May 29, 1956 P. I. HUPPERT ET AL 2,747,863

DOOR OPENING DEVICE

Filed Nov. 24, 1954 2 Sheets-Sheet 1

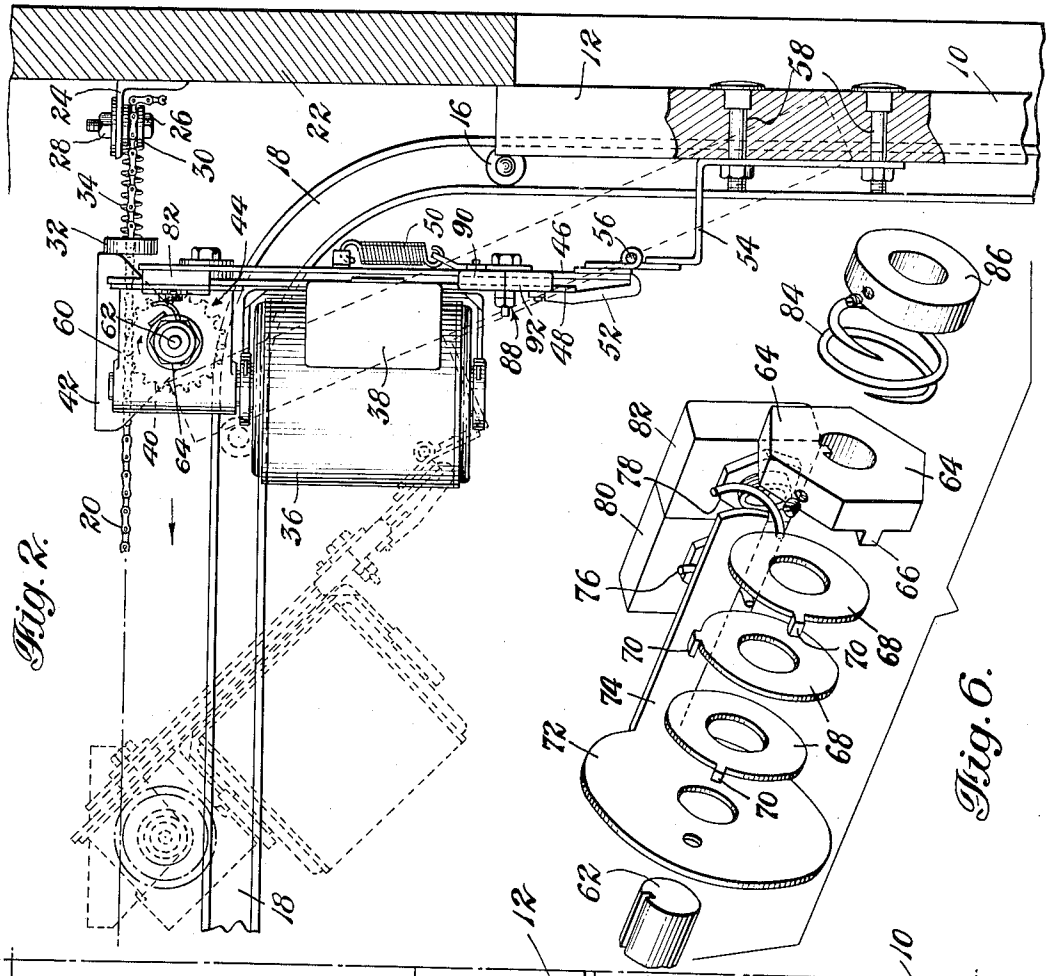


Fig. 2.

Fig. 6.

