United States Patent [19]

Farmer

[11] **3,797,171**

[45] **Mar. 19, 1974**

[54] **GARAGE DOOR OPENER**

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[52] **U.S. Cl.** **49/360,** 49/199, 160/188

[51] **Int. Cl.** **E05f 15/16**

[58] **Field of Search** 49/199, 200, 358, 360; 160/188, 193

[56] **References Cited**

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Attorney, Agent, or Firm—Clarence A. O'Brien; Harvey B. Jacobson

[57] **ABSTRACT**

A door operating device having two identical sets of rollers spaced from one another along a guide rail. Each set of rollers has a roller engaging a surface of the guide rail, and another, opposed roller engaging another surface of the same guide rail. A frame supported by the rollers for movement therewith has mounted thereon a reversible motor and a drive train for transmitting power from the motor to a roller of each of the roller sets. A bar connected to the frame is attached to a shock absorbing arrangement mounted on a door to be opened and closed by the device. A control system including limit switches on the frame and triggering members associated with the rail limits and reverses movement of the device along the rail.

14 Claims, 7 Drawing Figures

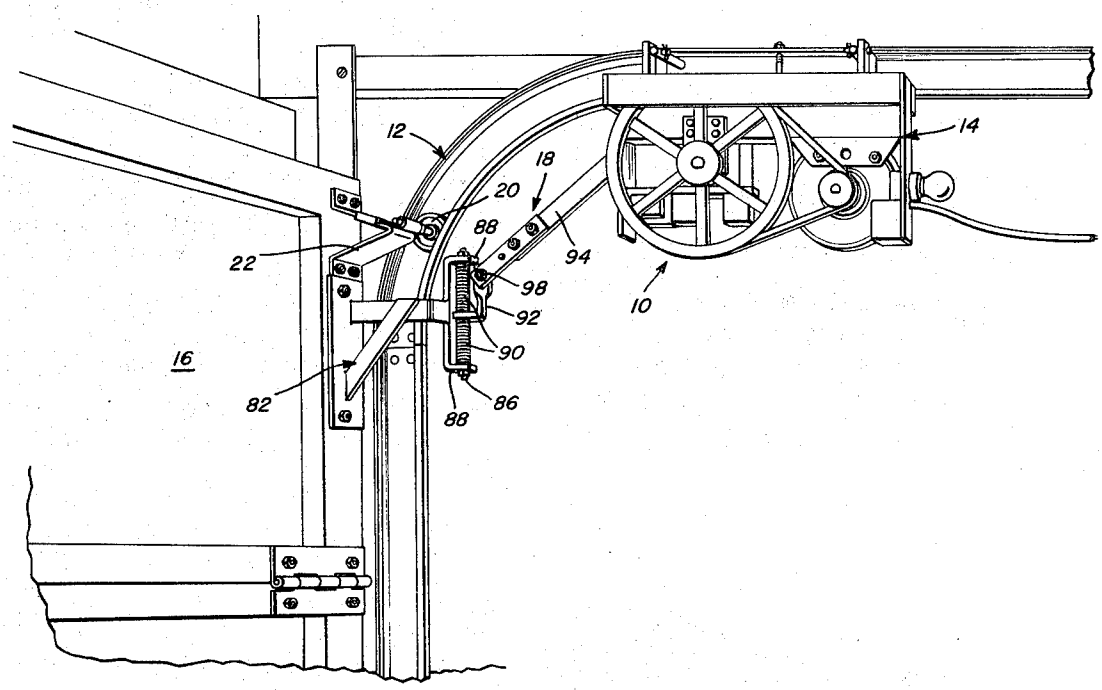


Fig. 1

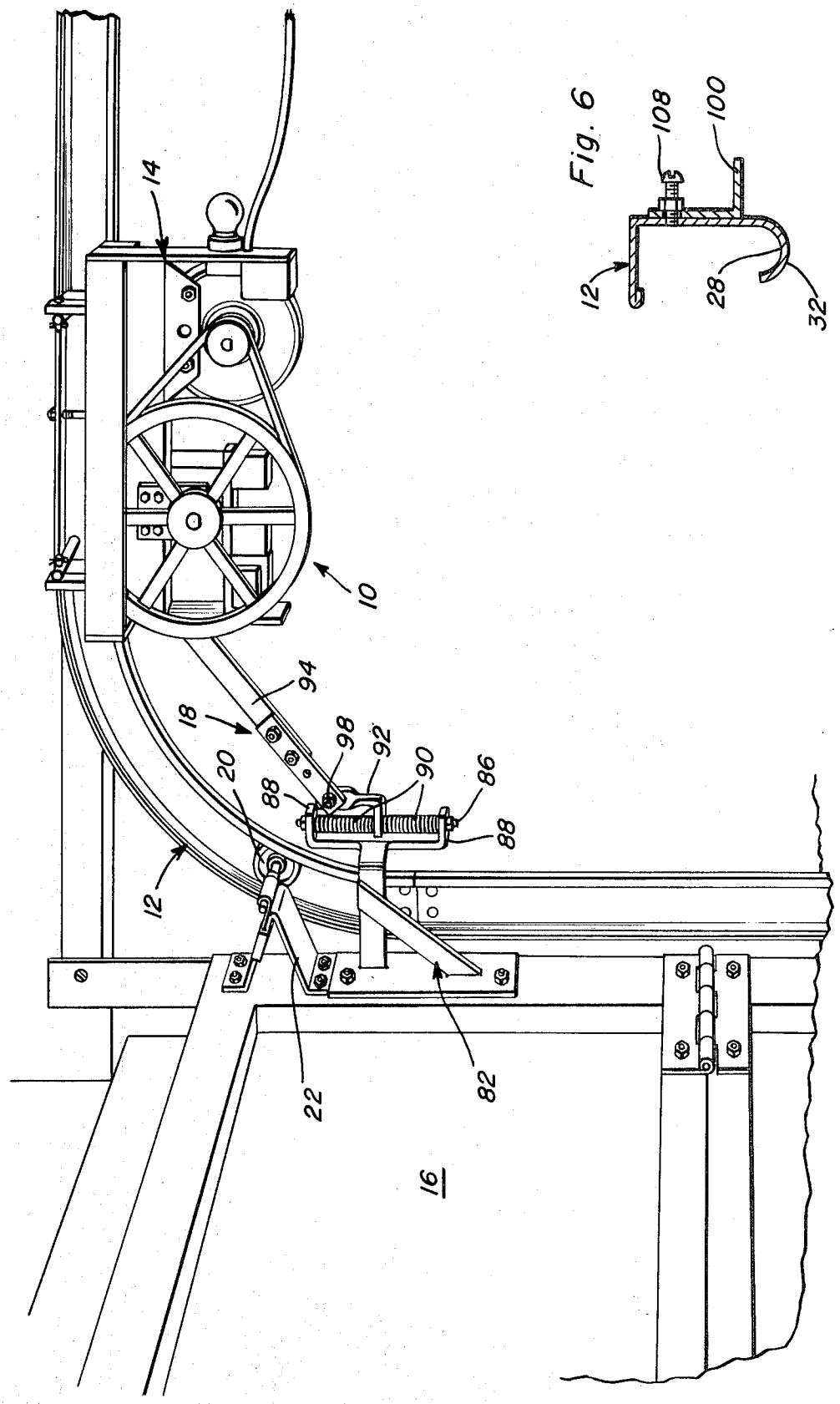


Fig. 6

Fig. 2

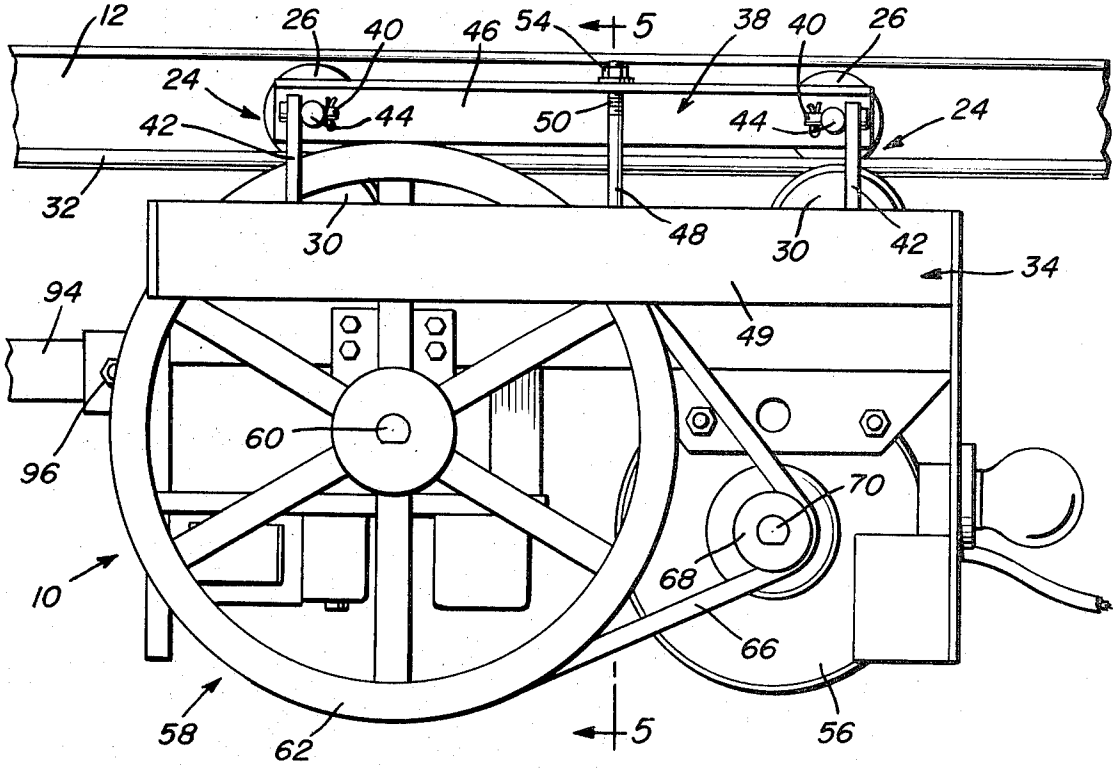

12
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Fig. 3

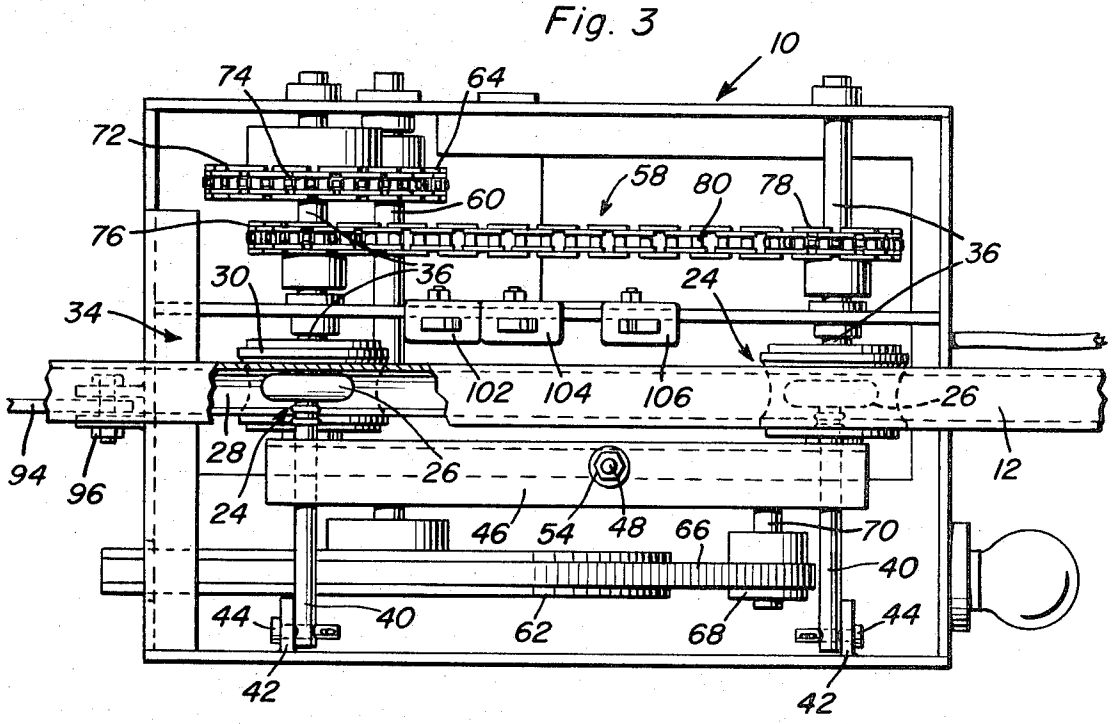

10
74
64
72
58
80
78
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36
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102
104
106
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96
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Fig.4

