

June 19, 1956

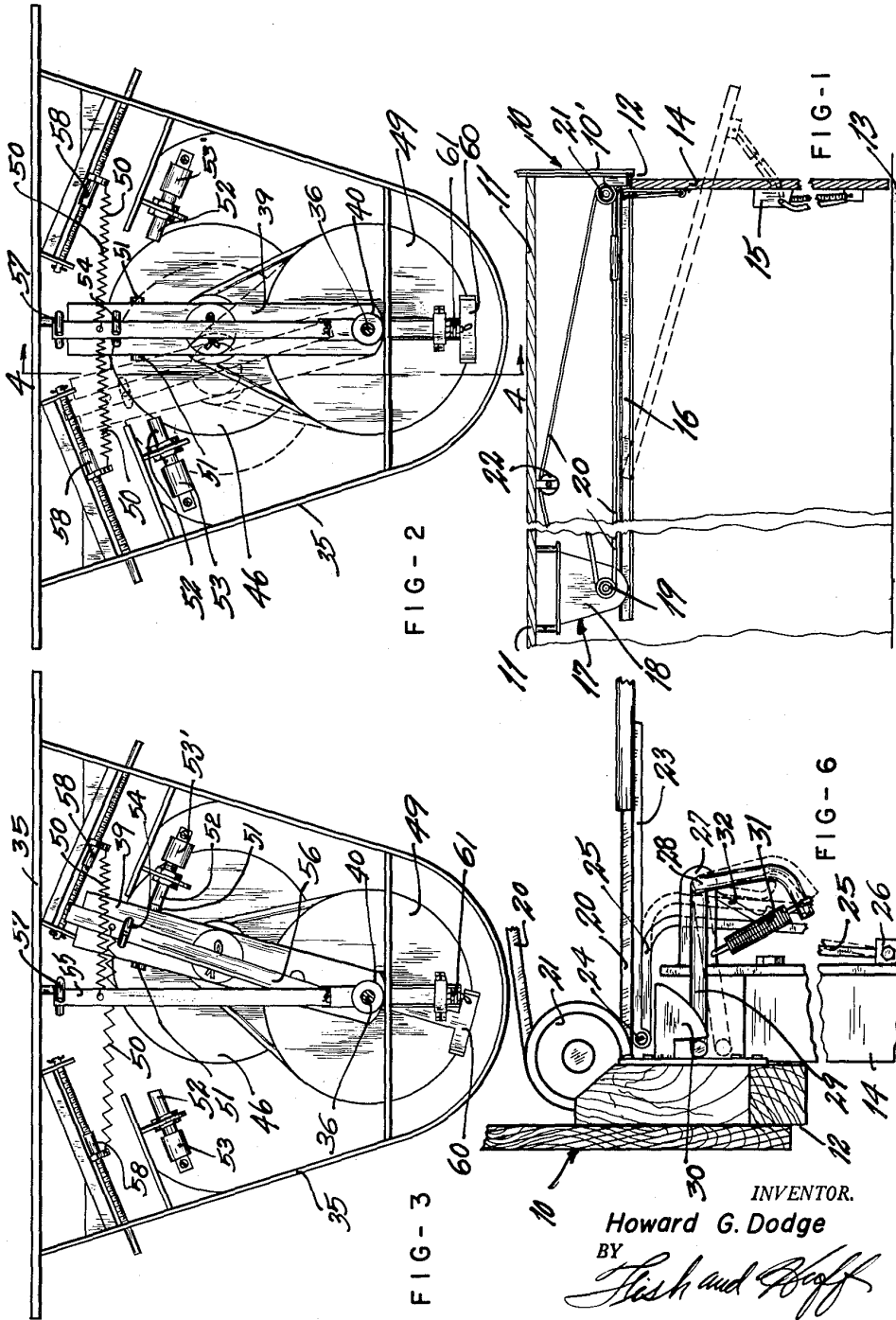
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2,751,219

