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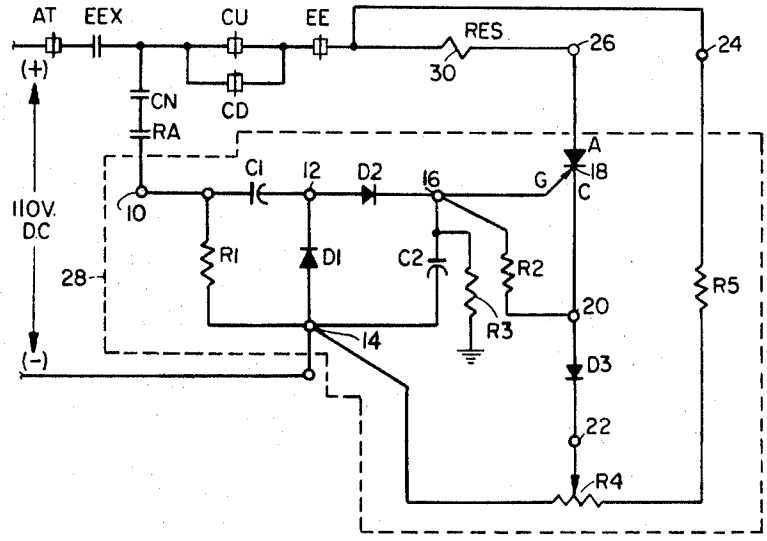
[54] **CAR STOP COUNTER AND CAR RESET CIRCUIT**
15 Claims, 2 Drawing Figs.

[52] **U.S. Cl.** ..... **187/29 R**
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[50] **Field of Search** 187/29

[56] **References Cited**
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ABSTRACT: A circuit includes a charging means to sense the number of stops made by an elevator in response to car calls at which there are no passenger transfers made. After a predetermined number of such stops are made, the remaining car calls are automatically cancelled.