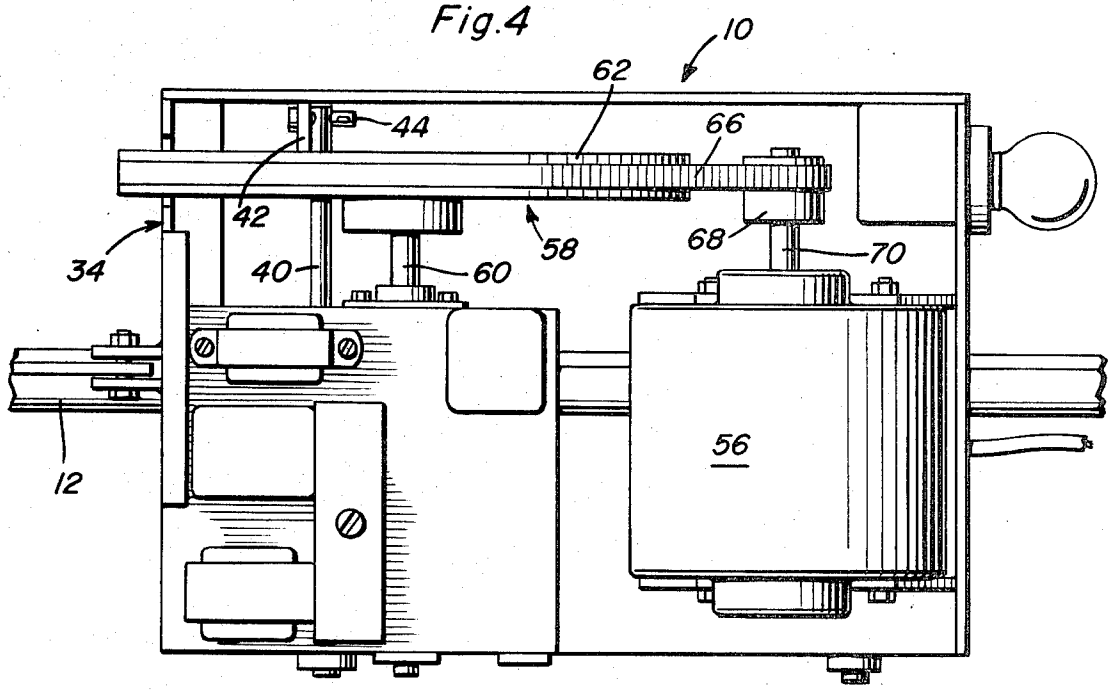
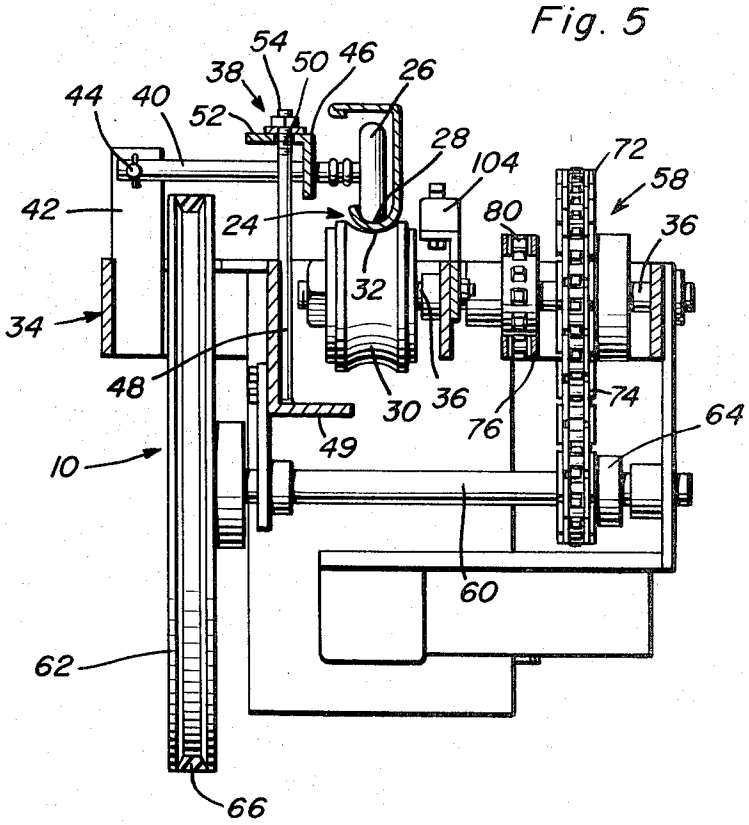

10
62
44
66
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34
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56
