Aug. 24, 1965 E. E. LODGE 3,202,415

AUTOMATIC DOOR OPERATOR

Filed March 22, 1962 4 Sheets-Sheet 1

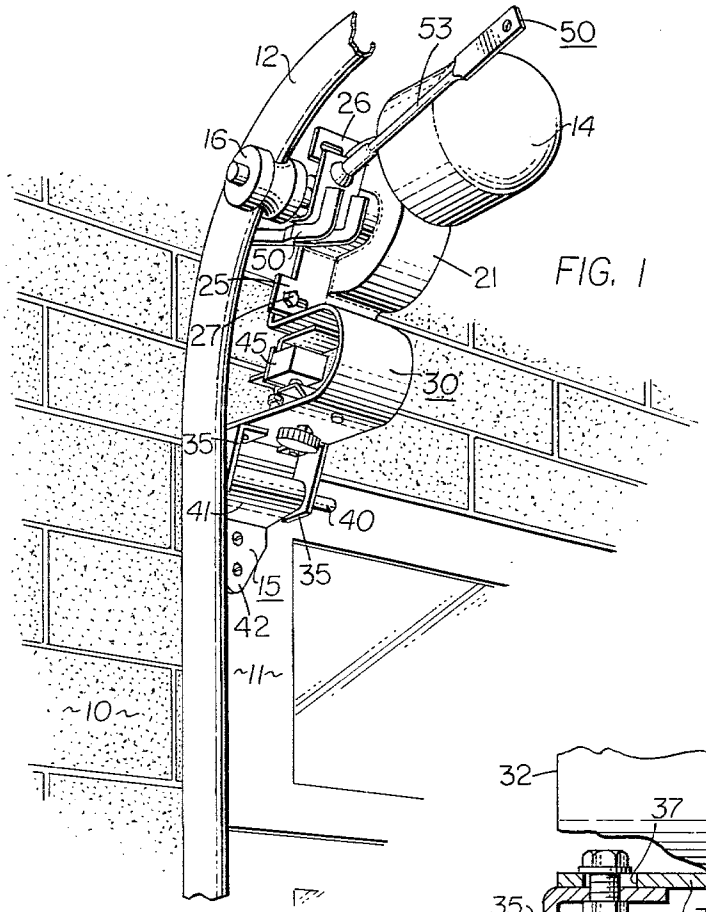


FIG. 1

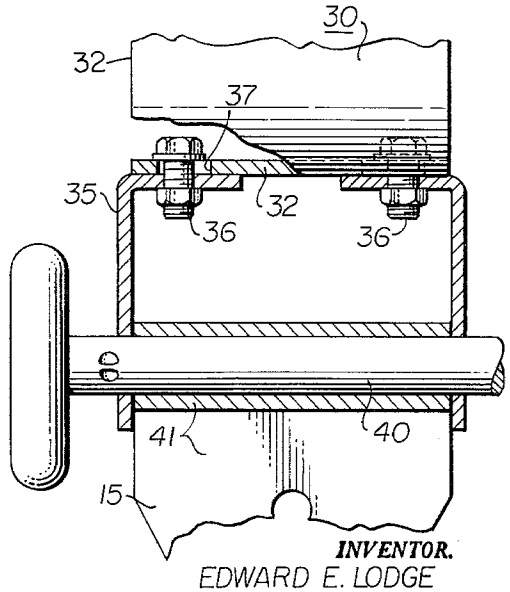


FIG. 5

INVENTOR.
EDWARD E. LODGE
BY
Eber J. Hyde
ATTORNEY

Aug. 24, 1965 E. E. LODGE 3,202,415

AUTOMATIC DOOR OPERATOR

Filed March 22, 1962 4 Sheets-Sheet 2

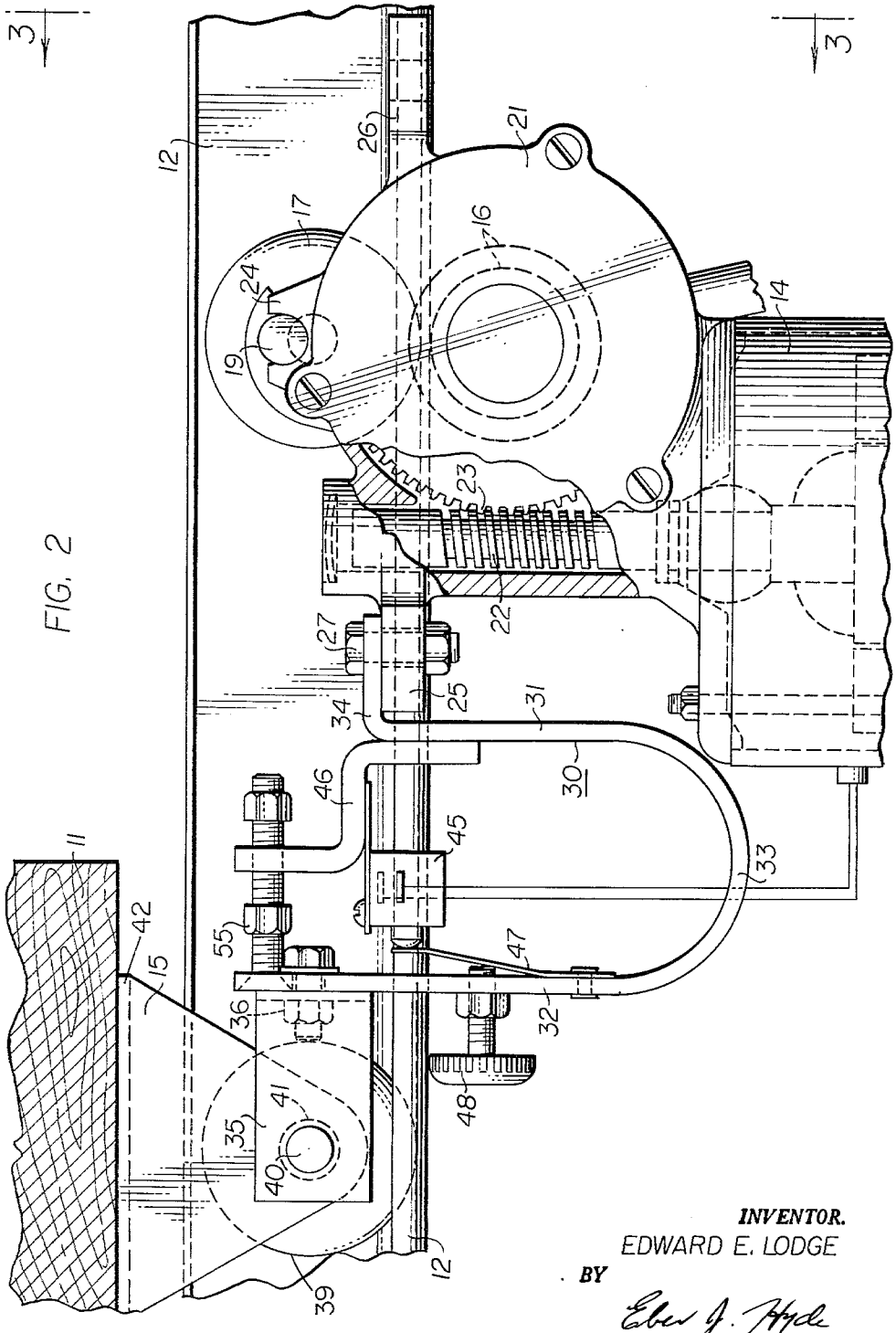


FIG. 2

INVENTOR.
EDWARD E. LODGE
BY
Eber J. Hyde
ATTORNEY

Aug. 24, 1965 E. E. LODGE 3,202,415

AUTOMATIC DOOR OPERATOR

Filed March 22, 1962 4 Sheets-Sheet 3

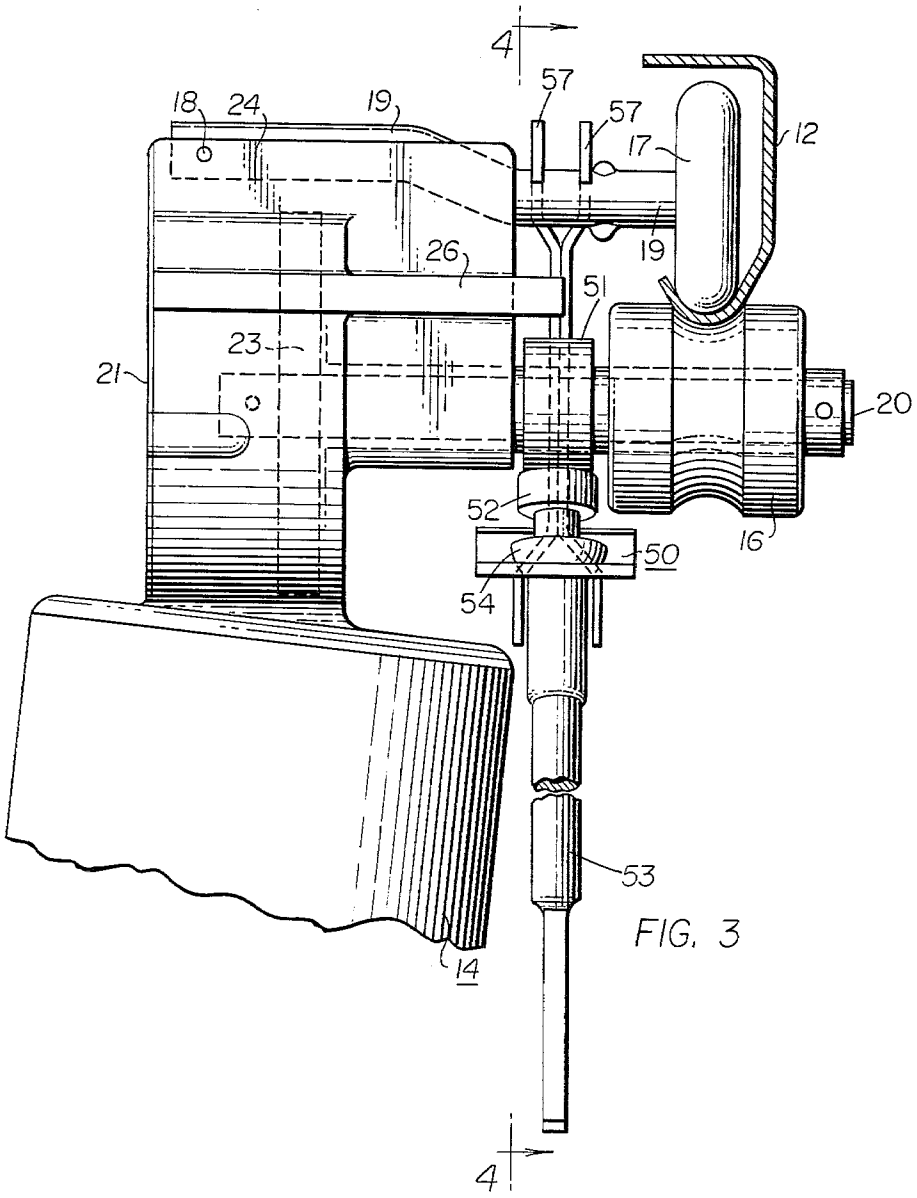


FIG. 3

INVENTOR.
EDWARD E. LODGE
BY
Ebert J. Hyde
ATTORNEY

Aug. 24, 1965 E. E. LODGE 3,202,415

AUTOMATIC DOOR OPERATOR

Filed March 22, 1962 4 Sheets-Sheet 4

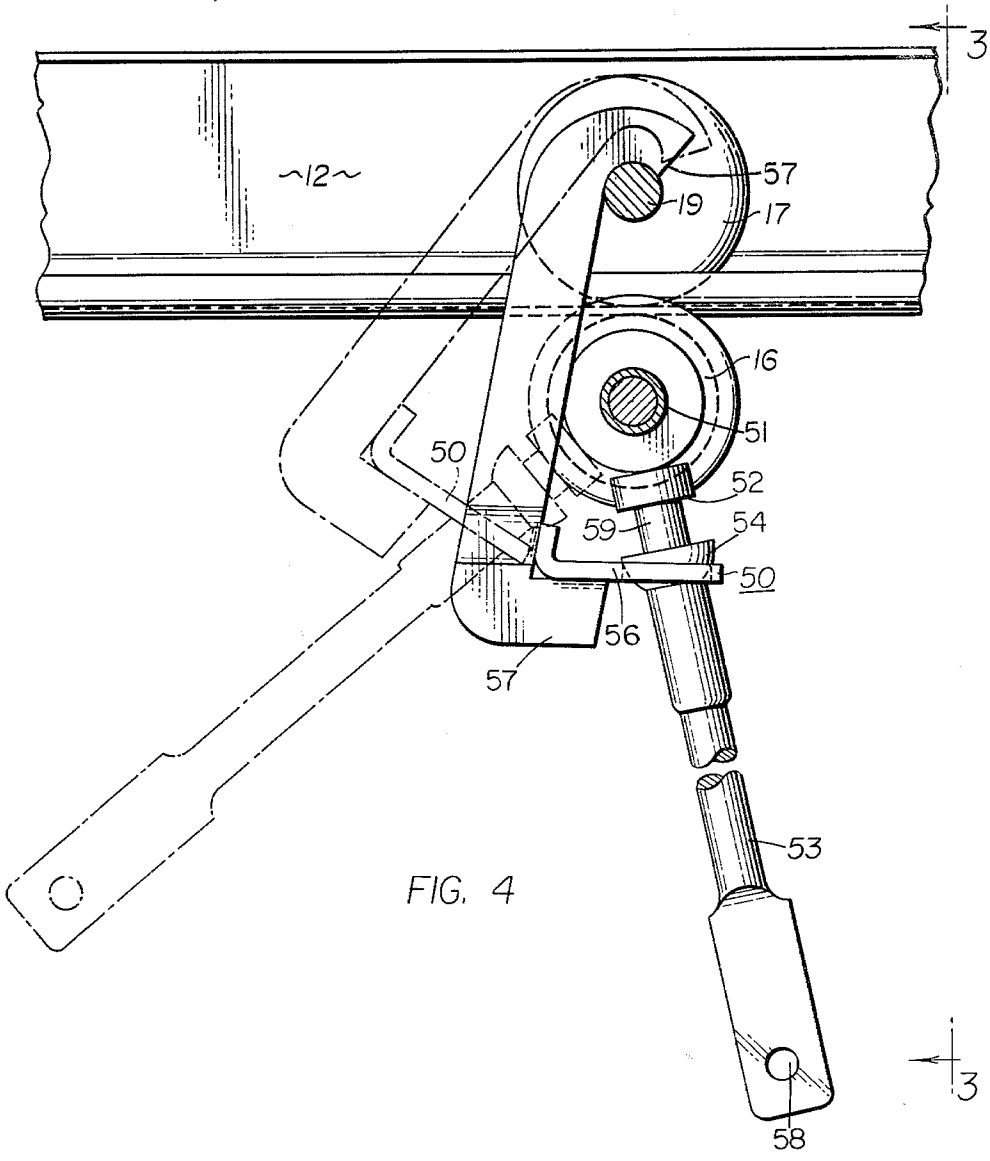


