March 25, 1941. V. J. GORMAN 2,236,136

AUTOMATIC ELEVATOR CONTROL

Filed Sept. 6, 1938 2 Sheets-Sheet 1

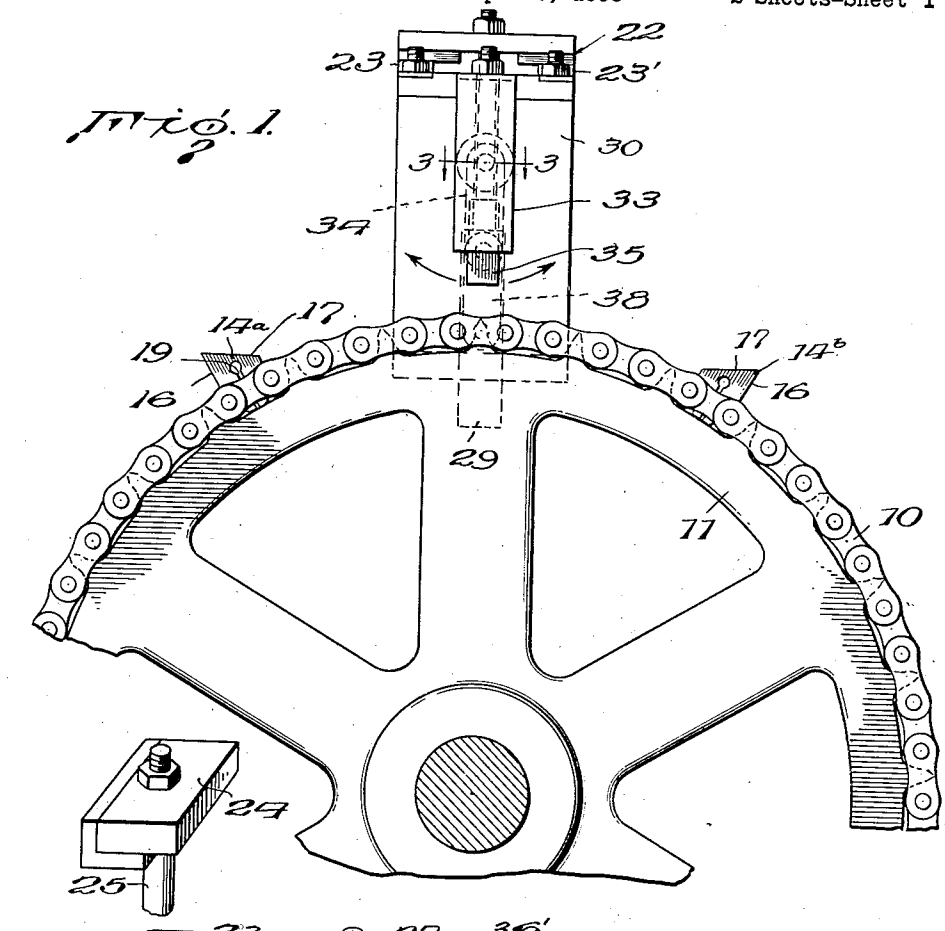


Fig. 1.

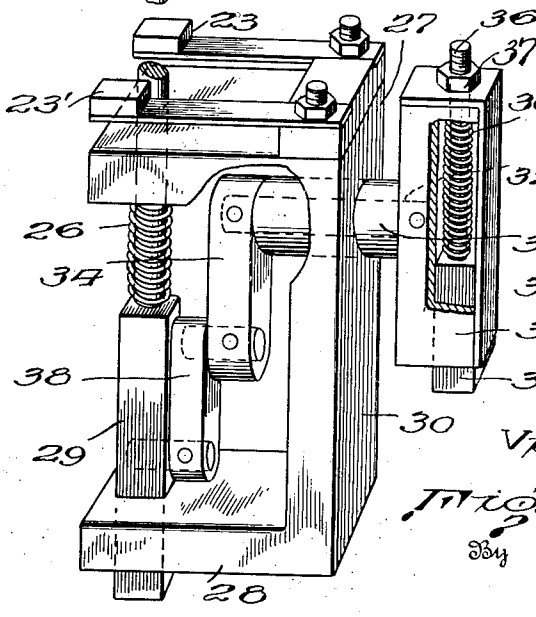


Fig. 2.

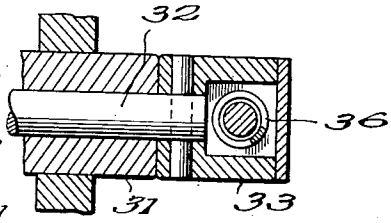


Fig. 3.

