Nov. 15, 1966 E. E. LODGE 3,284,952

AUTOMATIC DOOR OPERATOR

Original Filed March 22, 1962 4 Sheets-Sheet 1

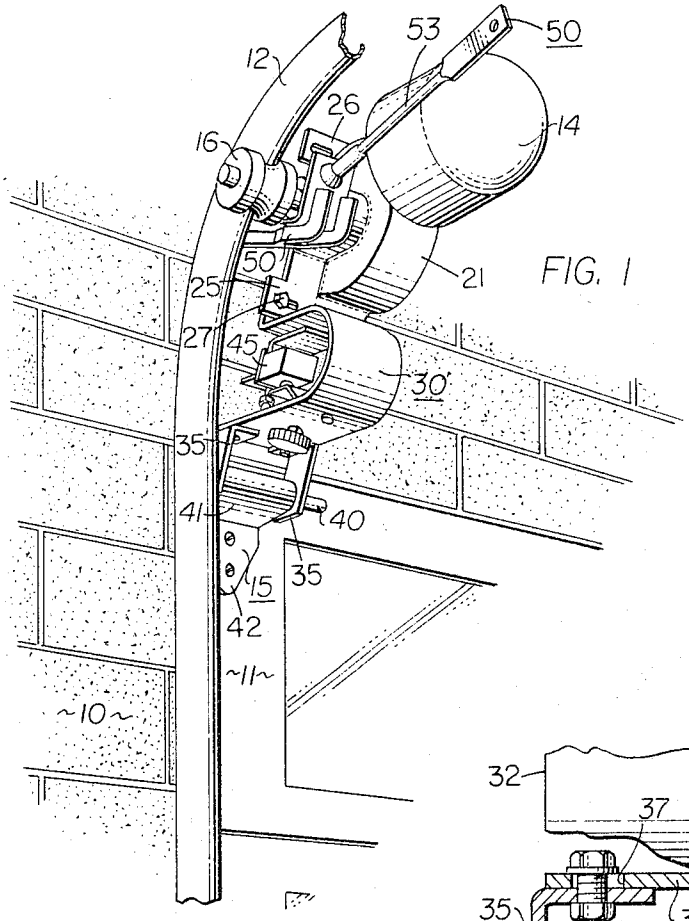


FIG. 1

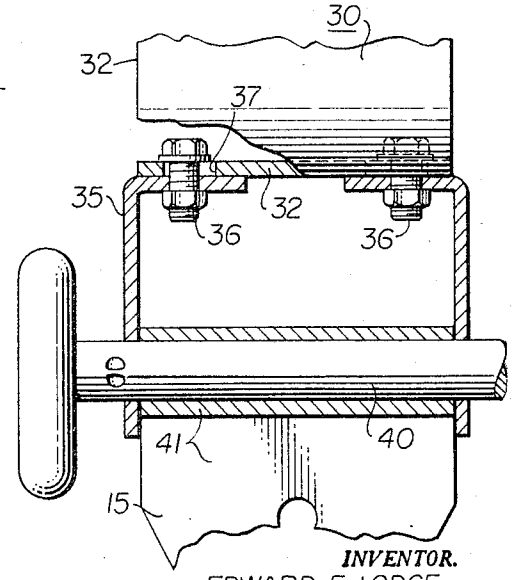


FIG. 5