FIG. 4

INVENTOR.
EDWARD E. LODGE
BY
Eber J. Hyde
ATTORNEY

United States Patent Office 3,202,415 Patented Aug. 24, 1965

3,202,415

AUTOMATIC DOOR OPERATOR

Edward E. Lodge, 2881 Plymouth Road, Cleveland 24, Ohio

Filed Mar. 22, 1962, Ser. No. 181,647
6 Claims. (Cl. 268—59)

This invention pertains to a door operating mechanism for opening and closing vertically movable doors such as garage doors.

This invention is a further development of the device shown, described and claimed in Patent No. 2,925,267, issued Feb. 16, 1960 to Matt A. Volf. In theVolf patent a motor and drive device is connected to one of the upper corners of the door and is coupled to one of the two side rails on which the door travels by a rubber drive roller and a pinch roller.

It has been found by experience that certain types of garage doors tend to cock and bind in their two spaced-apart tracks or side rails when driving power is applied only to one corner of the door. This can be especially noticeable in 16 foot or double doors where the span between the tracks is quite wide.

It is an object of the present invention to provide a connection between the motor device and the door which forces the corner of the door to which the motor device is connected, and hence the entire door, to track or move accurately in relation to the tracks on which the door is mounted, thereby to eliminate cocking and binding of the door in its tracks.

Still another object of the invention is to provide an operator for a garage door wherein the motor unit, after it is in driving engagement with the door track, and the means for connecting the motor unit to a corner of the door are rigid and force the corner of the door to move in a line which is parallel to the plane of the track, and hence to force the entire door to move straight up or down, thereby preventing cocking of the door and permitting the use of a single motor drive unit operating on only one of the regular door tracks to open and close the door.

Still another object of the invention is the provision of a connection between a garage door and a motor operator which is rigid in all directions essential to force the door to track properly and which is resiliently flexible in one other direction to actuate a safety switch when necessary, and which provides the required pivoting action between the motor unit and the door.

