

June 24, 1958

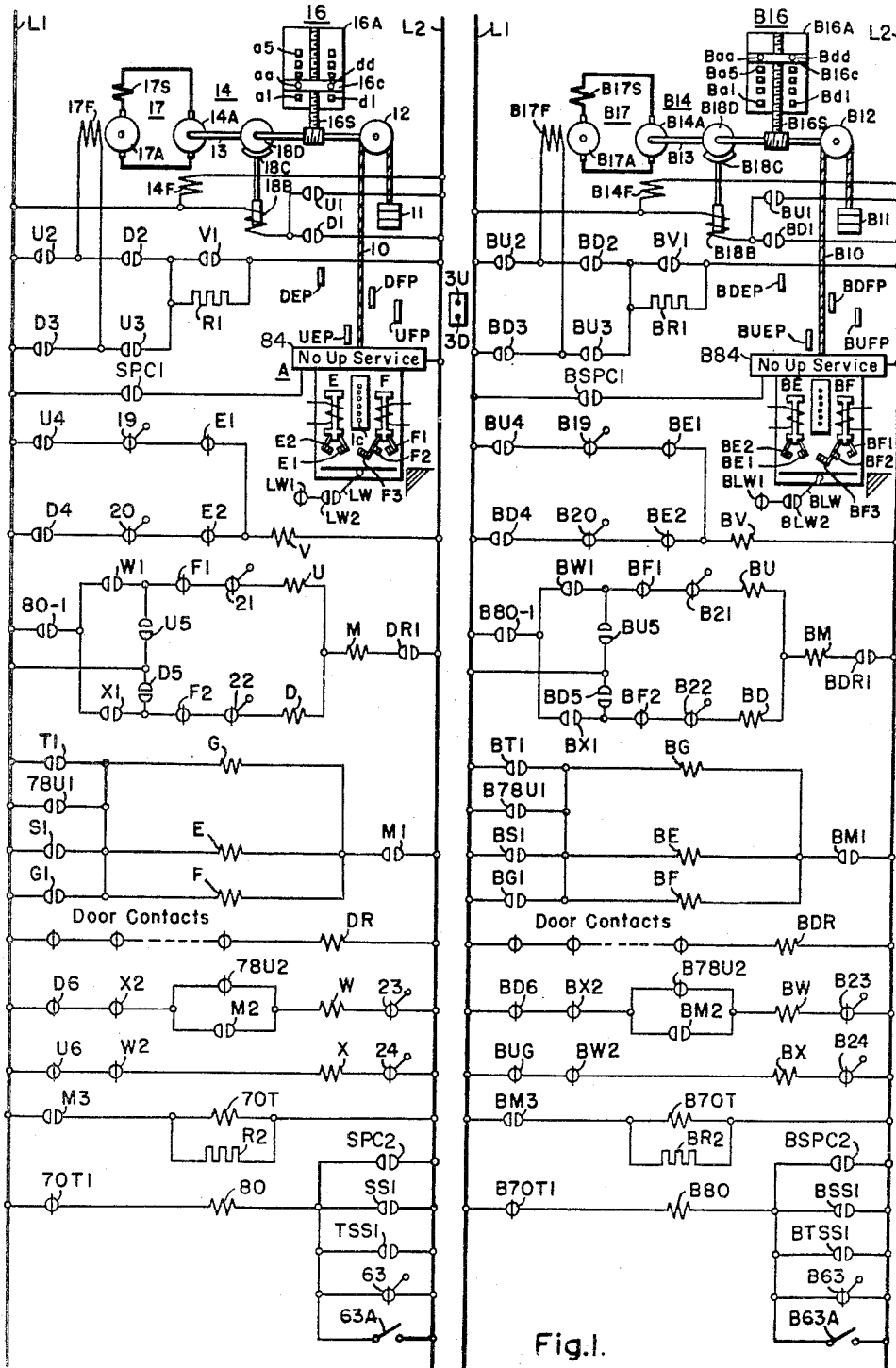
D. SANTINI ET AL

2,840,189

ELEVATOR SYSTEMS

Filed April 15, 1957

8 Sheets-Sheet 1



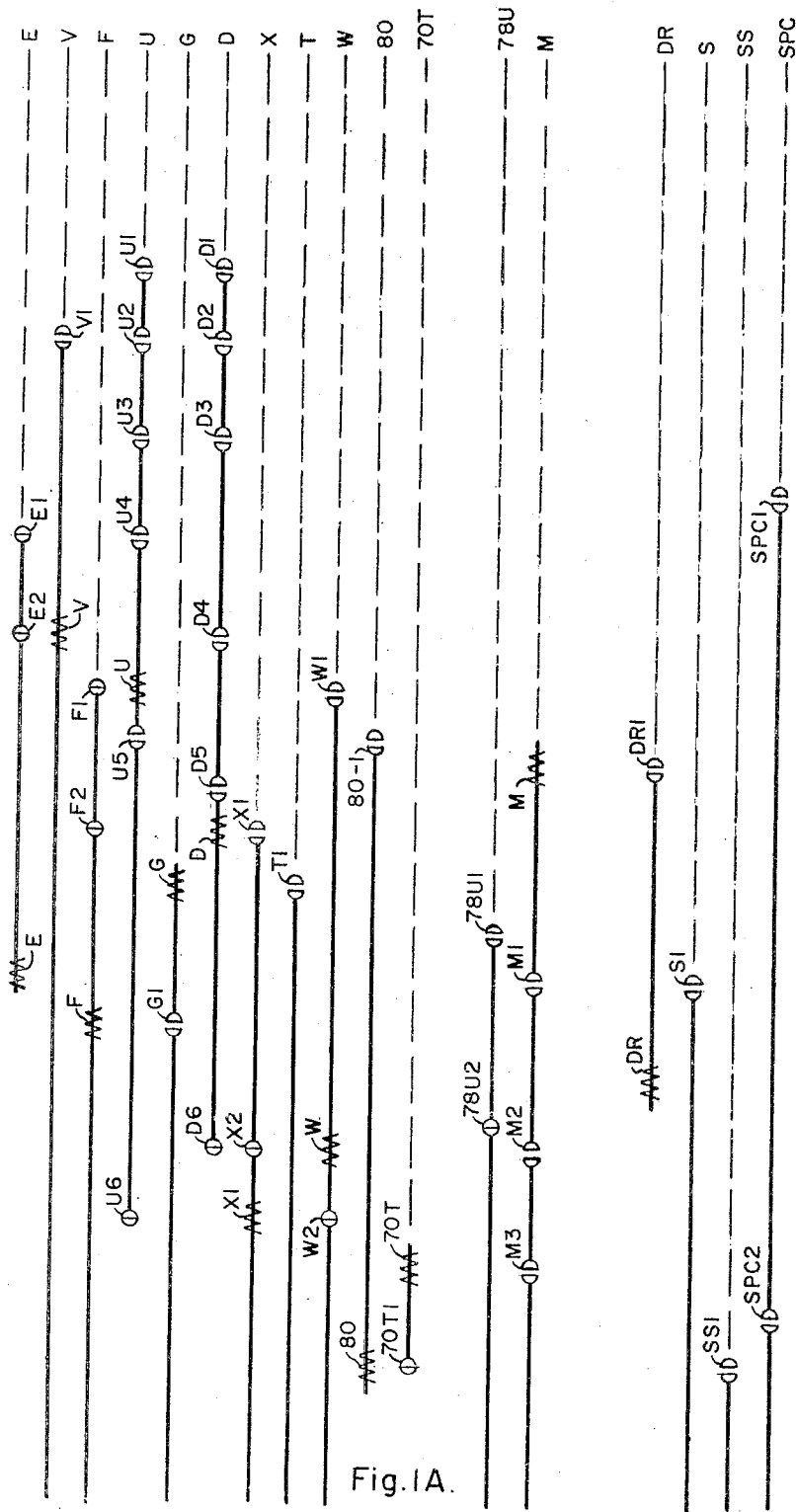
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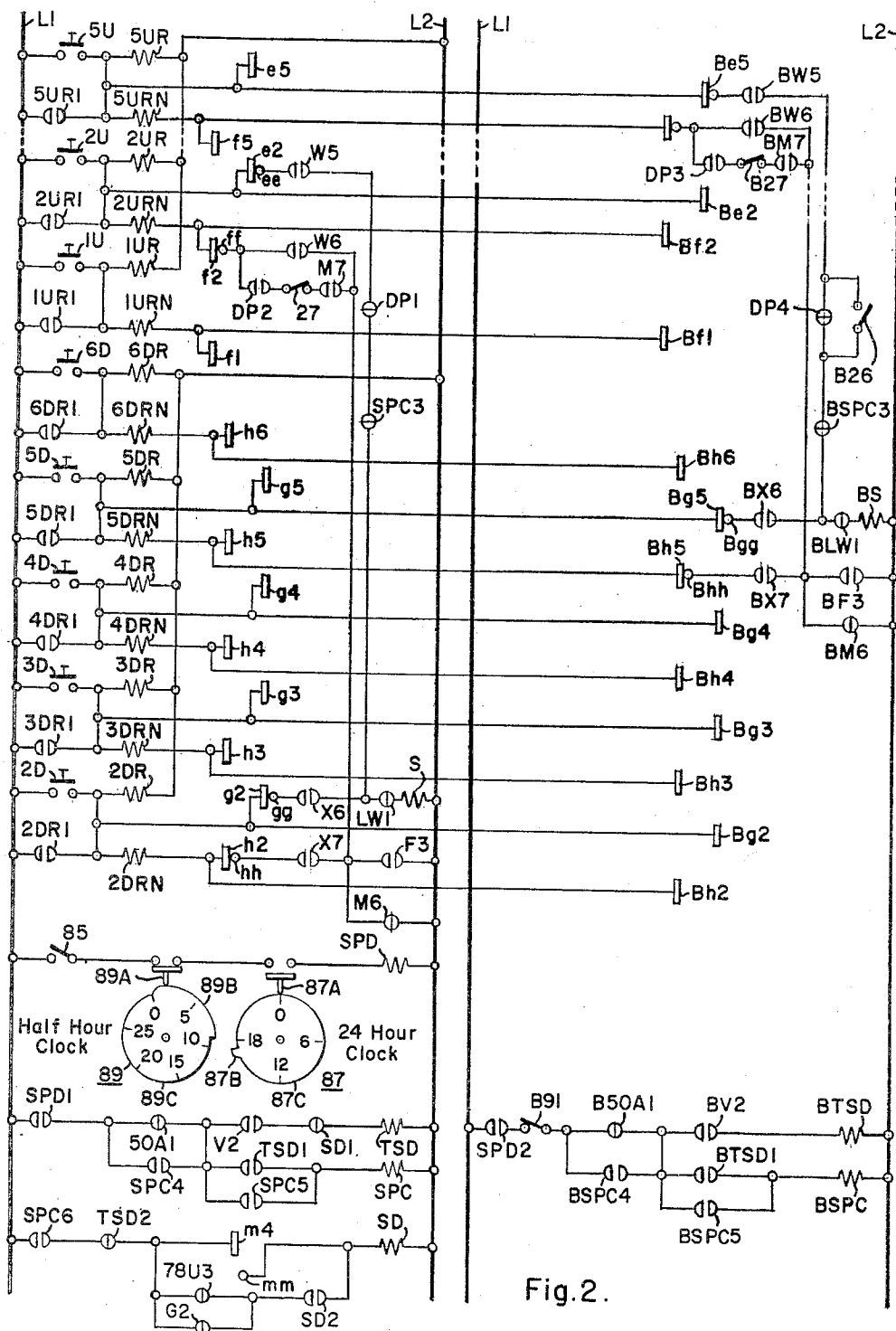


