

May 27, 1958

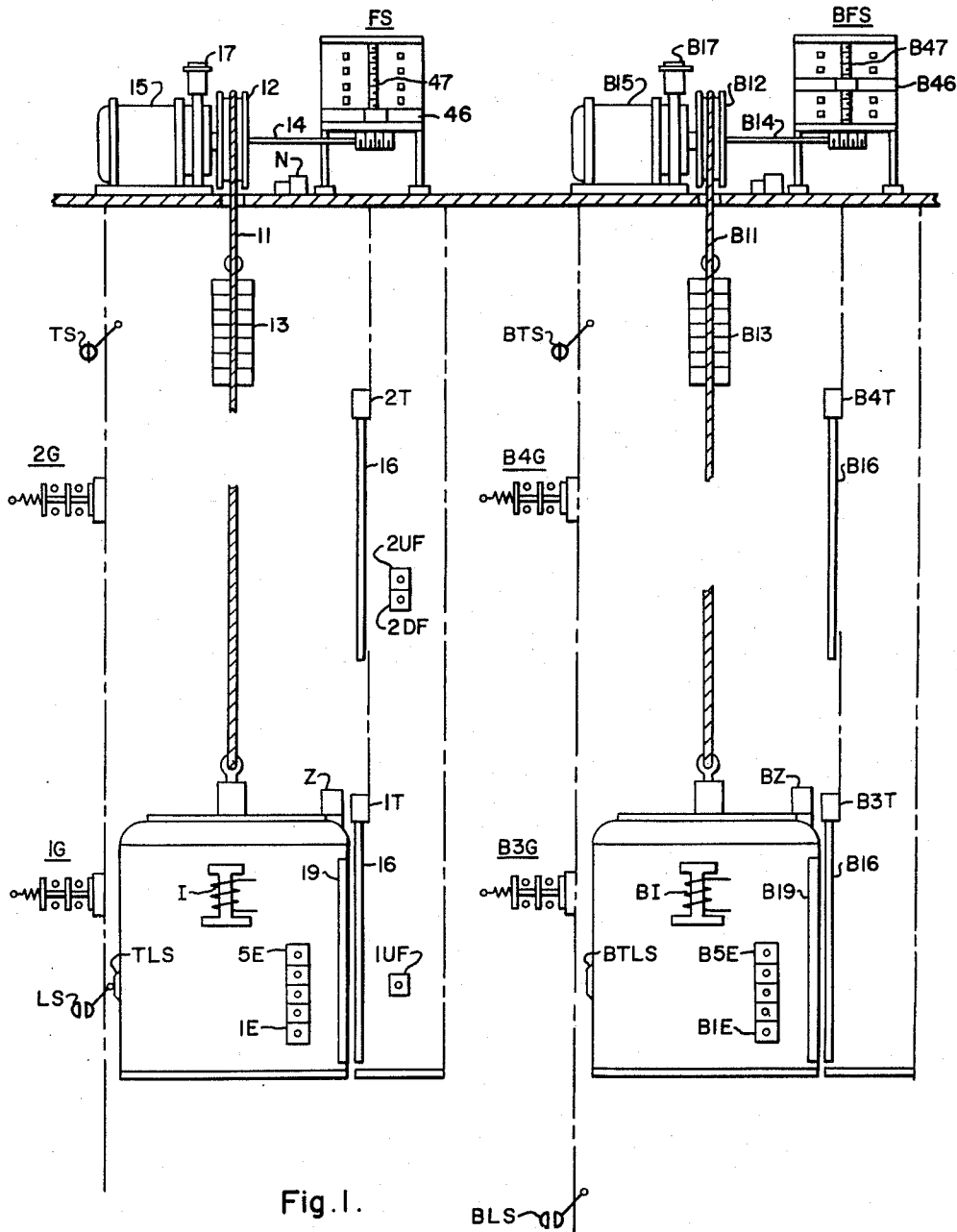
A. R. HOCKSTEIN ET AL

2,836,262

ELEVATOR SYSTEMS

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7 Sheets-Sheet 1



WITNESSES:

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May 27, 1958

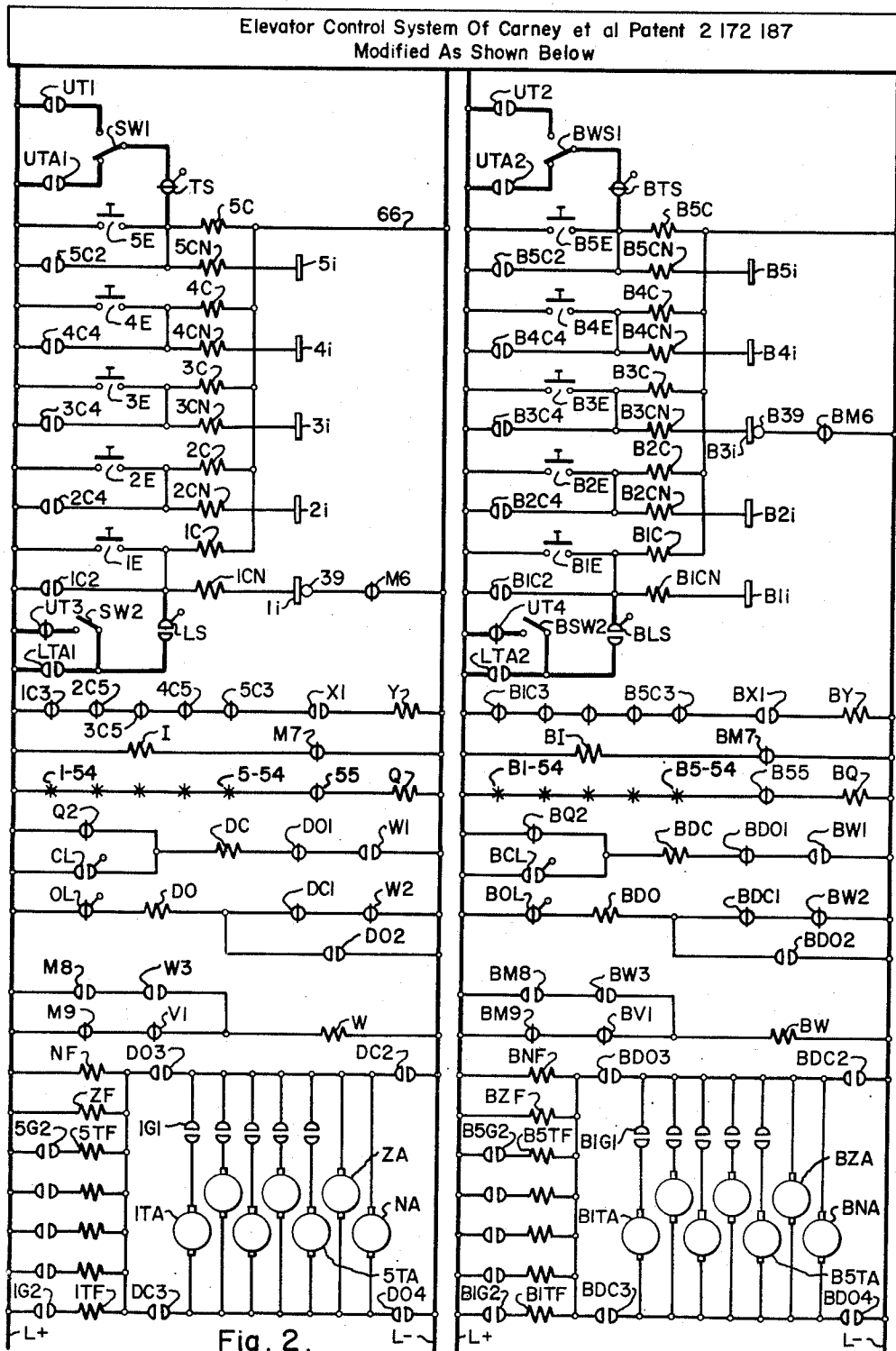
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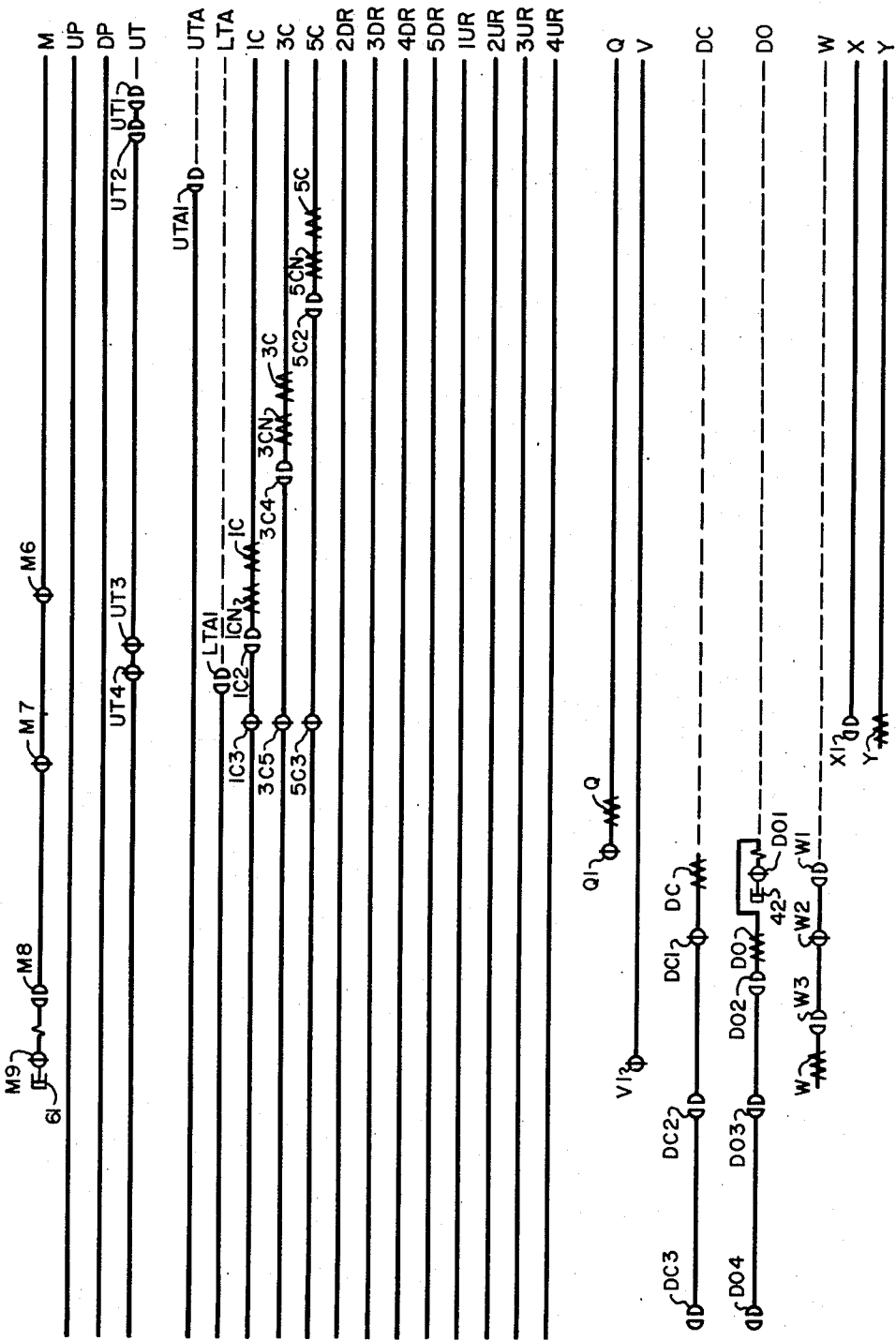