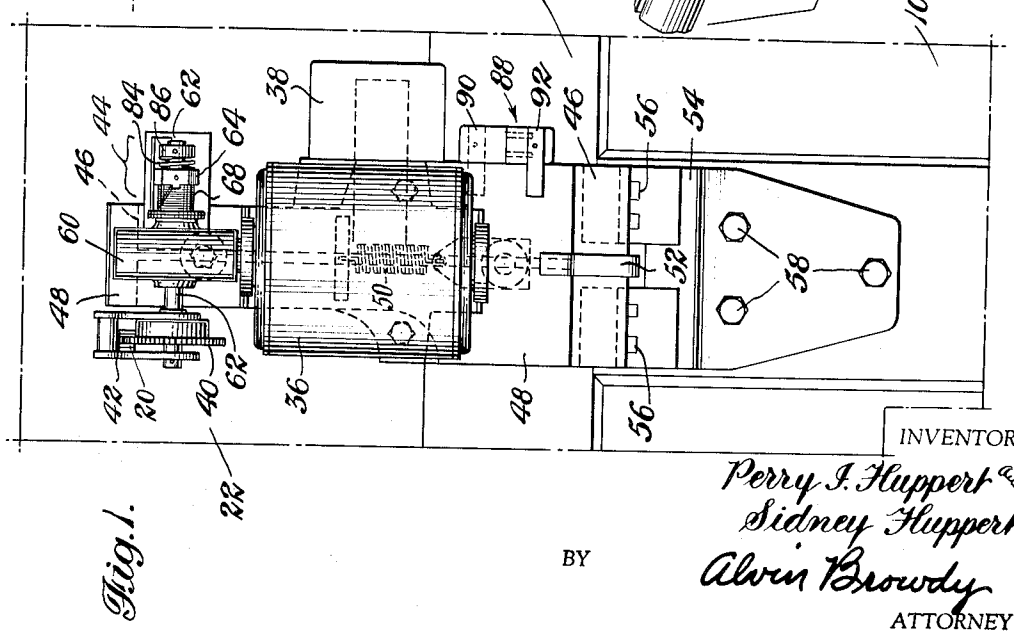


Fig. 1.

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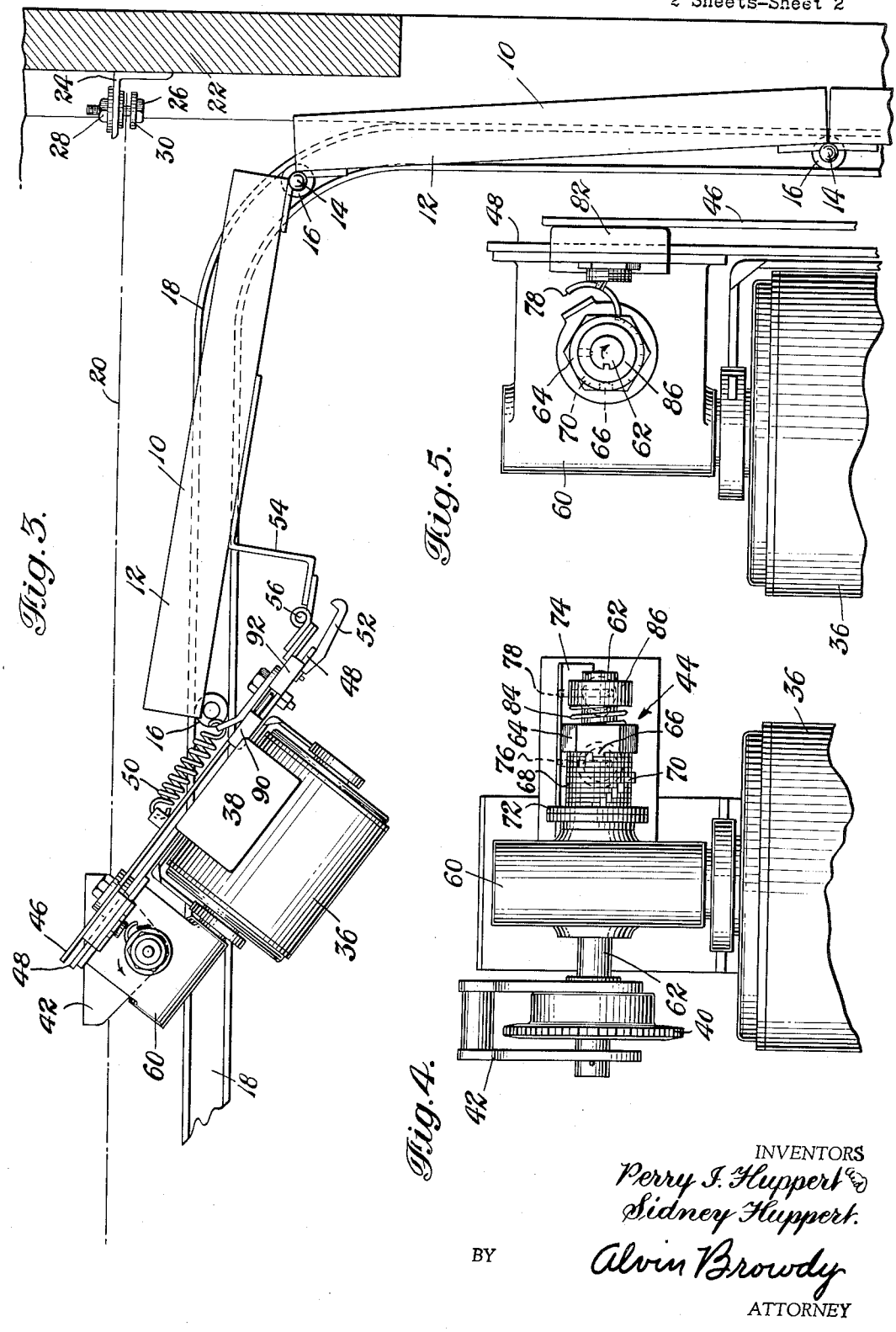


