Aug. 16, 1955 B. A. ANDREWS 2,715,662

DOOR OPERATING MECHANISM HAVING MOTOR ACTUATOR

Filed Aug. 13, 1951 2 Sheets-Sheet 1

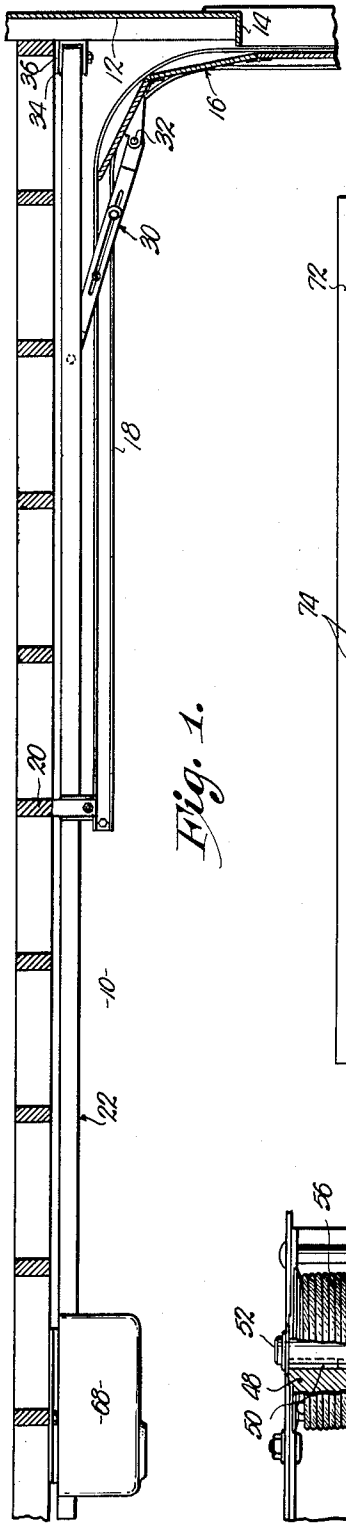


Fig. 1.

