May 24, 1966 G. W. JACKSON 3,252,503

GARAGE DOOR OPERATOR

Filed April 27, 1964 3 Sheets-Sheet 1

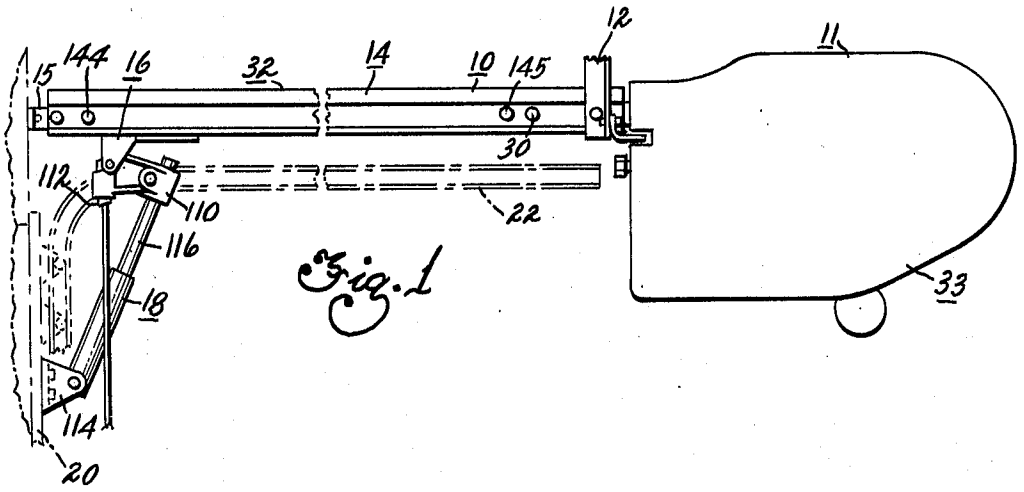


Fig. 1

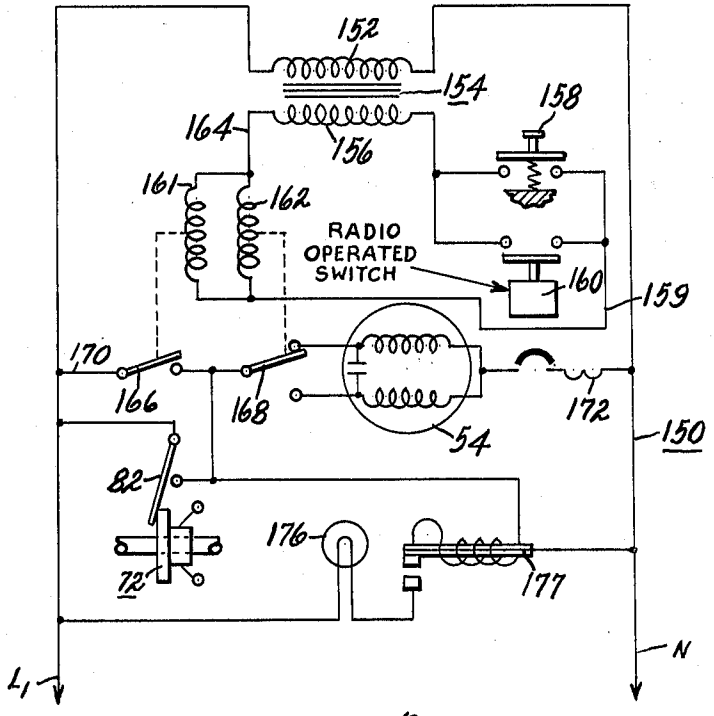