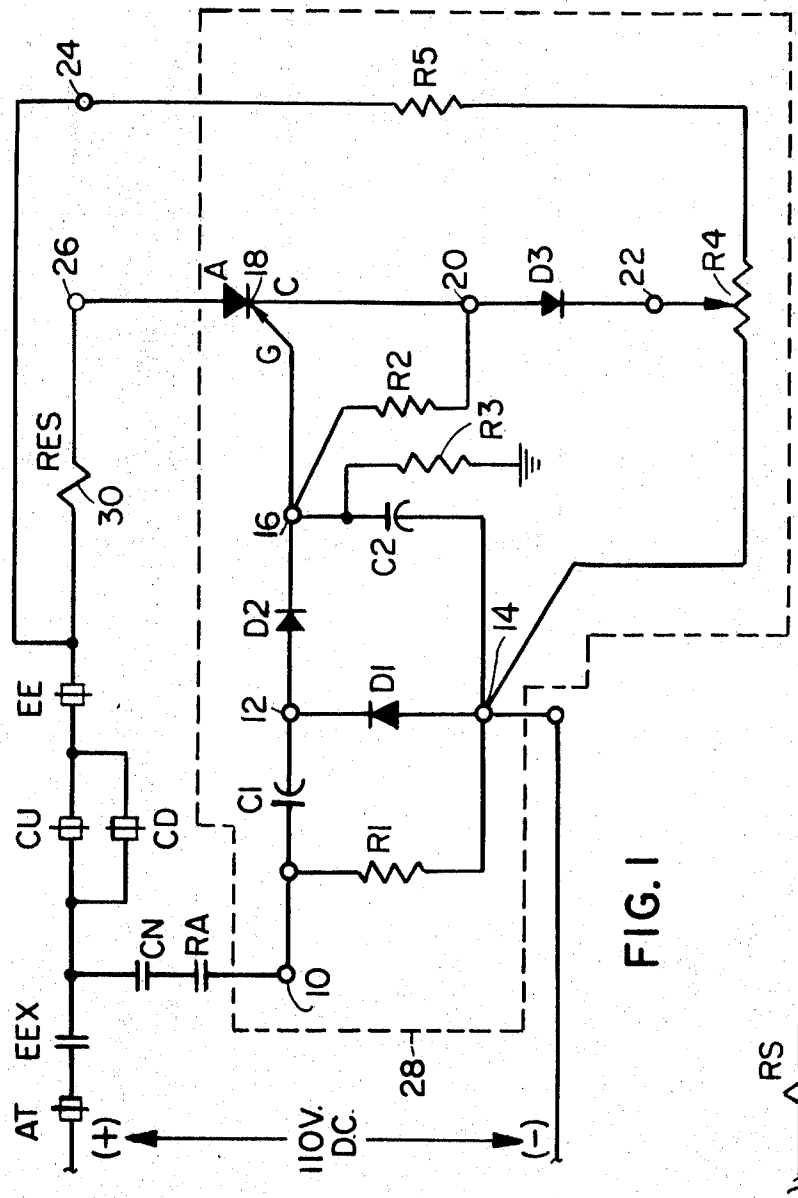


FIG. 1

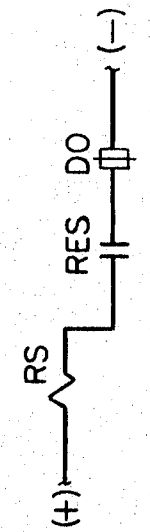


FIG. 2

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CAR STOP COUNTER AND CAR RESET CIRCUIT

The present invention generally relates to elevator car control systems, and particularly to a circuit for incorporation into a control system of this type which detects the presence of nuisance car calls and is effective to reset the remaining car calls upon that detection.

In recent years, many elevator systems in apartment houses and office buildings have been converted to automatic control in which floor selection is made by the passenger by making a car call, that is, by pressing a suitable floor select button located in the elevator car. No attendant rides in the car with the passengers. While this automatic elevator operation has reduced the cost of operation of elevator systems, mainly by eliminating the need for elevator attendants, it has created several problems unique to such attendantless automatic operation, among which is the possibility of the making of what may be described as "nuisance" car calls.

These are car calls made by a passenger who, upon leaving the elevator, presses a plurality of floor select buttons in an indiscriminate and usually sequential manner. Once operation of the elevator is resumed, the elevator car, under automatic control, is caused to stop at each of those floors selected by the pressed buttons. Passengers riding in the elevator car are forced to make each of these undesired stops and persons waiting on the bottom floor or lobby of the building are forced to wait for the elevator car while it makes each of these undesired and timewasting stops.

Thus, as long as the elevator car is forced to open its door and stop at the floors in response to the nuisance car calls, it may be considered as being effectively removed from service insofar as the true needs of the current and prospective passengers of the elevator are concerned.

It would therefore be desirable to improve the operation of an automatic elevator control system to enable it to detect the presence of such nuisance car calls and to reset or cancel all remaining car calls when a nuisance car call condition is detected. One proposed solution to this problem has been to weigh the passengers and load of the elevator car and to compare that weight to the number of registered car calls. When there are more registered car calls than would normally correspond to the number of passengers riding in the car (as determined by the weight of the elevator), a nuisance car call condition is indicated. This proposed system would, however, require the use of complex and expensive additional components in the elevator control system. Moreover, that system would not prove to be consistently reliable due to the difficulty involved in determining the of an empty or a near-empty elevator car with the requisite degree of accuracy, and then accurately relating that weight to the number of registered car calls, since all passengers may be going to the same floor, or each passenger may be going to a different floor. As a result, although it is directed to the solution of a relatively troublesome problem in the operation of automatic elevator control systems, this approach has found only limited acceptance largely as a result of these drawbacks. Thus, the need still exists in the elevator control art for an accurate and yet reliable system for use in automatic elevators for detecting a condition in which nuisance car calls are registered and for cancelling or resetting the car calls upon that detection.

It is therefore an object of the present invention to provide a reliable and accurate circuit for use in an elevator control system for detecting the registering of nuisance car calls and the resetting of car calls upon that detection.

It is a further object of the present invention to provide a nuisance call detection circuit which utilizes relatively low-cost circuit elements and which may be readily incorporated into an existing automatic elevator control system.

It is another object of the present invention to provide a nuisance call detector circuit for use in an automatic elevator system which can be preset to establish car call resetting for a predetermined number of excess registered car calls. It is still another object of the present invention to provide a nuisance call detector circuit of the type described which is economical and simple in construction, and yet reliable in use, and which

increases the efficiency of elevator operation by preventing the temporary effective removal of the elevator from operation upon the presence of nuisance car calls.

It is yet another object of the present invention to provide, in an elevator control system, a nuisance car call detection circuit in which the possibility of false operation due to noise or pulses is substantially eliminated.

In the nuisance call detector circuit of the present invention, means are provided to sense a stop made in response to a car call and to sense whether there is a passenger transfer made during that stop. If the number of these sensed stops exceeds a predetermined, preset number of stops at which there are no sensed passenger transfers, an indication is provided that the car stops are being made in response to nuisance car calls which, if not reset, would cause the elevator car to make addition wasteful stops.