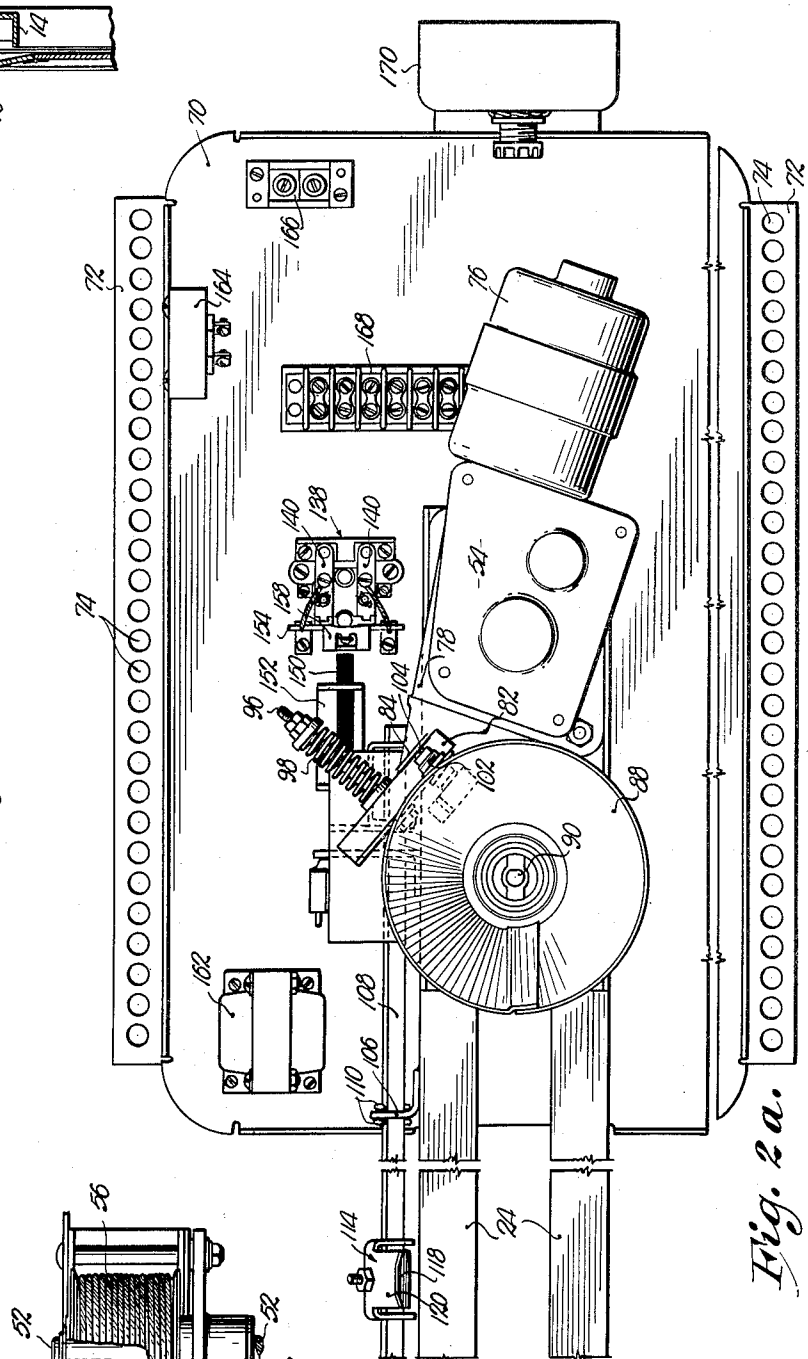


Fig. 2a.

Fig. 4.

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DOOR OPERATING MECHANISM HAVING MOTOR ACTUATOR

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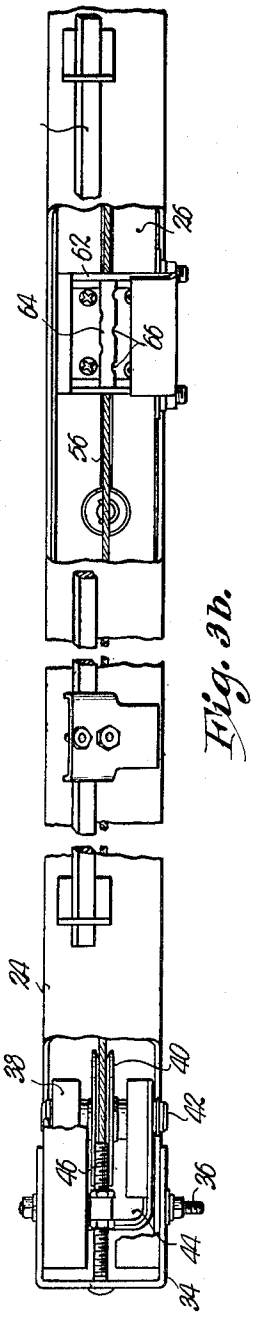


Fig. 3b.

