

March 8, 1932.

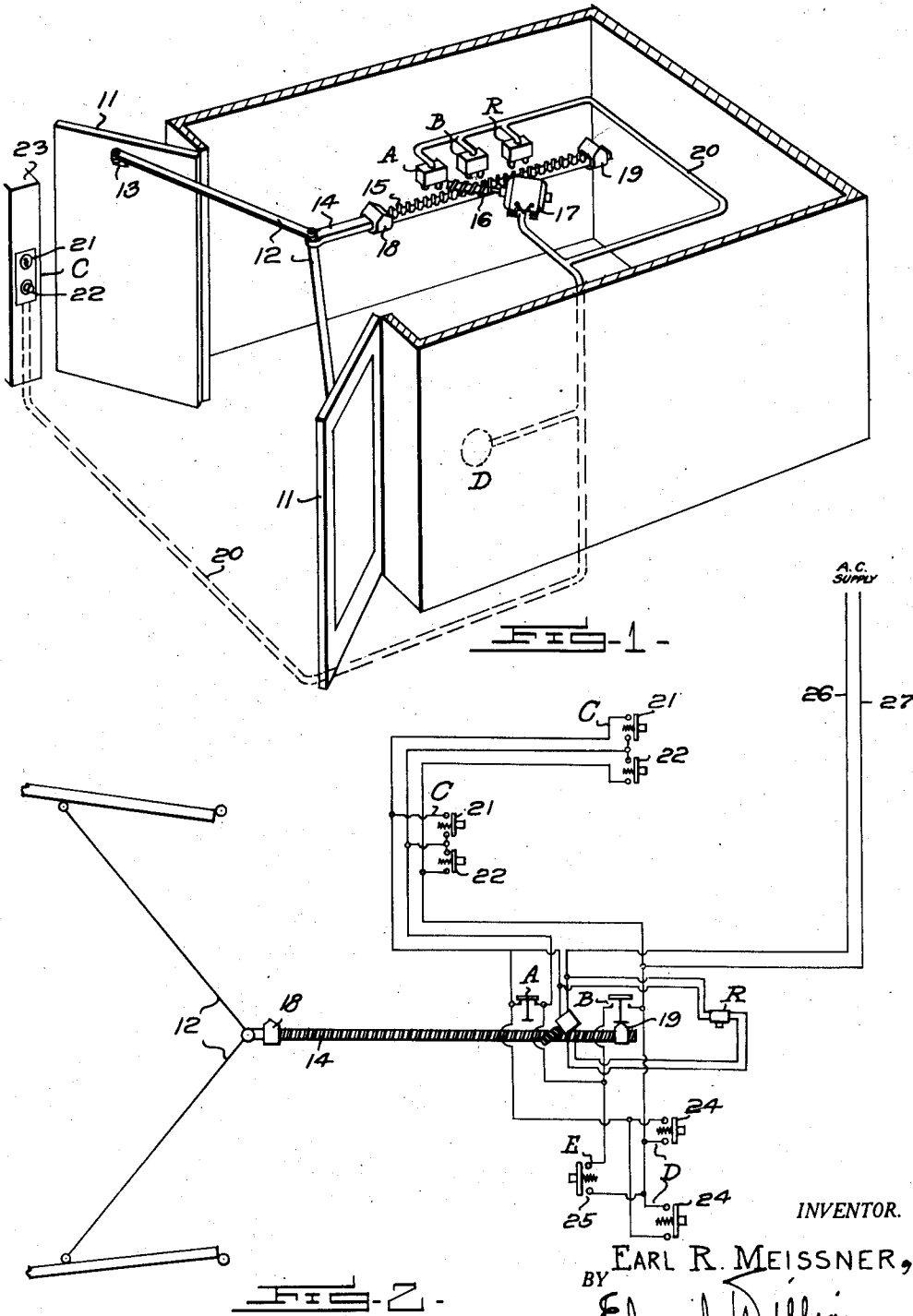
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1,848,136

ELECTRIC DOOR OPERATOR

Filed July 16, 1929

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

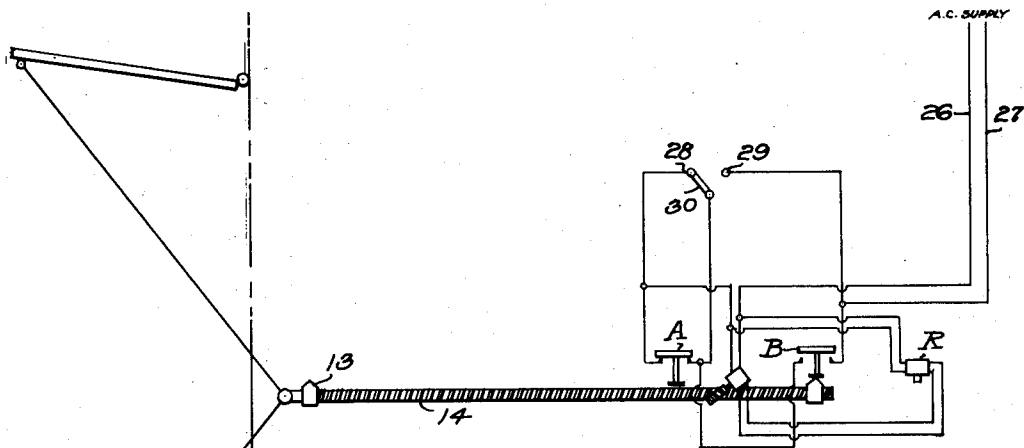


FIG. 3.

