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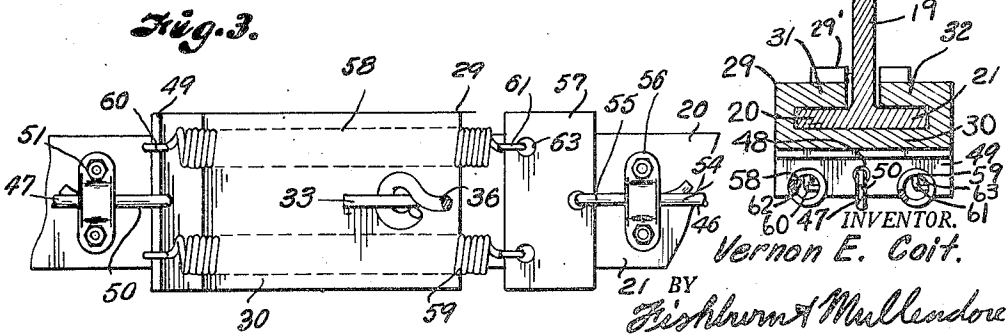
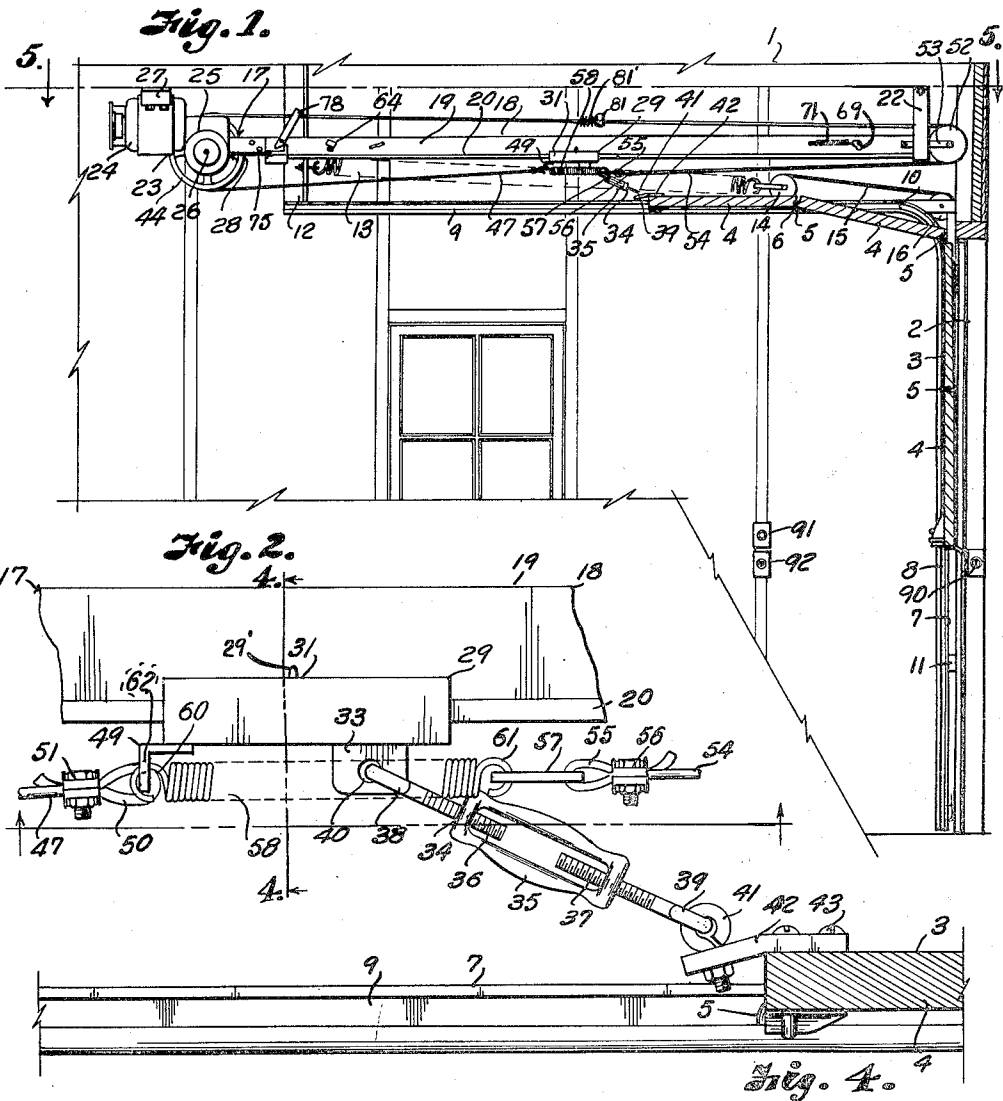
V. E. COIT

