Jan. 6, 1953 W. F. EAMES 2,624,425

ELECTRICAL ELEVATOR SYSTEM HAVING SELECTIVE CONTROL OF RESPONSE TO CALLS

Filed June 7, 1950 4 Sheets-Sheet 1

Fig.1.

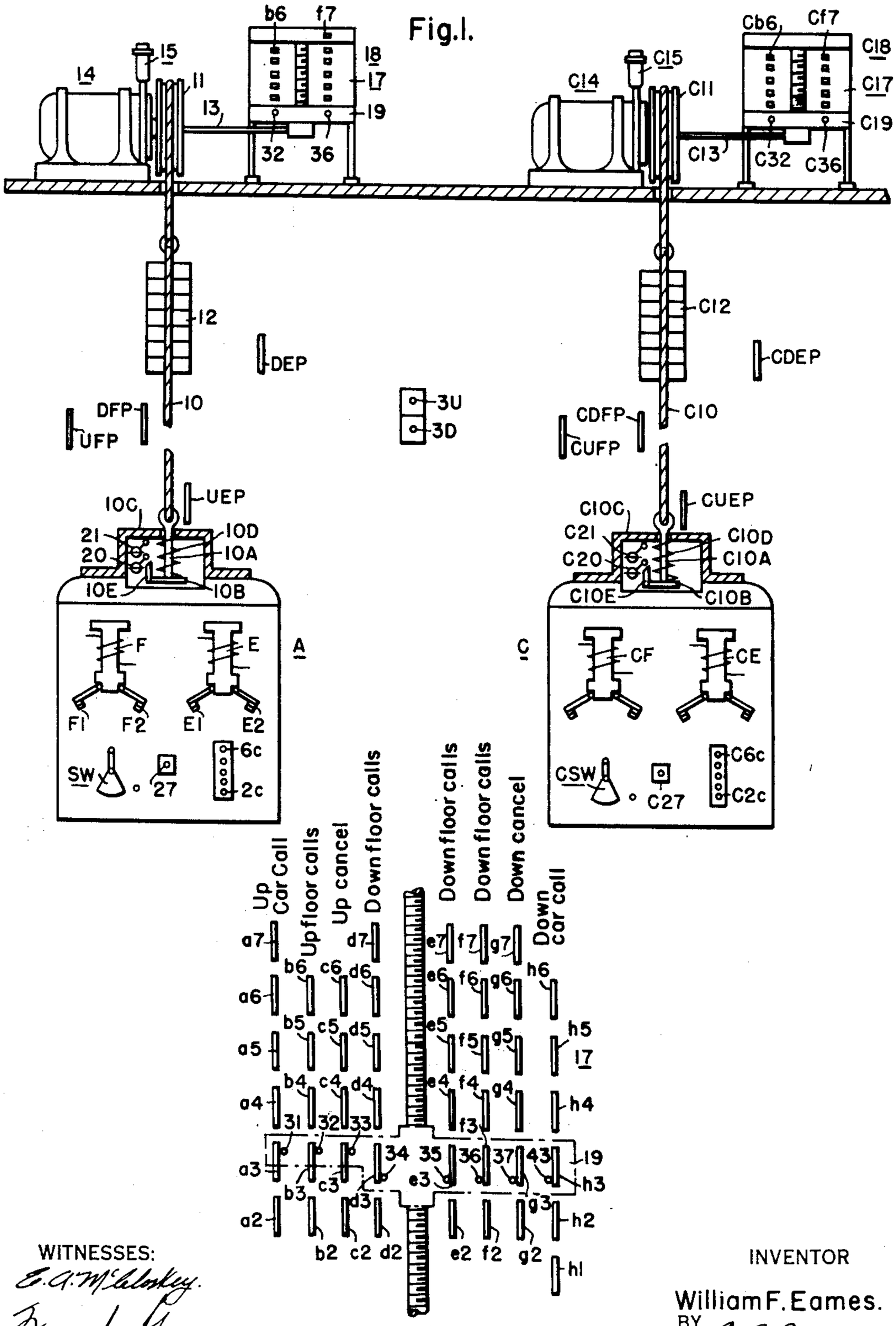

Fig.2.

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ELECTRICAL ELEVATOR SYSTEM HAVING SELECTIVE CONTROL OF RESPONSE TO CALLS

Filed June 7, 1950 4 Sheets-Sheet 2

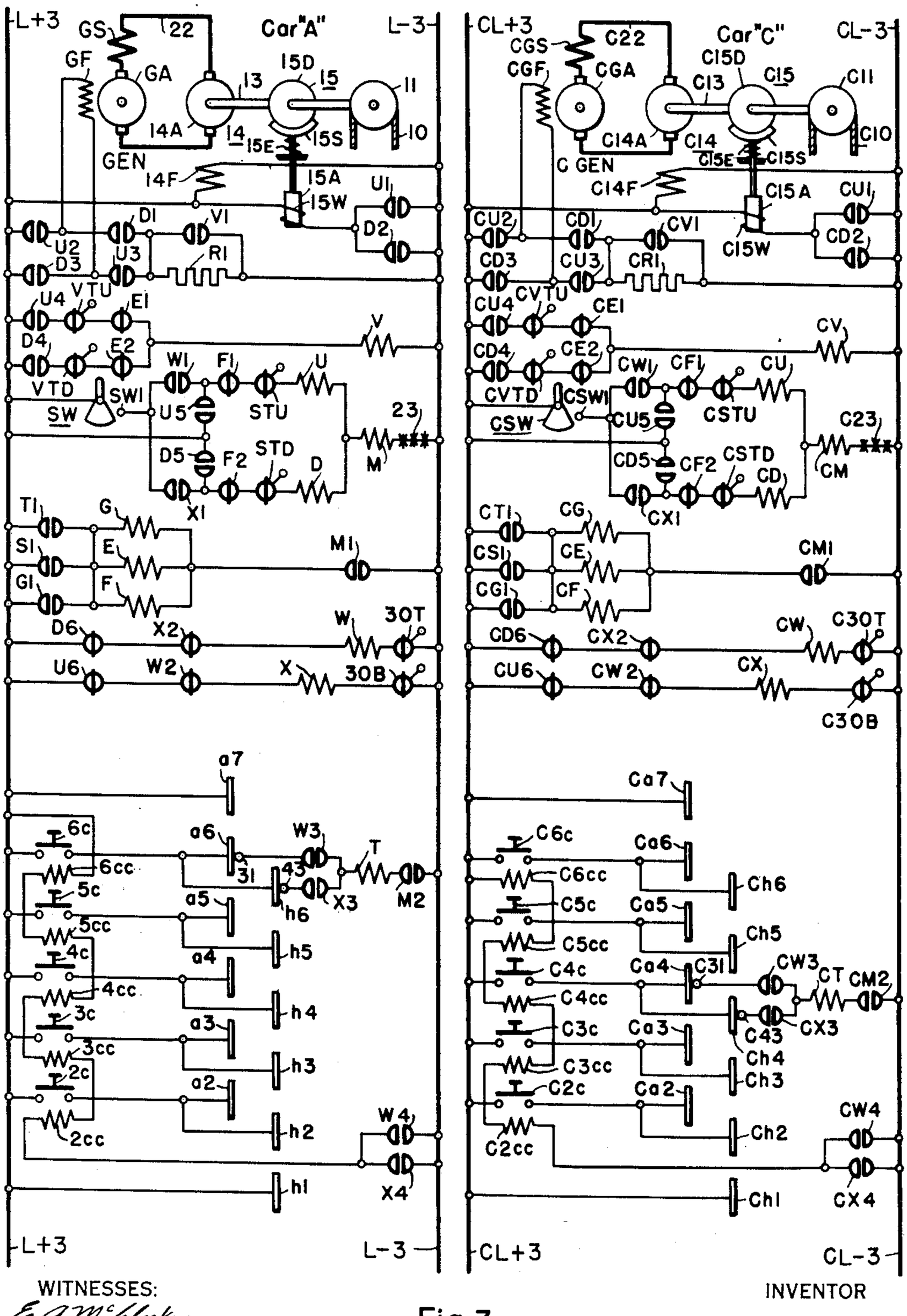

Fig.3.

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ELECTRICAL ELEVATOR SYSTEM HAVING SELECTIVE CONTROL OF RESPONSE TO CALLS