Fig. 2A.

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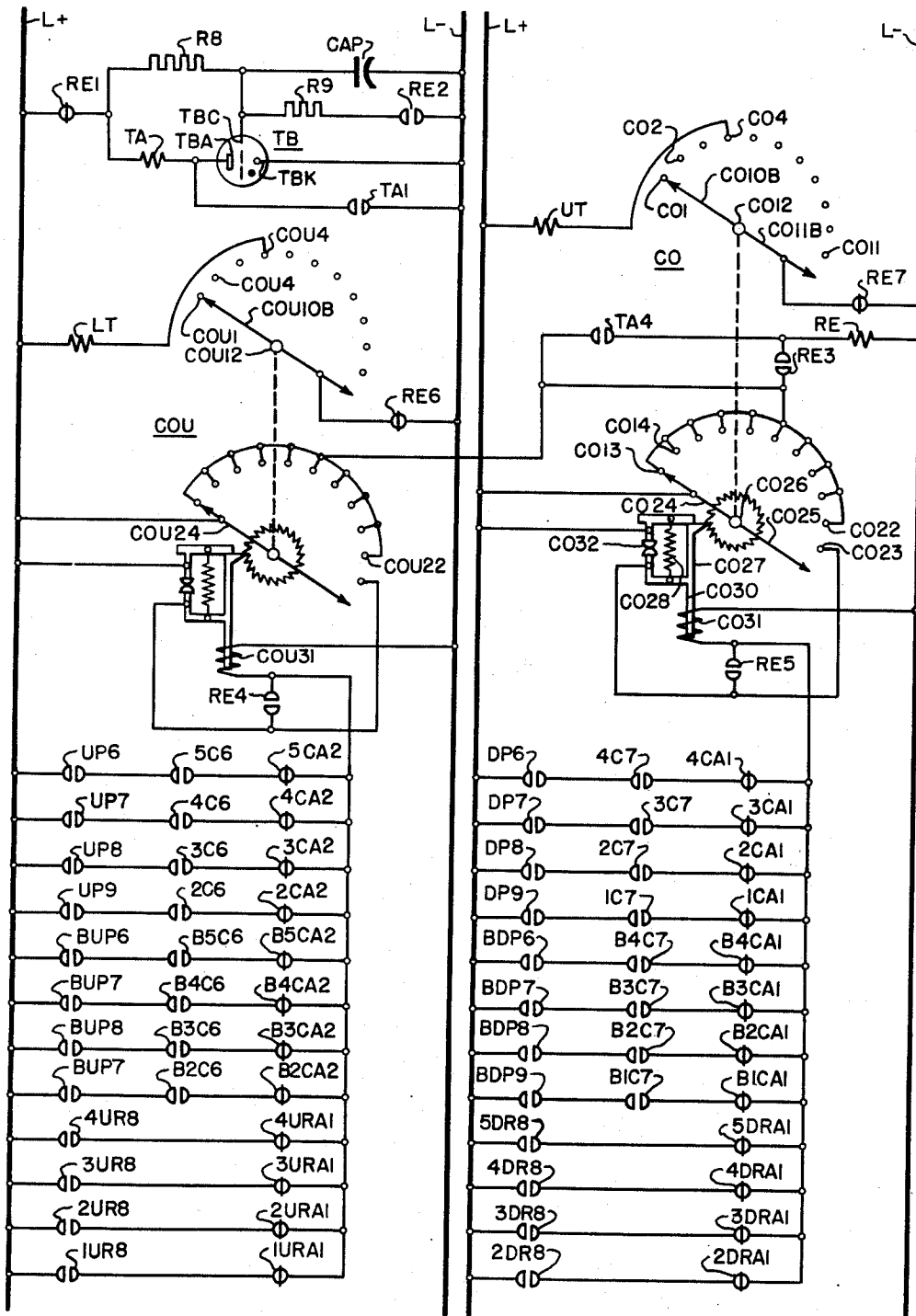


Fig. 3.

