May 29, 1956 H. L. MILLER 2,747,864

DOOR OPERATING APPARATUS

Original Filed Nov. 1, 1951

2 Sheets-Sheet 1

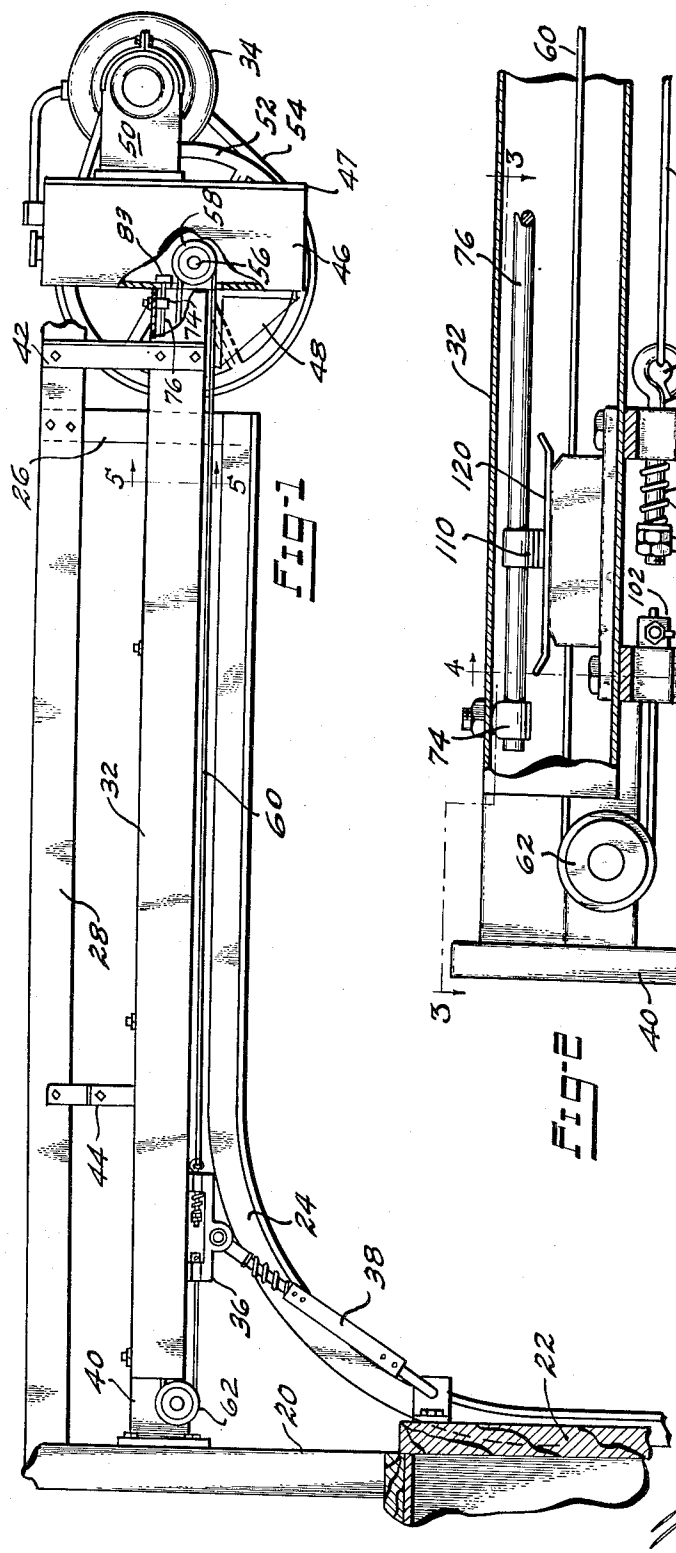

Fig-1

Fig-2

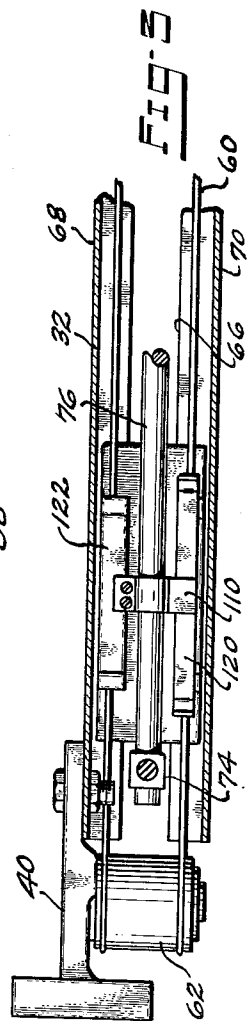

Fig-3

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Original Filed Nov. 1, 1951 2 Sheets-Sheet 2

Fig-4

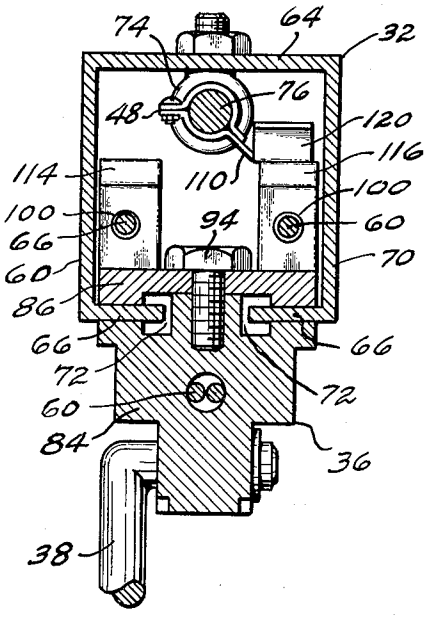


Fig-5

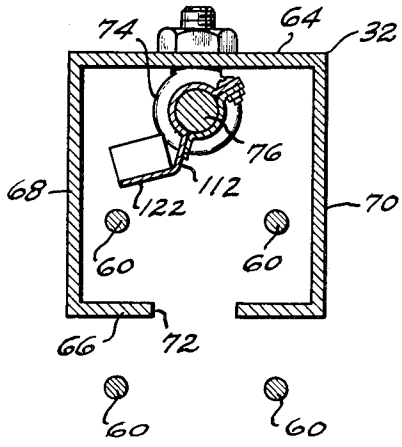
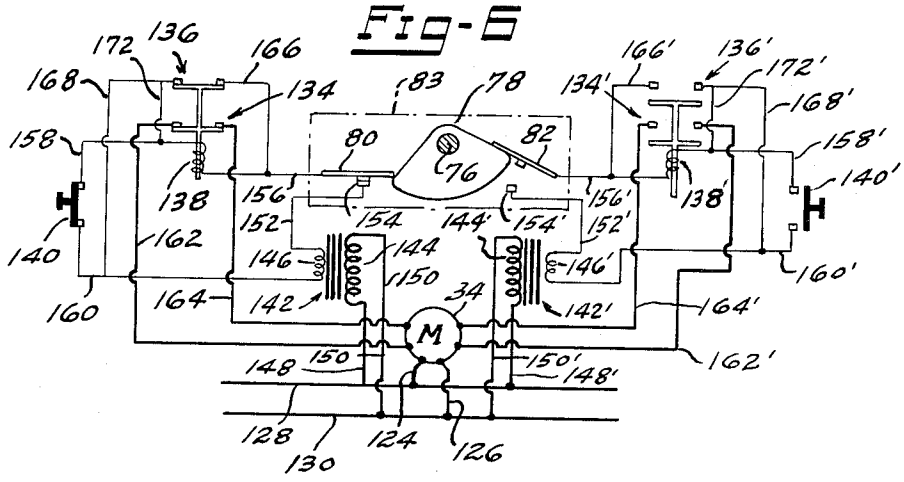


Fig-6



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DOOR OPERATING APPARATUS

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Original application November 1, 1951, Serial No. 254,300, now Patent No. 2,687,297, dated August 24, 1954. Divided and this application December 10, 1952, Serial No. 325,077

3 Claims. (Cl. 268—59)

This invention relates generally to door operating apparatus and particularly to apparatus for operating overhead type doors.