As herein described, the present circuit comprises a capacitive voltage divider which is incrementally charged each time a car stop made in response to a car call is sensed. Unless the charged capacitor is subsequently discharged by the sensing of a passenger transfer at that stopped-car position, that charge will continue to build up each succeeding car stop until it reaches a level sufficient to actuate a switching device. That switching device, when actuated in this manner, energizes a reset relay which causes all remaining car calls, which may all be considered as being nuisance car calls, to be reset or cancelled.

A relatively high resistance may be connected across the charging capacitor to provide a relatively slow discharge path to ground therefor, so that no cancellation is made of the registered car calls, even if no passenger transfer is made, when the elevator has made a relatively long run between stops. This condition probably indicates that an erroneous rather than a nuisance car call was made to cause the car to stop at a floor at which no passenger transfer was made, and would not require the resetting of the other registered car calls.

The switching device may be preset by means of an adjustable control to establish the number of excess stops absent a passenger transfer required to actuate the car call reset relay. The system may thus, if desired, be allowed to accommodate a low number (e.g., one) of nuisance car calls such as when a passenger accidentally presses the wrong floor select button, while still causing the car calls to be reset when a substantial number of such nuisance car calls is detected. On the other hand, only a single car call without any sensed passenger transfers may be deemed sufficient to actuate the car call reset relay.

To the accomplishment of the above and to such other objects as may hereinafter appear, the present invention relates to a car call counter and reset circuit for use in an elevator control system as defined in the appended claims and as described in this specification, taken together with the accompanying drawing, in which:

FIG. 1 is a schematic circuit diagram of a car call counter and reset circuit illustrating the features of the present invention; and

FIG. 2 is a schematic diagram of auxiliary relay circuitry which may be used with the circuit of Fig. 1 in the resetting of registered car calls upon the detection of nuisance car calls.

Broadly considered, the present invention provides a circuit for incorporation into an elevator control system which senses the number of stops made by the elevator car in response to a car call only, and whether or not there is a passenger transfer made at a car stop. If the number of such stops exceeds a preset number without any sensed passenger transfers, an indication is provided of a nuisance car call, and the circuit is then effective to reset the remaining car calls, thereby to avoid any subsequent false and wasteful stops of the elevator car.

The circuit comprises a capacitive voltage divider having a common point connected to the control terminal of a switching device. Upon each stopping of the car, a signal is applied to the voltage divider and incrementally increases the charge level at that point. The sensing of a passenger transfer

at a car stop causes that point to be discharged. In the event, however, that no such passenger transfer is sensed, the capacitive divider is not discharged and the charge may then reach a level at which the switching device is rendered conductive. Once that occurs, the reset relay is energized and the associated car call circuitry is reset, thereby cancelling all the other car calls.

As shown in Figs. 1 and 2, the circuit of the present invention is shown incorporated into an elevator control system in which the following functional designations are applied to the relays shown in the drawings:

AT = Attendant operation
CD = Car call below car
CN = Car stop being made
CU = Car call above car
DO = Door open signal
EE = Electric eye signal
EEX = Electric eye malfunction
RA = Car running signal
RES = Reset
RS = Car call reset

The nuisance car call detection circuit shown in Fig. 1 comprises a capacitive voltage divider which is defined by a first capacitor C1 and a second capacitor C2. One plate of capacitor C1 is connected to an input terminal 10 and its other plate is connected to a point 12 which in turn is connected to ground at a terminal 14 through a diode D1. Point 12 is also connected through a diode D2 to a point 16. A resistor R1 is connected between point 10 and terminal 14. A capacitor C2 is connected between terminal 14 and point 16, and a resistor R3 is connected between point 16 and ground.

Point 16 is connected to the gate terminal G of a switching device here shown as silicon-controlled rectifier (SCR) 18, which also has an anode terminal A and a cathode terminal C. Point 16 is connected through a resistor R2 to a point 20 which is also connected to the cathode C of SCR 18. Point 20 is in turn connected through a diode D3 to a point 22, which is connected to the wiper arm of a potentiometer R4. One end of potentiometer R4 is connected to ground at point 14, and its other end is connected through a resistor R5 to a terminal 24. Similarly, the anode A of SCR 18 is connected to a terminal 26.

