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TIMING SYSTEM

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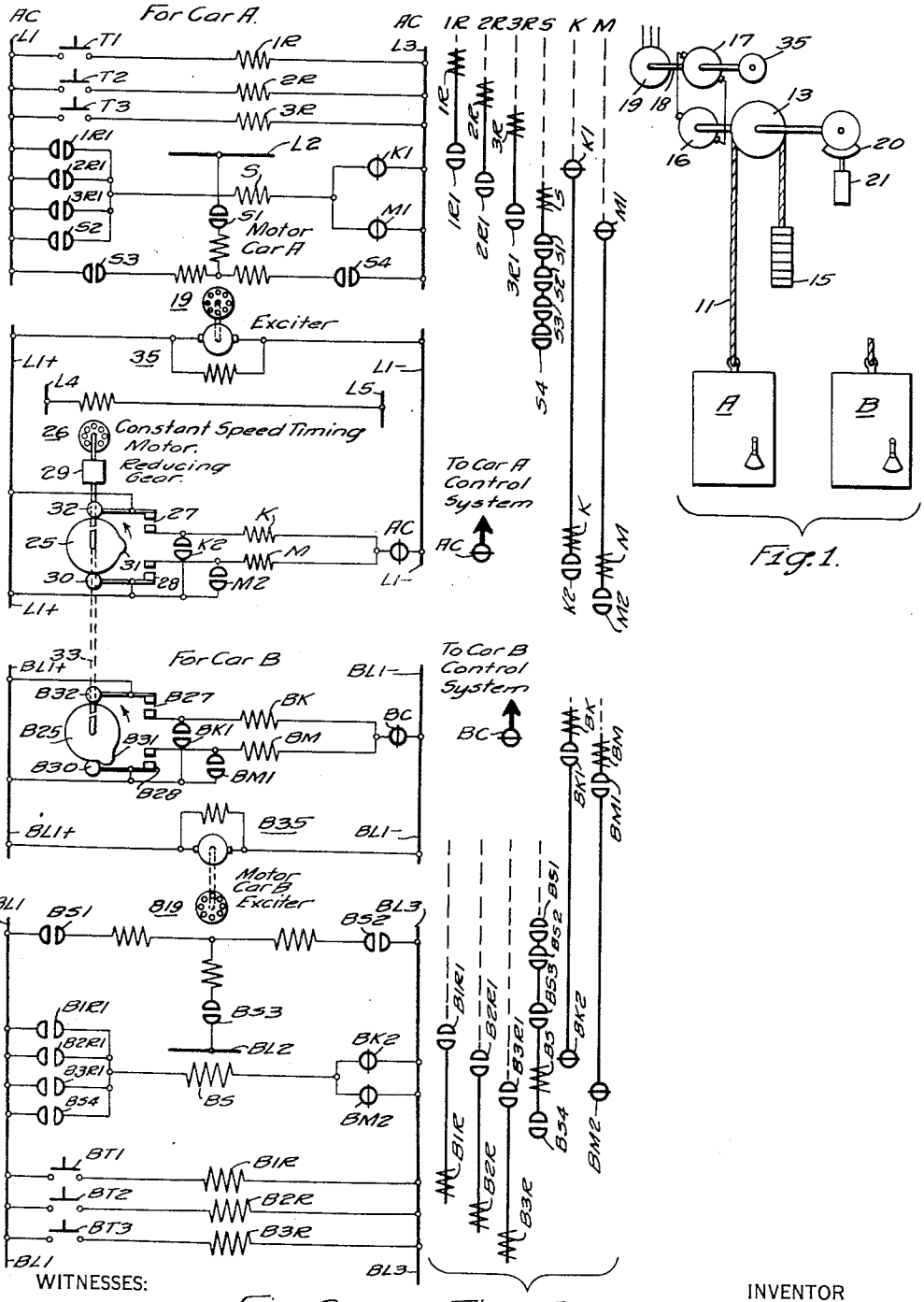


Fig. 2.

Fig. 2A.

Fig. 1.

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TIMING SYSTEM

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My invention relates to timing systems and more particularly to timing systems for opening or for closing electrical circuits at predetermined intervals of time. A timing system of this character may be used for many different purposes. For instance, it may be used in an elevator system to control an electrical circuit in such manner as to cause the electric motive power of an elevator car to shut down after the expiration of a predetermined interval after the car is not required for service.

One object of my invention is to provide a timing system and mechanism for opening or closing an electric circuit after a given interval of time which shall be inexpensive to construct, install, operate and maintain in operation.

