June 11, 1957 W. F. EAMES 2,795,295

ELEVATOR SYSTEMS

Filed July 15, 1954 10 Sheets-Sheet 1

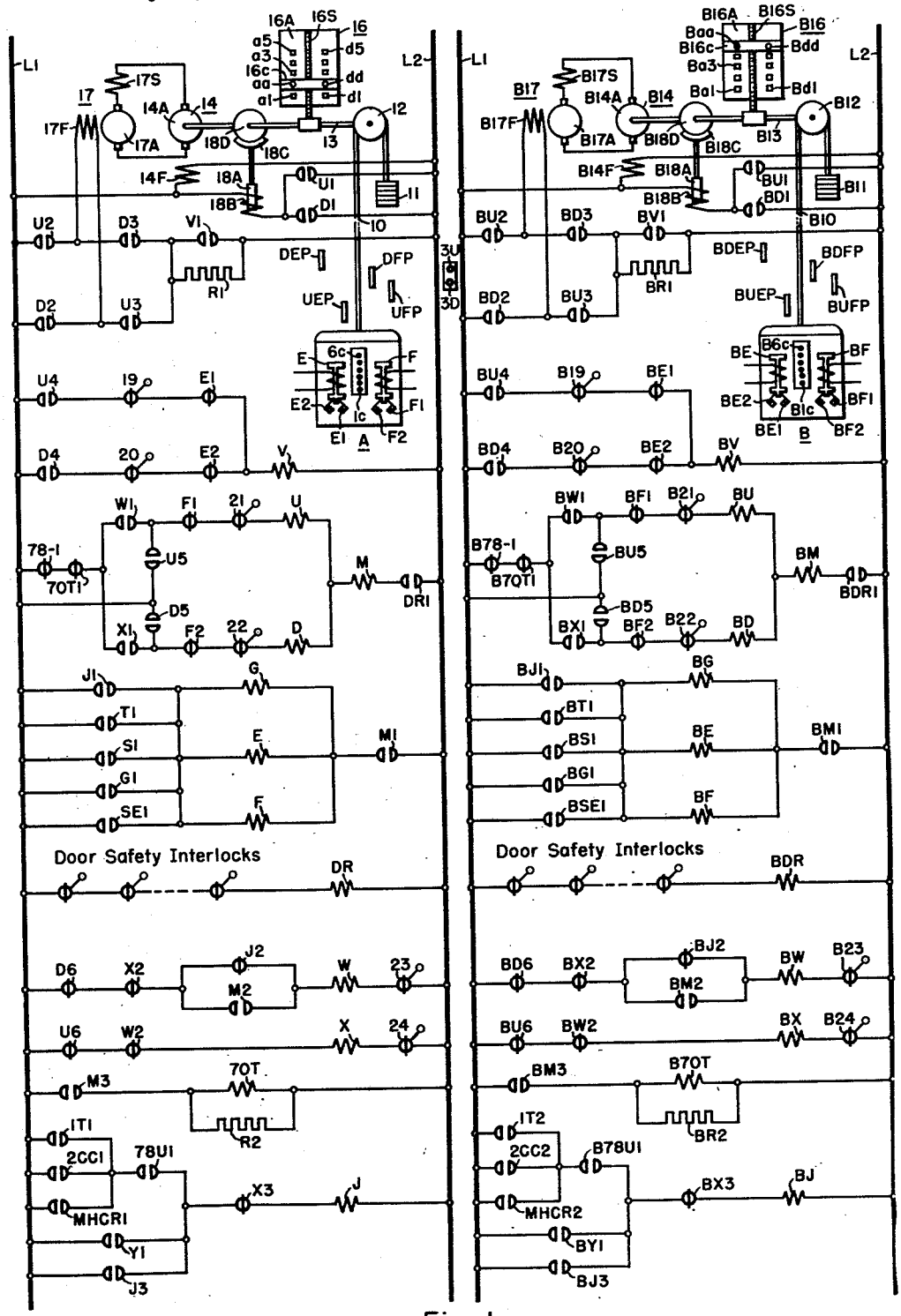


Fig. 1.

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ELEVATOR SYSTEMS

Filed July 15, 1954 10 Sheets-Sheet 2

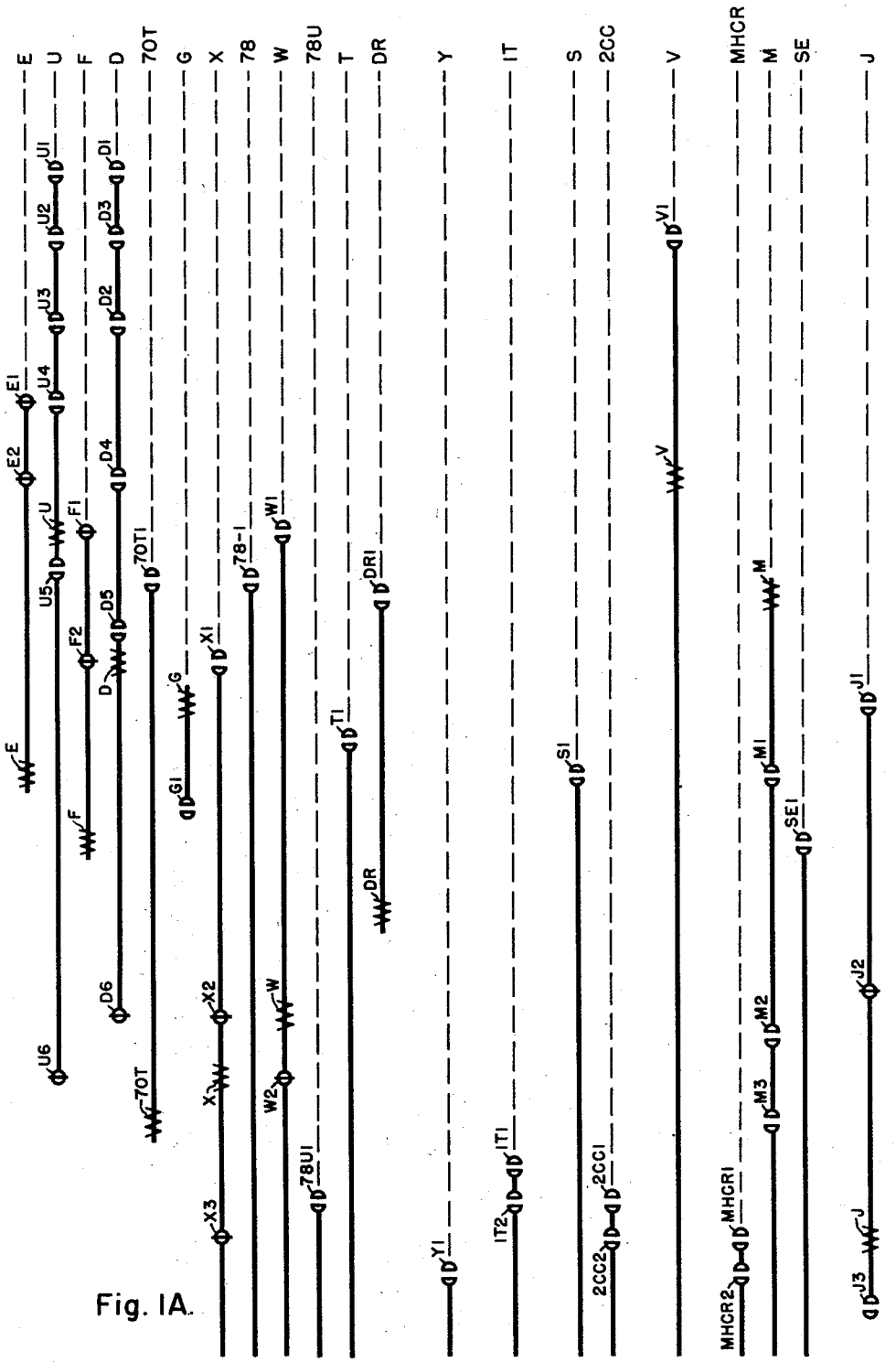


Fig. IA.

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ELEVATOR SYSTEMS

Filed July 15, 1954 10 Sheets-Sheet 3

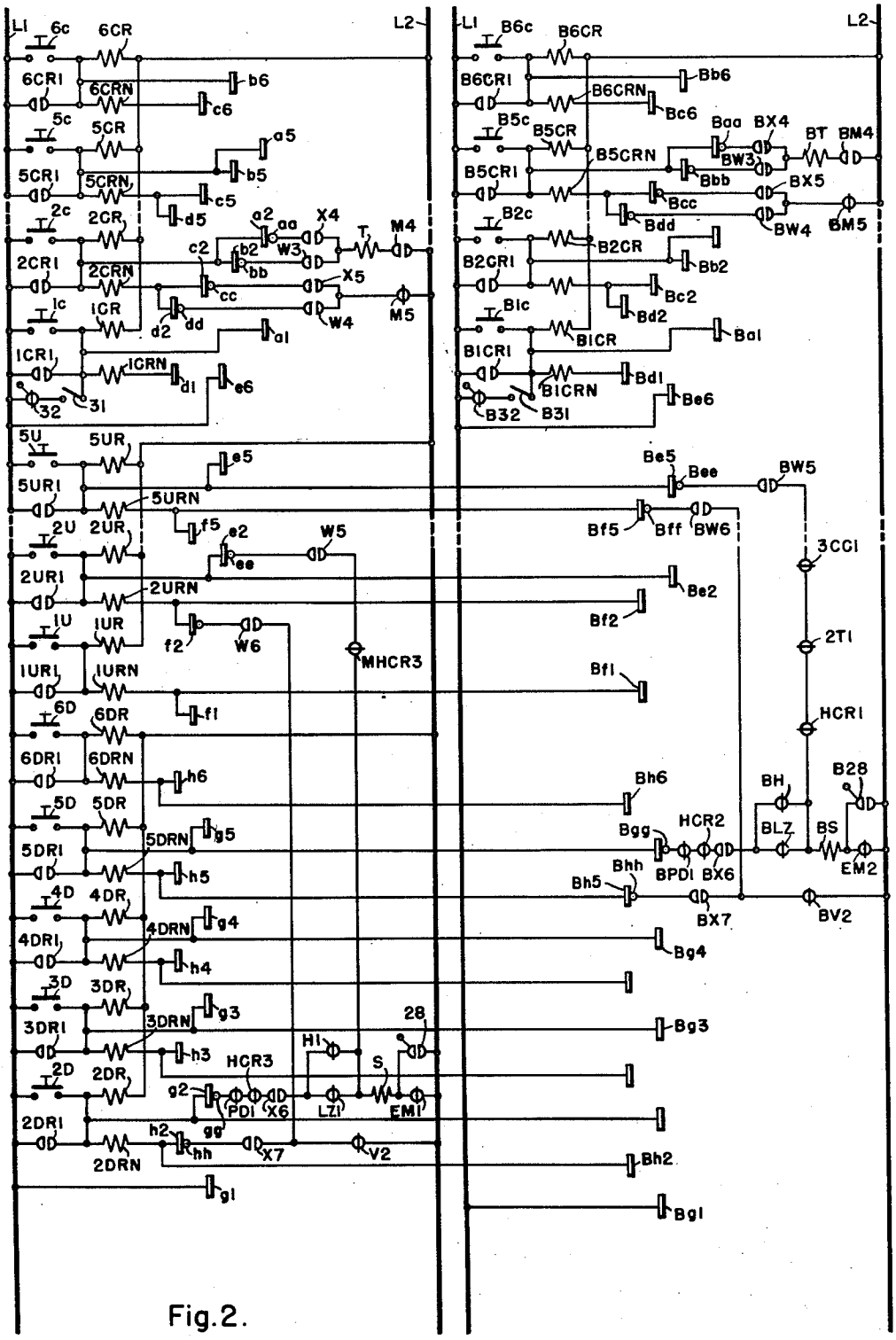


Fig.2.

ELEVATOR SYSTEMS

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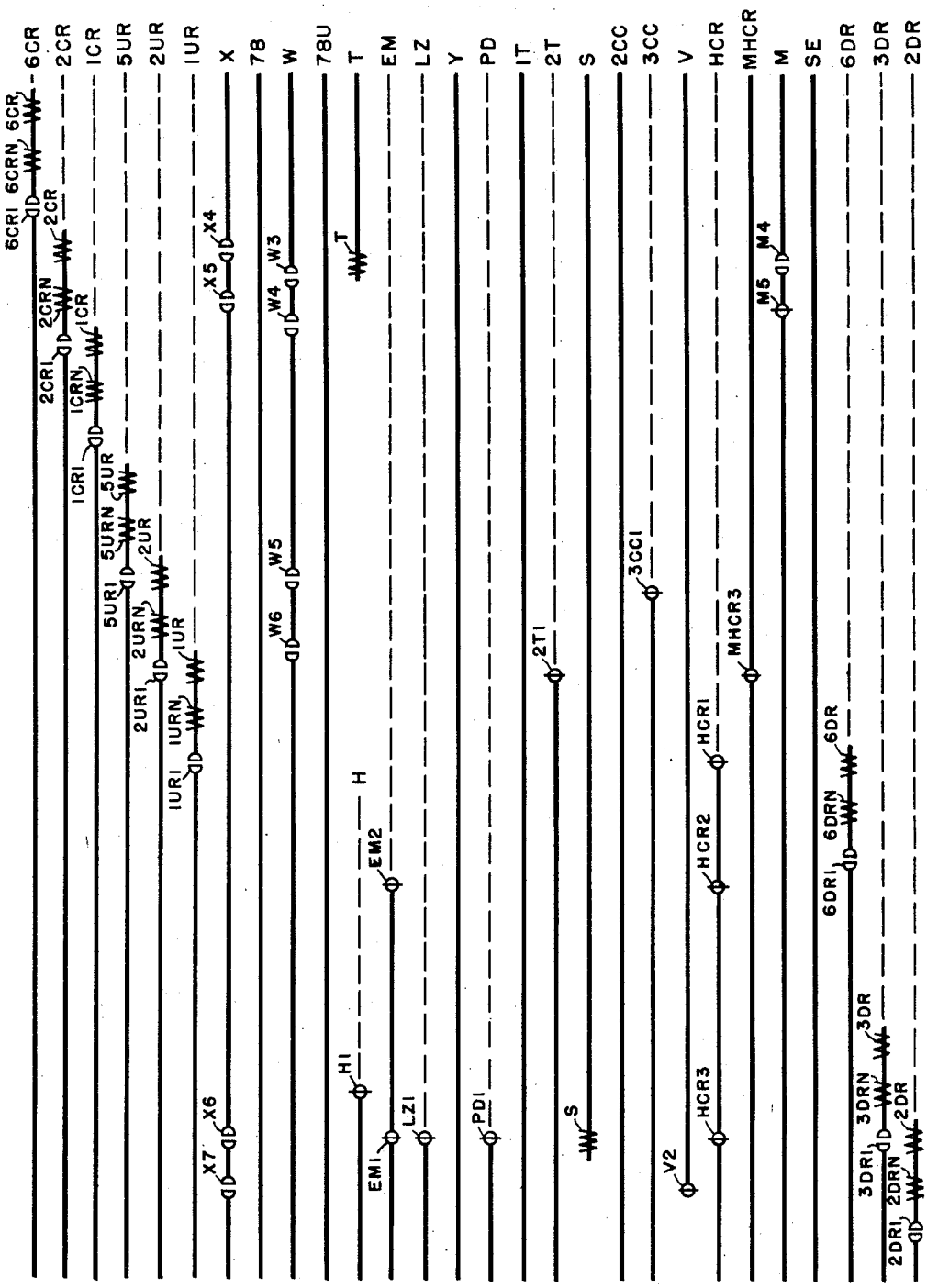


Fig. 2A.