Fig. 3.

Fig. 5.

Fig. 4.

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DOOR OPENING DEVICE

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2 Claims. (Cl. 268—59)

This invention relates to an electric door operator and more particularly to a motor driven mechanism for opening and closing doors of the overhead type, such as are used in garages, warehouses and the like.

Doors of this type are commonly used and utilize upwardly and rearwardly extending trackways within which ride rollers affixed to the sides of the door panel or panels and have spring assemblies to assist in the raising of the door and to restrain the descent thereof. In the past, such doors have been provided with handles and can be manually raised and lowered. It has also been suggested that electric motors be provided for automatically operating doors of this type. Usually in a split level rambler type home, the garage has very little headroom and most devices on the market will not function with the small clearance provided between the top of the door and the ceiling. The present invention is particularly suited for the conversion of existing installations to automatic operation.

This invention has an object to provide an electric door operator which may be installed in garages and the like with very little headroom.

A further object of the present invention is to provide an electric door operator which automatically cuts off the power to the motor when an obstruction is encountered in closing the door.

A still further object of the present invention is to provide an electric door control in a small compact unit which automatically cuts off the power and reverses the rotation of the motor at the end of each opening or closing operation.

Another object of the invention is to provide an electric door control unit which is simple in construction and can be packaged in a reasonably small container for storage in conventional shelves of a store.

Other objects and the nature and advantages of the instant invention will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

Fig. 1 is a front elevational view of the device with the door in closed position;

Fig. 2 is a side elevational view of the device with the door in closed position in full lines and showing the device with the door in process of opening in dotted lines;

Fig. 3 is a side elevational view of the device in the closing operation after the door has encountered an obstruction;

Fig. 4 is an enlarged front elevational view of a portion of the device showing the novel switch arrangement;

Fig. 5 is a side elevational view similar to Fig. 4; and

Fig. 6 is an exploded view of the switch arrangement.

The present invention provides a simple arrangement, particularly suited for the conversion of existing installations by merely attaching the device to the upper inner portion of the garage door, hanging a chain overhead from the front to the rear of the garage, and arranging an electric outlet for plugging in the device. A gear, rotated by a reversible motor, is provided in contact with

the chain, so that when the motor is actuated the gear travels along the chain to raise or lower the door. A novel control mechanism is provided integral with the device in the form of a compact switch arrangement which automatically cuts off the motor circuit when the gear has traveled a predetermined number of revolutions and simultaneously reverses the direction of travel. A safety device is likewise provided in the form of a switch which automatically breaks the circuit when an obstruction is encountered in closing the door.