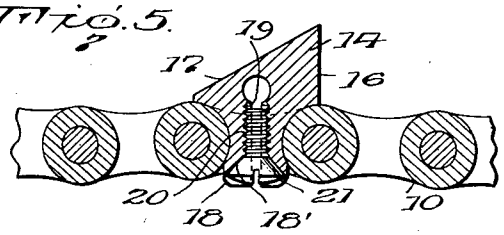
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AUTOMATIC ELEVATOR CONTROL

Filed Sept. 6, 1938 2 Sheets-Sheet 2

Fig. 5.



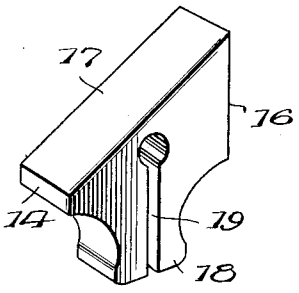
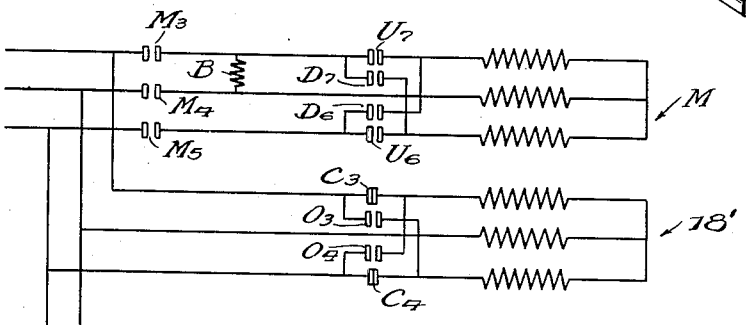


Fig. 4.



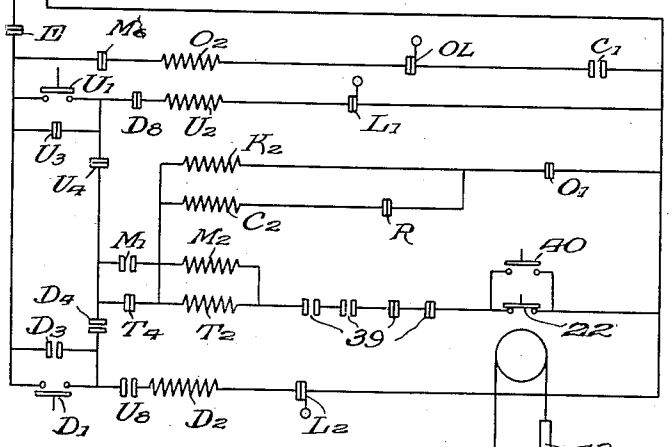
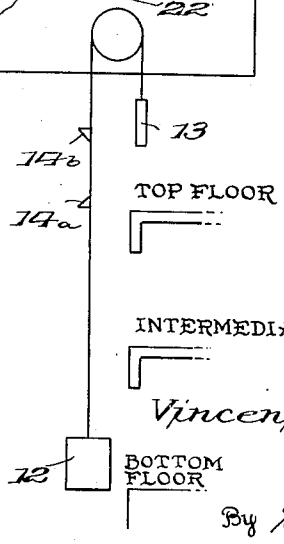


Fig. 6.



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AUTOMATIC ELEVATOR CONTROL

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Application September 6, 1938, Serial No. 228,709

3 Claims. (Cl. 200—52)

The present invention relates to electric elevators, particularly to apparatus for automatically stopping and starting automatic elevators.

While various arrangements have previously been designed to stop electric elevators automatically when they reach a floor or landing, the mechanisms employed in the past are either difficult to adjust for accuracy, or, because of their disposition in the elevator hatchway, are not ready accessible. In some types of automatic stopping devices, for instance, a chain attached to the elevator car and driving a reduction unit is employed. Since an adjustment of the stopping mechanism is in turn multiplied through the reduction unit, it will be apparent that slight inaccuracies in adjustments will result in stopping the car at some distance either above or below the floor level. In other forms of car stops, where the switches, contacts, or similar devices are positioned in the hatchway at floor levels or in the path of the elevator to obtain a 1 to 1 ratio, it is necessary for a repair man to enter the hatchway, get on the top of the car, and go from floor to floor to check the stops.

It is an object of the present invention to provide means having a 1 to 1 ratio with the movement of the car to which the stop mechanism is attached.

It is also an object of the invention to provide a stop mechanism which will, after a short lapse of time, permit the motor circuit to close so that, when the doors to the car and landings are closed, the elevator automatically starts.