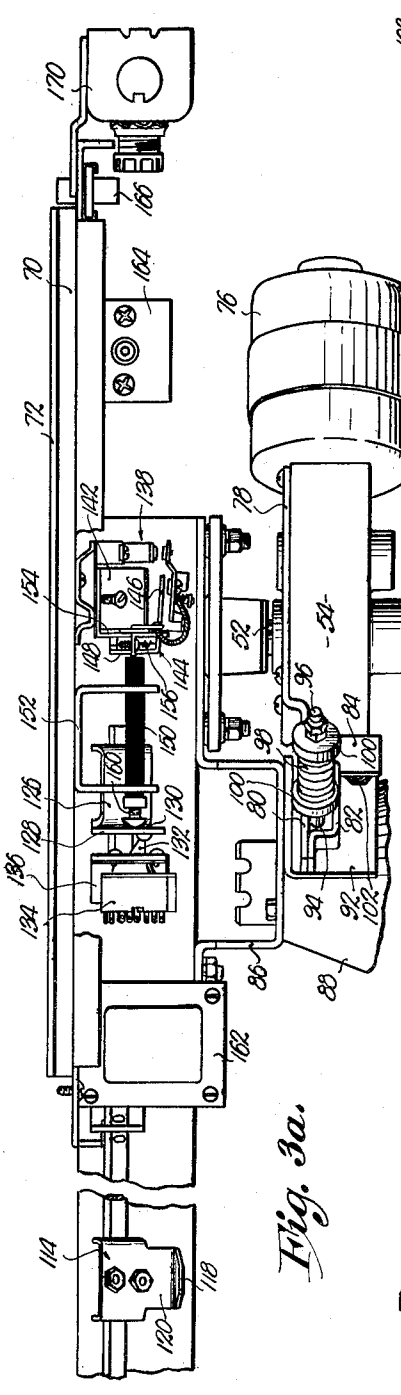


Fig. 3a.

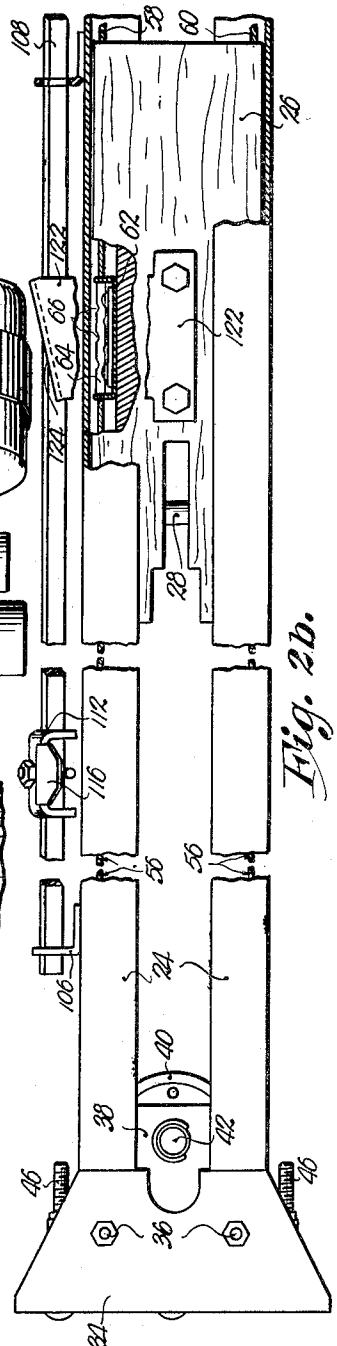


Fig. 2b.

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2,715,662

DOOR OPERATING MECHANISM HAVING MOTOR ACTUATOR

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Application August 13, 1951, Serial No. 241,550

4 Claims. (Cl. 200—47)

This invention relates to garage door opener mechanism adapted for operation through use of an electric motor forming a part thereof and including a reciprocable follower operably connected to the door for shifting the latter to and from an open position disposed beneath the ceiling of the garage or in a substantially horizontal plane above the uppermost edge of the door opening.

This invention relates to the subject matter of a co-pending application, Serial No. 736,684, filed March 24, 1947, now patent No. 2,574,684, Nov. 13, 1951, entitled "Door Controlling Mechanism And Limit Switch" and in the names of the applicant hereof and one George M. Pro, and is a continuation in part of my co-pending application Serial No. 61,473, filed November 22, 1948, now abandoned entitled "Motor Actuated Door Operator."

The electric circuit for controlling the motor of the door actuating mechanism hereof, and shown in part hereby, forms the subject matter of my co-pending application, Serial No. 241,551 filed on even date herewith, now abandoned, and entitled "Electric Motor Circuit For Door Controlling Mechanism."

Reference may be had to my U. S. Letters Patent No. 2,558,032, dated June 26, 1951, for disclosure of a similar motor control circuit. The aforesaid motor circuit may be placed in operation either through the provision of one or more manual control switches located on the garage or at points remote therefrom, or through the medium of a relay connected therewith and placed in operation by means of the generation of supersonic sound waves.

