

July 18, 1961

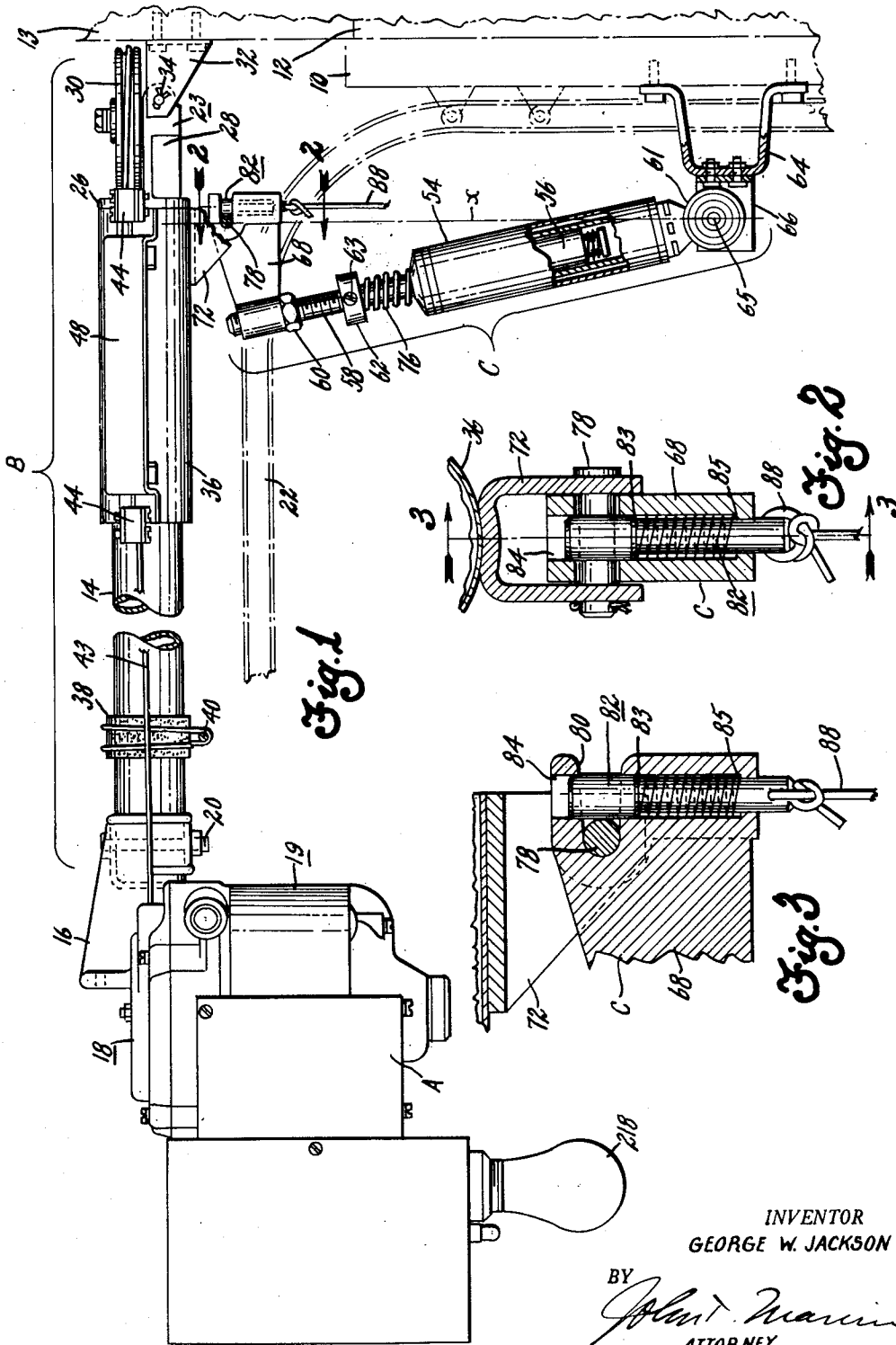
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2,992,819