Fig. 2.

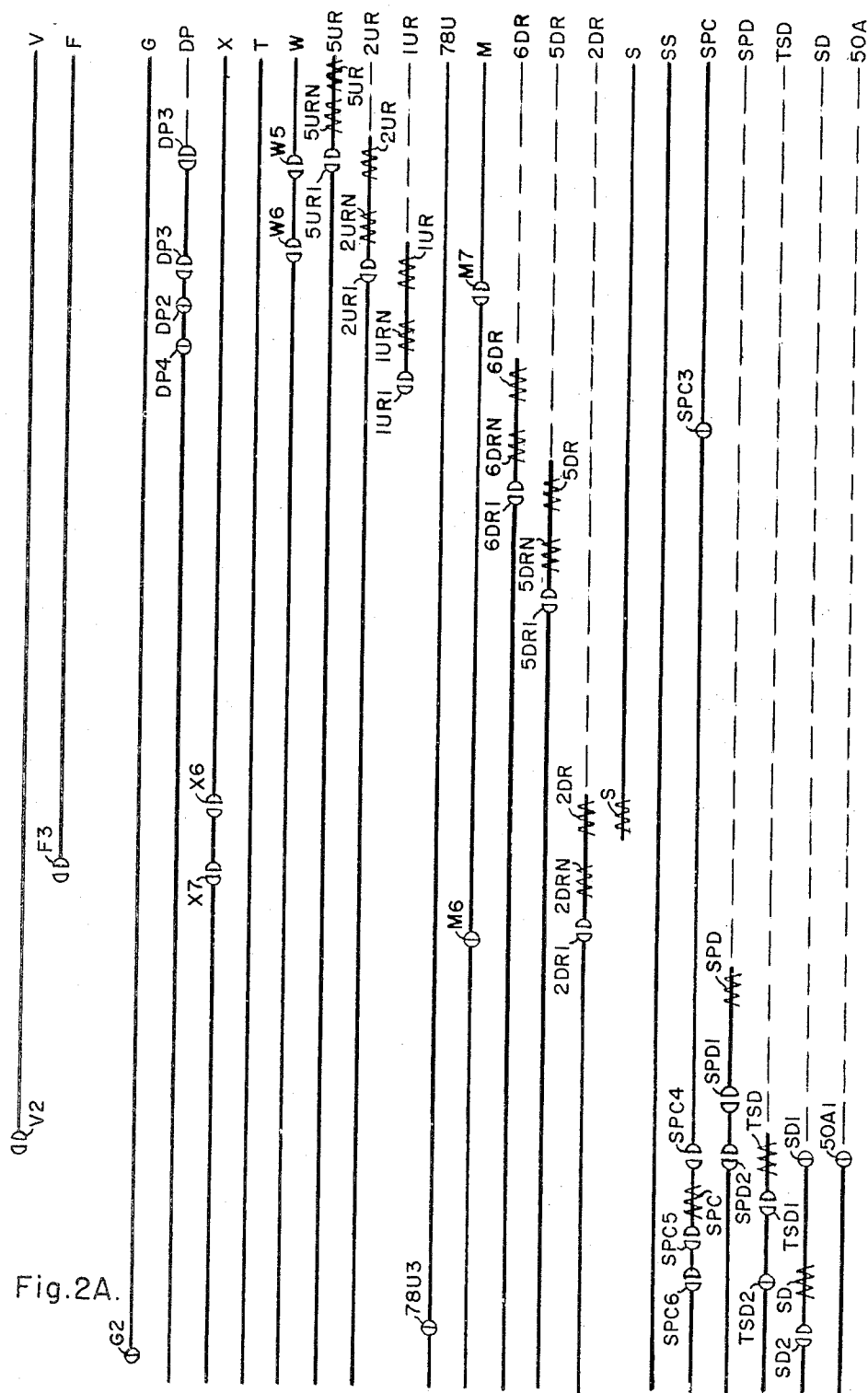
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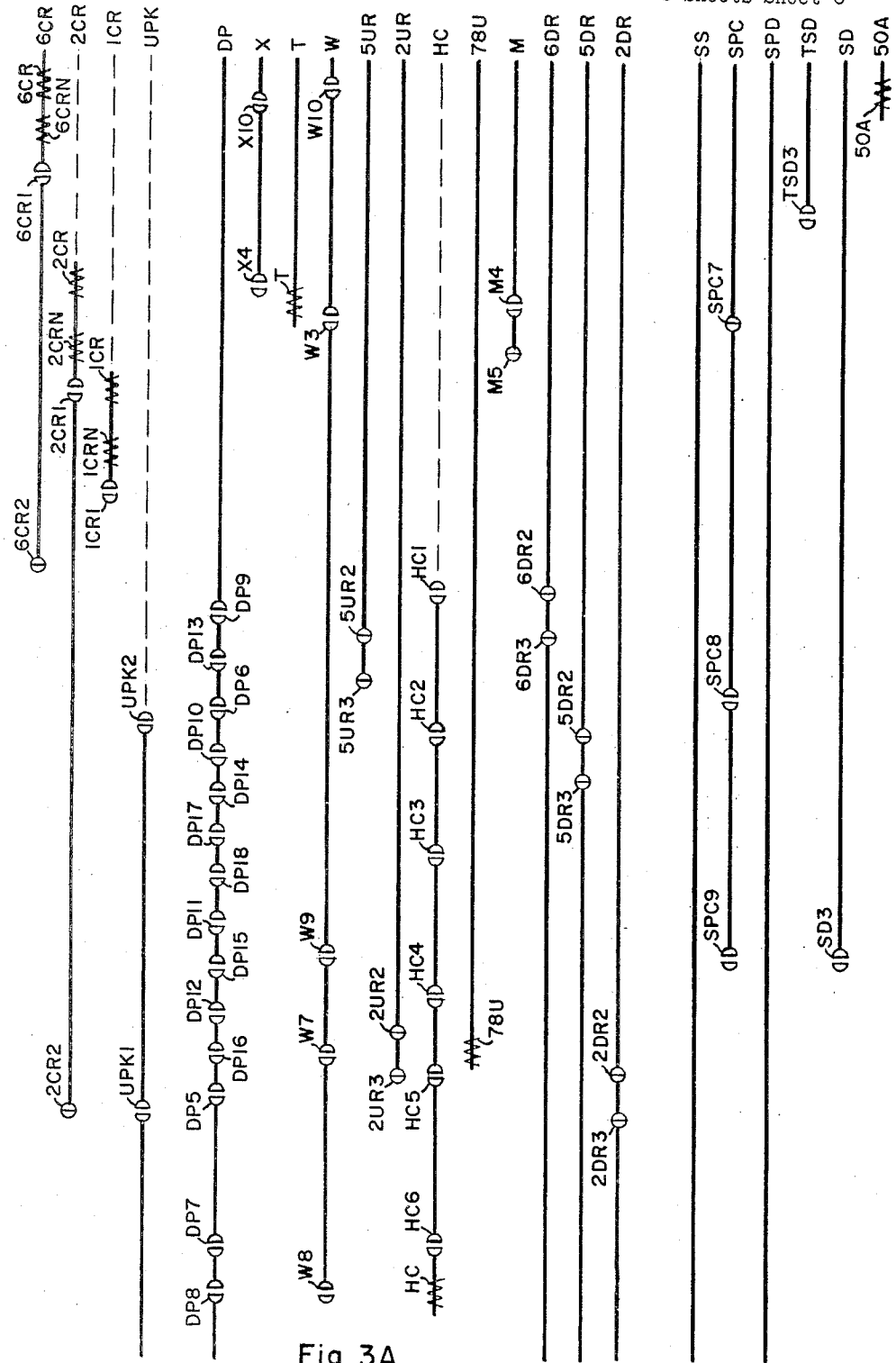
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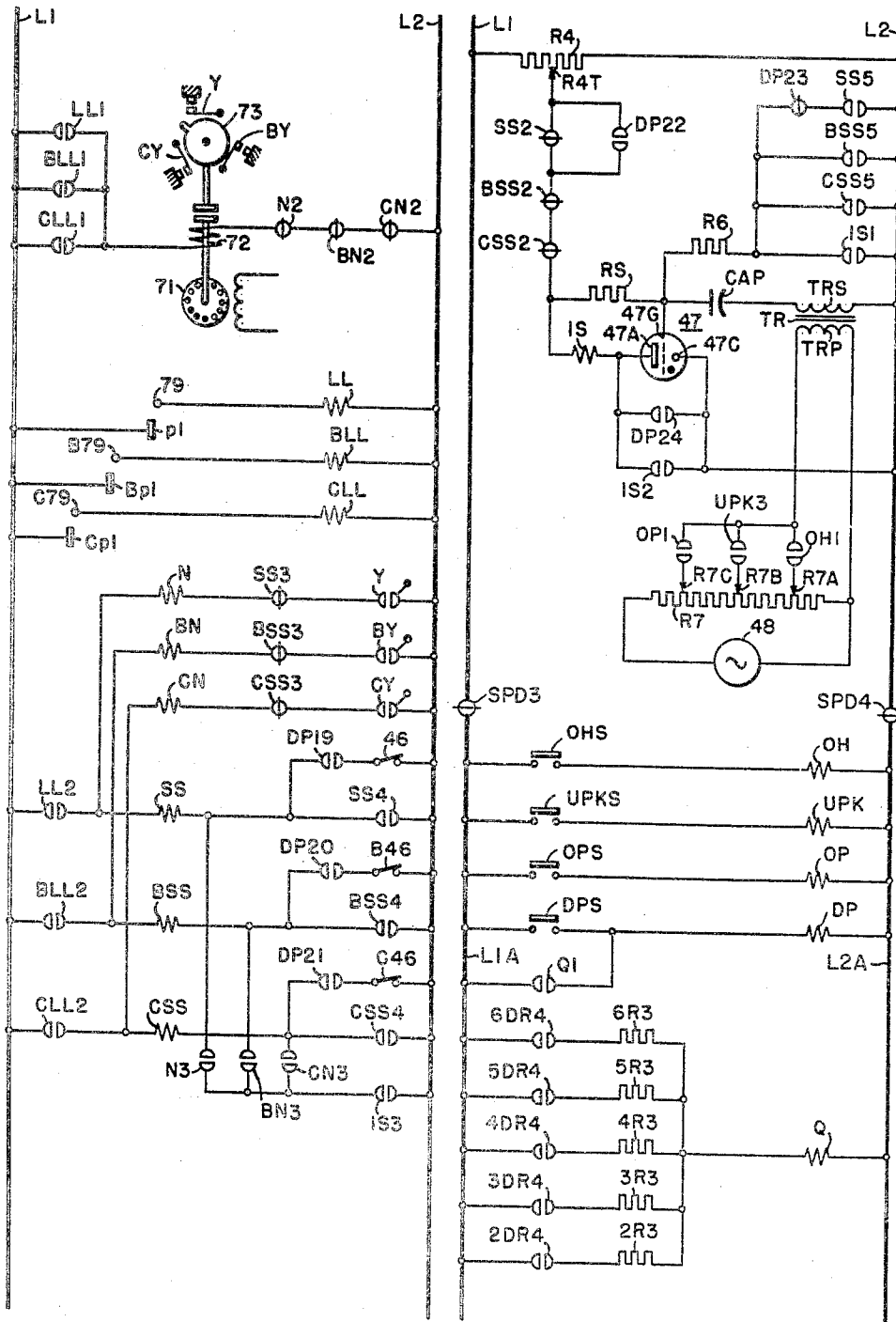