TORQUE SENSITIVE REVERSIBLE MOTION ACTUATOR

Filed Aug. 30, 1954

3 Sheets-Sheet 1



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3 Sheets-Sheet 2

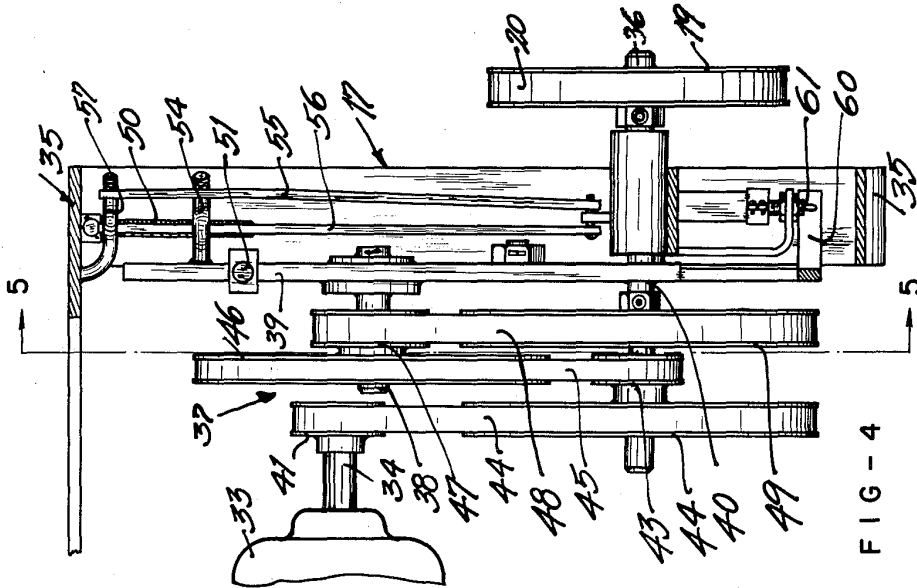


FIG - 4

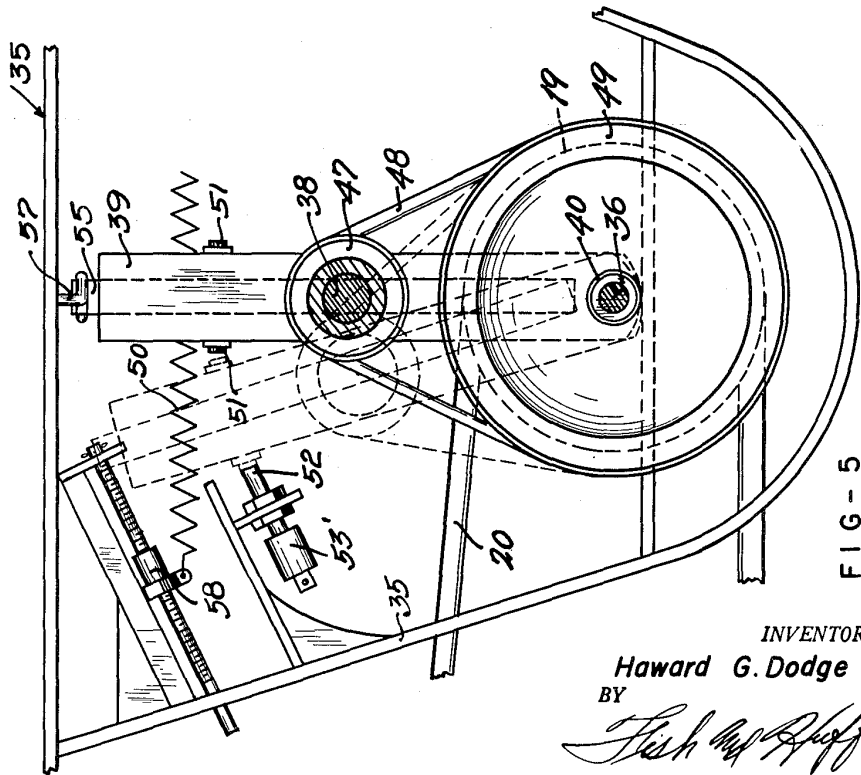


FIG - 5

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3 Sheets-Sheet 3

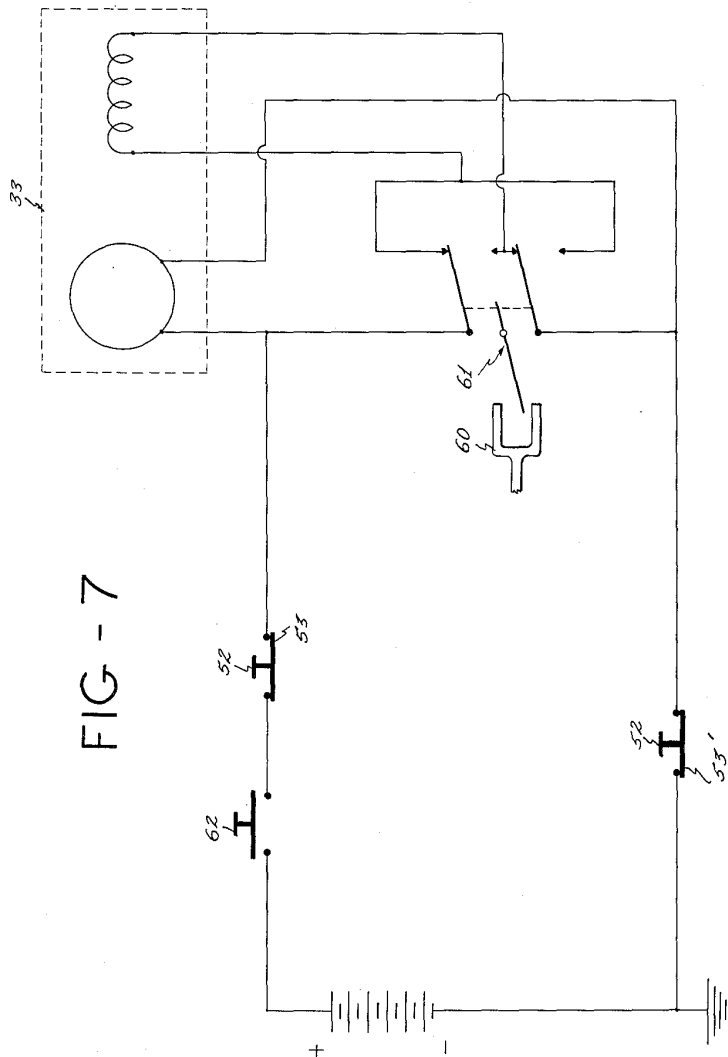


FIG - 7

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2,751,219

TORQUE SENSITIVE REVERSIBLE MOTION ACTUATOR

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2 Claims. (Cl. 268—59)

This invention relates to torque sensitive reversible motion actuators for producing a desired movement and halting the movement when the torque exceeds that normally required and reversing the actuator upon subsequent operation thereof.

Although not necessarily limited thereto the present device is admirably suited for the operation of a vertically movable garage door wherein a motor driven endless belt is trained about pulleys and is suitably secured to the door intermediate the pulleys so that actuation of the belt will cause the door to be moved to open and closed positions. The present application is a continuation in part of my copending application Serial No. 353,636, filed May 7, 1953, and entitled Garage Door Opener, now abandoned.

Among other advantages and features this invention provides means whereby a door such as a garage door may be opened and closed by an automatically reversible torque sensitive motion actuator which is adapted to halt operation upon increase of torque at the motor exceeding that required to open and close the door, thus precluding the possibility of injury to a person or mutilation of an object which may be inadvertently disposed in the path of movement of the door.

Many types of door opening and closing devices have been employed to automatically operate garage doors, but it has been found to be very difficult to devise a garage door operating mechanism which substantially eliminates the possibility of damaging the door mounting and/or actuating mechanism or obstruction which may be disposed in the path of movement of the door.