12

Fig. 5


54
38
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104
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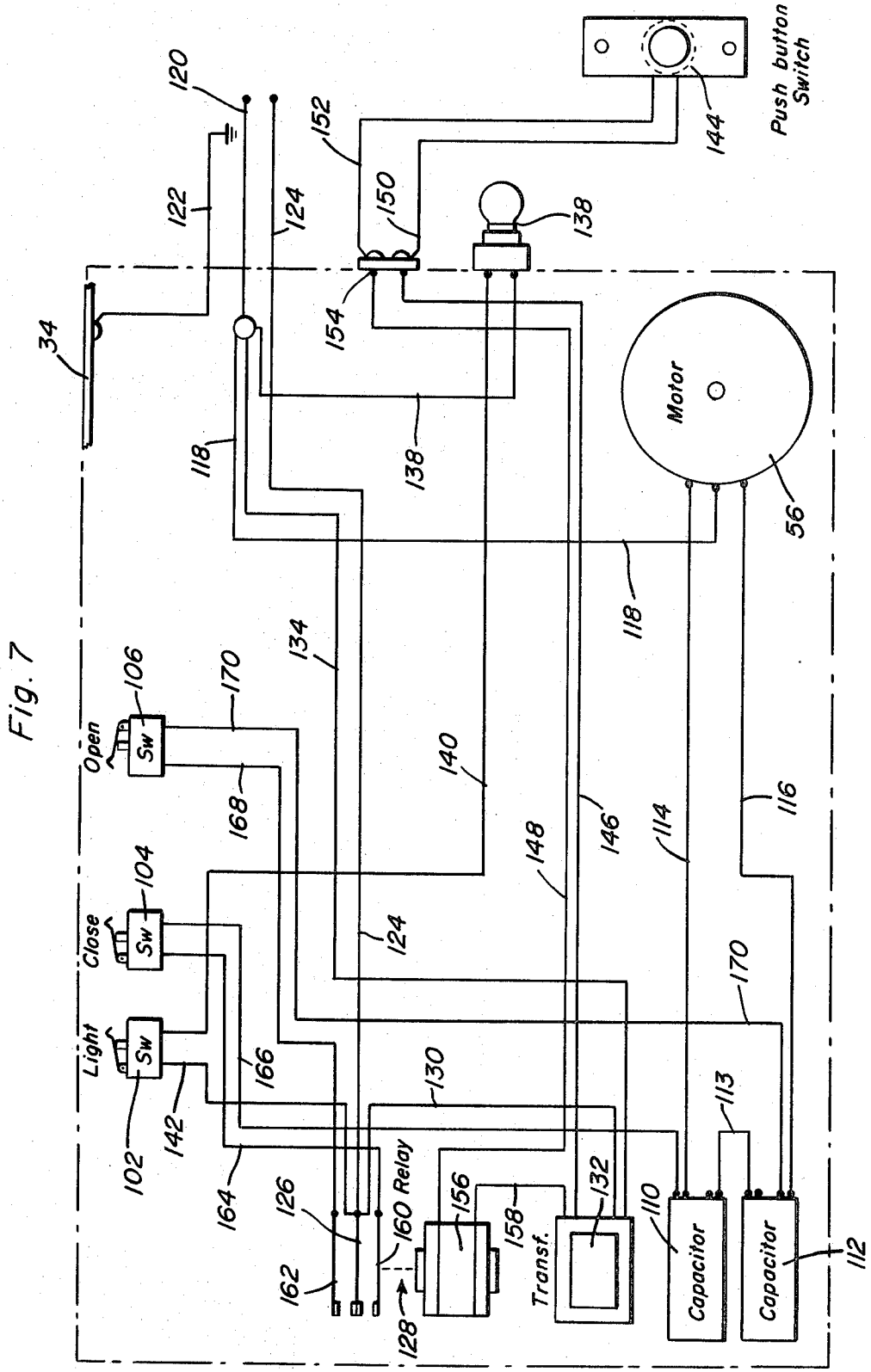