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ELEVATOR SYSTEMS

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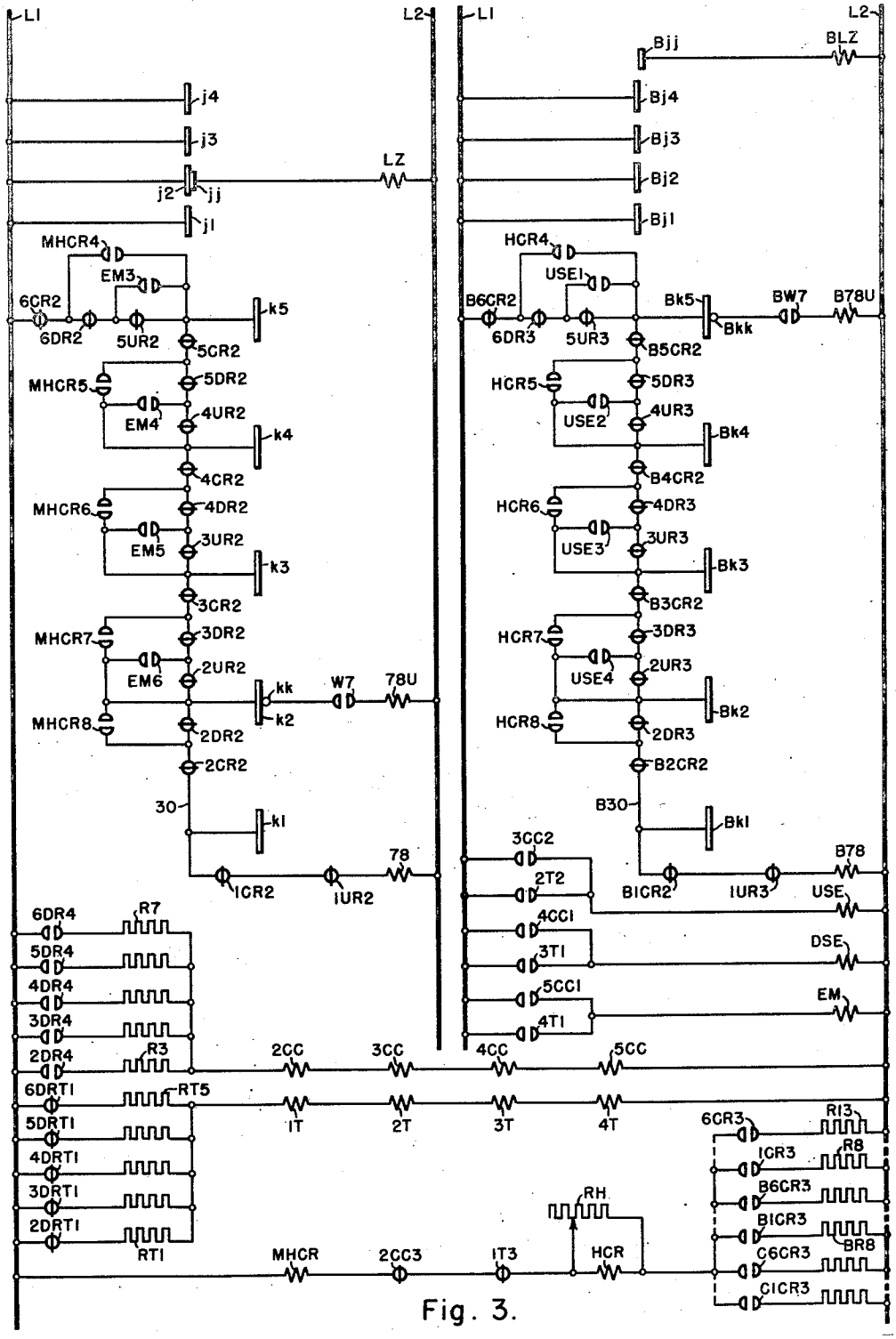


Fig. 3.

ELEVATOR SYSTEMS

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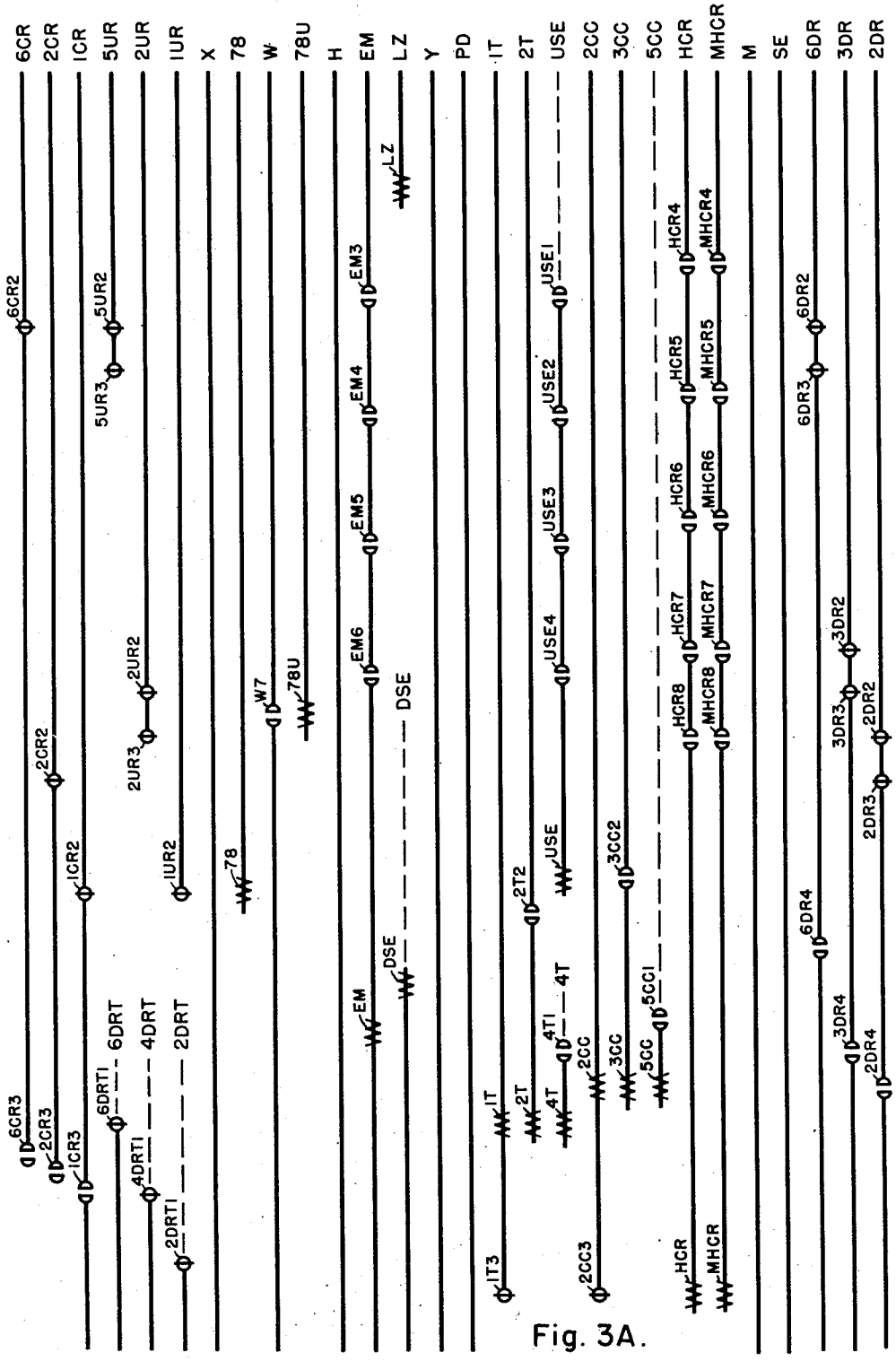


Fig. 3A.

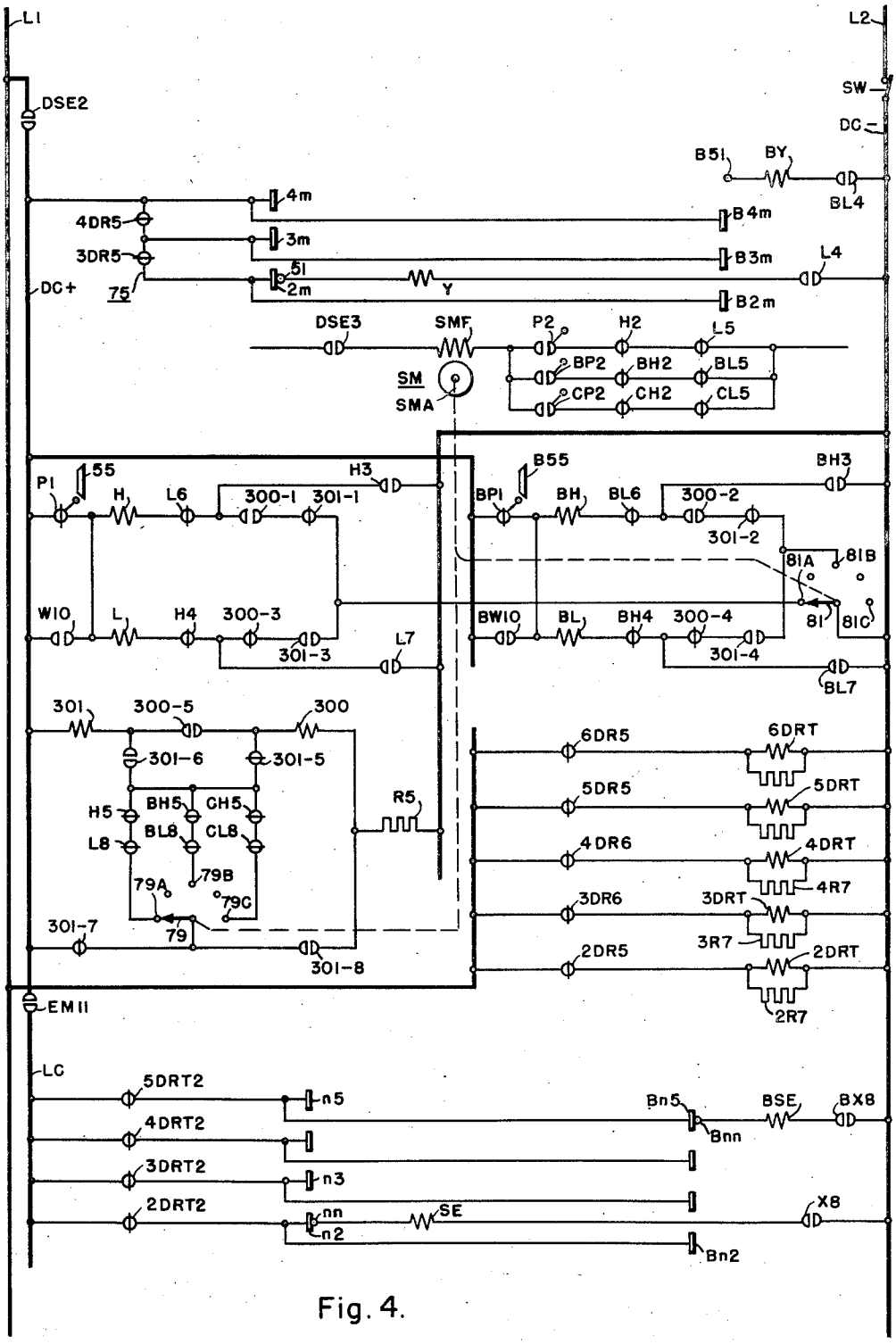

L1
L2
DSE2
SW
DC
B51
BY
BL4
4m
4DR5
B4m
3m
3DR5
B3m
L4
51
DC+
75
2m
Y
B2m
DSE3
SMF
P2
H2
L5
BP2
BH2
BL5
SM
SMA
CP2
CH2
CL5
P1
55
H3
B55
BH3
H
L6
300-1
301-1
BP1
BH
BL6
300-2
301-2
81A
81B
81
81C
W10
L
H4
300-3
301-3
L7
BW10
BL
BH4
300-4
301-4
BL7
301
300-5
300
301-6
301-5
R5
H5
BH5
CH5
L8
BL8
CL8
79A
79B
79C
79
301-7
301-8
6DR5
6DRT
5DR5
5DRT
4DR6
4DRT
4R7
3DR6
3DRT
3R7
2DR5
2DRT
2R7
EM11
LC
5DRT2
n5
Bn5
BSE
BX8
4DRT2
Bnn
3DRT2
n3
2DRT2
nn
SE
X8
n2
Bn2

Fig. 4.

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ELEVATOR SYSTEMS

Filed July 15, 1954 10 Sheets-Sheet 8

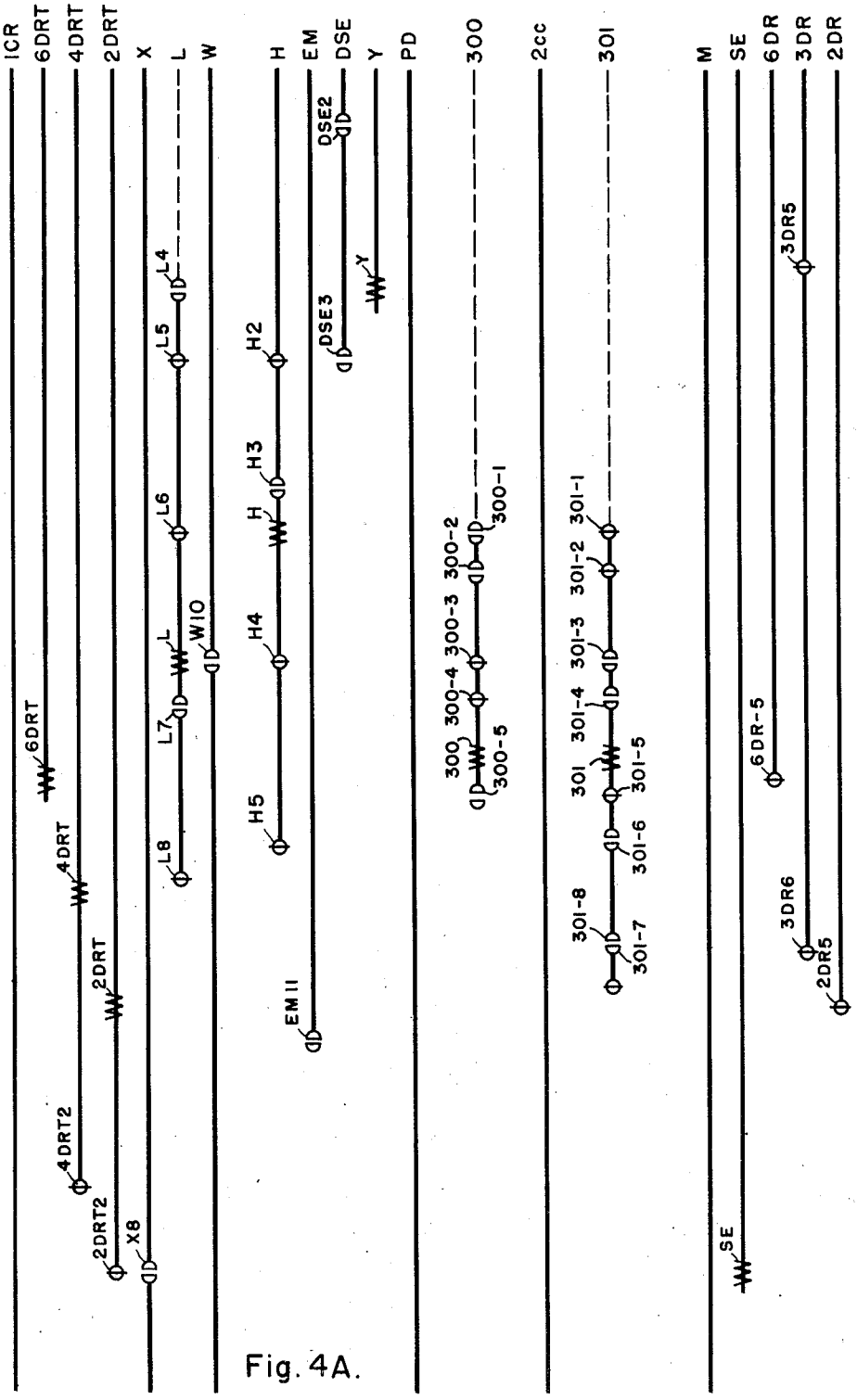


Fig. 4A.