A co-pending application filed on even date herewith and entitled "Sound Generator And Transmitter For Door Controlling Mechanism" discloses structure for creating such sound waves and adapted for operation by the vacuum line of an automobile. An assembly for receiving the sound waves and converting the same into energy capable of actuating the aforesaid relay, forms the subject matter of another co-pending application filed on even date herewith and entitled "Electronic Control Unit For Door Controlling Mechanism," said patent and all of the aforesaid co-pending applications having a common assignee.

It is the most important object of the present invention to improve upon the door controlling mechanism of my said co-pending application Serial No. 61,473, and particularly upon the torque control therein set forth by provision of a more positively operating, spring-loaded limit means for the swinging motor and speed reducer provided as a safety measure to automatically open a switch within the motor circuit in the event of overload on the electric motor.

Another important object of the present invention is to provide a motor actuator for door control mechanism wherein the speed reducer that carries the motor is freely swingable on its driven shaft and provided with an extension that is spring-loaded in one direction permitting swinging of the motor and the speed reducer in response to overload as the door is opened to in turn actuate a safety switch within the motor circuit.

Another important object of this invention is to provide a switch and relay control assembly that includes a cam mounted on a follower forming a part of the door actuator for actuating a bar that is in turn connected with a reversing switch for the reversible electric motor, together with a relay forming a part of the motor circuit.

A further object hereof is to provide an elongated bar as just above set forth capable of oscillating on its transverse axis and having projections within the path of travel of the cam member for swinging the bar as the follower and cam reciprocate along an elongated track therefor.

Other objects include the way in which the reversing switch is provided with an actuator arm pivotally connected with a portion of the bar; the manner of providing an elongated plunger within the path of travel of the actuator arm; the way in which the relay is provided with a trip member within the path of travel of the plunger; and many additional, more minor objects including details of construction of the operating mechanism, together with the manner of associating the controls above set forth therewith.

In the drawings:

Figure 1 is a vertical, cross-sectional view through a garage showing a door therefor, together with door operating mechanism having a motor actuator made pursuant to the present invention.

Fig. 2*a* is an enlarged, fragmentary, inverted, elevational view of one end of the mechanism, a portion of the hollow case or housing forming a part thereof, being entirely removed.

Fig. 2*b* is an inverted plan view, parts being broken away for clearness and illustrating the remainder of such mechanism, i. e. that end thereof proximal to the door shown in Fig. 1.

Fig. 3*a* is a fragmentary, side elevational view showing that part of the mechanism illustrated in Fig. 2*a* remote from the garage door.

Fig. 3*b* is a continuation of Fig. 3*a* and a side elevational view of that part of the mechanism shown by Fig. 2*b*, parts being broken away to reveal details of construction; and

Fig. 4 is a view similar to Fig. 3*a*, parts being broken away and showing the cable-receiving drum that is connected to the drive shaft of the speed reducer.

A garage or other building structure shown in Fig. 1 of the drawings is broadly designated by the numeral **10** and includes a vertical wall **12** having an access opening **14** therein that is in turn normally closed by a conventional door **16** that is composed of a number of articulated sections as is clearly shown by said figure.

A pair of opposed tracks, one only if which is illustrated in Fig. 1 of the drawings and designated by the numeral **18**, is provided to guide the door **16** from its normally closed position to a position where the entire door **16** is disposed in substantially a horizontal plane. Girders **20** forming a part of the garage **10**, are normally utilized to support the track **18** and in accordance with the present invention, the operating mechanism hereof is likewise adapted for support by such girders **20**.