Push button Switch
144
120
152
150
122
124
138
154
34
Motor
56
118
138
118
134
106
Open
Sw
170
140
168
148
146
114
116
104
Close
Sw
124
170
Light
Sw
166
130
113
102
142
164
126
160 Relay
156
158
132
110
Capacitor
Capacitor
112
162
128
Transf.

Fig. 7

GARAGE DOOR OPENER

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to a door operating device, and in particular to a device for opening and closing a garage door mounted on tracks for upward and downward movement.

2. Description of the Prior Art

Numerous devices have been proposed for opening and closing garage doors. These known devices generally use one of several basic arrangements. A motor drive unit may move along either a door guiding rail or a specially provided guide rail, or such a unit may be mounted on the door and engage a, for example, rack arranged adjacent the door and parallel to its path. Alternatively, the motor may be fixedly mounted and manipulate the door by a cable in the manner of a winch, or by a, for example, chain and sprocket torque transmitting arrangement.

Examples of typical rail traveling, motor drive unit arrangements may be found in U.S. Pat. Nos. 2,925,267 and 3,202,415. A probelm encountered with this type of device is a tendency for the door to cock and bind in its track due to the moving force being applied to only one side of the door. Thus, prior proposals have attempted to provide a rigid, stable unit which will move the associated corner of the door parallel to its rail and cause the door to track properly.

SUMMARY OF THE INVENTION

It is an object of the present invention to provide a rail traveling, garage door operating device having improved tracking properties with respect to the rail which it engages.

It is another object of the present invention to provide a rail traveling, garage door operating device having a shock-absorbing attachment to the door for permitting the door to track smoothly.

It is yet another object of the present invention to provide a garage door operating device which may be installed on existing garage doors simply and inexpensively, and without requiring additional head-room over the existing rail.

These and other objects are achieved according to the present invention by providing a door operating device having an arrangement including sets of rollers spaced from one another along an associated guide rail for engaging the guide rail for movement along same, a power drive unit connected to the set of rollers for moving same and itself along the guide rail, and an arrangement including a resilient unit for connecting a frame of the power drive unit to a door for moving the door with the device.

According to a preferred embodiment of the present invention, each set of rollers is the same as each other set, and includes a roller engaging a one surface of the guide rail, and another roller engaging a surface of the guide rail opposed to the one surface. One of the rollers is connected to the motor drive unit for actuation thereby, and its shaft is in turn connected to the drive unit frame for moving same along the guide rail.

According to an advantageous feature of the present invention, the distance between the rollers of each roller set may be varied for adjusting the tension of the rollers against the guide rail.

A preferred embodiment of the arrangement connecting the motor dirve unit to a door has a support bracket connected to the door. This support bracket is provided with a U-shaped portion at an end spaced from the door. A rod is connected to and extended between legs of this U-shaped portion, and a pair of compression springs are arranged on the rod. An angle bracket slidably engages the rod between the springs for being cushioned thereby. A bar is pivotally connected to the drive unit frame and the angle bracket.