The above-described electrical components, exclusive of the relays, may be conveniently packaged in a module, indicated by the broken line 28 in Fig. 1, the terminals 10, 14, 24 and 26 being connected to the appropriate external relay circuitry of the elevator control system as shown. In operation, whenever a car stop is made in response to a car call, a pulse is applied to terminal 10 through the closed contacts of relays AT, EEX, CN and RA to thereby produce a charge buildup at point 16 and across capacitor C2. After the input pulse is removed, e.g. when the elevator car is at a stop, the contacts of relay RA open and capacitor C1 discharges through resistor R1 to ground. If no passenger transfer is sensed at that stop, capacitor C2 and thus point 16 remains charged as the discharge of capacitor C2 is then prevented by diode D1. As a result, when there is no passenger transfer at a stop made in response to a car call, charge is retained at point 16 even after the input pulse is removed from terminal 10. After a predetermined number of such car stops without a corresponding passenger transfer is made, the potential at point 16 and thus at the gate terminal of SCR 18, reaches a sufficient level to render that SCR conductive. When this occurs, current is caused flow across the anode-cathode circuit of SCR 18 and through the closed contacts of relays AT, EEX, CU or CD, and EE, through the energizing coil 30 of relay RES, thereby energizing that relay.

Referring now to Fig. 2, when relay RES is energized in this manner, its contacts are caused to close. The energization of the car call reset relay RS is, however, prevented until the elevator door is closed, at which time relay DO become deenergized, thus permitting reset relay RS to be energized through the then closed contacts of relays DO and RES. Thus, upon the effective "counting" of a predetermined number of nuisance pulses and the closing of the elevator door, relay RS is energized and all other registered car calls are reset or cancelled.

It will be recalled that when a passenger transfer is made at the time a car is stopped in response to a car call, it is desired to discharge capacitor C2, and reduce the level at point 16 substantially to ground, thereby resetting the detector circuit. As herein shown, passenger transfer is detected by a photocell which, when its light beam is interrupted by the passenger, causes a relay EE to be energized, thereby opening the normally closed contacts of relay EE. When this occurs, the path between the input supply line, terminal 24 and point 22 is opened so that the voltage at point 22 falls substantially to zero, and a discharge path is provided for capacitor C2 through the gate to cathode of SCR 18, diode D3 and resistor R4 to ground at terminal 14. As noted, the discharge of capacitor C2 prevents the actuation of SCR 18 and causes the circuit to be reset, and the receipt of the next car stop signal at terminal 10 will again start charging capacitor C2.

The number of required car stops in excess of a preset number without any sensed passenger transfers required to energize reset relay RES is conditioned by the potential at the cathode of SCR 18, which in turn is established by an adjustment of potentiometer R4. In a typical application of this circuit, it is desired to reset or cancel the car calls after the circuit has counted two or three excess car call stops. This is effected by establishing through the adjustment of potentiometer R4 the proper potential level at the cathode of SCR 18 with respect to the expected potential level developed at point 16 for that number of undesired car stops.

Once the reset relay RES is energized by the counting of the desired number of car stops without the sensing of a corresponding passenger transfer, it will remain so energized until there are no more car calls registered, at which time both relays CU and CD are energized and their contacts opened, thereby removing the energizing current from the coil of relay RES.

In a typical design of the nuisance car call detecting circuit of this invention, the value of capacitor C2 is approximately 10 times that of capacitor C1, and assuming a supply voltage of 110 volts DC, the first car stop pulse places a change of approximately 10 volts across capacitor C2. When that pulse is removed upon the completion of the car stop, capacitor C1 is discharged at a moderately rapid rate through resistor R1 to ground. The value of resistor R1 is preferably high, e.g., approximately 4.7 megohm, so that capacitor C1 will not discharge too quickly, thereby preventing multiple counting of pulses as a result of noise or the like. As a result, the circuit of the present invention is responsive only to car stop signals and is not affected by extraneous pulses or noise signals in the system.

The value of resistor R3 is also preferably very high e.g. in the range of 40 megohm, to provide a relatively slow discharge path for capacitor C2 to ground. This is done to permit capacitor C2 to discharge between car stops if there is a long run or distance between car stops, even when there is no corresponding passenger transfer made at either of the stops, as this may be the result of an error on the part of the passenger rather than a nuisance car call. That slow discharge thus prevents the undesired cancellation of the car calls.

A resistor such as resistor R3 may not be required in a practical circuit to provide the slow discharge path for capacitor C2, as the inherent leakage paths present in the circuit may provide the necessary slow discharge path for that capacitor for the purposes described above.