This application is a division of my copending application for door operating apparatus, filed November 1, 1951, Serial #254,300 and issued August 24, 1954, as Patent No. 2,687,297.

One of the objects of my invention is to provide an improved arrangement of the components of door operating apparatus to make installations possible where head room clearance in a building is limited.

Specifically, it is an object of my invention to provide a compact door operating apparatus of the type having a guide rail for a traveling door carrier, by locating certain carrier operated devices of the apparatus within the rail.

Other objects of the invention will be apparent from the following detailed description taken in connection with the accompanying drawings in which

Fig. 1 is a side elevational view of my overhead door operating apparatus shown installed in a building to operate a door thereof;

Fig. 2 is an enlarged side elevational view of the apparatus, partly broken away and in section;

Fig. 3 is a sectional view of the apparatus taken longitudinally thereof along line 3—3 of Fig. 2;

Fig. 4 is a vertical cross sectional view of the apparatus, taken along line 4—4 of Fig. 2;

Fig. 5 is another vertical cross sectional view of the apparatus, taken along line 5—5 of Fig. 1; and

Fig. 6 is a diagrammatical view of an electrical control system for my door operating apparatus.

In Fig. 1, my door operating apparatus is shown installed in a building in a wall of which a doorway is closed by a so-called overhead door 22. The door 22 is guided in conventional door tracks 24, which extend upwardly and rearwardly from wall 20 to guide the door between closed and overhead open positions. Hangers 26 may be used to support the inner ends of tracks 24 from a supporting geam 28 of the building. Preferably the door 22 is counterbalanced by the well known springs (not shown) or by other suitable means.

The door operating apparatus comprises, in general, a supporting member and guide rail 32, an electric motor 34, and a traveling link or door carrier 36. Door carrier 36 is connected to door 22 by a link 38 and is moved along rail 32 by motor 34 in one direction to raise the door and in the opposite direction to close the door. Motor 34 is of the reversible type to obtain operation of door 22 in both directions.

Any suitable means, such as, a mounting bracket 40 and a pair of spaced hangers 42, 44 may be used to support the door operating apparatus on the building. Bracket 40 secures one or the forward end of rail 32 to wall 20, and the spaced hangers 42, 44 suspend the rail from support 28 respectively at the inner end of the rail and at a point intermediate its ends.

Controls for motor 34 and other electrical devices shown diagrammatically in Fig. 6, are housed within a casing 46 which is secured to the inner end of rail 32 by a bracket 48 on which the rail rests. Casing 46 has a rear wall 47 which serves as a control panel, and also serves as a mounting for motor 34 which is rigidly secured to the outer side thereof by a suitable mounting bracket 50.

Motor 34 has a drive pulley which drives a larger, speed reducing pulley 52 through a belt drive 54, the pulley 52 being on a shaft 56, journaled within casing 46. Secured on shaft 56 at the inner end of rail 32 is a drive pulley 58 which drives a cable 60 to which carrier 36 is attached to move therewith. Extending longitudinally of the rail 36, the cable 60 passes around drive pulley 58 and around an idler pulley 62 which is mounted on bracket 40 at the outer end of rail 32.

The rail 32 is a hollow, elongated member of preferably rectangular or box section having a top 64, bottom 66, and opposite sides 68, 70 (see Figs. 4 and 5). In the bottom 66 of rail 32 is a guide slot 72 extending longitudinally thereof wherein carrier 36 is received and guided in its travel along the rail. Secured to the top 64 of and within hollow rail 32, are spaced supports or bushings 74 which support a rotatable cam shaft 76 within rail 32. Shaft 76 extends longitudinally of rail 32 into casing 46 wherein the shaft has fixed thereto, a cam 78 for operating a pair of limit switches 80, 82 (see Fig. 6) that control motor 34 to limit door travel. The limit switches 80, 82 may be enclosed in a casing 83, Fig. 1, which is mounted at the inner end of the rail.