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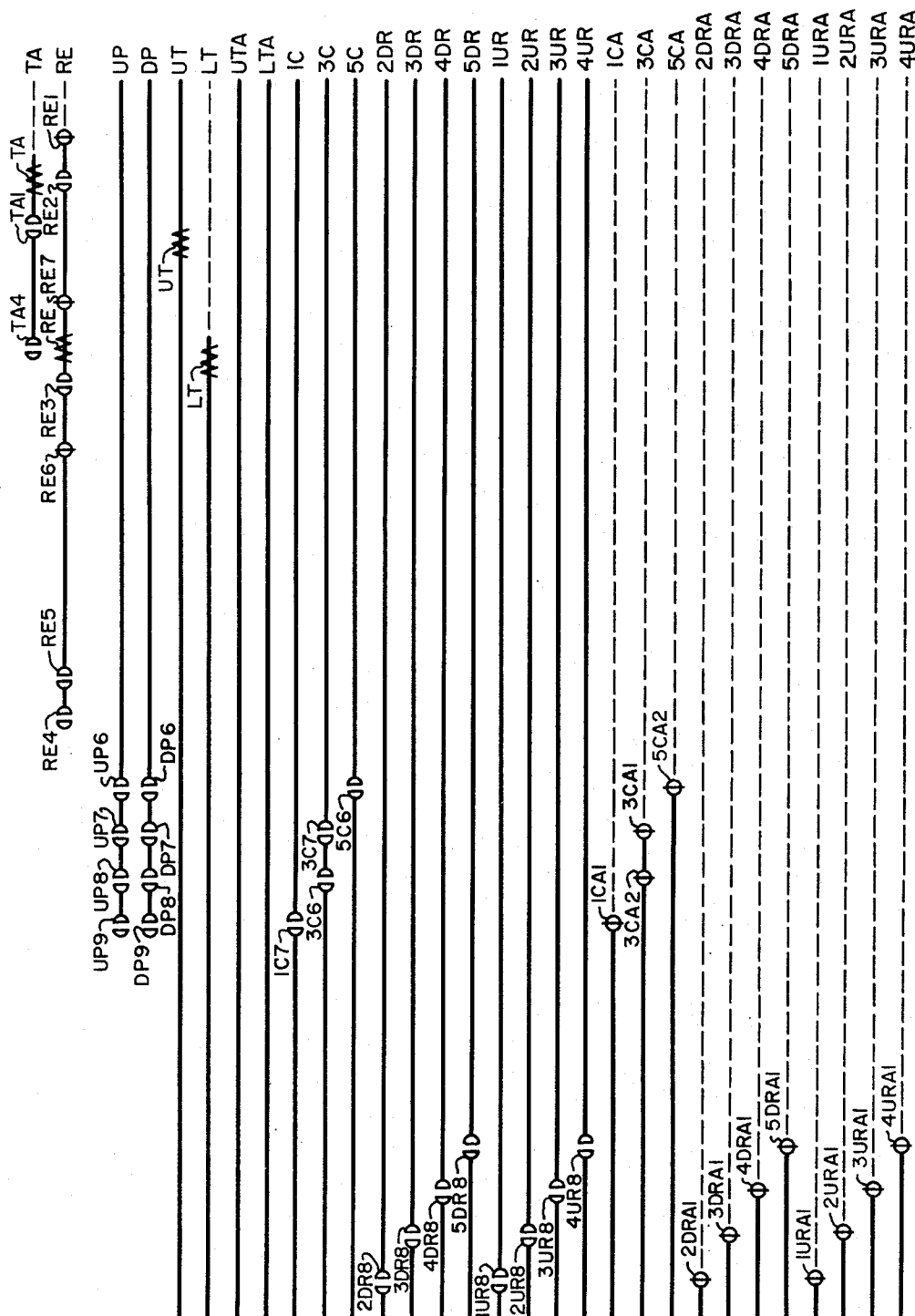
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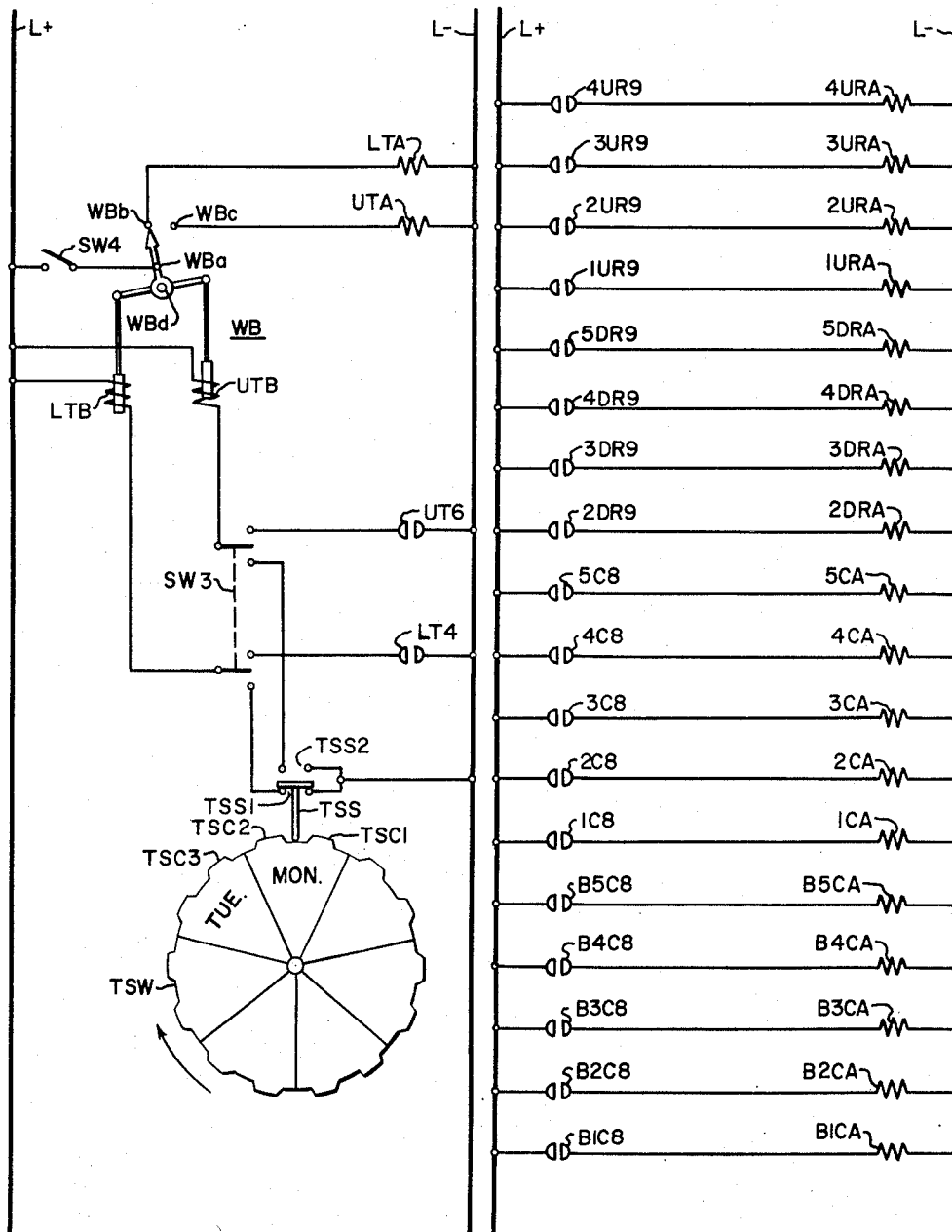


Fig. 4.