Another object is to provide a timing system and mechanism which will close or open an electric circuit after a given interval of time and which will reset itself for a following sequence of operation upon the operation of the circuit controlled by it.

A further object is to provide a timing system which will not only open or close an electric circuit after a given interval of time, but will also reset itself instantly during the interval of time, upon operation of the circuit by another means, without completing its cycle of operation and start another cycle of operation when operation of the circuit again stops.

A further object is to provide a timing system and mechanism in which one master timing element or motor may be utilized to control any desired number of separate circuits entirely independent of each other.

It is also an object of my invention to provide a timing system and mechanism of the character indicated which will not require the use of mechanical clutches or equivalent mechanical devices.

Although my timing system and mechanism may be used for controlling any circuit which it is desired to open or close at predetermined intervals or in a predetermined manner, it will, for convenience, be illustrated and described in connection with an elevator system in which it is desired to have the motor generator sets for one or more of the cars shut down during the periods when there are no passengers for such cars.

In the accompanying drawing,

Figure 1 is a diagrammatic representation of an elevator system with which my invention may be used. Two cars are shown but, for economy of space, the power system for only one car is illustrated.

Fig. 2 is a "straight line" diagrammatic representation of a timing system and mechanism constructed in accordance with my invention for effecting the shutting down of the motor generator sets for the cars shown in Fig. 1 during the periods when there are no passengers, and

Fig. 2A is a representation of the relays embodied in Fig. 2.

The illustration of the relays in Fig. 1 shows them with their coils and contact members disposed in horizontal alignment with their positions in the straightline circuits of Fig. 1 so that the reader may readily determine the identity of any relay, the number and kind of its contact members and the position of its coil and its contact members in the straight line circuits.

Referring more particularly to the drawing, I have illustrated an elevator system as comprising two cars A and B. Referring to car A, it is shown as suitably suspended by a cable 11 which passes over a hoisting drum 13 to a suitable counterweight 15. The hoisting drum 13 is directly coupled to a hoisting motor 16. A variable voltage system of control, such as the Ward-Leonard system, is provided for operating a hoisting motor 16 wherein the motor is operated by a suitable generator 17 which is mounted upon a shaft 18 driven by a suitable motor 19. A brake 20 operated by an electromagnet 21 is provided for applying a braking effect to the hoisting drum 13 when the car is brought to a stop. The driving motor is shown as a three-phase alternating current motor which may be connected to any suitable source of power by means of the supply conductors L1, L2 and L3.

The driving motor 19 may be connected to its supply conductors by the contact members S1, S3 and S4 of a starting relay S which, in turn, is controlled by one of a plurality of push button relays 1R, 2R and 3R operated by push buttons T1, T2 and T3. The push buttons may be located at any suitable points in connection with the elevator system where they may be operated by an attendant or by intending passengers to start the motor generator set of the car when it is desired to start the car in operation. When one of the starting buttons is pressed, the relay S causes the driving motor 19 to start and it will then remain in operation until the relay S is deenergized.

Elevator systems of the character illustrated are installed in many apartment houses. In such houses the elevator systems are usually operated by the tenants and very often are not required for service at different periods of time. For in-

stance, a number of passengers may use the cars frequently for awhile and then there may be no passengers for the next half hour or hour. Therefore, it is economical to have the motor generator sets of the cars shut down during the periods that they are not needed. This shutting down of the cars may be accomplished automatically by some means which disconnects the driving motor from its supply circuits after the expiration of a predetermined interval after the cessation of calls for the car. My improved timing means is particularly applicable for disconnecting the driving motor 19 from its supply circuits and stopping its motor generator set when the car is not being used.

My improved timing means is illustrated in connection with car A as comprising a pair of timing relays K and M, a timing disk 25 for controlling the relays and a constant speed timing motor 26 for driving the timing disk. The timing relays K and M are provided with contact members K1 and M1 disposed in parallel in the circuit of the relay S. These contact members normally remain in a closed condition so that the relay S may be energized any time by pressing one of the starting buttons T1, etc. However, when both pairs of contact members K1 and M1 are opened, the starting relay S, if energized, will be deenergized and open its contact members to stop the driving motor 19. The timing relay K is controlled by an energizing pair of contact members 27 which are closed at predetermined intervals by the timing disk 25. The timing relay M is likewise controlled by a pair of energizing contact members 28 also operated by the timing disk 25. Each of these relays is provided with a self-holding circuit so that if it is energized temporarily by the closure of the energizing contact members, it will remain energized.