Fig. 4.

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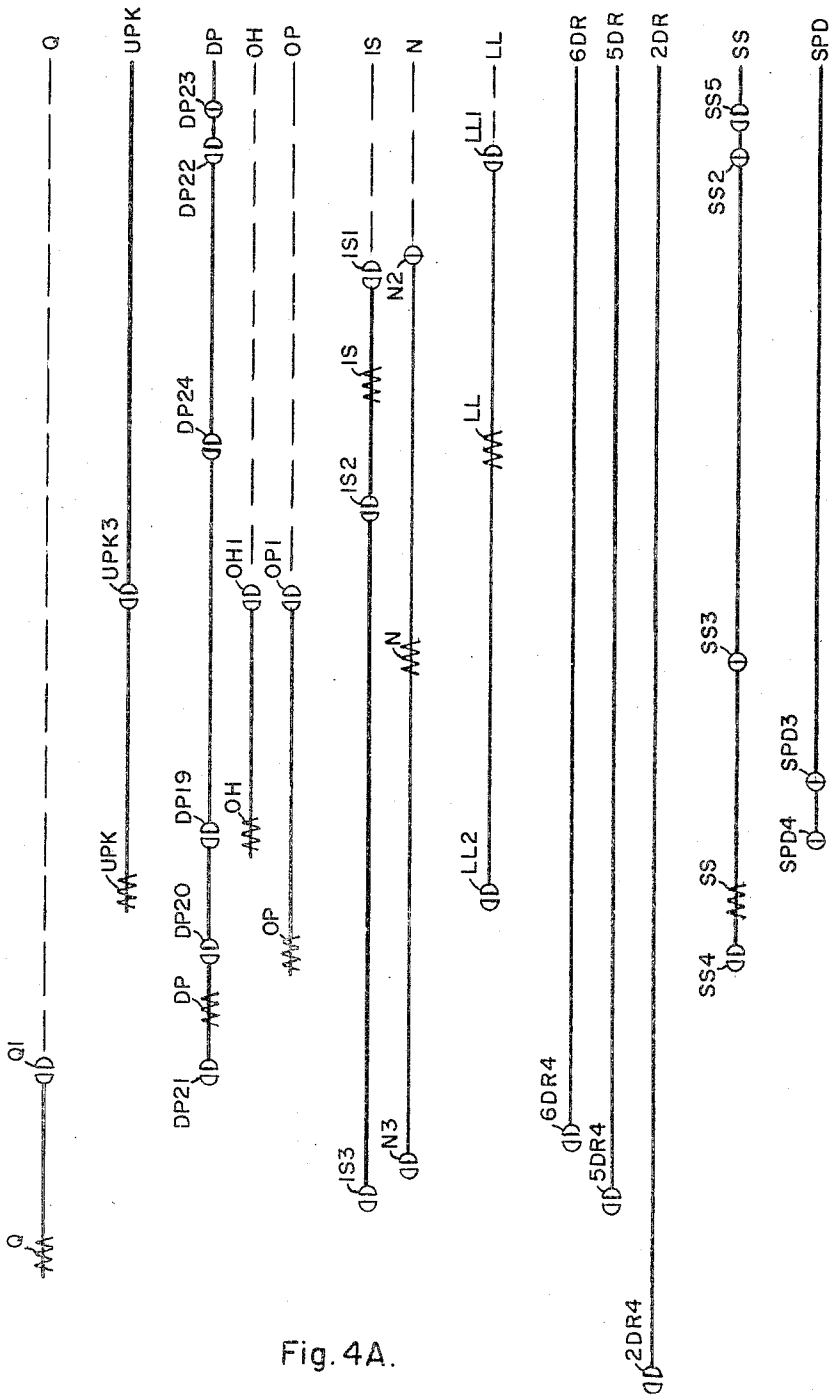


Fig. 4A.