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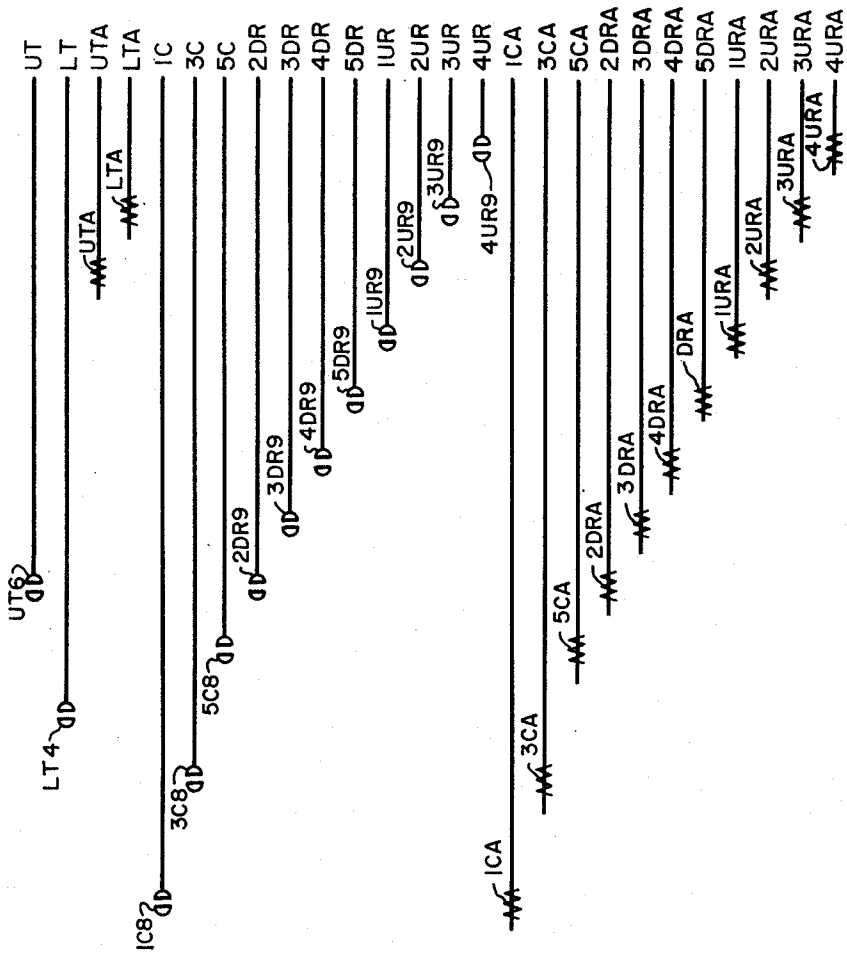


Fig. 4A.

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ELEVATOR SYSTEMS

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10 Claims. (Cl. 187—29)

This invention relates to elevator systems and it has particular relation to systems wherein elevator cars are parked when no elevator service is required.

In some elevator systems it is the practice to permit the elevator cars to move only when elevator service is required. When no elevator service is required the elevator cars park at suitable parking stations. Such an elevator system may provide an operation known as "collective operation."

In a system designed to provide collective operation, a single floor-call push button may be provided on each floor served by an elevator car. If a call is registered for a floor by operation of the associated push button, the elevator car stops at such floor regardless of the direction in which the elevator car approached the floor. Car-call push buttons may be provided for registering calls desired by passengers in the elevator car. When designed for automatic operation, an elevator car is started in operation only when a call for service is registered in the system. When no call for service is registered, the elevator car remains parked at a floor.

A second elevator system may be designed to provide "selective-collective operation." In such a system an up-floor-call push button is provided at each floor from which elevator service in an up direction is desired. A down-floor-call push button is provided from each floor from which elevator service in the down direction is desired. When set for up travel an elevator car answers floor calls registered only by up-floor-call push buttons at least until the highest call of this type is answered. When set for down travel, the elevator answers floor calls registered only by the down-floor-call push buttons at least until the lowest call of this type is answered. Car-call push buttons also may be provided. The elevator car is permitted to move only when a call is registered in the system. In the absence of a registered call for elevator service, the elevator car is parked at a suitable parking station.

In accordance with the invention an elevator car is parked at a selected one of a plurality of parking stations and the selection is changed under certain conditions to provide the most efficient operation of the elevator system. Thus, during a period wherein a demand for elevator service predominantly in the up direction is expected an elevator car in the absence of calls for service may be parked adjacent its lower terminal floor. During a period when elevator service may be expected predominantly in the down direction an elevator car in the absence of a call for service may be parked at a parking station located adjacent its upper terminal floor.

In accordance with the invention a parking station is selected automatically. In one embodiment of the invention the selection is based on traffic conditions or service demands. Thus, if a traffic condition such as a substantial registration of up floor calls occurs, a parking station adjacent a lower terminal floor may be selected. Alternatively, a traffic condition indicating a period of substan-

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tial demand for down elevator service, for example, registration of a substantial number of down floor calls, may result in selection of a parking station adjacent the upper terminal floor.

Once a parking station has been selected in response to a service demand predominantly in a first direction, the parking station may be retained until a predetermined service demand occurs in a second direction. In another modification of the invention a primary parking station may be established and a secondary parking station becomes effective only for a period determined by predetermined traffic condition.

In some elevator installations the demand for elevator service follows a reasonably well-defined time pattern. For such an installation a timing mechanism may be employed for selecting different parking stations during different periods of time.

The invention is applicable to an elevator installation employing a single elevator car. It is also desirable for an elevator system wherein a plurality of elevator cars are arranged in a bank, and it will be described with particular reference to a bank of elevator cars.

It is, therefore, an object of the invention to provide an elevator system wherein a plurality of parking stations are provided for an elevator car and wherein a specific parking station is selected to be effective in response to a predetermined condition which occurs automatically during the operation of the elevator system.

It is a further object of the invention to provide an elevator system having a plurality of parking stations with a selector responsive to a traffic condition for determining which of the parking stations shall be effective.

It is also an object to provide an elevator system having a plurality of parking stations wherein a timing mechanism is provided for rendering each of the parking stations effective during a different period of time.

It is another object of the invention to provide an elevator system having a plurality of parking stations wherein one of the parking stations constitutes a primary parking station and wherein another parking station is effective only for a period determined by the duration of a predetermined condition.

It is still a further object of the invention to provide an elevator system having a plurality of parking stations wherein each of the parking stations is effective until occurrence of a predetermined condition results in selection of another parking station.

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 diagrammatic representation of an elevator system embodying the invention;

Fig. 2 is a diagrammatic representation of a control circuit for the elevator system illustrated in Fig. 1;

Figs. 3 and 4 are diagrammatic representations in straight line form showing further a portion of the control circuits for the elevator system of Fig. 1, and

Figs. 2A, 3A and 4A are key illustrations of the relays embodied in Figs. 2, 3 and 4 respectively. If Figs. 2, 3 and 4 are horizontally aligned respectively with Figs. 2A, 3A and 4A, it will be found that the corresponding coils and contacts on the pairs of figures are substantially in horizontal alignment.

In order to simplify the presentation of the invention, the invention has been illustrated as applied to the elevator system of the Carney et al. Patent 2,172,187 which issued September 5, 1939. The entire system of the Carney et al. patent is incorporated herein with certain additions which will be discussed below. The conventions employed in the Carney et al. patent will be followed herein.

Figure 1

Figure 1 of the drawings is identical with Fig. 1 of the Carney et al. patent with the exception of certain additions which will be discussed below. The reference characters in the present Fig. 1 for similar components are identical with those in the Carney et al. patent and designate the same components.

The only additions to Fig. 1 of the Carney et al. patent are represented for the elevator car A by the switches LS and TS. The switch LS is a cam operated switch which is biased to closed position and which is opened by a cam TLS which is secured to the elevator car A only when the elevator car A is in a lower parking station which may be the first floor of the building served by the elevator car.

The switch TS is a cam operated switch which is normally biased to closed position and which is opened by the cam TLS only when the elevator car A is in an upper parking station which may be the fifth floor of the building served by the elevator car. Similar switches are provided for the elevator car B and for any other car incorporated in the system. In Fig. 1 the elevator car A is shown at the first floor whereas the elevator car B is shown at the third floor.

Figure 2

Figure 2 includes all the components of Figs. 3, 4 and 5 of the aforesaid Carney et al. patent. The present Fig. 2 is intended to represent a system identical with that shown in Figs. 3, 4 and 5 of the Carney et al. patent with certain additions which will be discussed below. The present Fig. 2 illustrates, in detail, only Fig. 4 of the aforesaid Carney et al. patent, to which the additions are applied. The present Fig. 2 employs the same reference characters utilized in the Carney et al. patent to designate the same components. In certain cases, as pointed out below, additional contacts are provided for the relays of the Carney et al. patent.

Turning now to the additions which are shown in Fig. 2 in heavy lines, it will be noted that the car button 1E is shunted by an added circuit which includes, in series, the mechanically-operated switch LS and make contacts LTA1 of a third parking relay LTA. The make contacts LTA1, in turn, are shunted through a circuit which contains break contacts UT3 of a first parking relay UT and a manually operated switch SW2.