The constant speed timing motor drives the timing disk 25 through a reducing gear 29 which is designed to reduce the speed of the disk to the desired speed. For example, in the present instance, it will be assumed that the disk is so driven that it makes one revolution each 8 minutes. The disk is provided with a cam portion 31 which alternately engages the arms 32 and 30 of the energizing contact members 27 and 28 and thereby temporarily closes each of these pairs of contact members every 8 minutes. At this speed of rotation, the disk 25 will close the contact members 28 for energizing the timing relay M and 4 minutes later close the contact members 27 for energizing the relay K so that one of the relays will be energized every 4 minutes. In order to prevent the energization of these relays while the car A is in operation, a pair of control contact members AC is placed in the circuit for the relays. This pair of contact members is connected to and so controlled by the control system of car A that they remain closed while the car is at rest and open when the car is in operation. As an example of contact members controlled by a control circuit for a car, reference may be had to the Milton Barouch Patent No. 1,819,454, issued August 18, 1931.

Further, in accordance with my invention, the supply circuit represented by the conductors L1+ and L1− for the timing relays is supplied with energy by an exciter 35. The exciter 35 is shown as mounted upon the outer end of the shaft 18 of the generator 17. Hence, when the driving motor 19 is shut down, the exciter 35 will stop its operation and thereby deenergize the timing relays K and M, if energized, and prevent them from being energized while the car A is shut down regardless of the constant operation of the timing disk 25 by the timing motor 26.

The constant speed timing motor 26 may be of any suitable type and may be supplied by any suitable source of constant energy, as represented by the supply conductors L4 and L5.

The operating system for car B is similar to that for car A and it is provided with a timing system like that for car A. However, the constant speed timing motor 26 may be used for driving the timing disk B25 for the timing system of car B by mounting it upon an extension 33 of the shaft from the motor 26 to the timing disk 25. With this arrangement, the timing motor will drive the timing disk for both cars and for as many other cars as may be desirable at the same constant speed, regardless of the operation of any other parts of the system.

The invention may be better understood by an assumed operation of the apparatus. It will be assumed that an attendant passenger, desirous of operating the car A, presses the starting button T1. This energizes the button relay 1R to close its contact members 1R1 which energizes the starting relay S by a circuit extending from conductor L1 through the contact members 1R1, coil S and the closed contact members K1 or M1 to supply conductor L3. Upon being energized, relay S closes its contact members S1, S2, S3 and S4. The closing of the contact members S2 provides a self-holding circuit for the relay S and the closing of the contact members S1, S3 and S4 energizes the driving motor 19 and causes it to start in operation. The driving motor 19 is now in operation and drives the exciter 35 so that it energizes the supply conductor L1+ and L1−, thus supplying energy for energizing the timing relays K and M when their circuits are closed.

It will be assumed that the timing motor 26 is in operation and driving the disk 25 and the disk B25 to make a complete revolution once every 8 minutes. The operation of the driving motor 19 also places the generator 17 in operation and it will be assumed that the passenger operates the control system (not shown) of car A to start it in operation. The operation of the control system opens the control contact members AC and thereby prevents energization of the timing relays K and M even though their circuits are closed at intervals by the operation of the timing disk 25, thus preventing operation of the timing relays while car A is in motion.

It will be assumed now that the passenger operates the control system (not shown) to stop the car. The operation of the control system to stop the car causes the control contact members AC to close and thereby prepare the circuits of the timing relays K and M for energization at predetermined intervals after the car stops its operation. The energization of the timing relays now depends upon the closure of the energizing contact members 27 and 28. Assuming that the timing disk 25 is in the position shown and is rotating in the direction indicated by the arrow at the rate of one revolution in 8 minutes, in approximately two minutes the cam 31 will engage the arm 32 and close the contact members 27. This operation energizes the timing relay K and causes it to close its self-holding contacts K2. The energized relay K also opens its contact members K1 in the circuit for the relay S but that does not now deenergize that relay be-

cause the contact members M1 in the parallel circuit are still closed. Assuming that the car A still remains at rest and that the contact disk 25 continues its constant speed rotation, in 4 minutes the cam 31 passes from the arm 32 to the arm 30 and operates it to close its contact members 28, thereby energizing the timing relay M. The energized relay M closes its contact members M2 thereby establishing a self-holding circuit for itself and also opens its contact members M1 in the circuit for the relay S. Inasmuch as the contact members K1 and M1 are now open, the starting relay S is deenergized and thereby opens its self-holding contact members S2 and its contact members S1, S3 and S4 in the circuit of the driving motor 19, thus deenergizing and stopping the motor 19.