The means for moving door **16** through the aforesaid path of travel and forming the subject matter hereof, includes an elongated track broadly designated by the numeral **22** and including a pair of substantially identical track portions **24**, each of which is U-shaped in cross-section and disposed in facing relationship to reciprocably receive an elongated follower block **26** for sliding movement therein. The track **22** is preferably disposed in a horizontal plane beneath the girders **20** to which it is affixed for movement of the follower block **26** toward and away from the wall **12** of the building structure **10**. One end of the block **26** is bifurcated as in clearly shown in

Fig. 2*b* of the drawings, and a transverse pivot pin **28** pivotally receives one end of a connector **30** (Fig. 1) that is also pivotally joined to a bracket **32** on door **16**.

The precise construction of the connector **30** forms no part of the present invention and is fully disclosed in my copending application, Serial No. 61,475, filed November 22, 1948, and entitled "Releasable Hitch For Door Actuating Mechanism."

That end of the track **22** adjacent the wall **12** is provided with a U-shaped connector **34** for the sections **24** of track **22**, a plurality of bolts **36** serving to join the connector **34** to the track **22**. A substantially U-shaped yoke **38** shiftably disposed within the track **22**, has an idler pulley **40** disposed between the legs thereof and rotatably carried by a vertical shaft **42** between the track portions **24** and secured to such legs of the yoke **38**.

An elongated, vertical bar **44**, on the inner face of the bight of yoke **38**, receives a pair of adjusting bolts **46** that are in turn secured to the bight of the U-shaped connector **34**. Connector **34** may be utilized if desired, to support the proximal end of track **22** on one of the girders **20** and/or end wall **12** of building **10**.

A rotatable drum **48** between the track sections **24** at that end of the track **22** remote from the end wall **12** of building **10**, is spleened as at **50** to a vertical driven shaft **52** (Fig. 4) and forming a part of a speed reducer broadly designated by the numeral **54** (Figs. 2*a* and 3*a*). A flexible cable **56** coiled about the drum **48**, extends from the latter and is coiled about the idler pulley **40**, there being cable stretches **58** and **60** within each track portion **24** respectively. One side edge of the follower block **26** is provided with a U-shaped bracket **62** having a pair of spaced-apart, horizontal, perforated legs as is clear in Figs. 2*b* and 3*b*, for threadably receiving the cable stretch **58**.

An elongated tube **64** on the cable stretch **58** between the legs of bracket **62**, is crimped at a number of points as at **66** or otherwise secured directly to the cable section **58** whereby to attach the latter to the bracket **62**.

That end of the track **22** remote from wall **12**, extends into a hollow casing or housing broadly designated by the numeral **68**, all but top plate **70** of housing **68** being removed in Figs. 2*a* and 3*a* of the drawings. Housing **68** and particularly top plate **70** thereof, has a pair of opposed, horizontal flanges **72** thereon each provided with a longitudinally extending row of openings **74**, and selectively adaptable to receive suitable fastening elements for joining the housing **68** to girders **20** or the like within the building **10**.

The shaft **52** of speed reduced **54** depends from the track **22** as shown in Fig. 3*a* and speed reducer **54**, as well as an electric motor **76**, secured to the speed reducer **54**, are supported solely by the shaft **52** for swinging movement on the vertical axis of the latter.

Motor **76** is provided with a drive shaft in the usual manner and the same is operably connected with the driven shaft **52** through the medium of a train of gears forming a part of the speed reducer **54** and not herein illustrated. A plate **78** secured to the upper face of speed reducer **54**, extends laterally in an arm **80** disposed substantially radially with respect to the shaft **52** and having a U-shaped bracket **82** on the lower face thereof, together with a small plate **84** depending from the arm **80**, plate **78**, arm **80**, bracket **82** and plate **84** all being swingable with the speed reducer **54** as the latter and the motor **76** swing on the vertical axis of shaft **52**.

A U-shaped bracket **86** depending from the track **22** to which it is secured, receives a frusto-conical reflector at the bight thereof for an electric lamp (not shown) insertable within a socket **90** at the apex of the reflector **88**. The rigidly mounted bracket **86** also mounts a stationary stop member **92** that depends from the bight of bracket **86** having an opening **94** therein for receiving a bolt **96** that extends laterally from that face of the stop member **92** opposite to the reflector **88**. The bolt

96 passes loosely between the arm **80** and the bracket **82** and has a spring **98** coiled thereon.