2,690,908

GARAGE DOOR ACTUATOR

Filed Feb. 9, 1952

2 Sheets-Sheet 1



ATTORNEYS.

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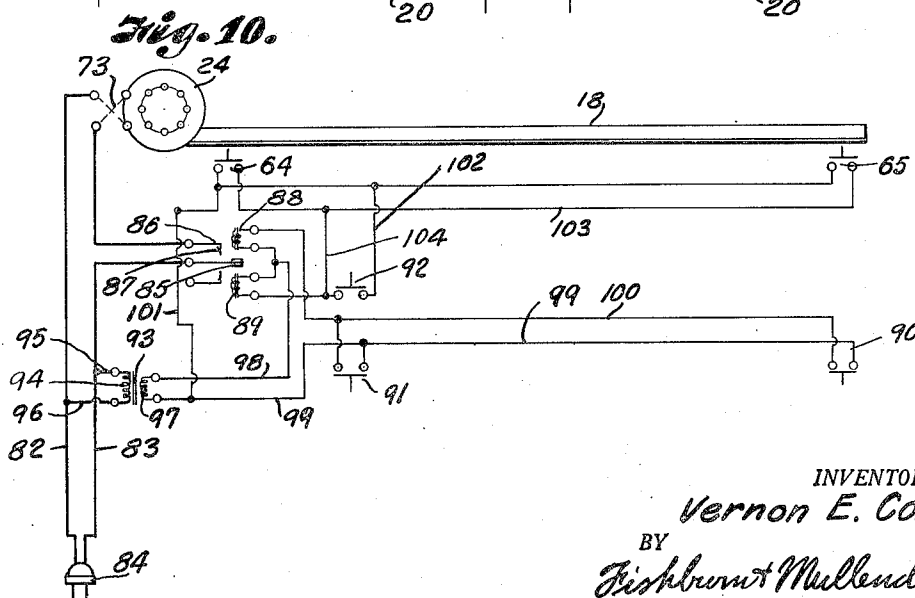
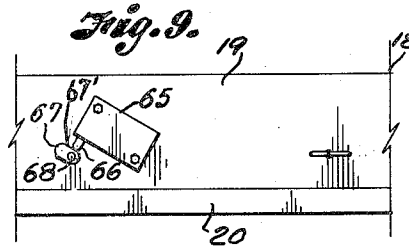
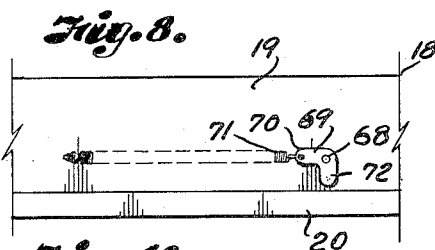
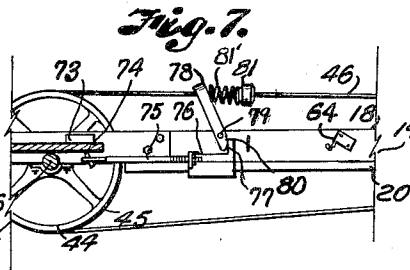
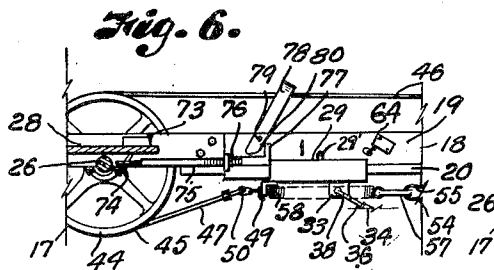
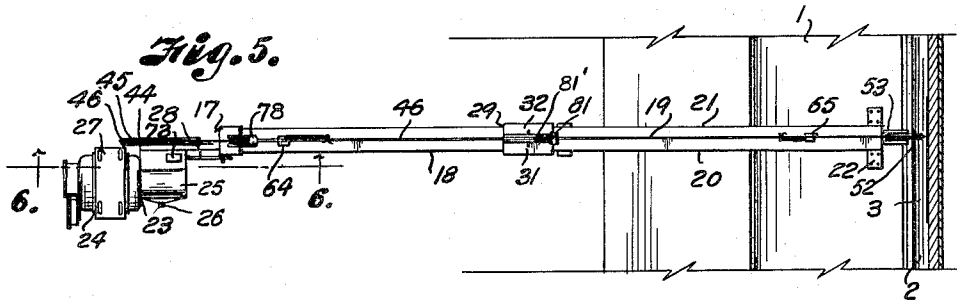
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2 Sheets-Sheet 2