With this thought in mind this invention contemplates electrically actuated door opening and closing means wherein movement of the door is instigated by closing an electrical circuit through conventional switches and relays to actuate an electric motor and provides means for opening the circuit should the torque at the motor increase above that required for opening and closing the door.

It is therefore one object of this invention to provide, for operating a garage door, electrically actuated means designed to halt operation of the door should the torque at the motor exceed the amount required for normal movements of the door.

Another object of the invention lies in the provision of an automatically reversible torque sensitive motion actuator which is comparatively simple in construction, strong, durable, highly efficient and reliable in use, compact, and which may be manufactured at a low cost.

All of the foregoing and other objects of the invention will become apparent from a study of the following specification taken in connection with the accompanying drawings wherein like characters of reference designate corresponding parts throughout the several views and wherein a preferred form of the invention is shown. It should be understood however that the drawings and description are illustrative only and should not be construed as limiting the invention except insofar as it is limited by the prior art and the appended claims.

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In the accompanying drawings:

Figure 1 is a vertical cross section taken through a garage door and a fragmentary portion of a garage having portions broken away for convenience of illustration;

Figure 2 is a vertical elevation of the improved motion actuator having its cover removed and upon an enlarged scale;

Figure 3 is a view similar to Figure 2 and showing the motion transmitting mechanism swiveled by excess torque;

Figure 4 is a vertical view partially in cross section and taken at line 4—4 of Figure 2;

Figure 5 is a view taken substantially at line 5—5 of Figure 4 and having parts broken away for convenience of illustration; and

Figure 6 is an enlarged view of the catch mechanism for the top of the garage door.