Preferably the carrier 36 is made in two bolted together sections comprising, a lower section 84 and an upper section 86. The lower carrier section 84 rides against the under surface of rail bottom 66, and the upper section rides on the upper surface of the rail bottom within the hollow rail. To the lower carrier section 84 is connected the door link 38 and the lower side of cable 60 which extends directly below and longitudinally of the hollow rail 36. An upstanding boss on lower carrier section 84 extends through rail slot 72 to engage the underside of upper carrier section 86, and the opposed surfaces of the sections are recessed to provide a loose fitting slide with rail 66. Studs 94 or other suitable means may be used for rigidly securing the carrier sections together.

In the assembly of cable 60 and carrier 36, the cable is threaded through an eye 96 of an adjustable anchor member 98 in one end of the carrier and the ends of the cable are passed around double grooves in pulley 58, through rail 32 and guide apertures 100 in carrier upper section 86, around double grooves in pulley 62 to the carrier lower section 84 to which the cable ends are secured by an anchor member 102. Adjustable anchor 98 extends through a clearance hole in the carrier and has a threaded shank 104 on which adjustment and lock nuts 106 act against an adjusting coil spring 108, for ready adjustment of the cable tension.

The limit switches 80, 82 are actuated by carrier 36 through mechanism which includes the rotatable shaft 76, shaft rotating levers or arms 110, 112, and arm operating cams 114, 116. Shaft 76 extends longitudinally of and within rail 32, arms 110, 112 are on shaft 76, and cams 114, 116 are on the top of carrier 36.

Arms 110, 112 are spaced the required distance apart on shaft 76 corresponding with the distance of door travel desired, and they are preferably secured to shaft 76 by easily releasable clamps so that adjustment of the arms along the shaft may be readily made. The arms 110, 112 extend laterally in opposite directions from shaft 76 and carry shoes 120, 122 respectively on the outer ends

thereof for engagement by the cams 114, 116 respectively. As shown, the shoes 120, 122 are elongated lengthwise of rail 32 and preferably have upturned ends to engage and ride up on cam surfaces 114, 116.

Limit switch cam 78 is rotated with shaft 76 to operate the movable switch arms 80, 82 and these switches control separate circuits of motor 34. The switch arms, 80, 82 are biased to closed positions, and actuator 78 is designed to open one switch and close the other or to alternately open and close the switches. For example, on door opening operation, switch 80 is opened and switch 82 closed by cam 78 when carrier 36 reaches the end of its travel rearwardly and cam 114 turns shaft 76 clockwise (Figs. 4 and 5) through engaging the shoe 122.

Referring particularly to Fig. 6, the electric motor 34 is connected by leads 124, 126 to main leads 128, 130 which may be the usual 110 volt line. Since the circuits controlled by limit switches 80, 82 are alike, reference is made only to the circuits controlled by switch 80 and the other circuits are given primed reference characters to avoid unnecessary repetitious description.

Limit switch 80 controls the circuit of a motor controlling relay 134 and of a holding relay 136 which are interlocked or have a common relay coil 138. A push button switch 140 initiates energization of relay coil 138 and relay 136 functions to keep the circuit of coil 138 closed after the push button is released.

A transformer 142 is provided to reduce the current for relay coil 138 and comprises the usual primary coil 144, secondary coil 146. Opposite ends of the transformer primary 144 are connected by leads 148, 150 respectively, to main leads 128, 130. One end of the transformer secondary coil 146 is connected by a lead 152 to a contact 154 with which limit switch arm 80 makes contact, and arm 80 is connected by a lead wire 156 to one end of relay coil 138. The other end of relay coil 138 is connected by a lead 158 to one contact of push button switches 140 from the other contact of which a lead 160 connects to the other end of secondary coil 146 to complete the circuit. Thus, when switch 140 is pushed, a circuit will be made through transformer secondary coil 146, closed contacts 80, 154 and relay coil 138 which closes contacts of motor relay 134 and of the holding relay 136 to start motor 34. The contacts of motor relay 134 and of the holding relay 136 are connected to the motor 34 by leads 162, 164 and the contacts of the holding relay 136 are connected by leads 166, 168 respectively to leads 156, 158 to provide a holding circuit. A lead wire 172 connects lead 168 and lead 158 of the relay holding circuit. When switch button 140 is pushed, the following holding circuit for the relay is effected: From one end of transformer secondary coil 146 through lead 152, limit switch 80, lead 156, relay coil 138, leads 172, 168 and 160 to the other end of transformer secondary coil 146.

