Dec. 12, 1961 G. A. CURTIS 3,012,520

REVERSIBLE DRIVING MECHANISM WITH AUTOMATIC STOP

Filed Nov. 18, 1959 2 Sheets-Sheet 1

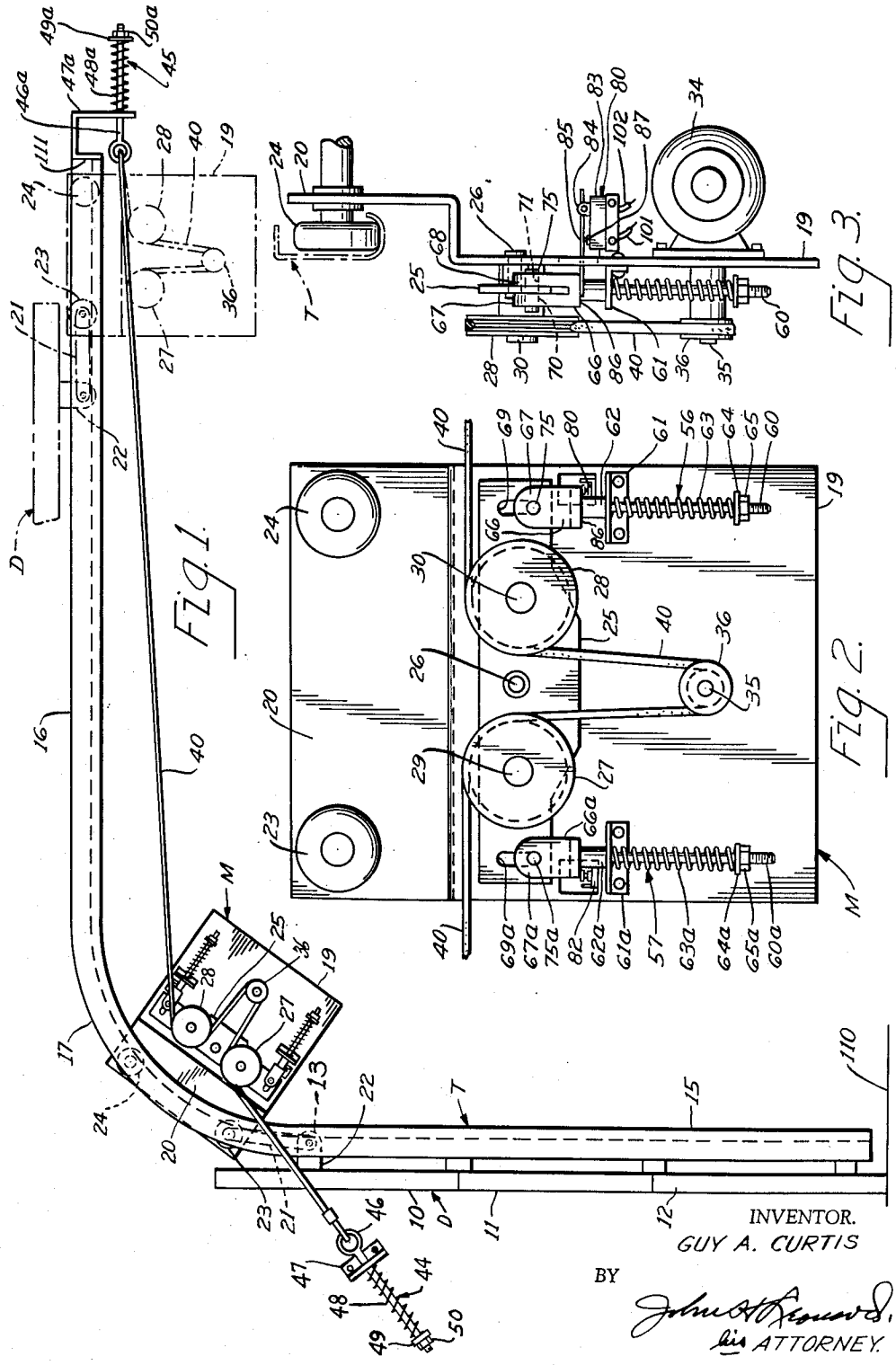

Fig. 1.

Fig. 2.

Fig. 3.