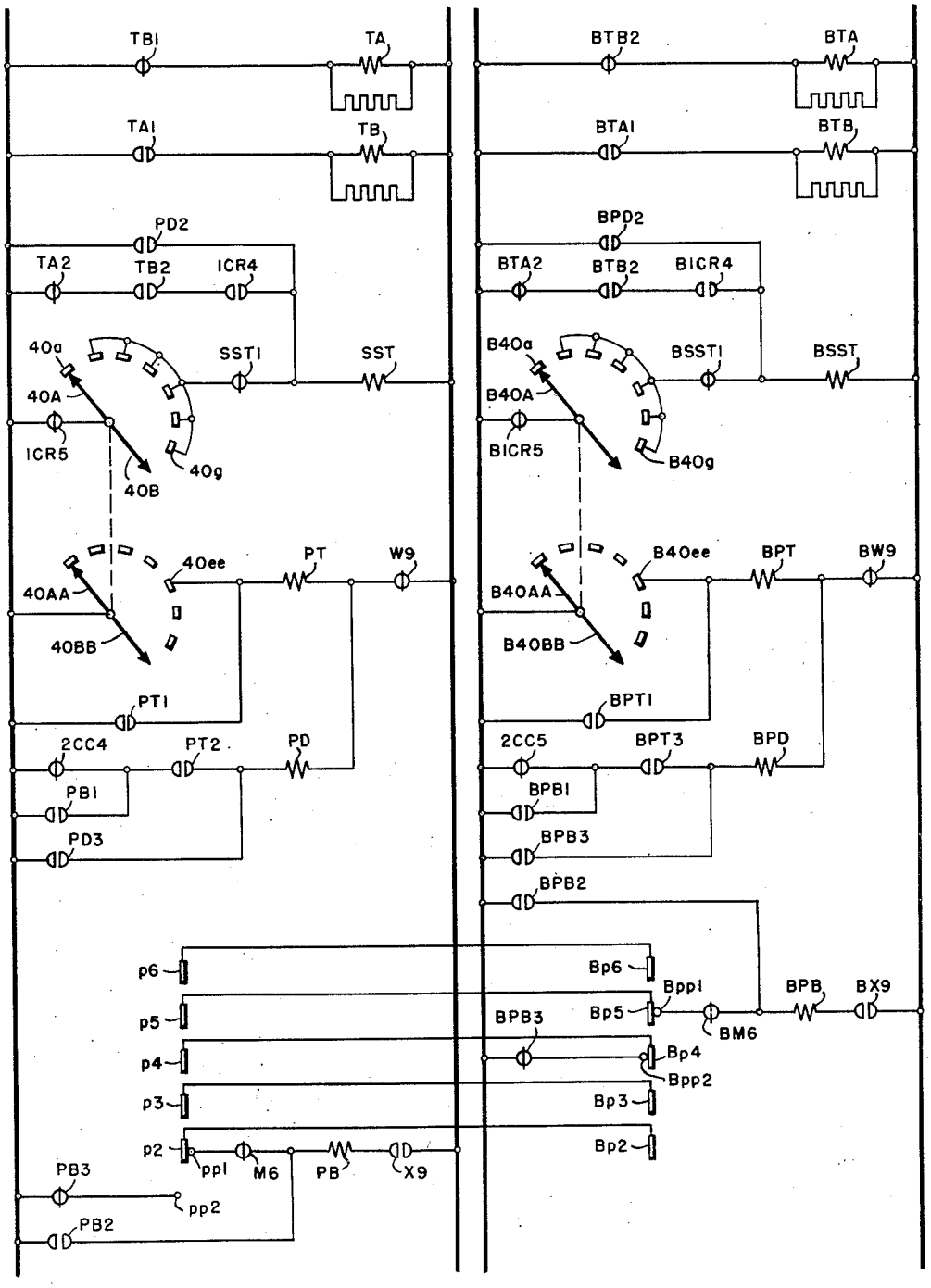

TBI
TA
TAI
TB
PD2
TA2
TB2
ICR4
40a
SSTI
SST
40A
ICR5
40B
40g
40AA
40ee
PT
W9
40BB
PTI
2CC4
PT2
PD
PBI
PD3
p6
p5
p4
p3
p2
PB3
pp2
PB2
ppI
M6
PB
X9
BTB2
BTA
BTAI
BTB
BPD2
BTA2
BTB2
BICR4
B40a
BSSTI
BSST
B40A
BICR5
B40g
B40AA
B40ee
BPT
BW9
B40BB
BPTI
2CC5
BPT3
BPD
BPBI
BPB3
BPB2
Bp6
Bppl
BPB
BX9
Bp5
BM6
Bp4
Bpp2
Bp3
Bp2

Fig. 5.

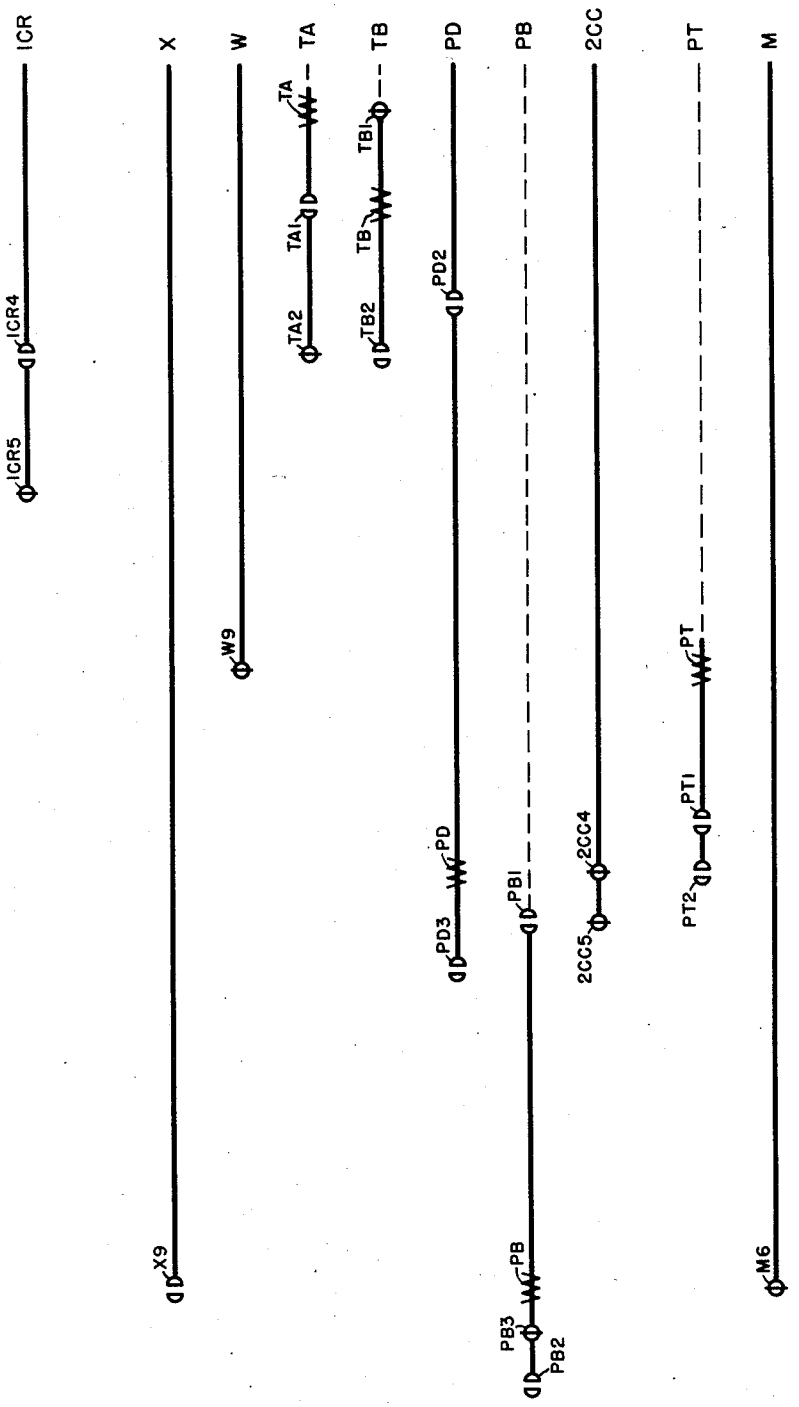

ICR
X
W
TA
TB
PD
PB
2CC
PT
M
ICR4
ICR5
TA
TA1
TA2
TB1
TB2
PD2
W9
PD
PD3
PB1
2CC4
2CC5
PT
PT1
PT2
X9
PB
PB3
PB2
M6

Fig. 5A.

United States Patent Office 2,795,295 Patented June 11, 1957

2,795,295

ELEVATOR SYSTEMS

William F. Eames, Westfield, N. J., assignor to Westinghouse Electric Corporation, East Pittsburgh, Pa., a corporation of Pennsylvania

Application July 15, 1954, Serial No. 443,618

45 Claims. (Cl. 187—29)

This invention relates to elevator systems which are automatically modified to provide different modes of operation and it has particular relation to elevator systems having graduated responses to graduated variations in service demand.

It is well known that the demand for service from an elevator system in the average building varies appreciably throughout the day. For example, during the night in an office building the elevator system usually is required to provide very little service. This period is referred to as an "off-hours" period of operation.

At the start of a business day a substantial demand for service in the up direction from the lower terminal floor occurs. This period is known as an "up-peak" period. A similar period often occurs immediately following the lunch hour.

Immediately prior to the lunch hour and after the close of the business day a peak demand for down service generally is encountered. Such periods are designated "down-peak" periods.

During the remainder of the business day the demand for elevator service in the two directions of travel is substantially balanced. Such periods are known as "off-peak" periods.

In accordance with the invention an elevator system is provided with a gradual change in the mode of operation to accommodate a gradual change in the service demand. The gradual change in the mode of operation may be effected by computing or selecting means such as a time clock which provides each mode of operation at the desired time of the business day. However, in a preferred embodiment of the invention the variation in the mode of operation is effected in response to the demand for elevator service.

Thus in response to a gradual increase in the demand for down elevator service the carrying capacity of the elevator system in the down direction is gradually increased. This increase may be at the expense of the service in the up direction. However, during the down-peak periods the demand for up service is generally small. Consequently, the invention provides increased efficiency in the overall performance of the elevator system.

Although aspects of the invention are applicable to elevator systems employing only a single car, the invention is particularly suitable for systems employing a plurality of elevator cars and will be discussed with reference to a multiple car elevator system. For purposes of illustration it will be assumed that during off-peak periods the elevator system is conditioned to operate each elevator car on through trips between terminal floors or landings.

In order to determine the extent of the need for elevator service in a given direction suitable computing mechanism is provided. For example, the demand in the down direction may be determined by the number of down floor calls or by the number of priority down floor calls. A priority down floor call is a down floor call which for some reason is entitled to greater weight than

other down floor calls. For example, a down floor call which has been registered for more than a predetermined time such as 40 seconds may be considered to be a priority down floor call. Alternatively a call from a certain floor may be considered to be a priority down floor call.

In response to a small demand for service in the down direction as represented by a small number of down floor calls or a small number of priority down floor calls, the elevator cars of the system may be arranged to reverse when traveling in the up direction at the highest floor or landing for which a call is registered provided the call is not an up floor call.

If the demand for service in the down direction increases to what may be termed a moderate demand as represented by a somewhat larger number of registered down floor calls or priority down floor calls, certain or all of the elevator cars of the bank may be prevented from responding to up floor calls.

If the demand for elevator service in the down direction increases still further to what may be termed a heavy demand, the carrying capacity of the elevator system in the down direction may be still further increased. For example, the floors served by the elevator cars may be divided into zones and certain elevator cars may be assigned to serve each of the zones of floors.

As a final example, if the demand for service in the down direction increases to what may be termed an extreme demand, the elevator cars may be assigned to respond only to priority calls.

From the foregoing discussion it is clear that as the demand for elevator service in one direction gradually increases, the capacity of the elevator to provide such service is gradually increased. In the preferred embodiment of the invention the reverse is also true. As the demand for elevator service in the given direction decreases, the capacity of the elevator system to provide such service is gradually decreased.

The operation of an elevator system during an up-peak period now will be considered. This demand is computed by measuring a function of the registered car calls. For example, if the registered car calls exceed a predetermined number, the carrying capacity of the elevator system in the up direction may be automatically increased by assigning part of the elevator cars during up travel to reverse at the farthest floor in the up direction for which a call is registered. Such cars may be prevented from responding to up floor calls. If the registered car calls exceed a predetermined larger number all of the elevator cars may be assigned to reverse at the highest floor for which a car call is registered and the elevator cars may be prevented from responding to all floor calls.

If an elevator car makes a large number of stops during a trip between terminal floors, the elevator car may be substantially delayed in reaching its destination and passengers within the elevator car may complain of the slow service. In accordance with the invention the movement of the elevator car may be expedited under such conditions.

If the elevator car is traveling towards the lower terminal floor, the delay may be measured conveniently by computing the duration of registration of a car call for the lower terminal. If this duration exceeds a predetermined value, the movement of the elevator car may be expedited by preventing it from responding to registered down floor calls. If desired, such bypassing may be permitted only if the registered down floor calls are below a certain number. The bypassing also may be permitted if the duration of the car call for the lower terminal floor exceeds a predetermined value and the elevator car is passed by another elevator car traveling

in the down direction even though a large number of down floor calls may be registered.

It is therefore an object of the invention to provide an elevator system wherein the capacity of the elevator system to handle traffic in a predetermined direction is gradually increased in response to predetermined conditions.

It is a further object of the invention to provide an elevator system wherein the capacity of the elevator system to handle traffic in a predetermined direction is gradually increased in response to a gradual increase in the demand for elevator service in such direction.

It is an additional object of the invention to provide an elevator system wherein the mode of operation of the elevator system is responsive to registered car calls.

It is another object of the invention to provide an elevator system wherein movement of an elevator car is expedited in response to failure of the elevator car to deliver passengers with reasonable promptness.

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 to 5 are schematic views with circuits shown in straight-line form of further portions of the elevator system illustrated in Fig. 1; and

Figs. 1A to 5A, respectively are key representations of relays and switches illustrated in Figs. 1 to 5. If Figs. 1A to 5A are horizontally aligned respectively with Figs. 1 to 5, 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 cases involving groups of similar relays only representative relays are shown in the key representations.

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 three elevator cars serving a structure having six floors or landings. The elevator cars are designated by the reference supporters A, B and C. Inasmuch as the circuits associated with the three elevator cars are similar, it will suffice to show primarily the circuits associated with the elevator cars A and B. However certain components associated with the elevator car C also will be referred to.

Because of the similarity of the circuits and components associated with the three elevator cars, compenents associated with the elevator cars B and C will be identified by the same reference characters employed for the components associated with the elevator car A preceded by the appropriate letter B or C. For example, the resistors **R8**, **BR8** and **CR8** are associated respectively with the elevator cars A, B and C. Consequently the discussion will be directed primarily to the elevator car A and its circuits.

Relays and 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.

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 the drawings all relays are shown deenergized.

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

E—Inductor slowdown relay
F—Inductor stopping relay
V—Speed relay
U—Up switch
M—Running relay
D—Down switch
G—Holding relay
W—Up preference relay
X—Down preference relay
70T—Non-interference relay
DR—Door relay
HC—High call reversal relay
1CR to 6CR—Car call registering relays
T—Car call stopping relay
78U—Call-above relay
S—Floor call stopping relay
78—Call relay
Q—Quota relay
LZ—Zone relay
H—High-zone car relay
L—Low-zone car relay
SE—Timed floor call stopping relay
J—Reversal relay
PD—Pass relay
SST—Stop time relay
APB—Relative position relay
TA—First timing relay
TB—Second timing relay

APPARATUS COMMON TO ALL CARS

1UR to 5UR—Up floor call registering relays
2DR to 6DR—Down floor call registering relays
HCM—Bank high call reversal relay
DSE—First down service demand relay
EM—Second down service demand relay
2CC, 3CC, 4CC, 5CC—Down call quota relays
1T, 2T, 3T, 4T—Timed call relays
HCR—Second car-call quota relay
MHCR—First car-call quota relay
300—First selection relay
301—Second selection relay
2DRT to 6DRT—Floor-call timing relays
USE—Modifying relay

Figure 1

Fig. 1 shows the elevator cars A and B and certain control circuits associated therewith. The elevator car A will be assumed to be stopped at the second floor of the structure whereas the elevator car B 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. Circuits for the elevator A are shown in the left-hand column of Fig. 1.

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 direct-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 **1***c* to **6***c* 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 prospective 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.

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 initial energization of the winding of the relay alone does not initially open 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. The inductor relay may be of the type which when it opens the contacts maintains the contacts open until the relay winding is deenergized even though the relay passes beyond the inductor plate. 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. 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.

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 *a*1 to *a*5 and *d*1 to *d*5 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 *a*3 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 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 VI of a speed relay for full speed operation of the elevator car.