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2,840,189

ELEVATOR SYSTEMS

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Application April 15, 1957, Serial No. 653,025

21 Claims. (Cl. 187—29)

This invention relates to elevator systems and it has particular relation to elevator systems wherein a plurality of elevator cars are arranged in a bank for the purpose of serving the floors of a structure.

It is well known that elevator systems must have sufficient flexibility to handle various traffic conditions. For example, in an office building, an elevator system may be called on to handle the traffic conditions which occur during peak periods wherein large numbers of passengers desire to travel in one direction at substantially the same time. Such a traffic condition may occur, for example, at the close of a business day during a "down peak" period when large numbers of passengers desire to proceed downwardly from the higher floors at approximately the same time.

During a down peak period, the elevator cars tend to become fully loaded at the higher floors of the building. Under such circumstances, passengers awaiting service at the lower floors of the building may be kept waiting for an unduly long period of time. One solution proposed for this problem involves the division of the floors of a building into zones with one or more elevator cars assigned to provide service primarily for each of the zones. Such a system is disclosed in the Bouton et al. Patent 2,376,113, and has proven to be of material assistance in solving the problem of providing adequate service during peak periods.

In accordance with the invention, during a peak period elevator cars in a bank may be assigned or "spotted" to serve specific floors of a building. During the existence of such a peak period a first car in the bank will be assigned to serve a first floor of the building or a first group of floors in a predetermined sequence. A second car may be assigned to serve a second floor or a second group of floors for the same period of time. During the existence of a down-peak period, the assignment of each car to provide such special service may be deferred until the elevator car has answered all car calls registered therefor. Furthermore, when the elevator car is assigned to provide special service during a down-peak period, the elevator car is preferably conditioned to ignore calls for service in the up direction. If a number of elevator cars are associated in a bank, one of the elevator cars may be assigned to answer calls for elevator service in the up direction while the remainder of the elevator cars are assigned to provide the special service.

The invention results in materially improved efficiency for the bank of elevator cars. If the demand for elevator service from each of the floors receiving special service is sufficient, each of the elevator cars is fully loaded promptly after it stops at a floor. Consequently, the elevator cars are capable of providing an increased number of round trips with a resultant improvement in efficiency of operation.

It is therefore an object of the invention to provide an elevator system offering improved elevator service

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for a period wherein large numbers of prospective passengers at each of several floors desire to travel in a given direction at substantially the same time.

It is a further object of the invention to provide an elevator system having a number of elevator cars arranged in a bank wherein each of several of the elevator cars is assigned to serve a specific floor or group of floors for a period of time.

It is an additional object of the invention to provide an elevator system wherein each of several elevator cars arranged in a bank is assigned while traveling in a first direction to stop and reverse at a separate specific floor on each of several trips.

It is also an object of the invention to provide an elevator system wherein an elevator car during a first series of trips in a first direction is assigned to stop and reverse at a first floor and wherein the elevator cars during a second series of trips in the same direction is assigned to stop and reverse at a second specific floor.

It is another object of the invention to provide an elevator system wherein an elevator car is assigned to provide elevator service for a specific floor only if no call for elevator service is registered for a passenger in the elevator car.

It is still a further object of the invention to provide an elevator system as defined in the preceding objects wherein an elevator car assigned to provide special service for a floor or a group of floors is conditioned to ignore calls for elevator service in a predetermined direction.

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

Figure 1 is a schematic view with circuits shown in straight line form of a portion of an elevator system embodying the invention;

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

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

In order to simplify the presentation of the invention, the invention will be illustrated as applied to the elevator system of Suozzo Patent 2,748,894 which issued June 5, 1956. Insofar as practicable, the same conventions employed in the Suozzo patent are here employed.

FIGURE 1

In Fig. 1 the following apparatus is common to both the present Fig. 1 and Fig. 1 of the aforesaid Suozzo patent:

Apparatus for car A

- 10, rope
- 11, counterweight
- 12, sheave
- 14, motor
- L1 and L2, direct current buses
- 1c to 6c, car-call push buttons
- 3U, up-floor-call push button
- 3D, down-floor-call push button
- E, inductor slowdown relay
- F, inductor stopping relay
- LW, load switch
- 16, floor selector
- 17, direct current generator

18B, brake coil
V, speed relay
U, up switch
M, running relay
D, down switch
G, holding relay
DR, door relays
W, up preference relay
X, down preference relay
70T, non-interference relay
80, auxiliary start relay

As explained in the aforesaid Suozzo patent, similar components are provided for each of the other elevator cars B and C.

In addition to the foregoing components, Fig. 1 shows a sign 84 (shown enlarged for purposes of illustration) in the elevator car which is illuminated in response to closure of the make contacts SPC1 of a first auxiliary spotting relay. This sign may bear a suitable legend such as "no up service" and is illuminated when the elevator car A is assigned for special service under such conditions that it does not provide service for passengers desiring to travel in the up direction. A similar sign may be provided for each elevator car. If desired, a suitable sign may be located at each landing or floor served by the elevator car.

Fig. 1 also discloses make contacts SPC2 across the switch 63A. When the contacts SPC2 are closed, the auxiliary start relay 80 is controlled only by the break contacts 70T1 of the non-interference relay 70T. Except for these additions, Fig. 1 is similar to Fig. 1 of the aforesaid Suozzo patent and may be understood more fully by reference to such patent.

FIGURE 2

In Fig. 2 the following apparatus is shown:

Apparatus for car A

S, floor call stopping relay
TSD, main spotting relay
SPC, first auxiliary spotting relay
SD, second auxiliary spotting relay

Apparatus common to all cars

1UR to 5UR, up floor call registering relays
2DR to 6DR, down floor call registering relays
SPD, spotting time relay

Except for the following additions, Fig. 2 is similar to Fig. 2 of the aforesaid Suozzo patent. It will be noted that for the elevator car A, break contacts SPC3 are provided for the purpose of controlling in part, the energization of the floor call stopping relay S. If the break contacts SPC3 are opened while the elevator car A is set for travel in the up direction, the floor call stopping relay S cannot be energized.

The spotting time relay SPD is designed to pickup during a period in which special or spotting service is desired. The relay SPD may be connected across the direct current buses L1 and L2 through any suitable time switch having adequate accuracy. In the present embodiment, the energization of the relay SPD is controlled by a manually operated switch 85 and two time clocks 87 and 89 which are connected in series. The time clock 87 includes a switch 87A which is biased to open condition and which is operated to close condition by means of a cam 87B positioned on a drum 87C which is rotated about its axis at the rate of one revolution in 24 hours. By proper dimensioning and positioning of the cam 87B the switch 87A may be closed during any desired interval of time. For present purposes, it will be assumed that the switch 87A is maintained in closed condition from approximately 5 p. m. to 5:10 p. m. each day. If desired, the clock may include a mechanism for skipping certain days during which operation of

the switch 87A is not desired. However, for present purposes it will be assumed that the switch 87A is closed at the specified time during each day.

Although the clock 87 alone may be employed for controlling the operation of the relay SPD, a more accurate control is provided by provision of the time clock 89. The time clock 89 includes a switch 89A which is biased to open condition but which is operated to closed condition by means of a cam 89B which is mounted on drum 89C. The drum is rotated at a rate of one revolution in one-half hour. By proper dimensioning and positioning of the cam 89B, the switch 89A may be maintained in closed condition during any desired portion of each half hour interval. For present purposes, it will be assumed that the switch 89A is closed promptly two minutes after the beginning of a one-half hour interval and is maintained closed for a period of seven minutes. The two clocks have their switches connected in series. This means that if the manually operated switch 85 is closed the relay SPD is energized promptly at two minutes past five o'clock each afternoon and is deenergized at nine minutes past five o'clock, thus providing a seven minute period of energization each day.

Pick up of the spotting time relay SPD results in closing of the make contacts SPD1 to prepare the main spotting relay TSD for energization. However, this relay can be energized only if the break contacts 50A1 are closed to indicate that there is no car call registered in the elevator car A. In addition, the make contacts V2 must be closed. These contacts V2 are provided on the speed relay V of the Suozzo system and are closed as long as the elevator car A is in full speed operation. Finally the break contacts SD1 of a second auxiliary spotting relay SD must be closed.

When the main spotting relay TSD picks up it closes its make contacts TSD1 to complete an energizing circuit for the first auxiliary spotting relay SPC which may be traced as follows:

L1—SPD1—50A1—TSD1—SPC—L2

When the relay SPC picks up, it closes its make contacts SPC4 and SPC5 to complete with the make contacts SPD1, a self-holding circuit.

The second auxiliary spotting relay SD is energized through the circuit

L1—SPC6—TSD2—m4—mm—SD—L2

The brush mm engages the contact segment m4 when the elevator car A is adjacent its upper spotting floor which in this case is assumed to be the fourth floor. When the relay SD picks up, it closes its make contacts SD2 to establish with the break contacts 78U3 a holding circuit around the contact segment m4 and the brush mm. The break contacts 78U3 are operated by the relay 78U of the aforesaid Suozzo patent.