An arrangement including limit switches and a stepping switch or relay is mounted on the motor drive unit frame, and limit switch trigger members are associated with the guide rail for limiting and reversing the movement of the device along the rail.

These together with other objects and advantages which will become subsequently apparent reside in the details of construction and operation as more fully hereinafter described and claimed, reference being had to the accompanying drawings forming a part thereof, wherein like numerals refer to like parts throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a fragmentary, perspective view showing a door operating device according to the present invention operably connected to a garage door.

FIG. **2** is a fragmentary, side elevational view showing the device of FIG. **1.**

FIG. **3** is a top plan view, partly cut away and in section, showing the device of FIGS. **1** and **2.**

FIG. **4** is a bottom plan view showing the devices of FIGS. **1** to **3.**

FIG. **5** is a sectional view, taken generally along the line **5—5** of FIG. **2.**

FIG. **6** is a transverse, vertical sectional view through a garage door guide rail showing a limit switch trigger member mounted thereon.

FIG. **7** is a schematic diagram of a control system for a device according to the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

FIG. **1** of the drawings shows a door operating device **10** according to the present invention arranged on a guide rail **12** such as conventionally used for guiding upwardly and downwardly moving garage doors and the like. Device **10** includes a motor drive unit **14** connected to a, for example, garage door **16** as by an arrangement **18.** Door **16** has rollers **20** (only one of which is shown) mounted on brackets, such as bracket **22.** It is to be understood that a rail (not shown) similar to rail **12** is arranged at the other vertical side (not shown) of door **16.**

Referring now to FIGS. **2** to **5** of the drawings, device **10** engages rail **12** by means of, for example, two sets of rollers **24** spaced from one another along the path of rail **12.** Desirably, device **10** only travels along that portion of rail **12** which is normally arranged in a horizontal plane. Each set of rollers **24** has a roller **26** engaging the surface **28** of rail **12,** and a roller **30** engaging a surface **32** of rail **12** opposed to surface **28.** Roller **26** may be standard door roller such as roller **20** and functions as a pinch roller, while roller **30** is a friction roller which may be constructed from a suitable, known resilient material such as a synthetic rubber.

Unit 14 is connected to roller sets 24 for movement therewith.

Unit 14 has a frame 34, and rollers 30 are mounted on shafts 36 rotatably mounted to frame 34 in a known manner. Rollers 30 rotate with shafts 36, which are rotated in a manner to be set out below.

An arrangement 38 may be provided for adjustably tensioning rollers 26, 30 with respect to rail 12. Rollers 26 are rotatably mounted on shafts 40, which may be pivotally mounted to supports 42 as by pins 44. Supports 42 are fixedly mounted on frame 34 in a suitable, known manner. A longitudinally extending member 46 is connected to shafts 40 as by means of holes provided therein. A, for example, rod 48 is fixedly mounted in a known manner on a, for example, angle member 49 forming a portion of frame 34, and is adjustably connected to member 46, as by screw threads 50 passing through an opening 52 provided in member 46 and by a nut 52 threadedly engaging screw threads 50. Selective adjustment of nut 54 permits the distance between shafts 36 and 40, the latter being fixedly connected to frame 34, to be varied to achieve a desired tension of rollers 26, 30 against guide rail 12.

Frame 34 has a motor 56 — which may be, for example, a reversible electric motor — mounted thereon in a conventional manner. A drive train 58 transmits torque from motor 56 to shafts 36 of rollers 30 for reversibly moving device 10 along rail 12.

Drive train 58 has a shaft 60 rotatably mounted on frame 34 in a known manner, and a pulley 62 and a sprocket 64 are mounted on shaft 60 for rotation therewith. A belt 66, which may be standard V-belt as shown, is arranged about pulley 62 and a motor pulley 68 mounted on a motor shaft 70 for rotation thereby and for transmitting torque from motor 56 to sprocket 64. A sprocket 72 is mounted on a one shaft 36 for rotation therewith, and a sprocket chain 74 is arranged on sprockets 64, 72 for transmitting torque to the one shaft 38 and rotating same. A sprocket 76 is also mounted on the one shaft 38 for rotation therewith, and a sprocket 78 is mounted on the other shaft 38 also for rotation therewith. A sprocket chain 80 is arranged on sprockets 76 and 78 for transmitting torque from the one shaft 38 to the other shaft 38 and rotating the latter. The various sprockets and sprocket chains may be any suitable, standard sprockets and sprocket chains.

As can best been seen in FIG. 1 of the drawings, arrangement 18 has a support bracket 82 connected to door 16. This support bracket 82 is provided with a U-shaped portion 84 at an end spaced from door 16, and a, for example, rod 86 connected to and extending between legs 88 of portion 84. A pair of compression springs 90 are arranged on rod 86, and an angle bracket 92 is arranged slidably engaging rod 86 between springs 90 for being cushioned thereby. A bar is pivotally connected to frame 34 as a pivot joint 96 (FIGS. 2 and 3), and extends from frame 34 toward bracket 82 for being pivotally connected to bracket 92 as at a pivot joint 98. Springs 90 act to absorb sudden changes of motion between door 16 and device 10, and permit door 16 to move uniformly along its guide rails.