Fig. 2

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GARAGE DOOR OPERATOR

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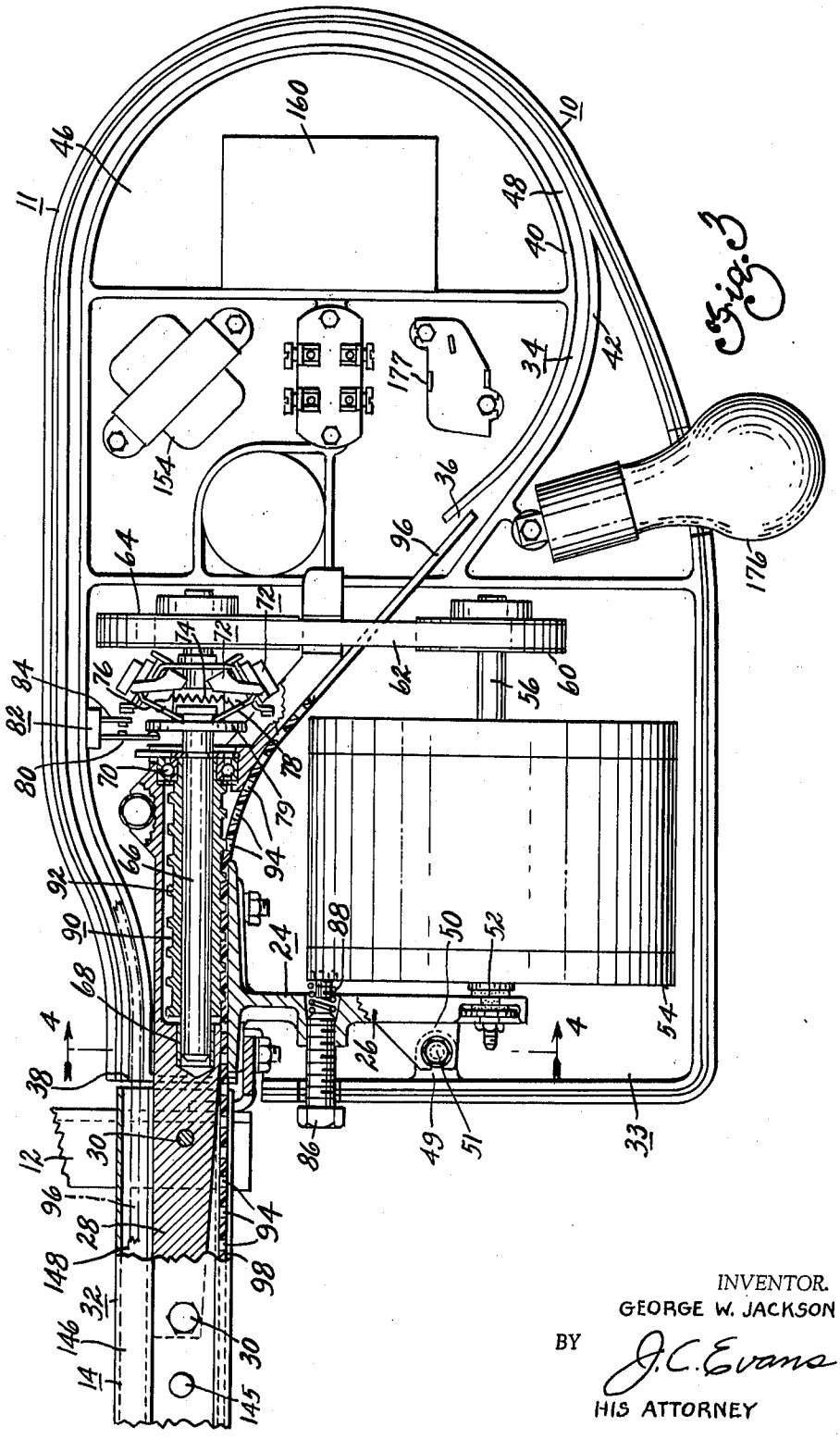