The car button 5E is shunted by a circuit which includes the mechanically-operated switch TS, make contacts UTA1 of a fourth parking relay and a single-pole, double-throw switch SW1. When the switch SW1 is operated to its second position it established a shunt around the car button 5E which includes the mechanically-operated switch TS, the switch SW1 and make contacts UT1 of the first serve relay.

Similar additions are illustrated for the elevator car B.

Figures 3 and 4

Figures 3 and 4 show circuits for controlling the operation of the parking relays LT, UT, LTA, and UTA. These circuits include contacts which are added to certain relays of the Carney et al. patent. For example, for Fig. 3 make contacts 2C6 to 5C6 are added respectively to the car call registering relays 2C to 5C of the Carney et al. patent. Make contacts 1C7 to 4C7 are added respectively to the car call registering relays 1C to 4C of the Carney et al. patent. Make contacts 1UR3 to 4UR3 are added respectively to the up-floor call registering relays 1UR to 4UR of the Carney et al. patent. Finally, make contacts 2DR3 to 5DR3 are added respectively to the down-floor call registering relays 2DR to 5DR of the Carney et al. patent.

The first parking relay UT has its energization controlled by a stepping switch CO which has a semi-circular row of contacts CO1 to CO11. The contacts are engaged by one of the brushes CO10B to CO11B which are dis-

placed from each other 180 degrees about a shaft CO12. The brushes are connected to the bus L— through break contacts RE7 of the reset relay RE.

The brushes CO10B and CO11B are reset periodically to the positions illustrated in Fig. 3. The brushes are stepped by the shaft CO12 in a clockwise direction for an angular distance corresponding to the spacing of successive contacts CO1 to CO11 for each registration of a call requiring down travel of an elevator car.

The first parking relay UT has one terminal connected to the bus L+ and its remaining terminal connected to a selected one of the contacts CO1 to CO11. The particular contact selected determines the number of stepping operations required of the brushes before the first parking relay UT is connected for energization. For present purposes it will be assumed that the contact CO4 is the selected contact. Consequently, the brushes must step three times from their reset positions before the first parking relay can be energized. During a resetting operation of the stepping relay the break contacts RE7 open to prevent energization of the first parking relay UT.

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

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

The pawl CO27 has a magnetic core CO30 associated with a solenoid CO31. The solenoid is connected for energization across the buses L+ and L— through a parallel circuit having a separate arm for each call which may be registered requiring travel in the down direction. For the purposes of illustration, circuits for the cars A and B have been illustrated.

An arm is provided for each car call which may be registered requiring down travel. For the elevator car A, arms are illustrated for the first to the fourth floors. One of the arms for the first floor contains the contacts 1C7, DP9 and 1CA1. Another arm for the fourth floor contains the contacts 4C7, DP6 and 4CA1. Thus, if a car call is registered in the elevator car A for the first floor the contacts 1C7 close. If the car is set for down travel the contacts DP9 will be closed. Shortly after the contacts 1C7 close, the contacts 1CA1 open (as shown below) to provide a momentary pulse for the solenoid CO31. A similar arm is provided for each intermediate floor, and corresponding arms are provided for each of the elevator cars. One of these arms is momentarily closed for each car call which is registered while the car in which the call is registered is set for down travel.

An arm is also provided for each down floor call which may be registered. Thus, one arm for the fifth floor contains make contacts 5DR8 of the up floor-call registering relay 5DR and break contacts 5DRA1 which open shortly after the make contacts 5DR8 to close to provide a momentary circuit closure. A similar arm is provided for each down call registering relay.

Each floor-call registering relay IUR to 4UR and 2DR to 5DR and each car call registering relay 1C to 5C has make contacts controlling the energization of an auxiliary relay, respectively, 1URA to 4URA, 2DRA to 5DRA and 1CA to 5CA. For example, the relay 4UR has make contacts 4UR9 controlling energization of the relay 4URA.

Consequently, for each registered down floor or car call, a pulse of current is supplied to the solenoid CO31 to attract the associated magnetic core CO30 against the bias of the spring CO28. Upon completion of the pulse,

the spring CO28 urges the pawl CO27 against the stop CO29. During such movement, the pawl advances the shaft CO12 one step. Each step of the shaft CO12 corresponds to the angular distance between successive contacts CO1 to CO11 and CO13 to CO23.

For resetting purposes, the solenoid CO31 is connected across the buses L+ and L- through make contacts RE5 of the reset relay and self-stepping contacts CO32 of the stepping switch. By inspection of Fig. 3, it will be observed that the contacts CO32 are biased to their closed conditions by the spring CO28 and are opened when the pawl CO27 is moved down by the solenoid CO31. Consequently, as long as the contacts RE5 remain closed, the stepping switch steps rapidly in a clockwise direction as viewed in Fig. 3. Such stepping switches are well known in the art. It will be noted that the contacts CO23 are connected to the bus L+ through the self-stepping contacts CO32.

The stepping switch COU associated with the relay LT is identical to the stepping switch CO with the exception that the parallel arms controlling stepping of the switch COU respond only to calls requiring up movement of the cars to make the stepping switch COU respond only to registered calls requiring travel of the elevator cars in the up direction. Similar components of the stepping switches CO and COU are identified by similar reference characters except that the prefix COU rather than CO is employed for reference characters associated with the switch COU.

As clearly shown in Fig. 3, the solenoid COU31 is connected across the buses L+ and L- through a parallel circuit having a separate arm for each registerable call requiring up travel of the elevator cars. Thus, for the elevator car A the solenoid COU31 is connected across the buses L+, L- through a circuit including a plurality of parallel arms each including one of the sets of contacts 2C6 to 5C6, one of the sets of contacts UP6 to UP9 and one of the sets of contacts 2CA2 to 5CA2. The solenoid COU31 receives a pulse for each operation of a car call push button only if the car is set for up travel.

Similar circuits are shown for the elevator car B.

The solenoid COU31 may also be energized through an additional arm provided for each of the up floor-call registering relays in a manner analogous to the association of the solenoid CO31 with the down floor-call registering relays. Thus, energizing arms are provided for the make contacts 4UR8, 3UR8, 2UR8 and 1UR8, respectively, which also include break contacts 1URA1 to 4URA1 respectively.

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

When the break contacts RE1 close, the capacitor CAP starts to charge. After the lapse of a predetermined interval, the charge across the capacitor CAP becomes sufficient to initiate a discharge in the tube TB. When the reset relay RE picks up, it opens its break contacts RE1 to deenergize the timing relay TA and closes its make contacts RE2 to establish a discharge circuit for the capacitor CAP.

It is believed desirable at this point to describe a cycle of operations of certain circuits shown in Figs. 3 and 4. Let it be assumed that the components are in the con-

ditions illustrated in Figs. 3 and 4, and that the break contacts RE1 have just reclosed to start the charging of the capacitor CAP.

As the capacitor CAP charges, it will be assumed that the elevator car A starts a down trip and that a down floor call is registered at the second floor. Also, the elevator car B starts an up trip and up floor calls are registered at the first, second and fourth floors.

As the down floor call is registered at the second floor, the make contacts 2DR8 close to complete with the break contacts 2DRA1 an energizing circuit for the solenoid CO31. Also, the contacts 2DR9 close to energize the auxiliary relay 2DRA. The auxiliary relay opens its contacts 2DRA1 to restrict the energization of the solenoid CO31 to a brief pulse. In response to such energization the solenoid attracts the magnetic core CO31 against the bias of the spring CO28. Since the solenoid CO31 immediately is deenergized, the spring CO28 moves the pawl CO27 upwardly to advance the shaft CO12 and the associated brushes through one step and the brushes CO10B and CO24 respectively, engage the contacts CO2 and CO14. During the stepping operation, the self-stepping contacts CO32 open and reclose without affecting the operation of the system.

In an analogous manner, the three registered up floor calls at the first, second and fourth floors supply three successive pulses of energy to the solenoid COU31 for the purpose of advancing the stepping switch COU three steps. Thus, closure of make contacts 1UR8, 2UR8 and 4UR8 of the up floor-call registering relays complete energizing circuits for the solenoid COU31. Closure of contacts 1UR9, 2UR9 and 4UR9, respectively, energize the relays 1URA, 2URA and 4URA. These relays open their contacts 1URA1, 2URA1 and 4URA1 to interrupt the energizing circuits established by the contacts 1UR8, 2UR8 and 4UR8, and thus three pulses are provided for the solenoid. The probability that two pulses may occur simultaneously is remote and may be disregarded. This advances the shaft COU12 three steps to bring the brush COU10 into engagement with the contact segment COU4.