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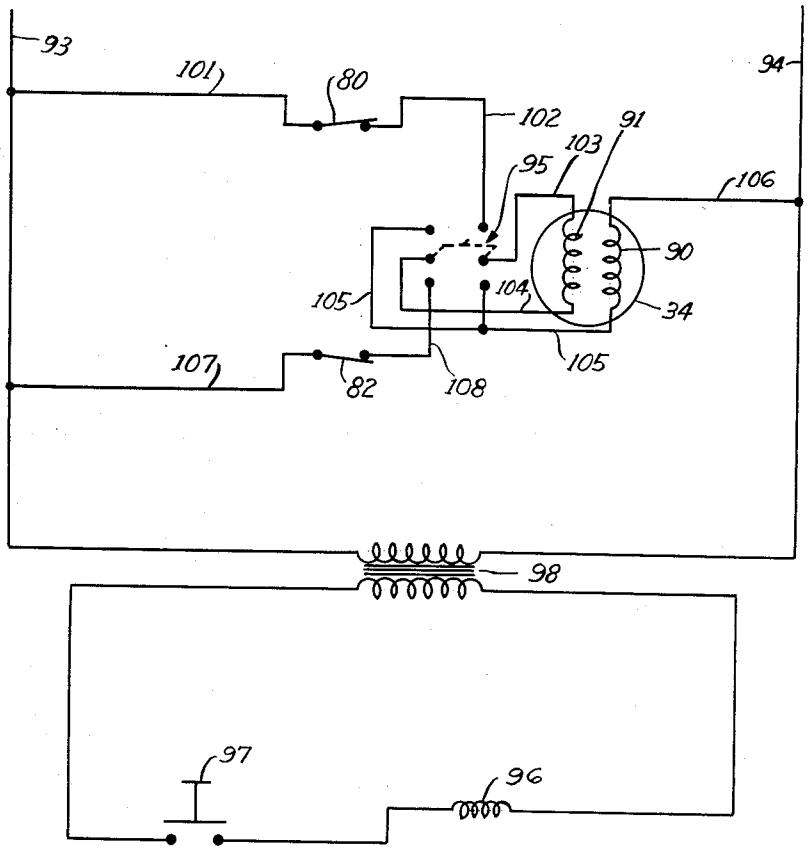

Fig. 4.

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REVERSIBLE DRIVING MECHANISM WITH AUTOMATIC STOP

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This invention relates to a door operating mechanism, and more particularly to a door opening and closing mechanism for overhead type garage doors.

Many prior devices for operating overhead garage doors have inherent disadvantages. For example, they are relatively complicated structures which are difficult and expensive to install, usually requiring considerable time of a highly skilled installation crew. Additionally, because of the necessity of providing a free path of movement for the door, the motor drive unit is usually disposed in a relatively inaccessible location. Also, many prior devices employ impositive drive arrangements with the resultant necessity of positioning and installing the mounts for the drive unit and cooperating racks independently of the door and door guide rails. Such mounts are difficult to support because the mounts must not interfere with the movement of the door, yet must be accurately aligned relative to the door and its guide rails in a very limited space.

Further disadvantages of prior devices are the necessity of extremely accurate alignment of the numerous relatively moving parts and of frequent adjustments of these parts, and the inapplicability of such devices to numerous existing structures due to the lack of the necessary space above or beside the door for the mounting of a motor drive unit and associated independent tracks and racks.

It is an object of the present invention to provide an overhead garage door operator that is simple, rugged, and inexpensive to manufacture and install, and which requires for installation substantially no structure in addition to that required for the door itself.

A further object of the invention is to provide an overhead garage door mechanism capable of arresting movement of the door when an obstruction in the path of the door is encountered by the door in either direction of movement of the door.

A further object of the invention is to provide an overhead garage door operator providing economy in manufacture, warehousing, and shipping, simplicity in design, convenience and dependability in operation, and savings in cost in building construction.

A further object of the invention is to provide an overhead garage door operator that is relatively light in weight, that is quiet in operation, and which may be applied to any standard existing overhead garage door.

More specific objects of the invention are the provision of an overhead garage door operator providing a minimum of slippage in the operation of the mechanism, the use of stampings in place of castings for the major parts thereof, and providing a structure which may be quickly and simply fabricated, installed, and repaired.

Briefly, the foregoing objects are accomplished by the provision of an overhead garage door operating mechanism coupled to the door for travel on one of the door tracks. Most overhead type garage doors are provided with rollers at the opposite vertical edges thereof for travel in roller tracks mounted interiorly of the garage at opposite sides of the door opening, with each of the tracks including a vertical front portion operatively connected to a rearwardly extending horizontal top portion by an intermediate curved section of track.