It is a further object of the invention to provide separate travel controls or stop mechanisms for the up and down travel of the elevator, each of these mechanisms tripping a motor control switch when the car is moving in one direction, but which is ineffective to trip the control when the car is traveling in the opposite direction.

Other objects of the invention will be apparent from the following description of a preferred embodiment thereof and from the appended drawings, in which:

Fig. 1 is a fragmentary front elevation of the mechanism employed for tripping a motor control switch;

Fig. 2 is a perspective of the switch shown in Fig. 1;

Fig. 3 is a transverse section on line 3—3 of Fig. 1;

Fig. 4 is an enlarged perspective of one of the cams employed in the apparatus;

Fig. 5 is a fragmentary longitudinal section through one of the cams and the chain; and

Fig. 6 is a schematic wiring diagram of the stop mechanism and circuits for the controls and motor.

It will be assumed that the apparatus is in use in an elevator such as that installed in department stores where the car completes a full trip up and then a full trip down, stopping at each floor on each trip. In this type of elevator, the car is stopped automatically, the door then opened, and, after the door is closed, the car resumes its travel in the same direction, except, of course, when it reaches its upper and lower limits.

In the present invention, the stop mechanism comprises a chain attached at one end to the car and at its other end to a counterweight, this chain having secured thereto at intervals equal to the distance between floors a series of cams designed to trip a control switch. In Fig. 1, it will be seen that the chain 10 is a conventional link chain passing over a toothed wheel or sprocket 11, the teeth of the sprocket being spaced a distance such that they mesh with every other link of the chain. As shown in Fig. 6, one end of the chain is attached to car 12 and its other end to counterweight 13.

Adapted to be secured to this chain are cam pieces 14. Each cam piece comprises a projecting portion having a straight side 16 perpendicular to the path of the chain and an inclined face 17. A tooth portion 18, flared at its end as at 18', is designed to fit into the space between two links, this portion being preferably split at 19 and being of spring steel so that it will snap into said space. The portion 18 may be tapped at 20, if desired, to receive an expansion screw 21, which presses the sides of the said portion firmly against the adjacent links.

Sprocket 11 is located in the machine room above the elevator shaft and is easily accessible so that the cam pieces may be removed and adjusted with respect to the chain at such intervals that the car will be stopped substantially at floor levels. Positioned above the sprocket is a switch 22 comprising contacts 23, 23', and bridge member 24. The latter is mounted on a reciprocable rod 25 normally held in switch-closing position by spring 26. Contacts 23, 23' are connected to terminals of the car operating motor circuit which is broken when bridge member 24 is lifted out of engagement with the said contacts. The contacts are mounted on an insulator fastened to a substantially U-shaped bracket 27 in the lower flange 28 of which is provided a guide opening to accommodate the square end 29 of rod 25. Fixed

in the connecting web 30 of bracket 27 is a bushing 31 in which is journaled shaft 32 to one end of which is secured a housing 33 and to the other end of which is fastened a rocker arm 34. Slidably mounted in housing 33 is a plunger 35 normally urged to project beyond the end of the housing by spring 36. The upper end of the plunger is reduced and threaded, as at 36', to receive a nut 37 which limits the distance the plunger may project beyond the end of the housing. Rocker arm 34 is connected through link 33 with rod 25 so that, upon rotation of shaft 32, rod 25 is elevated and the switch opened.

The coaction between cams 14 and switch 22 will now be explained. Assuming that the sprocket is rotating in a counterclockwise direction, that is, when the car is on its down trip, and that cam 14a first engages plunger 35, in this case, the straight side 16 of the cam engages the plunger and rocks housing 33 and arm 34. Hence, the switch is opened. Further movement of the car and chain in the same direction brings cam 14b into engagement with the plunger, but the inclined face 17 of the cam merely lifts the plunger against spring 36 and the housing does not rock. The switch, therefore, remains closed. When the car is ascending, the reverse of this operation takes place, that is, cam 14b first engages the plunger to open switch 22, but cam 14a merely rides under the plunger without rocking the latter.

It will be understood, of course, that there is one "down" cam and one "up" cam for each floor, except the first and top floors, there being limit switches for each of these two floors located in the path of the car. Now if it be found that the car does not stop approximately at the level of any floor, it is only necessary to remove the cam corresponding to the particular stop and move it two, or a multiple of two, of the spaces between links of the chain, the direction of adjustment being dependent on whether the car stops below or above a floor level. Since the lengths of the links are relatively small, for instance one-half inch or smaller, and the chain travels at the same rate and distance as the car, it is obvious that relatively accurate adjustments of the stop mechanism may be made in the machine room at the top of the shaft.