FIG. 6 shows one example of an arrangement for adjustably mounting a trigger member 100 on a guide rail 12. One member 100 may be provided for a light switch 102 (FIG. 3) and a "close" position limit switch 104, and another member 100 provided for an "open" position limit switch 106. A, for example, screw and nut assembly 108 is lockably arranged in a threaded bore provided in rail 12 for permitting adjustment of member 100 parallel to rail 12 as by slot 109.

FIG. 7 of the drawings shows a schematic diagram of a preferred control circuit for limiting and reversing the movement of a device 10, according to the present invention, along a rail 12. Motor 56 is illustrated as a standard split-capacitor type of reversible electric motor with a pair of conventional capacitors 110, 112 connected together by a wire 113 and arranged in series with the auxiliary winding (not shown) of motor 56 by means of wires 114 and 116. Current can flow to motor 56 through wire 114 to rotate motor 56 in a one direction, and through wire 116 for rotating motor 56 in the opposite direction. A third wire 118 goes to motor 56 directly from a power line 120, which may be connected to a, for example, conventional residential electrical outlet (not shown). This outlet is advantageously part of an electrical distribution system provided with a ground wire connected to wire 122, which is in turn connected to frame 34 for grounding unit 14. The other power line 124 is connected to a contact 126 of a stepping switch or relay 128. This relay 128 may be, for example, a conventional two-position ratchet relay. A wire 130 passes from contact 126 to the primary of a suitable, known transformer 132, together with a wire 134 which is connected to power line 120 together with wire 118. Another wire 136 is run to a conventional lamp arrangement 138. Light switch 102 is also connected to lamp arrangement 138 as by a wire 140, and to contact 126 by a wire 142. The switch 102 and lamp arrangement 138 are in this manner connected across power lines 120, 124.

The secondary of transformer 132 is connected across a, for example, conventional push button switch 144 as by wires 146, 148 and wires 150, 152 connected to wires 146, 148, respectively, as by a suitable, known terminal board 154, and to an armature 156 of relay 128 by means of a wire 158. Switch 144 is a normally open switch, while a 24 volt coil has been found satisfactory for armature 156. Each actuation of switch 144 will move contact 126 of relay 128 from one of contacts 160, 162 to the other of same.

Contact 160 is connected to swtich 104 as by a wire 164. Switch 104 is also connected to capacitor 110 by a wire 166. Similarly, switch 106 is connected to contact 162 by a wire 168, and to capacitor 112 by a wire 170.

Switches 102, 104, and 106 are desirably normally-closed switches opened by engaging an associated member 100. Thus, when door 16 is closed, contact 126 of relay 128 will be in contact with contact 160, and switch 104 will be contacting its associated member 100 on rail 12 to interrupt the circuit therethrough to motor 56. The alternate circuit to motor 56 through switch 106 is now interrupted by relay 128. Switch 102 is also opened by the, for example, same member 100 as interrupting switch 104 to place lamp arrangement 138 in an unlighted mode. Closing switch 144 as by manual actuation will now move contact 126 from contact 160 into contact with contact 162. Since switch 106 is closed, a circuit is completed in a one direction through capacitors 110, 112, wire 113, and wire 114 to rotate motor 56 in a corresponding one direction. Upon disengagement of switches 102, 104 from their associated member 100 by movement of device 10

along rail **12**, the circuit to lamp arrangement **138** will be closed by the closing of switch **102**, but the reverse direction circuit to motor **56** through switch **104** will be interrupted by the motor relay **128**. When switch **106** engages its associated member **100**, the circuit therethrough will be broken. The next closing of switch **144** will move contact **126** back into contact with contact **160** and reverse the above procedure to close door **16**.

Motor **56** is preferably provided in a conventional manner with a thermal cut-out switch (not shown). Thus, if door **16** is restrained by an obstacle arranged in its path as door **16** is opening or closing, rollers **30** will slip against rail **12**, overheating motor **56** by overloading same so that the thermal switch will interrupt the circuit to motor **56**.

With a, for example one-fourth hp. motor **56**, a conventional garage door **16** has been opened and closed at the rate of 6 inches per second by application of 4 to 150 lbs. of force to the rail **12**.

It is to be understood that structural details of a device **10** may be changed within the scope of the present invention. In particular, a different drive train may be used for transmitting torque from motor **56** to rollers **30** than drive train **58** described above.

As can be readily appreciated from the above description, a device **10** according to the present invention can be installed on existing garage door track without major modification of the track and door, only bracket **82** and member **100** need be installed, and without it being necessary to provide extra head-room above the guide rail **12**. The friction drive of rollers **26**, **30** may be adjusted, if necessary, by arrangement **38**.