Figure 7 is a wiring diagram illustrating the electric circuit used.

Referring now in detail to the drawings, Figure 1 discloses portions which represent at 10 a garage having a ceiling or other horizontal support member 11 disclosed above the door opening 12 formed in one wall 10' of the garage. The garage is supplied with a concrete or other type floor surface 13 and has a vertically moveable closure or door 14 supported by mounting means 15 on the wall 10' of the garage. To guide movement of the upper edge of the door 14 I have disclosed one of a pair of laterally spaced horizontally extending parallel guide rails 16 which extend inwardly of the garage from the wall having the opening 12, and moveably carry rollers (not shown) journaled on the door 14.

The motion actuator is indicated in general by the numeral 17 and as seen in Figure 1 is supplied with a metal or other type housing 18 which is removable to provide access to the working parts. The actuator is supported from the support member 11. A V-belt pulley 19, disposed in a vertical plane, is part of the actuator 17, as will be more fully described hereinafter, and has trained thereabout an endless belt 20 which extends forwardly from the pulley 19 and is trained about a second pulley 21 journaled in any convenient manner upon the wall 10' of the garage 10 above the opening 12 and midway its width. To provide means for applying tension to the belt 20, I provide an idler pulley 22 which is secured to the ceiling 11 and the belt 20 is trained thereover.

Resiliently or securely fastened to the belt 20 is a connecting link 23 which is pivotally secured at 24 to the upper end of an angular arm 25 pivoted at 26 to the door 14. Also secured to the door are a pair of inwardly extending laterally spaced ears 27, one disposed at each side of the arm 25 and, which journal the ends of a rod 28 for axial rotation. The rod is provided with a right angle latch arm 29 adapted to cooperate with a latch member 30 anchored to the garage 10 to releasably latch the door in the closed position. A spring 31 is provided to yieldably hold the latch arm 29 in latching relation to the latch member 30 and thus prevent accidental movement of the door from the closed position. However, the rod 28 is provided with a radially extending actuating finger 32 which bears against the arm 25 and is disposed in such a position that when the arm 25 is pivoted at 26 inwardly of the garage the rod 28 is axially rotated and the latch arm 29 is moved from the full line position to the broken line position shown in Figure 6, thus being released from the member 30 and permitting the door to open. The arm 25 at the end of its movement strikes the rod 28 which constitutes a stop for the arm and permits the door to be pulled by the belt 20 through the link 23 and arm 25.

The subject matter of the present invention is contained in an automatically reversible torque sensitive

motion actuator indicated in its entirety by the numeral 17 and briefly consists of a reversible prime mover 33, here shown to be an electric motor, having a motor shaft 34 which constitutes a driving shaft. The motor 33 is preferably supported by the frame 35 of the motion actuator but may be supported at any point found convenient and desirable. Journalled for rotation upon the frame 35 I provide a driven shaft 36 which is fixed to and supports the pulley 19. Intermediate the driven shaft 36 and the driving shaft 34 I provide a swivel mounted motion transmitting mechanism 37 which is here shown to be a series of belts and pulleys to provide means for transmitting the rotary motion from the driving shaft 34 to the driven shaft 36 at a greatly reduced speed.

In this construction the motion transmitting mechanism includes a stub shaft 38 which is anchored at right angles to rockable arm 39 journalled at 40 coaxial with shaft 36. To assist in understanding the invention I disclose the transmitting mechanism in detail as having a driving shaft 34 provided with a relatively small pulley 41 fixed thereon. Journalled for rotation on shaft 36 in the plane of pulley 41 is a large pulley 42 which is ganged with a small pulley 43. A belt 44 is trained about the pulleys 41 and 42. A belt 45 is trained about the pulley 43 and about a large pulley 46 journalled on the stub shaft 38 and ganged with a small pulley 47. Still another belt 48 is trained about the small pulley 47 and a large pulley 49 fixed to the shaft 36. Thus it will be seen that rotary motion of driving shaft 34 will impart rotary motion to the shaft 36 and therefore will rotate the pulley 19 causing the belt 20 to move the door 14 to open and closed positions.

The torque at the motor 33 or driving shaft 34 required to move the door 14 provides reverse torque at the pulley 49 and therefore the small pulley 47 endeavors to travel an arcuate path defined from the axis of shaft 36 and causing the rockable arm 39 to swing from the full line position of Figure 2 to the broken line position of Figures 2 and 5 or to the full line position of Figure 3. Since the arm 39 is disposed above the center of gravity I provide yieldable means 50—50 which are shown to be tension springs that oppose each other and yieldably maintain the rockable arm 39 in a vertical position. When the torque becomes great enough to overcome either spring 50 the arm 39 is caused to swivel at 40 according to whichever direction the torque is applied.