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 slow-down 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.

Assuming that the foregoing contacts 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, 70T1, 78—1, 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, 70T1, 78—1, 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.

If the elevator car A is to be operated by a car attendant the contacts 78—1 and 70T1 may be replaced by a manually-operated switch which is closed by the car attendant when the car is to be moved from a floor at which it is stopped. However in a preferred embodiment of the invention the automatically-operated contacts 78—1 and 70T1 are employed.

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 energizing circuit for these relays E, F and G, one of the following 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 J1 are closed to indicate that the elevator car A is conditioned to reverse at the next floor reached by the elevator car. 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. Fourth, the contacts SE1 are closed to indicate that the elevator car A is approaching a floor for which a priority floor call has been registered for a long period of time.

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 energized). 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 J2 which are closed when the elevator car A is not conditioned to reverse at the nearest floor in its direction of travel. 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 dropout. This delay may be provided in any suitable manner as by connecting a resistor R2 across the relay coil. The time delay in dropout 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.

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 is open, the contacts associated therewith are also open to prevent energization of the door relay DR.

Energization of the high call reversal relay J prepares the elevator car A to reverse during up travel at the nearest floor. The high call reversal relay J may be energized if the elevator car A is conditioned for up travel (break contacts X3 are closed) and if certain other conditions are satisfied.

Thus, if at least a predetermined number of priority down floor calls are registered, make contacts 1T1 are closed. If at least a predetermined number of down floor calls are registered, make contacts 2CC1 are closed, or if at least a predetermined number of car calls are registered for the system, the make contacts MHCR1 are closed. If in addition to one of these closures the make contacts 78U1 are closed to indicate no higher calls remain to be answered (in some cases no higher car calls), the energizing circuit for the reversal relay J may be completed.

If the elevator car A is assigned to reverse at the highest down floor call in a low zone of floors, the make contacts Y1 are closed to complete with the contacts X3 an energizing circuit for the relay J which establishes a holding circuit through the contacts X3 and J3.

Figure 2

Figure 2 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 this figure.

It will be recalled that the elevator car A is provided with a plurality of push buttons 1*c* to 6*c* for the purpose of registering car calls. Inasmuch as car call push buttons and associated circuits for the intermediate floors are similar, they are not illustrated in Fig. 2 for the third and fourth floors. Each of these push buttons has associated therewith a car call registering relay 1CR to 6CR respectively. In this group only representative relays 6CR, 2CR and 1CR are shown in Figs. 2A and 3A. 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 *a*1 to *a*5 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 *b*2 to *b*6 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 *c*2 to *c*6 and a brush *dd* cooperates with a row of contact segments *d*1 to *d*5 for the purpose of cancelling

registered car calls as they are answered respectively 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 *a*1 designates the contact segment for the first floor in the *a* row.

By reference to Fig. 2, it will be observed that when the car call push button 5*c* 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 *a*5 and *b*5 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 *a*5 to complete the following circuit for the car call stopping relay T:

L1, 5CR1, *a*5, *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 *c*5 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 cancelling circuit:

L1, 5CR1, 5CRN, *c*5, *cc*, X5, M5, L2

The operating coil of the registering relay 5CR and the cancelling coil 5CRN are wound in opposition on a common core. Consequently, energization of the cancelling 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 *a*5, however, the brush *cc* remains in engagement with the associated contact segment *c*5 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 contacts W3 and W4 of the up preference relay are closed. As the elevator car A nears the fifth floor, the brush *bb* engages the contact segment *b*5 to complete the following circuit:

L1, 5CR1, *b*5, *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 *dd* engages the contact segment *d*5 to complete the following circuit:

L1, 5CR1, 5CRN, *d*5, *dd*, W4, M5, L2

The energization of the cancelling coil 5CRN resets the call registering relay 5CR. During the stopping operation, the brush *bb* preferably passes slightly above the associated contact segment *b*5 whereas the brush *dd* remains in engagement with the associated contact segment *d*5 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. 2 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, contact segments for the sixth floor need not be provided in the *a* and *d* rows. By reference to Fig. 2 it will be noted that only contact segments *b*6 and *c*6 are provided for the sixth 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, contact segments for the first floor need not be provided in the *b* and *c* rows. For this reason, in the car call registering circuits only contact segments *a*1 and *d*1 are illustrated for the first floor.

The central part of Fig. 2 illustrates up floor call registering circuits. These circuits are operated by means of normally-open push buttons 1U to 5U common to all of the elevator cars which are located respectively at the first to fifth floors. Inasmuch as the push buttons and associated circuits for the intermediate floors are similar, they are not shown for the third and fourth 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 *e*1 to *e*6, respectively for the first to sixth floors, is provided for the elevator car A and cooperate with a brush *ee*. A brush *ff* cooperates with a row of contact segments *f*1 to *f*5, respectively for the first to fifth floors 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 MHCR3 (Fig. 2) of the first car-call quota relay MHCR are closed. (Although the elevator car B may employ similar contacts of the relay MHCR, in the embodiment illustrated the elevator car B does not employ such contacts but instead employs in the corresponding circuit break contacts HCR1 of a second car-call quota relay HCR. In addition, the elevator car B circuit includes break contacts 3CC1 of a down call quota relay 3CC and break contacts 2T1 of a timed call relay 2T.) It is assumed that break contacts EM1 of the second down service demand relay EM are closed. As the elevator car A nears the fifth floor, the brush *ee* engages the contact segment *e*5 to complete the following circuit:

L1, 5UR1, *e*5, *ee*, W5, MHCR3, S, EM1, L2

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 *f*5. As slow down of the elevator car is initiated, the break contacts V6 close to complete the following cancelling circuit:

L1, 5UR1, 5URN, *f*5, *ff*, W6, V2, L2

This resets the up floor car registering relay 5UR. As the elevator car A comes to a stop, the brush *ee* preferably passes slightly above the contact segment *e*5. However, the brush *ff* remains in engagement with the contact segment *f*5 as long as the elevator car A remains at the fifth floor. By inspection of Fig. 2, it will be observed that the contact segment *e*5 is connected to the corresponding contact segments for the other elevator cars in the bank (such as contact segment B*e*5 for the elevator car B). Similarly, the contact segment *f*5 is connected to corresponding contact segments (such as the contact segment B*f*5) 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.

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.

During up travel, the elevator cars also stop at the sixth floor if they reach such floor. For this reason, a single contact segment *e*6 suffices for the sixth floor and is permanently connected to the bus L1. 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 for the second to sixth floors, respectively which have associated therewith down floor call registering relays 2DR to 6DR and cancelling coils 2DRN to 6DRN. Each push button cooperates with its call registering relay and its cancelling coil in the manner discussed with reference to the up floor call push buttons. Only relays 2DR, 3DR and 6 DR in this group are shown in Figs. 2A, 3A and 4A.

For the elevator car A, a row of contact segments *g*1 to *g*5 cooperates with a brush *gg* and a row of contact segments *h*2 to *h*6 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. It will be assumed the brake contacts PD1, HCR3, H1, LZ1 and EM1 are closed.

As the elevator car A nears the fifth floor, the brush *gg* engages the contact segment *g*5 to complete the following circuit:

L1, 5DR1, *g*5, *gg*, PD1, HCR3, X6, H1 and LZ1 *in* parallel, S, EM1, L2

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 *h*5. The initiation of slow down of the elevator car A results in closure of the break contacts V2 to complete the following cancelling circuit:

L1, 5DR1, 5DRN, *h*5, *hh*, X7, V2, L2

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 *g*5, but the brush *hh* remains in engagement with the associated contact segment *h*5.

The contact segment *g*5 is connected to corresponding contact segments (such as the contact segment B*g*5) of the remaining cars. Similarly, the contact segment *h*5 is connected to the corresponding contact segments (such as the contact segment B*h*5) 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. Since the elevator car A always stops at the lower terminal floor, a single first floor contact segment *g*1 may be provided for the elevator car A and this contact segment may be permanently connected to the bus L1.

A normally-open mechanical switch 28 may be cam-operated to closed position as the elevator car A approaches the upper and lower terminal floors to shunt the contacts EM1.

Figure 3

As shown in Fig. 3, the presence of the elevator car A in a low zone of floors is determined by a zone relay LZ which is connected between a brush *jj* and the bus L2. The brush coacts with contact segments *j*1 to *j*4 for the first to fourth floors which constitute a low zone. These contact segments are located on the floor selector. The brush *jj* has a length sufficient to bridge adjacent contact segments.

In Fig. 3, a call circuit 30 for car A 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 the highest floor for which a down floor call on a car call is registered provided no up floor call is registered for such floor or a higher floor.

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 buttons the relay 78 is deenergized.

The call circuit 30 has associated therewith a row of contact segments *k*1 to *k*5 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 *k*5 is connected to the call circuit between the contacts 5UR2 and 5CR2. The contact segment *k*4 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.

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 of the first car-call quota relay MHCR are provided for the purpose of shunting the break contacts of the floor call relays. When the relay MHCR is energized, the contacts MHCR4 to MHCR8 close to shunt contacts 5UR2 to 2UR2 and 6DR2 to 2DR2.

Although contacts of the relay MHCR similarly may be associated with the call circuit B30 for the elevator car B, in a preferred embodiment of the invention a separate relay HCR has make contacts HCR4 to HCR8 associated with the call circuit B30 to shunt contacts 5UR3 to 2UR3 and 6DR3 to 2DR3, as clearly shown in Fig. 3.

Make contacts EM3 to EM6 and USE1 to USE8 are arranged to shunt contacts of the up floor call registering relays in the call circuits 30 and B30 for floors above the first floor.

The down call quota relays 2CC to 5CC indicate the presence of predetermined service demands. As shown in Fig. 3, the quota relays preferably are energized in ac-

cordance with the number of registered down floor calls. The energization of the relays is dependent on the condition of a parallel circuit having five parallel arms. Each arm contains a suitable resistor and a set of make contacts of a separate one of the down floor call registering relays. The resistors are so proportioned that a predetermined number of down floor calls must be registered before the relays will pick up.

The number of calls to which the down call quota relays respond depends on the number of floors of the elevator system, the number of elevator cars and other factors of the particular installation. For present purposes it will suffice to assume that the relays 2CC, 3CC, 4CC and 5CC pick up respectively in response to registration of two, three, four and five down floor calls.

The timed call relays 1T, 2T, 3T and 4T compute the number of registered down floor calls which have been registered for more than a predetermined time. To this end the relays are energized through a parallel circuit having five parallel arms. Each of the arms includes a set of break contacts 2DRT1 to 6DRT1. These contacts close respectively when down floor calls have been registered respectively at the second to sixth floors for more than a predetermined time.

The resistors RT1 to RT5 in the parallel circuit and the timed call relays 1T to 4T are so selected that each of the time call relays picks up in response to registration of at least a predetermined number of down floor calls for more than a predetermined time. For present purposes, it will suffice to assume that the relay 1T picks up if one or more down floor calls has been registered for more than the predetermined time. The relay 2T picks up only if it is energized through two or more of the resistors RT1 to RT5 to indicate that two or more timed out or priority down floor calls are registered. In an analogous manner the relays 3T and 4T pick up in response to the presence of at least respectively three and four timed out or priority down floor calls.

The down call quota relays 2CC to 5CC and the timed call relays 1T to 4T are employed for computing the demand for elevator service in the down direction and for controlling the operation of the elevator system in accordance with such demand. It will be recalled that closure of the make contacts 1T1 or 2CC1 (Fig. 1) prepares the reversal relay J for energization as the elevator car A when traveling up approaches the farthest floor for which a call is registered provided such call is not an up floor call. In Fig. 2 opening of either the break contacts 2T1 or the break contacts 3CC1 prevents response of the elevator car B to up floor calls. In Fig. 3 closure of the make contacts 2T2 or 3CC2 energizes the modifying relay USE.

The pickup of the down call quota relay 4CC or of the timed call relay 3T indicates a still further increase in the demand for down service. The pickup of either of these relays is accompanied by closure of the make contacts 4CC1 or 3T1 to energize the first down service relay DSE (Fig. 3). As will be pointed out in connection with Fig. 4 the energization of this relay increases the capacity of the elevator system to handle down traffic.

A still further increase in the demand for down service is accompanied by pickup of the down call quota relay 5CC or of the timed call relay 4T. Pickup of either of these relays is accompanied by closure of the make contacts 5CC1 or 4T1 to energize a second down service demand relay EM. Pickup of this relay results in opening of the break contacts EM1 (Fig. 2) and similar contacts for the other elevator cars of the system to prevent energization of the floor call stopping relays. As will be pointed out in the discussion of Fig. 4, during the energization of the second down service demand relay EM the elevator cars can respond to down floor calls only if such calls have been registered for more than a predetermined time.

The performance of the elevator system also is controlled by the first car call quota relay MHCR (Fig. 3) and the second car call quota relay HCR. These relays are connected in series with each other and in series with break contacts 2CC3 and 1T3 for energization through a parallel circuit containing a plurality of arms. Each of the arms includes a set of make contacts of a separate one of the car call registering relays and a resistor. In order to conserve space only two arms are illustrated for each of the elevator cars A, B and C. Thus for the elevator car A one of the arms contains break contacts 1CR3 and a resistor R8. A second arm contains break contacts 6CR3 and a resistor R13. It will be understood that a similar arm is provided for each of the car call registering relays associated with each of the elevator cars.

The first car call quota relay MHCR is designed to pick up when energized through at least a predetermined number of the parallel arms of its energizing circuit. For present purposes it will be assumed that this relay is picked up only if energized through at least three arms of the parallel circuit.

The second car call quota relay HCR is designed to pick up when energized through a larger number of arms of the parallel circuit. For the purpose of discussion it will be assumed that this relay is designed to pick up only if energized by at least six arms of the parallel circuit. The pickup point of either of the relays may be adjusted in any suitable manner as by connecting an adjustable resistor thereacross. As a specific example, an adjustable resistor RH is illustrated in parallel with the second car call quota relay HCR.

If desired, each of the parallel arms through which the relays HCR and MHCR are energized may include make contacts of the up preference relay for the associated elevator car. If such an expedient is adopted, the relays are energized in accordance with the number of car calls registered by passengers desiring to travel in the up direction. However for present purposes it will be assumed that such contacts of up preference relays are not employed.

Figure 4

Fig. 4 shows circuits for the auxiliary high floor-call relay Y which controls reversal of an elevator car A when it is assigned to the low zone. In addition, Fig. 4 shows circuits for the high zone car relay H which assigns the elevator car A to the high zone and for the low zone car relay L which assigns the car A to the low zone. These relays are controlled by a first selection relay 300 and a second selection relay 301 which are common to all of the elevator cars.

The transfer of the elevator system to down peak operation is initiated by closure of make contacts DSE2 and DSE3 of the down service relay DSE (Fig. 3) which is common to all of the cars.

Referring to the auxiliary high floor-call relay Y in greater detail, it will be noted that this relay is connected between the brush 51 and the bus DC— only when the make contacts L4 of the low zone car relay are closed (such closure indicates that the elevator car A is assigned to the low zone). The buses DC+ and DC— are connected respectively to the buses L1 and L2 when the contacts DSE3 and a manual switch SW are closed.

The contact segments 2*m* to 4*m* are associated with a low-zone high down floor-call circuit 75. The circuit 75 includes break contacts of the down floor-call registering relays for the low-zone floors above the second floor arranged in the order of the floors. The circuit 75 has one terminal connected to the bus DC+.

The contact segments 2*m* to 4*m* of the low zone floors are connected to the circuit 75 in such a way that the break contacts of the floor registering relays requiring further travel of the elevator car in the up direction are located between the contact segment and the bus DC+. Thus, all of the break contacts are located between the contact segment 2*m* and the bus DC+. As a further

example, the contact segment 3*m* is connected between the break contacts 3DR5 and 4DR5. This means that the only contacts 4DR5 requiring travel of the elevator car above the third floor are between the contacts 3*m* and the bus DC+. Since the fourth floor is assumed to be the top floor of the low zone, the contact segment 4*m* for the fourth floor is connected directly to the bus DC+.