In one form of the invention, the door operating mechanism is mounted on a base plate having casters or rollers adapted to travel on the horizontal top portion of

one of the garage door tracks and supporting the plate parallel to a generally upright plane. The plane is coupled to the door for travel along the track therewith. A movable plate or control member is mounted on the upper portion of the base plate for limited movement in a plane substantially parallel to the plane of the base plate, such mounting preferably being by means of a pivot enabling the movable plate, hereinafter referred to as the pivot plate, to tilt about a pivotal axis a predetermined amount in opposite directions relative to the base plate. Force directing means in the form of a pair of horizontally spaced force directing pulleys are mounted on the pivot plate for rotation about parallel horizontal axes. Disposed on the base plate is a suitable reversible drive means, such as an electric motor, having on its drive shaft a driving pulley. Operatively interwound about the motor pulley and the force directing pulleys is a suitable drive belt of the fabric or chain type, or the like, which is tautly mounted by its ends interiorly of the garage adjacent and substantially parallel to the aforementioned horizontal top portion of the garage door track on which the base plate rides. The driving pulley is arranged for drivingly engaging the belt at a location between the points of engagement of the belt with the force directing pulleys. Thus, the belt tractionally contacts all of the pulleys such that energization of the motor causes the base plate to travel along its path on the track and, in turn, move the garage door along its tracks, with the direction of travel of the door operating mechanism and door being determined by the direction of rotation of the motor.

With the aforedescribed structure, whenever the motor is energized and power is tractionally applied to the belt through the turning or torque action of the motor pulley, the pivot plate will be caused thereby to pivot or tilt on the base plate. The greater the torque action of the motor pulley, the greater the pull on the belt, the greater the applied tilting force, and the greater the tilting of the pivot plate. Thus, if the door strikes an obstruction in its path of travel while the motor pulley is driving, the tension on the cable in the driving direction is thereby increased and, in turn, reacts on one of the pivot plate pulleys to cause the pivot plate to tilt a substantial amount. The degree or amount of such tilting action may be controlled by a suitable biasing device such, for example, as a pair of spaced springs operatively interposed between the pivot plate and the base plate so that the tilting action of the pivot plate is resisted a predetermined amount by the springs. Suitable adjusing means may be provided on the springs for adjusting the biasing force of the same.

Disposed in horizontally spaced relation immediately below the pivot plate are settable means which include a pair of self opening limit switches which are normally held closed and are preselectively actuated by the pivot plate depending on its direction of tilt. The arrangement is such that, in one direction of travel of the pivot plate, when the pivot plate tilts a predetermined amount in the direction of travel, the first limit switch is released and opens for stopping the motor and the second limit switch remains held closed providing a stand-by circuit for reversing the motor. When the pivot plate is driven in the opposite direction of travel, the first limit switch is returned thereby to a closed position. If the plate is tilted in the new direction of travel, the second limit switch is thereby released and opens. The limit switches are wired into the motor control circuit such that if the door strikes an obstruction while travelling upward to open position, the pivot plate tilts and releases the first limit switch which then opens, thereby stopping the motor from rotating in the direction that opens the door. However, at this point, the second limit switch is still held in closed position such that the motor may be energized for rotation in the opposite direction,

thus enabling the door to be closed. When the door is urged in the downward direction, the tension on the belt is reversed and the pivot plate is restored to normal position by the springs and the first limit switch is closed.

When the door strikes an obstruction while traveling downwardly to closed position, the pivot plate tilts from its normal intermediate position in the new direction of travel and releases the second limit switch which opens, thereby stopping the motor from rotating in the direction that closes the door. At this point, the first limit switch is still held closed, thus enabling the door to be opened when the motor is next energized.

With this construction, the travel of the door in either direction will be stopped almost instantly when the door strikes an obstruction, such stopping action being effected by a door operating mechanism that is simple and light in structure, positive in action, and which may be easily mounted in an accessible position.

Other objects and advantages of the invention will be apparent from the following description taken in conjuction with the drawings, in which:

FIG. 1 is a partial side elevational interior view of a garage having an overhead door (shown in closed position) and incorporating a door operating mechanism constructed in accordance with the invention; this view also shows in dot-dash lines the door and door operating mechanism in open position;

FIG. 2 is an enlarged front elevational view of the door operator shown in FIG. 1;

FIG. 3 is a right side elevational view of the door operator shown in FIG. 2; and

FIG. 4 is a schematic wiring diagram of a portion of the motor control circuit of the door operator shown in FIG. 2.