Fig. 3

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GARAGE DOOR OPERATOR

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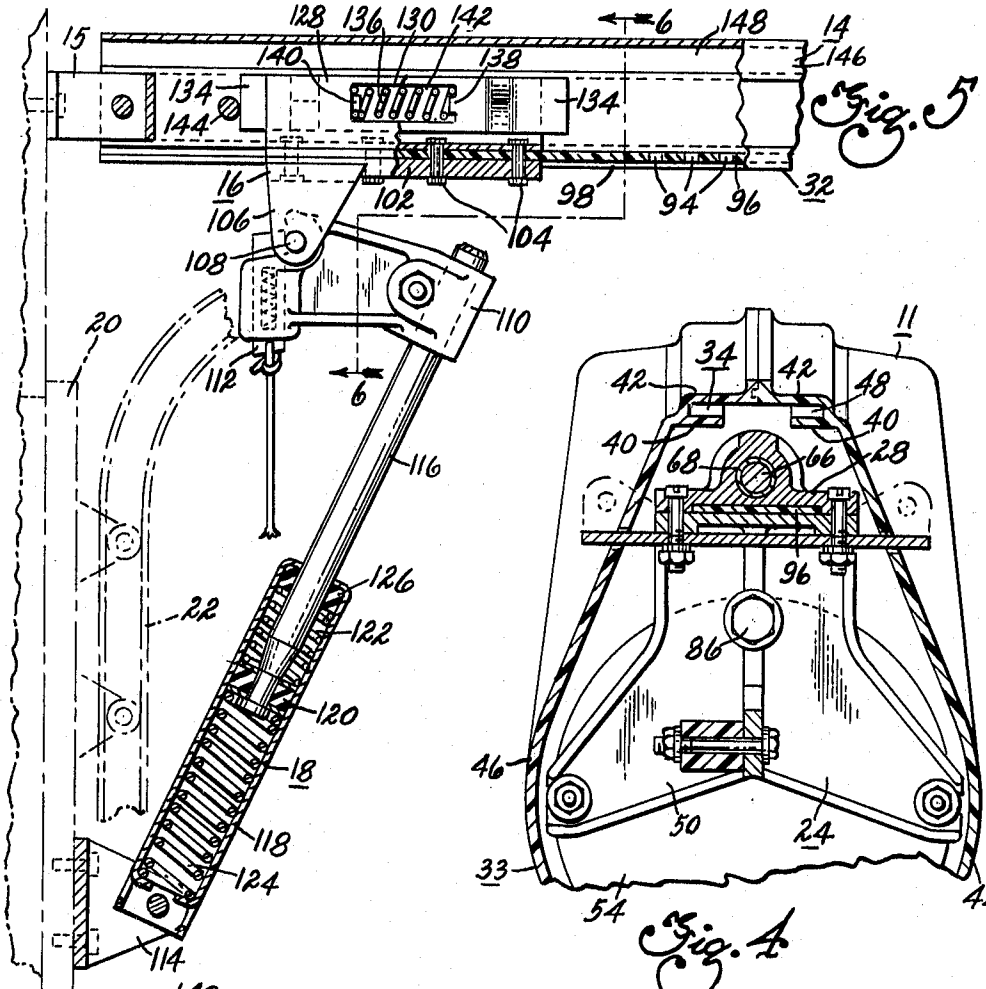


Fig. 5

Fig. 4

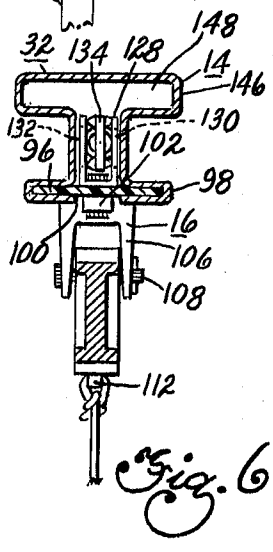


Fig. 6

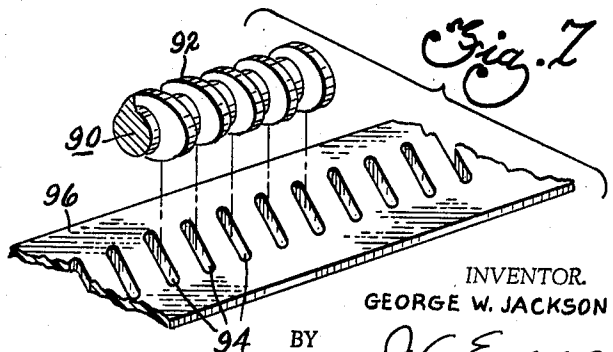


Fig. 7

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United States Patent Office 3,252,503 Patented May 24, 1966

3,252,503

GARAGE DOOR OPERATOR

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Filed Apr. 27, 1964, Ser. No. 362,742
6 Claims. (Cl. 160—193)

This invention relates to an operating mechanism and more particularly to an operator for opening and closing a closure element such as a garage door or the like.