The relay LT is assumed to be connected to the contact COU4. Consequently, the engagement of contact COU4 by the brush energizes the relay LT.

It will be assumed next that at this stage the capacitor CAP has charged to a value sufficient to fire the tube TB and pick up the relay TA. The relay TA closes its make contacts TA1 to establish with the break contacts RE1 a self-holding circuit.

The timing relay TA also closes its make contacts TA4 to establish with the stepping switches an energizing circuit for the reset relay RE. The reset relay opens its break contact RE1 to deenergize the timing relay TA. In addition, make contacts RE2 close to establish with the resistor R9 a discharge circuit for the capacitor CAP. Closure of make contacts RE3 establishes with the stepping switches a self-holding circuit for the resetting relay. Closure of the make contacts RE5 completes with the self-stepping contacts CO32 a self-stepping circuit for the solenoid CO31. Consequently, the switch CO rapidly steps in a clockwise direction until the brush CO24 engages the contact CO23 to maintain energization of the solenoid CO31. As the brush CO24 leaves the contact segment CO22, it is no longer effective for completing a self-holding circuit for the relay RE. In a similar manner, closure of the make contacts RE4 establishes a self-stepping circuit for the stepping switch COU and this resets until the brush COU24 leaves the contact COU22. Since the arms CO24 and COU24 have passed respectively the contacts CO22 and COU22, the reset relay RE is now deenergized. The make contact RE5 opens to deenergize the solenoid CO31 and this permits the spring CO28 to advance the shaft CO12 one step to bring the brush CO23 into engagement with the contact segment CO13. In

a similar manner the opening of the make contacts RE4 advances the shaft COU12 one step.

During a resetting operation break contacts RE6 and RE7 open to prevent energization of the relays LT and UT during the resetting operation.

It will be recalled that the opening of the break contacts RE1 resulted in dropout of the timing relay TA. Opening of the make contacts TA4 had no immediate effect on the operation of the system.

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

Turning now to the third and fourth parking relays it will be noted that the energization of these relays depends on the position of a walking beam switch WB. The walking beam of this switch is pivoted for rotation about an axis Wb_d and carries a movable contact Wb_a which is moved between two fixed contacts Wb_b and Wb_c. The third parking relay LTA is connected between the fixed contact Wb_b and the bus L—. The fourth parking relay UTA is connected between the fixed contact Wb_c and the bus L—. The movable contact Wb_a is connected to the bus L+ through a manually-operated switch SW4.

The position of the walking beam of the walking beam switch is controlled by a coil LTB having an armature connected pivotably to the left hand end of the walking beam and by a coil UTB having an armature connected pivotably to the right hand end of the walking beam. One terminal of each of these coils is connected to the bus L+. The remaining terminals are connected respectively to the blades of a double-pole, double-throw manually-operated knife switch SW3. The upper terminals of the switch are connected to the bus L— respectively through the make contacts UT6 and LT4. The lower terminals of the switch are connected to the bus L— respectively through front contacts TSS2 and back contacts TSS1 of a cam-operated switch TSS.

The contacts TSS1 and TSS2 are intended to be closed and open during predetermined periods of time. To this end they may be operated by any conventional time switch. For illustrative purposes it will be assumed that the switch is operated by a time wheel TSW which rotates in a clockwise direction as viewed in Figure 3 at the rate of one revolution per week. This wheel is divided into seven sectors, one for each day of the week, some of the days being indicated on their respective sectors. Each of the sectors may have one or more cams selected or adjusted to operate the switch during desired periods of time. For example, the Monday sector is illustrated as having two cams TSC1 and TSC2. The cam TSC1 may be designed to operate the switch TSS to open the back contacts TSS1 and close the front contacts TSS2 during a period of time on Monday when a preponderance of travel in the down directions is expected. For example, this period of time may be between the hours of 7 and 9 in the morning.

If a second period during which such travel is expected occurs during the hours of 7 and 8 in the evening on Monday, the cam TSC2 may be designed to operate the switch TSS to open the back contacts TSS1 and close the front contacts TSS2 between the hours of 7 and 8 on Monday. In a similar manner cams may be associated with each of the other sectors for which periods are expected to occur regularly in which the travel on the elevator system is preponderantly in the down direction.

Operation

For the first operation it will be assumed that the switch SW1 of Fig. 2 is in its upper position connecting the make contacts UT1 and the switch TS across the contacts 5C2. The switch SW2 is assumed to be closed. The switch SW4 of Fig. 4 is assumed to be open and the components of Fig. 3 are assumed to be in the positions

illustrated immediately after a reset operation. The capacitor CAP now starts to charge for the purpose of measuring the necessary resetting time for the stepping switches.

Returning to Fig. 2, it will be noted that the switches condition the system to establish the lower terminal floor as a parking station for elevator car A. As long as the elevator car A is at its parking station the switch LS is open. However, as soon as the elevator car A leaves the lower terminal floor the switch LS closes as a result of movement of the cam TLS (Fig. 1) away from the switch LS. Such closure connects the coil 1C for energization through the switch LS, the break contacts UT3 and the switch SW2. The energized coil 1C in effect registers a car call for the first floor and the elevator car now must be returned to the first floor before it can be parked.

At this stage it will be assumed that down floor calls are registered in rapid succession for the fifth, fourth and third floors. The sequence for registering such floor calls will be understood from the aforesaid Carney et al. patent. The registration of the down floor calls for the fifth floor is accompanied by closure of the make contacts 5DR8 to complete with the break contacts 5DRA1 an energizing circuit for the solenoid CO31 of the stepping switch CO. The registration of the down floor call also results in closure of the make contacts 5DR9 to energize the auxiliary relay 5DRA. The auxiliary relay thereupon opens its break contacts 5DRA1 to deenergize the solenoid CO31. This permits the spring CO28 to move the pawl CO27 for the purpose of advancing the stepping switch brushes one step. Such movement of the brushes has no immediate effect on the operation of the system.

In a similar manner the registration of the down floor call for the fourth floor results in a second stepping operation of the stepping switch. The second stepping operation also has immediate effect on the operation of the system.

Should the time delay measured by the charge of the capacitor CAP expire at this time the stepping switches would reset in the manner previously described without affecting the operation of the system. However, it will be assumed that the time delay has not expired at the time the down floor call is registered at the third floor. The registration of the down floor call at the third floor produces a third operation of the stepping switch CO in the manner which will be understood from the foregoing discussion.

The brush CO10B now engages the contacts CO4 and with the break contacts RE7 establishes an energizing circuit for the first parking relay UT. The opening of the break contacts UT3 of Fig. 2 prevents a parking call to be registered for the lower terminal floor. The closure of the make contacts UT1 establishes the upper terminal floor as the parking floor. It will be noted that when the elevator car A is away from the upper terminal floor the switch TS is closed for the reason that the cam TLS of Fig. 1 is displaced from the switch TS. Consequently, the switch TS and the make contacts UT1 together with the switch SW1 establish a shunt around the contacts 5C2 to register a parking call for the upper terminal floor by energization of the coil 5C. This is desirable for the reasons that the registration of a number of down floor calls indicate a demand for service preponderantly in the down direction. Such service may be expedited by parking the elevator car A at the upper terminal floor during the brief lulls in the demand for service.

In a similar manner the break contacts UT4 and the make contact UT2 operate to transfer the parking station for the elevator car B from the lower terminal to the upper terminal floor.