Referring now to the drawings, Fig. 2 shows a conventional door 10 to which door operating apparatus according to the invention has been applied. The door 10 to be operated is illustrated as made up of a plurality of horizontal sections 12 hinged together at 14 and adapted to travel from a vertical closed position to an overhead substantially horizontal position. The door 10 has the usual rollers 16 engaged within the upwardly and rearwardly extending tracks 18. As is well known, such doors are counter-balanced by means such as springs, not shown.

In adapting such a conventional door for automatic operation pursuant to the present invention, a chain assembly is mounted at its one end adjacent to the upper end of the doorway onto the garage structure 22 over the door, and at its other end rearwardly adjacent the garage ceiling. The chain 20 can be a bicycle type chain with spaced rungs adapted to receive the teeth of a gear. The chain 20 is attached at each end to a bracket 24 by means of a bolt 26, nut 28, and washers 30. A resilient bumper 32 in the shape of a washer mounted on the chain 20 is separated from the bracket 24 by a spring 34. The bumper 32 can be made of natural or synthetic rubber, cork or the like.

The device itself is mounted on the door 10 near the upper end of the top horizontal section 12 preferably at the center thereof. The main parts of the device are the reversible motor 36, relay 38, gear 40, chain carriage 42 and switch arrangement 44. The chain carriage 42 houses the gear 40 and the chain maintaining the teeth of the gear in engagement with the chain. Upon rotation of the gear 40 when actuated by the motor 36, the teeth of the gear travel along the chain carrying the door along until such time as the switch arrangement 44 cuts off the motor 36.

The device includes a pair of relatively movable plates 46 and 48 connected by a spring 50. A latch 52 integrally attached to plate 48 acting in conjunction with the spring 50 latches the two plates in the position shown in Fig. 2. Plate 46 is hingedly attached to bracket 54 by means of hinges 56. The bracket 54 is adapted to be bolted to the garage door by bolts 58.

The remainder of the device is attached to the plate 48. The motor 36, relay 38 and switch arrangement 44 are so wired that the relay 38 with its transformer therein reduces the 110 volts source of supply to 6 volts, and the actuation of the motor 36 and its direction is controlled by the switch arrangement 44. The reversible motor 36 is connected to the gear 40 through a conventional gear reducer 60 which reduces the speed of rotation from the 1725 R. P. M. of the motor to approximately 20 R. P. M. for the gear.

The gear 40 is of such a diameter that nine revolutions of the gear will cause a travel of six feet, or a distance of eight inches per revolution. Of course, larger or smaller gears may be used, as desired. A portion of the switch arrangement 44 is attached onto shaft 62 which likewise carries the gear 40, so that a portion of the switch arrangement revolves with the gear. The switch arrangement includes a nut 64 attached to the shaft 62 so that the nut rotates with the shaft. The nut 64 is provided on one side with a lug 66 projecting outwardly therefrom.

A plurality of discs 68 are mounted on the shaft 62 and are free to rotate with respect to the shaft. Each disc is provided with a projecting lug 70 which is bent at right angles to the disc. The lugs 70 and the lug 66 on the nut 64 are all located in the same plane. Upon rotation of the shaft 62, the nut 64 will likewise rotate therewith, and when the lug 66 reaches the lug 70 on the first disc adjacent to the nut 64, the first mentioned lug will engage the second lug and cause the first disc to rotate with the nut. With each rotation of the nut 64, another disc 68 will be picked up by engagement of its lug with the lug of the adjoining rotating disc until all of the discs have been engaged. The last disc 68 is connected to a larger disc 72 which rotates therewith. The disc 72 may be called the switch actuating means. The disc 72 is provided with a bar 74 integral therewith and extending at right angles to the disc 72 adjacent its outer periphery. Mounted on the plate 48 are a pair of saddles 76 and 78 which are attached to snap switches 80 and 82, respectively. When the disc 72 with its integral bar 74 is rotated along with the last disc 68, the bar 74 is carried into engagement with the saddles 76 and 78 and carry them sufficiently far to actuate the snap switches 80 and 82. When actuated, the switch 80 is adapted to cut off the current to the motor 36, thereby stopping the motor. The switch 82 is adapted to reverse the direction of rotation of the motor when actuated.