Filed June 7, 1950 4 Sheets-Sheet 3

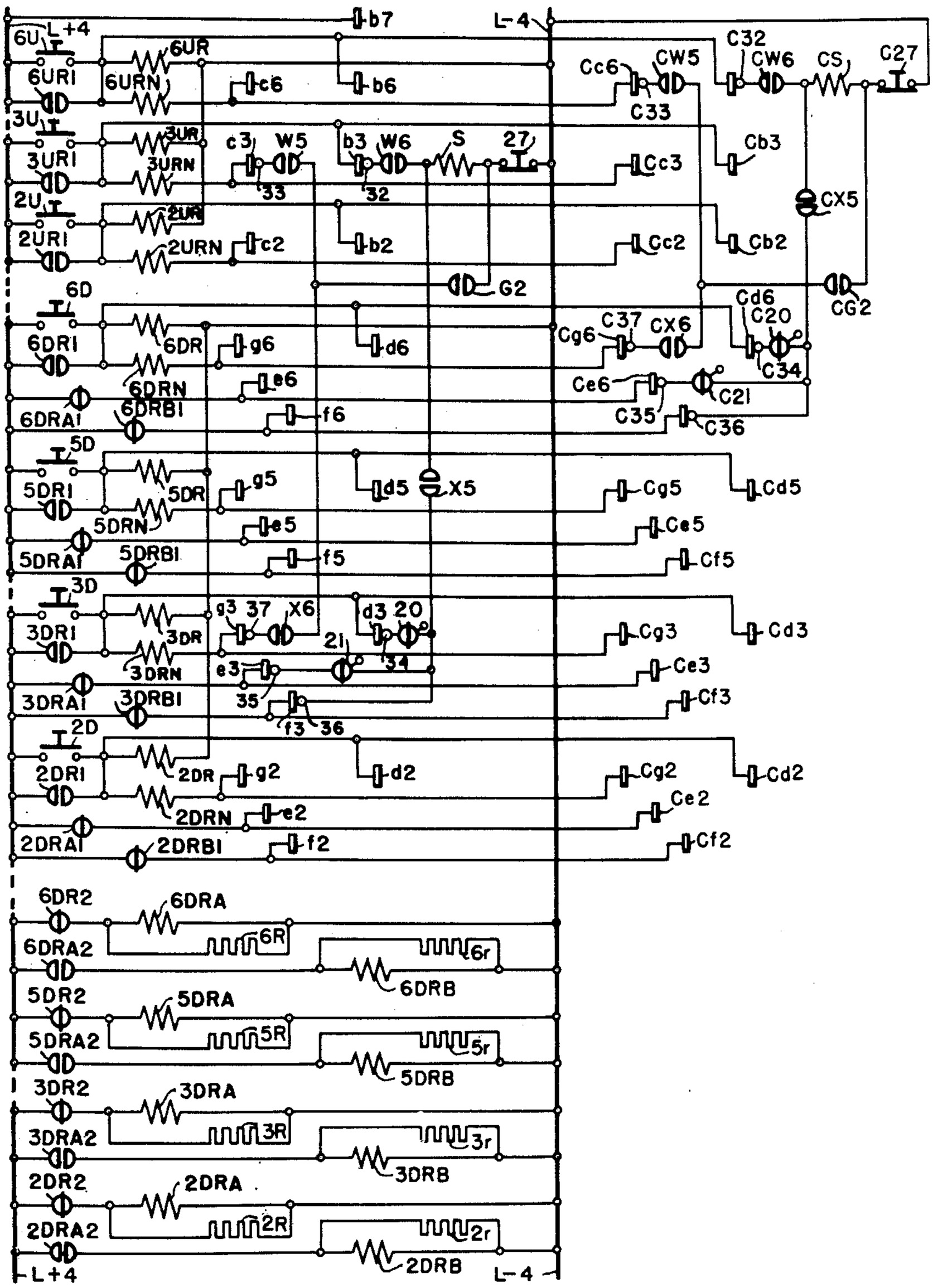

Fig.4.

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ELECTRICAL ELEVATOR SYSTEM HAVING SELECTIVE CONTROL OF RESPONSE TO CALLS

Filed June 7, 1950 4 Sheets-Sheet 4

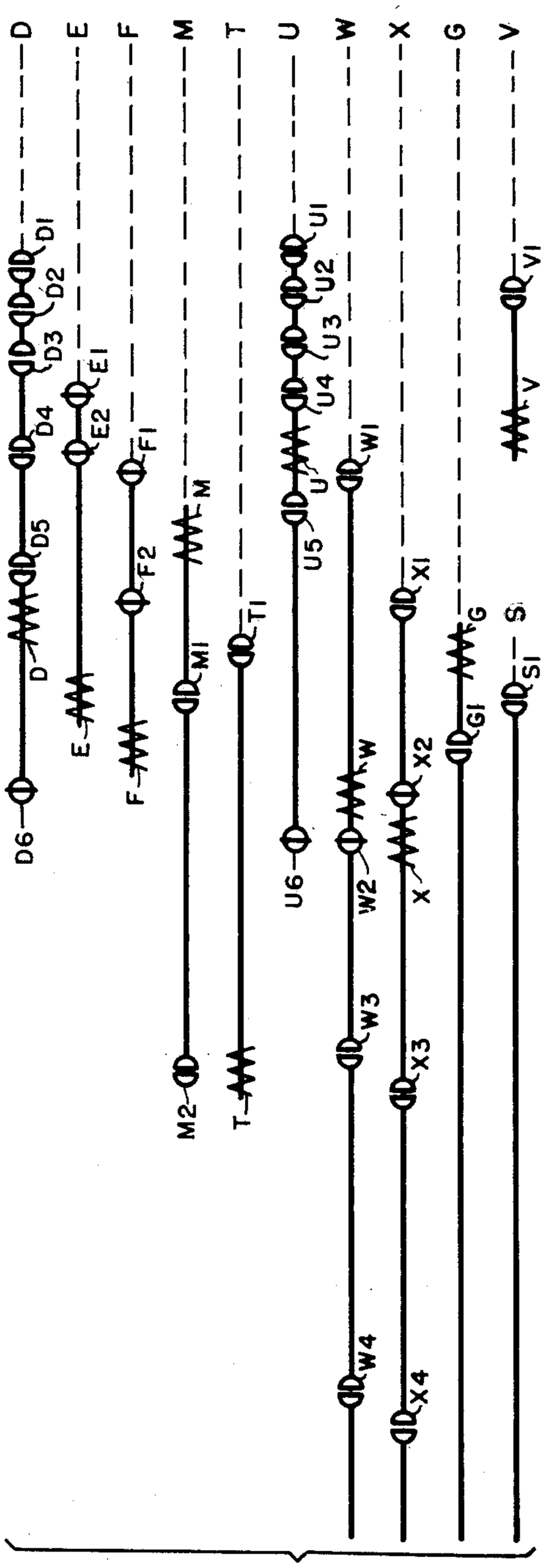

Fig. 3A.

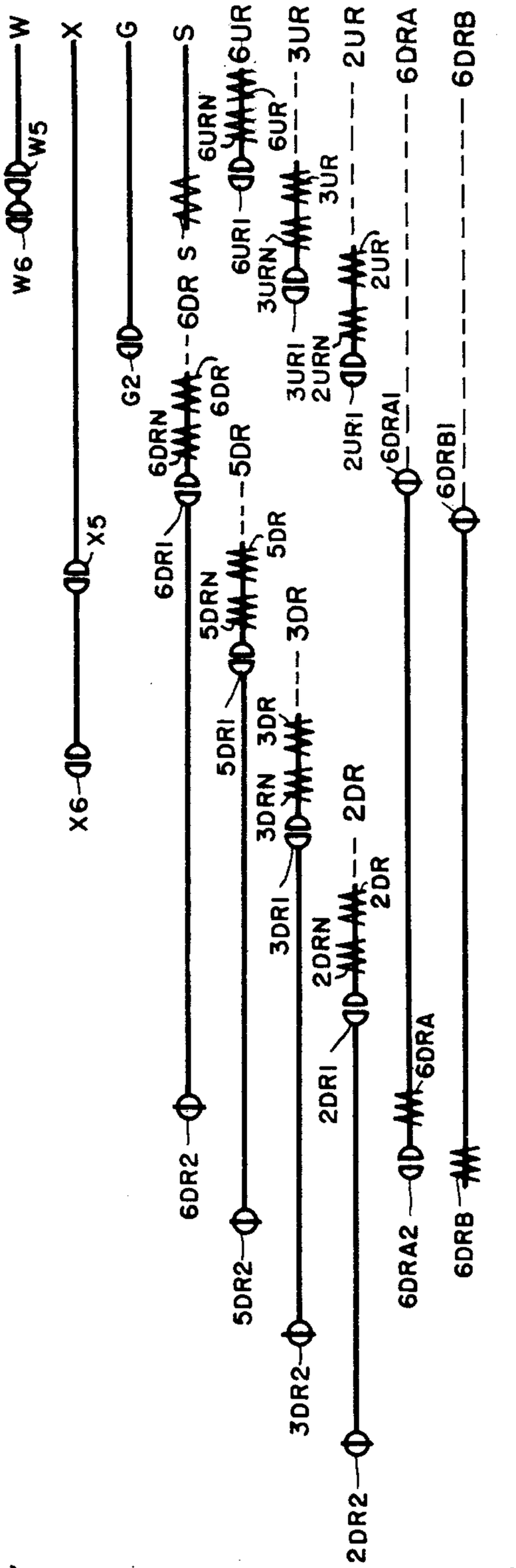

Fig. 4A.

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UNITED STATES PATENT OFFICE

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ELECTRICAL ELEVATOR SYSTEM HAVING SELECTIVE CONTROL OF RESPONSE TO CALLS

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Application June 7, 1950, Serial No. 166,620

30 Claims. (Cl. 187—29)

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My invention relates to electrical elevator systems and it has particular relation to elevator systems having a response to floor or landing calls which is dependent on elevator car loading.

Under certain conditions intending elevator passengers have been required to wait for service for an unduly long time. Although unreasonable waits for service may be encountered by a passenger desiring to travel in an up direction, the problem is encountered more frequently for passengers desiring to travel in a down direction and the invention will be discussed with reference to the down travel problem.

As a specific example of the problem reference may be made to the operation of an elevator system in a building during down peak periods. Thus, in the usual office building a heavy flow of traffic in the down direction is encountered at noon and at the close of the business day. At such times elevator cars may fill at the upper floors of the building and may pass calls from the lower floors of the building.

In accordance with the invention, the response of an elevator car to calls for service is controlled by a suitable factor such as car loading. As previously pointed out, the control may be desirable under certain conditions for up calls from the various floors or landings. Since the problem is more frequently encountered in connection with down peak operation the invention is illustrated and described with reference to such down peak operation.

As applied to the down peak operation the time during which floor or landing calls have been registered without being answered by an elevator car is measured for each call. Each elevator car serving the floors or landings answers the calls which have been registered for a time dependent on the car loading.

As a specific example, an elevator car which is loaded to less than fifty per cent of its capacity may answer all floor or landing calls which have been registered and which are encountered during the down travel of the elevator car. However, if the elevator car has a load in excess of fifty per cent of its capacity it may bypass all down floor or landing calls which have been registered for less than a predetermined time. Calls which have been registered for more than a predetermined time may be referred to as "priority calls."

If still further flexibility is desired the elevator car when it reaches a greater loading such as nine-tenths of its rated capacity may be conditioned during its down travel to bypass all down floor or landing calls which have been registered for less than a second predetermined time which is substantially longer than the first predetermined time. Calls which have been registered for more than the second predetermined time may be referred to as "high priority calls."