DOOR OPERATING MECHANISM

Filed June 22, 1955

4 Sheets-Sheet 1



July 18, 1961

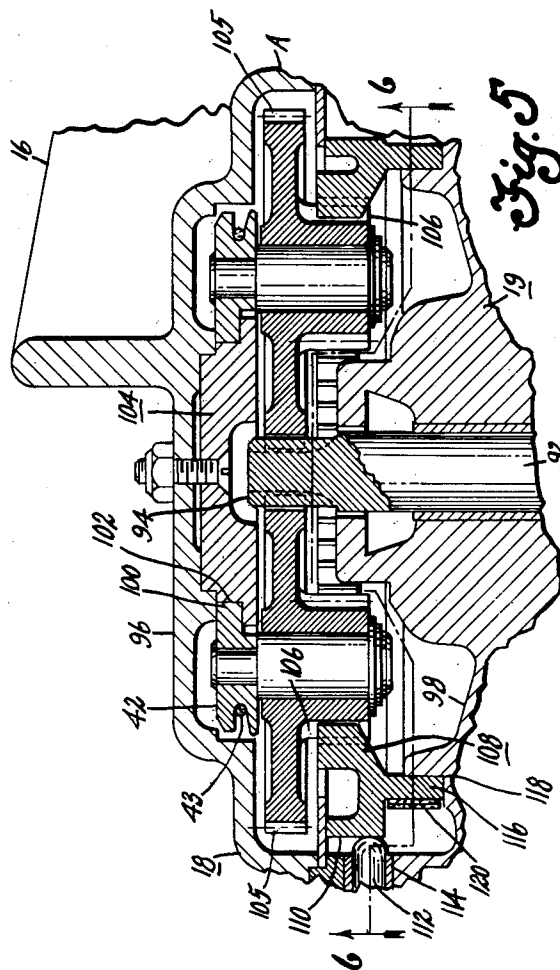
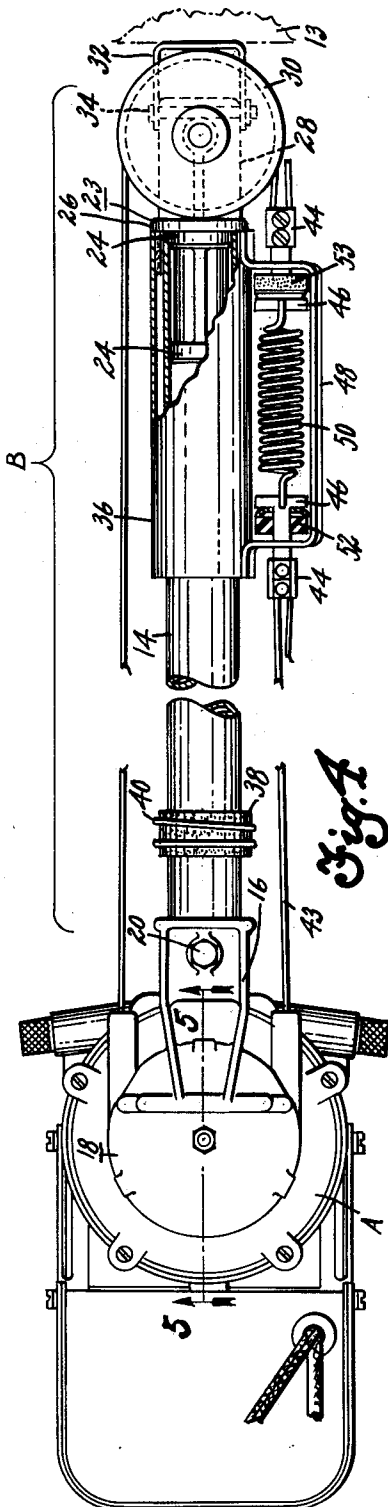
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DOOR OPERATING MECHANISM

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4 Sheets-Sheet 2



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DOOR OPERATING MECHANISM

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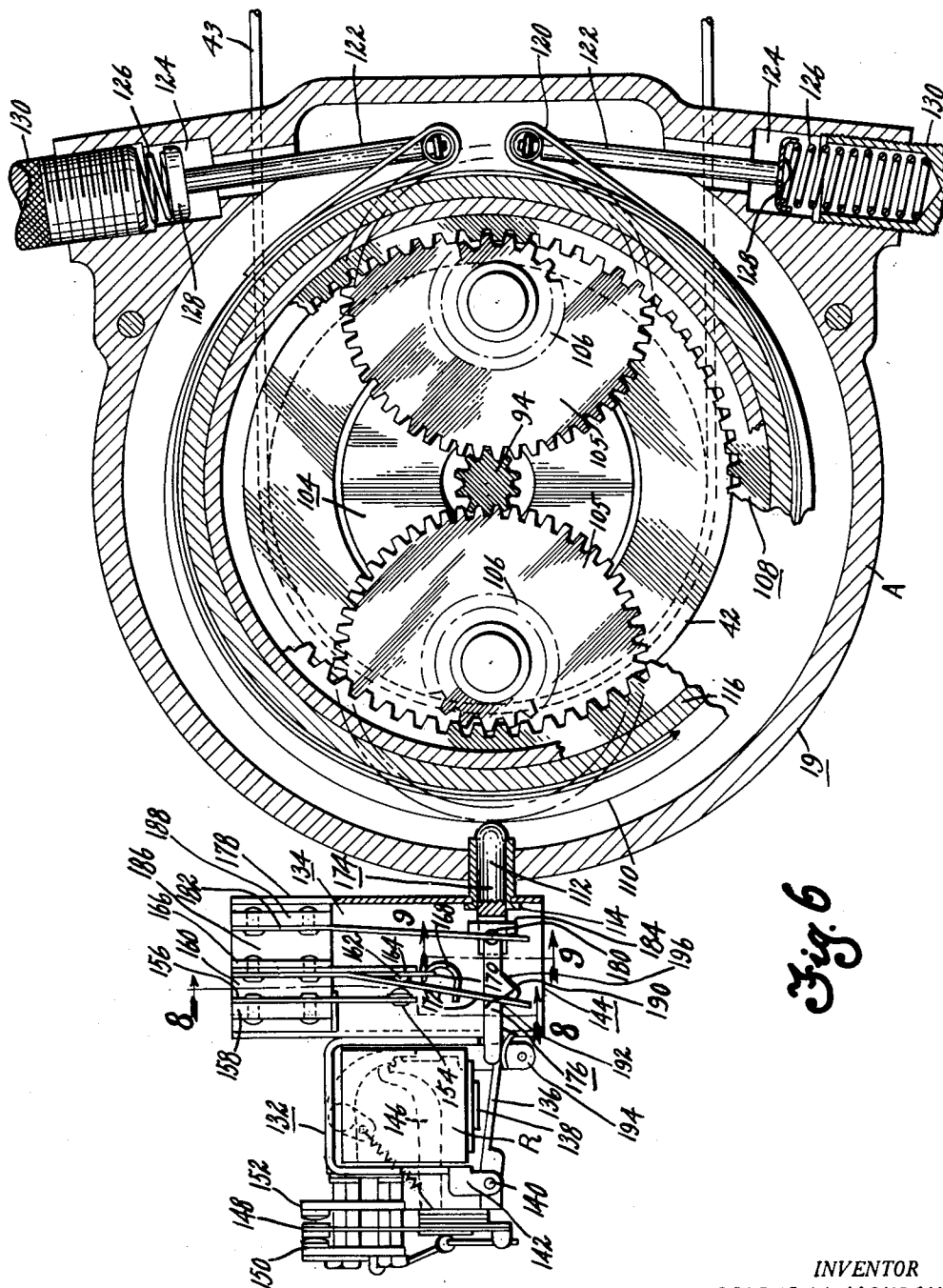