It is a further object of the invention to provide a door operator which is resiliently clamped to the regular door rail and wherein the clamping mechanism is reversible so it can be used on either the right-hand or the left-hand rail; the clamping mechanism being adjustable to establish the proper coupling between drive and pinch rollers, and being releasable in the event of power failure, and which above all does not unduly load the gears and bearings of the motor device.

It is also an object of the invention to provide a door operator having a drive roller which is small compared to previous drive rollers, thereby reducing the torque output required from the motor, with consequent reduction in the size of the gears in the gear box, resulting in higher efficiency of the unit to the point that a series wound motor can, for the first time, be used in door operator service.

For a better understanding of the present invention, together with other and further objects thereof, reference is had to the following description taken in connection with the accompanying drawings, and its scope will be pointed out in the appended claims.

An aspect of the present invention lies in the provision

of a door operating device for use with a vertically slidable door, such as a garage door, mounted on two spaced apart regular side rails, wherein reversible electric motor means are used, and wherein a pair of rollers one of which is a drive roller and the other of which is a pinch roller are used to couple the motor to one of the regular rails. One of the rollers, preferably the drive roller, is made of rubber and the rollers couple to opposite sides of the rail. The rubber drive roller is driven by the motor and the coupling roller is at a location on the opposite side of the rail. Pinching means squeeze the rollers together. Pivot means connect the motor unit to the door to provide for the required pivoting action therebetween about an axis parallel to the axes of the pinch rollers, and a U-shaped connector rigidly connects the pivot means to the motor means. The pivot means, the U-shaped connector and the pinch rollers in the door track combine to form a connection with controlled rigidity, except for the pivoting motion, which holds the door against cocking motion in respect to its tracks, yet permits a controlled amount of flexibility sufficient to actuate a safety switch under emergency conditions.

With reference to the drawings there is shown in FIGURE 1 a section of a garage and garage door, showing a regular door track and the unit of the present invention mounted between the regular track and the door.

FIGURE 2 is a side view of the mounted operator showing the door in its up position.

FIGURE 3 is an end view of the mounted operator showing the toggle clamp.

FIGURE 4 is a side view of the toggle clamp.

FIGURE 5 is a sectional view taken through the portion of the device which connects the operator to the door.

With reference to FIGURE 1 the reference character 10 indicates a garage wall and the door is indicated by reference character 11. A pair of regular tracks or rails 12 (only one of which is shown) are connected to the garage 10 in any suitable manner and constitute the two spaced apart rails on which the door 11 runs. The motor unit 14 of the present invention is connected to the door by hardware means 15 and to the rail 12 on which the door runs by means of pinch rollers means 16, 17. Thus the standard door rail, without modification, is used by the operator, and it is not necessary to add a special center rail for the operator. Further, it is not necessary, as it has been in the past where the operator runs on one of the regular door rails, to have a drive roller on the far rail with a power connection from the motor unit to the far drive roller to prevent cocking and binding of the door.

The operator or motor unit comprises four major components; the first of which is the motor 14 and the gear box 21 which through shaft 20 drives the rubber drive roller 16; the second of which is a U-shaped connector 30 which is connected between the motor and gear box units 14, 21 and the door; the third of which is the connector means 35 for connecting the U-sshaped connector to the regular door hardware; and the fourth of which is a toggle clamp 50 for clamping the two drive rollers 16, 17 together on opposite sides of the door rail 12.

The details of the motor unit 14 and of the gear box 21 are not shown in great detail, but they comprise a series wound motor which drives a worm gear 22 which in turn drives a gear 23 in the gear box 21. Gear 23 drives the rubber drive roller 16 which is tightly coupled to the underneath side of the track 12.

As shown in FIGURE 3, the rubber roller 16 is grooved to accommodate the underneath side of track 12. The shaft 19 of the coupling roller 17 is pivotally mounted by pivot means 18 to the top of the gear box 21 and extends

across the gear box toward the track 12, carrying with it the rotatable coupling wheel 17 at its outer end. A U-shaped locating device 24 mounted on the top of the gear box 21 receives a portion of the shaft 19 to prevent it from moving sideways, as shown in FIGURE 2.

The motor and gear box unit 14, 21 carry two mounting brackets 25, 26 (FIGURE 2) to only one of which the U-shaped connector 30 is rigidly bolted by two spaced-apart bolts 27 (only one of which is shown in FIGURE 1) for right-hand rail mounting and to the other of which brackets it may be bolted for left-hand rail mounting.