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AUTOMATIC DOOR OPERATOR

Original Filed March 22, 1962 4 Sheets-Sheet 2

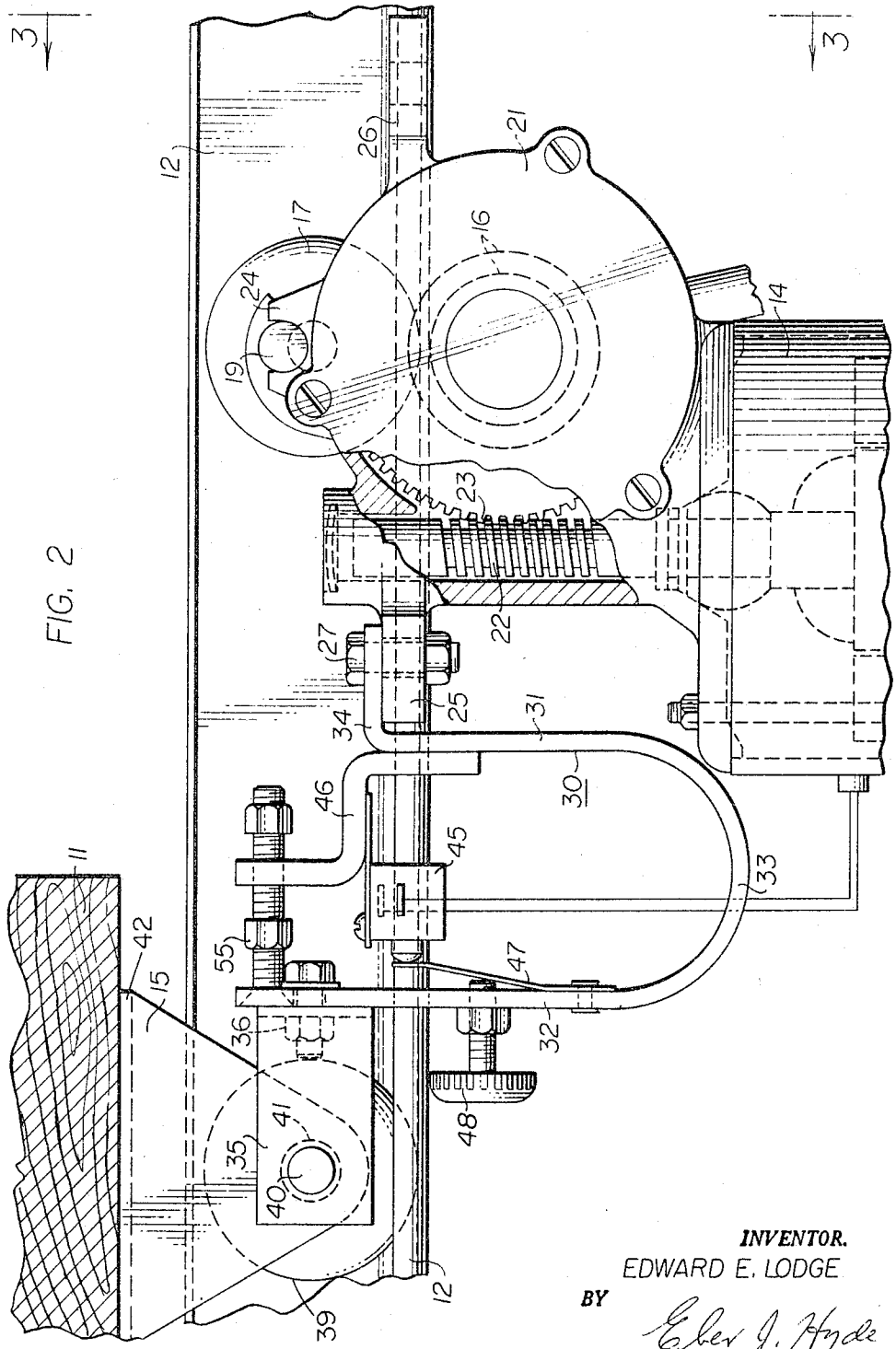


FIG. 2

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Nov. 15, 1966 E. E. LODGE 3,284,952