Fig. 6

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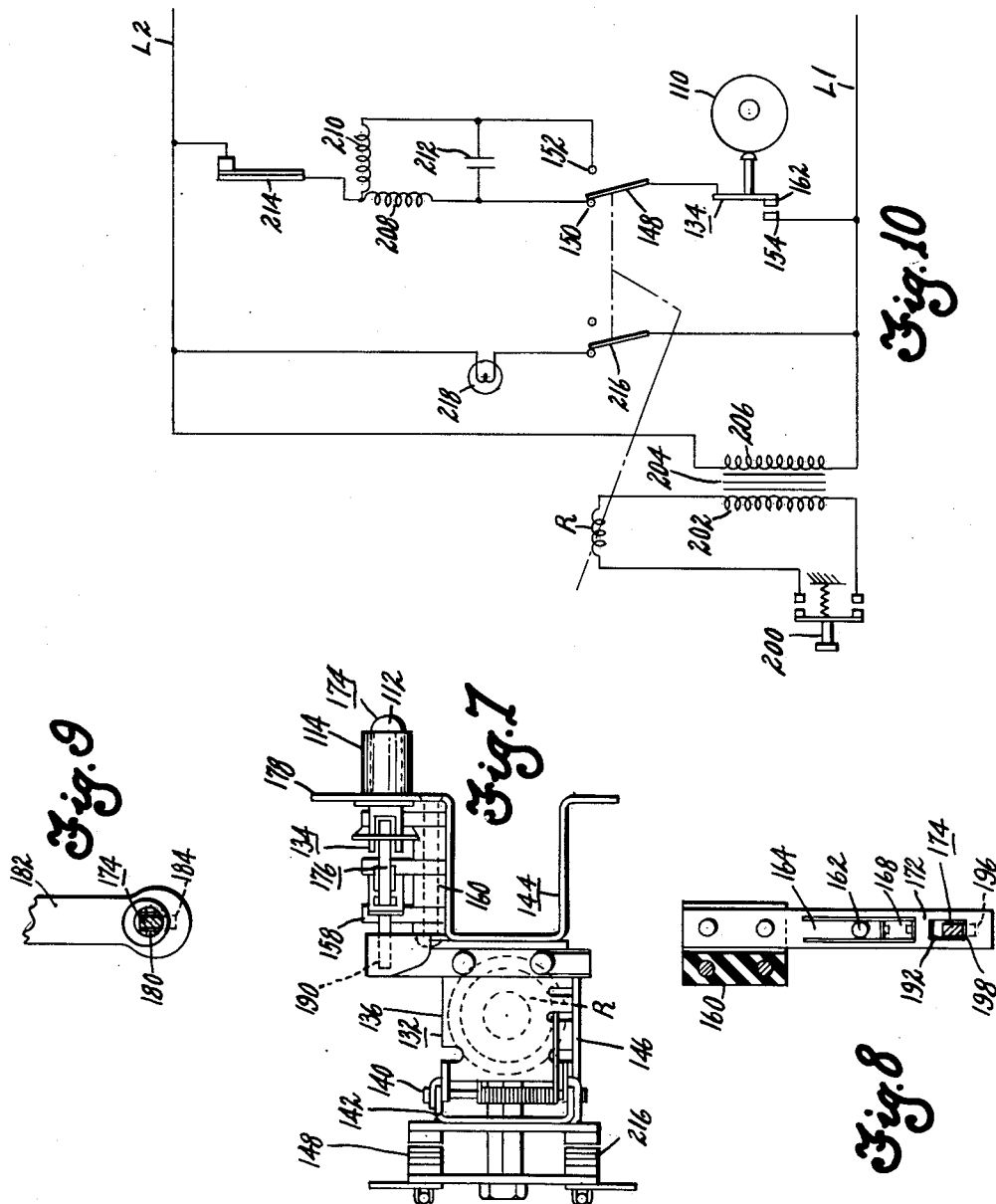
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DOOR OPERATING MECHANISM

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4 Sheets-Sheet 4



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2,992,819

DOOR OPERATING MECHANISM

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7 Claims. (Cl. 268—59)

This invention relates to power operated mechanisms for operating closures and particularly closures of the operating type.

It is an object of this invention to provide a power operating mechanism for operating sliding closures and the like which includes a carriage slidably mounted on a longitudinal support operatively connected to a closure whereby a reciprocating movement of the carriage is operative to move the closure between open and closed positions and an electric motor operated means which reciprocally drives the carriage and actuates a control means when the closure encounters an obstruction to its movement.

It is another object of this invention to provide an electric motor operated means adapted to reciprocally move a carriage on a longitudinal support operative to open and close sliding doors and the like which includes a power transmission mechanism having a pulley for driving the carriage and a cam, operatively connected to an electric reversible motor driven pinion, wherein the cam is placed under a predetermined brake load whereby the pinion normally drives the pulley and when the load imposed on the pulley exceeds the load imposed on the cam, the pulley stalls and the cam is rotated to actuate a control means.

It is a further object of this invention to provide a power operated mechanism for operating closures of the sliding type which includes a carriage slidably mounted on a longitudinal support adapted to be reciprocally driven by a rope having ends thereof attached to the carriage to form an endless rope drive and including a link pivotally connecting the carriage to the closure, wherein the cable ends are cushioned with respect to the carriage and the link includes shock absorbing and spring means, whereby the closure may be moved between open and closed positions in a relatively noiseless and smooth manner and whereby the closure is constantly spring urged in a closed position.