To prevent the relay SD from dropping out too rapidly, break contacts G2 of the holding relay G may be connected across the contacts 78U3.

Although a relay similar to the second auxiliary spotting relay SD may be provided for the elevator car B, it will be assumed that the elevator car B has only one spotting floor and consequently does not need a relay similar to the second auxiliary relay SD. Under these circumstances, the relays BTSD and BSPC for the elevator car B are energized by circuits similar to those employed for the corresponding relays of elevator car A except that no contacts corresponding to the contacts SD1 are employed for the elevator car B. A manually operated switch B91 may be provided to control the energization of the relays BTSD and BSPC for purposes hereinafter discussed.

FIGURE 3

The following apparatus is common to the present Fig. 3 and Fig. 3 of the aforesaid Suozzo patent.

Apparatus for car A

1CR to 6CR, car call registering relays
T, car call stopping relay
78U, call above relay
HC, high car call reversal relay

The present Fig. 3 is similar to the Fig. 3 of the aforesaid Suozzo patent except for the following additions. For the elevator car A, a car call relay 50A is provided which is energized through either of two sets of make contacts W10 and X10 as long as a car call is registered for the elevator car A. In addition, break contacts SPC7 are connected in series with the make contacts W3 for the purpose of controlling in part, the energization of the car call stopping relay T. The contacts W10 and X10 are operated respectively by the up preference relay W and the down preference relay X of the aforesaid Suozzo patent. When the elevator car A reverses at a floor, the contacts W10 and X10 are both open for a short time to assure reset of any car call registering relay which is energized at the time.

It will be assumed that the elevator car A has two spotting floors which are the second and fourth floors. Contact segments 12 and 14 are provided for these floors. When the elevator car A is adjacent the second floor, a brush 11 engages the contact segment 12. When the elevator car is adjacent the fourth floor the brush 11 engages the contact segment 14. The contact segments and brush may be provided on the floor selector 16 of the aforesaid Suozzo patent.

The contact segment 14 is connected to the bus L1 through the make contacts SPC8 and its position determines the upper spotting floor for the elevator car A. The contact segment 12 is connected to the bus L1 through the make contacts SD3 and determines the lower spotting floor for the elevator car A.

The brush 11 is connected to the left hand terminal of the call above relay 78U through the make contacts W9 and make contacts SPC9. The make contacts W9 are operated by the up preference relay W of the aforesaid Suozzo patent.

It will be noted that no contact segment corresponding to the contact segment 12 is provided for the elevator car B. This is for the reason that for present purposes, it is assumed that the elevator car B has one spotting floor, the fifth floor. Had the elevator car B been provided with a second spotting floor such as the third floor a contact segment corresponding to the contact segment 12 would be provided to engage the brush 11 when the elevator car B is adjacent the third floor.

In the aforesaid Suozzo patent, car call registering relays and associated components are shown only for representative floors; namely, floors 1, 2, 5 and 6. Inasmuch as the elevator car A here is arranged to be spotted at the fourth floor, Fig. 3 here shows car call registering relays for the floors 1, 2, 4 and 6. For purposes hereinafter set forth, make contacts TSD3 are connected across the push button 4C.

Inasmuch as the elevator car B is spotted at the fifth floor, representative car call registering relays are here shown for car B for the floors 1, 2, 5 and 6, and make contacts BTSD3 are connected across the push-button B5c for the spotting floor.

FIGURE 4

The following apparatus is common to the present Fig. 4 and Fig. 4 of the aforesaid Suozzo patent:

Apparatus for car A

LL, position relay
N, loading relay
SS, starting relay

Apparatus common to all cars

1S, timing relay
OH, off hours relay
UPK, up peak relay
OP, off peak relay
DP, down peak relay
Q, quota relay

The present Fig. 4 is similar to Fig. 4 of the Suozzo patent except for the addition of break contacts SPD3 and SPD4 which divide the right-hand buses L1 and L2 into two parts. The lower parts L1A and L2A are connected to a source of direct current energy only when the break contacts SPD3 and SPD4 are closed.

OPERATION

When the manually-operated switch 85 of Fig. 2 is open, the present elevator system operates precisely in the same manner as the system described in the aforesaid Suozzo patent. This operation may be fully understood by reference to the patent. For this reason the present discussion of the operation of the system will be directed primarily to the modification introduced by closure of switch 85.

During the day the drums of the time clocks rotate in a counterclockwise direction as viewed in Fig. 2. It will be understood that during each half hour the cam 89B closes the switch 89A but such closure has no effect as long as the switch 87A remains open. At five o'clock each afternoon the cam 87B engages the switch 87A and closes the switch. However, such closure has no effect on the energization of the relay SPD for the reason that the switch 89A is open at this time. It is assumed that five o'clock in the afternoon represents a time when most of the prospective passengers for the elevator system leave their offices located on floors above the first floor for the purpose of proceeding to the first floor.

At two minutes after five o'clock, the switch 89A closes to complete an energizing circuit for the spotting time relay SPD. As a result of its energization, the relay SPD closes its make contacts SPD1 for the purpose of preparing the main spotting relay TSD for energization.

It will be assumed that the elevator car A at this time is proceeding in a downward direction and that a passenger in the elevator car has operated the car call push-button 1c for the purpose of registering a call for the first floor. As a result of such operation, the car call registering relay 1CR and the car call relay 50A are both energized. The operation of the relay 1CR will be understood from the aforesaid Suozzo patent.

Due to this energization the relay 50A opens its break contacts 50A1 to prevent energization of the main spotting relay TSD. Inasmuch as the elevator car A is proceeding at full speed toward the first floor, its speed relay V is energized and picked up for the reasons presented in the aforesaid Suozzo patent and the make contacts V2 are closed. However, such closure has no effect at this time on the energization of the relay TSD.

As the elevator car A nears the first floor the speed relay V is deenergized for the reasons presented in the aforesaid Suozzo patent and the make contacts V2 open. As the elevator car stops at the first floor, the break contacts M5 (Fig. 3) close to reset the car call registering relay 1CR by the sequence discussed in the aforesaid Suozzo patent. As a result of this reset, the make contacts 1CR1 open to deenergize the car call relay 50A and the break contacts 50A1 consequently close. However, since the make contacts V2 are now open the closure of the contacts 50A has no effect at this time on the operation of the system.

From the description in the aforesaid Suozzo patent it will be understood that as the car A stops at the first floor, the down preference relay X is deenergized and

the up preference relay is then energized. However, for a brief time, both sets of contacts W10 and X10 are open and any energized car call registering relay is reset by such open contacts.

It will be assumed that the elevator car A now leaves the first floor without any passenger by the sequence discussed in the aforesaid Suozzo patent. As the elevator car leaves, the speed relay V picks up to close its make contacts V2. This completes the following circuit:

L1—SPD1—50A1—V2—SD1—TSD—L2

Consequently, the main spotting relay TSD for the elevator car A picks up.

The pick up of the relay TSD results in opening of the break contacts TSD2 to prevent energization of the second auxiliary spotting relay SD. Also, make contacts TSD3 close to energize the car call registering relay 4CR. In addition, the make contacts TSD1 close to complete with the contacts SPD1 and 50A1 an energizing circuit for the first auxiliary spotting relay SPC. This relay closes its make contacts SPC4 and SPC5 to complete with the make contact SPD1 a self-holding circuit. Consequently, once it picks up the relay SPC remains picked up over the duration of the period measured by the time clocks during which special or spotting service is desired.

Due to its pick up the first auxiliary spotting relay closes its make contacts SPC1 (Fig. 1) to illuminate the sign 84. This advises prospective passengers that the elevator car A will not accept calls requiring service in the up direction. In addition, make contacts SPC2 close to place the auxiliary start relay 80 under the sole control of the break contacts 70T1 of the non-interference relay 70T.

Turning to Fig. 2, it should be noted that the pick up of the first spotting relay results in opening of the break contacts SPC3 to prevent energization of the floor call stopping relay S in response to registered up floor calls. For example, let it be assumed that as the elevator car A reaches the first floor, a prospective passenger at the second floor registers an up floor call by operation of the pushbutton 2U. It will be recalled from the aforesaid Suozzo patent that such registration connects the contact segment e2 to the bus L1. As the elevator car A nears the second floor, the brush ee reaches the contact segments e2. However, since the contacts SPC3 are open, the engagement of the contact segments e2 by the brush ee cannot energize the floor call stopping relay S and the elevator car bypasses the second floor.

The energized first auxiliary spotting relay also closes its make contacts SPC6. However, since the break contacts TSD2 are now open and also since the brush mm is displaced from its contact segment m4, the second auxiliary spotting relay SD is not energized at this time.