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GARAGE DOOR ACTUATOR

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Application February 9, 1952, Serial No. 270,862

5 Claims. (Cl. 268—59)

1

This invention relates to a door actuator adapted for remote control and which is particularly suitable for opening and closing an overhead door such as used in garages, warehouses and like places.

The principal objects of the present invention are to provide a door actuating mechanism which is of simple and inexpensive construction; to provide an actuating mechanism that automatically secures the door in closed position; and to provide an actuating mechanism that may be sold as a packaged unit, completely assembled and wired, with exception of the remote control switch circuits, so as to facilitate installation by the ordinary house mechanic and without the necessity of employing a skilled electrician.

Other objects of the invention are to provide a door actuating unit to which a current supply may be established by a cord having a plug adapted for insertion in any convenient outlet receptacle such as a conventional wall socket and to provide a door actuating unit with low voltage controls that are safely connected with the remote control switches.

In accomplishing these and other objects of the invention hereinafter pointed out, I have provided improved structure, the preferred form of which is illustrated in the accompanying drawing wherein:

Fig. 1 is a vertical central section through a garage door equipped with a remote controlled door actuating mechanism embodying the features of the present invention.

Fig. 2 is an enlarged fragmentary side elevational view particularly illustrating the connecting link between the door and the actuator.

Fig. 3 is an underneath plane view of the slide shown in Fig. 2.

Fig. 4 is a section on the line 4—4 of Fig. 2.

Fig. 5 is a horizontal section on the line 5—5 of Fig. 1.

Fig. 6 is a fragmentary view of the trip mechanism in position for actuating the motor reversing switch when the door reaches open position, the section being taken on the line 6—6 of Fig. 5.

Fig. 7 is a similar view of the trip mechanism in position for actuating the reversing switch when the door is in closed position.

Fig. 8 is a fragmentary view showing one of the trip levers for actuating the limit switches.

Fig. 9 is a view of one of the limit switches.

Fig. 10 is a wiring diagram of the motor, transformer, limit switches, the main start and stop switch, remote control switches and the electric circuits therefor.

2

Referring more in detail to the drawings:

1 designates a building such as a home garage having a door opening 2 that is adapted to be closed by an overhead door 3. The door illustrated is commonly known as an "overhead door" and is shown as comprising a plurality of horizontal sections 4 that are connected together by hinge joints 5 which have rollers 6 that operate in guide tracks 7 at the respective sides of the door. The guide tracks 7 are usually of channel shape cross section and have vertical portions 8 and horizontal portions 9 that are connected by curving portions 10 so as to guide the door from vertical door closing position to substantially horizontal overhead open position. The vertical portions 8 of the guide tracks are attached to the sides of the door frame by suitable brackets 11 while the upper horizontal portion 9 is suitably supported from the ceiling of the garage by brackets 12.

