Sept. 1, 1936. W. F. WEATHERS 2,052,911

DOOR OPERATING MECHANISM

Original Filed April 15, 1935 2 Sheets-Sheet 1

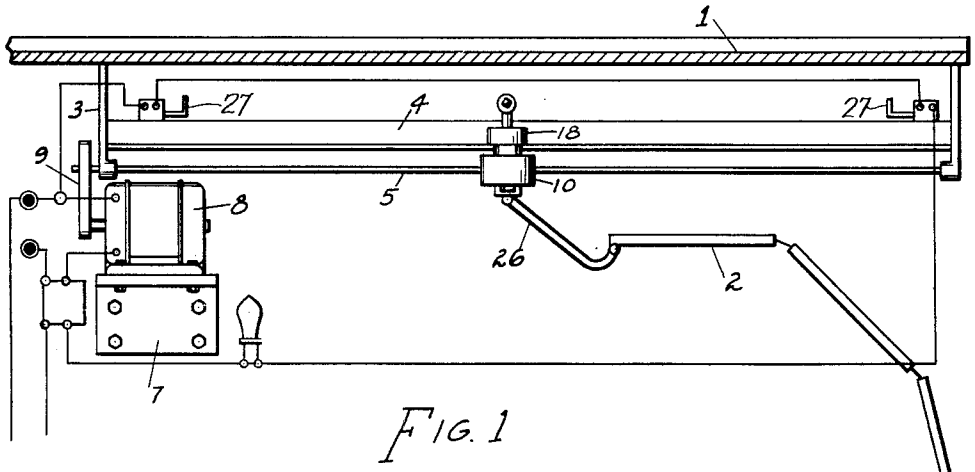


FIG. 1

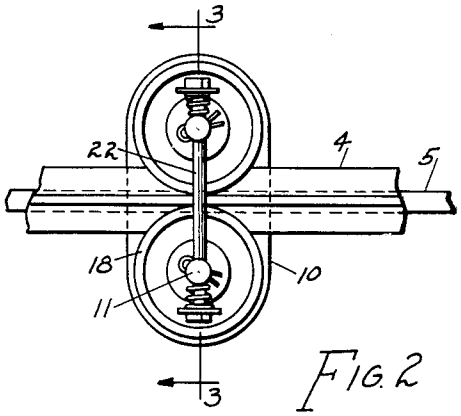


FIG. 2

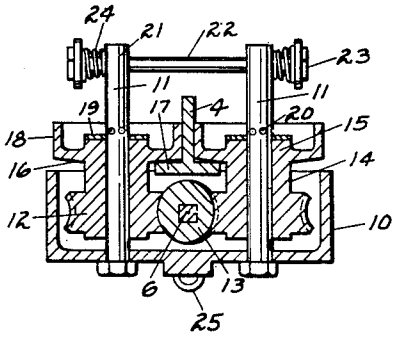


FIG. 3

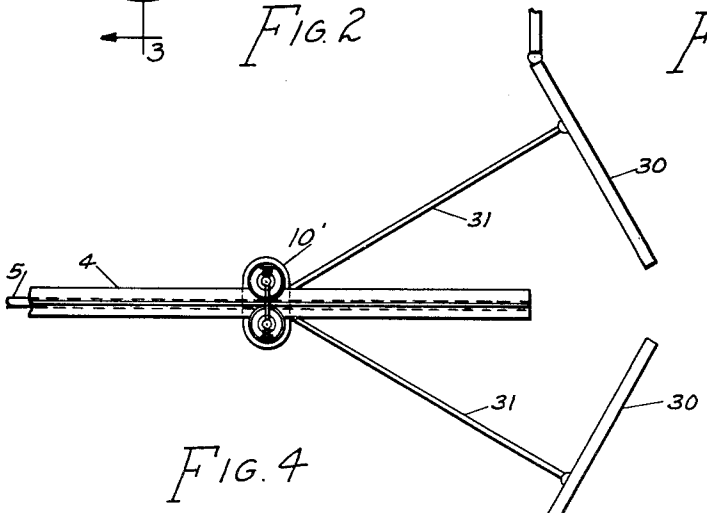


FIG. 4

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DOOR OPERATING MECHANISM

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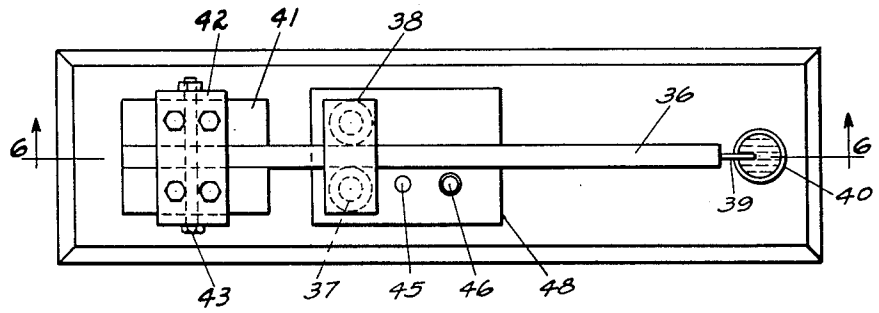


FIG. 5

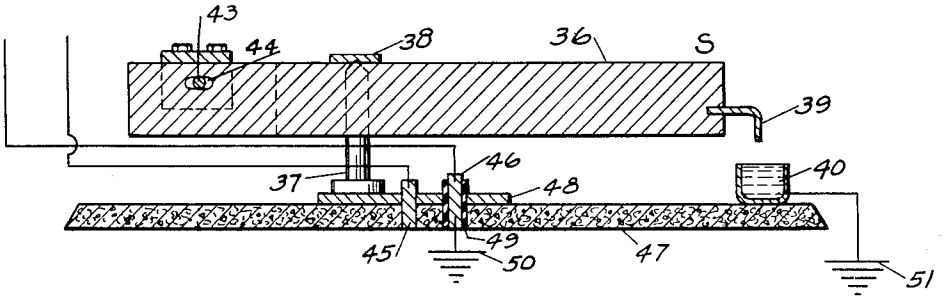


FIG. 6

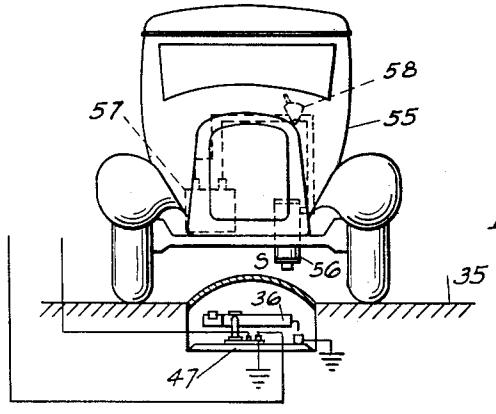


FIG. 7

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DOOR OPERATING MECHANISM

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Application April 15, 1935, Serial No. 16,428
Renewed January 22, 1936

12 Claims. (Cl. 74—25)

The present invention pertains to a novel mechanism for operating a door, such as a garage door, of the sliding or swinging type. The mechanism belongs to the general class of operators controlled by an electrical system and embodies certain novel features of mechanical simplicity and safety.

Among the objects of the invention is the provision of a door operator consisting of a comparatively small number of simple and inexpensive parts and one that has a friction drive capable of slipping to avoid injury to persons caught in the path of the door and to prevent binding or injury of the mechanism in the event of obstruction of the door.

In the accomplishment of these objects, the door operator includes a pair of pulleys suspended from the base of an inverted T-track and having frictional engagement with the web thereof. These pulleys carry worm gears held in mesh with a worm slidable on a rotatable square shaft. Resilient means, such as springs, is provided for holding the pulleys in frictional engagement with the web of the track. In the event of an obstruction as mentioned above, this resilient means permits the pulleys to rotate against the track without travelling along the track, so that no damage is done either to the obstruction or to the mechanism. The device is operated through the rotation of the square shaft and worm by suitable electrical control apparatus, whereupon the worm drives the gears and pulleys and slides along the square shaft.