A pair of opposed cups **100** on the bolt **96**, receive the spring **98** and one of the cups **100** rests directly on the proximal edges of arm **80** and bracket **82**.

A safety switch **102** secured to the stop member **92** has a reciprocable, spring-loaded actuating plunger **104** normally engaged by the plate **84** for holding the switch **102** closed. One of the track portions **24** has a plurality of L-shaped brackets **106** on the side thereof for receiving an elongated, polygonal, horizontal bar **108** for oscillatory movement on its longitudinal axis, and transverse keys or the like **110** in the bar **108**, adjacent one of the brackets **106**, restrains the bar **108** against movement on its longitudinal axis.

A pair of spaced, U-shaped projections **112** and **114** are rigidly secured to the bar **108**, the projection **112** having an ear **116** extending laterally from the bight thereof and the projection **114** having an ear **118** on a portion **120** extending from the bight of projection **114**.

A cam plate **122** on the follower **26**, projects laterally beyond the track **22** in partial overlapping relationship to the bar **108** and has an inclined cam edge **124** thereon. A third U-shaped projection **126** on the bar **108** disposed within the housing **68**, has an arm **128** on one leg thereof and substantially perpendicular to the longitudinal axis of bar **108**, provided with an opening for pivotally receiving a spherical element **130** on actuating arm **132** forming a part of a reversible electric switch **134** for the electric circuit of reversible motor **76**, switch **134** being carried by an L-shaped bracket **136** on that track portion **24** having brackets **106** thereon.

Plate **70** of housing **68** carries a relay broadly designated by the numeral **138** having a pair of normally open, spring-loaded poles **140** and a coil **142** adapted when energized, to attract the poles **140** and thereby close the same. An L-shaped trip **144** has a horizontal leg **146** between coil **142** and the poles **140** and a vertical leg **148** within the path of travel of a reciprocable, insulated plunger **150** carried by a U-shaped bracket **152** depending from plate **70**. The leg **146** of the trip **144** is pivotally carried by a portion **154** forming a part of the relay **138** and the trip **144** is held biased in the position shown in Fig. 3*a* by a spring **156** interconnecting the leg **146** of trip **144** adjacent the leg **148** and a projection **158** on portion **154**. That end of the plunger **150** opposite to the trip **144** has an adjustable screw **160** provided with a dome-shaped head within the path of travel of the spherical portion **130** of switch actuating arm **132**.

By way of explanation, the motor circuit of my copending application above mentioned and entitled "Electric Motor Circuit For Door Controlling Mechanism," includes relay **138**, reversing switch **134** and safety switch **102**. When the motor circuit is initially closed, either manually or through the automatic supersonic sound structure above mentioned, coil **142** of relay **138** is immediately energized, attracting the poles **140** and thereby closing the same, one of the poles **140** being within a holding circuit for relay **138**. Motor **76** is thereupon immediately energized for travel in a direction to either move the follower **26** away from wall **12** to open the door **16** or toward the wall **12** to close the door **16**, depending upon the position of the reversing switch **134**.

Assuming the door **16** to be closed, operation of motor **76** in one direction, rotates the shaft **52** and thereby the drum **48** to shift the follower block **26** toward the housing **68**. Because of the connection **30** between block **26** and the door **16**, the latter will be moved to the open horizontal position. As the block **26** and particularly, the cam plate **122**, approach the housing **68**, edge **124** of plate **122** will contact the ear **118** of extension **114**, thereby swinging the bar **108** on its longitudinal axis in one direction. Such swinging movement is imparted to the extension **126** and the arm **128** to actuate the arm **132** of switch **134** and thereby reversing the same to

place motor **76** in a stand-by condition for operation in the opposite direction to close the door **16**. Simultaneously, with the reversing of switch **134**, spherical portion **130** of the arm **132** engages the domed end of screw **160** to move the plunger **150** toward the relay **138**.