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 side elevation view of the door operating mechanism including a fragmentary section of an adjacent wall and door to which it may be applied and showing in cross section a portion of a shock absorbing chamber and a manually detachable connection.

FIGURE 2 is a front elevation view in cross section taken along lines 2—2 in FIGURE 1 of the manually detachable connection.

FIGURE 3 is a side elevation view in cross section taken along line 3—3 in FIGURE 2 which is also shown in FIGURE 1.

FIGURE 4 is a top view of the door operating mechanism of FIGURE 1 showing portions of a carriage in cross section.

FIGURE 5 is a side elevation view in cross section taken along line 5—5 showing the transmission portion of a motor and control means.

FIGURE 6 is a cross sectional view of the transmission portion of a motor and control means having a por-

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tion of a ring gear broken away and a switch means which may be used therewith.

FIGURE 7 is a bottom view of the switch means shown in FIGURE 6.

FIGURE 8 is a cross sectional view taken along lines 8—8 in FIGURE 6.

FIGURE 9 is a cross sectional view taken along line 9—9 in FIGURE 6.

FIGURE 10 is a schematic circuit which may be used with the mechanisms of the present invention.

While the present invention may be used with a variety of sliding closures and particularly with closures which slide from a closed position in one plane to an open position in another plane, the preferred embodiment is described herein and shown in FIGURE 1 as a power operating mechanism for operating a door of the type which is moved in tracks 22 upwardly from a closed vertical position in a doorway to an open horizontal position above the doorway as is well known in the art.

The apparatus is illustrated generally in FIGURES 1 and 4 of the drawing. It includes a motor and control unit A, preferably attached to a ceiling by means of a support member 16, which includes a reversible motor, an electrical switch means shown in detail in FIGURES 6, 7, 8 and 9, a power transmission mechanism shown in detail in FIGURES 5 and 6 and a drive sheave pulley 42 of FIGURE 5. It further includes a mechanism B which includes a tube member 14 mounted horizontally over a doorway 12 and perpendicular thereto, a carriage 36 slidably mounted on tube 14, an idler pulley 30 and a drive pulley 42 of the power transmission unit A disposed at the other end of tube 14, and a cable 43 disposed about the pulleys and attached to carriage 36 whereby movement of drive pulley 42 causes a longitudinal movement of carriage 36 along tube 14. It also includes a shock absorbing, manually releasable link C for operatively attaching carriage 36 to door 10, the manually releasable feature of which is shown in detail in FIGURES 2 and 3.

The drive mechanism

Referring to FIGURES 1 and 4, a tube 14, disposed horizontally over a doorway 12 and perpendicular thereto, is held on one end to bracket member 16, integrally attached to a gear head 18 of motor and control unit A by bolt 20, the bracket member 16 also serving as a means for securing motor and control unit A to a support, as, for example, a ceiling. The other end of tube 14 is held by a support member 23 having cylindrical portions 24 engaging internal surfaces of tube 14, a collar or abutment 26 holding tube 14 against longitudinal movement, and a longitudinal projecting portion 28 which rotatably supports a sheave idler pulley 30 and is secured to wall 13 above doorway 12 by means of bracket 32 and bolt 34. A tubular carriage 36 is slidably mounted about tube 14 and has its longitudinal movement thereon limited in one direction by abutment 26 and in the other direction by an adjustable abutment consisting of a sleeve 38 of metal or preferably resilient material such as rubber, held in position by a clamp 40. Tubular carriage 36 is fitted with fiber cylindrical bearings internally and on each end thereof, suitably attached thereto, to provide a smooth and noiseless movement of carriage 36. Disposed within gear head 18 as may be seen in reference to FIGURE 5, is a sheave drive pulley 42 in aligned relation with respect to idler pulley 30. A cable 43 of steel or other suitable material is disposed about drive pulley 42 and idler pulley 30, and the ends thereof are looped and attached by means of clamps 44 to stem portions of T-shaped members 46 which in turn are disposed in apertures provided in opposed portions of outwardly extending bracket 48 of carriage 36. A ten-

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sion spring 50 connects head portions of T members 46 to provide cable tension between idler pulley 30 and drive pulley 42 whereby carriage 36 is caused to move longitudinally of tube 14 between abutment 26 and 38 in accordance with the direction of rotation of drive pulley 42. Rubber bumpers 52 and 53 are interposed between head portions of T members 46 and bracket member 48 to absorb starting shock of cable 43.

In the arrangement shown, with the idler pulley adjacent wall 13, a shock absorbing link C is pivotally attached to carriage 36 and door 10 which will be hereinafter fully described, and the position of carriage 36 in contact with abutment 26 corresponds to door 10 being in a fully closed position while the position of carriage 36 in contact with adjustable abutment 38 corresponds to door 10 being in an open position as desired. As may be readily seen, abutment 38 be moved in either direction to allow carriage 36 to move in the direction of drive pulley 42 to open doors of various heights to a desired open position.