Although the invention is shown and described herein with reference to overhead-type garage doors in which it has special advantages, it will be understood that it may be applied to any type of overhead door, or may be applied as a safety release device for a power-driven mechanism in which some of the advantages are derived.

Referring to the drawings, there is shown for purposes of illustration, a conventional overhead-type garage door D disposed in its vertical closed position, such door being formed of a plurality of hingedly connected, horizontally extending sections **10**, **11**, and **12**. Although the door is shown as a sectionally hinged door, it may be of any suitable construction as its specific construction forms no part of the invention. The door D is provided with rollers **13** journaled on the opposite vertical edges of the door to enable the door to ride or travel in support means in the form of spaced roller tracks T mounted interiorly of, and secured to, the garage at opposite sides of the door. Each of said tracks includes a front vertical portion **15** and an overhead horizontal top portion **16**, and an intermediate curved portion **17** joining the top portion and front portion.

In accordance with the preferred form of the invention, there is provided a door operating mechanism M mounted for travel on the track portions **16** and **17**, such mechanism operating to open and close the door in a manner to be described.

The mechanism M includes a support in the form of a base plate **19** having a rearwardly offset top portion **20**, such plate being connected or coupled through the pivotal link **21** to the door D through the bracket **22**, as shown. The base plate **19** contains suitable propelling means for propelling the plate along the track, and includes means for arresting movement of the propelling means under predetermined conditions. Such propelling means are now to be described.

Rotatably mounted in spaced relation on the base plate top portion **20** are a pair of casters or rollers **23** and **24** which are adapted to ride in the track T. Also mounted on the base plate is a strain sensing means which includes a control member or plate **25** which is movable to different positions on and relative to the plate **19**. For mounting the plate **25** for movement, it is pivotally mounted on the base plate **19** by means of the bolt **26** which forms a pivot point such that the plate **25** is a pivot plate and may move by pivoting or tilting a predetermined amount on the base plate in a plane substantially parallel to the plane of the base plate. Suitable force directing means are provided on the pivot plate **25**. These means may comprise a pair of idler rollers or pulleys or sprockets **27** and **28** which are rotatably mounted in spaced relation to each other on the pivot plate **25** by the bolts **29** and **30**, respectively.

A suitable reversible drive means, such as the gear head series motor **34**, may be centrally mounted on the lower portion of the base plate **19**, with a drive shaft **35** of the gear head thereof journaled in and extending through the plate **19** and having a drive pulley **36** secured to the outer end thereof. The motor **34** may be an electric motor having suitable energizing means connected thereto. Any suitable type of motor such as a hydraulic motor may be employed in place of the electric motor **34**. Although the motor is shown and described herein as being mounted on the base plate **19**, such motor could be mounted on the pivot plate with equal effectiveness.

In the preferred form, the motor is mounted so that the pulley **36** is disposed in operative spaced relation below the pulleys **27** and **28** substantially in the plane thereof.

Operatively interwound about the motor pulley **36** and the pivot plate pulleys **27** and **28** is a suitable elongated flexible member or drive line, which may be a belt, chain, or cable **40**, and the like. A flexible belt and conventional belt pulleys are shown for purposes of illustration, it being understood that a chain and sprocket type pulleys can be used if a more positive drive is desired. The belt is tautly mounted by its ends interiorly of the garage adjacent and substantially parallel to the upper portion of the track the mechanism M rides on. The belt **40** is mounted under a predetermined tension by spring-mounted eye bolt anchoring devices **44** and **45**. Since the anchoring devices **44** and **45** are identical in function and structure, the parts of device **44** are identified by numbers only and the corresponding parts of device **45** by the same numbers as used on device **44**, but followed by the suffix "*a*." The device **44** includes an eye bolt **46** to which the cable is secured, the shaft of the eye bolt passing through an aperture in the fixed bracket **47** in sliding relation therewith, such bracket being secured to the adjacent garage wall. A suitable coil spring **48**, of larger diameter than the bolt **46**, is telescoped onto the bolt in sliding relation therewith and is retained under compression thereon by the washer **49** and the nut **50**, such nut being threaded onto the end of the eye bolt, as shown. Thus, by threadedly adjusting the nut **50** on the eye bolt, the degree of compression of the spring **48** may be adjusted and, in turn, the tension of the belt **40** correspondingly adjusted.