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If a bank of elevator cars serves the aforesaid landings each of the elevator cars may be conditioned in the above-described manner to answer calls registered for a time dependent on the individual car loading.

Although the invention may be applied to any desired elevator installation having any desired number of elevator cars serving any desired number of floors or landings it will be assumed for the purpose of describing the invention that a bank of two elevator cars serves a building having seven floors or landings. The two elevator cars are designated as cars A and C. Since the elevator cars and the control circuits are substantially similar the description of the invention will be confined largely to the elevator car A and its associated car circuits. Reference characters employed for the car A and the control circuits for the car A will be employed also for the car C and the control circuits for the car C but will be preceded by the letter C to indicate that the reference characters are for components associated with the car C.

Insofar as possible relays and switches are shown in their deenergized conditions. Each relay may have make or front contacts which close when the relay is energized. Also, the relay may have break or back contacts which open when the relay is energized. Each relay is identified by a reference character and each set of contacts is identified by a reference numeral. For example, the designation U4 indicates that reference is made to the fourth set of contacts of the up relay U.

It is an object of the invention to provide an elevator system wherein the response to calls from intending passengers is selectively controlled.

It is a further object of the invention to provide an elevator system wherein the time or duration of calls from intending passengers is measured and wherein calls are answered by an elevator car only if they have been registered for a time dependent on car loading.

It is also an object of the invention to provide an elevator system having a plurality of elevator cars each of which selects calls from intending passengers which it will answer in accord-

ance with the duration of registration of the calls and the loading of the individual elevator cars.

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 view in elevation with parts broken away and parts schematically shown of an elevator system embodying the invention;

Figure 2 is a view in elevation with parts broken away of a selector suitable for the system of Figure 1;

Figure 3 is a schematic view showing a portion of the control circuits employed in the system of Figure 1;

Figure 3A is a schematic view of relays employed in the control circuits of Figure 3. If Figures 3 and 3A are placed in horizontal alignment it will be found that the relay coils and contacts of the two figures are substantially in horizontal alignment.

Figure 4 is a schematic view showing further portions of the control circuits employed in the system of Figure 1, and

Figure 4A is a schematic view of relays employed in the control circuits of Figure 4. In some cases only representative relays are shown. If Figures 4 and 4A are placed in horizontal alignment it will be found that the relay coils and contacts of the two figures are substantially in horizontal alignment.

The following relays are specific to the car A.

V—Speed relay
U—Up relay
D—Down relay
M—Car running relay
G—Inductor holding relay
E—Inductor slow down relay
F—Inductor stopping relay
W—Up preference relay
X—Down preference relay
T—Car call stopping relay
S—Floor call stopping relay

The following relays are common to all of the cars:

2UR to 6UR—Up floor call registering relays
2DR to 7DR—Down floor call registering relays
2DRA to 6DRA—First down floor call timing relays
2DRB to 6DRB—Second down floor call timing relays

Figure 1

In Figure 1 the cars A and C are illustrated in association with their driving motors and certain associated equipment. As previously pointed out the elevator cars A and C and their control equipment are similar. For this reason the description will be restricted to the car A and its associated equipment. The reference characters for the car A and its associated equipment when preceded by the letter C are employed for designating similar components for the car C and equipment associated with the car C.

The car A is secured to one end of a flexible rope or cable 10 which passes over a sheave 11. A counterweight 12 is secured to the remaining end of the cable 10. The sheave 11 is attached to the shaft 13 of a direct current driving motor 14. Brake mechanism 15 is associated with the shaft 13 for the purpose of stopping rotation of the shaft 13.

A selector 17 has a screw 18 which is rotated by the shaft 13 through suitable gearing. A carriage 19 has threads for reception of the screw 18. The carriage is employed for moving contact brushes relative to stationary contact segments in accordance with movement of the elevator car A with respect to the floors or landings served by the elevator car. In order to simplify the illustration in Figure 1 only two rows of contact segments, the *b* and *f* rows, are illustrated. Brushes 32 and 36 are mounted on the carriage 19 for cooperation with the *b* and *f* rows of contact segments. It will be understood that each of the brushes engages successively the contact segments of the row associated with the brush in order to complete partially a separate control circuit as the elevator car A approaches each of its associated floors or landings.

The slow down and stopping of the elevator car A are controlled in part by two inductor relays E and F which are mounted on the elevator car. Such inductor relays are well known in the art. When the winding of the inductor relay E is energized contacts E1 and E2 of the inductor relay are not actuated until the inductor relay reaches one of its associated inductor plates UEP or DEP. If the elevator car is traveling up and the winding of the inductor relay E is energized the contacts E1 are opened when the inductor relay reaches the next up inductor plate UEP associated therewith. This inductor plate completes a magnetic circuit which results in operation of the contacts E1. In an analogous manner when the elevator car travels downwardly the contacts E2 are opened when the inductor reaches its next down inductor plate DEP provided that the winding of the inductor relay E is energized. In an analogous manner the inductor relay F cooperates with up inductor plates UEP and down inductor plates DEP.

It will be understood that four inductor plates similar to those illustrated in Figure 1 are provided for each of the intermediate landings served by the elevator car. Two inductor plates UFP and UEP are provided for the upper terminal landing and two inductor plates DFP and DEP are provided for the lower terminal landing. The inductor plates UEP and DEP determine the initiation of slow down of the elevator car as it approaches the landing at which it is to stop. The inductor plates UFP and DFP determine the stopping point for the elevator car as it approaches the landing at which it is to stop.

Each of the intermediate floors or landings has two push buttons associated therewith. These push buttons are common to all of the cars. A push button station for the third floor is illustrated in Figure 1. This station includes an up push button 3U and a down push button 3D. At the upper terminal landing only one down push button is required.

In order to stop the elevator car A at floors desired by car passengers a push button station is mounted on the elevator car. This station has push buttons 2*c* to 6*c* for the respective floors 2 to 6. When any of the push buttons are operated the elevator car is stopped at the floor represented by the push button.

The elevator car A also carries a car switch SW which may be operated to start the elevator car from a floor at which it is stopped. Also a bypass button 27 is provided which may be operated by the car attendant to bypass calls at any of the floors served by the elevator car.

The elevator car A has preference means which is responsive to the load carried by the elevator car. This means includes mechanism in Figure

1 located between the elevator car A and the cable 10. It will be noted that the cable 10 is secured to an eye at one end of a rod 10A which has a plate 10B secured to its other end. The rod is mounted for sliding movement in an opening of a bracket 10C which is secured to the elevator car A. A compression spring 10D is located between the plate 10B and the bracket 10C. Consequently, as the load of the elevator car increases the spring 10D is compressed to a greater degree and the plate 10B approaches the bracket 10C. Such approach is employed for actuating a plurality of mechanically-operated switches 20 and 21. It will be noted that the plate 10B has a cam 10E secured thereto. As the spring 10D is compressed the cam 10E successively engages and opens the normally-closed switches 20 and 21.

Figure 2

The selector 17 is illustrated in greater detail in Figure 2. Eight rows of contact segments are provided in the selector 17. The contact segments *a*2 to *a*7 assist in controlling the response of the elevator car to car calls registered for car passengers while the elevator car is traveling in the up direction. In designating the contact segments each numeral of a reference character for a contact segment represents the floor with which the contact segment is associated.

The row of contact segments *b*2 to *b*6 assist in controlling the response of the elevator car to up floor calls.

The row of contact segments *c*2 to *c*6 assist in cancelling up floor calls which are answered by the elevator car.

Rows of contact segments *d*2 to *d*7, *e*2 to *e*7 and *f*2 to *f*7 assist in controlling the response of the elevator to down floor calls.

The row of contact segments *g*2 to *g*7 assists in cancelling down floor calls which are answered by the elevator car.

The row of contact segments *h*1 to *h*6 assists in controlling the response of the elevator car to down car calls registered for car passengers.

The carriage 19 has eight contact brushes which are insulated from each other and each of which cooperates with a separate one of the rows of contact segments. It will be understood that the contact segments are insulated from each other. The carriage 19 is illustrated in the position which is occupies when the elevator car is adjacent the third floor.

Figure 3

Figure 3 illustrates a portion of the control circuits for the elevator cars. Circuits are illustrated for the speed relay V, the up relay U, the down relay D, the car running relay M, the up preference relay W, the down preference relay X and the car call stopping relay T. Direct current for energizing the various control circuits is supplied from a suitable source through buses L+3 and L—3.

The armature 14A of the driving motor 14 is connected to the armature GA of a direct-current generator GEN through a loop circuit 22. A series field winding GS for the generator is included in the loop circuit in series with the armatures of the motor and generator. The armature of the generator is driven at a constant rate by means of a suitable motor (not shown). The driving motor and the generator are associated in a conventional variable-voltage system for driving the associated elevator car.

The brake 15 includes a brake drum 15D secured to the shaft 13 and brake shoe 15S which is biased against the drum by means of a spring 15E. The brake shoe 15S is retracted from its associated drum upon energization of a solenoid winding or coil 15W which cooperates with a magnetic armature 15A. The winding 15W is energized from the direct-current buses through either of the sets of contacts U1 or D2.

The driving motor 14 has a field winding 14F which is connected for energization across the direct-current buses.

The generator has a field winding GF which is connected for energization from the direct-current buses L+3, L—3 through a reversing switch. The reversing switch comprises the contacts D1, D3 and the contacts U2, U3 of the down and up relays. The specific contacts closed depend upon the direction of travel desired for the elevator car. The magnitude of the energization of the field winding GF is controlled by a resistor R1 which is connected in series with the field winding. The resistor may be shunted by means of make contacts V1 of the speed relay.

The speed relay V may be energized from the direct current buses through either of two paths. One path includes in series the make contacts U4, an upper limit switch VTU which is opened mechanically as the elevator car nears its upper terminal floor and the break contacts E1 of the slow down inductor relay. The second path includes in series the make contacts D4, the contacts of a lower limit switch VTD which are opened as the elevator car nears its lower terminal floor and the break contacts E2 of the slow down inductor relay.