One problem with many different types of garage door operators has been the provision therein of an elongated cable or chain used to interconnect a drive mechanism with a garage door. Such connecting members require considerable maintenance as for example, lubrication and if this is not conscientiously carried out the operator mechanism can become inoperative.

Accordingly, an object of the present invention is to replace such connecting members with a reliable, durable low cost interconnecting means that has high strength and requires no lubrication or other maintenance procedures to retain its original reliability.

A further object of the present invention is to substantially reduce the cost of a garage door operator by the provision of a self-lubricating, flexible elongated belt actuating element having one end thereof operatively connected to a door closure member and an opposite end thereof driven by a motor unit supported within a mounting member including means for guidingly storing the belt when it is moved into one of its operative positions.

A further object of the invention is to provide a compactly arranged garage door operator including a first unitary portion having a drive means and a belt storage capacity and a second unitary portion including means for supporting a self-lubricating, flexible elongated belt-like door actuating element during movement thereof by the drive means into various operative positions.

Further objects and advantages of the present invention will be apparent from the following description, reference being had to the accompanying drawings, wherein preferred embodiments of the present invention are clearly shown.

In the drawings:

FIGURE 1 is a view in elevation of a garage door operator including the present invention.

FIGURE 2 is a diagrammatic showing of an electrical control circuit for the improved operator.

FIGURE 3 is an enlarged view of the drive mechanism portion of the operator partially in section and partially in elevation with one side plate thereof removed.

FIGURE 4 is a view in vertical section taken along the line 4—4 of FIGURE 3.

FIGURE 5 is an enlarged view, partially in elevation and partially sectioned, of the door connecting end of the device shown in FIGURE 1.

FIGURE 6 is a view in vertical section taken along the line 6—6 of FIGURE 5, and

FIGURE 7 is a perspective view of a punched belt and worm drive element of the invention.

Referring now to the drawings, in FIGURE 1 a representative embodiment **10** of the invention is illustrated as comprising a first unitary portion **11** including the drive mechanism and a first belt storage enclosure supported by a fixed bracket **12**. A second, elongated unitary portion **14** of the device extended longitudinally from portion **11** includes a garage door operating assembly and another belt storage enclosure. The portion **14** at the end thereof spaced from portion **11** is supported by a suitable fixed bracket **15**. A slidable carrier **16** on portion **14** is illustrated as being connected to a shock absorber **18** serving

to operatively connect a door **20** slidably mounted on a track **22** to the improved garage door operator mechanism.

Referring now more particularly to FIGURE 3, the unit **11** of the improved device **10** is illustrated as including a motor mount **24** having a depending portion **26** and an extension **28** supported by bracket **12**. The extension **28** has one end thereof secured by suitable means for example, screws **30** between the sides of an elongated track **32** of the unit **14**. The motor mount **24** is enclosed by a housing **33** that includes an integrally formed curved guideway **34** having an open end **36** located rearwardly of and below the extension **28** and another open end **38** located above the extension **28** forwardly of the unit **11**. The curved guideway **34** includes wall portions **40**, **42** cooperating with side walls **44**, **46** of housing **33** to form an enclosed passageway **48** which can be characterized as being turned upon itself.

A projection **49** on housing side wall **46** is directed interiorly of the housing **33** as best seen in FIGURES 3 and 4 to supportingly receive a bolt **51** directed through a forwardly directed extension **50** on depending arm **26** whereby the housing **33** is supportingly held in place on motor mount **24**. A resilient coupling member **52** is inserted through the end of depending arm **50** to resiliently support a motor **54** within housing **33**.