Thus, the belt **40** drivingly or tractionally contacts all of the pulleys **27**, **28** and **36** such that energization of the motor **34** causes the base plate **19** to travel along its path and, in turn, move the garage door D along its tracks, with the direction of travel of the door being determined by the direction of rotation of the motor. The axis of the drive pulley **36** is positioned so that the pulley **36** tractionally engages the belt at a location between the points of engagement of the pulleys **27** and **28** with the belt.

With the pivot plate structure and pulley arrangement thus far described, the pivot plate **25** would pivot or tilt on the base plate **19** whenever the motor **34** is energized and power is tractionally applied to the belt **40** through the turning or torque action of the motor pulley **36**. The greater the torque action of the motor pulley **36**, the more the pivot plate **25** tends to tilt. The direction of tilt is determined by the direction of drive. Thus, if the door

should strike an obstruction in its path of travel, the torque on the motor pulley **36** would increase substantially and cause the pivot plate **25** to tilt a substantial amount. The belt load required for substantial tilting of the plate **25** may be preselectively controlled and the pivot plate **25** biasly retained in a neutral position on the base plate **19** by adjustable biasing or resilient means now to be described.

Disposed on the base plate **19** in spaced relation below the pivot plate **25** are a pair of biasing devices **56** and **57**. Since the devices **56** and **57** are identical in construction and operation, the parts of device **56** are identified by numerals only and the corresponding parts of device **57** by the same numerals as used on device **56**, but followed by the suffix "*a*." The device **56** includes a cylinder-head bolt **60** with the shaft thereof passing through an aperture in a fixed bracket **61** in sliding relation therewith, such bracket being secured to the base plate **19**. The cylindrical head **62** is of a larger diameter than the aperture in the bracket **61**. A coil spring **63**, of larger diameter than the bolt **60**, is telescoped onto the bolt in sliding relation therewith, such spring abutting the bracket **61** and being retained under compression on the bolt by a washer **64** and an adjusting nut **65**, such nut being threaded onto the end of the bolt. Secured to the upper end of the bolt head **62** is a connecting clevis **66**. The upper portion of the clevis **66** is formed into a bifurcated end portion including a pair of ears **67** and **68** spaced from each other to form a trough for receiving part of the lower portion of the pivot plate **25**, as shown. The lower portion of the pivot plate has an elongated slot **69** formed therein which is normally disposed in line with the apertures **70** and **71** in the ears **67** and **68**, respectively, to form a continuous aperture through these parts for receiving the locking pin **75**.

Accordingly, the respective ends of the pivot plate **25** are operatively connected to the biasing devices **56** and **57**, which function to selectively resiliently resist the tilting action of the pivot plate. Thus, when the pivot plate **25** tilts in a clockwise direction, the lower end of the slot **69***a* contacts the pin **75***a* of the biasing device **57**, thereby raising the bolts **60***a* and, in turn, further compressing the spring **63***a*. When the plate **25** tilts in a counterclockwise direction, the biasing device **56** functions to resist such tilting action in a like manner.

Disposed in operative relation below the bolt clevises **66** and **66***a* are suitable motor power control means in the form of conventional self opening limit switches **80** and **82**, respectively. Since the limit switches **80** and **82** are identical, a description of one will suffice for a description of both. The limit switch **80** includes a housing **83** having a bracket **84** to which one end of a lever **85** is pivotally secured for rotation in a vertical plane perpendicular to the plate **19**. The outer or free end of the lever **85** extends under and is in contact with the lower edge or shoulder **86** of the bolt clevis **66** when the pivot plate **25** is in its neutral position, as shown in FIGS. 2 and 3. A suitable push button **87** is disposed on top of the housing **83** in spaced relation to the bracket **84** and is held depressed by the lever **85** sufficiently to hold the switch closed when the plate **25** is in neutral position as illustrated in FIG. 2. The push button **87** may be farther depressed after the switch is closed. The plate **25** is normally held in neutral position by the biasing means and thus normally holds both switches **80** and **82** in closed position.

When the pivot plate **25** is rotated in a counterclockwise direction, in FIG. 2, the bolt clevis **66** is displaced upwardly thereby allowing the outer end of the lever **85** to rise which, in turn, allows the push button **87** to rise, thereby opening the control circuit through the switch **80** to the motor **34**, in a manner to be described. The limit switch **82** functions in a like manner when the pivot plate **25** rotates in a clockwise direction. A more detailed description of the limit switches **80** and **82** is not deemed necessary since they may be of any conventional type and their specific structure forms no part of the invention. Thus, in the illustrative example, the limit switches **80** and **82** provide settable means which are operated by means comprising the clevis **66**, lever **85**, and push button **87**. This means, in turn, are operated by the control member or plate **25**.