The car running relay M may be energized through either of two circuits. One of these circuits includes the car switch SW, make contacts W1 of the up preference relay, break contacts F1 of the stopping inductor relay, break contacts STU of an upper limit switch which is opened as the elevator car nears the upper terminal landing, the up relay U, the relay M and safety devices 23. The safety devices may include contacts which are closed only when the car and landing doors are closed. When the car running relay M is energized through this circuit the contacts U5 close to complete a holding circuit around the switch SW and the contacts W1.

The car running relay M also may be energized through a circuit which includes the car switch SW, the make contacts X1 of the down preference relay, the break contacts F2 of the stopping inductor relay, the break contacts STD of a lower limit switch which are opened as the elevator car nears its lower terminal landing, the down relay D, the relay M and the safety devices 23.

In order to energize the relays E, F and G the car running relay M must be energized to close its make contacts M1. In addition the car call stopping relay T or the floor call stopping relay S must be energized to close the contacts T1 or S1. When once energized the holding relay G closes its contacts G1 to maintain the energization of the inductor relay windings despite subsequent deenergization of the relays T and S.

The up preference relay W is energized through the break contacts D6 and X2 and through the break contacts 30T of an upper limit switch. The upper limit switch 30T is mechanically operated to open its contacts as the elevator car nears the upper terminal landing.

The down preference relay X is energized through the break contacts U6 and W2 and

through break contacts 30B of a lower limit switch which is opened as the elevator car nears its lower terminal landing.

The car call buttons 2c to 6c normally are biased to their open positions. When one of the buttons is operated by the car attendant it is maintained in operated condition by one of the windings 2cc to 6cc. It will be understood that each of the energized buttons is made of magnetic material which acts as an armature for the associated winding. The windings are energized through one of the sets of make contacts W4 or X4. Since these contacts are both momentarily open at each terminal landing it will be understood that all of the buttons 2c to 6c are reset at each of the terminal landings. Since it is assumed that the elevator cars operate on through trips, car call push buttons are not required for the upper and lower terminal landings. For this reason the contact segments a7 and h1 are connected to the bus L+3.

When any one of the car call buttons is actuated the associated contact segments are connected to the bus L+3. For example, if the car call button for the fourth floor is operated the contact segments a4 and h4 are connected to the bus L+3. As the elevator car nears the fourth floor a circuit is closed for the car call stopping relay T. If the car is traveling up the circuit is completed through the brush 31 and the make contacts W3. If the car is traveling down the circuit is completed through the brush 43 and the make contacts X3.

Figure 4

In Figure 4 the floor-call stopping relay S and the floor call circuits are illustrated Inasmuch as the control circuits for the intermediate floors are all similar, the circuits will be shown only for selected ones of the intermediate floors in order to conserve space. In designating the floor call push buttons and the registering relays, the numeral in each reference character represents the floor with which the component represented by such reference character is associated.

In the upper portion of Figure 4 the floor-call push buttons 2U, 3U and 6U are illustrated. It will be understood that the circuits for the fourth and fifth floors are similar to those illustrated for the third floor. Inasmuch as the elevator car always stops at the upper terminal landing, the contact segment b7 may be connected directly to the bus L+4.

When the push button 3U for the third floor is operated the up registering relay 3UR is energized from the direct current buses L+4, L—4 and closes its make contacts 3UR1 to establish a holding circuit around the push button. The contact segments b3 and Cb3 are now connected to the bus L+4. If the elevator car A is traveling up from the lower terminal landing the up preference relay contacts W6 are closed and when the brush 32 reaches the contact segment b3 a circuit is completed for the floor call stopping relay S as follows:

L+4, 3UR1, b3, 32, W6, S, 27, L—4

Had the car C been the first car to reach the third floor while traveling up, the car C would have responded to the up call from the third floor in the same way. In other words, the first elevator car to reach a floor at which a call is registered for the direction of travel of the elevator car normally answers the call.

As the elevator car A answered the call at the third floor the brush 33 engaged the contact segment c3 to complete a cancelling circuit for the cancelling coil as follows:

L+4, 3UR1, 3URN, c3, 33, W5, G2, 27, L—4

This results in the cancellation of the call at the third floor. The push buttons for the other intermediate landings for up floor calls operate in a similar manner.

Push buttons 2D, 3D, 5D and 6D are illustrated for registering down calls from the associated floors. The circuits for the fourth floor are not illustrated but it will be understood that they will be similar to those associated with the other floors. Since all of the down floor push buttons operate similarly, it will suffice to discuss the operation for the third floor. When the push button 3D is operated the following circuit is established:

L+4, 3D, 3DR, L—4

The make contacts 3DR1, consequently, close to establish a holding circuit around the push button. The contact segments d3 and Cd3 now are connected to the bus L+4.

If the elevator car A is traveling down the contacts X5 are closed. Consequently, when the elevator car nears the third floor, the following circuit is established:

L+4, 3DR1, d3, 34, 20, X5, S, 27, L—4

The floor call stopping relay S now is energized to initiate a stopping operation of the elevator car.

As the elevator car continues to approach the third floor the brush 37 engages the contact segment g3 to complete the following cancelling circuit:

L+4, 3DR1, 3DRN, g3, 37, X6, G2, 27, L—4

Since the coils 3DR and 3DRN are wound in opposition the contacts 3DR1 now open to cancel the call at the third floor.

Had the car C been the first car to reach the third floor while traveling down after a down call had been registered at the third floor, the car C would have answered the third floor call in the same manner. It will be understood that down floor calls from the remaining floors are answered in the same manner discussed for the third floor.

In order to improve the service for floor calls which have remained unanswered for a long time and to improve the general operation of the bank of elevator cars provision is made for measuring the time during which a floor call remains unanswered. Although such measurement could be made for up floor calls, the problems herein solved are present primarily for down floor calls and will be discussed with reference to such down floor calls. The timing circuits are illustrated in the lower part of Figure 4.

First timing relays 2DRA to 6DRA are provided for the various down floor call registering relays. Second timing relays 2DRB to 6DRB also are provided. It will be noted that the circuits for the fourth floor are not illustrated in Figure 4 but are similar to the circuits for the other floors. Since the timing circuits for the various floors are similar, it will suffice to discuss the timing circuits for the third floor.

When a down call is registered at the third floor the third floor registering relay is energized to open its break contacts 3DR2. This deenergizes the normally energized timing relay 3DRA. The relay 3DRA has a delayed drop out. The

delay in drop out may be obtained in any desired manner. In the specified embodiment herein illustrated it will be assumed that the delay is obtained by connecting a resistor 3R across the winding of the relay 3DRA. This resistor may be selected to provide the desired delay in drop out. If desired, the resistor may be adjustable to permit ready adjustment of the time delay. Also the delays for the different floors may vary if so desired.

At the end of the delay period the relay 3DRA drops out to close its break contacts 3DRA1 and to open its make contacts 3DRA2. Closure of the contacts 3DRA1 connects the contact segments *e*3 and C*e*3 to the bus L+4. Such connection of the contact segments *e*3 and C*e*3 indicates that a priority down call exists at the third floor.

The opening of the contacts 3DRA2 interrupts the energizing circuit for the normally-energized second timing relay 3DRB. This relay has a delayed drop out and may be similar in construction to the relay 3DRA. Thus, a resistor 3*r* is connected across the winding of the relay 3DRB to provide the desired delay in drop out thereof. Should the contacts 3DRA2 reclose before the expiration of the delay in drop out of the relay 3DRB (indicating that the third floor down call has been answered) the relay 3DRB is promptly reenergized and does not drop out. However, should the relay 3DRB drop out it closes its break contacts 3DRB1 to connect the contact segments *f*3 and C*f*3 to the bus L+4. Consequently, the connection of the contact segments *f*3 and C*f*3 to the bus L+4 indicates that a high priority down call exists for the third floor.

It will be appreciated that three rows of contact segments *d*2 to *d*6, *e*2 to *e*6 and *f*2 to *f*6 control the response to down floor calls. These rows are selected by operation of the mechanical load switches 20 and 21. The load switch 20 may be designed to open when more than a moderate load, such as 50 per cent of rated capacity, is carried by the elevator car. The switch 21 may be designed to open only if a larger load, such as 90 per cent of rated capacity, is reached or exceeded for the elevator car. It may be well to point out that as many rows of contact segments similar to the *e*-row may be employed as desired, each row being effective for a different time of call registration. Also the number of switches 20, 21 employed would depend on the number of rows of contact segments, each switch being responsive to a different car loading. However, the invention will be understood adequately as applied to a system having the number of contact segments and switches here illustrated.

As long as the switch 20 is closed, indicating that the elevator car A is lightly loaded, the brush 34 is effective for stopping the elevator car A at each of the down floor calls reached by the elevator during its travel towards the lower terminal landing. However, as soon as the switch 20 opens, indicating that the elevator car A has reached or exceeded a predetermined loading, such as 50 per cent of its normal rated capacity, the brush 34 is ineffective for completing a stopping circuit for the floor call stopping relay S and the stopping of the elevator car A is now under control of the brush 35. This brush 35 is effective for stopping the elevator car S only at those down floor calls which have been registered for a time sufficient to result in drop out of the relays 2DRA to 6DRA associated with such down floor calls.

As soon as the elevator car A reaches or exceeds a loading sufficient to open the switch 21, the brush 35 becomes ineffective for controlling the stopping of the elevator car A and the stopping of the elevator car now is under the control of the brush 36. This brush permits stopping of the elevator car only at the down floor calls which have been registered for a time sufficient to permit drop out of the relays 2DRB to 6DRB associated with such down floor calls in addition to drop out of the relays 2DRA to 6DRA. In this way the duration of the registration of a down floor call necessary to stop a down traveling elevator car varies as a function of the loading of the elevator car.

The switches C20 and C21 operate in a similar manner to control the stopping of the elevator car C for down floor calls.