Returning to Fig. 3, it will be assumed next that the reset time measured by the capacitor CAP expires and

that the relay TA picks up to initiate a resetting operation of the stepping switches by the sequence previously discussed. Such resetting of the stepping switches results in deenergization of the parking relay UT. However, it will be assumed that this relay has a long delay in drop out which may be, for example, of the order of five minutes. If during the five minute delay in drop out of the relay UT a succession of calls requiring down travel of the elevator cars again brings the brush CO10B or the brush CO11B into engagement with the contacts CO4 the relay UT will remain picked up for another period of five minutes. If during the five minute period calls requiring down travel of the elevator car are not received at a rate sufficient to reenergize the relay UT, the relay UT drops out. The resultant opening of the make contacts UT1 of Fig. 2 accompanied by the reclosure of the break contacts UT3 again establishes the lower terminal floor as the parking station for the elevator car A. In a similar manner the opening of the make contacts UT2 and the closing of the break contacts UT4 establish the lower terminal floor as the parking station for the elevator car B.

Thus, it will be seen that the relay UT operates to establish the upper terminal floor as the parking floor only for the duration of a traffic condition or service demand indicating a substantial demand for service in the down direction, and at all other times the lower terminal floor is the parking floor.

Next, it will be assumed that the switch SW1 of Fig. 2 is operated to connect the make contacts UTA1 and the switch TS across the contacts 5C2. The switch SW2 is open. The switch SW3 is operated to its upper position as illustrated in Fig. 4. The switch SW4 is closed. It will also be assumed that the walking beam switch WB is in the position illustrated in Fig. 4 and this means that the third parking relay LTA is energized and picked up. Consequently, the make contacts LTA1 of Fig. 2 are closed. Such closure selects the lower terminal floor as the parking station for the elevator car A. If the elevator car A is displaced from the lower terminal floor the make contacts LTA1 together with the switch LS establishes an energizing circuit for the coil 1C to register a call requiring the return of the elevator car A to the lower terminal floor before it can park. Closure of the make contacts LTA2 similarly selects the lower terminal floor as the parking station for the elevator car B.

It will be assumed next that down floor calls are registered at the fifth, fourth and third floors to bring the brush CO10B into engagement with the contact segment CO4 in the manner described above. This indicates a substantial demand for service in the down direction.

As a result of its energization the relay UT closes its make contacts UT1 and UT2 and opens the break contacts UT3 and UT4. However, because of the positions of the switches SW1, SW2, BSW1 and BSW2, the contacts UT1, UT2, UT3 and UT4 do not affect the operation at this time of the system. However, the closure of make contacts UT6 now establishes with the switch SW3 an energizing circuit for the coil UTB and the walking beam switch consequently moves the contact WBa into engagement with the fixed contact WBc. This results in energization of the fourth parking relay UTA. The operation of the walking beam switch also deenergizes the third parking relay LTA and this relay opens its make contacts LTA1 and LTA2 to discontinue the selection of the lower terminal floor as the parking floor.

The energization of the fourth parking relay UTA closes make contacts UTA1 and UTA2 to select the upper terminal floor as the parking floor. Thus, if the elevator car A is displaced from the upper terminal floor the switch TS is closed and the coil 5C is energized through the switch TS and the closed make contacts UTA1 to register a call requiring return of the elevator car to the upper terminal floor before it can park. Similar comments apply to the elevator car B.

If a similar demand for service in the down direction occurs within the drop out time of the relay UT this relay remains picked up. However, if the demand for service in the down direction is insufficient for a five minute period to reenergize the relay UT this relay drops out. The reopening of the make contacts UT1 and UT2 and the reclosure of the break contacts UT3 and UT4 have no effect at this time on the operation of the system. The opening of the make contacts UT6 deenergizes the coil UTB but the walking beam switch remains in the position to which it was last operated and the deenergization of the coil UTB does not affect the operation of the system at this time.

It will be assumed next that after the walking beam switch has operated to select the upper terminal floor as a parking floor and after the relay UT has dropped out, a traffic condition or service demand arises indicating a substantial demand for service in the up direction. For example, it will be assumed that the elevator car B is at the third floor set for up travel when a car call is registered for the fifth floor and that the elevator A is at the first floor set for up travel when car calls are registered for the second and fifth floors. The sequence for registering such calls can be understood from the aforesaid Carney et al. patent.

The registration of the car call for the fifth floor in the elevator car B results in closure of the make contacts B5C6 of Fig. 3. Inasmuch as the elevator car is assumed to be set for up travel the make contacts BUP6 are closed. Consequently, an energizing circuit is established for the stepping switch COU which steps the switch one step from the position illustrated in Fig. 3. It will be assumed that the capacitor CAP has just started a measurement of a resetting period of the stepping switches. The car call also results in closure of make contacts B5C8 to energize the auxiliary relay B5CA. This relay may have a slight delay in pick up to assure prior pick up of the relay BUP. The relay B5CA opens its break contacts B5CA2 to terminate the energization of the stepping switch COU and this switch consequently completes its first stepping operation. If the reset period for the stepping switch COU expires before further advance of the stepping switch, the stepping switch is reset without operating the relay LT in the manner previously described. However, it will be assumed that prior to the expiration of the reset period the car calls registered in the elevator car A for the second and fifth floors result in two additional operations of the stepping switches COU in a manner which will be understood from the foregoing discussion. As a result of such stepping operations the brush COU10B engages the contacts COU4 to energize the relay LT through the break contacts RE6.

The second parking relay LT now closes its make contacts LT4 to complete with the switch SW3 an energizing circuit for the coil LTB. The energized coil LTB operates the walking beam switch WB back to the position illustrated in Fig. 4. The walking beam consequently moves the contact WBa away from the fixed contacts WBc to deenergize the fourth parking relay UTA. This relay opens its make contacts UTA1 and UTA2 to terminate the selection of the upper terminal floor as the parking floor. In addition, the walking beam switch engages the contacts WBa and WBb to complete an energizing circuit for the third parking relay LTA. This relay recloses make contacts LTA1 and LTA2 to restore the selection of the lower terminal floor as the parking floor.

From this discussion it follows that the relays LTA and UTA, in response to a substantial service demand predominantly in one direction, select a parking floor and retain the selection until a substantial demand for service in the opposite direction occurs.

For the final operation it will be assumed that the switches SW1, SW2, BSW1 and BSW2 are in the positions illustrated in Fig. 2, that the switch SW3 is oper-

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ated to move the knife blades into engagement with the lower switch terminals in Fig. 4 and the switch SW4 is closed. This places the selection of a parking floor under the control of the time switch. With the switch TSS in the position illustrated in Fig. 3, the back contacts TSS1 are closed and an energizing circuit is established through the switch SW3 for the coil LTB. This retains the walking switch SWb in the position illustrated in Fig. 3. It will be recalled that when the walking beam switch is in the position illustrated the third parking relay LTA is energized and selects the lower terminal floor as the parking floor. During certain periods of the day when substantial service in the down direction is expected, the switch TSS is operated to close its front contacts TSS2. For example, in an apartment house a substantial demand for down service may occur between the hours of 7 to 9 in the morning when occupants leave the apartment house for their places of employment. Again in an apartment house a substantial amount of down service may occur between the hours of 7 to 9 in the evening following the dinner hour. As previously explained, cams such as the cams TSC1 and TSC2 for Monday are dimensioned and positioned to operate the switch TSS into position to close the front contacts TSS2 and open the back contacts TSS1 during the desired periods of time. When the switch TSS is so operated it interrupts the energization of the coil LTB and completes an energizing circuit through the switch SW3 for the coil UTB. As a result of such change in energization of its coils, the walking beam switch WB operates to interrupt the energizing circuit for the third parking relay LTA and to establish an energizing circuit for the fourth parking relay UTA. From the preceding discussion it will be recalled that the drop out of the relay LTA followed by the pick up of the relay UTA selects the upper terminal floor as the parking floor for the elevator cars. A similar cam is selected and positioned on the wheel TSW to operate the switch TSS during each period for which the upper terminal floor is to be the parking floor.

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

We claim as our invention:

1. In an elevator system, a structure having a plurality of floors, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure to serve the floors, and control means for moving the elevator cars and stopping the elevator cars at selected floors, said control means comprising call registering means for registering calls for floors at which an elevator car is desired to stop, means responsive to call registration for moving and stopping at least one of the elevator cars to serve the call registration, said structure providing a plurality of parking stations each effective when selected for receiving one of the elevator cars when no call remains registered requiring further service, selecting means automatically effective during the operation of the elevator system to carry passengers for selecting a first period during which first ones of said parking stations are effective and a second period during which second ones of said parking stations are effective to park the elevator cars, and parking means responsive to absence of call registration during said first period for initiating the parking of the elevator cars in the first ones of the parking stations, said parking means being responsive to absence of call registration during said second period for initiating the parking of the elevator cars in the second ones of the parking stations.