A portion of the control circuit for controlling operation of the reversing motor **34** is shown in FIG. 4. The motor **34** contains conventional field and armature windings **90** and **91**, respectively, with suitable current being supplied from the lines **93** and **94**. The double-pole double-throw remotely controlled switch, generally designated as **95**, functions to reverse the flow of current through the armature winding **91** and thus reverse the direction of rotation of the motor in a well known manner, as will be described. The switch **95** is remotely controlled by the winding **96** and the normally open motor control push button switch **97**, the winding **96** receiving its power from the transformer **98**. The double-pole switch **95** is of the type wherein momentary actuation of the push button **97** throws the switch **95** into one position, with the ensuing actuation of the push button throwing the switch **95** to its other position, such automatic remote control feature being conventional.

In operation, with the switch **95** closed in its upper position, current flows from the line **93**, in turn, through the line **101**, the limit switch **80**, the line **102**, the switch **95**, the line **103**, the armature winding **91**, the line **104**, the switch **95**, the line **105**, the field winding **90**, the line **106**, to the other supply line **94**, thereby driving the motor in one direction.

When the switch **95** is thrown to its lower position, current flows from the supply line **93**, in turn, through the line **107**, the limit switch **82**, the line **108**, the switch **95**, the line **104**, the armature winding **91**, the line **103**, the switch **95**, the line **105**, the field winding **90**, the line **106**, to the other supply line **94**, thereby driving the motor in the other direction.

Operation of the door operating mechanism M will now be described. It will be assumed initially that the door is in its down or closed position. Also, for purposes of illustration, it will be assumed that when the switch **95** is in its upper position in FIG. 4, the motor **34** is driven to lower or close the door, and when the switch **95** is in its lower position, the motor **34** is thus reversed to raise or open the door, although it will be understood that the opposite structural setup may apply.

Accordingly, when the door D is being closed originally, both limit switches are in their closed positions. When it finally closes, it strikes the floor **110** of the garage, or a prepositioned stop disposed in the door's path of travel near the floor. Thus, when the door strikes such obstruction, the pivot plate tilts a substantial amount counterclockwise against the force of the spring **63** and allows the limit switch **80** to open, the switch **82** remaining closed. When the switch **80** opens, power to the motor is cut off and the door comes to rest in its closed position even though the switch **82** is closed, because of the position of the double-throw switch **95**. Power cannot flow through the switch **82** from the line **93** until the switch **95** is thrown to its upper position by operating the push button **97**. If the door strikes an obstruction during travel toward closed position, the same operation occurs and the door is stopped.

To raise or open the door, the motor control push button **97** is depressed, thereby throwing the switch **95** to its lower position. Current may then flow from the line **93**, in turn, through the line **101**, the still closed switch **82**, and the motor windings, as aforedescribed, to raise the door. As soon as the motor starts to drive, it reduces the tension on the belt **40** between the drive pulley and the anchor device **44** and increases the tension in the remaining portion of the belt. This reduces the belt pressure on the pulley **27** and the spring **63** returns the plate

25 to neutral position, whereupon the switch 80 is closed by the clevis 66. At this point both switches 80 and 82 are in their closed positions.

When the door reaches the end of its upward travel, the base plate 19 strikes the obstruction or stop 111. This causes the belt to press on the pulley 28 sufficiently to tilt the pivot plate 25 clockwise a substantial amount and release the limit switch 82 so that it opens. This cuts off power to the motor and the door comes to rest in its fully open position. At this point, the switch 80 remains closed, thus permitting the door to be closed or lowered on the ensuing actuation of the motor control push button 97 in the manner aforedescribed. Should the door strike any obstruction at any point along its path of travel in either direction, the tension on the belt will be increased in the driving direction and will tilt the plate and operate the corresponding limit switch in the same manner as when the door reaches its fully raised or full lowered position.

The force required to lower the door is such that if a person should become caught beneath the door as it is being lowered, the door would stop before causing any injury.

It should be noted that the direction of door travel after it is started in either direction may be instantly reversed by reversing the actuating motor control push button 97.