The U-shaped connector 30 is shown in detail in FIGURE 2. It preferably is made of hot rolled steel rather than spring steel in order to reduce costs, though of course spring steel may be used. It is comprised of two legs 31, 32 which are substantially parallel with an interconnecting arcuate portion 33 connected to the two legs and forming a closed end. The other end is open and at the open end the leg 31 has an outwardly extending mounting bracket 34 which is connected to the motor and gear box unit 14, 21 by means of the two bolts 27. Leg 32 of the U-shaped connector has connected to it by bolts 36 two spaced-apart L-shaped connectors 35, one leg of each of which has a hole through it through which the axle 40 of a regular door roller 39 extends to establish a pivot about which pivotal motion takes place between the door and the motor unit as the door opens and closes. Between the spaced-apart L-shaped connectors 35 (FIGURE 1) and mounted around the axle 40 of the door roller 39 is the upper door bushing 41 which forms part of the regular door hardware and which is tightly connected to the door 11 by flat plate 42 screwed to the face of the door.

It is very important that the L-shaped connectors 35 be bolted tightly to the broad U-shaped connector 30 and that they bear against the edges of the door bushing 41 so that there is no lateral play of the bushing 41 between the L-shaped connectors 35. Since the width of the door bushings 41 can vary from door-to-door, the legs of the connectors 35 which are bolted to the U-shaped connector 30 each should have a transverse slot 37 (FIGURE 5) to accommodate bolts 36. Thus upon mounting the door operator to the door, using only the unmodified regular door hardware which is found at the top door roller 39, the two L-shaped connectors 35 are pushed in as close to each other as possible, the regular door bushing 41 holding them apart. The bolts 36 then are tightened. This, together with the broad U-shaped connector 30, provides the highly important stability at the location where the operator is connected to the door. This stability is essential. Otherwise the corner of the door has some lateral freedom and the door will cock and bind. Thus it will be seen that one of the important functions of the U-shaped connector is to permit pivoting action about axle 40 with respect to the bushing 41 with an absolute minimum of any other motion, thus constraining the corner of the door and the door operator to move up and down as a unit.

At the other side of the motor unit, opposite from the U-shaped connector, the rubber drive roller 16 and the coupling roller 17 are closely coupled to the track 12, and since the coupling roller is within the groove of the track and the rubber roller is outside and is shaped to conform to the bottom of the track, the motor unit is constrained to move parallel to the plane of the track. This forces the upper corner of the door to which the motor unit is connected to move in a plane parallel to the track, and prevents cocking and binding of the door in its tracks.

The device of the present invention is the first door operator which can run on only one of the two regular door tracks, without a driving connection across to the opposite door track, and operate the door without binding, even though it may be a loose fitting 16-foot wide door.

The U-shaped connector 30 has a second major function. In conjunction with a micro-switch 45 mounted on one of its legs and electrically connected into the motor circuit, it serves as a safety device.

When the door is moving down and hits an obstruction, the legs 31, 32 of the U-shaped connector while having controlled rigidity in a transverse direction can move toward each other, the arcuate portion 33 bending slightly, and the micro-switch 45 is actuated by switch arm 47 connected to leg 32 to break the electrical circuit to the motor. As shown, micro-switch 45 is carried by the bracket 46 connected to the connector legs 31 and it extends toward the other connector leg 32 on which is mounted the adjustable switch actuating blade 47. The blade 47 is a spring member which is held in position by an adjustable screw threaded device 48 which is threaded through the leg 32 into engagement with the blade 47 to adjust the permitted amount of bending of the U-shaped connector 30 before the micro-switch 45 operates, thus to adjust the amount of force the downwardly moving door will exert before the micro-switch is actuated to shut off the motor.

Since the U-shaped connector 30 is made of hot rolled steel rather than spring steel it is essential that it not be over-bent. To prevent this the bracket 46 serves another purpose. A stop device 55 is connected between the bracket 46 and the opposite leg 32 of the U-shaped connector 30. This stop-device, after the connector bends enough to close switch 45, exerts a positive stopping action between the legs 31, 32 at the open end thereof, which prevents over bending of the connector, especially in the portion 33.