The invention also includes a magnetic control switch embedded in the pavement leading to the door. This switch is adapted to be operated by a suitable electro-magnet on the approaching vehicle to open the door. The door may be closed, and also opened, by suitable manual switches in the garage or in the adjacent building or in both.

The invention is fully disclosed by way of example in the following description and in the accompanying drawings in which

Figure 1 is an elevation of an installation according to the invention;

Figure 2 is a plan view of the operator;

Figure 3 is a section on the line 3—3 of Figure 2;

Figure 4 is a plan view of an installation for swinging doors;

Figure 5 is a plan view of the magnetic switch;

Figure 6 is a section on the line 6—6, showing also a wiring diagram for the switch, and

Figure 7 is an elevation of an automobile over the magnetic switch, illustrating the means for actuating the switch.

Reference to these views will now be made by use of like characters which are employed to designate corresponding parts throughout.

In Figure 1 the numeral 1 indicates the ceiling of a garage or other structure provided with a movable door which is indicated in this case as consisting of hinged sections 2. Hangers 3 are suspended from the ceiling and support a track 4 perpendicular to the door opening. In the hangers is also journaled a shaft 5 which is of square cross section as indicated by the numeral 6 in Figure 3. A suitable bracket 7 carried by the building structure supports a reversible electric motor 8 which is geared to one end of the shaft 5 as indicated by the numeral 9.

The door operating unit is shown more clearly in Figures 2 and 3 and embodies a cup shaped supporting member 10 suspended from the track 4 by means presently to be described. Shafts 11 extend upwardly from the bottom of the member 10, and on each shaft is rotatably mounted a worm gear 12 at the level of the square shaft 5. Between the worm gears, the shaft 5 carries a worm 13 meshing with both gears.

Each of the gears 12 is formed with an upwardly extending boss 14 around the corresponding shaft 11, and on top of the boss is formed an integral pulley 15. Each pulley has a convex lower face 16 making a point contact with the horizontal base 17 of the track 4 which is of inverted T-shape. The cylindrical side wall 18 of each pulley is in frictional engagement with the web of the track 4.

A washer 19 is mounted on each pulley 15 and around the shaft 11 and is engaged on its upper surface by a cotter pin 20 passed through the shaft. In this manner the shafts 11 are prevented from dropping through the worm gears which, in turn, are suspended from the fixed track.

The shafts 11 are extended upwardly beyond the pulleys, and through their upper end 21 is passed a loose rod 22. Nuts 23 are applied to the ends of the rod, and between each nut 23 and the adjacent shaft end 21 is interposed a coil spring 24. The nuts are adjusted to bring the pulley wall 18 into the desired frictional contact with the web of the track 4, but the springs 24 permit slipping of the pulleys relatively to the track, under certain circumstances, for a purpose which will presently appear. The bottom of the member 10 carries an eye 25 or other suitable structure for the attachment of one end of a hook or link 26, the other end of which

is connected to the upper panel of the door 2 as clearly illustrated in Figure 1. The member 10 is cup-shaped and adapted to contain a lubricant for the gears 12 and worm 13.

In the operation of the device as thus far described, the shaft 5 is turned by the motor 8, the latter being reversible and controlled by switching mechanism described below. As the shaft 5 turns, the worm 13 thereon turns the gears 12 and pulleys 15. The latter ride on the track 4 by reason of the engagement of their walls 18 with the web of the track, while the friction or resistance of the supporting base 17 is minimized by reason of the convex bottoms of the pulleys. The worm 13 slides freely on the square shaft 5 and is carried along with the operating unit inasmuch as it is held between the gears 12. The provision of a square shaft affords a simple and inexpensive means of slidably mounting the worm 13, and the shaft need only be round at its ends to be journaled in the hangers 3.