Operation car A travels up

A typical operation of the elevator car A now will be considered. It will be assumed initially that the elevator car A is at the lower terminal landing, that it has received its dispatch signal and that the elevator car attendant has closed his doors.

It will be understood that as the elevator car A reaches the lower terminal landing the switch 30B opened to deenergize the down preference relay X. This relay, consequently, closes its break contacts X2 to complete an energizing circuit for the up preference relay W. The up preference relay closed its make contacts W1 to prepare the elevator car for up travel. Also break contacts W2 opened to prevent subsequent energization of the down preference relay. In addition, contacts W3 and W6 were closed to prepare other parts of the system for operation.

Upon receipt of the dispatch signal the car attendant closes the switch SW to complete the following circuit:

L+3, SW, SW1, W1, F1, STU, U, M, 23, L—3

The car running relay M closes its contacts M1 to prepare the relays E, F and G for subsequent energization.

The up relay U closes its make contacts U1 to energize the brake winding 15W. This results in release of the brake.

Closure of the make contacts U2 and U3 connects the generator field winding F for energization with proper polarity to produce up travel of the elevator car.

Make contacts U4 close to connect the speed relay V for energization. This relay closes its contacts V1 to shunt the resistor R1. The elevator car now is conditioned for full acceleration.

Make contacts U5 close to establish a holding circuit around the switch SW and the contacts W1 of the up preference relay.

Break contacts U6 open to prevent energization of the down preference relay X.

As the elevator car leaves the lower terminal landing, it will be assumed that an up floor call is received from the third floor. Such a call is registered by operation of the push button 3U (Figure 4). As a result of the push button operation the up call registering relay 3UR is energized and closes its make contacts 3UR1 to establish a holding circuit around the push button. Contact segments *b*3 and C*b*3 are now connected to the bus L+4.

Assuming that the elevator car A is the first car to approach the third floor while traveling

up, the brush 32 reaches the contact segment *b*3 to complete the following circuit:

L+4, 3UR1, *b*3, 32, W6 S, 27, L—4

The energization of the floor call stopping relay S results in closure of the make contacts S1 (Figure 3) to complete an energizing circuit for the windings of the relays E, F and G. The relay G closes its make contacts G1 to establish a holding circuit around the contacts S1. The windings of the inductor relays E and F remain energized but these relays fail to operate their contacts until they reach their associated inductor plates.

As the elevator car A approaches the third floor the brush 33 reaches the contact segment *c*3 and completes the following circuit:

L+4, 3UR1, 3URN, *c*3, 33, W5, G2, 27, L—4

Since the coils 3UR and 3URN are wound in opposition to each other the third floor call now is cancelled.

Referring to Figure 1 it will be noted that as the car A approaches the third floor the inductor relay E finally reaches the inductor plate UEP for the third floor. This completes a magnetic circuit which results in opening of the contacts E1 of the slow down inductor relay. By reference to Figure 3 it will be noted that opening of the contacts E1 results in deenergization of the speed relay V. This relay opens its make contacts V1 to introduce the resistor R1 in series with the generator field winding. The elevator car A, consequently, slows down to a landing speed.

Returning again to Figure 1, the elevator car A approaches the third floor at its landing speed. When the stopping inductor relay F reaches the inductor plate UFP for the third floor, a magnetic circuit is completed which results in opening of the contacts F1.

The opening of the contacts F1 (Figure 3) deenergizes the up relay U and the car running relay M. The latter relay opens its contacts M1 to deenergize the relays E, F and G.

The deenergization of the up relay U results in opening of the contacts 1 to deenergize brake winding 15W. The spring 15E, consequently, applies the brake to stop the elevator car accurately at the third floor. At the same time contacts U2 and U3 open to deenergize the generator field winding. Contacts U4 and U5 open but have no immediate effect on the operation of the system. Contacts U6 close but since the contacts W2 remain open, the down preference relay X remains deenergized.

It will be assumed that a passenger enters the elevator car at the third floor and desires to proceed to the sixth floor. As a result of the request by the passenger the car attendant operates the push button 6*c* to connect the contact segments *a*6 and *h*6 to the bus L+3. He then operates his switch SW to start the car upwardly in the same manner by which he started the elevator car from the lower terminal landing.

Inasmuch as the contacts X3 are open the contact segment *h*6 does not effect the operation of the elevator car during its up travel. However, when the brush 31 reaches the contact segment *a*6 the following circuit is established:

L+3, 6*c*, *a*6, 31, W3, T, M2, L—3

The relay closes its contacts T1 to energize the relays E, F and G. These cooperate to slow down and stop the elevator car at the sixth floor in the same manner discussed with reference to the third floor operation. Upon discharge of the car passenger at the sixth floor the car attendant starts his elevator car from the sixth floor in the same manner discussed with reference to the lower terminal landing.

As the elevator car nears the seventh floor the brush 31 engages the contact segment *a*7 and the brush 32 (Figure 4) engages the contact segment *b*7. The resulting energization of either of the relays T or S energizes the relays E, F and G (Figure 3) to stop the elevator car at the seventh floor in the manner discussed with reference to the stopping of the elevator car at the third floor.

As the elevator car reaches the seventh floor the upper limit switch 30T opens to deenergize the up preference relay W. This relay opens its contacts W1 to prevent subsequent energization of the up relay U and closes its break contacts W2 to permit energization of the down preference relay X. Immediately after the deenergization of the up preference relay W both of the sets of contacts W4 and X4 momentarily are open. This results in resetting of the push button 6*c*.

Operation—Car A travels down

It will be assumed next that the car A has received its dispatch signal and is about to start down from the seventh floor. It is assumed further that down floor calls have been registered at the second and third floors. As a result of such registration the contacts 2DR1 and 3DR1 of the down floor call registering relays are closed. The contacts 2DR2 and 3DR2 of these relays are open. It will be assumed that the relay 2DRA has been deenergized by the opening of the contacts 2DR2 for a time sufficient to drop out and close its contacts 2DRA1. Also the contacts 2DRA2 were opened on drop out of the relay to initiate a timing out operation of the second timing relay 2DRB.

In order to start the car A from the upper terminal floor the car attendant closes his doors and his switch SW. The closure of the switch EW completes the following circuit:

L+3, SW, SW1, X1, F2, STD, D, M, 23, L—3

The car running relay M closes its contacts M1 and M2 to prepare the relays E, F, G and T for subsequent energization.

The down relay D closes its contacts D2 to release the brake 15. At the same time contacts D1 and D3 close to connect the generator field winding GF for energization with proper polarity for down travel of the elevator car. Contacts D4 close to energize the speed relay V. This relay closes its contacts V1 to establish a shunt across the resistor R1. The elevator control system now is conditioned for rapid acceleration for the elevator car in a down direction.

Contacts D5 close to establish a shunt around the car switch SW and the contacts X1. Contacts D6 open to prevent energization of the up preference relay W.

As the car A leaves the upper terminal landing it is assumed that a down floor call is registered from the sixth floor. This results in energization of the down floor call registering relay 6DR which closes its holding contacts 6DR1 and which opens its break contacts 6DR2. The relay 6DRA now starts to time out.

As the elevator car A moves downwardly its brush 34 ultimately engages the contact segments *d*6 to complete the following circuit:

L+4, 6DR1, *d*6, 34, 20, X5, S, 27, L—4

The stopping relay S closes its make contacts S1 (Figure 1) to complete an energizing circuit for the relays E, F and G. The relay G closes its make contacts G1 to establish a holding circuit around the contacts S1.

During the down travel, and following the energization of the relay S, the brush **37** (Figure 4) engages the contact segment *g*6 to complete the following circuit:

L+4, 6DR1, 6DRN, *g*6, 37, X6, G2, 27, L—4

The energization of the cancelling coil 6DRN cancels the down floor call registered for the sixth floor.

Referring to Figure 1 it will be noted that as the elevator car A proceeds towards the sixth floor the slow down inductor relay E reaches the inductor plate DEP for the sixth floor and opens its contacts E2. The opening of the contacts E2 (Figure 3) deenergizes the speed relay V. The speed relay V opens its contacts V1 to introduce the resistor R1 in series with the field winding GF. The elevator car A now slows down to its landing speed.

Continued movement of the elevator car A at its landing speed brings the stopping inductor relay F to the inductor plate DFP for the sixth floor. This completes a magnetic circuit which results in opening of the contacts F2. By reference to Figure 3 it is clear that opening of the contacts F2 results in deenergization of the down relay D and the car running relay M. The relay M opens its contacts M1 to deenergize the relays G, E and F. The contacts M2 also open but have no immediate effect on the operation of the system.

Upon deenergization of the down relay the contacts D2 open to deenergize the brake winding 15W. Therefore, the brake is applied to stop the elevator car at the sixth floor. Also contacts D1 and D3 open to deenergize the generator field winding GF. Contacts D4 and D5 open but have no immediate effect on the operation of the system. Contacts D6 close but since the contacts X2 remain open the up preference relay W is not energized.

It will be assumed now that the relay 2DRB (Figure 4) has timed out and closed its contacts 2DRB1 to connect the contact segment *f*2 and C*f*2 to the bus L+4. Also it is assumed that the relay 3DRA has timed out. This relay closes its contacts 3DRA1 to connect the contact segments *e*3 and C*e*3 to the bus L+4.

At this point a down floor call is registered from the fifth floor. The down call from the fifth floor results in energization of the down floor call registering relay 5DR which closes its self holding contacts 5DR1. In addition, the relay opens its contacts 5DR2 to initiate a timing out opertaion of the relay 5DRA.

At the sixth floor a sufficient number of passengers enter the elevator car to load the elevator car slightly in excess of one half of its rated capacity. Such loading results in opening of the switch 20 (Figure 1) by the cam 10E. Referring to Figure 4 it will be noted that the opening of the switch 20 renders the brush 34 ineffective and the contact segments *d*2 to *d*6 no longer control the stopping of the elevator car for down floor calls.