AUTOMATIC DOOR OPERATOR

Original Filed March 22, 1962 4 Sheets-Sheet 3

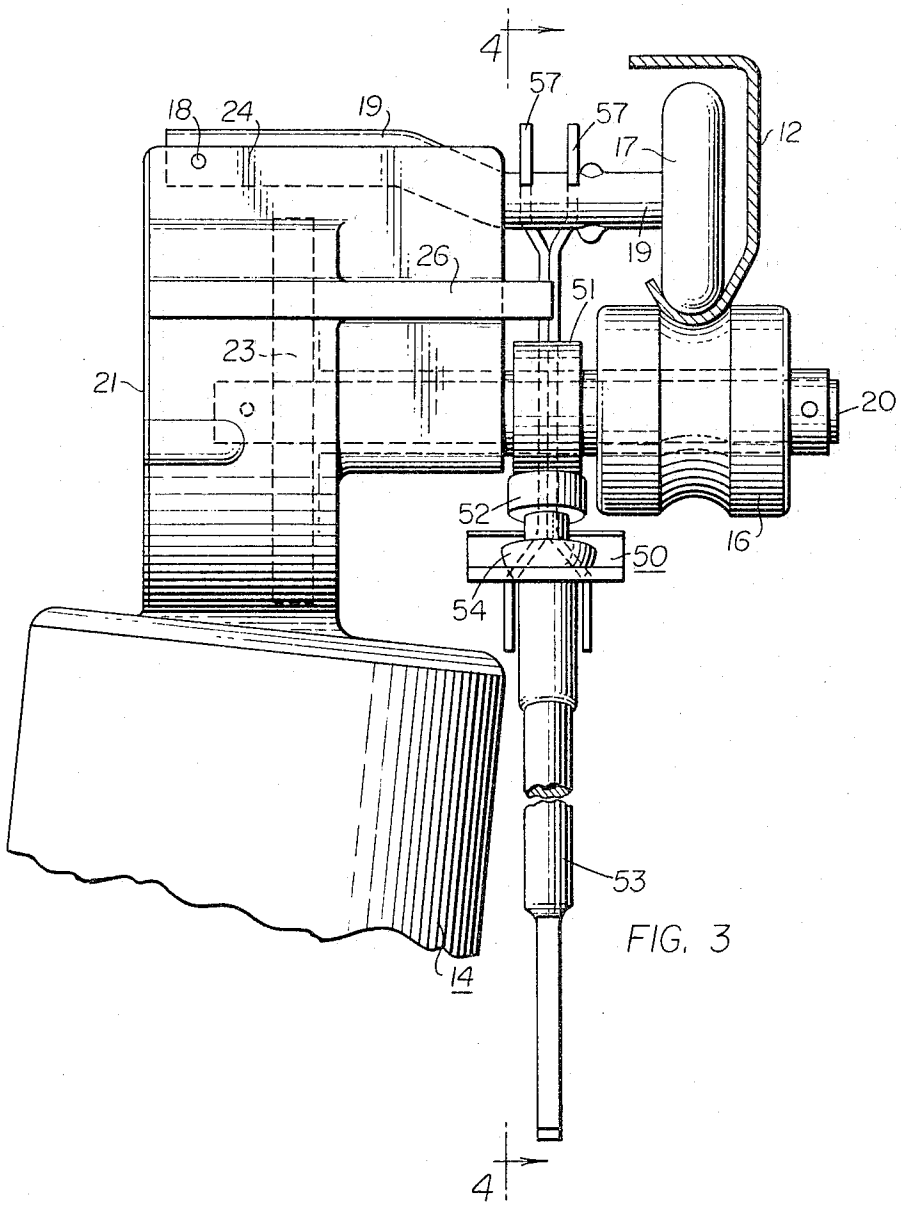


FIG. 3

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AUTOMATIC DOOR OPERATOR

Original Filed March 22, 1962 4 Sheets-Sheet 4

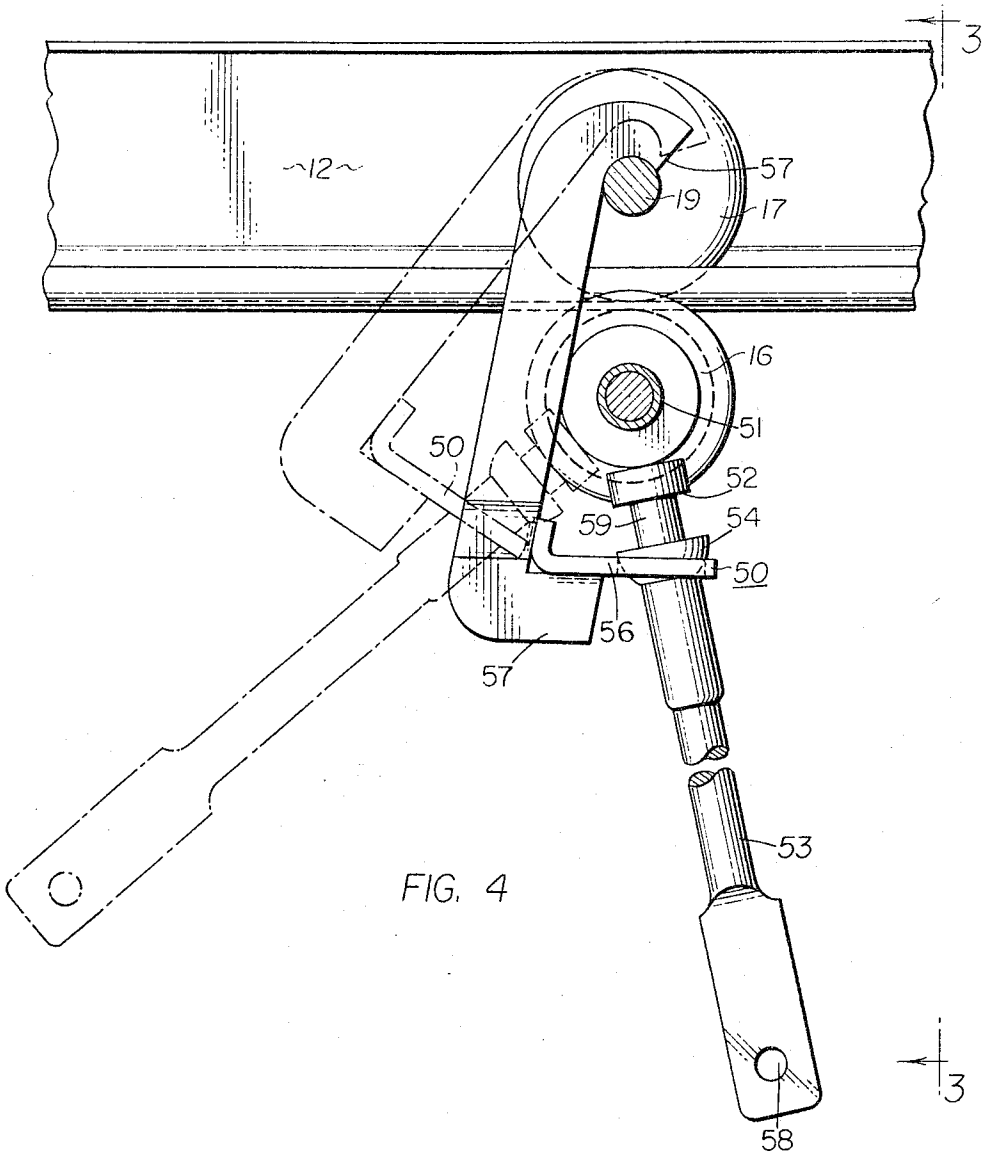


FIG. 4

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3,284,952

AUTOMATIC DOOR OPERATOR

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Original application Mar. 22, 1962, Ser. No. 181,647, now Patent No. 3,202,415, dated Aug. 24, 1965. Divided and this application Nov. 27, 1964, Ser. No. 414,115

7 Claims. (Cl. 49—360)

This is a division of application Serial No. 181,647 filed March 22, 1962, now Patent No. 3,202,415. 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 United States Patent 2,925,267, issued February 16, 1960, to Matt A. Volf. In the Volf 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.

In the parent application the claims are directed to the U-shaped rigid connector between the door and the motor unit. In the present application the claims are directed to a toggle mechanism for clamping the pinch rollers to a track.

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 toggle clamping device for quickly and easily clamping pinch rollers to a rail, and wherein a simple, inexpensive and easily operated adjustment permits adjustment of the coupling pressure exerted by the pinch rollers on the rail.

It is a further object of the invention to provide a door operator which is resiliently clamped to the regular door rail or to an auxiliary 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.

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 invention lies in the provision of a toggle device for pinching together on either side of a rail a pinch roller and a drive roller. The toggle device is located between the motor unit and the rollers and engages the axle of at least one of the rollers. The operating arm of the toggle device has two positions: one in which no pinching bias is established between the two rollers and the second in which the arm is in an over-center, stable, position and a strong bias is exerted forcing the rollers together on either side of a rail. Simple adjustment means are provided so that by merely turning the operating arm the magnitude of the bias can be changed.

With reference to the drawings there is shown in FIGURE 1 a section of a garage and a 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 constitutes 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 roller means **16, 17**. Thus the standard door rail, without modifications, 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 rotor **14** and the gear box **21** which through shaft **20** drives the rubber belt 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-shaped 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 couple 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** are then 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 through 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 **33** 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 claimed in this application 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 **56** 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. Rotation of handle **53** in a counterclockwise direction causes the stem portion **59** to be thrust out toward the bushing **51**. This operation is best performed while the toggle is in its relaxed position shown in dotted lines. Thereafter when the toggle is thrown into its over-the-center, stable position, an increased biasing force will be exerted between the two rollers.

