car, and means responsive to the rate at which elevator car stops are made in the system for varying the magnitude of said substantial time.

29. In an elevator system, a structure having a plurality of landings including a pair of terminal landings and a plurality of intermediate landings located between the terminal landings, an elevator car, means mounting the elevator car for movement relative to the structure to serve the landings, motive means for moving the elevator car and control means cooperating with the motive means to move and stop the elevator car at selected landings, said control means comprising landing call means operable when adequately energized for registering calls for elevator service from each of said intermediate landings, a source of energy for supplying adequate energy to the landing call means, means cooperating with the motive means in response to registration of calls by said call means for moving the elevator car and stopping the elevator car at each of the landings for which a call is registered by the call means, and modifying means responsive to a condition of the source of energy wherein the source cannot supply adequate energy to the landing call means for assigning the elevator car to stop at certain of the intermediate landings.

30. In an elevator system, a structure having a plurality of landings, a plurality of elevator cars, means mounting each of the elevator cars for movement relative to the structure to serve the landings, motive means for moving each of the elevator cars, and control means cooperating with the motive means to move and stop the elevator cars at selected landings, said control means comprising landing call means common to said elevator cars and operable when adequately energized for registering calls for elevator service from each of said landings, a source of energy for supplying adequate energy to the landing call means, and means responsive to a condition of the source of energy wherein the source cannot supply adequate energy to the landing call means for assigning one of said elevator cars to stop at part of said landings and for assigning another of said elevator cars to stop at other of said landings.