Plunger **150** comes into contact with the leg **148** of trip **144**, swinging the latter against the action of spring **156** to move the leg **146** of trip **144** against the poles **140** and thereby opening relay **138** regardless of the holding circuit above mentioned.

When the motor circuit is again closed, motor **76** will rotate in the opposite direction, by virtue of the reversing of switch **134**, to shift the follower **26** toward the wall **12**, thereby closing the door **16**. As the edge **124** of plate **122** comes into contact with the ear **116** of extension **112**, the bar **108** will be oscillated in the opposite direction to return the switch arm **132** to the position shown in Fig. 3*a*. The plunger **150** will again be actuated to operate trip **144** and thereby open the relay **138**.

In the event the door **16** jams during its movement to the closed position, thereby throwing an overload on the motor **76**, safety switch **102** within the motor circuit, will open to deenergize the motor **76**. Such overload tends to cause swinging movement of motor **76**, speed reducer **54**, arm **80**, bracket **82** and plate **84** about the axis of shaft **52**, against the action of spring **98**. As plate **84** moves away from spring-loaded plunger **104**, switch **102** will open.

The same operation takes place if for some reason relay **138** fails to open when the door **16** reaches the lower limits of its path of travel since such overload on the motor **76** will automatically open switch **102**.

There is also provided in the motor circuit, and as fully disclosed in my last mentioned co-pending application, a circuit breaker within the circuit for motor **76** capable of opening automatically and deenergizing the motor **76** whenever an overload appears in the circuit thereby protecting the assembly whenever the door **16** jams either during movement to the open position or to the closed position.

A transformer **162** and terminal supports **164**, **166** and **168** for the motor circuit, are carried within the housing **68** on top plate **70** and an electrical connecting box **170** is provided on one end of the housing **68**.

Having thus described the invention what is claimed as new and desired to be secured by Letters Patent is:

1. In control mechanism having a motor, an elongated track and a motor driven follower reciprocably carried by the track, an elongated bar parallel with the path of travel of the follower and mounted on the track for oscillation on its transverse axis; means for holding the bar against longitudinal movement; a pair of spaced projections rigidly mounted on the bar; a reversing switch connected to the bar for movement thereby and coupled electrically with said motor; and a cam member on the follower engageable with one projection when the follower moves toward one end of the track for moving the bar in one direction to actuate the switch, and engageable with the other projection when the follower moves toward the opposite end of the track for moving the bar in the opposite direction to actuate the switch.

2. In control mechanism having a motor, an elongated track and a motor driven follower reciprocably carried by the track, an elongated bar parallel with the path of travel of the follower and mounted on the track for oscillation on its transverse axis; means for holding the bar against longitudinal movement; a pair of spaced projections rigidly mounted on the bar; a reversing switch connected to the bar for movement thereby and coupled electrically with said motor; a cam member on the follower engageable with one projection when the follower moves toward one end of the track for moving the bar in one direction to actuate the switch, and engageable with the other projection when the follower moves toward the opposite end of the track for moving the bar in the opposite direction to actuate the switch; a reciprocable plunger disposed for movement each time the bar is moved; and a relay having parts within the path of travel of the plunger for actuation thereby.

3. In control mechanism having a motor, an elongated track and a motor driven follower reciprocably carried by the track, an elongated bar mounted on the track for movement on its transverse axis; a pair of spaced projections on the bar; a reversing switch having a swingable actuator arm connected to the bar for movement thereby, said switch being coupled electrically with said motor; a cam member on the follower engageable with one projection when the follower moves toward one end of the track for moving the bar in one direction to actuate the switch, and engageable with the other projection when the follower moves toward the opposite end of the track for moving the bar in the opposite direction to actuate the switch; a relay having a trip member; and means within the path of travel of said actuator arm for operating said trip member each time the bar is moved.

4. In control mechanism as set forth in claim 1, wherein said cam member is provided with an element slidably engageable on one side thereof with said one projection and on the opposite side thereof with the other projection.

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