When the down service relay DSE operates to place the system on down peak operation, its make contacts DSE3 close to prepare a motor SM for operation. This motor may be of any desired type. For example, it may be a stepping relay which has a plurality of commutator switches. In the present embodiment it will be assumed that the motor SM is an alternating-current motor having an armature SMA and a field winding SMF. When this motor is energized, it rotates a commutating movable contact 79 to engage successively contacts 79A, 79B and 79C. One of these contacts is provided for each of the elevator cars of the bank. For present purposes, it will be assumed that elevator cars A, B and C are in the bank and that the three contacts 79A, 79B and 79C are associated therewith.

The motor SM also operates a movable contact 81 which similarly is associated with contacts 81A, 81B and 81C.

The energization of the motor SM may be completed through any one of the three parallel circuits, one for each of the elevator cars. Thus, if the elevator car A is not assigned to the low zone, the break contacts L5 are closed. If the elevator car A is not assigned to the high zone, the break contacts H2 are closed. When the elevator car A in its down trip reaches a point such as 5 feet below the second floor, the mechanical switch P2 is closed to complete an energizing circuit for the motor SM through the contacts DSE3. Each of the three elevator cars A, B and C may similarly control the energization of the motor SM. The motor SM and associated circuits select the order in which the elevator cars are assigned to the high and low zones.

Assignments of the elevator cars to the high zone or to the low zone are cancelled upon arrival of the elevator cars at a predetermined point such as adjacent the second floor carrying down travel. At this point the mechanical switch P1 is opened by its cam 55 to terminate any assignment of the associated elevator car A. The mechanical switch recloses subsequently such as at a point 5 feet below the second floor to prepare the high-zone car relay H and the low-zone car relay L for subsequent energization. At the same time the motor SM starts to advance or move the movable contacts 79 and 81 for the purpose of "finding" an elevator car ready for assignment.

The movable contact 81 controls, in part, the energization of the selection relays 300 and 301. If the make contacts 300—1 and the break contacts 301—1 of these relays are closed, and if the movable contact 81 is in engagement with the fixed contact 81A, the high-zone car relay H will be energized and will establish a holding circuit for itself through its make contacts H3.

On the other hand, if the break contacts 300—3 and the make contacts 301—3 are closed at the time the movable contact 81 engages the fixed contact 81A, an energizing circuit is established for a low-zone car relay L and this relay establishes a holding circuit for itself through its make contacts L7.

When the elevator car A reaches the lower terminal floor, the make contacts W10 of the up preference relay close to maintain the energization of either of the relays H or L despite subsequent opening of the mechanical switch P1.

The selection relays 300 and 301 are employed for the purpose of assigning the elevator cars in a predetermined sequence to the high and low zones. In the present case, successive elevator cars available for assignment are assigned alternately to the high and low zones of floors.

Let it be assumed initially that the selection relays 300 and 301 are deenergized. As the elevator car A nears the lower terminal floor and is made available for assignment to one of the zones of floors, the motor SM operates the movable contact 79 to scan the fixed contacts associated therewith. When the movable contact 79 engages the contact 79A associated with the car A, the following energizing circuit for the first selection relay 300 is established:

DC+, 301—7, 79, 79A, L8, H5, 301—5, 300, R5, DC—

The resistor R5 limits the flow of current under certain conditions wherein the resistance of associated parts of the circuit is reduced.

As a result of its energization, the first selection relay 300 closes its make contacts 300—1 to establish an energizing circuit for the high-zone car relay H. This assigns the car A to the high zone.

At the same time, the relay 300 closes its make contacts 300—5 to establish an energizing circuit for the second selection relay 301 as follows:

DC+, 301, 300—5, 300, R5, DC—

The high zone car relay H is conditioned to operate slightly in advance of the relay 301 and opens its break contacts H5 to isolate the relays 300 and 301 from the movable contact 79.

Let it be assumed next that the elevator car B is approaching the lower terminal floor and that it is conditioned for assignment to one of the zones while the selection relays 300 and 301 remain energized. As the elevator car B nears the lower terminal floor, the motor SM again is operated to move the movable contacts 79 and 81. When the movable contact 79 reaches the fixed contact 79B, a shunting circuit is established for the selection relay 300 which may be traced from one terminal of the relay coil through the make contacts 300—5, the make contacts 301—6, the break contacts BH5, the break contacts BL8, the fixed contact 79B, the movable contact 79 and the make contacts 301—8 to the remaining terminal of the relay coil. As a result of the deenergization of the first selection relay 300, the break contacts 300—4 close to complete the following circuit for the low-zone car relay for the car B:

DC+, BP1, BL, BH4, 300—4, 301—4, 81B, 81, DC—

Inasmuch as the contacts 300—5 and the contacts BL8 now are both open, the second selection relay 301 is deenergized.

From the immediately preceding discussion, it follows that the selection relays 300 and 301 are effective for assigning successive available elevator cars alternately to the high and low zones of floors.

A system for assigning elevator cars alternately to different zones in a manner similar to that discussed for Fig. 4 is set forth in my copending application, Serial No. 264,036, filed December 29, 1951, which is now Patent 2,688,383.

The floor call timing relays 2DRT to 6DRT are employed for the purpose of measuring the duration of registration of each down floor call. For example, the floor call timing relay 2DRT for the second floor is connected across the buses L1 and L2 through break contacts 2DR5 of the down floor call registering relay 2DR for the second floor. When a down floor call is registered for the second floor the break contacts 2DR open to deenergize the floor call timing relay 2DRT. This relay has a substantial time delay in dropout. This time delay may be provided in any suitable manner. For purposes of illustration it will be assumed that a resistor 2R7 is connected across the relay for the purpose of delaying its dropout. For present purposes it will be assumed that the delay in dropout of the relay is of the order of 40 seconds. Each

of the remaining floor call timing relays 3DRT to 6DRT similarly is associated with break contacts of the down floor call registering relay for the associated floor.

It will be recalled that break contacts 2DRT1 to 6DRT1 of the floor call timing relays control the energization of the timed call relays 1T to 4T (Fig. 3). In addition, the floor call timing relays have break contacts 2DRT2 to 5DRT2 (Fig. 4) which are employed for the purpose of controlling the energization of a timed floor call stopping relay SE for the elevator car A and similar relays for the remainder of the elevator cars employed in the system.

By inspection of Fig. 4 it will be noted that the elevator car A is provided with a row of contact segments *n*2 to *n*5 which may be mounted on the floor selector for the elevator car A. Each of these contact segments is connected to a similar contact segment for each remaining elevator car of the system. A brush *nn* is associated with the row of contact segments for the elevator car A. As the elevator car A moves from the sixth floor to the lower terminal floor, the brush *nn* successively engages the contact segment *n*5 to *n*2 as the elevator car approaches respectively the fifth to second floors.

Each of the contact segments such as *n*2 is connected to a conductor LC through break contacts such as 2DRT2 of the floor call timing relay associated with the same floor. The brush *nn* is connected to the bus DC— through the timed floor call stopping relay SE and make contacts X8 of the down preference relay X. The conductor LC is connected to the bus L1 through make contacts EM11 and DSE2. Consequently, if the contacts DSE2 and EM11 are closed and the elevator car A is traveling in the down direction, the timed floor call stopping relay SE will be energized as the elevator car A approaches each floor for which a down floor call has been registered for more than a predetermined time.

Figure 5

In Fig. 5 circuits are illustrated for expediting the travel of an elevator car carrying a passenger who has been unduly delayed in reaching his destination.

The circuits of Fig. 5 include two timing relays TA and TB. Each of these relays has a substantial time delay in dropout which may be provided in any suitable manner as by connecting a resistor across the relay. It will be noted that the first timing relay TA is connected across the buses L1 and L2 through break contacts TB1 of the second timing relay. The second timing relay TB is connected across the buses through make contacts TAV of the first timing relay TA. Consequently, the timing relays TA, TB drop out and pick up at timed intervals.

The timing relays have break contacts TA2 and make contacts TB2 connected in series with make contacts 1CR4 of the car call registering relay for the first floor for the purpose of controlling the energization of a stepping relay SST. The stepping relay SST has a pair of contact arms 40A and 40B which are displaced from each other angularly about an axis 180°. These arms coact with a semicircular row of contact segments 40*a* to 40*g*. The arms are shown in their initial positions wherein the arm 40A engages the contact segments 40*a*. The contact arm 40B has just left the contact segment 40*g*. The contact segments 40*b* to 40*g* all are connected to the bus L2 through break contacts SST1 of the stepping switch and the winding of the stepping switch. For each energization of the winding of the stepping switch the contact arms are advanced through an angular distance corresponding to the angular distance between adjacent contact segments. At the contact arm 40A finally leaves the contact segment 40*g* the contact arm 40B engages the contact segment 40*a*. Such stepping switches are well known in the art.

The contact arms 40A and 40B are connected to the bus L1 through break contacts 1CR5 associated with the car call relay for the first floor.

The stepping switch also has a second pair of arms 40AA and 40BB which are rotated with the first set of contact arms 40A and 40B. The second set of arms is associated with a second row of contact segments of which only the contact segment 40*ee* is connected to the bus L2 through an auxiliary relay PT and break contacts W9 of the up preference relay. The contact arms 40AA and 40BB are connected directly to the bus L1. It will be noted that the auxiliary relay PT has make contacts PT1 which cooperate with the break contacts W9 to establish a holding circuit for the relay.

The auxiliary relay PT has make contacts PT2 for controlling in part the energization of the pass relay PD. This relay has break contacts PD1 (Fig. 2) for controlling in part the energization of the floor call stopping relay S. In addition, make contacts PD2 (Fig. 5) establish an independent energizing circuit for the step winding of the stepping switch. Make contacts PD3 cooperate with the break contacts W9 to establish a holding circuit for the pass relay PD.

The initial energization of the pass relay PD requires closure not only of the break contacts W9 and the make contacts PT2 but also of one of the sets of contacts 2CC4 or PB1. The break contacts 2CC4 remain closed as long as the registered down floor calls remain below a predetermined number. For present purposes it will be assumed that the break contacts 2CC4 remain closed as long as less than two down floor calls are registered.

The make contacts PB1 close when another elevator car passes the elevator car A.

The passing of one elevator car by another elevator car is detected by the relative position relay PB and by similar relays for the other elevator cars of the system. Each of the elevator cars is provided with a row of contact segments which may be mounted on the associated floor selector. For example, the elevator car A has a row of contact segments *p*2 to *p*6 which have two brushes *pp*1 and *pp*2 associated therewith. The brush *pp*1 is connected to the bus L2 through break contacts M6 of the running relay M, relay PB and make contacts X9 of the down preference relay. When the relay PB picks up it establishes a holding circuit for itself through its make contacts PB2 and the make contacts X9.

The brush *pp*2 is connected to the bus L1 through break contacts PB3 of the relative position relay. During down travel this brush leads the brush *pp*1 by one floor. For example, if the elevator car A is at the fifth floor, the brush *pp* engages the contact segment *p*5 and the brush *pp*2 engages the contact segments *p*4. Each of the contact segments *p*2 to *p*6 is connected to each corresponding contact segment for the remainder of the elevator cars. As will be shown below when the elevator car A is set for down travel while stopped at a floor and is passed by another car such as the elevator car B traveling down, the relative position relay PB will be energized unless the elevator car B has its relay BPB energized at the time.

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 A 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 5*c* (Fig. 2) 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.

The car call registering relay also closes its make contact 5CR3 (not shown in Fig. 3 but similar to 6CR3). However, it will be recalled that the energization of the relays MHCR and HCR through a single one of the resistors R8 to R13 is insufficient to pick up either relay.

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, 70T1, 78—1, 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 closes to complete the following energizing circuit for the speed relay V:

L1, U4, 19, E1, V, L2

The speedy relay closes its make contacts V1 to shunt the resistor R1 and conditions the elevator car for full speed operation. The speed relay V also opens its break contacts V2 (Fig. 2) without immediate effect on the system 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 J2. Make contacts M3 close to energize the non-interference relay 70T. The non-interference relay opens its break contacts 70T1 but such opening has no immediate effect on the operation of the system.

Referring to Fig. 2, the running relay M closes its make contacts M4 and opens its break contacts M5. Such contact operations have no immediate effect on the operation of the system.

As the elevator car nears the fifth floor, the brush *kk* (Fig. 3) engages the contact segment *k*5 which is positioned above the open break contacts 5CR2. Consequently, the call-above relay 78U is energized through the circuit:

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

The relay 78U closes its make contacts 78U1 (Fig. 1). Under the assumed conditions, the energization of the relay 78U has no immediate effect on the operation of the system.

However, the approach of the elevator car A towards the fifth floor brings the brush *bb* (Fig. 2) into engagement with the contact segment *b*5 to energize the car call stopping relay T through the circuit

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

The car call stopping relay closes its make contacts T1 (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 slowdown and stopping relays E and F prepares these relays for subsequent operation. As the elevator car A nears the fifth floor, the inductor slowdown 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. Closing of break contacts V2 (Fig. 2) has no immediate effect on the system.

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 non-interference relay 70T. This relay now starts to time out. Opening of make contacts M4 (Fig. 2) has no immediate effect on system operation.

Referring to Fig. 2, it should be noted that as the elevator car A continues its approach toward the fifth floor, the brush *dd* engages the contact segment *d*5. When the running relay drops out to close its break contacts M5, the following cancelling circuit is completed.

L1, 5CR1, 5CR*n*, *d*5, *dd*, W4, 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 *b*5.

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 (Fig. 3). The make contacts 5CR3 open to interrupt the partial energization of the relays MHCR and HCR.

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 can not 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 affect 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 *e*2 to establish the circuit:

L1, 2UR1, *e*2, *ee*, W5, MHCR3, S, EM1, L2

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 V2 completes the following cancelling circuit:

L1, 2UR1, 2URN, *f2*, *ff*, W6, V2, L2

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. In addition, the registering relay 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 78—1. The down floor registering relay 4DR further closes its make contacts 4DR4 to energize partially the relays 2CC to 5CC, but these relays do not pick up. Opening of break contacts 4DR5 (Fig. 4) have no immediate effect on system operation. Opening of break contacts 4DR6 starts a timing out operation of the relay 4DRT. 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 mechanical switch 28 closes and the brush *ee* (Fig. 2) engages the segment *e6* to complete the following energizing circuit:

L1, *e6*, *ee*, W5, MHCR3, S, EM1 and 28 in parallel, L2

The relay S closes its make contacts S1 (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:

L1, 4DR1, *g4*, *gg*, PD1, HCR3, X6, H1 and LZ1 in parallel, S, EM1, L2

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 closes its contacts V2 (Fig. 2) and opens its make contact V1 (Fig. 1) 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. Such opening 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 cancelling circuit:

L1, 4DR1, 4DRN, *h4*, *hh*, X7, V2, L2

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. Opening of contacts 4DR4 interrupts the partial energization of the relays 2*cc* to 5*cc*. Closing of contacts 4DR5 (Fig. 4) has no immediate effect on system operation. Contacts 4DR6 are assumed to reclose before the relay 4DRT has timed out.

It will be assumed that the passenger at the fourth floor enters the elevator car and operates the push button 1*c* (Fig. 2) 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 non-interference relay 70T to drap 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.

Closure of contacts 1CR3 partially energizes the relays MHCR and HCR. Closing of the contacts 1CR4 starts a timed stepping of the stepping switch SST (Fig. 5). Contacts 1CR5 open the resetting circuit.

As the elevator car A nears the first floor, the brush *aa* (Fig. 2) 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 *dd* engages the contact segment *d*1 to complete the following cancelling circuit:

L1, 1CR1, 1CRN, *d*1, *dd*, W4, 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. Opening of contacts 1CR3 interrupts the partial energization of relays MHCR and HCR. Opening of contacts 1CR4 and closure of contacts 1CR5 (Fig. 5) resets the stepping switch SST. 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.

UP-PEAK OPERATION

It will now be assumed that all of the elevator cars are parked at the lower terminal floor when a passenger entering the elevator car A registers a car call for the second floor and passengers register car calls in the elevator car B for the third, fourth and fifth floors. Such registrations result in opening of the break contacts 2CR2, B3CR2, and B5CR2 (Fig. 3) and relays 78 and B78 drop out. In addition, make contacts 2CR3, B3CR3, B4CR3 and B5CR3 (not showin in Fig. 3) close to energize the car call quota relays MHCR and HCR. It is assumed in this example that the resistors R8, etc. are so dimensioned that currents flowing through at least three resistors are required to energize the quota relay MHCR sufficiently to pick up, and that currents flowing through at least six resistors are required to pick up the quota relay HCR.