When the elevator is operated by an attendant rather than in an automatic mode, the present circuit is effectively removed from the system or disabled, since the contacts of relay AT are then opened. Similarly, the contacts EEX are caused to open upon the sensing of a malfunction of the photocell to prevent operation of the circuit, should the photocell which controls the operation of relay EE prove to be

inoperative. As a result, the malfunction of the photocell does not cause the resetting of car calls which would otherwise occur in the event that the photocell is inoperative even when all car stops are made in response to a proper (not nuisance) car call.

The nuisance car call detector circuit of the present invention thus provides a reliable and yet relatively economical circuit for incorporation into an elevator control system which permits the elevator to sense the presence of nuisance car calls and to thereupon cancel all remaining car calls. This significantly increases the efficiency of elevator operation when it operates in an automatic mode and reduces the frustration of those passengers waiting for the elevator to make a stop at their floor, since it prevents the car from making unauthorized and time-consuming stops along its way in response to the nuisance car calls. The circuit contains relatively few components, all of which are standard and thus the circuit may be readily and economically manufactured. The circuit may be readily installed in an otherwise conventional elevator control system to operate in conjunction with the relays commonly provided in that system.

The number of nuisance car calls required to trigger the circuit into operation and to reset the remaining nuisance car calls may be initially adjusted to determine the number of such nuisance car calls required for operation.

This number may be subsequently varied to meet system requirements at any time after installation, simply by adjusting the setting of potentiometer R4. Moreover, provision is made in the circuit to prevent the making of erroneous counts of pulses due to system noise and the like, and to avoid the cancellation of car calls in the event that these car calls are made at floors which are a great distance apart, which in all likelihood indicates an error on the part of a passenger rather than the making of a series of nuisance car calls.

While the circuit is shown operating in conjunction with relays, solid-state devices could be similarly energized upon the actuation of SCR 18. Thus, while only a single embodiment of the present invention has been herein specifically described, it will be apparent that this and other modifications may be made to the circuit, all within the spirit and scope of the invention.

We claim:

1. In an elevator control system, a circuit for resetting the car calls upon the sensing of a predetermined number of nuisance car calls, said circuit comprising means including a charging means effective to sense the number of car calls made, means effective to sense the number of passenger transfers from the elevator car, and means actuated upon the number of sensed car calls exceeding the number of passenger transfers and effective when so actuated to reset the previously made car calls.

2. The circuit of claim 1, in which said resetting means comprises switching means operatively connected to said car call sensing means.

3. The circuit of claim 2, in which said passenger transfer sensing means comprises means effective when actuated by a passenger transfer to discharge said charging means.

4. The circuit of claim 3, in which said charging means comprises first capacitance means, and second capacitance means operatively connected to said first capacitance means and defining therewith a capacitive voltage divider operatively connected to said switching means.

5. The circuit of claim 4, in which said switching means comprises semiconductor means having a control terminal operatively connected to said second capacitor, the charge on said second capacitor being incrementally increased for each of said sensed car calls, said semiconductor means being actuated when the charge on said second capacitor reaches a predetermined level.

6. The circuit of claim 4, further comprising variable means operatively connected to said switching means and effective to preset said switching means, thereby to establish the number of excess car calls relative to said passenger transfer required to actuate said switching means.

7. The circuit of claim 6, further comprising a resistor having a relatively high-resistance value operatively connected to said second capacitance means and effective to provide a relatively slow discharge path for said charging means.

8. The circuit of claim 5, further comprising variable means operatively connected to said switching means and effective to preset said switching means, thereby to establish the number of excess car calls relative to said passenger transfer required to actuate said switching means.

9. The circuit of claim 3, further comprising variable means operatively connected to said switching means and effective to preset said switching means, thereby to establish the number of excess car calls relative to said passenger transfer required to actuate said switching means.

10. The circuit of claim 1, further comprising variable means operatively connected to said resetting means and effective to preset said resetting means, thereby to establish the number of excess car calls relative to said passenger transfer required to actuate said resetting means.

11. The circuit of claim 4, further comprising a resistor having a relatively high-resistance value operatively connected to said second capacitance means and effective to provide a relatively slow discharge path for said charging means.

12. The circuit of claim 3, further comprising means effective to discharge said charging means at a relatively slow rate whenever said passenger transfer sensing means is not effective to discharge said charging means.

13. The circuit of claim 1, in which said passenger transfer sensing means comprises means effective when actuated by a passenger transfer to discharge said charging means.

14. The circuit of claim 13, in which said charging means comprises first capacitance means, and second capacitance means operatively connected to said first capacitance means and defining therewith a capacitive voltage divider.

15. The circuit of claim 14, further comprising a resistor having a relatively high-resistance value operatively connected to said second capacitance means and effective to provide a relatively slow discharge path for said charging means.

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