Shock absorbing link mechanism

Referring to FIGURE 1, a shock absorbing link mechanism C is pivotally attached to carriage 36 and door 10. It includes a shock absorbing mechanism of conventional construction including cylinder 54, piston 56 operable therein in a well known manner and a piston rod 58 connected to piston 56 and extending externally of cylinder 54. Cylinder 54 has an eye member 61 pivotally attached to bracket 66 by means of bolt 65, which, in turn, is bolted to bracket 64 and door 10 to form a pivotal connection between link C and door 10. The opposite end of link C is pivotally attached to carriage 36 by manually detachable means including bracket or dog 68 having an aperture and internal thread portions receiving threaded portions of rod 58 locked thereto by nut lock 60, bracket 72 mounted on carriage 36 and carrying pin 78, and slidable pin 82, the details of which will be clearly described hereinafter. Link C further includes a compression coil spring 76 disposed about external portions of piston rod 58 and interposed between cylinder 54 and collar 62, adjustably mounted on piston rod 58 by means of set screw 63. The parts are dimensioned and adjusted so that when carriage 36 is positioned against abutment 26, in a door closed position, a line X passing through the axis of pin 78 and bolt 65 in a vertical plane is substantially parallel to the vertical axis of door 10, or preferably, the axis of pin 78 is located over center with respect to bolt 65 or on the door side of a line passing through the axis of bolt 65 and is parallel to the vertical axis of door 10, whereby a toggle action is effected which locks the door even though the operating mechanism is capable of free wheeling. When the parts are so adjusted, compression spring 76 is operative to urge and maintain door 10 in a fully closed position.

The manually releasable pivotal connection between link C and carriage 36 may be more clearly seen by reference to FIGURES 2 and 3. Bracket 72 attached to carriage 36 consists of a pair of spaced downwardly depending members carrying therebetween a horizontally disposed pin 78. Bracket or dog 68 has a laterally slotted portion 80 which defines a latch for receiving pin 78 and a latch pin 82 having an enlarged head portion slidably disposed in aperture 84 disposed normal to slot 80 and having a reduced diameter lower portion, for locking carriage pin 78 within latch slot 80. A compression spring is disposed about pin 82 within recess 84 between shoulder 83 of the enlarged portion of pin 82 and shoulder 85 of reduced diameter portion of recess 84 for normally maintaining pin 82 positioned across slot 80, in a closed position. A cord 88 is provided for manually retracting latch pin 82.

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Motor and control mechanism

Referring to FIGURES 5 and 6, the motor and control mechanism A (FIGURE 4) includes a motor rotor, not shown, suitably mounted in a motor housing 19 (FIGURE 1) for vertical positioning having a shaft 92 and pinion 94 fixed thereto projecting into gear head 18 which consists of an outer wall 96 and an inner wall 98. Drive pulley 42 is in the form of a ring having an annular portion 100 riding in a groove provided between annular shoulder 102 of circular retaining member 104 bolted to outer gear head wall 96. Rotatably mounted on drive pulley 42 are a pair of oppositely disposed sun gears 105 meshing with pinion 94 and having reduced diameter gear portions 106 meshing with internal ring gear 108. Internal ring gear 108 has a cam or eccentric outer surface 110 engaging an actuating plunger 112 reciprocably slidable in guide sleeve 114 disposed in wall 98 and forming part of a switch mechanism, which may be used with the present invention, to be described hereinafter, and circular projection 116 journalled on flange 118 of inner gear head wall 98. The outer surface of circular projection 116 is substantially encircled by clutch or brake band 120, the ends of which are suitably attached to inner ends of plungers 122 which, in turn, are disposed in apertures 124 of gear head portion 98 substantially tangentially to circular projection 116. Plungers 122 are urged toward each other by compression springs 126 disposed between flanged ends 128 of plungers 122 and adjustable retaining plugs 130 whereby gear ring 108 is placed under a predetermined load by brake band 120.

In operation, pinion 94 drives sun gears 105. The load imposed by clutch or brake band 120 on gear ring 108 is sufficient to cause sun gears 105 to drive the drive pulley 42, which, in turn, causes longitudinal movement of carriage 36, FIGURE 4. When carriage 36 reaches the limit of its travel in either direction, engaging abutments 38 or 26, the load imposed thereby on drive pulley 42 overcomes the load imposed by brake band 120 on ring gear 108 and sun gears 104 drive ring gear 108 which actuates switch plunger 112 by means of the rotating cam surface 110 to stop the motor as will be hereinafter described more fully.

As indicated above and shown in FIGURE 1, door 10 is in a fully closed position when carriage 36 engages abutment 26 and is in an open position when carriage 36 engages abutment 38. To open and close the door by means of an electric motor driven carriage 36, it is desirable that the electric motor be of the reversible type and to control the electric motor by means of a reversing switch adapted to reverse the flow of current through the electric motor alternately each time the control switch is operated. It is also desirable that there be provided a main line control switch in series with the reversing switch to control the starting and stopping of the motor in response to carriage 36 reaching either abutment 26 or 38. The main line control switch is also operationally connected with the reversing switch so that actuation of the reversing switch will also effect actuation of the main line control switch to provide for closing of electrical circuit through the reversing switch and thereby permit operation of the electric motor in the direction of rotation established by the position of the reversing switch. The switches are related in such a manner that when the main line control switch has been actuated by the reversing switch in initiating operation of the motor, the reversing switch may thereafter be actuated any number of times without causing any actuation of the main line control switch whereby the movement of carriage 36 may be reversed any time it is situated between abutments 26 and 38.

Referring to FIGURES 6 and 7, the reversing switch is generally designated as 132 and connected in series therewith is the control switch generally designated as 134. This switch mechanism is the subject matter of co-

pending application Serial No. 500,126, filed in the name of George W. Jackson on April 8, 1955, and assigned to the assignee of the present invention, now Patent No. 2,826,658.

Reversing switch 132 includes a solenoid relay coil R having associated therewith an armature 136 attracted by core 138 when energized. Armature 136 is pivotally mounted on pivot pin 140 carried on bracket 142 which supports relay coil R and which is supported on a U-shaped base 144.