The registration of a large number of car calls indicates the presence of a substantially high service demand. Inasmuch as each stop of the elevator car requires substantial time, it follows that the stopping of the elevator cars a number of times as required by a large number of registered car calls appreciably slows the elevator cars.

The registration of a large number of car calls at the lower terminal floor may occur, for example, during an up peak period such as the start of a business day in an office building served by the elevator system. For this reason, it is desirable to expedite the return of the elevator car to the lower terminal floor.

If desired, the return of the elevtaor car further may be expedited by preventing the elevator car A from answering certain registered floor calls during its travel. For example, during the morning up peak, few up calls generally are registered by operations of the up floor call push buttons. For this reason, it is permissible in many cases to expedite the return of the elevator cars to the lower terminal floor by preventing one or more of the elevator cars from answering registered up floor calls during up travel thereof. To this end, the break contacts MHCR3 (Fig. 2) of the first quota relay MHCR open when this relay is energized to prevent energization of the floor call stopping relay during up travel of the elevator car A. Similar contacts may be employed in other cars if so desired. However, as shown, they are not provided for the elevator car B.

To expedite return of the elevator car A, it is desirable that the break contacts of the floor call relays in the call circuit 30 be shunted during such travel of the elevator car. To this end, the make contacts MHCR4 to MHCR8 of the quota relay MHCR shunt the break contacts of the floor call relays above the first floor in the call circuit 30. As shown, such contacts are not provided for the elevator car B.

The elevator car A proceeds upwardly in the manner previously described answering the registered car call for the second floor. As the elevator car nears the second floor, the brush *kk* (Fig. 3) engages the contact segment *k*2 to complete the following energizing circuit for the call-above relay 78U:

L1, 6CR2, MHCR4, 5CR2, MHCR5, 4CR2, MHCR6, 3CR2, MHCR7, *k*2, *kk*, W7, 78U, L2

As a result of its energization, the call-above relay closes its make contacts 78U1 (Fig. 1) to complete with the contacts MHCR1 and X3 an energizing circuit for the reversal relay J which closes contacts J1 to energize the relays G, E and F. Under the assumed conditions, these relays G, E and F also would have been energized in the manner previously described as the elevator car A answered the registered car call for the second floor.

In addition, the reversal relay opens its break contact J2. Inasmuch as the make contacts M2 of the running relay open as the car comes to a stop, it follows that the up preference relay W is deenergized as the elevator car stops at the fourth floor. The deenergized up preference relay closes its break contacts W2 to complete an energizing circuit for the relay X. Since the down preference relay now is energized and the up preference relay W is deenergized the elevator car A is conditioned to return to the lower terminal floor. The operation of the system in returning the elevator car A to the lower terminal floor will be understood from the foregoing discussion. By reversing the elevator car A at the intermediate floor, the return of the elevator car to the lower terminal floor is materially expedited.

To assure prompt return of the elevator car A to the first floor, the manual switch 31 may be closed to connect the mechanical switch 32 across the push button 1*c* for the first floor. This mechanical switch is biased into closed condition and is cam-operated to open as the elevator car A reaches the lower terminal floor. Consequently, as soon as the car leaves the first floor the switch 32 closes to establish a parking call for the first floor.

Let it be assumed next that before the elevator car A left the first floor two additional car calls where registered by passengers therein pressing the buttons 5*c* and 6*c*. This results in the energization of the relays HCR and MHCR (Fig. 3) through the make contacts 5CR3 and 6CR3 as well as through the make contacts 2CR3, B3CR3, B4CR3 and B5CR3. Both relays HCR and MHCR are picked up under these conditions. The effect of pick up of the relay MHCR has been discussed.

Upon picking up, the relay HCR opens its break contacts HCR1 and HCR2 (Fig. 2) to prevent response of the elevator car B to all floor calls. Opening of contacts HCR3 prevents response by the elevator car A to down floor calls.

Closure of contacts HCR4 to HCR8 (Fig. 3) shunts the contacts of the floor call registering relays for floors above the first floor. Consequently the elevator car B is conditioned to reverse when it reaches the farthest floor in the up direction for which a car call is registered.

DOWN PEAK OPERATION

For the purpose of illustrating the gradual increase in carrying capacity in the system in the down direction as the demand for elevator service increases, it will be assumed initially that down floor calls are registered at the second and third floors. The sequence for registering such calls will be understood from the foregoing discussion. It will be recalled that as a result of registration of these floor calls the break contacts 2DR5 and 3DR6 (Fig. 4) open and the floor call timing relays 2DRT and 3DRT start to time out.

In addition the down call quota relays 2CC, 3CC, 4CC and 5CC all are energized through two arms of the associated parallel circuit. Such energization is sufficient to pick up only the relay 2CC.

As a result of its energization the down call quota relay 2CC closes its make contacts 2CC1 (Fig. 1) to prepare the reversal relay J for subsequent energization. Similar contacts 2CC2 associated with the reversal relay BJ for the elevator car B also are enclosed. Each of the elevator cars now is conditioned during up travel to stop and reverse at the highest floor for which a call is registered provided such call is not an up floor call. For example, let it be assumed that immediately after the pick up of the down call quota relay 2CC the elevator car A is traveling up and approaches the third floor. During such approach the brush *kk* (Fig. 3) engages the contact segment *k*3. Since it is assumed that no call is registered for a floor above the third floor and that no up floor call is registered for the third floor the following circuit is completed:

L1, 6CR2, 6DR2, 5UR2, 5CR2, 5DR2, 4UR2, 4CR2, 4DR2, 3UR2, *k*3, *kk*, W7, 78U, L2

Since the call above relay 78U now is energized, the make contact 78U1 (Fig. 1) closes to complete with the contacts 2CC1 and X3 an energizing circuit for the reversing relay J. This energized relay then operates in the manner previously discussed to stop and reverse the elevator car A at the third floor. During its return to the lower terminal floor the elevator car A accepts passengers from the third and second floors in a manner which will be understood from the preceding discussion.

When it picks up the down call quota relay 2CC also opens its break contacts 2CC3 to prevent energization of the car call quota relays MHCR and HCR. At the same time break contacts 2CC4 and 2CC5 (Fig. 5) open without immediately affecting the operation of the system.

Next it will be assumed that a down floor call is registered only for the second floor but that this floor call has remained unanswered for a time sufficient to permit dropout of the floor call timing relay 2DRT (Fig. 4). It will be recalled that this timing relay starts to time out as soon as registration of a call at the second floor opens the break contacts 2DR5.

Upon dropping out, the floor call timing relay 2DRT closes its break contacts 2DRT1 (Fig. 3) to energize the timed call relays 1T to 4T. However, the energization of these relays through only one arm of the associated parallel circuit is sufficient to pick up only the relay 1T.

Upon pickup the relay 1T closes its make contacts 1T1 and 1T2 (Fig. 1) to prepare the reversal relays for subsequent energization. Consequently, the effect of the closure of the contacts 1T1 and 1T2 is similar to that of the closure of the contacts 2CC1 and 2CC2 which has just been described.

In addition the timed call relay 1T opens its break contacts 1T3 (Fig. 3) to prevent energization of the car call quota relays HCR and MHCR.

From the foregoing discussion it is clear that the pick-up of either the relay 2CC or the relay 1T results in an increase in the carrying capacity of the elevator system in the down direction.

Next it will be assumed that down floor calls are registered for the second, third and fourth floors. As a result of such registrations, the break contacts 2DR5, 3DR6 and 4DR6 (Fig. 4) open to start timing out operation of the floor call timing relays 2DRT, 3DRT and 4DRT.

The registration of these three calls also results in closure of the make contacts 2DR4, 3DR4 and 4DR4 (Fig. 3) to energize the down call quota relays 2CC, 3CC, 4CC and 5CC. However, the energization applied through three arms of the parallel circuits is sufficient to pick up only the relays 2CC and 3CC. The relay 2CC operates in the manner previously discussed to condition the elevator cars to reverse when traveling up at the highest floor for which a call is registered unless the call is an up floor call. The relay 3*cc* opens its break contacts 3CC1 (Fig. 2) to prevent the elevator car B from responding to up floor calls. Also contacts 3CC2 close to energize the relay USE. The relay USE closes its contacts USE1 to USE4 for the purpose of shunting contacts of the up floor-call registering relays in the circuit B30 for the elevator car B. The elevator car B now is set to reverse at the highest of the car calls and down floor calls. This further expedites elevator service in the down direction.

Next let it be assumed that two down floor calls are registered for the second and third floors and that these calls have been registered for a time sufficient to permit dropout of the floor call timing relays 2DRT and 3DRT (Fig. 4). As a result of such dropouts these relays close their break contacts 2DRT1 and 3DRT1 (Fig. 3) to energize the timed call relays 1T to 4T. However such energization through two of the parallel arms associated with the relays suffices to pick up only the relays 1T and 2T. The relay 1T operates in the manner previously described to condition the elevator cars to reverse when traveling up at the highest floor for which a call is registered provided such call is not an up floor call. The relay 2T opens its break contacts 2T1 (Fig. 2) to prevent the elevator car B from responding to up floor calls. In this way service in the down direction is expedited.

For the next operation to be discussed it will be assumed that down floor calls are registered for the second, third, fourth and fifth floors. As a result of such registrations make contacts 2DR4, 3DR4, 4DR4 and 5DR4 (Fig. 3) close to energize the down call quota relays 2CC, 3CC, 4CC and 5CC through four arms of the associated parallel circuit. Such energization suffices to pick up the relays 2CC, 3CC and 4CC. The operation of the relays 2CC and 3CC has been discussed above.

Upon picking up the down call quota relay 4*cc* closes its make contacts 4CC1 to energize the first down service demand relay DSE. This relay closes its make contacts DSE2 and DSE3 (Fig. 4) for the purpose of dividing the floors into zones and for alternatively assigning each elevator car approaching the lower floor to the high and low zones of floors. This zoning operation will be clear from the discussion of Fig. 4.

Had only three down floor calls been registered and had all of the three calls timed out, the timed call relays 1T to 4T (Fig. 3) would have been energized through three arms of the parallel circuit. Such energization would have sufficed to pick up the relays 1T, 2T and 3T. The relays 1T and 2T would operate in the manner previously described. The pickup of the relay 3T would result in closure of the make contacts 3T1 to energize the first down service demand relay. Consequently, the energization of either of the relays 3T or 4CC results in a substantial increase in the carrying capacity of the elevator system in the down direction.

For the next condition to be examined it will be assumed that down floor calls are registered for the second, third, fourth, fifth and sixth floors. Under such circumstances the down call quota relays 2*cc* to 5*cc* will be energized through all of the parallel arms associated therewith and all of the quota relays will be picked up. Inasmuch as the effect of pickups of the relays 2CC, 3CC and 4CC already has been considered, consideration need be given at this point only to the effect of the pickup of the quota relay 5CC.

As a result of its pickup the quota relay 5*cc* closes its make contacts 5CC1 to energize the second down service demand relay EM. It should be noted that this relay also may be energized as a result of closure of the make contacts 4T1. Consequently, a similar result is obtained if four down floor calls have been registered for a time sufficient to permit dropout of four of the floor call timing relays 2DRT to 6DRT. Under such circumstances the timed call relays 1T to 4T (Fig. 3)

would be energized through four arms of the associated parallel circuit and all of the timed call relays would be picked up. As before noted, the pickup of the relay 4T results in closure of the make contacts 4T1 to energize the second down service demand relay EM.

Pickup of the second down service demand EM results in opening of the break contacts EM1 and EM2 to prevent energization of the floor call stopping relays S and BS. The stopping of the elevator cars during down travel now is controlled by the timed floor call stopping relays SE and BSE (Fig. 4). An elevator car now stops in response to a down floor call only if the down floor call has been registered for more than a predetermined time. Inasmuch as passengers tend to accumulate during the time required to make a down floor call effective for stopping the elevator car, it follows each stop of an elevator car in response to such a call results in the loading of a larger number of passengers and an increase in the capacity of the elevator system to carry passengers in the down direction.

To illustrate the stopping operation under these conditions it will be assumed that the elevator car A is traveling down towards the third floor and that a down floor call for the third floor has been registered for a time sufficient to permit the floor call timing relay 3DRT to time out and close its break contacts 3DRT2. As the elevator car A approaches the third floor the brush *nn* engages the contact segment *n*3 to complete the following energizing circuit:

L1, DSE2, EM11, 3DRT, *n*3, *nn*, SE, X8, L2

The energized time floor call stopping relay SE now closes its make contacts SE1 to complete with the make contacts M1 an energizing circuit for the relays E, F and G. These cooperate in the manner previously discussed to stop the elevator car A at the third floor.

If either of the relays 5CC or 4T is energized and picked up, it follows that either the relay 2*cc* or the relay 1T must be picked up to close its contacts 1T1 or 2CC1 (Fig. 1). Consequently, if the elevator system is conditioned during down travel to respond only to down floor calls which have been registered for more than a predetermined time, the contacts 1T1 or 2CC1 must be closed to condition the elevator cars to reverse at the farthest floor when traveling in the up direction for which a call is registered provided such a call is not an up call. Under these conditions it may be desirable to connect the call above relay 78U to a circuit which energizes the relay as the associated elevator car nears the highest floor for which either a car call is registered or a down floor call has been registered for more than a predetermined time. For present purposes it will suffice to condition the relay 78U to pick up when the elevator car during up travel nears the highest floor for which a car call or a down floor call is registered. To this end make contacts EM3 to EM6 are associated with the call circuit 30 and make contacts USE1 to USE4 are associated with the call circuit B30 for the purpose of shunting contacts of the up floor call registering relays. Consequently, when the second down service demand relay EM is energized, each elevator car is conditioned during up travel to stop at the highest floor for which a car call or a down floor call is registered and to reverse at such floor.

ACCELERATED CAR CALL SERVICE

Let it be assumed that a passenger enters the elevator car A at the sixth floor and presses the car call button for the first floor to energize the car call registering relay 1CR. As a result of such call registration, make contacts 1CR4 (Fig. 5) close to complete partially an energizing circuit for the stepping switch SST. It will be recalled that at intervals both of the sets of contacts T1—1 and TB1 are closed. At each of these intervals the winding of the stepping switch SST is energized to advance the switch one step. At the same time the break contacts 1CR5 open to prevent energization therethrough of the stepping switch.

If the elevator car is unduly delayed on its trip to the lower terminal floor, the contact arm 40AA steps until it finally engages the contact segment 40*ee*. This completes with the break contacts W9 of the up preference relay an energizing circuit for the auxiliary relay PT. The auxiliary relay closes its make contacts PT1 to complete with the break contacts W9 a holding circuit for the auxiliary relay. In addition make contacts PT2 close to prepare the pass relay PD for energization.

Assuming that less than two down floor calls are registered at the time the contacts PT2 close, an energizing circuit is completed for the pass relay as follows:

L1, 2*cc*4, PT2, PD, W9, L2

The pass relay PD opens its break contacts PD1 (Fig. 2) to prevent the elevator car A from responding to down floor calls. This expedites the movement of the elevator car A towards the lower terminal floor and brings the delayed passenger to his destination as rapidly as possible.

The pass relay PD also closes its make contacts PD2 (Fig. 5) to maintain the winding of the step switch SST energized. This prevents unnecessary stepping of the step switch. At the same time make contacts PD3 close to establish with the break contacts W9 a self-holding circuit for the pass relay PD.

As the elevator car A reaches the lower terminal floor, the car call relay 1CR resets in the normal manner to open its make contacts 1CR4 and close its break contacts 1CR5. These contact changes do not immediately affect the operation of the system.

As the elevator car A stops at the lower terminal floor, the up preference relay W picks up in the normal manner and opens its break contacts W9 to deenergize the auxiliary relay PT and the pass relay PD. Opening of the make contacts PT1 and PT2 of the auxiliary relay has no effect on the immediate operation of the system.

The pass relay PD when it is deenergized closes its break contacts PD1 (Fig. 2) and opens its make contacts PD3 (Fig. 5) without immediate effect on the operation of the system. However, opening of make contacts PD2 restores the stepping switch to control by its self-stepping contacts SST1 and contacts 1CR5. The stepping switch now steps until the contact arm 40A leaves the contact segment 40*g*. Since neither of the contact arms now is connected to the contacts SST1, the stepping switch remains in its reset condition.