The door is substantially counterbalanced by a counterbalancing mechanism including coil springs 13 having one end attached to the brackets 12 and opposite ends carrying a pulley 14 which is connected with the door through a cable 15 operating over a guide pulley 16. It is to be understood that one end of the cable 15 is anchored at the lower end of the door and the other end of the cable to a fixed part, for example, one of the brackets 11. When the door is in down or closed position, the cable 15 tensions the coil springs 13 so that the stored up action in the springs assists in raising the door when the door is to be moved to open position.

The structure thus far described specifically forms no part of the present invention and is illustrated to show one type of door with which the present invention may be used to automatically open and close the door by motor power energized through remotely located switches.

17 designates the operating unit that is connected with the door and which is constructed in accordance with the present invention. The operating mechanism is assembled so that it may be sold as a packaged unit; that is, the parts are all connected and all of the electric circuits completed with the exception of the remote control switch circuits as later described.

The unit includes a rail 18 which is preferably of T shape cross section to provide a central stiffening web 19 and laterally disposed flanges 20 and 21 projecting from opposite edges thereof, as best shown in Fig. 4. The forward end of the rail is adapted for support from the ceiling or other overhead structure of the garage by

a bracket 22 that is preferably permanently fixed to the forward ends of the flanges 20 and 21 as by welding or the like.

The opposite or rear end of the rail is connected with a motor and speed reduction assembly 23, the motor 24 being arranged so that the rotational axis of the armature thereof is parallel with the rail, and the speed reduction portion 25 is positioned so that the driven shaft 26 thereof extends transversely of the rear end of the rail, as best shown in Fig. 1.

The motor 24 of the assembly has a base 27 that is adapted for attachment to the overhead structure of the garage as later described. Extending from the speed reducer is a bracket or plate like portion 28 for attaching the rear end of the rail 18 so that when the base 27 of the motor and the bracket 22 is attached to the ceiling or overhead structure of the garage, the rail 18 is supported in substantially horizontal position and preferably midway between the door guide rails 8.

Slidable on the flanges 20 and 21 is a slide or carriage 29 which includes a plate portion 30 having side flanges 31 and 32 extending upwardly and over the upper face of the flanges 20 and 21 as best shown in Fig. 4. Projecting from the underside of the plate portion 30 of the slide is a lug 33 that is adapted to be connected with the upper section 4 of the door by an adjustable connector 34 including a turnbuckle 35 having right and left studs 36 and 37 that are provided with eyes 38 and 39. The eye 38 is engaged in an opening 40 in the lug 33, and the eye 39 is engaged with an eye 41 that is fixed to a plate 42 which is secured to the upper section of the door by fastening devices 43 as best shown in Fig. 2.

In order to drive the slide or carriage along the rail or track, the drive shaft 26 of the speed reducer 25 carries a pulley 44 having a grooved periphery 45 for containing one or more wraps of a cable 46 so as to provide the necessary contact to operate the cable for moving the slide.

The cable 46 is connected with the slide by extending one end 47 thereof through an opening 48 in an angle 49 that extends transversely across the slide and is fixed to the underside of the plate portion 30 thereof. After the end 47 of the cable is passed through the opening 48, the end is extended retractively and connected to form a loop 53 by means of a clamp 51. The other end of the cable extends over an idler pulley 52 that is rotatably carried at the opposite end of the rail 18 on a bracket 53.

After extending over the idler pulley 52, the end 54 of the cable is connected similarly to the opposite end 47 by means of a loop 55 and clamp 56 with an equalizer 57 which is connected with the angle 49 by laterally disposed coil springs 58 and 59 having hook shaped ends 60 and 61 that hook into openings 62 and 63 of the angle 49 and equalizer 57. With this arrangement, it is obvious that the springs tension the wraps of cable around the drive pulley and that rotation of the pulley 44 in one direction moves the slide or carriage 29 retractively along the length of the rail 18 to carry the upper section of the door therewith and effect opening thereof.