The armature 136 is adapted to actuate the reversing mechanism 146 by which contact member 148 is alternately disposed between contacts 150 and 152 each time relay coil R is energized to thereby reverse the flow of current through the motor to cause it to rotate alternately in an opposite direction.

The mechanism constituting switch mechanism 132 is a relatively standard reversing switch adapted for reversing electric circuit to an electric motor.

The main line control switch 134 includes a contact 154 carried on rigid arm 156 supported between electrical insulating blocks 158 and 160 carried on base 144. A second contact 162 is carried upon a resilient contact arm 164 which is supported between electrical insulating blocks 160 and 166. Resilient contact arm 164 is adapted to move contact 162 into and out of engagement with contact 154. Response to snap acting movements is effected upon resilient arm 164 by means of a U-shaped leaf spring 168 carried between end 170 of arm 164 and an actuating member 172. As the actuating member 172 moves inwardly and outwardly of the motor housing 19 as hereinafter described, the points of engagement of spring 168 with the actuating member and with arm 164 effects a toggle action on arm 164 to move contact 162 toward and away from contact 154 in a manner well known in the art.

The actuating member 172 is operated by means of actuator 174 which comprises a plunger 112 which engages cam surface 110 and a second portion 176. The plunger 112 is reciprocally slidable in guide sleeve 114 carried in wall 178 of base 144. The actuation portion 176 is carried on plunger 112 by means of a pivot pin 180 which provides for oscillation of actuator portion 176 relative to the axis of plunger 112. Further, actuator portions 112 and 176 are in substantial alignment so that reciprocation of plunger 112 is transmitted to the actuator portion 176.

The actuator portion 176 is disposed normally in generally axial alignment with plunger 112 by means of a leaf spring member 182 which engages a ledge 184 provided in actuator portion 176. The ledge 184 is generally angularly shaped in the plane of leaf spring 182 whereby the normal positions of actuator portion 176 is co-axial of the axis of plunger 112. The leaf spring 182 is carried between insulating blocks 186 and 188 supported on base 144.

The actuator portion 176 has a finger 190 which extends through an opening 192 in actuator member 172 and is adapted to be engaged by an arm 194 projecting from armature 136 of solenoid relay coil R. The actuator portion 176 is also provided with a ledge 196 adapted to engage actuating member 172 on the forward edge 198 of slot 192 to hold the actuating member 172 in the position shown in FIGURE 6.

The position of the switch mechanism shown in FIGURE 6 is the normal position attained when carriage 36 is in contact with abutments 26 or 38.

FIGURE 10 shows schematically an electric circuit for causing operation of the motor to effect opening and closing of a garage door. In the circuit, a manually operated push button control 200 which closes an electric circuit through secondary coil 202, of a transformer 204, the primary coil 206 thereof being connected to power lines L1 and L2, closing the circuit by push button 200 or other means as, for example, radio remote control, energizes

solenoid R which, in turn, through operation of armature 136 effects actuation of reversing mechanism 146 of switch mechanism 132 whereby contact carrying arm 148 is moved alternately between contacts 150 and 152. The contacts 150 and 152 are in series circuit with windings 208 and 210 of an electric motor, a capacitor 212 being provided to effect starting of the motor in a well known manner. When switch arm 148 is in the position shown in FIGURE 10, the motor will operate in one direction of rotation and when arm 148 engages contact 152 the motor will operate in a reverse direction of rotation. A thermal overload switch 214 is provided in series with the motor to break the circuit in event of an overload condition.

In series circuit with arm 148 of switch mechanism 132 there is provided the contacts 154 and 162 of switch mechanism 134 adapted to be opened and closed by the cam member 110 when it is rotated.

A second contact carrying arm 216 may be provided on switch mechanism 132 to effect closing of an electric circuit to a lamp 218 when the carriage 36 is moved toward abutment 38 and to break the circuit to lamp 218 when carriage 36 is moved toward abutment 26 of tube 14. To this end contact carrying arm 216 is interconnected with contact carrying arm 148 to operate concurrently therewith and is on the opposite side of switch mechanism 132 as shown in FIGURE 7.

Operation

FIGURE 1 shows carriage 36 and link C in a door closed position. Carriage 36 engaging abutment 26 has reached a limit of travel in a door closed direction. Link C is pivotally mounted to the door 10 a vertical distance from its base to effect a full door closure. However, to secure a closure of a desired degree of snugness, link C may be lengthened or shortened by variation of the depth to which piston rod 58 is screwed into bracket 68. Further, the longitudinal position of collar 62 may be varied to increase or decrease the distance to which spring 76 will force connecting rod 58 out of cylinder 54 and thus vary the effective length of link C.

When the motor is energized to open the door, the initial impact of cable 43 on carriage 36 will be cushioned by bumper 52 giving the motor an opportunity to gain momentum before receiving a load and subsequent impact on door 10 will be absorbed by the shock absorber of link C in a well known manner to further enable the motor to attain its speed before receiving the full load of the door. When the door reaches its open position, the impact of carriage 36 on abutment 38 will be cushioned by the resilient nature of abutment 38 and by cushion 52, and the momentum of the moving door will be cushioned by the shock absorber of link C in a well known manner. When the motor is energized to return the door to a closed position, initial starting impact is absorbed by a bumper 53 and the impact of carriage 36 against door 10 through link C is cushioned by the shock absorber of link C and spring 76, if necessary, to enable the motor to gain momentum before receiving the full load. As the door is being closed, piston rod 58 is forced into cylinder 54 against compression spring 76 as it cushions the impact, and as the door reaches a fully closed position, the impact of carriage 36 engaging abutment 26 or the door meeting an obstruction, is taken by bumper 53 and the shock absorber including spring 76. As previously mentioned, spring 76 also serves to hold the door in the fully closed position.