Let it be assumed next that at the time the auxiliary relay PT was energized, three down floor calls were registered. Under such circumstances the down call quota relay 2CC would be energized and its break contacts 2CC4 would be opened to prevent energization therethrough of the pass relay PD.

It will be assumed further that immediately after such energization of the auxiliary relay PT, the elevator car A stops at the third floor and while stopped is passed by the elevator car B. As the elevator car A stops at the third floor, the break contacts M6 of the running relay close to prepare the car position relay PB for subsequent energization. As the elevator car B during down travel overtakes the elevator car A, the brush B*pp*2 engages the contact segment B*p*3 for the third floor to complete the following circuit:

L1, BPB3, B*pp*2, B*p*3, *p*3, *pp*1, M6, PB, X9, L2

The relative position relay PB closes its make contacts PB2 to establish with the make contacts X9 a self-holding circuit. In addition, make contacts PB1 close to complete with the contacts PT2 and W9 an energizing circuit for the pass relay PD. This relay operates in the manner previously discussed to expedite the travel of the elevator car A towards the lower terminal floor.

Finally the relative position relay PB opens its break

contacts PB3 to prevent energization therethrough of the relative position relay of another elevator car, even though during further travel towards the lower terminal floor the elevator car A passes another elevator car.

As the elevator car A stops at the lower terminal floor, the down preference relay drops out to open its make contacts X9. This resets the relative position relay PB.

This patent application is in part a continuation of my copending patent application, Serial No. 264,036, filed December 29, 1951, which has issued as Patent 2,688,383.

Although the invention has been described with reference to certain specific embodiments of the invention, numerous modifications embodying the invention are possible. Consequently the foregoing discussion and the illustrations 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 pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, selection means effective during the operation of the elevator car for selecting automatically each of a plurality of periods during which increases in elevator carrying capacity in the first direction are desired, and means responsive to selection of said periods by the selection means for providing for each of the periods a different capacity of said elevator car to answer calls registered by said call means for elevator service in said first direction.

2. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, selection means effective during the operation of the elevator car for selecting automatically three periods during which different elevator carrying capacities are desired in the first direction, means responsive to selection by the selection means of a first period for expediting to a first extent elevator service by said elevator car in said first direction for at least part of the calls registered by said call means, means responsive to selection by the selection means of a second period demand for expediting to a second extent greater than the first extent elevator service by said elevator car in the first direction for at least part of the calls registered by said call means, and means responsive to a selection by the selection means of a third period for expediting to a third extent greater than the second extent elevator service by said elevator car in the first direction for at least part of the calls registered by said call means.

3. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, second call means operable for registering calls for elevator service in a second direction for each of the intermediate floors, said stopping means being effective when the elevator car travels in the second direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the second call means, means responsive to expiration of a substantial time following the stopping of the elevator car at an intermediate floor for starting the elevator car in the direction in which the elevator car approached such floor, means for stopping and reversing the elevator car at each of the terminal floors, selection means for automatically selecting periods during which different elevator service is desired, means responsive to a selection by the selection means of a first period for stopping and reversing an elevator car traveling in the second direction at the farthest floor in such direction for which a call is registered by the first call means provided no call is registered by the second call means for such farthest floor or for any floor beyond said farthest floor, and means responsive to selection by the selection means of a second period for establishing a modified operation stopping and reversing the elevator car when traveling in the second direction at the farthest floor in such direction for which a call is registered by the first call means, said modified operation preventing response by the elevator car to calls registered by the second call means.

4. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, second call means operable for registering calls for elevator service in a second direction for each of the intermediate floors, said stopping means being effective when the elevator car travels in the second direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the second call means, means responsive to expiration of a substantial time following the stopping of the elevator car at an intermediate floor for starting the elevator car in the direction in which the elevator car approached such floor, means for stopping and reversing the elevator car at each of the terminal floors, selection means effective during operation of the elevator car for selecting automatically periods during which different elevator service is desired, means responsive to selection by the selection means of a first period for stopping and reversing an elevator car traveling in the second direction at the farthest floor in such direction

for which a call is registered by the first call means provided no call is registered by the second call means for such farthest floor or for any floor beyond said farthest floor, and means responsive to selection by the selection means of a second period for assigning the elevator car to answer a call registered by the first call means only if such call has a predetermined characteristic differing from the normal characteristic of a registered call.

5. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, second call means operable for registering calls for elevator service in a second direction for each of the intermediate floors, said stopping means being effective when the elevator car travels in the second direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the second call means, means responsive to expiration of a substantial time following the stopping of the elevator car at an intermediate floor for starting the elevator car in the direction in which the elevator car approached such floor, means for stopping and reversing the elevator car at each of the terminal floors, means responsive to a first traffic demand for stopping and reversing an elevator car traveling in the second direction at the farthest floor in such direction for which a call is registered by the first call means provided no call is registered by the second call means for such farthest floor or for any floor beyond said farthest floor, and means responsive to a second traffic demand for assigning the elevator car to answer a call registered by the first call means only if such call has been registered for more than a predetermined time.

6. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, second call means operable for registering calls for elevator service in a second direction for each of the intermediate floors, said stopping means being effective when the elevator car travels in the second direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the second call means, means responsive to expiration of a substantial time following the stopping of the elevator car at an intermediate floor for starting the elevator car in the direction in which the elevator car approached such floor, means for stopping and reversing the elevator car at each of the terminal floors, means responsive to a first traffic demand for preventing response by the elevator car to calls registered by the second call means, and means responsive to a second traffic condition for assigning the elevator car to answer a call registered by the first call means only if such call has a predetermined characteristic differing from the normal characteristic of a registered call.

7. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, second call means operable for registering calls for elevator service in a second direction for each of the intermediate floors, said stopping means being effective when the elevator car travels in the second direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the second call means, means responsive to expiration of a substantial time following the stopping of the elevator car at an intermediate floor for starting the elevator car in the direction in which the elevator car approached such floor, means for stopping and reversing the elevator car at each of the terminal floors, means responsive to a first traffic demand for preventing response by the elevator car to calls registered by the second call means, and means responsive to a second traffic condition for assigning the elevator car to answer a call registered by the first call means only if such call has been registered for more than a predetermined time.

8. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, second call means operable for registering calls for elevator service in a second direction for each of the intermediate floors, said stopping means being effective when the elevator car travels in the second direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the second call means, means responsive to expiration of a substantial time following the stopping of the elevator car at an intermediate floor for starting the elevator car in the direction in which the elevator car approached such floor, means for stopping and reversing the elevator car at each of the terminal floors, selection means effective during operation of the elevator system for selecting automatically periods during which different elevator services are desired, means responsive to selection by the selection means of a first period for establishing a modified operation stopping and reversing an elevator car traveling in the second direction at the farthest floor in such direction for which a call is registered by the first call means provided no call is registered by the second call means for such farthest floor or for any floor beyond

said farthest floor, and means responsive to a selection by the selection means of a second period while the system has said modified operation for preventing response by the elevator car during a trip in the first direction to calls registered by the first call means for certain of said floors.

9. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, second call means operable for registering calls for elevator service in a second direction for each of the intermediate floors, said stopping means being effective when the elevator car travels in the second direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the second call means, means responsive to expiration of a substantial time following the stopping of the elevator car at an intermediate floor for starting the elevator car in the direction in which the elevator car approached such floor, means for stopping and reversing the elevator car at each of the terminal floors, means responsive to a first traffic demand for preventing response by the elevator car to calls registered by the second call means, and means responsive to a second traffic condition for assigning the elevator car when traveling in the second direction towards a predetermined intermediate floor to stop and reverse at the farthest floor between the elevator car and said predetermined intermediate floor for which a call is registered by the first call means even though a call is registered for a floor beyond said predetermined intermediate floor.

10. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, second call means operable for registering calls for elevator service in a second direction for each of the intermediate floors, said stopping means being effective when the elevator car travels in the second direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the second call means, means responsive to expiration of a substantial time following the stopping of the elevator car at an intermdeiate floor for starting the elevator car in the direction in which the elevator car approached such floor, means for stopping and reversing the elevator car at each of the terminal floors, selection means effective during operation of the system for selecting periods during which different elevator services are desired, means responsive to selection by the selection means of a first period for stopping and reversing an elevator car traveling in the second direction at the farthest floor in such direction for which a call is registered by the firt call means provided no call is registered by the second call means for such farthest floor or for any floor beyond said farthest floor, means responsive to selection by the selection means of a second period for preventing response by the elevator car to calls registered by the second call means, and means responsive to selection by the selection means of a third period for preventing the elevator car during travel in the first direction from answering calls registered by the first call means for less than a predetermined time.

11. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator esrvice in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, second call means operable for registering calls for elevator service in a second direction for each of the intermediate floors, said stopping means being effective when the elevator car travels in the second direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the second call means, means responsive to expiration of a substantial time following the stopping of the elevator car at an intermediate floor for starting the elevator car in the direction in which the elevator car approached such floor, means for stopping and reversing the elevator car at each of the terminal floors, means responsive to a first traffic demand for stopping and reversing an elevator car traveling in the second direction at the farthest floor in such direction for which a call is registered by the first call means provided no call is registerd by the second call means for such farthest floor or for any floor beyond said farthest floor, means responsive to a second traffic demand for preventing response by the elevator car to calls registered by the second call means, means responsive to a third traffic demand for preventing the elevator car during travel in the first direction from answering calls registered by the first call means for less than a predetermined time, and means responsive to a fourth traffic demand for assigning the elevator car when traveling in the second direction towards a predetermined intermediate floor to stop and reverse at the farthest floor between the elevator car and said predetermined intermediate floor for which a call is registered by the first call means even though a call is registered for a floor beyond said predetermined intermediate floor.

12. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, a plurality of car call means operable for registering calls for each of a plurality of floors desired by passengers within the elevator car, said stopping means being effective for stopping the elevator car at each

of the floors approached by the elevator car for which a call is registered by the car call means, and modifying means responsive to a function of operated car call means for modifying the response of said elevator car to calls registered by the call means.

13. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, a plurality of car call means operable for registering calls for each of a plurality of floors desired by passengers within the elevator car, said stopping means being effective for stopping the elevator car at each of the floors approached by the elevator car for which a call is registered by the car call means, and modifying means responsive to a first function of operated car call means for modifying the response of said elevator car to calls registered by the call means, and means responsive to a second function of operated car call means for further modifying the response of the elevator car to calls registered by the call means.

14. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, a plurality of car call means operable for registering calls for each of a plurality of floors desired by passengers within the elevator car, said stopping means being effective for stopping the elevator car at each of the floors approached by the elevator car for which a call is registered by the car call means, and modifying means responsive to a predetermined number of operated car call means for modifying the response of said elevator car to calls registered by the call means.

15. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, a plurality of car call means operable for registering calls for each of a plurality of floors desired by passengers within the elevator car, said stopping means being effective for stopping the elevator car at each of the floors approached by the elevator car for which a call is registered by the car call means, and modifying means responsive to a first number of operated car call means for modifying the response of said elevator car to calls registered by the call means, and means responsive to a second number of operated car call means for further modifying the response of the elevator car to calls registered by the call means.

16. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, a plurality of car call means operable for registering calls for each of a plurality of floors desired by passengers within the elevator car, said stopping means being effective for stopping the elevator car at each of the floors approached by the elevator car for which a call is registered by the car call means, and modifying means responsive to a function of operated car call means for transferring the elevator system from a condition wherein the elevator car reverses its direction of travel at said terminal floors to a condition for stopping and reversing the elevator car traveling in a predetermined direction at the farthest floor in such direction for which a call is registered by the car call means.

17. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, a plurality of car call means operable for registering calls for each of a plurality of floors desired by passengers within the elevator car, said stopping means being effective for stopping the elevator car at each of the floors approached by the elevator car for which a call is registered by the car call means, and modifying means responsive to a function of operated car call means for transferring the elevator system from a condition wherein the elevator car reverses its direction of travel at said terminal floors to a condition for stopping and reversing the elevator car traveling in a predetermined direction at the farthest floor in such direction for which a call is registered by the car call means even though a call is registered by the first call means for a floor beyond said farthest floor.

18. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the

elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, second call means operable for registering calls for elevator service in a second direction for each of the intermediate floors, said stopping means being effective when the elevator car travels in the second direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the second call means, means responsive to expiration of a substantial time following the stopping of the elevator car at an intermediate floor for starting the elevator car in the direction in which the elevator car approached such floor, means for stopping and reversing the elevator car at each of the terminal floors, a plurality of car call means operable for registering calls for each of a plurality of floors desired by passengers within the elevator car, said stopping means being effective for stopping the elevator car at each of the floors approached by the elevator car for which a call is registered by the car call means, and modifying means responsive to a function of operated car call means for modifying the response of said elevator car to calls registered by the call means.

19. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, second call means operable for registering calls for elevator service in a second direction for each of the intermediate floors, said stopping means being effective when the elevator car travels in the second direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the second call means, a plurality of car call means operable for registering calls for each of a plurality of floors desired by passengers within the elevator car, said stopping means being effective for stopping the elevator car at each of the floors approached by the elevator car for which a call is registered by the car call means, means responsive to expiration of a substantial time following the stopping of the elevator car at an intermediate floor for starting the elevator car in the direction in which the elevator car approached such floor, means for stopping and reversing the elevator car at each of the terminal floors, and modifying means responsive to a first function of operated car call means for modifying the response to said elevator car to calls registered by the call means, and means responsive to a second function of operated car call means for further modifying the response of the elevator car to calls registered by the first and second call means.

20. In an elevator system, a structure having a pair of terminal floors and a plurality of floods intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, second call means operable for registering calls for elevator service in a second direction for each of the intermediate floors, said stopping means being effective when the elevator car travels in the second direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the second call means, a plurality of car call means operable for registering calls for each of a plurality of floors desired by passengers within the elevator car, said stopping means being effective for stopping the elevator car at each of the floors approached by the elevator car for which a call is registered by the car call means, means responsive to expiration of a substantial time following the stopping of the elevator car at an intermediate floor for starting the elevator car in the direction in which the elevator car approached such floor, means for stopping and reversing the elevator car at each of the terminal floors, and modifying means responsive to a function of operated car call means for transferring the elevator system from a condition wherein the elevator car reverses its direction of travel at said terminal floors to a condition for stopping and reversing the elevator car traveling in a predetermined direction at the farthest floor in such direction for which a call is registered by the car call means even though a call is registered for a floor beyond such farthest floor by any of the first and second call means.

21. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, a plurality of car call means operable for registering calls for each of a plurality of floors desired by passengers within the elevator car, said stopping means being effective for stopping the elevator car at each of the floors approached by the elevator car for which a call is registered by the car call means, and modifying means responsive to a function of operated car call means for causing said elevator car to pass without stopping floors for which calls are registered by the first call means for service in the direction of travel of the elevator car.

22. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate

floors approached by the elevator car for which a call is registered by the call means, second call means operable for registering calls for elevator service in a second direction for each of the intermediate floors, said stopping means being effective when the elevator car travels in the second direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the second call means, a plurality of car call means operable for registering calls for each of a plurality of floors desired by passengers within the elevator car, said stopping means being effective for stopping the elevator car at each of the floors approached by the elevator car for which a call is registered by the car call means, means responsive to expiration of a substantial time following the stopping of the elevator car at an intermediate floor for starting the elevator car in the direction in which the elevator car approached such floor, means for stopping and reversing the elevator car at each of the terminal floors, and modifying means responsive to a registration of at least one call by the car call means for certain of the said floors for at least a predetermined substantial time for modifying the operation of the elevator car.

23. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, a plurality of car call means operable for registering calls for each of a plurality of floors desired by passengers within the elevator car, said stopping means being effective for stopping the elevator car at each of the floors approached by the elevator car for which a call is registered by the car call means, modifying means responsive to a function of operated car call means for causing said elevator car to pass without stopping floors for which calls are registered by the first call means for service in the direction of travel of the elevator car, and means responsive to a predetermined call registration by said first call means for blocking said passing operation of the bypass means.

24. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, a plurality of car call means operable for registering calls for each of a plurality of floors desired by passengers within the elevator car, said stopping means being effective for stopping the elevator car at each of the floors approached by the elevator car for which a call is registered by the car call means, modifying means responsive to a function of operated car call means for causing said elevator car to pass without stopping floors for which calls are registered by the first call means for service in the direction of travel of the elevator car, and means responsive to registration by the first call means of calls for floors in excess of a predetermined number for blocking said passing operations by the modifying means.