The car attendant closes his doors and starts the elevator car down in the same manner discussed with reference to the starting of the elevator car from the upper terminal landing. As the elevator car approaches the fifth floor the

brush 34 engages the contact segment *d*5. Because the switch 20 is open the engagement of the contact segment *d*5 by the brush can not stop the elevator car at the fifth floor and the elevator car consequently passes the call at the fifth floor.

As the elevator car approaches the third floor the brush 35 engages the contact segment *e*3 to complete the following circuit:

L+4, 3DRA1, *e*3, 35, 21, X5, S, 27, L—4

Since the relay S is energized it initiates a stopping operation of the elevator car at the third floor in the same manner by which it controlled the stopping of the elevtaor car at the sixth floor during the down travel of the elevator car. Also the brush 37 engages the contact segment *g*3 to cancel the call at the third floor in the same manner by which the engagement of the brush 37 with the contact segment *g*6 cancelled the call at the sixth floor.

It will be noted that the opening of the switch 20 has removed the contact segments *d*2 to *d*6 from service and has made the stopping of the elevator car A dependent on the contact segments *e*2 to *e*6.

It will be assumed now that at the third floor a sufficient number of passengers enter the elevator car to raise its loading slightly above 90 per cent of rated capacity. As a result of such loading the switch 21 (Figure 1) is opened by its associated cam 10E. The opening of the switch 21 (Figure 4) renders ineffective the brush 35 and the contact segment *e*2 to *e*6. The stopping of the elevator car now is controlled by the brush 36 and the contact segments *f*2 to *f*6. Consequently, the elevator car can stop only for high priority calls which are registered by drop out of one or more of the relays 2DRB to 6DRB.

The elevator car A is now started down from the third floor in the same manner by which it was started from the upper terminal floor. As the elevator car proceeds downwardly the brush 36 engages the contact segment *f*2. It will be recalled that the contact segment *f*2 was connected to the bus L+4 through the contacts 2DRB1 to indicate the presence of a high priority down floor call. Consequently, the following circuit is established:

L+4, 2DRB1, *f*2, 36, X5, S, 27, L—4

The energization of the relay S results in the stopping of the elevator car A at the second floor in the same manner by which the elevator car was stopped at the sixth floor. It will be understood further that the brush 37 engages the contact segment *g*2 to energize the cancelling coil 2DRN. Since the cancelling coils can be energized only when the contacts G2 are closed it is clear that floor calls are cancelled for the floors at which the elevator car stops.

The car attendant now completes his loading operation at the second floor and proceeds towards the lower terminal landing. The starting of the elevator car from the second floor is similar to that described for the seventh floor.

When the brush 43 (Figure 3) reaches the contact segment *h*1 the following circuit is completed:

L+3, *h*1, 43, X3, T, M2, L—3

It will be understood that during down travel of the elevator car the brush 43 cooperates with the row of contact segments *h*1 to *h*6 to stop the elevator car at any floor desired by car passengers.

Upon energization the relay T closes its con-

tacts T1 to energize the relays E, F and G. These cooperate to slow down and stop the elevator car at the lower terminal landing in the same manner by which the elevator car was stopped at the sixth floor during its down travel.

As the elevator car reaches the lower terminal landing the lower limit switch 30B is opened to deenergize the down preference relay X. At this time the contacts X4 and W4 both are momentarily open and any operated push buttons 2c to 6c are reset. The relay X also closes its break contacts X2 to prepare the up preference relay W for subsequent energization.

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

I claim as my invention:

1. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car to serve the landings, call registering means for registering calls from each of the landings, control means operable in cooperation with the driving means and the call registering means to stop the elevator car during its travel successively at the landings for which calls have been registered by the call registering means, said control means including preference means responsive to a first predetermined condition for causing a call registered by said registering means for less than a first predetermined time to be ineffective for stopping the elevator car, said call if registered by the registering means for more than a predetermined time being effective for stopping the elevator car despite the occurrence of said condition, additional means responsive to a second predetermined condition for causing a call registered for more than the first predetermined time but less than a second predetermined time to be ineffective for stopping the elevator car, said last-named call if registered by the registering means for more than the second predetermined time being effective for stopping the elevator car despite the occurrence of said second condition.

2. A system as claimed in claim 1, wherein the preference means is responsive to the first predetermined condition for causing all calls registered by the registering means for less than the first predetermined time to be ineffective for stopping the elevator car, said calls if registered by the registering means for more than said first predetermined time being effective for stopping the elevator car despite the occurrence of said first condition, and said additional means being responsive to a second predetermined condition for causing all calls registered for more than the first predetermined time but less than a second predetermined time to be ineffective for stopping the elevator car, said last-named call if registered by the registering means for more than the second predetermined time being effective for stopping the elevator car despite the occurrence of said second predetermined condition.

3. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car to serve the landings, call registering means for registering calls from each of the landings, control means operable in cooperation with the driving means and the call registering means to stop the elevator car during its travel successively at the landings for which calls have been registered by the call registering means, said control means including preference means responsive to a first predetermined loading of the elevator car for causing a call registered by said registering means for less than a first predetermined time to be ineffective for stopping the elevator car, said call if registered by the registering means for more than a predetermined time being effective for stopping the elevator car despite the occurrence of said loading of the elevator car.

4. In an elevator system for a structure having a plurality of landings, a plurality of elevator cars, driving means for moving independently each of the elevator cars to serve the landings, call registering means for registering calls from each of the landings, control means operable in cooperation with the driving means and the call registering means to stop each elevator car during its travel successively at the landings for which calls have been registered by the call registering means said control means including preference means responsive to a first predetermined condition for causing a call registered by said registering means for less than a first predetermined time to be ineffective for stopping the elevator cars, said call if registered by the registering means for more than a predetermined time being effective for stopping the elevator cars despite the occurrence of said condition.

5. In an elevator system for a structure having a plurality of landings, a plurality of elevator cars, driving means for moving independently each of the elevator cars to serve the landings, call registering means for registering calls from each of the landings, control means operable in cooperation with the driving means and the call registering means to stop each elevator car during its travel successively at the landings for which calls have been registered by the call registering means, said control means including preference means responsive to a first predetermined loading of the elevator car for causing a call registered by said registering means for less than a first predetermined time to be ineffective for stopping any of said elevator cars having more than said predetermined loading, said call if registered by the registering means for more than a predetermined time being effective for stopping any of said elevator cars having more than said predetermined loading despite the occurrence of said loading of the elevator cars.

6. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car in up and down directions to serve the landings, down call registering means for registering down calls from each of the landings, control means operable in cooperation with the driving means and the call registering means to stop the elevator car during its down travel successively at the landings for which down calls have been registered by the call registering means, said control means including preference means responsive to a first predetermined condition for causing a down call registered by said registering means for less than a first predetermined time to be ineffective for stopping the elevator car when the car approaches the landing of the down call while traveling down, said down call if registered by the registering means for more than a predetermined time being effective for stopping the elevator car when the car approaches the landing of the down call while traveling down despite the occurrence of said condition.

7. In an elevator system for a structure having a plurality of landings, a plurality of elevator cars, driving means for moving independently

each of the elevator cars to serve the landings, down call registering means operable in cooperation with the driving means and the call registering means to stop each elevator car during its down travel successively at the landings for which down calls have been registered by the call registering means, said control means including preference means responsive to a first predetermined loading of the elevator cars for causing a down call registered by said registering means for less than a first predetermined time to be ineffective for stopping the elevator cars, said down call if registered by the registering means for more than a predetermined time being effective for stopping the elevator cars despite the occurrence of said loading of the elevator cars.

8. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car to serve the landings, call registering means for registering calls from each of the landings, a plurality of groups of stopping elements, each of the landings having a separate stopping element in each of the groups, connections responsive at least in part to operation of a call registering means for any of the landings for placing the stopping elements for the associated landing in stopping condition, control means cooperating selectively with the groups of stopping elements for initiating a stopping operation of the elevator car at the landings for which the registering means have been operated, and selecting means controlled by traffic conditions for determining which of the groups of stopping elements is selected to cooperate with the control means for initiating stopping operations of the elevator car.

9. In an elevator system for a structure having a plurality of landings, a plurality of elevator cars, driving means for moving independently each elevator car to serve the landings, call registering means for registering calls for each of the landings, a plurality of groups of stopping elements, each of the landings having a separate stopping element in each of the groups, connections responsive at least in part to operation of a call registering means for any of the landings for placing the stopping elements for the associated landing in stopping condition, the groups being responsive to different durations of registration of calls by the call registering means for placing the stopping elements in stopping condition, control means cooperating selectively with the groups of stopping elements for initiating a stopping operation of the elevator car at the landings for which the registering means have been operated, and selecting means controlled by the load on the elevator car for determining which of the groups of stopping elements is selected to cooperate with the control means for initiating stopping operations of the elevator car.

10. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car to serve the landings, call registering means for registering calls for each of the landings, control means operable in cooperation with the driving means and the call registering means to stop the elevator car during its travel successively at the landings for which calls have been registered by the call registering means, said control means including means responsive to a characteristic of the calls registered by the call registering means for dividing said calls into groups, each representative of a different value of said characteristic, and means selectively operable into a first condition for causing the elevator car when conditioned for travel in a first direction to stop at each of the calls registered by the call registering means, said selectively operable means being operable into a second condition wherein the elevator car when conditioned for travel in the first direction is caused to pass calls in certain of said groups and to stop at calls in another of said groups.

11. In an elevator system for a structure having a plurality of landings, a plurality of elevator cars, driving means for moving independently each of the elevator cars to serve the landings, call registering means for registering calls from each of the landings, control means operable in cooperation with the driving means and the call registering means to stop each elevator car during its travel successively at the landings for which calls have been registered by the call registering means, means for weighting each of said calls registered by the call registering means in accordance with a predetermined pattern, said control means including preference means selectively operable into a first condition for causing one of the elevator cars when set for travel in a first direction to stop for all calls reached by such elevator car which are registered by the call registering means, said preference means being selectively operable into a second condition for causing said last-named elevator car when set for travel in said first direction to stop only at calls registered by the call registering means which have a predetermined weighting.