Mounted on opposite sides of the web portion 19 of the rail 18 near the respective ends thereof are limit switches 64 and 65 respectively, having actuating buttons 66 (Fig. 9) that are adapted to be engaged by cam portions 67' of rock

levers 67. The levers 67 are fixed on shafts 68 journaled in the web 19. The opposite ends of the shafts 68 carry bell crank levers 69 (Fig. 8) each having one arm 70 connected with springs 71 which hold the other arms 72 in position to be engaged by lugs 29' on the slide 29.

The levers 67 are shaped so that when the carriage 29 moves from one end of the track toward the other end, the first arm will be rocked by a lug 29' but the shape of the cam portion is such that the cam is ineffective for actuating the first limit switch. However, when the carriage is moving in the opposite direction the cam is effective in actuating the limit switch to open the control circuit and stop the motor. When the circuit is opened the motor will coast a sufficient distance to set the reverse switch now to be described.

The unit also includes a reversing switch 73 that is mounted on the bracket 28 to which the rail is connected and which has an operating lever 74 that is connected by a link 75 with a secondary slide 76 that is also mounted on the flanges 19 of the rail 18 but which has a restricted movement, sufficient to effect actuation of the reversing switch arm.

The slide 76 has an upstanding flange 77 that is adapted to be engaged by a lever 78 which is pivotally mounted on the web 19 of the rail 18 as indicated at 79, the lever having a cam shape portion 80 engaging against the flange 77. The upper end of the lever 78 extends alongside of the upper run of the cable and is actuated by a lug or button 81 that is attached to the cable. The slide 76 is actuated in the opposite direction by engagement of the slide 29 so that the arm of the reversing switch 73 is operated in both directions.

In case dirt, snow or the like has accumulated under the door, the button 81 is provided with a spring 81' which engages the lever 78 and effects operation of the switch to reverse action of the door. Where there is a complete movement of the door, the spring merely compresses.

The motor 24 is supplied with current, for example, from a 110-volt circuit, through conductors 82 and 83 that carry a plug 84 that is adapted to be inserted in any convenient wall socket or the like. The conductor 82 is shown as directly connected to one of the terminals of the reversing switch. However, the conductor 83 is connected with a movable contact 85 of electromagnet switch 86 which has a contact 87 connected with the other terminal of the reversing switch for controlling current to the motor.

The switch 86 includes electromagnets 88 and 89 arranged respectively to close circuits through the contacts 85 and 87 and to open the circuit through the contacts so as to start the motor under remote control of an outside key actuated switch 90 and indoor push button or manual switch 91 and an emergency stop switch 92 and the limit switches 64 and 65.

In order to simplify installation, the circuits including the switches 64, 65, 90, 91 and 92 as well as electromagnets 88 and 89, are supplied at a lower voltage from a transformer 93 that has the primary connected with the conductors 82 and 83 by branch conductors 95 and 96. The secondary 97 of the transformer 93 is connected by a conductor 98 with one terminal of the winding of each electromagnet 88 and 89. The other terminal of the secondary winding 97 is connected with the switches 90 and 91 through a conductor 99 so that current may be supplied to one

5

terminal of each of the switches 90 and 91. The other terminals of the switches 90 and 91 are connected by a conductor 100 with the other terminal of the winding for the electromagnet 83.

Thus when either of the switches 90 or 91 are closed, the electromagnet 83 is energized to close the switch for establishing current flow to the motor. Low voltage current is also supplied to one terminal of each of the limit switches 64 and 65 through a conductor 101 and to one terminal of the emergency stop switch through a branch conductor 102. The other terminal of each of the limit switches is connected through a conductor 103 and conductor 104 with the other terminal of the winding of the electromagnet 83. Thus when circuit is closed to either one of the switches 64, 65 or 92, the electromagnet 83 is energized to open the motor circuit and stop operation of the motor.