Another advantage of the present structure resides in the fact that, when the door is stopped either by its reaching the end of its travel toward open or closed position or by striking an obstruction, the driving mechanism and belt maintain the pressure which had been preselected for urging the door in the direction in which it was then travelling. For example, let it be assumed that the biasing spring for the upward travel of the door is set so that the mechanism exerts a 50 pound pull on the door, and a sudden cold snap tightens the door in its tracks and thereby necessitates a pull of 55 pounds to start the door. Under these conditions, the mechanism will still maintain a 50 pound pull on the door even though the current had been turned off by the switch 82. Therefore, a slight lift of a few pounds by hand applied to the door will restart the door in the same direction, relieving the pull of the belt on the pulley 28 so that the plate 25 will tilt back to neutral position and close the switch 82. The closing of the switch 82 thereupon energizes the motor and it restarts driving the door in the same direction.

Furthermore, it should be noted that when the door is stopped in either the closed or the open position, the tension of the belt which existed when the door was stopped remains and urges the gears and motor to rotate in the reverse direction. If, then, the push button is operated to move the door in the reverse direction, this stored tension in the belt 40, since it urges the motor and gear mechanism to rotate in the reverse direction, assists the motor in starting in the reverse direction.

The motor 34 is a high speed motor with a large gear reduction head so that it is self locking against reversal by the pull of the belt 40 on the pulley 36. Consequently, a lost motion connection is provided between the respective clevises and the tilting plate 25 for reducing shocks which would otherwise be occasioned if the motor were stopped abruptly upon opening of its control switch. The lost motion connection is provided by slots 69 and 69*a*. For example, assuming in FIG. 2 that the plate 25 was tilted clockwise thus opening the switch 82. This would disconnect the motor from its source of power. However, due to the kinetic energy of the motor, there would be additional drive on the belt 40 urging the plate to tilt further in the clockwise direction. The lost motion between the pin 75 and the upper end of the slot 69 permits this further tilting of the plate 25 against the necessarily progressively increasing resistance of the spring 63*a* resulting from the progressive compression of the spring 63*a*. Thus, the motor is gradually brought down to rest. This also allows the clevis 66 to rest on the lever 85 of the switch 80 during the additional tilting without further downward movement of the lever 85. Without the slots, stopping of the motor would be so abrupt as to cause dangerous inertial shocks, particularly where a chain instead of a somewhat resilient belt is used for driving the door.

Thus there is provided a door operating mechanism of relatively simple construction having means for positively arresting movement of the door when an obstruction in the path of the door is encountered. The mechanism M is positioned immediately adjacent the top of the door and thus does not take up valuable space. Additionally, the mechanism M is easily accessible in such position, thereby enabling the same to be simply and quickly installed and repaired, and enabling the same to be adapted easily to any standard existing overhead door. The structure is such that most of the parts may be made of light stampings instead of the usual heavy castings, thereby providing lightness in weight. Thus the mechanism M of the invention operates as a safety release device. Some of the advantages can be retained by mounting the belt on the door and the mechanism M on the wall, thus causing the door and belt to be driven by, and relative to, the mechanism.

When the mechanism is used as a safety release device, the mechanism M may be held stationary such that the belt 40 is then movable endwise of the plate 19 in either direction. If the belt or an object driven thereby should jam in its movement, the mechanism M would immediately stop the drive. In either event, should the door strike an obstruction in its path of travel, the mechanism M will function as a safety release device to arrest movement of the door almost instantly.

Having thus described my invention, I claim:

1. A safety release device for a power driven mechanism and comprising a control member, a pair of pulleys mounted on the member and spaced apart radially from each other, a belt in driving engagement with both pulleys and movable endwise when driven relative to the member, power operated means for driving the belt in opposite directions relative to the member, a support supporting the member for movement in opposite directions, respectively, relative to the support, to predetermined positions by forces imposed, respectively, on the pulleys when the belt is driven in opposite directions, respectively, resilient means normally biasing the member to a neutral position between said predetermined positions, means operable by the member when the member is moved to said predetermined positions, respectively, to render the power operated means inoperative to continue the drive of the belt in said one direction and thereby to arrest the drive of the belt in said one direction.

2. The structure according to claim 1 wherein said belt is secured in fixed position at its ends and the member and support travel lengthwise of the belt when the belt is driven relative to the support.

3. The structure according to claim 2 wherein said support is carried on a track for movement therealong by the driving of the belt relative to the control member.