The rockable arm 39 is provided with a pair of opposed strikers 51 adapted to strike the actuating buttons 52 of normally closed limit switches 53 carried by the frame 35. As the torque becomes great enough to cause the rockable arm 39 to swivel to one side or the other a striker 51 contacts the actuator 52 of its companion switch 53 and opens the switch thus halting the movement of the garage door.

Inspection of Figure 4 will reveal that the rockable arm 39 is provided with a right angle undulatory finger 54 which passes intermediate a pair of rockable levers 55 and 56. As the arm 39 rocks to the right, as viewed in Figure 3, the lever 56 is carried by the finger 54 thus stretching the spring 50 while the opposed lever 55 is supported by a stop 57 carried by the frame 35. Movement of the arm 39 in the opposed direction will cause the lever 55 to move therewith and stretch the opposed spring 50.

In Figure 5 it is clearly seen that means are provided at 58 to adjust the tension of the springs 50 so that sufficient torque may be applied to shaft 36 to cause the door to open and close without undue rocking movement of arm 39.

At its lower end the rockable arm 39 is provided with a depending yoke 60 which is adapted to strike and actuate a reversing switch 61 carried by the frame 35. As the rockable arm 39 swivels to the position where it strikes an actuating button 52 of limit switches 53 or 53'

it will simultaneously actuate the reversing switch 61 so that subsequent operation of the motion actuator will be in a reverse direction from the direction of movement present when stopping. Therefore, should the garage door descend upon the hood or other part of an automobile or other object, the increased torque will cause the actuator to halt and reverse the actuator so that subsequent energizing of the motor 33 will cause the door to raise instead of lower. Obviously the garage door may be stopped at any point upon striking an obstruction without doing damage to the door mechanism or the obstruction and therefore providing a very safe and convenient garage door control means.

In theoretical practice it appears that the arm 39 will remain in a position wherein the striker 51 retains the actuating button 52 in such position as to maintain the limit switch 53 or 53' in an open condition. However, in actual practice this is not the case since the springs 50—50 tend to return the arm 39 to its normal position when the torque created by the prime mover 33 is released and also the slack or lost motion present due to the endless belt 20 permits the arm this return movement.

Associate with the prime mover 33, I employ any one of a number of conventional wiring circuits preferably using a low voltage secondary control circuit in which the switches 53 and 53' are interposed to control a magnetic relay for selective operation of a primary circuit including the prime mover 33 and the reversing switch 61. Since this circuit may assume a number of various wiring organizations which are well known in the art it is not thought necessary to enlarge this treatise by a detailed disclosure thereof.

The circuit shown in Figure 7 is a typical motor reversing circuit embodying the switches 53, 53' and 61. Such a circuit is shown, although in greater detail, in the patent to Steven No. 2,586,273. Other examples are found in the Johnson Patent No. 2,070,832, and in the Chandler Patent No. 2,208,119. As is customary in these devices a manually operable main switch 62 is provided.

I have disclosed a motion transmitting mechanism for convenience of revealing the invention as having a plurality of belts and pulleys, it will be understood, however, that gears or other equivalents are encompassed in the term "motion transmitting mechanism" and the use thereof is envisioned.

Having thus described the invention, what I desire to secure by Letters Patent of the United States is:

1. In a garage door operating mechanism wherein a door is carried by a mounting and is movable to open and closed positions by operation of a reversible drive mechanism, a control device for the drive mechanism comprising a rockable arm interposed in said drive mechanism and urged to swing in one direction from a mid point in response to torque transmitted by the drive mechanism when it is moving in one direction and urged to swing in the opposite direction in response to torque transmitted by the drive mechanism when it is moving in the opposite direction, a pair of spring pressed members engaging the rocker arm at the mid point, one member opposing movement of the arm in one direction from mid point, means restraining said member from following the arm when it moves in the opposite direction from said mid point, the other member opposing movement of the arm from said mid point in said opposite direction, and means restraining the last named member from following the arm when the arm moves in said one direction and is opposed by the first named member.

2. A mechanism for operating doors such as garage doors, comprising a reversible electric motor, an electric circuit operably connected to said motor for energizing and controlling it, a driving shaft rotatable by said motor, a driven shaft, a pivotally mounted motion transmitting mechanism operably connecting said shafts and operative by torque between said shafts to move about its pivotal

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