At the ends of its travel, the travelling unit strikes and operates limit switches 27 that break the circuit and condition the motor 8 for reverse rotation on its next operation by means of well known electrical apparatus that need not be shown or described here.

The previously mentioned yielding engagement of the pulley walls 18 with the web of the track is a safeguard against injury to a person, particularly a child who might be standing in the way of a closing door. In such an event, the door does not continue to move against the obstruction under the power of the motor, but the operating mechanism merely slips at the surfaces 18, this slipping being permitted by the yieldability of the springs 24.

When swinging doors are provided as indicated by the numeral 30 in Figure 4, the bottom of the cup 10' is connected to them by rods 31 in the conventional manner.

In opening the door from the outside, the electric motor 8 is controlled by a balanced, magnetic switch which, in turn, is operated from an automobile. This system is shown in Figures 5, 6 and 7. The magnetic switch is embedded in the pavement 35 and includes a magnetized bar 36 delicately balanced on a pair of pointed pins 37 at opposite sides of the bar supporting a cross piece 38 secured to the bar. One end of the bar carries a contact finger 39 adapted to enter a mercury cup 40 therebeneath, but normally out of contact with the cup. The other end of the bar carries weights 41 at opposite sides, supported by means of a clip 42 straddled over the tops thereof and secured to the bar by a bolt 42 passed horizontally through the whole assembly. The bolt is received in a slot 44 in the bar 36 to permit adjustment of the weight for balancing the bar on its pivot point. The adjustment is, of course, secured by tightening the bolt.

Binding posts 45 and 46 are provided in the base 47 of the switch for plugging into the motor circuit. The post 45 is permanently in electrical communication with the switch contact 39 through a base plate 48, the pins 37, the member 38 and the bar 36. The other post 46 is insulated from the switch structure by a bushing 49 and is grounded at 50. The mercury cup 41 is also grounded at 51. The switch structure is covered by a suitable protecting plate 52 permeable to magnetic flux.

The approaching motor vehicle 55 carries an electro-magnet 56 with one pole downward. The bar 36 is also magnetized, and its pole carrying the contact finger 39 is like the downward pole of the magnet 56, to be repelled thereby. The magnet 56 is adapted to be energized by the battery 57 of the automobile, and its circuit is controlled by a switch 58 on the instrument board of the automobile. When the magnet 56 is brought over the magnetic switch and at not too great a distance therefrom, and energized, the contact 39 is forced into the mercury cup 40 and the motor circuit is closed to operate the door mechanism and open the door.

To reduce the possibility of closing the switch by an unauthorized person having a magnet adapted to attract the weighted end of the bar, the weight is made rather heavy and not only balances the bar, but requires the use of a rather strong attracting magnet which is not likely to be carried by unauthorized persons or mischievous children.

Although a specific embodiment of the invention has been illustrated and described, it will be understood that various alterations in the details of construction may be made without departing from the scope of the invention, as indicated by the appended claims.

What I claim is:

1. In a door opener, a rotatable shaft, a worm slidably keyed thereon, means for turning said shaft, a track, a pair of non-rotatable shafts, pulleys rotatable on said shafts and engaging opposite sides of and suspended from the track, a supporting member connected to said non-rotatable shafts, worm gears formed on said pulleys and engaging said worm at opposite sides thereof, and resilient means for holding said pulleys against said track.

2. In a door opener, a rotatable shaft, a worm slidably keyed thereon, means for turning said shaft, a track, a pair of non-rotatable shafts, pulleys rotatable on said shafts and engaging opposite sides of and suspended from the track, a supporting member connected to said non-rotatable shafts, worm gears formed on said pulleys and engaging said worm at opposite sides thereof, resilient means for holding said pulleys against said track, and means for adjusting said resilient means.

3. In a door operator, a rotatable shaft, a worm slidably keyed thereon, means for turning said shaft, a track, a pair of non-rotatable shafts, pulleys rotatable on said shafts and engaging opposite sides of and suspended from the track, a supporting member connected to said non-rotatable shafts, worm gears formed on said pulleys and engaging said worm at opposite sides thereof, and resilient means bearing on said non-rotatable shafts for holding said pulleys against said track.