Referring to Fig. 3, it will be noted that the energization of the relay SPC also results in opening of the break contacts SPC7. This prevents the elevator car A from answering registered car calls during travel in the up direction. Closure of make contacts SPC8 connects the contact segment i4 to the bus L1. Inasmuch as the make contacts W9 are closed during up travel of the elevator car A, closure of the make contacts SPC9 connects the brush tt to the left hand terminal of the call above relay 78U.

As the elevator car A nears the fourth floor, the brush tt engages the contact segment i4 to complete the following circuit:

L1—SPC8—i4—tt—W9—SPC9—78U—L2

Inasmuch as the call above relay 78U is now energized, it initiates the stopping and reversing of the elevator car A at the fourth floor by the sequence discussed in the aforesaid Suozzo patent.

As the elevator car A reverses at the fourth floor, the

make contacts W10 and X10 both open to reset any of the car call registering relays which is picked up at the time of such reversal.

At this time of the day the probability is good that the elevator car A will be fully loaded at the fourth floor. If this is the case, the loading of the car results in opening of the contacts LW1 to prevent further stopping of the elevator car in response to registered floor calls. The elevator car A then would proceed directly to the first floor. If the elevator car A is not fully-loaded, it responds to registered car calls and down floor calls in the manner discussed in the aforesaid Suozzo patent during the descent of the elevator car A to the first floor.

During this period, the break contacts SPD3 and SPD4 (Fig. 4) are open. Consequently, the relays OH—UPK—OP—DP and Q do not affect the operation of the system at this time.

The slow down of the elevator car A at the fourth floor was effected by drop out of the speed relay V in the manner set forth in the aforesaid Suozzo patent. In dropping out, the speed relay opened its make contacts V2 to deenergize the main spotting relay TSD. This relay opened its make contacts TSD1, but such opening had no immediate effect on the operation of the system for the reason that the contacts are shunted by the make contacts SPC5.

In addition, the relay TSD closed its break contacts TSD2 to prepare the second auxiliary spotting relay SD for energization. Opening of the make contacts TSD3 had no immediate effect on system operation.

The continued approach of the elevator car to the fourth floor resulted in engagement of the contact segment m4 by the brush mm. This engagement completed the following energizing circuit:

L1—SPC6—TSD2—m4—mm—SD—L2

The energized relay SD opened its break contacts SD1 to prevent energization of the main spotting relay TSD. In addition, the relay SD closed its make contacts SD2 to prepare a holding circuit for the relay SD for subsequent completion.

As explained in the aforesaid Suozzo patent, the reversal of the elevator car A at the fourth floor is accompanied by drop out of the up preference relay W. Such drop out opened the make contacts W9 to deenergize the call above relay 78U and this relay consequently closed its break contacts 78U3 to complete with the make contacts SD2 a holding circuit around the contact segment m4 and the brush mm. Also such reversal is accompanied by a temporary pick up of the holding relay G which opens its break contacts G2.

The energization of the second auxiliary spotting relay SD also closed the make contacts SD3 (Fig. 3) to connect the contact segment i2 to the bus L1.

As the elevator car A left the fourth floor on its return trip, the brush mm left the contact segment m4. However, because of the holding circuit through the contacts 78U3 and SD2, the relay SD remained energized.

On reaching the first floor, the elevator car A discharges its passengers during the interval provided by the non-interference relay 70T. It will be recalled from the Suozzo patent that upon the expiration of this interval the non-interference relay drops out to close its break contacts 70T1. By inspection of Fig. 1 it will be noted that such closure completes with the contacts SPC2 an energizing circuit for the auxiliary starting relay 80 and the elevator car A thereby is restarted from the first floor.

As the elevator car A nears the second floor on its up trip, the brush tt (Fig. 3) engages the contact segment i2 to complete the following circuit:

L1—SD3—i2—tt—W9—SPC9—78U—L2

The energization of the call above relay 78U initiates

the stopping and reversing of the elevator car A at the second floor in a manner which will be clear from the aforesaid Suozzo patent. It will be understood that incident to the reversal operation the make contacts W10 and X10 are both momentarily open to reset any car call registering relays which may be energized at this time.

As a result of its energization, the call above relay 78U also opens its break contacts 78U3. Since the brush *mm* at this time is displaced from its contact segments *m4* it follows that the opening of the break contacts 78U3 deenergizes the second auxiliary spotting relay SD. The delay in drop out of the relay SD following opening of the contacts 78U3 may be sufficient to assure prior operation of the relay G. In the specific embodiment illustrated, break contacts G2 of the holding relay prevent drop out of the relay SD until after the relay G picks up. When it drops out, the relay SD closes its break contacts SD1 to prepare the main spotting relay TSD for subsequent energization. Opening of the contacts SD2 has no immediate effect on the operation of the system. Opening of the make contacts SD3 interrupts the connection of the contact segment *t2* to the bus L1.

The elevator car A now received passengers awaiting transportation from the second floor and starts down. The starting of the elevator car is accompanied by pick up of the speed relay V in the manner set forth in the aforesaid Suozzo patent. Such pick up closes the make contacts V2 to complete the following circuit:

L1—SPD1—56A1—V2—SD1—TSD—L2

Consequently, the main spotting relay again is energized to close its make contacts TSD1 and open its break contacts TSD2 without immediate effect on the operation of the system.

The elevator car A returns to the first floor and discharges its passengers in a manner which will be clear from the aforesaid Suozzo patent. In stopping at the first floor, the elevator car A causes its speed relay V to drop out and such drop out is accompanied by opening of the make contacts V2 to deenergize the main spotting relay TSD. This relay opens its make contacts TSD1 and closes its break contacts TSD2 without immediate effect on the operation of the system.

Upon the expiration of the time measure by the non-interference relay 70T, the break contacts 70T1 close to complete with the make contacts SPC2 an energizing circuit for the auxiliary start relay 80 and the elevator car A is started from the first floor. Incident to this starting, the speed relay V picks up and closes its make contacts V2 to complete an energizing circuit for the main spotting relay TSD. This relay again closes its make contacts TSD1 and opens its break contacts TSD2 without immediate effect on the operation of the system.

As the elevator car A nears the second floor, the brush *tt* engages the contact segment *t2*. However, since the make contacts SD3 are now open, such engagement has no effect on the operation of the system at this time.

Continued movement of the elevator car A brings it adjacent the fourth floor at which point the brush *tt* engages the contact segment *t4* to complete an energizing circuit as follows:

L1—SPC8—*t4*—*tt*—W9—SPC9—78U—L2

Consequently, the energized call above relay 78U initiates the stopping and reversing of the elevator car A at the fourth floor. The stopping of the elevator car is accompanied by a drop out of the speed relay which opens its make contacts V2 to deenergize the main spotting relay TSD. This relay opens its make contacts TSD1 without any effect on the operation of the system and closes its break contacts TSD2. Since the brush *mm* is in engagement with the contact segment *m4*, an energizing circuit is now complete for the second auxiliary spotting relay SD and the cycle is repeated. Thus, the elevator

Car A on up trips from the first floor is stopped and reversed alternately at the fourth and second floors.

If the second and fourth floors are the only floors on which sufficient traffic is expected at this time to require spotting of an elevator car, the switch B91 may be opened to render the relays BTSD and BSPC ineffective. Under such circumstances, the elevator car B operates substantially in the same manner discussed in the aforesaid Suozzo patent.

However, if an additional floor, such as the fifth floor, has sufficient traffic at this time to justify spotting of an elevator car at such floor the switch B91 may be closed. Under such circumstances, the relays BTSD and BSPC operate to stop and reverse the elevator car B at the fifth floor by a sequence which will be understood from the preceding discussion of the elevator car A. The stopping and reversing of the elevator car B at the fifth floor takes place for the reason that the contact segment B/5 is positioned for engagement by the brush *Btt* when the elevator car B nears the fifth floor.

It will be noted that the elevator car B is not provided with a relay corresponding to the relay SD. For this reason the elevator car B does not have a lower spotting floor but stops and reverses at the fifth floor on each of its up trips.

If the building has an additional floor such as the third floor which justifies the spotting of an elevator car thereat, the elevator car B may be provided with a relay corresponding to the relay SD for the purpose of stopping and reversing the elevator car B at the third floor on alternate up trips.

If the sixth floor justifies a spotting of an elevator car thereat, the elevator car C may be arranged to proceed directly from the first floor to the sixth floor in a manner which will be clear from the discussion of the operation of elevator car A. However, for present purposes it will be assumed that the elevator car C operates in the manner discussed in the aforesaid Suozzo patent.

The time clocks 87 and 89 continue to operate until nine minutes past 5 o'clock when the cam 89B releases the switch 89A to deenergize the spotting time relay SPD. This relay drops out to deenergize the relays TSD and SPC. The deenergization of the relay SPC is accompanied by opening of the make contacts SPC6. Consequently, the second auxiliary spotting relay SD must also be deenergized. The relay TSD opens its make contacts TSD1 and closes its break contacts TSD2. The relay SPC opens its make contacts SPC1 to deenergize the sign 84 in the elevator car A. Consequently, prospective passengers understand that the elevator car A now is conditioned to provide service in the up direction.

