Dec. 21, 1926. 1,611,561

W. W. ROBINSON

DOOR OPERATING MECHANISM

Filed, Jan. 23. 1925 2 Sheets-Sheet 1

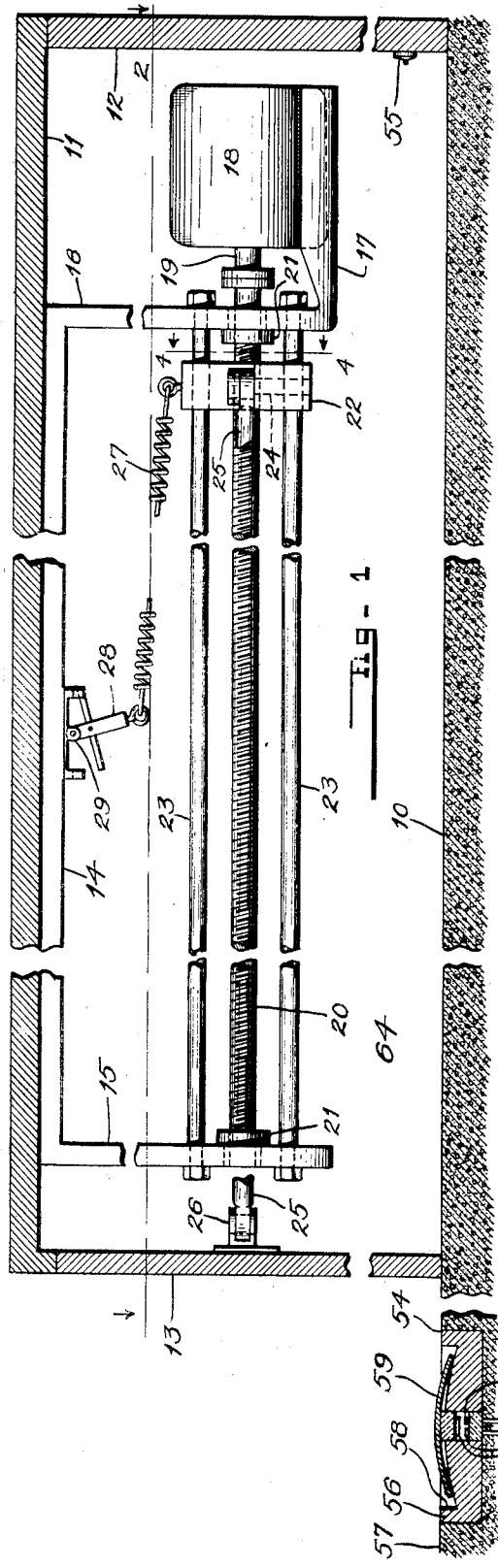


Fig - 1

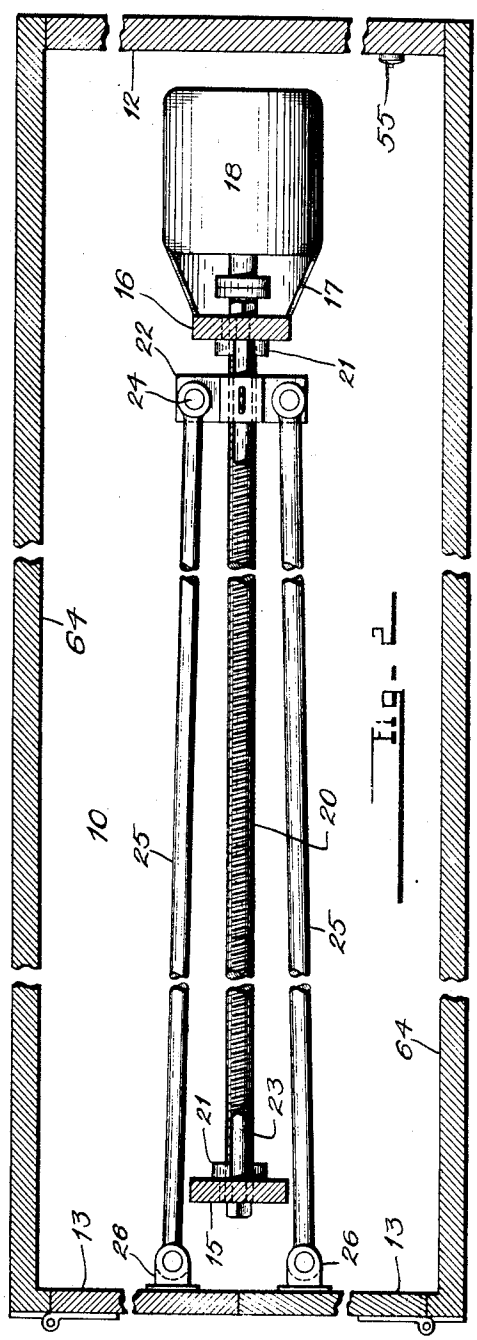


Fig - 2

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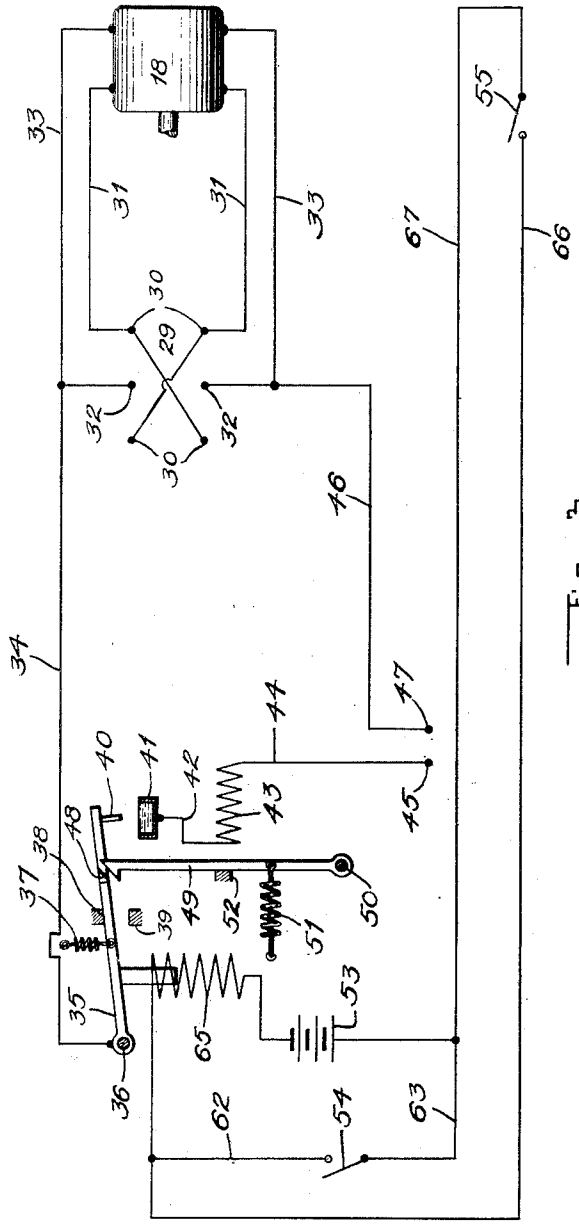


Fig. 3

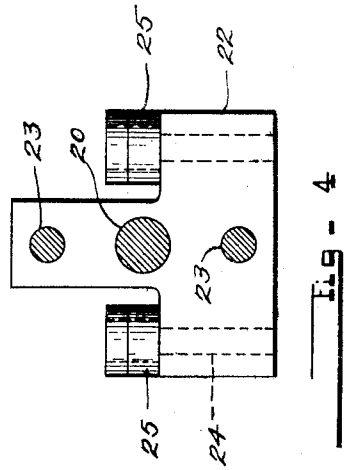


Fig. 4

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UNITED STATES PATENT OFFICE.

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DOOR-OPERATING MECHANISM.

Application filed January 23, 1925. Serial No. 4,166.

My invention relates to door operating mechanisms.

The primary object of my invention is to provide a mechanism adapted to open and close garage doors, and other doors of a similar nature, characterized by an automatic operation of said mechanism and by other features pertinent thereto, hereinafter described.

A further object is to provide a motor driven mechanism of the character described whose operation is manually started by a suitable agency positioned close to, or remote from, said doors, and is automatically stopped when said doors have reached a fully opened or a fully closed position, means being provided to automatically place said motor in a condition to reverse the movement of said doors when the latter have reached either of said positions.

These and further objects of my invention will be set forth in the following specifications, reference being had to the accompanying drawings, and the novel means by which said means are effectuated will be definitely pointed out in the claims.

In the drawings:—

Fig. 1 is a sectional elevation of a garage showing my improved mechanism applied thereto. In this view, the links operatively connecting the doors to the motor are only partially shown for the sake of clearness.