The stopping of the motor 19 stops the operation of the exciter 35 and the generator 17. The stopping of the exciter 35 deenergizes the supply circuit L1+ and L1− and this, in turn, deenergizes the timing relays K and M so that they reclose their contact members K1 and M1 in the circuit for the starting relay S, but that relay does not now become energized, because its self-holding contact members S2 are open.

The stopping of the generator 17 reduces the expense of operating the motor generator set when the car is not needed but it will be apparent that, as already described, the motor generator set is ready to start in operation the instant the car is needed in operation.

By the foregoing, it is seen that the timing system will operate to shut down the motor generator set of an elevator car at some point between 4 minutes and 8 minutes after the control system of the car is operated to stop the car unless the car is placed in operation before the expiration of that time. In the present system, the average time for shutting down the motor generator set of the car after it comes to rest is approximately 6 minutes. It is never less than 4 and never more than 8 minutes by reason of the rotation of the timing disk 25 once every 8 minutes. Of course, this time of rotation may be changed to any desired period by changing the reducing gear 30 accordingly, but it will be seen that the motor generator set for a car will shut down and save further operation within a predetermined time after the car is dropped out of service, and that this provides considerable saving in operating an elevator system where the service required is fitful and intermittent.

It will be assumed now that an intending passenger presses the push button BT3 to start car B in operation. The pressing of this button energizes button relay B3R which closes its contact member B3R1 and thereby energizes the starting relay BS for car B. The energized relay BS closes its self-holding contact members BS4 and also closes its contact members BS1, BS2 and BS3 for energizing the driving motor B19. The driving motor B19 now starts in operation and drives the exciter B35 to supply energy to the supply conductors BL1+ and BL1−, thus preparing the timing relays BK and BM for operation. It will also be assumed that the attendant operates the control system (not shown) of car B to start car B up or down its hatchway. This operation causes the control contact members BC to open and thereby prevent energization of the timing relays BK or BM while car B is in operation. It will be assumed now that the passenger on car B operates the control system of that car to stop it and bring it to rest. This operation of the control system effects the closing of the contact members BC. Therefore, the relays BK and BM are now in condition to be energized. The timing disk B25 has been rotated constantly by the timing motor 26 and it will be assumed that at the instant the contact members BC close, the disk is in the position shown in the drawing where the cam B31 has just passed under the arm B30. As the disk continues its operation in the direction of the arrow, it will, upon the expiration of approximately 4 minutes, pass under the arm B32 and thereby close the contact members B27. This energizes the timing relay BK which thereupon closes its self-holding contact members BK1 and opens its contact members BK2 in the circuit of the starting relay BS. However, this does not affect the relay BS because the circuit for that relay now extends through the parallel contact members BM1. It will be assumed that the disk B25 continues its rotation and at the end of 3 minutes it is approaching closely to the arm B30 for closing the contact members B28. However, at this point another intending passenger operates the control system of car B to start that car in operation and this effects the opening of the control contact members BC. The opening of the control contact members BC at this instant deenergizes the timing relay BK and prevents energization of the timing relay BM thereby restoring the timing system for car B to its unoperated condition while car B is in operation, and preparing it to again be ready to effect a shut down of the driving motor and generator of car B when that car is again permitted to stand without operation for longer than the predetermined period.

Therefore, it will be seen that my improved timing system not only acts to shut down a motor generator set for a car within a predetermined time after that car fails to receive any calls for service but that it also acts to restore itself for another cycle of operation whenever the car associated with it is again placed in operation before the expiration of the predetermined time for which the timing system has been set to shut down the motive power of the car after it fails to receive calls for service.

It will also be seen that my improved system provides a timing means which will operate to open an electric circuit at a predetermined time after the occurrence of a predetermined condition; that it will, if partially operated, act to reset itself for a new cycle of operation upon the occurrence of certain circumstances before it is first operated; that the system comprises a relatively simple number of relays, timing means and contact members; and that it does not require the use of any clutches or other mechanical equivalents for resetting itself for other cycles of operation. It will also be apparent that only one constant speed timing motor is required for operating the timing disks or timing means of any desired number of timing systems. It will be further seen that when a circuit (for instance the circuit of the relay S) is operated by my timing system, the operation of that timing circuit operates to restore the timing system and makes it ready for the next cycle of operation.