The relay SPC also opens its make contacts SPC2 to render the elevator car A subject to control by the dispatcher mechanism. Closure of the break contacts SPC3 (Fig. 2) permits the elevator car A to stop during up trips in response to registered up floor calls. Opening of make contacts SPC4 and SPC5 has no immediate effect on the operation of the system. Closure of break contacts SPC7 (Fig. 3) permits the elevator car A during up trips to stop in response to registered car calls. Opening of make contacts SPC8 renders the contact segment *t4* ineffective for initiating a stopping and reversing of the elevator car A.

Inasmuch as the contacts SD3 now remain open, the contact segment *t2* is ineffective for initiating a stopping and reversal of the elevator car A at the second floor.

The break contacts SPD3 and SPD4 are closed. Consequently, the elevator system now operates in the same manner as the system in the aforesaid Suozzo patent.

About 10 minutes after five o'clock, the cam 87B clears the switch 87A. However, the opening of the switch 87A has no effect at this time on the operation of the system.

From the foregoing discussion, it will be appreciated that except for the period between two minutes after five o'clock in the afternoon and nine minutes after five

o'clock the present elevator system operates in the same manner as the system of the aforesaid Suozzo patent. However, during this seven minute period the elevator car A is spotted alternately at the fourth and second floors for the purpose of expediting movement of passengers from these floors.

Each of the elevator cars of the bank may be spotted in this manner at a separate floor or group of floors in a predetermined sequence. Preferably, each elevator car spotted does not respond to car calls or registered floor calls in one direction of travel. Also each elevator car to be spotted preferably cannot be initially assigned for a spotting operation until it has answered all registered car calls. To provide elevator service for registered floor calls to which the spotted cars do not respond, one of the elevator cars of the bank may be assigned to answer such calls.

Inasmuch as each spotted car is loaded substantially at a single floor, the efficiency of the elevator system is materially improved.

Let it be assumed next that the elevator car A is above the fourth floor traveling down when the spotting time relay SPD picks up, and that no car call is registered. The main spotting relay TSD now is energized by the circuit.

L1—SPD1—50A1—V2—SD1—TSD—L2

The relay TSD picks up to close its make contacts TSD1 and TSD3 and to open the break contacts TSD2. Closure of contacts TSD1 completes the following circuit:

L1—SPD1—50A1—TSD1—SPC—L2

The energized relay SPC closes its self-holding contacts SPC4 and SPC5. In addition, closure of the make contacts SPC1 illuminates the sign 84 indicating that the elevator car A is not available for up service. Closure of the make contacts SPC2 places the auxiliary start relay 80 under the sole control of the break contacts 70T1 of the non-interference relay 70T. Opening of the break contacts SPC3 prevents the elevator car A from answering registered up floor calls. Closure of the make contacts SPC6 has no immediate effect on the system.

Closure of the contacts TSD3 in effect registers a car call for the upper spotting floor which is the fourth floor. Consequently, the elevator car stops at the fourth floor by the sequence described in the aforesaid Suozzo patent. The stopping of the car is accompanied by opening of the make contacts V2 to deenergize the main spotting relay TSD. Opening of the make contacts TSD1 and TSD3 has no immediate effect on the system but closure of the break contacts TSD2 completes the following circuit:

L1—SPC6—TSD2—m4—mm—SD—L2

The relays SD and TSD thereafter spot the elevator car A alternately at the second and fourth floors by the sequence previously discussed until the spotting time relay drops out.

In an analogous manner, if the elevator car B is traveling down above the fifth floor when the spotting time relay SPD picks up the make contacts BTSD3 are closed to register a call for the spotting floor (i. e. the fifth floor for the car B) and the elevator car B stops at such floor if it is conditioned to provide a spotting operation (i. e. the switch B91 is closed).

Although the invention has been described with reference to certain specific embodiments thereof, numerous modifications embodying the invention are possible.

We claim as our invention:

1. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of floors intermediate said terminal floors, a plurality of elevator cars, motor means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motor means for moving the elevator cars and stop-

ping the elevator cars at desired floors of the structure, said control means including first means for controlling the elevator cars for movement between said terminal floors and second means automatically effective during movement of each of said elevator cars towards the second terminal floor for stopping and reversing each of the elevator cars at a predetermined different one of said intermediate floors.

2. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of floors intermediate said terminal floors, a plurality of elevator cars, motor means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motor means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means including first means for controlling the elevator cars for movement between said terminal floors and second means automatically effective during movement of each of said elevator cars towards the second terminal floor for stopping and reversing a first one of said elevator cars on successive trips successively at first and second predetermined ones of said intermediate floors in accordance with a predetermined sequence.

3. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of floors intermediate said terminal floors, a plurality of elevator cars, motor means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motor means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means including call registering means for registering calls for elevator service for each of said intermediate floors, first means for controlling the elevator cars for movement between said terminal floors, and second means automatically effective during each of a plurality of first trips towards the second terminal floor of a first one of the elevator cars for automatically stopping and reversing the first one of the elevator cars at a first one of the intermediate floors, and third means coacting with the second means during each of a plurality of second trips towards the second terminal floor of the first one of the elevator cars for automatically stopping and reversing the first one of the elevator cars at a second one of the intermediate floors.

4. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of floors intermediate said terminal floors, a plurality of elevator cars, motor means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motor means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means including call registering means for registering calls for elevator service for each of said intermediate floors, first means for controlling the elevator cars for movement between said terminal floors, and second means automatically effective during each of a plurality of first trips towards the second terminal floor of a first one of the elevator cars for automatically stopping and reversing the first one of the elevator cars at a first one of the intermediate floors, third means coacting with the second means during each of a plurality of second trips towards the second terminal floor of the first one of the elevator cars for automatically stopping and reversing the first one of the elevator cars at a second one of the intermediate floors, and fourth means effective during each of a plurality of trips of a second one of the elevator cars towards the second terminal floor for automatically stopping and reversing the second one of the elevator cars at a third one of the intermediate floors.

5. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of intermediate floors positioned between the terminal floors,

7. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of intermediate floors positioned between the terminal floors, a plurality of elevator cars, motive means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motive means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means comprising first call registering means for each of the intermediate floors operable for registering calls for elevator service towards the second terminal floors, second call registering means for

9. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of floors intermediate said terminal floors, a plurality of elevator cars, motor means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motor means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means including first means for controlling the elevator cars for movement between said terminal floors, timing mechanism for measuring intervals of time, and reversing means responsive to said timing mechanism for establishing a modified mode of operation of the elevator system at predetermined times, said reversing means being effective during said predetermined times for stopping and re-

versing each of the elevator cars set for travel towards the second terminal floor at a predetermined different one of the intermediate floors.

10. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of floors intermediate said terminal floors, a plurality of elevator cars, motor means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motor means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means including first means for controlling the elevator cars for movement between said terminal floors, timing mechanism for measuring intervals of time, and reversing means responsive to said timing mechanism for establishing a modified mode of operation of the elevator system at predetermined times, said reversing means being effective during said predetermined times for stopping and reversing a first one of the elevator cars set for travel towards the second terminal floor alternately at first and second intermediate floors.

11. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of floors intermediate said terminal floors, a plurality of elevator cars, motor means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motor means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means including first means for controlling the elevator cars for movement between said terminal floors, timing mechanism for measuring intervals of time, and reversing means responsive to said timing mechanism for establishing a modified mode of operation of the elevator system at predetermined times, said reversing means being effective during said predetermined times for stopping and reversing a first one of the elevator cars set for travel towards the second terminal floor alternately at first and second intermediate floors, said reversing means additionally being effective during said predetermined times for stopping and reversing a second one of the elevator cars at a third intermediate floor during each of a plurality of trips of the second one of the elevator cars towards the second terminal landing.

12. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of intermediate floors positioned between the terminal floors, a plurality of elevator cars, motive means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motive means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means comprising first call registering means for each of the intermediate floors operable for registering calls for elevator service towards the second terminal floors, second call registering means for each of the intermediate floors operable for registering calls for elevator service towards the first terminal floor, third call registering means operable for registering calls for each intermediate floor desired by passengers in each of the elevator cars, first means for moving the elevator cars between the terminal floors and stopping each of the elevator cars at each intermediate floor approached by the elevator car in response to a call registered by the registering means for the floor being approached by the elevator-car-to-be-stopped which may be served by such approaching elevator car, timing mechanism operable from a first condition to a second condition at predetermined periods of time, second means cooperating with the first means in response to operation of the timing mechanism to the second condition, for conditioning a first one of the elevator cars on a plurality of first trips towards the second terminal floor to stop and reverse at first one of the intermediate floors, and third

means cooperating with the first means in response to operation of the timing mechanism to the second condition for conditioning said first one of the elevator cars on a plurality of second trips towards the second terminal floor to stop and reverse at a second one of the intermediate floors, and third means cooperating with the first means in response to operation of the timing mechanism to the second condition for conditioning a second one of the elevator cars on a plurality of trips towards the second terminal landing to stop and reverse at a second one of the intermediate floors.

13. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of intermediate floors positioned between the terminal floors, a plurality of elevator cars, motive means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motive means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means comprising first call registering means for each of the intermediate floors operable for registering calls for elevator service towards the second terminal floors, second call registering means for each of the intermediate floors operable for registering calls for elevator service towards the first terminal floor, third call registering means operable for registering calls for each intermediate floor desired by passengers in each of the elevator cars, first means for moving the elevator cars between the terminal floors and stopping each of the elevator cars at each intermediate floor approached by the elevator car in response to a call registered by the registering means for the floor being approached by the elevator-car-to-be-stopped which may be served by such approaching elevator car, timing mechanism operable from a first condition to a second condition at predetermined periods of time, second means cooperating with the first means in response to operation of the timing mechanism to the second condition for conditioning a first one of the elevator cars on a plurality of first trips towards the second terminal floor to stop and reverse at first one of the intermediate floors, and third means cooperating with the first means in response to operation of the timing mechanism to the second condition, for conditioning a second one of the elevator cars on a plurality of trips towards the second terminal landing to stop and reverse at a second one of the intermediate floors.

14. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of intermediate floors positioned between the terminal floors, a plurality of elevator cars, motive means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motive means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means comprising first call registering means for each of the intermediate floors operable for registering calls for elevator service towards the second terminal floors, second call registering means for each of the intermediate floors operable for registering calls for elevator service towards the first terminal floor, third call registering means operable for registering calls for each intermediate floor desired by passengers in each of the elevator cars, first means for moving the elevator cars between the terminal floors and stopping each of the elevator cars at each intermediate floor approached by the elevator car in response to a call registered by the registering means for the floor being approached by the elevator-car-to-be-stopped which may be served by such approaching elevator car, timing mechanism operable from a first condition to a second condition at predetermined periods of time, second means cooperating with the first means in response to operation of the timing mechanism to the second condition for conditioning a first one of the elevator cars on a plurality of first trips towards the

15. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of intermediate floors positioned between the terminal floors, a plurality of elevator cars, motive means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motive means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means comprising first call registering means for each of the intermediate floors operable for registering calls for elevator service towards the second terminal floors, second call registering means for each of the intermediate floors operable for registering calls for elevator service towards the first terminal floor, third call registering means operable for registering calls for each intermediate floor desired by passengers in each of the elevator cars, first means for moving the elevator cars between the terminal floors and stopping each of the elevator cars at each intermediate floor approached by the elevator car in response to a call registered by the registering means for the floor being approached by the elevator-car-to-be-stopped which may be served by such approaching elevator car, second means cooperating with the first means in response to occurrence of a predetermined condition for conditioning a first one of the elevator cars on a plurality of first trips towards the second terminal floor to stop and reverse at a first one of the intermediate floors, means responsive to presence of a call registered by the third call registering means for rendering the second means ineffective for said conditioning, and third means cooperating with the first means in response to occurrence of said predetermined condition for conditioning said first one of the elevator cars on a plurality of second trips towards the second terminal floor to stop and reverse at a second one of the intermediate floors.

16. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of intermediate floors positioned between the terminal floors, a plurality of elevator cars, motive means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motive means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means comprising first call registering means for each of the intermediate floors operable for registering calls for elevator service towards the second terminal floors, second call registering means for each of the intermediate floors operable for registering calls for elevator service towards the first terminal floor, third call registering means operable for registering calls for each intermediate floor desired by passengers in each of the elevator cars, first means for moving the elevator cars between the terminal floors and stopping each of the elevator cars at each intermediate floor approached by the elevator car in response to a call registered by the registering means for the floor being approached by the elevator-car-to-be-stopped which may be served by such approaching elevator car, timing mechanism operable from a first condition to a second condition at predetermined periods of time, second means cooperating with the first means

17. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of intermediate floors positioned between the terminal floors, a plurality of elevator cars, motive means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motive means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means comprising first call registering means for each of the intermediate floors operable for registering calls for elevator service towards the second terminal floors, second call registering means for each of the intermediate floors operable for registering calls for elevator service towards the first terminal floor, third call registering means operable for registering calls for each intermediate floor desired by passengers in each of the elevator cars, first means for moving the elevator cars between the terminal floors and stopping each of the elevator cars at each intermediate floor approached by the elevator car in response to a call registered by the registering means for the floor being approached by the elevator-car-to-be-stopped which may be served by such approaching elevator car, second means cooperating with the first-means in response to occurrence of a predetermined condition for conditioning a first one of the elevator cars on a plurality of first trips towards the second terminal floor to stop and reverse at a first one of the intermediate floors, and third means cooperating with the first means in response to occurrence of said predetermined condition for conditioning said first one of the elevator cars on a plurality of second trips towards the second terminal floor to stop and reverse at a second one of the intermediate floors, and means responsive to said conditioning of the second and third means for rendering said first call registering means ineffective for stopping said first one of the elevator cars.

18. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of intermediate floors positioned between the terminal floors, a plurality of elevator cars, motive means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motive means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means comprising first call registering means for each of the intermediate floors operable for registering calls for elevator service towards the second terminal floors, second call registering means for each of the intermediate floors operable for registering calls for elevator service towards the first terminal floor, third call registering means operable for registering calls for each intermediate floor desired by passengers in each of the elevator cars, first means for moving the elevator cars between the terminal floors and stopping each of the elevator cars at each intermediate floor approached by the elevator car in response to a call registered by the registering means for the floor being approached by the elevator-car-to-be-stopped which may be served by such approaching elevator car, timing mechanism operable from a first condition to a second condition at predetermined periods of time, second means co-

operating with the first means in response to operation of the timing mechanism to the second condition for conditioning a first one of the elevator cars on a plurality of first trips towards the second terminal floor to stop and reverse at first one of the intermediate floors, and third means cooperating with the first means in response to operation of the timing mechanism to the second condition, for conditioning a second one of the elevator cars on a plurality of trips towards the second terminal landing to stop and reverse at a second one of the intermediate floors, and means responsive to said conditioning by the second and third means for rendering said first call registering means ineffective for stopping said first one of the elevator cars.

19. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of intermediate floors positioned between the terminal floors, a plurality of elevator cars, motive means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motive means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means comprising first call registering means for each of the intermediate floors operable for registering calls for elevator service towards the second terminal floors, second call registering means for each of the intermediate floors operable for registering calls for elevator service towards the first terminal floor, third call registering means operable for registering calls for each intermediate floor desired by passengers in each of the elevator cars, first means for moving the elevator cars between the terminal floors and stopping each of the elevator cars at each intermediate floor approached by the elevator car in response to a call registered by the registering means for the floor being approached by the elevator-car-to-be-stopped which may be served by such approaching elevator car, timing mechanism operable from a first condition to a second condition at predetermined periods of time, second means cooperating with the first means in response to operation of the timing mechanism to the second condition for conditioning a first one of the elevator cars on a plurality of first trips towards the second terminal floor to stop and reverse at first one of the intermediate floors, third means cooperating with the first means in response to operation of the timing mechanism to the second condition for conditioning said first one of the elevator cars on a plurality of second trips towards the second terminal floor to stop and reverse at a second one of the intermediate floors, and fourth

means cooperating with the first means in response to operation of the timing mechanism to the second condition for conditioning a second one of the elevator cars on a plurality of trips towards the second terminal landing to stop and reverse at a third one of the intermediate floors, and means responsive to said conditioning by the second and third means for rendering the first call registering means ineffective for stopping said first and second ones of the elevator cars, a third one of the elevator cars during said last-named conditioning being responsive to calls registered by the first call registering means.

20. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of floors intermediate said terminal floors, a plurality of elevator cars, motor means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motor means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means including first means for controlling the elevator cars for movement between said terminal floors, timing mechanism responsive to occurrence of a predetermined time for operating from a first condition to a second condition, and assigning means responsive to operation of the timing mechanism to the second condition for assigning one of the elevator cars to stop at a predetermined one of the intermediate floors.

21. In an elevator system for a structure having a first terminal floor, a second terminal floor and a plurality of floors intermediate said terminal floors, a plurality of elevator cars, motor means for moving each of the elevator cars relative to the structure to provide elevator service for the floors, and control means cooperating with the motor means for moving the elevator cars and stopping the elevator cars at desired floors of the structure, said control means including first means for controlling the elevator cars for movement between said terminal floors, timing mechanism responsive to occurrence of a predetermined time for operating from a first condition to a second condition, and assigning means responsive to operation of the timing mechanism to the second condition for assigning a first one of the elevator cars to stop at certain of said floors and for assigning a second one of the elevator cars to stop at certain of said floors at which the first one of the elevator cars is not assigned to stop by the assigning means.

No references cited.

Notice of Adverse Decision in Interference

In Interference No. 89,897 involving Patent No. 2,840,189, D. Santini and G. Macredis, Elevator systems, final decision adverse to the patentees was rendered Dec. 11, 1961, as to claims 1, 6, 9, 13, 16, 18, 20 and 21.
[*Official Gazette September 3, 1963.*]

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