The motor **54** has a drive shaft **56** secured to a drive pulley **60** having a belt **62** directed thereof and thence over a driven pulley **64** secured on one end of a rotatable driven shaft **66**. In the illustrated embodiment of the invention the shaft **66** is directed coaxially of an open end of extension **28** and one end thereof is rotatably supported by a sleeve bearing **68** in a small diameter opening in the extension **28** and at the opposite end thereof by a ball roller bearing **70** supported in a large diameter opening of the extension **28**. Between the portion of the shaft **66** within the open end of extension **28** and the driven pulley **64** is located a centrifugally operated governor assembly **72** including a spring **74** biasing fingers **76**, **78** into a desired relationship against a governor sleeve **79** slidably supported upon the rear end of shaft **66** to move relative to a spring biased arm portion **80** of a control switch **82** movable with respect to a second contact carrying arm **84** for purposes to be discussed.

In order to obtain a desired drive belt tension an adjusting screw **86** is threadably directed through the motor mount **24** to be engaged with one end of a compression spring **88** having the opposite end thereof in engagement with the front face of the motor **54** whereby the motor can be pivoted about the longitudinal axis of coupling member **52** to vary the tension of belt **62**.

Secured for rotation with the shaft **66** is a worm element **90** having a continuously formed helical tooth portion **92** thereon that is meshed with openings **94** formed in an elongated tape or belt-like element **96** that is best illustrated in FIGURE 7 as having a width substantially greater than its depth in the representative embodiment and as having openings therein formed so as to mesh with the worm tooth portions **92** so as to produce an advance of the belt **96** with respect to the worm **90** upon rotation of the shaft **66**.

The belt **96** more particularly is formed of a self-lubricating, high strength plastic material, for example, nylon, and it is slidably supported in a channel shaped lower guideway **98** of the track **32** which includes a longitudinally directed opening **100** throughout the length thereof. By virtue of this belt arrangement the mechanism **10** has been found to require less maintenance to retain its original reliability over long periods of use. This fact is attributable in part to the self-lubricating properties of the belt, in part to its resistance to corrosion

and in part to the relationship of the belt to other operative members in the device. While nylon represents one suitable belt material, it will be appreciated by those skilled in the art that other synthetic and natural plastics having similar lubricating and high strength properties are equally suitable for use in the present invention.

With reference to the end of the track **32** shown in FIGURE 5, it can be seen that the belt **96** is fastened to a base **102** of carrier **16** by suitable fastening means such as rivets **104**. A depending clevis **106** on the carrier **16** has a pin **108** directed therethrough that is arranged to interlockingly connect with a grooved bracket **110** that carries a clamp type lock assembly **112** operated to connect or disconnect the shock absorber assembly **18** to the device **10**. At the opposite end of the shock absorber assembly **18** a bracket **114** is pivotally mounted and adapted to be connected to the door **20**. The assembly **18** is thereby selectively connectable between the belt **96** and the door **20** for movement therewith and for dampening against deceleration and acceleration of the door **20** during movement thereof between its fully opened and fully closed positions.

The shock absorber assembly **18** more particularly includes an elongated piston arm **116** secured at one end thereof to the bracket **110** and having the opposite end thereof directed into a cylinder **118** where a piston **120** is secured to the opposite end of piston arm **116** for relative slidable movement within the cylinder **118**. On one side of the piston **120** within the cylinder **118** is a first coil spring **122** for producing a desired snubbing action upon movement of the arm **116** exteriorally of the cylinder **118** and in the opposite end of the cylinder is a second coil spring **124** for producing a desired snubbing action upon movement of the arm **116** interiorally of the cylinder **118**. At the upper end of the cylinder **118** is a ring insert **126** that guidingly directs the arm **116** during its relative movement with respect to the cylinder **118**.