4. In a door operator, a rotatable shaft, a worm slidably keyed thereon, means for turning said shaft, a track, a pair of non-rotatable shafts, pulleys rotatable on said shafts and engaging opposite sides of and suspended from the track, a supporting member connected to said non-rotatable shafts, worm gears formed on said pulleys and engaging said worm at opposite sides thereof, a rod passed through said non-rotatable shafts, nuts adjustably mounted on the ends of said rod, and a spring inserted between each nut and the adjacent shaft end.

5. In a door operator, a rotatable shaft, a worm slidably keyed thereon, means for turning said shaft, a track having a horizontal base and a vertical web, a pair of non-rotatable shafts, pulleys rotatable on said shafts and engaging opposite sides

of said web and suspended from said base, a supporting member connected to said non-rotatable shafts, worm gears for driving said pulleys mounted on the last mentioned shafts and engaging said worm at opposite sides thereof, and resilient means for holding said pulleys against said track.

6. In a door operator, a rotatable shaft, a worm slidably keyed thereon, means for turning said shaft, a track having a horizontal base and a vertical web, a pair of pulleys engaging opposite sides of said web and suspended from said base, the side walls of said pulleys being cylindrical where engaging said web and the bottoms being convex where engaging said base, shafts for said pulleys, worm gears for driving said pulleys mounted on the last mentioned shafts and engaging said worm at opposite sides thereof, and resilient means for holding said pulleys against said track.

7. In a door operator, a rotatable shaft, a worm slidably keyed thereon, means for turning said shaft, a track having a horizontal base and a vertical web, a pair of pulleys engaging opposite sides of said web and suspended from said base, the side walls of said pulleys being cylindrical where engaging said web and the bottoms being convex where engaging said base, shafts for said pulleys, worm gears for driving said pulleys mounted on the last mentioned shafts and engaging said worm at opposite sides thereof, resilient means for holding said pulleys against said track, and means for adjusting said resilient means.

8. In a door operator, a rotatable shaft, a worm slidably keyed thereon, means for turning said shaft, a track, a pair of pulleys engaging opposite sides of and suspended from the track, shafts for a casing for said worm carried by said last-mentioned shafts and adapted to contain a lubricant, worm gears for driving said pulleys mounted on the last mentioned shafts and engaging said worm within said casing, and resilient means for holding said pulleys against said track.

9. In a door operator, a track, a member movable along the track to actuate a door, and actuating means for said member including spring pressed pulleys frictionally engaging opposite sides of said track, worm gears for rotating said pulleys, a motor driven shaft between said worm gears, and a worm non-rotatably but slidably mounted on said motor driven shaft and meshing with said worm gears.

10. In a door operator, a track, a member movable along the track to actuate a door, and actuating means for said member including pulleys frictionally engaging opposite sides of said track, worm gears for rotating said pulleys, a motor driven shaft between said worm gears, and a worm operable by said motor driven shaft and meshing with said worm gears, the member aforesaid being cup-shaped in configuration and forming a contour for the worm and worm gears and for a lubricant for said parts.

11. In a door operator, a track having a base portion and an upstanding web portion, a member movable along said track to actuate a door, and actuating means for said member including pulleys frictionally engaging opposite sides of the web of said track, at least one of said pulleys being mounted to ride upon the base portion of said track, worm gears for rotating said pulleys, a motor driven shaft between said worm gears, and a worm operable by said motor driven shaft and meshing with said worm gears.

12. In a door operator a track, a member movable along said track to actuate a door, and actuating means for said member including upright shafts connected to said member and disposed upon opposite sides of the track, pulleys on said shafts and engaging opposite sides of said track, yieldable means associated with said shafts for maintaining the pulleys firmly against the track, and motor driven means also associated with said shafts for driving said pulleys.

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