12. In an elevator system for a structure having a plurality of landings, a plurality of elevator cars, driving means for moving independently each of the elevator cars to serve the landings, call registering means for registering calls from each of the landings, control means operable in cooperation with the driving means and the call registering means to stop each elevator car during its travel successively at the landings for which calls have been registered by the call registering means, means for weighting each of said calls registered by the call registering means in accordance with a predetermined pattern, said control means including preference means for each of the elevator cars selectively operable into a first condition for causing the associated one of the elevator cars when set for travel in a first direction to stop for all calls reached by such elevator car which are registered by the call registering means, said preference means being selectively operable into a second condition for causing the associated elevator car when set for travel in said first direction to stop only at calls registered by the call registering means which have a predetermined weighting.

13. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car to serve the landings, call registering means for registering calls from each of the landings, control means operable in cooperation with the driving means and the call registering means to stop the elevator car during its travel successively at the landings for which calls have been registered by the call registering means, said control means including preference means responsive to a first predetermined loading of the elevator car for causing a call registered by said registering means for less than a first predetermined time to be ineffective for stopping the elevator car, said call if registered by the registering means for more than a predetermined time being effective for stopping the elevator car despite the occurrence of said

loading of the elevator car, in combination with additional means responsive to a second predetermined loading of the elevator car greater than the first-named loading for causing a call registered for more than the first predetermined time but less than a second predetermined time to be ineffecive for stopping the elevator car, said last-named call if registered by the registering means for more than the second predetermined time being effective for stopping the elevator car despite the occurrence of said second predetermined loading.

14. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car to serve the landings, call registering means for registering calls from each of the landings, control means operable in cooperation with the driving means and the call registering means to stop the elevator car during its travel successively at the landings for which calls have been registered by the call registering means, said control means including preference means responsive to a first predetermined loading of the elevator car for causing a call registered by said registering means for less than a first predetermined time to be ineffective for stopping the elevator car, said call if registered by the registering means for more than a predetermined time being effective for stopping the elevator car despite the occurrence of said loading of the elevator car, the preference means being responsive to the predetermined loading of the elevator car for causing all calls registered by the registering means for less than the first predetermined time to be ineffective for stopping the elevator car, said calls if registered for more than a predetermined time being effective for stopping the elevator car despite the occurrence of said predetermined loading.

15. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car to serve the landings, call registering means for registering calls from each of the landings, control means operable in cooperation with the driving means and the call registering means to stop the elevator car during its travel successively at the landings for which calls have been registered by the call registering means, said control means including preference means responsive to a first predetermined loading of the elevator car for causing a call registered by said registering means for less than a first predetermined time to be ineffective for stopping the elevator car, said call if registered by the registering means for more than a predetermined time being effective for stopping the elevator car despite the occurrence of said loading of the elevator car, in combination with additional means responsive to a second predetermined loading of the elevator car greater than the first-named loading for causing a call registered for more than the first predetermined time but less than a second predetermined time to be ineffective for stopping the elevator car, said last-named call if registered by the registering means for more than the second predetermined time being effective for stopping the elevator car despite the occurrence of said second predetermined loading, the preference means being responsive to the first predetermined loading of the elevator car for causing all calls registered by the registering means for less than the first predetermined time to be ineffective for stopping the elevator car, said calls if registered by the registering means for more than said first predetermined time being effective for stopping the elevator car despite the occurrence of said first loading of the elevator car, and said additional means being responsive to a second predetermined loading of the elevator car for causing all calls registered for more than the first predetermined time but less than a second predetermined time to be ineffective for stopping the elevator car, said last-named calls if registered by the registering means for more than the second predetermined time being effective for stopping the elevator car despite the occurrence of said second predetermined loading of the elevator car.

16. In an elevator system for a structure having a plurality of landings, a plurality of elevator cars, driving means for moving independently each of the elevator cars to serve the landings, call registering means for registering calls from each of the landings, control means operable in cooperation with the driving means and the call registering means to stop each elevator car during its travel successively at the landings for which calls have been registered by the call registering means, said control means including preference means responsive to a first predetermined condition for causing a call registered by said registering means for less than a first predetermined time to be ineffective for stopping the elevator cars, said call if registered by the registering means for more than a predetermined time being effective for stopping the elevator cars despite the occurrence of said condition, the preference means being responsive to the predetermined condition for causing all calls registered by the registering means for less than the first predetermined time to be ineffective for stopping the elevator cars, said calls if registered for more than a predetermined time being effective for stopping the first available one of the elevator cars despite the occurrence of said condition.

17. In an elevator system for a structure having a plurality of landings, a plurality of elevator cars, driving means for moving independently each of the elevator cars to serve the landings, call registering means for registering calls from each of the landings, control means operable in cooperation with the driving means and the call registering means to stop each elevator car during its travel successively at the landings for which calls have been registered by the call registering means, said control means including preference means responsive to a first predetermined condition for causing a call registered by said registering means for less than a first predetermined time to be ineffective for stopping the elevator cars, said call if registered by the registering means for more than a predetermined time being effective for stopping the elevator cars despite the occurrence of said condition, in combination with additional means responsive to a second predetermined condition for causing a call registered for more than the first predetermined time but less than a second predetermined time to be ineffective for stopping the elevator cars, said last-named call if registered by the registering means for more than the second predetermined time being effective for stopping the first one of the elevator cars despite the occurrence of said second condition.

18. In an elevator system for a structure having a plurality of landings, a plurality of elevator cars, driving means for moving independently each of the elevator cars to serve the landings, call registering means for registering calls from each of the landings, control means operable in

cooperation with the driving means and the call registering means to stop each elevator car during its travel successively at the landings for which calls have been registered by the call registering means, said control means including preference means responsive to a first predetermined condition for causing a call registered by said registering means for less than a first predetermined time to be ineffective for stopping the elevator cars, said call if registered by the registering means for more than a predetermined time being effective for stopping the elevator cars despite the occurrence of said condition, in combination with additional means responsive to a second predetermined condition for causing a call registered for more than the first predetermined time but less than a second predetermined time to be ineffective for stopping the elevator cars, said last-named call if registered by the registering means for more than the second predetermined time being effective for stopping the first one of the elevator cars despite the occurrence of said second condition, the preference means being responsive to the first predetermined condition for causing all calls registered by the registering means for less than the first predetermined time to be ineffective for stopping the elevator cars, said calls if registered by the registering means for more than said first predetermined time being effective for stopping the first available one of the elevator cars despite the occurrence of said first condition, and said additional means being responsive to a second predetermined condition for causing all calls registered for more than the first predetermined time but less than a second predetermined time to be ineffective for stopping the elevator cars, said last-named call if registered by the registering means for more than the second predetermined time being effective for stopping the first available one of the elevator cars despite the occurrence of said second predetermined condition.

19. In an elevator system for a structure having a plurality of landings, a plurality of elevator cars, driving means for moving independently each of the elevator cars to serve the landings, call registering means for registering calls from each of the landings, control means operable in cooperation with the driving means and the call registering means to stop each elevator car during its travel successively at the landings for which calls have been registered by the call registering means, said control means including preference means responsive to a first predetermined loading of the elevator car for causing a call registered by said registering means for less than a first predetermined time to be ineffective for stopping any of said elevator cars having more than said predetermined loading, said call if registered by the registering means for more than a predetermined time being effective for stopping any of said elevator cars having more than said predetermined loading despite the occurrence of said loading of the elevator cars, in combination with additional means responsive to a second predetermined loading of the elevator cars for causing a call registered for more than the first predetermined time but less than a second predetermined time to be ineffective for stopping any of said elevator cars having more than said second predetermined loading, said last-named call if registered by the registering means for more than the second predetermined time being effective for stopping any of said elevator cars having more than said second prede-

termined loading despite the occurrence of said second loading of the elevator cars.

20. In an elevator system for a structure having a plurality of landings, a plurality of elevator cars, driving means for moving independently each of the elevator cars to serve the landings, call registering means for registering calls from each of the landings, control means operable in cooperation with the driving means and the call registering means to stop each elevator car during its travel successively at the landings for which calls have been registered by the call registering means, said control means including preference means responsive to a first predetermined loading of the elevator car for causing a call registered by said registering means for less than a first predetermined time to be ineffective for stopping any of said elevator cars having more than said predetermined loading, said call if registered by the registering means for more than a predetermined time being effective for stopping any of said elevator cars having more than said predetermined loading despite the occurrence of said loading of the elevator cars, in combination with additional means responsive to a second predetermined loading of the elevator cars for causing a call registered for more than the first predetermined time but less than a second predetermined time to be ineffective for stopping any of said elevator cars having more than said second predetermined loading, said last-named call if registered by the registering means for more than the second predetermined time being effective for stopping any of said elevator cars having more than said second predetermined loading despite the occurrence of said second loading of the elevator cars, the preference means being responsive to the first predetermined loading of the elevator cars for causing all calls registered by the registering means for less than the first predetermined time to be ineffective for stopping any of said elevator cars having more than said first predetermined loading, said calls if registered by the registering means for more than said first predetermined time being effective for stopping any of said elevator cars despite the occurrence of said first loading of the elevator cars, and said additional means being responsive to a second predetermined loading of the elevator cars for causing all calls registered for more than the first predetermined time but less than a second predetermined time to be ineffective for stopping any of the elevator cars having more than the second predetermined loading, said last-named calls if registered by the registering means for more than the second predetermined time being effective for stopping any of the elevator cars despite the occurrence of said second predetermined loading of the elevator cars.

21. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car in up and down directions to serve the landings, down call registering means for registering down calls from each of the landings, control means operable in cooperation with the driving means and the call registering means to stop the elevator car during its down travel successively at the landings for which down calls have been registered by the call registering means, said control means including preference means responsive to a first predetermined condition for causing a down call registered by said registering means for less than a first predetermined time to be in-

effective for stopping the elevator car when the car approaches the landing of the down call while traveling down, said down call if registered by the registering means for more than a predetermined time being effective for stopping the elevator car when the car approaches the landing of the down call while traveling down despite the occurrence of said condition, the preference means being responsive to the predetermined condition for causing all down calls registered by the registering means for less than the first predetermined time to be ineffective for stopping the elevator car when the car approaches the respective landings having registered down calls while traveling down, said down calls if registered for more than a predetermined time being effective for stopping the elevator car when the car approaches landings having registered down calls while traveling down despite the occurrence of said condition.