As previously noted, cable 43 is maintained in tension about the pulleys by spring 50. Under nonoperating conditions, T members 46 and spring 50 are loosely held within bracket 48 of carriage 36. On energization of the motor to cause rotation of drive pulley 42 in either direction, the appropriate T member engages carriage bracket 48 through the corresponding bumper to result in a firm connection while spring member 50 takes up any slack in the rope drive.

In describing the operation of the switch mechanism, relative movement of the switch parts will be indicated as moving inwardly or outwardly of the motor housing 19. The mechanism shown in FIGURE 6 is in a position attained at the end of the movement of garage door 10 upon either the opening or closing thereof. The cam surface 110 has effected inward movement of actuator 174 to cause the ledge 196 thereof to move actuator member 162 of switch mechanism 134 inwardly to effect opening of contacts 154 and 162 and thereby stop operation of the motor in response to carriage 36 having reached either abutment 26 or 38 whereby drive pulley 42 has been stalled so as to cause the motor to rotate cam 110.

When the garage door is to be moved in an opposite direction, the push button switch 200 is closed energizing the solenoid relay coil R of switch mechanism 132. Energization of relay coil R attracts armature 136 toward core 138 and thereby actuates mechanism 146 to move contact carrying arm 148 either inwardly or outwardly depending on its previous setting to set up the circuit to motor windings 208 and 210 for reverse rotation from that effected just prior to the previous stopping of the motor.

When armature 136 moves against core 138 of relay coil R, the actuator portion 176 is oscillated in a clockwise direction about its pivot 180 to thereby release actuator member 172 from the ledge 196 of the actuator portion 176, the opening 192 allowing the actuator member 172 to move downwardly over ledge 196 as the actuator portion 176 is moved in the clockwise direction.

When the actuator member 172 moves outwardly, the spring member 168 effects a snap action of the contact carrying arm 164 to close contact 162 upon contact 154 and thereby close electric circuit to the electric motor to start the same.

After actuating member 172 has been released from ledge 196, armature 136 may thereafter be moved toward relay coil 138 by its energization to reverse the direction of rotation of the motor and thereafter reverse the direction of movement of carriage 36 without effecting the now closed position of contacts 162 and 154, the inner end 190 of actuator portion 176 being free to oscillate on its point 180, sufficient clearance being provided in the opening 192 for this purpose. The spring member 182 will return actuator portion 176 as shown in FIGURE 6 whenever the relay coil is deenergized by opening of push button 200. Thus, the actuator portion 190 is always reset to the active position irrespective of the number of times the relay coil R may be deenergized after initial actuation of the relay coil which has effected closing of contacts 154 and 162 to start the motor.

With the switch mechanism in the position aforementioned effecting the initial starting of the motor, the motor will not stop until the garage door reaches an open or closed position and carriage 36 engages abutment 26 or 38 or meets an obstruction which prevents the door from reaching its full open or closed position as determined by abutment 26 or 38. In either event, stopping of the garage door in its movement will cause drive pulley 42 to stop. As a result, the overload created thereby causes pinion 94 to drive sun gears 105 rotationally about their axes and thereby rotate ring gear 108 against the load imposed by brake band 120. When this occurs, cam surface 110 rotates with ring gear 108 to allow the actuator 174 to move inward until plunger 112 engages the low side of the cam surface which is 180° opposed to the engagement of cam surface 110 with plunger 112 shown in FIGURE 6.

When actuator 174 reaches the low point of its reciprocation, the ledge 196 will be drawn downwardly through opening 192 in the actuating member 172 to reset ledge 196 in engagement with the forward edge 198 of opening 192.

Continued rotation of cam surface 110 will cause an upward movement of plunger 112 as the cam surface is

now rotating to the high point shown in FIGURE 6 so that actuator 174 moves upwardly, actuator member 172 will be carried by ledge 196 in an upward direction until spring 168 effects a snap opening movement of contacts 154 and 162 as shown in FIGURE 6, to again open the circuit to the motor. The switch mechanism is now reset to provide for actuation of the motor in the opposite direction on subsequent energization of relay coil R.

While the embodiments of the present invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. A motor and control means comprising in combination a reversible electric motor having a shaft; a pinion operatively connected to and driven by said shaft; a drive pulley disposed coaxially of said pinion; a sun gear mounted on a radius of said drive pulley and meshing with said pinion; an internal ring gear having a cam surface, disposed coaxially of said pinion and meshing with said sun gear; a brake associated with said ring gear for applying a predetermined load thereto whereby said pinion normally drives said drive pulley; and a control means associated with said cam surface and the electrical circuit of said motor and responsive to the rotation of the cam surface whereby a load applied to said drive pulley which exceeds the load applied to said ring gear by said brake causes said drive pulley to stall and said pinion to drive said ring gear to actuate said control means, a revolution of said cam surface being operative to deenergize said motor and set said motor electrical circuit for reverse motor operation on subsequent energization of said motor.

2. A power operating mechanism for operating sliding closures and the like comprising, in combination, a longitudinal support; a carriage slidably mounted on said support and operatively attached to a closure whereby a reciprocating movement of said carriage is operative to open and close said closure, an idler pulley mounted on one end of said support; a drive pulley disposed on the other end of said support; a cable disposed about said pulleys in rope drive relation and attached to opposite portions of said carriage, and a motor and control means comprising a reversible electric motor having a shaft, a pinion operatively connected to and driven by said shaft, said pinion being disposed coaxially of said drive pulley, a sun gear mounted on a radius of said drive pulley and meshing with said pinion, an external ring gear having a cam surface disposed coaxially of said pinion and meshing with said sun gear; a brake associated with said ring gear for applying a predetermined load thereto whereby said pinion normally drives said drive pulley to open and close said closure, and a control means associated with said cam surface and responsive to the rotation thereof whereby a load applied to said drive pulley due to said closure having reached an open or closed position exceeds the load applied to said ring gear by said brake causing said drive pulley to stall and said pinion to drive said ring gear and cause said cam to actuate said control means.