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.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. In a door operating device for use with a motor operated vertically slidable door mounted on track means and wherein the motor means is connected to the door; a pair of rollers mounted on spaced apart axle means one a pinch roller and the other a drive roller, at least one of which is made of resilient rubber-like material and at least one of which is driven by said motor means, one of said rollers engaging one side of said track means and the other engaging the opposite side of said track means at a location opposite said first roller; toggle action pinching means located between said motor and said rollers for squeezing said rollers together on opposite sides of said track including a hook engaging one of said axles and bushing means engaging the other axle; pivot means

for connecting the motor to the door for pivoting motion about an axis parallel to the axes of said pinch rollers and rigid against other motions; and a connector rigidly connected to said pivot means and rigidly connected to said motor means; said pivot means, said connector and said pinch rollers in said track forming a rigid connection, except for said pivoting motion, which holds the door against cocking motion in respect to the track means.

2. A door operating device as set forth in claim 1, further characterized by said pinch roller axle means having its roller mounted at one end thereof, means pivotally connecting the other end of said axle means to said motor means whereby said pinch roller can be raised and lowered in respect to said drive roller, and by said toggle action pinching means located between said pinch roller and said motor means exerting a clamping action through said hook and bushing on said axle means pulling said pinch roller toward said drive roller.

3. A door operating device as set forth in claim 2, further characterized by said toggle action means being mounted on said bushing around said pinch roller axle extending from said motor means to said drive roller, and having said hook portion of said toggle device connected over said pinch roller axle.

4. A door operating device as set forth in claim 3, further characterized by said toggle action means including adjustment means for adjusting the pressure exerted by the toggle means between the pinch rollers thereby to adjust the degree of clamping action obtained between the drive and pinch rollers to compensate for wear and loosening of parts thereof.

5. A door operating device as set forth in claim 4, further characterized by a manually operable lever connected to said toggle means whereby manual release of the coupling action between said drive and pinch rollers can be obtained by moving said lever.

6. In a door operating device for use with a motor operated vertically slidable door mounted on track means and wherein the motor means is connected to the door; a pair of rollers mounted on spaced apart axle means, one a pinch roller and the other a drive roller, at least one of which is made of resilient rubber-like material and at least one of which is driven by said motor means, one of said rollers engaging one side of said track means and the other engaging the opposite side of said track means at a location opposite said first roller, said pinch roller axle means having its roller mounted at one end thereof,

and means pivotally connecting the other end of said pinch roller axle means to said motor means whereby said pinch roller can be raised and lowered in respect to said drive roller; toggle action pinching means located between said motor and said rollers on opposite sides of said track, said toggle action means including a hook engaging one of said axles and bushing means engaging the other axle means for exerting a clamping action through said hook and bushing on said axle means pulling said pinch roller toward said drive roller, at least the said hook portion being reversible whereby said door operating device can be attached to either the right hand or left hand rail of a door; said toggle action means including adjustment means for adjusting the pressure exerted by the toggle means between the pinch rollers thereby to adjust the degree of clamping action obtained between the drive and pinch rollers to compensate for wear and loosening of parts; pivot means for connecting the motor to the door for pivoting motion about an axis parallel to the axes of said pinch rollers and rigid against other motions; and a connector rigidly connected to said pivot means and rigidly connected to said motor means; said pivot means, said connector and said pinch rollers on said track forming a rigid connection except for said pivoting motion which holds the door against cocking motion in respect to said track means.

7. A door operating device as set forth in claim 6, further characterized by said bushing portion of said clamping means being permanently connected to said motor shaft and by said bushing portion including threaded means, complementary means for threaded engagement with said permanently mounted threaded means and in engagement with an arm which hooks over the shaft of the pinch roller, said threaded complementary means providing pressure adjustment and being separable from the permanently mounted threaded means for reversal of said hook arm.

References Cited by the Examiner

UNITED STATES PATENTS

2,752,150	6/1956	Richmond et al.	268—74
2,925,267	2/1960	Volf	268—59

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