2. In an elevator system, a structure having a plurality of floors, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure to serve the floors, and control means for moving the elevator cars and stopping the elevator cars at selected floors, said control means comprising call registering

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means for registering calls for floors at which an elevator car is desired to stop, means responsive to call registration for moving and stopping at least one of the elevator cars to serve the call registration, said structure providing a plurality of parking stations each effective when selected for receiving one of the elevator cars when no call remains registered requiring further service, selecting means responsive to a first elevator traffic condition encountered in the operation of said elevator cars for selecting a first period during which first ones of the parking stations are effective to park the elevator cars, said selecting means being responsive to a second elevator traffic condition encountered in the operation of said elevator cars for selecting a second period during which second ones of the parking stations are effective to park the elevator cars, and parking means responsive to absence of call registration during said first period for initiating the parking of the elevator cars in the first ones of the parking stations, said parking means being responsive to absence of call registration during said second period for initiating the parking of the elevator cars in the second ones of the parking stations.

3. In an elevator system, a structure having a plurality of floors, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure to serve the floors, and control means for moving the elevator cars and stopping the elevator cars at selected floors, said control means comprising call registering means for registering calls for floors at which an elevator car is desired to stop, means responsive to call registration for moving and stopping at least one of the elevator cars to serve the call registration, said structure providing a plurality of parking stations each effective when selected for receiving one of the elevator cars when no call remains registered requiring further service, selecting means comprising timing mechanism for selecting a first time period during which first ones of the parking stations are effective for parking the elevator cars, and a second time period during which second ones of the parking stations are effective for parking the elevator cars, and parking means responsive to absence of call registration during said first period for initiating the parking of the elevator cars in the first ones of the parking stations, said parking means being responsive to absence of call registration during said second period for initiating the parking of the elevator cars in the second ones of the parking stations.

4. In an elevator system, a structure having a plurality of floors, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure to serve the floors, and control means for moving the elevator cars and stopping the elevator cars at selected floors, said control means comprising call registering means for registering calls for floors at which an elevator car is desired to stop, means responsive to call registration for moving and stopping at least one of the elevator cars to serve the call registration, said structure providing a plurality of parking stations each effective when selected for receiving one of the elevator cars when no call remains registered requiring further service, selecting means automatically effective during the operation of the elevator system to carry passengers for selecting a first period during which first ones of said parking stations are effective and a second period during which second ones of said parking stations are effective to park the elevator cars, said selecting means comprising primary parking means for parking the elevator cars at the first ones of the parking stations in the absence of call registrations, and secondary parking means responsive to a predetermined traffic condition for parking the elevator cars at the second ones of the parking stations in the absence of call registrations only for a period determined by the duration of said traffic condition, said secondary parking means upon expiration of the last-named period restoring

the elevator cars to control by the primary parking means.

5. In an elevator system, a structure having a plurality of floors, a plurality of elevator cars, means mounting the elevator cars for movement relative to the structure to serve the floors, and control means for moving the elevator cars and stopping the elevator cars at selected floors, said control means comprising call registering means for registering calls for floors at which an elevator car is desired to stop, means responsive to call registration for moving and stopping at least one of the elevator cars to serve the call registration, said structure providing a plurality of parking stations each effective when selected for receiving one of the elevator cars when no call remains registered requiring further service, selecting means responsive to a first elevator traffic condition encountered in the operation of said elevator cars for selecting a first period during which first ones of the parking stations are effective to park the elevator cars and retaining such selection despite a change from the first elevator traffic condition to a second elevator traffic condition which does not satisfy the first elevator traffic condition, said selecting means being responsive to a third elevator traffic condition encountered in the operation of said elevator cars for selecting a second period during which second ones of the parking stations are effective to park the elevator cars, and parking means responsive to absence of call registration during said first period for initiating the parking of the elevator cars in the first ones of the parking stations, said parking means being responsive to absence of call registration during said second period for initiating the parking of the elevator cars in the second ones of the parking stations.

6. In an elevator system, a structure having a plurality of vertically-spaced floors, a plurality of elevator cars, means mounting the elevator cars for vertical movement relative to the structure to serve the floors, and control means for moving the elevator cars and stopping the elevator cars at selected floors, said control means comprising call registering means for registering calls for floors at which an elevator car is desired to stop, said call registering means comprising first call registering means for registering calls for each of a plurality of the floors for elevator service in down direction, second call registering means for registering calls for each of a plurality of the floors for elevator service in the up-direction, and third call registering means for each of the elevator cars for registering calls for each of a plurality of floors desired by passengers in the elevator cars, means responsive to call registration for moving and stopping at least one of the elevator cars to serve the call registration, said structure providing first parking stations adjacent the upper ends of the paths of travel of the elevator cars and second parking stations adjacent the lower ends of the paths of travel of the elevator cars, and service demand means responsive to a first traffic condition indicating a substantial demand for down elevator service for conditioning the control means to park the elevator cars at the first parking stations in the absence of call registration, and service demand means responsive to a traffic condition indicating a substantial demand for up elevator service for conditioning the control means to park the elevator cars at the second parking stations in the absence of call registration.

7. In an elevator system, a structure having a plurality of floors, an elevator car, means mounting the elevator car for movement relative to the structure to serve the floors, and control means for moving the elevator car and stopping the elevator car at selected floors, said control means comprising call registering means for registering calls for floors at which the elevator car is desired to stop, means responsive to call registration for moving

and stopping the elevator car to serve the call registration, said structure providing first and second parking stations for the elevator car, selecting means automatically effective during the operation of the elevator car to carry passengers selecting a first period during which the first parking station is effective to park the elevator car and a second period during which a second parking station is effective to park the elevator car, and parking means responsive to absence of call registration during said first period for initiating parking of the elevator car at the first parking station, said parking means being responsive to absence of call registration during said second period for initiating parking of the elevator car at the second parking station.

8. In an elevator system, a structure having a plurality of vertically-spaced floors, an elevator car, means mounting the elevator car for vertical movement relative to the structure to serve the floors, and control means for moving the elevator car and stopping the elevator car at selected floors, said control means comprising call registering means for registering calls for floors at which the elevator car is desired to stop, means responsive to call registration for moving and stopping the elevator car to serve to call registration, said structure providing upper and lower parking stations for the elevator car, means responsive to a first traffic condition indicating a substantial demand for down elevator service for rendering effective the upper parking station, means responsive to a second traffic condition indicating a substantial demand for up elevator service for rendering effective the lower parking station, and means responsive to absence of call registration for parking the elevator car in the effective parking station.

9. In an elevator system, a structure having a plurality of vertically-spaced floors, an elevator car, means mounting the elevator car for vertical movement relative to the structure to serve the floors, and control means for moving the elevator car and stopping the elevator car at selected floors, said control means comprising call registering means for registering calls for floors at which the elevator car is desired to stop, means responsive to call registration for moving and stopping the elevator car to serve the call registration, said structure providing upper and lower parking stations for the elevator car, timing means for selecting first and second periods of time, means rendering the upper parking station effective during the first periods and the lower parking station effective during the second periods, and means responsive to absence of call registration for parking the elevator car in the effective parking station.

10. In an elevator system, a structure having a plurality of vertically-spaced floors, an elevator car, means mounting the elevator car for vertical movement relative to the structure to serve the floors, and control means for moving the elevator car and stopping the elevator car at selected floors, said control means comprising call registering means for registering calls for floors at which the elevator car is desired to stop, means responsive to call registration for moving and stopping the elevator car to serve the call registration, said structure providing first and second parking stations for the elevator car, first means responsive to a first traffic condition for rendering effective the first parking station and maintaining said first parking station effective despite subsequent elimination of said traffic condition, means responsive to a second traffic condition for rendering the second parking station effective and terminating the effectiveness of the first parking station, and means responsive to absence of call registration for parking the elevator car in the effective parking station.

No references cited.