3. A motor and control means comprising in combination an electric motor having a shaft; a pinion operatively connected to and driven by said shaft; a drive pulley disposed coaxially of said pinion; a sun gear mounted on a radius of said drive pulley and meshing with said pinion, an internal ring gear disposed coaxially of said pinion and meshing with said sun gear; said ring gear having a continuous curvilinear cam surface and a cylindrical axial projection; a brake associated with said projection for applying a predetermined load thereto whereby said pinion normally drives said drive pulley; and a control means associated with said cam surface and responsive to the rotation thereof whereby a load applied to said drive pulley which exceeds the load applied to said ring gear by said brake causes said drive pulley to stall and said pulley to drive said ring gear to cause said cam surface to actuate said control means.

4. A motor and control means comprising in combina-

tion a motor housing having a gear head; said gear head including an inner wall having cylindrical axial projection and an outer wall; an electric motor having a shaft, mounted in said housing; a pinion extending into said gear head coaxially of said gear head projection, operatively connected to and driven by said shaft; a drive pulley disposed coaxially of said pinion within said gear head; a plurality of sun gears mounted on a radius of said pulley and meshing with said pinion; an internal ring gear having continuous curvilinear cam surface and a cylindrical axial projection; the inner surface of said ring gear projection being journaled to said gear head projection; a brake associated with said ring gear for applying a predetermined load thereto whereby said pinion normally drives said drive pulley; and control means associated with said cam surface and responsive to a revolution thereof whereby a load applied to said drive pulley which exceeds the load applied to said ring gear by said brake means causes said drive pulley to stall and said pinion to drive said ring gear to actuate said control means.

5. A motor and control means comprising in combination, a motor housing having a gear head; said gear head including an inner wall and an outer wall; a circular retaining plate attached to the inner side of said outer wall, having a radial flange whereby a circumferential groove is formed between said outer wall and said flange; an annular drive pulley having inner portions thereof disposed and adapted for rotation within said groove; a motor disposed in said housing having a shaft; a pinion operatively connected to and driven by said shaft and being disposed coaxially of said pulley; a sun gear mounted on a radius of said drive pulley and meshing with said pinion; an internal ring gear having a cam surface disposed coaxially of said pinion and meshing with said sun gear; a brake associated with said ring gear for applying a predetermined load thereto whereby said pinion normally drives said drive pulley; and a control means associated with said cam surface and responsive to the rotation thereof whereby a load applied to said drive pulley which exceeds the load applied to said ring gear by said brake causes said drive pulley to stall and said pinion to drive said ring gear to actuate said control means.

6. A motor and control means comprising in combination a motor housing having a gear head; an electric motor having a shaft, mounted within said housing; a pinion operatively connected to and driven by said shaft extending into said gear head; a drive pulley disposed within said gear head coaxially of said pinion; a sun gear mounted on a radius of said drive pulley, meshing with said pinion; and an internal ring gear having a cam surface and a cylindrical brake surface, disposed coaxially of said pinion and meshing with said sun gear; a brake associated with said cylindrical brake surface comprising a brake band having spaced ends disposed about said cylindrical brake surface and spring means associated

with said ends normally urging said ends toward each other whereby said ring gear receives a predetermined load and said pinion normally drives said pulley; and control means associated with said cam surface and responsive to the rotation thereof whereby a load applied to said drive pulley which exceeds the load applied to said ring gear by said brake causes said drive pulley to stall and said pinion to drive said ring gear to actuate said control means.

7. A door opening and closing mechanism comprising, a rotative door-operating element having connection with a door for opening it while rotating in one direction and closing it when rotating in the other direction, a speed-reduction assemblage drivably connected to said rotative element for imparting door-operating rotation thereto, an input shaft operably connected to said speed reduction assemblage and in axial alignment with said rotative door-operating element, said input shaft operating at a higher rate of rotation than the door-operating element, a switch-operating member having a circular clutch face mounted concentrically with both the input shaft and the rotative door-operating element and being differentially coupled therewith whereby to exert torque force on the switch-operating member while transmitting power from the input shaft to the door-opening element, said switch-operating member having means eccentrically located with respect to the axis of its circular clutch face for actuating a switch upon rotative movement thereof, and mounting means frictionally holding the switch-operating member at said circular clutch face areas whereby to permit slippage of the switch-operating member only when the torque force thereon is increased beyond a predetermined value.

References Cited in the file of this patent

UNITED STATES PATENTS

1,321,136	Morava	Nov. 11, 1919
1,650,742	Rowan	Nov. 29, 1927
1,702,479	Mosch	Feb. 19, 1929
1,933,700	Blodgett	Nov. 7, 1933
2,070,058	McCloud	Feb. 9, 1937
2,132,951	Hall	Oct. 11, 1938
2,222,716	Mageoch	Nov. 26, 1940
2,225,003	Gorman	Dec. 17, 1940
2,378,262	Vallen	June 12, 1945
2,544,239	Schirmer	Mar. 6, 1951
2,567,029	Sauter	Sept. 4, 1951
2,589,480	Curtis	Mar. 18, 1952
2,639,143	Vaughn	May 19, 1953
2,687,297	Miller	Aug. 24, 1954
2,778,631	Ginte	Jan. 22, 1957

FOREIGN PATENTS

193,767	Great Britain	Mar. 1, 1923
---------	---------------	--------------