Although I have shown and described only one embodiment of my invention, it is to be understood that many modifications thereof and changes therein may be made without departing from its spirit and scope.

I claim as my invention:

1. In a timing system for periodically operating an electric circuit, a plurality of contact mem-

bers, a mechanism for closing said contact members at regular intervals of time, a plurality of relays each provided with a self-holding circuit, means responsive to successive operations of said contact members for energizing one at a time each of said relays, each relay when energized remaining energized through its self-holding circuit, and means responsive to a predetermined number of said relays being energized for operating said electric circuit.

2. In a timing system for periodically operating an electric circuit, a plurality of contact members, a mechanism for closing the contact members at regular intervals of time, a plurality of relays each provided with a self-holding circuit, means responsive to successive operations of said contact members for energizing one at a time each of said relays, each relay when energized remaining energized through its self-holding circuit, means responsive to a predetermined number of said relays being energized for operating said electric circuit, and means for deenergizing all of said predetermined number of relays to restore their self-holding circuits to inactive condition.

3. In a timing system for periodically operating an electric circuit, a plurality of contact members, a mechanism for closing the contact members at regular intervals of time, a plurality of relays each provided with a self-holding circuit, means responsive to successive operations of said contact members for energizing one at a time each of said relays, each relay when energized remaining energized through its self-holding circuit, means responsive to a predetermined number of said relays being energized for operating said electric circuit, and means responsive to operation of said electric circuit for deenergizing all of said predetermined relays to restore their self-holding circuits to inactive condition.

4. In a timing system for periodically operating an electric circuit, a plurality of relays, a timing motor, means for connecting the motor to a source of energy, means responsive to operation of the timing motor for successively energizing said relays at predetermined intervals, and means responsive to energization of a predetermined number of said relays for operating said electric circuit.

5. In a timing system for operating an electric circuit, a plurality of relays each provided with a self-holding circuit, a substantially constant speed timing motor, means for connecting the motor to a source of energy, means responsive to operation of the motor for successively energizing said relays at predetermined intervals, means responsive to energization of a predetermined number of said relays for operating the electric circuit, and means for deenergizing all of said relays and restoring their self-holding circuits to their normally ineffective condition.

6. In a timing system for periodically operating an electric circuit, means for energizing the circuit, a plurality of relays, a timing motor, means responsive to operation of the motor for successively energizing said relays at predetermined intervals, means responsive to energization of a predetermined number of said relays for deenergizing the circuit, and means responsive to deenergization of the circuit for deenergizing the relays.

7. In an elevator system for operating a car in a hatchway, a motor generator set for operating the car, a motor for driving the generator, a switch for connecting the driving motor to a source of energy, a plurality of relays, a timing motor, means responsive to operation of the timing motor for successively energizing the relays at predetermined intervals, means responsive to the energization of a predetermined number of the relays for rendering the switch ineffective and deenergizing the driving motor.

8. In an elevator system for operating a car in a hatchway, a motor-generator set for the car, a control means for controlling the motor-generator set to operate the car, a motor for driving the generator, switch means for connecting the driving motor to a source of electric energy, a plurality of relays, means responsive to operation of the control means to stop the car for preparing the relays for energization, a timing motor, means responsive to operation of the timing motor for successively energizing the relays at predetermined intervals after they are prepared for operation, and means responsive to energization of a predetermined number of the relays for disconnecting the driving motor from its source of energy.

9. In an elevator system for operating a car in a hatchway, a motor generator set for the car, a control means for controlling the motor-generator set to operate the car, a motor for driving the generator, switch means for connecting the driving motor to a source of electric energy, a plurality of relays, means responsive to operation of the control means to stop the car for preparing the relays for operation, a timing motor, means responsive to operation of the timing motor for successively energizing the relays at predetermined intervals after they are prepared for operation, means responsive to energization of a predetermined number of the relays for disconnecting the driving motor from its source of energy, and means responsive to stopping of the driving motor for deenergizing all of said predetermined number of energized relays.

10. In an elevator system for operating a car in a hatchway, a motor generator set for the car, control means for controlling the motor-generator set to operate the car, a motor for driving the generator, a switch for connecting the driving motor to a source of electric energy, a plurality of relays, a timing motor, means responsive to operation of the timing motor for successively energizing the relays at predetermined intervals, means responsive to operation of a predetermined number of the relays for rendering the switch ineffective, and means responsive to operation of the control means to start operation of the car for rendering the relays ineffective to be energized while the car is in operation.