22. In an elevator system for a structure having a plurality of landings, a plurality of elevator cars, driving means for moving independently each of the elevator cars to serve the landings, down call registering means operable in cooperation with the driving means and the call registering means to stop each elevator car during its down travel successively at the landings for which down calls have been registered by the call registering means, said control means including preference means responsive to a first predetermined loading of the elevator cars for causing a down call registered by said registering means for less than a first predetermined time to be ineffective for stopping the elevator cars, said down call if registered by the registering means for more than a predetermined time being effective for stopping the elevator cars despite the occurrence of said loading of the elevator cars, in combination with additional means responsive to a second predetermined loading of the elevator cars for causing a down call registered for more than the first predetermined time but less than a second predetermined time to be ineffective for stopping any of the elevator cars approaching the landing of the registered down call while traveling down with the second predetermined loading, said last-named call if registered by the registering means for more than the second predetermined time being effective for stopping any of the elevator cars approaching the landing of the registered down call while traveling down with the second predetermined loading.

23. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car to serve the landings, call registering means for registering calls from each of the landings, a plurality of groups of stopping elements, each of the landings having a separate stopping element in each of the groups, connections responsive at least in part to operation of a call registering means for any of the landings for placing the stopping elements for the associated landing in stopping condition, control means cooperating selectively with the groups of stopping elements for initiating a stopping operation of the elevator car at the landings for which the registering means have been operated, and selecting means controlled by traffic conditions for determining which of the groups of stopping elements is selected to cooperate with the control means for initiating stopping operations of the elevator car, the stopping elements in each of the groups being arranged in a row corresponding in sequence to

the landings represented thereby, said control means including a traveler for each of said rows of stopping elements, and means for moving each of said travelers relative to the associated row of stopping elements in accordance with movement of the elevator car relative to the landings corresponding to the stopping elements, each of said stopping elements if in stopping condition and if selected by the selecting means being effective when reached by its associated traveler for initiating a stopping operation of the elevator car at the corresponding landing.

24. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car to serve the landings, call registering means for registering calls from each of the landings, a plurality of groups of stopping elements, each of the landings having a separate stopping element in each of the groups, connections responsive at least in part to operation of a call registering means for any of the landings for placing the stopping elements for the associated landing in stopping condition, control means cooperating selectively with the groups of stopping elements for initiating a stopping operation of the elevator car at the landings for which the registering means have been operated, and selecting means controlled by traffic conditions for determining which of the groups of stopping elements is selected to cooperate with the control means for initiating stopping operations of the elevator car, the stopping elements in each of the groups being arranged in a row corresponding in sequence to the landings represented thereby, said control means including a traveler for each of said rows of stopping elements, and means for moving each of said travelers relative to the associated row of stopping elements in accordance with movement of the elevator car relative to the landings corresponding to the stopping elements, each of said stopping elements if in stopping condition and if selected by the selecting means being effective when reached by its associated traveler for initiating a stopping operation of the elevator car at the corresponding landing, the selecting means being controlled by the load on the elevator car.

25. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car to serve the landings, call registering means for registering calls from each of the landings, a plurality of groups of stopping elements, each of the landings having a separate stopping element in each of the groups, connections responsive at least in part to operation of a call registering means for any of the landings for placing the stopping elements for the associated landing in stopping condition, control means cooperating selectively with the groups of stopping elements for initiating a stopping operation of the elevator car at the landings for which the registering means have been operated, and selecting means controlled by traffic conditions for determining which of the groups of stopping elements is selected to cooperate with the control means for initiating stopping operations of the elevator car, the stopping elements in each of the groups being arranged in a row corresponding in sequence to the landings represented thereby, said control means including a traveler for each of said rows of stopping elements, and means for moving each of said travelers relative to the associated row of stopping elements in accordance with move-

ment of the elevator car relative to the landings corresponding to the stopping elements, each of said stopping elements if in stopping condition and if selected by the selecting means being effective when reached by its associated traveler for initiating a stopping operation of the elevator car at the corresponding landing, said connections including means responsive to registration of calls by the call registering means for less than a predetermined time for placing stopping elements in a first one of said rows in stopping condition, and means responsive to calls only if registered by the call registering means for more than the predetermined time for placing the stopping elements of a second one of said rows in stopping condition.

26. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car to serve the landings, call registering means for registering calls for each of the landings, a plurality of groups of stopping elements, each of the landings having a separate stopping element in each of the groups, connections responsive at least in part to operation of a call registering means for any of the landings for placing the stopping elements for the associated landing in stopping condition, control means cooperating selectively with the groups of stopping elements for initiating a stopping operation of the elevator car at the landings for which the registering means have been operated, and selecting means controlled by traffic conditions for determining which of the groups of stopping elements is selected to cooperate with the control means for initiating stopping operations of the elevator car, the stopping elements in each of the groups being arranged in a row corresponding in sequence to the landings represented thereby, said control means including a traveler for each of said rows of stopping elements, and means for moving each of said travelers relative to the associated row of stopping elements in accordance with movement of the elevator car relative to the landings corresponding to the stopping elements, each of said stopping elements if in stoping condition and if selected by the selecting means being effective when reached by its associated traveler for initiating a stopping operation of the elevator car at the corresponding landing, said connections including means responsive to registration of calls by the call registering means for less than a predetermined time for placing stopping elements in a first one of said rows in stopping condition, and means responsive to calls only if registered by the call registering means for more than the predetermined time for placing the stopping elements of a second one of said rows in stopping condition, the selecting means being controlled by the magnitude of the load of the elevator car for selecting the first one of said rows or the second one of the rows for cooperation with the control means to initiate stopping operations of the elevator car.

27. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car to serve the landings, call registering means for registering calls for each of the landings, a plurality of groups of stopping elements, each of the landings having a separate stopping element in each of the groups, connections responsive at least in part to operation of a call registering means for any of the landings for placing the stopping elements for the associated landing in stopping condition, control means cooperating selectively with the groups of stopping elements for initiating a stopping operation of the elevator car at the landings for which the registering means have been operated, and selecting means controlled by traffic conditions for determining which of the groups of stopping elements is selected to cooperate with the control means for initiating stopping operations of the elevator car, the stopping elements in each of the groups being arranged in a row corresponding in sequence to the landings represented thereby, said control means including a traveler for each of said rows of stopping elements, and means for moving each of said travelers relative to the associated row of stopping elements in accordance with movement of the elevator car relative to the landings corresponding to the stopping elements, each of said stopping elements if in stopping condition and if selected by the selecting means being effective when reached by its associated traveler for initiating a stopping operation of the elevator car at the corresponding landing, said connections including means responsive to registration of calls by the call registering means for less than a predetermined time for placing stopping elements in a first one of said rows in stopping condition, and means responsive to calls only if registered by the call registering means for more than the predetermined time for placing the stopping elements of a second one of said rows in stopping condition, the connections including means responsive to calls only if registered by the call registering means for more than a predetermined time substantially greater than the first-named predetermined time for placing the stopping elements of a third one of said rows in stopping condition, said selecting means being responsive to successive increases in load of the elevator car for successively selecting the first, second and third ones of said rows for cooperation with the control means to initiate stopping operations of the elevator car.

28. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car to serve the landings, call registering means for registering calls for each of the landings, control means operable in cooperation with the driving means and the the call registering means to stop the elevator car during its travel successively at the landings for which calls have been registered by the call registering means, said control means including means responsive to a characteristic of the calls registered by the call registering means for dividing said calls into groups, each representative of a different value of said characteristic, and means selectively operable into a first condition for causing the elevator car when conditioned for travel in a first direction to stop at each of the calls registered by the call registering means, said selectively operable means being operable into a second condition wherein the elevator car when conditioned for travel in the first direction is caused to pass calls in certain of said groups and to stop at calls in another of said groups, said characteristic being a function of the time during which each call registered by the call registering means remains unanswered.

29. In an elevator system for a structure having a plurality of landings, an elevator car, driving means for moving the elevator car to serve the landings, call registering means for register-

ing calls for each of the landings, control means operable in cooperation with the driving means and the call registering means to stop the elevator car during its travel successively at the landings for which calls have been registered by the call registering means, said control means including means responsive to a characteristic of the calls registered by the call registering means for dividing said calls into groups, each representative of a different value of said characteristic, and means selectively operable into a first condition for causing the elevator car when conditioned for travel in a first direction to stop at each of the calls registered by the call registering means, said selectively operable means being operable into a second condition wherein the elevator car when conditioned for travel in the first direction is caused to pass calls in certain of said groups and to stop at calls in another of said groups, said characteristic being a function of the time during which each call registered by the call registering means remains unanswered, the selectively operable means being responsive to the loading of the elevator car for determining which of said first and second conditions is controlling.

30. In an elevator system for a structure having a plurality of landings, a plurality of elevator cars, driving means for moving independently each of the elevator cars to serve the landings, call registering means for registering calls from each of the landings, control means operable in cooperation with the driving means and the call

registering means to stop each elevator car during its travel successively at the landings for which calls have been registered by the call registering means, means for weighting each of said calls registered by the call registering means in accordance with a predetermined pattern, said control means including preference means for each of the elevator cars selectively operable into a first condition for causing the associated one of the elevator cars when set for travel in a first direction to stop for all calls reached by such elevator car which are registered by the call registering means, said preference means being selectively operable into a second condition for causing the associated elevator car when set for travel in said first direction to stop only at calls registered by the call registering means which have a predetermined weighting, the preference means comprising means responsive to the load carried by each of the elevator cars for determining which of said conditions shall control each of the elevator cars.

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The following references are of record in the file of this patent:

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