Another important feature of the door operator lies in the motor unit which comprises the series wound electric motor, the gears to the rubber drive roller and the drive roller. Because a large gear 23 is driven by worm 22 and a small rubber coupling roller 16 is used, it is possible to use an inexpensive series wound motor. Preferably the diameter of the rubber drive roller 16 should be not greater than the diameter of the coupling wheel 17, and the diameter of the gear 23 should be about twice the diameter of the drive roller. This permits the use of the series wound motor with its advantage of maximum torque at zero speed.

An important feature of the invention is the toggle clamp 50 which tightly clamps together the two pinch rollers 16, 17 on opposite sides of the track 12.

The toggle clamp 50 comprises a bushing 51 which surrounds the axle 20 at a location between the rubber roller 16 and the gear box 21. It is important that the toggle be just as close as possible to the rubber roller and the pinch roller. Otherwise the lever arms and the forces involved work to a disadvantage. A broad collar 52 bears against the bushing 51 and is connected to a long handle 53. A ball and socket joint is formed between the partial ball 54 and a socket formed through the arm 56. Arm 56 is welded to the pair of hook arms 57 which extend up over and are hooked around the shaft 19 of the pinch roller 17. FIGURE 4 shows the toggle clamp in two different positions; the solid line drawing showing the position wherein the toggle is in its clamping position and the dotted line drawing showing the position wherein the toggle is in its relaxed, or unclamped, position. In this second position the clamp can be taken off, completely releasing the two rollers from each other. A chain or rope may be connected through hole 58 and extend downwardly so that a person can readily move the handle 53 from the clamped position to the other in the event of failure of the electric power so that the door can be operated by hand. The handle portion 53 is in threaded engagement with the stem portion 59 which is connected to the collar 52. If there is wear on the rubber pinch roller 16 tending to reduce the coupling between rollers 16 and 17, rotation of the handle 53 in the proper direction will re-establish the proper coupling force.

While there have been described what are at present considered to be the preferred embodiments of this invention, it will be obvious to those skilled in the art that various changes and modifications may be made therein without departing from the invention, and it is, therefore,

aimed in the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

I claim:

1. In a door operating device for use with a vertically slidable door mounted on two side tracks; reversible electric motor means; electric circuit means for operating said motor means; driving roller means driven by said motor means and in driving engagement with one of said side tracks, pivot means for connection to the door for pivoting motion about an axis parallel to the axis of said driving roller means and rigid against other motions; and a U-shaped connector formed from flat stock rigidly connected to said pivot means and rigidly connected to said motor means; said U-shaped connector having two spaced apart legs and providing spring motion of the legs toward each other as the door undergoes excess resistance to motion, safety switch means electrically connected in said circuit means and mounted in respect to said U-shaped connector to be actuated when excess resistance to door motion is encountered; said pivot means, said U-shaped connector and said driving roller means in engagement with said track forming a rigid connection between the door and the motor means except for said pivoting motion which connection restrains the door against cocking motion in respect to the said side tracks.

2. A door operating device as set forth in claim 1, further characterized by said safety switch means being mounted between legs of said U-shaped connector and by the legs of said connector moving toward each other when the door encounters excess resistance during closing motion.

3. A door operating device as set forth in claim 2, further characterized by said U-shaped connector being formed of hot rolled steel and by means for preventing the said legs from being permanently deformed in respect to each other.

4. A door operating device as set forth in claim 2, further characterized by adjustable means for adjusting the instant at which the safety switch is operated in relation to the motion of said legs toward each other.

5. A door operating device as set forth in claim 4, further characterized by the width of said U-shaped connector in a direction parallel to the axis of said driving roller means being substantially as wide as the bearing of the door hardware for maximum stability against cocking of the door.

6. A door operating device as set forth in claim 5, further characterized by said pivot means comprising two spaced apart L-bars one leg of each of which is rigidly connected to said U-shaped connector, and the other leg of each of which extends perpendicularly away therefrom and has a hole therein to accommodate the shaft of a door roller, the bearing of the door hardware extending between said two L-bars and being in engagement with each, said L-bars being sufficiently rigid and being so mounted that they will not to an appreciable degree spread outwardly, whereby the pivot connection between the door hardware and the pivot means permits substantially only rotary motion about an axis parallel to the axis of said drive roller.

References Cited by the Examiner

UNITED STATES PATENTS

2,925,267 2/60 Volf ..... 268—59

HARRISON R. MOSELEY, *Primary Examiner.*