When used for operating an overhead door, the unit as described is mounted at a point substantially midway of the width of the door by attaching the motor base 27 and bracket 22 to the ceiling or other horizontal supports that are located over the open position of the door. The plate 42 is attached to the upper section of the door and connected by the turnbuckle 35 with the slide 29, the turnbuckle being adjusted so that when the slide is at the forward end of the track, the turnbuckle is in position to automatically hold the door in closed position.

The switches 90, 91 and 92 are then mounted in the desired positions and connected with the low voltage circuit connections which are preferably located on a part of the unit. The plug 84 is then inserted in a convenient electrical outlet and the mechanism is ready for service. It is obvious that the installation is very simple and does not require the service of a skilled mechanic and electrician.

Assuming that the door is in closed position with the slide 29 at the forward end of the rail 18, any lifting pressure applied to the door will act in a substantially perpendicular direction against the slide and rail. Thus the door is automatically retained closed without the use of the customary bolt and lock mechanisms.

When the door is to be opened, a circuit may be closed to the electromagnet switch 86 from the outside of the garage by means of the switch 90 or from the inside by the switch 91. Closing of either switch energizes the electromagnet 83 so that the movable contact 85 engages the contact 87 thereby closing the circuit to the motor 24.

Operation of the motor 24 effects rotation of the pulley 44 through the speed reduction unit 25. Operation of the pulley moves the upper run of the cable 46 in the direction of the door, and the end 47 of the cable draws the slide 29 retractively along the track carrying the door therewith as shown in Fig. 1. When the door is completely open and the slide 29 reaches the end of its travel, it engages the slide 76 as shown in Fig. 6 to shift the slide 76 a sufficient distance to actuate the lever 74 of the reversing switch 73 through the link 75. However, just before or substantially simultaneously with this movement, the limit switch 64 is momentarily closed to energize the electromagnet 83 and effect opening of the contacts 85 and 87 so as to open the motor circuit.

The reversing switch controlling flow of current to the motor 24 is now in position to effect reverse operation of the armature of the motor.

6

The motor circuit may then be closed by closing one or the other of the switches 90 and 91 to again energize the electromagnet 83 and close the contacts 85 and 86. The pulley 44 is then rotated in reverse direction to cause the end 54 of the cable to pull the slide forwardly along the rail and move the door to closed position. Should the door meet an obstruction, the springs 53 become effective to allow a resilient action and prevent jamming of the operating mechanism. The springs 58 and 59 also maintain the desired frictional contact of the cable on the pulley 44 for effecting positive non-slip drive in either direction.

When the door reaches closed position, the slide 29 operates the limit switch 65, and the button 81 on the cable 46 engages the lever 78 to move the slide 76 in the opposite direction for effecting reverse position of the switch 73. The door is now in closed position and circuits are open. If an emergency stop is required any time during opening and closing of the door, this may be effected by closing the switch 92 to energize the electromagnet 83 in the same manner as the limit switches 64 and 65.

From the foregoing, it is obvious that I have provided a door operating mechanism that is of simple and inexpensive construction and which may be installed as a unit. It is also obvious that the control circuits carrying low voltage currents may be easily installed without complicated installation or mounting of the control circuit wires.

What I claim and desire to secure by Letters Patent is:

1. A control mechanism for door operating mechanism of the type including a guide track, a carriage having movable mounting on the guide track, means connecting the carriage with the door to be operated, a pulley at each end of the guide track, a cable operating over the pulleys and having ends connected with opposite ends of the carriage, a reversible motor, and a driving connection between the reversible motor and one of the pulleys to operate the carriage in opposite directions on the guide track, said control mechanism comprising a reversing switch, a current supply circuit connecting the motor and reversing switch, switch operating means movable on the guide track and connected with the reversing switch and having two positions on the guide track, said operating means being in position to be engaged by the carriage to move the operating means in one of said positions to effect operation of the motor in one direction, and means on one run of the cable for moving the switch operating means to said other position to effect operation of the motor in the opposite direction.