In addition to the snubbing action of the assembly **18**, a U-shaped carrier clevis **128** is also secured to the base **102** of the carrier **16** by the rivets **104**. Clevis **128** has openings **130**, **132** on the opposite sides thereof. Within clevis **128** is carried a slide bar **134** that supportably carries a spring element **136** within an opening **142** therein and the ends of the spring are secured around spaced tabs **138**, **140** so as to align the outside edges of the spring **136** with openings **130**, **132** to effect an interlocking relationship between the spring and the sides of the clevis **128**. It will be noted that the bar **134** has the ends thereof extending outwardly on either end of the U-shaped member **128** so that when the carrier **102** reaches a predetermined point at the front and rear ends of the track **32** the bar **134** will engage a stop **144**, **145** respectively to produce a relative movement between the U-shaped clevis member and the bar that is damped by the spring **136**. The dampening action of the spring **136** prevents an indesirable pulling of the belt **96** that might produce tearing thereof in the vicinity of the worm teeth.

On the upper portion of the track **32** is formed an enclosure **146** defining a storage space **148** into which the belt is directed from curved guideway **34** upon a predetermined movement of the belt into the enclosed passageway **48**. By virtue of the illustrated arrangement of the guideway **34** and belt enclosure **146** a storage of the belt is readily effected when door **20** is moved to an open position.

Referring now to FIGURE 2, a control circuit **150** is illustrated connected to lines L_1, N of a three wire power source. More particularly, lines L_1, N are connected respectively to the input and output terminals of a primary coil **152** of a step-down transformer **154**. The secondary coil **156** of the transformer **154** has one terminal thereof connected to a manually operated push switch **158** in parallel with a radio operated switch **160**. When either switch **158** or **160** is closed a relay circuit is completed from the one terminal through a conductor **159**, a pair of parallel relay coils **161**, **162** and a conductor **164** connected to the opposite terminal of the coil **156**. The coil **161** controls a single pole single throw relay switch **166** and coil **162** controls a latching relay switch **168**. Switches **166**, **168** are serially arranged in a conductor **170** across lines L_1, N to regulate the direction of rotation of electric motor **54**. The motor circuit includes a thermally responsive protector **172** and is representatively illustrated as being of the capacitor start type. The governor operated switch **82** completes a holding circuit for the motor until the operating speed thereof exceeds a predetermined maximum. The circuit also includes a source of illumination **176** for lighting the area around the garage door operator and a time delay switch **177** for closing the light following a predetermined period of time.

By virtue of the above described circuit, when the motor operates under a high torque, as for example, when the carrier **16** hits the stops **144**, **145** the motor pivots upwardly to cause pulley **60** to walk-up belt **62**. This produces a belt slippage and reduction in belt speed to produce an inward pulling of the governor arms **76**, **78** and consequent movement of sleeve **79** to open switch **82** to shut off the motor.

In view of the aforesaid remarks it will be appreciated by those skilled in the art that an economical, relatively compact, highly reliable garage door operator is herein disclosed that enables the initial reliability of the device to be prolonged over a substantial period of time without constantly maintaining the device.

While the embodiment of the present invention as herein disclosed, constitutes a preferred form, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. In a door operator mechanism, the combination of an elongated track having a lower channel shaped portion and an upper enclosed passageway, a housing at one end of said track including an enclosed guideway, a motor mount within said housing, motor means supported by said motor mount, a rotatable shaft, gear means secured for rotation with said shaft having a tooth portion thereon, an elongated flexible belt slidably supported within said track channel portion, means forming a plurality of spaced openings in said belt throughout the length thereof for receiving said tooth portion whereby said belt is movable within said track upon rotation of said shaft, said belt having one end thereof received by said curved enclosed guideway, said guideway serving upon a first relative movement of said belt with respect to said track to guide said belt into the upper enclosed track passageway to be stored therein, and carrier means secured to the opposite end of said belt adapted to be connected to a door closure member for moving such a member into open and closed positions upon relative movement between the belt and track.