25. In an elevator system, a structure having a pair of terminal floors and a plurality of floors intermediate the terminal floors, an elevator car, means mounting the elevator car for movement relative to the structure, motive means for moving the elevator car relative to the structure to serve said floors, and control means cooperating with the motive means for controlling the movement of the elevator car relative to the structure and the stopping of the elevator car at the floors, said control means comprising first call means operable for registering calls for elevator service in a first direction for each of the intermediate floors, stopping means effective when the elevator car travels in said first direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the call means, second call means operable for registering calls for elevator service in a second direction for each of the intermediate floors, said stopping means being effective when the elevator car travels in the second direction for stopping the elevator car at each of the intermediate floors approached by the elevator car for which a call is registered by the second call means, a plurality of car call means operable for registering calls for each of a plurality of floors desired by passengers within the elevator car, said stopping means being effective for stopping the elevator car at each of the floors approached by the elevator car for which a call is registered by the car call means, means responsive to expiration of a substantial time following the stopping of the elevator car at an intermediate floor for starting the elevator car in the direction in which the elevator car approached such floor, means for stopping and reversing the elevator car at each of the terminal floors, modifying means responsive to a registration of a call by the car call means for certain of the said floors for at least a predetermined substantial time for modifying the operation of the elevator car, and means responsive to registration by the first call means of calls for floors in excess of a predetermined number for blocking said modifying operation by the modifying means.

26. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, stopping means for each of the elevator cars effective when each of the elevator cars travels in the first direction for stopping the first available one of the elevator cars at each of the intermediate landings approached by the first available one of the elevator cars for which a call is registered by the call means, and means responsive to each of a plurality of successive increases in the demand for elevator service in the first direction for successively increasing the capacity of the elevator cars to answer calls registered by said call means for elevator service.

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

motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, stopping means for each of the elevator cars effective when each of the elevator cars travels in the first direction for stopping the first available one of the elevator cars at each of the intermediate landings approached by the first available one of the elevator cars for which a call is registered by the call means, selection means effective during operation of the system for automatically selecting a plurality of periods for which different elevator services are desired, means responsive to selection by the selection means of a first period for expediting to a first extent elevator service by all of said elevator cars in said first direction for at least part of the calls registered by the call means, means responsive to selection by the selection means of a second period for expediting to a second extent greater than the first extent elevator service by all of said elevator cars in the first direction for at least part of the calls registered by said call means, and means responsive to selection by the selection means of a third period for expediting to a third extent greater than the second extent elevator service by said elevator cars in the first direction for at least part of the calls registered by said call means.

28. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, second call means operable for registering calls for elevator service in a second direction at least for each of the intermediate landings, stopping means for each of the elevator cars, each of the stopping means being effective for stopping the associated elevator car at each of the landings approached by the associated elevator car for which a call is registered by the call means for service in the direction of travel of such associated elevator car, means cooperating with said stopping means for stopping and reversing each of the elevator cars at each of the terminal floors, selection means effective during operation of the system for automatically selecting periods during which different elevator services are desired, means responsive to selection by the selection means of a first period for conditioning each of the elevator cars when traveling in the second direction to stop and reverse at the farthest floor in such direction for which a call is registered by the first call means provided no call is registered by the second call means for such farthest floor or for any floor beyond said farthest floor, and means responsive to selection by the selection means of a second period for blocking response by the elevator cars to calls registered by the second call means to condition each of the elevator cars when traveling in the second direction to bypass calls registered by the second call means and to stop and reverse at the farthest floor in such direction for which a call is registered by the first call means.

29. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, second call means operable for registering calls for elevator service in a second direction at least for each of the intermediate landings, stopping means for each of the elevator cars, each of the stopping means being effective for stopping the associated elevator car at each of the landings approached by the associated elevator car for which a call is registered by the call means for service in the direction of travel of such associated elevator car, means cooperating with said stopping means for stopping and reversing each of the elevator cars at each of the terminal floors, means responsive to a first traffic demand for conditioning each of the elevator cars when traveling in the second direction to stop and reverse at the farthest floor in such direction for which a call is registered by the first call means provided no call is registered by the second call means for such farthest floor or for any floor beyond said farthest floor, and means responsive to a second traffic demand for assigning the elevator cars while traveling in the first direction to answer calls registered by the first call means only if such calls are registered for more than a predetermined time.

30. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, second call means operable for registering calls for elevator service in a second direction at least for each of the intermediate landings, stopping means for each of the elevator cars, each of the stopping means being effective for stopping the associated elevator car at each of the landings approached by the associated elevator car for which a call is registered by the call means for service in the direction of travel of such associated elevator car, means cooperating with said stopping means for stopping and reversing each of the elevator cars at each of the terminal floors, means responsive to a first traffic demand for blocking response by a plurality of said elevator cars to calls registered by the second call means, and means responsive to a second traffic demand for assigning a plurality of said elevator cars to answer calls registered by the first call means only if such calls have been registered for more than a certain time.

31. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, second call means operable for registering calls for elevator service in a second direction at least for each of the intermediate landings, stopping means for each of the elevator cars, each of the stopping means being effective for stopping the associated elevator car at each of the landings approached by the associated elevator car for which a call is registered by

the call means for service in the direction of travel of such associated elevator car, means cooperating with said stopping means for stopping and reversing each of the elevator cars at each of the terminal floors, means responsive to a first traffic demand for conditioning each of the elevator cars when traveling in the second direction to stop and reverse at the farthest floor in such direction for which a call is registered by the first call means provided no call is registered by the second call means for such farthest floor or for any floor beyond said farthest floor, and means responsive to a second traffic demand for blocking response by a plurality of said elevator cars to calls registered by the first call means for certain of said landings.

32. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, second call means operable for registering calls for elevator service in a second direction at least for each of the intermediate landings, stopping means for each of the elevator cars, each of the stopping means being effective for stopping the associated elevator car at each of the landings approached by the associated elevator car for which a call is registered by the call means for service in the direction of travel of such associated elevator car, means cooperating with said stopping means for stopping and reversing each of the elevator cars at each of the terminal floors, selection means effective during operation of the system for selecting automatically periods for which different elevator services are desired, means responsive to selection by the selection means of a first period for conditioning each of the elevator cars when traveling in the second direction to stop and reverse at the farthest floor in such direction for which a call is registered by the first call means provided no call is registered by the second call means for such farthest floor or for any floor beyond said farthest floor, means responsive to selection by the selection means of a second period for blocking response by the elevator cars to calls registered by the second call means, and means responsive to selection by the selection means of a third period for preventing a plurality of the elevator cars during travel in the first direction from answering calls registered by the first call means for less than a predetermined time.

33. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, second call means operable for registering calls for elevator service in a second direction at least for each of the intermediate landings, stopping means for each of the elevator cars, each of the stopping means being effective for stopping the associated elevator car at each of the landings approached by the associated elevator car for which a call is registered by the call means for service in the direction of travel of such associated elevator car, means cooperating with said stopping means for stopping and reversing each of the elevator cars at each of the terminal floors, selection means effective during operation of the system for selecting automatically periods during which different elevator services are desired, means responsive to selection by the selecting means of a first period for conditioning each of the elevator cars when traveling in the second direction to stop and reverse at the farthest floor in such direction for which a call is registered by the first call means provided no call is registered by the second call means for such farthest floor or for any floor beyond said farthest floor, and means responsive to selection by the selection means of a second period for blocking response by the elevator cars to calls registered by the second call means, means responsive to selection by the selection means of a third period for preventing a plurality of the elevator cars during travel in the first direction from answering calls registered by the first call means for less than a predetermined time, and means responsive to selection by the selection means of a fourth period for assigning a plurality of elevator cars on certain trips in the second direction towards a predetermined intermediate landing for modified operation, each of the elevator cars assigned for modified operation being conditioned to stop and reverse at the farthest floor in the second direction between the assigned elevator car and the predetermined intermediate landing for which a call is registered by the first call means even though a call is registered for a floor beyond the predetermined intermediate floor.

34. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, second call means operable for registering calls for elevator service in a second direction at least for each of the intermediate landings, stopping means for each of the elevator cars, each of the stopping means being effective for stopping the associated elevator car at each of the landings approached by the associated elevator car for which a call is registered by the call means for service in the direction of travel of such associated elevator car, means cooperating with said stopping means for stopping and reversing each of the elevator cars at each of the terminal floors, means responsive to a first traffic demand for conditioning each of the elevator cars when traveling in the second direction to stop and reverse at the farthest floor in such direction for which a call is registered by the first call means provided no call is registered by the second call means for such farthest floor or for any floor beyond said farthest floor, and means responsive to a second traffic demand for assigning certain of said elevator cars to serve a first group of landings adjacent a first one of said terminal landings and certain of said elevator cars to serve a second group of landings intermediate the first group and the second one of said terminal landings, each of said elevator cars during travel towards the second one of said terminal landings being conditioned to stop and reverse at the farthest landing in the associated group for which a call is registered by the call means for service towards the first one of said terminal landings even though a call is registered for a landing beyond said farthest landing for service towards the second one of said terminal landings.

35. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator

cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, a plurality of car call means for each of the elevator cars operable for registering calls for landings desired by passengers within the elevator cars, stopping means for each of the elevator cars, each of the stopping means being effective for stopping the associated 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 answered by such stopping of the elevator car, and modifying means responsive to a function of operated car call means of said elevator cars for modifying the response of the elevator cars to calls registered by the call means.

36. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, a plurality of car call means for each of the elevator cars operable for registering calls for landings desired by passengers within the elevator cars, stopping means for each of the elevator cars, each of the stopping mean being effective for stopping the associated 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 answered by such stopping of the elevator car, modifying means responsive to a function of operated car call means of said elevator cars for modifying the response of the elevator cars to calls registered by the call means, and second modifying means responsive to a second function of operated car call means for further modifying the response of said elevator cars to calls registered by the call means.

37. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, second call means operable for registering calls for elevator service in a second direction at least for each of the intermediate landings, a plurality of car call means for each of the elevator cars operable for registering calls for landings desired by passengers within the elevator cars, stopping means for each of the elevator cars, each of the stopping means being effective for stopping the associated 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 answered by such stopping of the elevator car, reversing means cooperating with the stopping means for stopping and reversing each of the elevator cars at each of the terminal lands, and modifying means cooperating with the reversing and stopping means in response to the number of calls registered by the car call means of said elevator cars for conditioning each of a plurality of the elevator cars set for travel in the second direction to stop and reverse at the farthest landing in the second direction for which a call is registered by the first call means or the car call means of the car to be reversed.

38. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, second call means operable for registering calls for elevator service in a second direction at least for each of the intermediate landings, a plurality of car call means for each of the elevator cars operable for registering calls for landings desired by passengers within the elevator cars, stopping means for each of the elevator cars, each of the stopping means being effective for stopping the associated 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 answered by such stopping of the elevator car, reversing means cooperating with the stopping means for stopping and reversing each of the elevator cars at each of the terminal landings, and modifying means cooperating with the reversing and stopping means in response to the number of calls registered by the car call means of said elevator cars for conditioning each of a plurality of the elevator cars set for travel in the second direction to stop and reverse at the farthest landing in the second direction for which a call is registered by the first call means or the car call means of the car to be reversed, said modifying means in operated condition being effective for blocking response of said last-named plurality of said elevator cars to said second call means.

39. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, second call means operable for registering calls for elevator service in a second direction at least for each of the intermediate landings, a plurality of car call means for each of the elevator cars operable for registering calls for landings desired by passengers within the elevator cars, stopping means for each of the elevator cars, each of the stopping means being effective for stopping the associated 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 answered by such stopping of the elevator car, reversing means cooperating with the stopping means for stopping and reversing each of the elevator cars at each of the terminal landings, modifying means cooperating with the reversing and stopping means in response to the number of calls registered by the car call means of said elevator cars for conditioning each of a plurality of the elevator cars set for travel in the second direction to stop and reverse at the farthest landing in the second direction for which a call is registered by the first call means or the car call means of the car to be reversed, and means

responsive to a second number of calls registered by the car call means for modifying the response of said elevator cars to at least part of said first and second call means.

40. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, second call means operable for registering calls for elevator service in a second direction at least for each of the intermediate landings, a plurality of car call means for each of the elevator cars operable for registering calls for landings desired by passengers within the elevator cars, stopping means for each of the elevator cars, each of the stopping means being effective for stopping the associated 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 answered by such stopping of the elevator car, reversing means cooperating with the stopping means for stopping and reversing each of the elevator cars at each of the terminal landings, modifying means cooperating with the reversing and stopping means in response to the number of calls registered by the car call means of said elevator cars for conditioning each of a plurality of the elevator cars set for travel in the second direction to stop and reverse at the farthest landing in the second direction for which a call is registered by the first call means or the car call means of the car to be reversed, and means responsive to a second number of calls registered by the car call means for modifying the number of elevator cars subject to said farthest landing reversal.

41. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, car call means for each of the elevator cars operable for registering calls for landings desired by passengers within the elevator cars, stopping means for each of the elevator cars effective when each of the elevator cars travels in the first direction for stopping the first available one of the elevator cars at any of the intermediate landings approached by the first available one of the elevator cars for which a call is registered by the call means, and modifying means for each of said elevator cars, each of the modifying means being responsive to a function of operated car call means for the associated elevator car for expediting movement of said associated elevator car.

42. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, car call means for each of the elevator cars operable for registering calls for landings desired by passengers within the elevator cars, stopping means for each of the elevator cars effective when each of the elevator cars travels in the first direction for stopping the first available one of the elevator cars at any of the intermediate landings approached by the first available one of the elevator cars for which a call is registered by the call means, modifying means having an effective and an ineffective condition for each of said elevator cars, each of the modifying means when in effective condition being responsive to a function of operated car call means for the associated elevator car for expediting movement of said associated elevator car, and means responsive to a predetermined relationship between a first elevator car having said function of operated car call means and at least one other of the elevator cars for transferring the modifying means of the first elevator car from ineffective to effective condition.

43. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, car call means for each of the elevator cars for registering calls for landings desired by passengers within the elevator cars, stopping means for each of the elevator cars effective when each of the elevator cars travels in the first direction for stopping the first available one of the elevator cars at each of the intermediate landings approached by the available one of the elevator cars for which a call is registered by the call means, modifying means for each of said elevator cars, each of the modifying means being responsive to a predetermined delay in the response of the associated elevator car while set for travel in the first direction to a call registered by the associated car call means for at least one landing for conditioning the associated elevator car to pass landings for which calls are registered by the first call means without stopping in response to such last-named call means.

44. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, car call means for each of the elevator cars for registering calls for landings desired by passengers within the elevator cars, stopping means for each of the elevator cars effective when each of the elevator cars travels in the first direction for stopping the first available one of the elevator cars at each of the intermediate landings approached by the available one of the elevator cars for which a call is registered by the call means, a modifying means for each of said elevator cars, each of the modifying means being responsive to a predetermined delay in the response of the associated elevator car while set for travel in the first direction to a call registered by the associated car call means for

at least one landing for conditioning the associated elevator car to pass landings for which calls are registered by the first call means without stopping in response to such last-named call means, and means responsive to a predetermined call registration by said first call means for rendering said modifying means ineffective.

45. In an elevator system a structure having a pair of terminal landings and a plurality of landings intermediate the terminal landings, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure, motive means for each of the elevator cars for moving the elevator cars relative to the structure to serve the landings, and control means cooperating with the motive means for controlling the movement of the elevator cars relative to the structure and the stopping of the elevator car at the landings, said control means comprising first call means operable for registering calls for elevator service in a first direction at least for each of the intermediate landings, car call means for each of the elevator cars for registering calls for landings desired by passengers within the elevator cars, stopping means for each of the elevator cars effective when each of the elevator cars travels in the first direction for stopping the first available one of the elevator cars at each of the intermediate landings approached by the available one of the elevator cars for which a call is registered by the call means, modifying means having an ineffective and an effective condition for each of said elevator cars, each of the modifying means when in effective condition being responsive to a predetermined delay in the response of the associated elevator car while set for travel in the first direction to a call registered by the associated car call means for at least one landing for conditioning the associated elevator car to pass landings for which calls are registered by the first call means wtihout stopping in response to such last-named call means, and means effective when one of the elevator cars set for travel in the first direction is substantially overtaken by another one of the elevator cars for placing the modifying means of the overtaken elevator car in effective condition.

No references cited.