It will thus be seen that a pair of adjustable cam devices is provided for each floor, one interrupting the "up" travel of the car and the other its "down" travel. These cams are all readily accessible at a common point without making it necessary to enter the hatchway. The switch which is tripped by the cams is intended to be placed in series with the relay coil of the contactor controlling the elevator driving motor and a suitable time delay device is used in parallel with this relay so that the driving motor circuit is not immediately closed after the cam passes switch 22. It is also intended that there be a further motor circuit control associated with the doors of the car and landings, this latter control preventing operation of the motor while the doors are open. Hence, by the time the doors are again closed by the operator, switch 22 and the time delay switch are both closed, the driving motor starting as soon as the doors are closed.

Referring to the wiring diagram in Fig. 6, it will be assumed that the "up" button switch U_1 has been momentarily closed, energizing relay U_2 to close switches U_3, U_4. The latter switches are on one end of a pivoted switch arm, on the other end of which is a switch U_8, the latter being normally closed when switches U_3 and U_4 at the opposite end of the switch arm are open. When the switch U_1 is closed, the door is open and at least one of the door-operated safety switches 39 is open, relay M_2 being thus deenergized.

Relay M_2 when energized closes switches M_1, M_3, M_4, M_5, controlling operation of the elevator motor M. Hence, when relay M_2 is deenergized, the motor cannot be operated.

Relay T_2 is deenergized at the same time relay M_2 is deenergized. Relay T_2 when energized opens a time or delay switch T_4, the latter being normally closed when relay T_2 is deenergized. With switch T_4 closed, relay C_2 is energized to close switches C_3, C_4 and open switch C_1. The reversible motor 18' then moves the door to closing position.

When the door is fully closed, all of the switches 39 will be closed, whereupon relays M_2, T_2 will be energized and the motor switches M_1, M_3, M_4, M_5 closed. When the door is fully closed, the resistance of the door frame will open a safety switch indicated at R, and since relays C_2 is in series with this switch, the door closing circuit of motor 18' will be opened. Switches U_6, U_7 being closed by relay U_2, the elevator will ascend until automatic switch 22 is tripped by cam 14a corresponding to the next landing position of the elevator, at which time switch 22 is opened. The motor switches are then opened and switch M_6 closed. In series with switches M_6 and C_1 is a door opening limit switch indicated at OL. This limit switch together with switches M_6 and C_1 will close when switch 22 opens at which time relay O_2 will be energized to close switches O_3, O_4 and operate motor 18' in a direction to open the door. The door will continue to open until limit switch OL opens. Switch O_1 is open when the switches U_3, U_4 are closed, so that door closing relay C_2 is inoperative during door opening operation.

It is apparent that operation of the elevator in a downward direction is controlled in a similar manner by the "down" switches designated generally by the letter D. During the down travel of the elevator cam 14a will act to trip switch 22, but cam 14b will merely lift plunger 35 on the tripping mechanism.

In addition to the relays and switches referred to hereinbefore, the circuits are provided with the usual emergency switch E, pass button 40, which may be closed to permit the car to pass a landing, upper and lower limit switches L_1 and L_2 at the top and bottom of the elevator well, brake operating relay B, and a cam retiring relay K_2, the latter operating a safety landing door locking device when the car is in operation. It is intended that the car door and landing doors be connected by suitable devices to permit the doors to be simultaneously opened by the motor 18'.

It will be apparent from the foregoing description of the parts and operation of the invention that a relatively simple and inexpensive arrangement of stop devices is provided. While the invention as described is illustrative of one form of the invention, it is not intended that it be limited to the exact arrangement of parts shown, but may be modified within the meaning of the appended claims.

What I claim as my invention is:

1. Mechanism for controlling the travel of elevators comprising an electric switch, a rockable member for opening said switch, a plunger slidable in said member and projecting therefrom, and cam means movable with the elevator, said

means being adapted to engage the plunger when moving in one direction to rock said member and open the switch but when moved in the other direction to lift said plunger without rocking said member.

2. Mechanism for controlling the travel of elevators comprising an electric switch, a rockable member for opening said switch, a plunger slidable in said member and projecting therefrom, and cam means movable with the elevator, said cam means traveling in a path such that the cam means will engage said plunger, said cam means having a face substantially parallel to the axis of said plunger and another face angularly disposed to said axis when the cam engages the plunger whereby said member will be rocked when the cam is moving in one direction and said plunger will be lifted without rocking said member when the cam is moving in a direction opposite to said one direction.

3. Mechanism for controlling the travel of an elevator as defined in claim 1 in which the means movable with the elevator comprises a link chain secured to the elevator and the cam means has a split resilient portion adapted to be inserted between adjacent links of the chain for snap engagement with adjacent links of the chain.

VINCENT J. GORMAN.