2. In a door operator mechanism the combination of an elongated track, a guideway formed on said track throughout the length thereof having a longitudinal opening throughout substantially the length thereof, an elongated non-metallic flexible belt of self-lubricating material having a width substantially greater than its depth slidably supported within said track guideway, carrier means secured to one end of said belt including a depending portion directed through said longitudinal guideway opening, means forming a plurality of openings in said belt, gear means having a tooth portion adapted to be meshed with said belt openings, drive means for driving said gear means with respect to said belt for producing movement of said belt with respect to said track, said belt upon a first predetermined relative movement thereof with respect to said track moving outwardly of said guideway, and means for storing said elongated belt as it moves exteriorally of said guideway

including a curvilinear portion and a portion extending in spaced parallelism to said guideway along the length thereof.

3. In a garage door operator mechanism the combination of an elongated track having a guideway with uninterrupted bent side walls therein on either side of a longitudinal opening therethrough, and elongated plastic belt slidably supported by said guideway and secured therein by said bent side walls against buckling movement with respect to said guideway, carrier means secured to one end of said belt having a depending portion adapted to be operatively connected to a movable closure member, motor support means adjacent one end of said track including generally perpendicularly arranged first and second portions, a rotatable shaft journalled for rotation in said first portion, motor means pivotally supported on said second portion below said first portion, gear means secured to said shaft for rotation therewith, drive means for operatively connecting said motor means to said rotatable shaft, means forming a plurality of openings throughout the length of said belt meshing with said gear means whereby said belt is moved relative to said track upon rotation of said shaft.

4. In a combination of claim 3 said shaft being directed along the longitudinal axis of said track and said bear means including a worm for producing the relative movement of said belt with respect to said track.

5. A garage door operator mechanism comprising an elongated track, means forming a guideway below said track, means forming an enclosed open ended passageway above said track throughout the length thereof, a motor support member at one end of said track including an extension directed interiorally of said track between said guideway and said upper passageway thereon, a housing for said motor support member including a curved guideway aligned with the one open end of said upper track passageway, a rotatable shaft having the opposite ends thereof rotatably supported within said support member extension, gear means secured to said shaft for rotation therewith including a tooth portion thereon, motor means pivotally mounted on said motor support, a drive shaft, a drive pulley secured to said drive shaft, a driven pulley secured to said rotatable shaft, means for operatively connecting said drive and driven pulleys, an elongated belt slidably mounted within said lower track guideway having one end thereof directed exteriorally of said guideway, means forming a plurality of openings in said elongated belt throughout substantially the length thereof to mesh with said gear tooth

for producing a relative movement of said belt with respect to said track upon rotation of said rotatable shaft, means for connecting the other end of said belt to a door closure member, said first mentioned end of said belt being directed into said curved housing guideway upon a first predetermined relative movement of said belt whereby said housing guideway serves to store said belt.

6. A garage door mechanism comprising an elongated track, a motor mount supported adjacent one end of said track, motor means pivotally mounted on said motor mount, a drive pulley on said motor means, a driven pulley, belt means for operatively connecting said drive pulley with said driven pulley, means including a yieldable spring engaging said motor means for moving said motor means in a direction to maintain a predetermined belt tension between said drive and driven pulleys, a rotatable shaft connected to said driven pulley, gear means secured to said shaft for rotation therewith, an elongated flexible non-metallic belt having a plurality of openings spaced throughout the length thereof, said belt slidably mounted on said elongated track, said openings in said belt meshing with said gear means whereby said belt is movable relative to said track means upon rotation of said shaft, door carrier means connected to said belt for moving a door into closed and open positions, circuit means for energizing said motor means including a centrifugal switch responsive to a predetermined speed of rotation of said shaft to de-energize said motor, and means for increasing the speed of rotation of said shaft upon the occurrence of a predetermined torque in said motor means including a depending arm for supporting said motor means below said driven pulley whereby said drive pulley will become frictionally engaged with said pulley belt means to move upwardly with respect to said driven pulley against the force of said yieldable spring to produce a belt slippage to reduce shaft speed to open said centrifugal switch.

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