4. The structure according to claim 1 wherein said power operated means includes a pulley for engagement with the belt at a location on the belt between the pulleys of said pair.

5. The structure according to claim 4 wherein said power operated means is an electric motor and the means operable by the member for rendering the power operated means inoperative are switches normally held closed and arranged to be operated by the member.

6. The structure according to claim 1 wherein said member is a plate and is pivotally mounted on said support for rocking about a pivotal axis to either of said predetermined positions.

7. A controlled drive mechanism comprising a support member, a control member mounted on the support mem-

ber for movement to different positions relative thereto, an elongated flexible element associated with the members, power operated propelling means drivingly engaging said flexible element for exerting tension thereon thereby to effect relative movement of the flexible element and members endwise of the flexible element, settable means settable for rendering the propelling means active and inactive, selectively, force directing means connected to the control member for movement therewith and connected to the flexible element for movement, together with the control member, in response to force applied to the force directing means by the flexible element due to changes in tension of the element by the propelling means, so that the control member is moved to one of said positions relative to the support member upon a preselected change in said tension, and means operatively connected to the control member and operated thereby when the control member moves to said one position to set the settable means.

8. The mechanism according to claim 7 wherein the settable means is normally set in position to render the propelling means active, and said force directing means and control member are moved to cause the settable means to be set to render the propelling means inactive in response to said force applied to the force directing means due to an increase in the tension of the element by the propelling means.

9. The mechanism according to claim 7 wherein the propelling means include power means mounted on one of the members.

10. The mechanism according to claim 7 wherein resilient means operatively interconnect the control member and support member and yieldably oppose said relative movement of the members to said one position.

11. The mechanism according to claim 10 wherein said resilient means is adjustable for varying the stress of the resilient means.

12. A mechanism according to claim 7 wherein said settable means includes at least one limit switch, and means movable by the control member to cause said limit switch to stop operation of the propelling means.

13. The mechanism according to claim 7 wherein said settable means includes at least two limit switches, and further includes means operable upon movement of the movable member in one direction to a predetermined position to set said switches in one relation to each other wherein one is open and the other is closed, and means operable upon movement of the movable member to another predetermined position to set said switches in another relation to each other wherein said one is closed and said other is open.

14. The mechanism according to claim 7 wherein said control member is a pivot plate pivotally mounted on the support for movement therewith and limited rotative movement relative thereto, concurrently.

15. A mechanism according to claim 7 wherein the

control member is pivotally mounted on the support member, the propelling means includes a drive pulley journaled on one of the members, the force directing means is a pair of idler pulleys rotatably mounted on said control member in radially spaced relation to each other and to the drive pulley and at opposite sides of the pivotal axis from each other, said elongated element is tractionally threaded about said drive pulley and said idler pulleys so that, as to each idler pulley, the portion of the element extending in the direction from the drive pulley to the idler pulley is angularly disposed to the portion of the element extending in the same direction, beyond the idler pulley, and thereby a predetermined tension in one tensioning direction, resulting from the application of torque by the drive pulley, causes the elongated flexible element to tilt the control member in said one tensioning direction, and a predetermined tension in the other tensioning direction resulting from the application of torque by the drive pulley causes the flexible element to tilt the control member in said other tensioning direction, and said settable means are set for causing the power means to transmit torque in opposite directions, respectively, dependent upon the direction of tilting of the control member.

16. A controlled drive mechanism comprising a track, a base plate mounted on the track for movement therealong in opposite directions, respectively, a pivot plate pivotally mounted on the base plate for limited rotation thereon in a plane substantially parallel to the plane of the base plate, reversible drive means mounted on the base plate and having a drive shaft with a drive pulley thereon, a pair of idler pulleys mounted in spaced relation to each other on said pivot plate so as to straddle the pivotal axis of the pivot plate, a drive belt extending lengthwise of the track and fixed at its ends and tractionally threaded about said pulleys, the peripheral surface of the drive pulley being engaged by the belt being offset, transversely of the axes of the pulleys from the peripheral surfaces of the idler pulleys being engaged by the belt, energizing means connected to said drive means for actuating the same, power control means disposed on said plates for controlling said energizing means in a preselected manner in response to the predetermined pivoting of said pivot plate, and each of said idler pulley wheels coacting with said pivot plate and with the drive belt to pivot the plate in a predetermined direction upon predetermined resistance to travel of the base plate along the track, and thereby actuate said power control means to control the travel of the base plate along said track.

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