Fig. 2 is a section along the line 2—2 in Fig. 1 looking in the direction of the arrows.

In Figs. 1 and 2, the electrical circuits have been omitted for the sake of clearness.

Fig. 3 is a diagram of the electrical connections used with my improved mechanism.

Fig. 4 is a section along the line 4—4 in Fig. 1, looking in the direction of the arrows, and showing the nut which is adapted to traverse the worm shaft hereinafter described.

In the drawings:—

10, 11, 12 and 64, represent, respectively, the floor, ceiling, back door and side wall of a garage, or other similar inclosure, and 13—13 represents the doors, closing the opening thereto.

A bracket 14 is secured to the ceiling 11 in any approved manner and said bracket is provided, at the end adjacent the doors 13, with a depending arm 15 and at the opposite end with a depending arm 16, which has integrally formed therewith the cradle 17. A motor 18 is mounted in said cradle and said motor is preferably an induction motor of the repulsion start type, due to its capacity for starting under full load.

The shaft 19 of said motor is coupled to a worm shaft 20, mounted in suitable bearings in the arms 15 and 16. The thrust of said shaft is absorbed by suitable collars, such as 21, which are secured thereto in any approved manner. A nut 22, having the shape of an inverted T is mounted on the shaft 20 and said nut is guided by the rods 23—23 placed above and below said shaft and secured in any approved manner in the arms 15 and 16.

Pins such as 24—24 are mounted in the arms of said nut and one end of each of the links 25—25 is pivotally connected thereto, the other end of each of said links being pivotally mounted in a bracket 26, secured to each of the doors 13—13. Therefore, as the shaft 20 is rotated by the motor 18, the nut 22 will traverse said shaft and operating through the links 25 will move the doors 13 outwardly when said nut moves toward the left and inwardly when said nut moves toward the right, as viewed in Fig. 1.

A spring 27 is secured at one end to the nut 22 and at the opposite end to the handle 28 of a reversing switch 29, which is secured to the bracket 14 and positioned midway between the arms 15 and 16, for a purpose hereinafter explained.

The end terminals 30 of the switch 29 are electrically connected by the leads 31—31 to the starting winding (not shown) of the motor 18 and the intermediate terminals 32—32 are electrically connected by the leads 33—33 to the running winding (not shown) of said motor. One of the terminals 32 is also connected through the lead 34 to the armature 35 which is pivoted on the pintle 36, and insulated therefrom in any approved manner. Said armature is normally held in the position shown in Fig. 3 by the interaction of the spring 37 and the stop 38. A stop 39 limits the downward movement of the armature 35 when moved as hereinafter described.

Said armature is further provided, adjacent its free end, with a contact 40 which is adapted to be immersed in the mercury cup 41, when said armature is moved downwardly, as viewed in Fig. 3. The mercury cup 41 has electrical connection, by means

of the lead 42, with a coil 43 and said coil is connected to a terminal 45 through a lead 44. The other of said terminals 32 is connected to a terminal 47, by means of a lead 46, and any suitable electromotive force is to be impressed on the terminals 45 and 47, in order to energize the motor 18. The coil 43 is provided in order to take advantage of the overload current which is produced in the motor circuit, in a manner hereinafter described, and may therefore be regarded as an overload coil.

The armature 35 is also provided with a lug 48, positioned between the contact 40 and the pintle 36, said lug being adapted to engage with a hooked finger 49 which is pivotally mounted on the pintle 50 and insulated therefrom in any approved manner. Said finger is normally held in the position shown in Fig. 3 by the interaction of a spring 51 and a stop 52. It should be noted that the coil 43 and the finger 49 comprise, for all essential purposes, an overload circuit breaker, as will become more apparent hereinafter.

In order to immerse the contact 40 in the mercury bath 41 and thereby energize the motor circuit, I preferably employ an independent circuit comprising a coil 65, adapted to coact with the armature 35 in the manner of a relay, a source of electrical energy 53, which may be a battery, as shown, a bell ringing transformer, or the like, and two switches, 54 and 55, respectively, which are arranged in parallel with said coil and said energy source.