Operation

To open door 20 by my apparatus, push button 140 is pushed which as mentioned above energizes motor relay 134 to start motor 34. Through the speed reduction pulley 52, motor 34 drives the cable pulley 53 which moves cable 60 and the carrier 36 attached thereto rearwardly along rail 32 pulling door 22 upwardly and rearwardly in its overhead tracks. When the door approaches the desired open position, cam 114 on carrier 32 engages shoe 122 and raises arm 112 which rotates shaft 76 in a direction such that cam 78 opens switch 80 and at the same time allows switch 82 to close. Opening of switch 80, of course, breaks the motor relay circuit and stops motor 34, thus stopping further movement of door 22. Switch 82 is closed by cam 78 so that the circuit of its push button 140' is set for return movement of door 22 to closed position. That is, upon pressing button 140', the door 22 will be moved toward closed position and just prior to reaching said position shoe 120 will be pivoted by carrier cam 116 and break the circuit to the motor 34 and setting the limit switches for the next door opening operation.

From the foregoing description, it will now be understood that I have provided an improved arrangement of the components thereof to allow for remote operation of limit switches by a traveling door carrier and that in this type door operator I have provided for enclosing the switch operating means and other components within the carrier guide rail. It will be seen that by arranging the components so as to enclose them in the carrier guide rail provides protection for operating parts and also results in a compact apparatus suitable for installations where head room is limited.

While I have shown and described my improved door operating apparatus in detail, it will be understood that the apparatus is subject to variation and therefore is to be limited only by the spirit and scope of the appended claims.

I claim:

1. In an overhead door operating apparatus, a hollow horizontal guide rail, a door carrier guided by and on the underside of said rail having a portion projecting thereinto, an electric motor adjacent one end of said rail, a flexible drive member having a lead side attached to said carrier below said rail and having a trailing side extending through said rail and through guide apertures in said carrier portion, means operatively connecting said motor and said flexible drive member, limit switches adjacent said one end of said rail to stop said motor when said carrier reaches predetermined positions on said rail, and an operating member within said hollow rail to operate said limit switches and arranged for operation by said carrier.

2. In an overhead door operating apparatus, a horizontal hollow rail, a reciprocal member extending longitudinally within said hollow rail, a reversible electric motor to move said reciprocal member in either direction longitudinally of said rail, a carrier member slidable along said rail and attached to said reciprocal member, said carrier member being adapted for attachment to a door, a switch controlling said reversible electric motor, a rotatable shaft extending longitudinally of and within said hollow rail, said shaft being operatively connected to and for operating said switch, a laterally extending arm attached to and rotatable with said shaft, and cam means on said carrier within said hollow rail to rotate said arm.

3. In an overhead door operating apparatus, a horizontal hollow rail for mounting on a building, a reciprocal drive member extending longitudinally within said hollow rail, a control box overlying and closing one end of said hollow rail, a reversible electric motor mounted on said control box operatively connected to and for reciprocating said drive member, a door carrier member adapted to be attached to an overhead door, said carrier being slidably guided on the underside of said hollow rail and projecting thereinto, switch means operable to control said reversible motor and disposed within said control box, a switch means operating rod operatively connected to said switch means and rotatable in opposite directions, said rod being rotatably mounted on and within said hollow guide rail above said carrier, and cooperable cam means on said carrier and rod to rotate the latter in one or the other of its opposite directions.

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