The foregoing is considered as illustrative only of the principles of the invention. Further, since numerous modifications and changes will readily occur to those skilled in the art, it is not desired to limit the invention to the exact construction and operation shown and described, and accordingly all suitable modifications and equivalents may be resorted to, falling within the scope of the invention.

What is claimed as new is as follows:

1. A door operating device, comprising, in combination:

a. a frame;

b. a pair of rollers forming a roller set, one roller of the pair being arranged engaging a one surface of a guide rail and the other roller of the pair being arranged engaging a surface of the guide rail opposed to the one surface, the pair of rollers also arranged opposite one another;

c. a shaft mounted on the frame, the one roller being rotatably mounted on the shaft;

d. a further shaft pivotally mounted on the frame, the other roller being rotatably mounted on the further shaft;

e. adjustment means connected to the further shaft and affixed to the frame for permitting the distance between the shaft and further shaft to be selectively, continuously varied while under tension for achieving a desired tension on the pair of rollers;

f. means connected to the pair of rollers for moving same along the guide rail; and

g. means for connecting the frame to a door.

2. A structure as defined in claim **1**, wherein same includes a plurality of sets of rollers spaced from one another along the guide rail.

3. A structure as defined in claim **2**, wherein the shaft is a plurality of shafts, and a one roller of each of the sets of rollers is rotatably mounted on a respective one of the shafts, the adjustment means includes a longitudinally extending member; and the further shaft is a plurality of shafts pivitally mounted on the frame and passing through holes provided in the longitudinally extending member, and the other roller of each of the sets of rollers is rotatably mounted on a respective one of the further shafts.

4. A structure as defined in claim **3**, wherein each of the sets of rollers has a roller engaging a one surface of a guide rail and another roller engaging a surface of the rail opposed to the one surface, one of the rollers of each of the sets of the rollers being connected to the moving means for actuation thereby.

5. A structure as defined in claim **4**, wherein the moving means is connected to the rollers for movement therewith.

6. A structure as defined in claim **5**, wherein the moving means includes a motor mounted on said frame, and means for transmitting torque from said motor to the shafts of the one rollers for reversibly moving the device along a guide rail.

7. A structure as defined in claim **6**, wherein the transmitting means includes a torque transfer shaft rotatably mounted on said frame, a pulley and a first sprocket mounted on said transfer shaft for rotation therewith, a belt arranged about said pulley and connected to said motor for transmitting torque from the motor to the first sprocket, a second sprocket mounted on the shafts of the one roller of one set of rollers for rotating same, a first sprocket chain connected to said sprockets for transmitting power to the one roller shaft and rotating same, and a third sprocket mounted on the roller shaft and a fourth sprocket mounted on the corresponding roller shaft of the other set of rollers for rotation with their associated shaft, and a second sprocket chain connected to the third and fourth sprockets for transmitting torque from the one roller shaft to the corresponding roller shaft.

8. A structure as defined in claim **7**, wherein the moving means further includes means cooperating with elements associated with the guide rail for limiting and reversing the movement of the device along the rail.

9. A structure as defined in claim **8**, wherein the connecting means has a support bracket connected to a door guided by the guide rail, said support bracket provided with a U-shaped portion at an end spaced from the door, a rod connected to and extending between legs of said portion, a pair of compression springs arranged on said rod and an angle bracket slidably engaging said rod and arranged between said springs for being cushioned thereby, and a bar connected to and extending from said frame and pivotally connected to said angle bracket.

10. A structure as defined in claim **1**, wherein the moving means includes a motor mounted on said frame, and means for transmitting torque from said motor to the shafts of the one rollers for reversibly moving the device along a guide rai.

11. A structure as defined in claim **10**, wherein the transmitting means includes a torque transfer shaft rotatably mounted on said frame, a pulley and a first

sprocket mounted on said transfer shaft for rotation therewith, a belt arranged about said pulley and connected to said motor for transmitting torque from the motor to the first sprocket, a second sprocket mounted on the shafts of the one roller of one set of rollers for rotating same, a first sprocket chain connected to said sprockets for transmitting power to the one roller shaft and rotating same, and a third sprocket mounted on the roller shaft and a fourth sprocket mounted on the corresponding roller shaft of the other set of rollers for rotation with their associated shaft, and a second sprocket chain connected to the third and forth sprockets for transmitting torque from the one roller shaft to the corresponding roller shaft.

12. The structure as defined in claim **1,** wherein the moving means is connected to the engaging means for movement therewith.

13. A structure as defined in claim **1,** wherein the moving means includes means cooperating with elements associated with a guide rail for limiting and reversing the movement of the device along the rail.

14. A structure as defined in claim **1,** wherein the connecting means has a support bracket connected to a door guided by the guide rail, said support bracket provided with a U-shaped portion at an end spaced from the door, a rod connected to and extending between legs of said portion, a pair of compression springs arranged on said rod and an angle bracket slidably engaging said rod and arranged between said springs for being cushioned thereby, and a bar connected to and extending from moving means and pivotally connected to said angle bracket.

* * * * *