It is contemplated that the switch 54 be placed without and the switch 55 within the garage. The switch 54 is preferably placed in the roadway and comprises a base 56, which is submerged flush with the surface of said roadway and is provided with a depression 58, in which rests a spring steel cap 59, having a convex surface when viewed from above. Only the edge of said cap bears on the bottom of the depression 58, and, therefore, when a suitable load is impressed on said cap, the crest of the latter will move vertically, thus operating as an ordinary push button. The cap 59 is provided with a contact 60, insulated therefrom, which is adapted to make an electrical connection between the contacts 61—61, said contacts being positioned in a suitable opening in the base 56. The contacts 61 are connected to the coil 65 and the battery 53 by the leads 62 and 63, respectively. The switch 55 is of the ordinary push button type, or it may be an ordinary knife switch, and is connected to said coil and said battery by the leads 66 and 67, respectively.

The operation of my improved mechanism is as follows:—

Assuming that a motor vehicle is approaching the garage, then in order to effect an opening of the doors 13, it is only necessary to place one of the wheels of said vehicle on the cap 59, thereby depressing the same and completing the circuit through the battery 53 and the coil 65. Said coil being energized, the armature 35 will be attracted thereto and the contact 40 will be immersed in the mercury bath 41, thereby completing the motor circuit, it being considered that there is an electromotive force always present at the terminals 45 and 47. The armature 35, in its downward movement, engages with the hooked finger 49 by means of the lug 48 and is thereby prevented from returning to its normal position under the action of the spring 37. By this construction, I avoid the necessity of maintaining the cap 59 in a depressed position during the entire opening of the doors, and in addition reduce the drain on the battery 53.

The motor circuit having been closed, the motor 18 begins to rotate and when it attains a suitable speed, the starting winding thereof is cut out in any approved manner, as by suitable elements within said motor operable by centrifugal force. The rotation of the motor 18 moves the nut 22 along the shaft 20 thereby, through the links 25—25, moving the doors 13—13 outwardly.

As the nut 22 traverses the shaft 20, it is obvious that the switch 29 will be moved to a position which is the reverse of that shown in Fig. 1 and that a gradually increasing tension will be produced in the spring 27 as said nut approaches the end of said shaft adjacent the opening to the garage, resulting in an additional load on the motor 18 and causing the flow of an overload current in the motor circuit. This current flow energizes the coil 43 sufficiently to attract the finger 49, thus releasing the lug 48 from engagement therewith, and the spring 37 will then raise the armature 35 and lift the contact 40 from the mercury cup 41, breaking the motor circuit. The strength of the spring 27 is so adjusted and the coil 43 is so arranged that the breaking of the circuit, above referred to, occurs when the doors have reached a fully opened position, or for a reverse operation, a fully closed position. Since the end terminals of the switch 29 are connected to the starting winding of the motor 18, the reversing of said switch by the spring 27 provides a means for reversing the direction of rotation of said motor when the switch 55 is closed, it being understood that this position in readiness for reversing obtains by the time the doors are fully opened, or fully closed if the operation has been the reverse of that described above, the action being entirely automatic. The reversing of the switch 29 does not affect the operation of the motor during the movement of the nut 22, as the starting winding of the motor is not included in the motor circuit during this

phase of the operation, as explained above. The vehicle having been placed in the garage, the doors may be closed by moving the switch 55, or any switch in parallel therewith, when the reverse of the operation above set forth will take place.

My improved mechanism renders unnecessary the dismounting of the driver of a vehicle in order to open the doors, as described above, and is further characterized by a marked simplicity of operation and the entire absence of complicated switches. While I have shown one preferred form of my improved door operating mechanism, it is to be understood that this is for purposes of illustration only and in no wise intended to limit the scope thereof, for many changes may be made therein without departing from the spirit thereof.

I claim:—

1. A door operating mechanism comprising in combination, a door, a motor, means operatively connecting said door and motor, means for energizing said motor, means adapted to cause an overload current flow in the motor circuit as said door approaches a fully opened and a fully closed position, and means adapted to break said circuit when the strength of said current attains a predetermined value, the cessation of said current occurring when said door reaches either of said positions.

2. A door operating mechanism comprising in combination, a door, a motor, means operatively connecting said door and motor, means for energizing said motor, means adapted to cause an overload current flow in the motor circuit as said door approaches a fully opened and a fully closed position, means adapted to break said circuit when the strength of said current attains a predetermined value, and means for placing said motor in readiness to reverse when said door has been moved to either of said positions.

3. A door operating mechanism comprising in combination, a door, an electric circuit having a motor, a worm shaft driven by said motor, a nut adapted to traverse said shaft and operatively connected to said door, a spring anchored at one end and at its opposite end secured to said nut, an overload circuit breaker in said circuit adapted to operate when said nut, in traversing said shaft, has exerted a predetermined tension on said spring, thereby causing an overload current flow in said circuit, said breaker being adjusted to function when said door is in a fully opened and a fully closed position.