11. In an elevator system for operating a car in a hatchway, a motor generator set for the car, control means for controlling the motor generator set to start or to stop the car, a motor for driving the generator, switch means for connecting the driving motor to a source of electric energy, a plurality of relays each provided with a self-holding circuit, means responsive to operation of the control system in operating the car for preventing energization of the relays while the car is running and for preparing the relays for energization while the car is stopped, a timing motor, means responsive to operation of the timing motor for successively energizing the relays at predetermined intervals after they are prepared for energization by the stopping of the car, means responsive to energization of a predetermined number of said relays for causing the switch means to disconnect the driving motor from its

source of energy, and means responsive to stopping of the driving motor for deenergizing all of the relays.

12. In an elevator system for operating a car in a hatchway, a motor-generator set for the car, a control means for controlling the motor generator set to operate the car, a motor for driving the generator, switch means for connecting the driving motor to a source of electric energy, a plurality of relays, an energizing circuit and a self-holding circuit for each of said relays, a pair of energizing contact members in each of said energizing circuits, means responsive to operation of the timing motor for successively closing and opening said energizing contact members at predetermined intervals, a second pair of contact members controlling said energizing circuit, means responsive to operation of the control means in stopping the car for closing said second pair of contact members, whereby the simultaneous closed condition of an energizing pair of contact members and said second pair of contact members effects energization of the relay associated therewith, and means responsive to energization of a predetermined number of relays for causing the switch to disconnect the driving motor from its source of electric energy.

13. In an elevator system for operating a car in a hatchway, a motor-generator for the car, a control means for controlling the motor generator set to operate the car, a motor for driving the generator, switch means for connecting the driving motor to a source of electric energy, a plurality of relays, an energizing circuit and a self-holding circuit for each of said relays, a pair of energizing contact members in each of said energizing circuits, means responsive to operation of the timing motor for successively closing and opening said contact members at predetermined intervals, a second pair of contact members controlling said energizing circuits, means responsive to operation of the control means in stopping the car for closing said second pair of contact members while the car is stopped and for opening them while the car is running whereby the opening of said second pair of contact members prevents energization of the relays, the simultaneous closing of an energizing pair of contact members and the said second pair of contact members energizes the relay associated therewith, means responsive to energization of a predetermined number of said relays for causing the switch means to disconnect the driving motor from its source of energy to shut down the motor generator set, and means responsive to the stopping of the driving motor for deenergizing the relays.

14. In an elevator system for operating a car in a hatchway, a motor generator set for the car, control means for controlling the motor generator set to operate the car, a motor for driving the generator, switch means for connecting the driving motor to a source of electric energy, a plurality of relays, an energizing circuit for each relay, an exciter operated by the driving motor for supplying electric energy to the energizing circuit, a pair of energizing contact members in each of the energizing circuits, a substantially constant speed timing motor, means responsive to operation of the timing motor for successively closing and opening the energizing contact members at predetermined intervals, a second pair of contact members associated with the energizing circuits, means responsive to operation of the control means in stopping the car for closing said second pair of contact members when the car is at rest whereby the simultaneous closed position of the said second pair of contact members and an energizing pair of contact members effects energization of the relay associated therewith, and means responsive to energization of a predetermined number of relays for causing the switch to disconnect the driving motor from its source of energy for shutting down the motor generator set and stopping the exciter to deenergize the relays.

15. In a timing system for operating a plurality of electric circuits, a plurality of relays associated with each circuit, means associated with each circuit for successively energizing at predetermined intervals the relays associated with that circuit, means associated with each circuit and responsive to energization of a predetermined number of relays associated with that circuit for operating that circuit, means associated with each circuit and responsive to operation of that circuit for deenergizing all the relays associated with that circuit, and a single timing motor for operating all of the interval energizing means associated with all the circuits.

16. In an elevator system for operating a plurality of cars in a hatchway, a motor generator set for each car, a control means for each car for causing the motor generator set associated with that car to operate it, a driving motor for each generator, a plurality of relays associated with each car, individual means responsive to operation of a control means to stop its car for preparing the relays associated with that car for energization, a single timing motor, means associated with each car and responsive to operation of the timing motor for successively energizing at predetermined intervals the relays associated with that car after they have been prepared for energization, and means responsive to energization of a predetermined number of the relays associated with a car for stopping the driving motor for the generator for that car.

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