In operation, it is seen that the switch arrangement 44 is so arranged that when the motor is actuated by external means, such as a switch on the garage the shaft 62 will revolve a number of times corresponding to the number of discs mounted on the shaft, at which time switches 80 and 82 will be simultaneously actuated and the motor will automatically cut off and reverse direction. Upon actuating the motor, a second time, the shaft will rotate in the other direction the same number of turns at which time the switches 80 and 82 will again be actuated and the motor will again cut off and reverse. By varying the number of discs 68 on the shaft 62, the number of revolutions of the gear 40 before actuating the switches 80 and 82 can be controlled, thereby controlling the distance traveled by the door. The number of discs 68 can be varied depending on the length of door used, so that for a six-foot door, nine discs will be used, whereas for a six-foot eight-inch door, ten discs will be used.

To insure engagement of the lug 66 or nut 64 with the lug on the first disc 68, a spring 84 may be provided between the nut 64 and a second nut 86 which is tightly secured to the shaft 62. The nut 64 can be splined onto the shaft 62 to rotate therewith but to permit relative lengthwise movement therewith. The spring 84 acts to force the nut 64 against the first disc 68.

A safety switch 88 is provided which is adapted to be actuated when an obstruction is encountered by the door while closing it. This switch includes a male portion or plug 90 mounted on plate 46 and a female portion or socket 92 mounted on the plate 48. These portions are mounted in alignment so that when the latch 52 is in engagement with plate 46, the two portions of the switch are in contact as shown in Fig. 2 and the circuit is complete. When, however, an obstruction is encountered by the door during the lowering operation so that the door and attached plate 46 stop moving, whereas the gear, motor and plate 48 tend to continue moving, the plate 48 moves against the action of spring 50 while plate 46 remains stationary, thereby separating the male portion or plug 90 and the female portion or socket 92 of the safety switch 88, as shown in Fig. 3, and thereby cutting the circuit to the motor 36. The strength of the spring 50 is regulated to require a pull of approximately 25 lbs. to actuate the safety switch. When the obstruction has been removed, an upward push on the door will again close

the contacts 90, 92 of the safety switch and the motor will again be actuated to continue the closing operation.

This safety feature is useful in automatically stopping the motor when the door comes in contact with an obstruction such as an automobile or the like.

The switch arrangement 44 described heretofore is useful in other applications as well as in a door closing device. For example, it would be useful in any device where a fixed length of travel in two directions is required, such as in an elevator. Where continuous operation in two directions is required, the snap switch 80 can be omitted so that the direction of travel can be reversed with each stroke without cutting out.

The device described can be conveniently packaged since there are no long rigid parts involved as in previously proposed devices for this purpose. The novel chain carriage 42 is the only support for the device onto the chain assembly. Practically no head room is required as the chain may be mounted adjacent to the ceiling and only the flat chain carriage 42 extends above the chain.

The method of actuation of the door opening mechanism may be by a switch located adjacent to the door on the garage or by conventional radio controlled means operating from the automobile directly to the relay on the device.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. In a door operating mechanism for an overhead opening door, a pair of relatively movable plates, a resilient means connecting said plates and adapted to resist relative movement of said plates, a socket mounted on one of said plates, a plug in alignment with said socket and mounted on the other said plate, said socket and plug adapted to be in engagement in the normal position of said plates and resilient means, one of said plates being attached to said door, means mounted on the other said plate for operating said door, whereby when said door encounters an obstruction in closing and stops movement said plates will move apart against the action of said resilient means until said socket and plug have become disconnected thereby inactivating said operating means.

2. In a door operating mechanism for an overhead opening door, a pair of relatively movable plates, a resilient means connecting said plates and adapted to resist relative movement of said plates, a pair of electrical contacts each of which is mounted on one of said plates in such a manner that said contacts are in contact and make a circuit when the plates are in their normal position, means for attaching one of said plates to said door, means mounted on said other plate for operating said door, whereby when said door encounters an obstruction in closing and stops movement, said plates will move apart against the action of said resilient means until said contacts are disconnected, thereby cutting the circuit and inactivating said operating means.

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