4. A door operating mechanism comprising in combination, a door, an electric circuit having a motor and a reversing switch, a worm shaft driven by said motor, said switch being positioned intermediate of the ends of said shaft, a nut adapted to traverse said shaft and operatively connected to said door, a spring secured at one end to said switch and at its opposite end to said nut, the traverse of said nut along said shaft acting to reverse said switch, and an overload circuit breaker in said circuit adapted to operate when said nut, in traversing said shaft, has exerted a predetermined tension on said spring, thereby causing an overload current flow in said circuit, said breaker being adjusted to function when said door is in a fully opened and a fully closed position.

5. A door operating mechanism comprising in combination, a door, an electric circuit having a motor and switch, means operatively connecting said door and motor, an independent circuit controlling said switch for energizing said motor, means adapted to cause an overload current flow in said motor circuit as said door approaches a fully opened and a fully closed position, and means adapted to break said circuit when the strength of said current attains a predetermined value.

6. A door operating mechanism comprising in combination, a door, an electric circuit having a motor and a reversing switch, a worm shaft driven by said motor, a nut adapted to traverse said shaft and operatively connected to said door, a spring secured at one end to said switch and at its opposite end to said nut, whereby said nut operates said switch to place said motor in readiness to reverse when said door has been moved to a fully opened and a fully closed position, and means for automatically stopping said motor when said door reaches either of said positions.

7. A door operating mechanism comprising in combination, a door, an electric circuit having a motor, an overload circuit breaker and a switch, means operatively connecting said door and motor, means for energizing said motor by controlling said switch comprising an electric circuit independent of the motor circuit, and means for causing an overload current flow in said motor circuit to operate said circuit breaker for de-energizing said motor, said flow being induced by a load additional to that exerted by said door and adapted to operate when said door reaches a fully opened and a fully closed position.

8. A door operating mechanism comprising in combination, a door, an electric circuit having a motor, an overload circuit breaker and a switch, means operatively connecting said door and motor, means for energizing said motor by controlling said switch comprising a normally open electric circuit independent of the motor circuit, means for closing said electric circuit and means for causing an overload current flow in said motor circuit to operate said circuit breaker for de-energizing said motor, said flow being induced by a load additional to

that exerted by said door and adapted to operate when said door reaches a fully opened and a fully closed position.

9. A door operating mechanism comprising in combination, a door, a motor, means operatively connecting said door and motor, means for energizing said motor, means adapted to cause an overload current flow in the motor circuit as said door approaches a fully opened and a fully closed position, and means adapted to break said circuit when the strength of said current attains a predetermined value.

10. A door operating mechanism comprising in combination, a door, a motor, means operatively connecting said door and motor, means for energizing said motor, means adapted to cause an overload current flow in the motor circuit, and means adapted to break said circuit when the strength of said current attains a predetermined value.

11. A door operating mechanism comprising in combination, a door, a motor, means operatively connecting said door and motor, means for energizing said motor, means adapted to cause an overload current flow in the motor circuit as said door approaches a fully opened and a fully closed position, means adapted to break said circuit when the strength of said current attains a predetermined value, the cessation of said current occurring when said door reaches either of said positions, and means for placing said motor in readiness to reverse when said door has been moved to either of said positions.

12. A door operating mechanism comprising in combination, a door, an electric circuit having a motor, an overload circuit breaker and a switch, means operatively connecting said door and motor, means for energizing said motor by controlling said switch comprising an electric circuit independent of the motor circuit, and means for causing an overload current flow in said motor circuit to operate said circuit breaker for de-energizing said motor, said flow being induced by the operation of a load additional to that exerted by said door.

13. A door operating mechanism comprising in combination, a door, an electric circuit having a motor and switch, means operatively connecting said door and motor, an independent circuit controlling said switch for energizing said motor, means adapted to cause an overload current flow in said motor circuit, and means adapted to break said motor circuit when the strength of said current attains a predetermined value.

14. A door operating mechanism comprising in combination, a door, an electric circuit having a motor and switch, means operatively connecting said door and motor, an independent circuit controlling said switch for energizing said motor, means adapted to cause an overload current flow in said motor circuit as said door approaches a fully opened and a fully closed position, and means adapted to break said motor circuit when the strength of said current attains a predetermined value, the cessation of said current occurring when said door reaches either of said positions.

In testimony whereof, I affix my signature.

WALTER W. ROBINSON.