2. A control mechanism for a door operating mechanism of the type including a guide track, a carriage having movable mounting on the guide track, means connecting the carriage with the door to be operated, a pulley at each end of the guide track, a cable operating over the pulleys and having ends connected with opposite ends of the carriage, and a reversible motor, a driving connection between the reversible motor and one of the pulleys to operate the carriage in opposite directions on the guide track, said control mechanism comprising a reversing switch, a current supply circuit connecting the motor and reversing switch, switch operating means movable on the guide track and connected with the reversing switch and having two positions on the guide track, said operating means being in position to

be engaged by the carriage to move the operating means in one of said positions to effect operation of the motor in one direction, means on one run of the cable for moving the switch operating means to said other position to effect operation of the motor in the opposite direction, and limit switches at ends of the guide track and in position to be engaged by the carriage to stop the carriage in timed relation with actuation of the reversing switch.

3. A control mechanism for a door operating mechanism of the type including a guide track, a carriage having movable mounting on the guide track, means connecting the carriage with the door to be operated, a pulley at each end of the guide track, a cable operating over the pulleys and having ends connected with opposite ends of the carriage, a reversible motor, and a driving connection between the reversible motor and one of the pulleys to operate the carriage in opposite directions on the guide track, said control mechanism comprising a reversing switch, a current supply circuit connecting the motor and reversing switch, operating means connected with the reversing switch and having two positions on the guide track to actuate the reversing switch, said operating means being in position to be engaged by the carriage to move the operating means in one of said positions, a lever having pivotal support on the guide track in position to engage the operating means, and a button on the cable and engageable with the lever to effect movement of the operating means to said other position.

4. A control mechanism for a door operating mechanism of the type comprising a guide track, a carriage having movable mounting on the guide track, means connecting the carriage with the door to be operated, a pulley at each end of the guide track, a cable operating over the pulleys and having ends connected with opposite ends of the carriage, a reversible motor, and a driving connection between the reversible motor and one of the pulleys to operate the carriage in opposite directions on the guide track, said control mechanism including a reversing switch, a current supply circuit connecting the motor and reversing switch, operating means connected with the reversing switch and having two positions on the guide track to actuate the reversing switch, said operating means being in position to be engaged by the carriage to move the operating means in one of said positions, a lever having pivotal support on the guide track in position to engage the operating means, a button on the cable and engageable with the lever to effect

movement of the operating means to said other position, a relay switch in the motor circuit including an electromagnet for rendering the switch effective in closing said circuit and an electromagnet for opening said circuit, low voltage circuits connected with the respective electromagnets, and operating switches in said low voltage circuits.

5. A control mechanism for a door operating mechanism of the type comprising a guide track, a carriage having movable mounting on the guide track, means connecting the carriage with the door to be operated, a pulley at each end of the guide track, a cable operating over the pulleys and having ends connected with opposite ends of the carriage, a reversible motor, and a driving connection between the reversible motor and one of the pulleys to operate the carriage in opposite directions on the guide track, said control mechanism including a reversing switch, a current supply circuit connecting the motor and reversing switch, operating means connected with the reversing switch and having two positions on the guide track to actuate the reversing switch, said operating means being in position to be engaged by the carriage to move the operating means in one of said positions, a lever having pivotal support on the guide track in position to engage the operating means, a button on the cable and engageable with the lever to effect movement of the operating means to said other position, a relay switch in the motor circuit including an electromagnet for rendering the switch effective in closing said circuit and an electromagnet for opening said circuit, low voltage circuits connected with the respective electromagnets, operating switches in said low voltage circuits, and limit switches at ends of the guide track and in position to be engaged by the carriage, said limit switches having connection in the low voltage circuit which is in connection with the last named electromagnet.

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