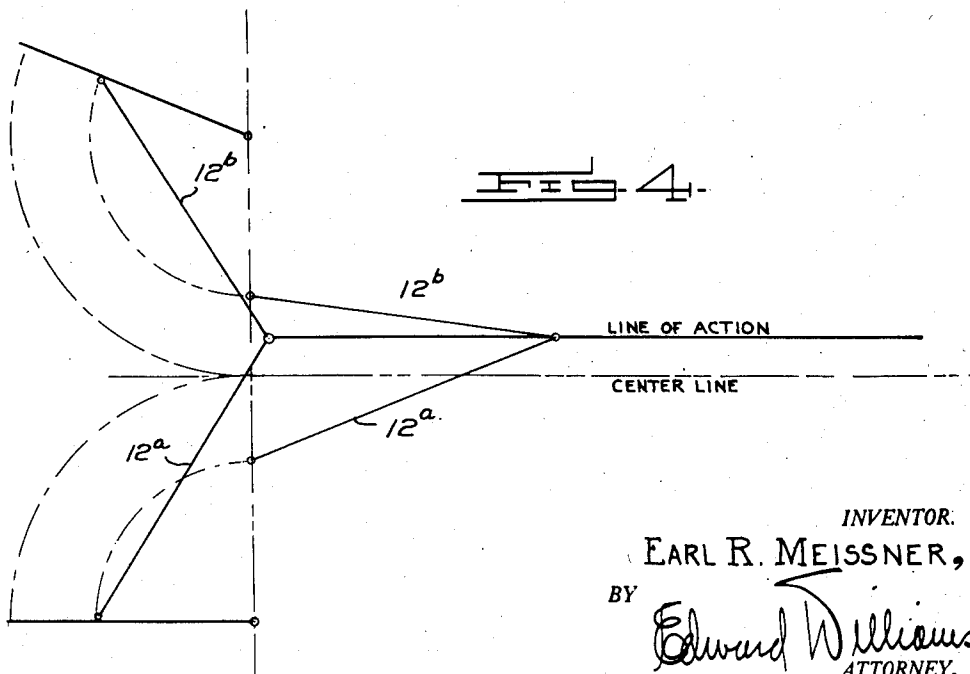


FIG. 4.

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ELECTRIC DOOR OPERATOR

Application filed July 18, 1929. Serial No. 378,738.

My invention relates to an electrically driven door operator and more particularly to such an operator for garage doors, though it is not necessarily limited to such an application, but may be used in connection with any closure member where a similar problem is involved. It is a matter of common experience to be inconvenienced when driving a car into a garage by being obliged to get out of the car, unlock the garage doors, open them, and, if the wind is blowing or the doors are not hung true, to fasten them securely open while the car is being driven into the garage, and then to reverse the procedure and lock the garage. It is an object of my invention to overcome the above mentioned difficulties by providing an electrically driven operator for garage doors, the operation of which may be initiated from any of a number of desired points.

While a great many structures and arrangements have been proposed heretofore to accomplish such a result, the fact that all of them were of such complexity or were so expensive as to outweigh their added convenience is evidenced by their almost universal failure to meet the public approval and their very limited application. It is a further object of this invention to devise an electrically driven door operator which shall be made up almost wholly of standard parts, which shall be easily assembled, simple in operation and consequently inexpensive to install.

Other and further objects of my invention will be apparent from the following description and will be pointed out with particularity in the appended claims. For a more complete understanding of my invention reference is had to the following description taken in connection with the accompanying drawings in which Fig. 1 is a simplified perspective view of my improved operator as applied to garage doors; Fig. 2 is a wiring diagram of the control for the electric motor used to drive the operator; Fig. 3 is a diagram

of a modification of the motor control, and Fig. 4 is a diagram illustrating the application of my improved operator to doors where it is desirable to obtain unequal openings of the doors.

Referring now to Fig. 1, the garage doors 11 are arranged to be opened and closed by means of the links 12 which are pivotally connected to the doors at 13, preferably near the top of the door and about two-thirds the width of the door from the hinged edge, to prevent undue strain on the hinges. One end of each of the links 12 is pivotally connected to the rack member 14, which is adapted to reciprocate in suitable guideways (not shown) supported from the roof in any desired manner.

The rack member 14 is provided with the teeth 15, cut on the bias, that is at an angle with the longitudinal axis of the rack, and is actuated by a worm 16 driven by a motor 17 angularly mounted with respect to the rack. By means of this arrangement, the rack may be actuated directly by the motor driven worm without the interposition of speed-reducing gearing or special complicated driving schemes as have been resorted to in previous arrangements. Attached to the rack 14 near its ends are the cams 18 and 19 which are adapted to operate the limit switches A and B and the reversing switch R, in the motor circuit, as explained more fully below. The connections to the motor 17 and to the various control switches are carried in the conduit 20 which extends to the control stations C and D located at any desired points although this feature forms no part of my invention and any desired wiring scheme may be used. The motor which I prefer to use in my arrangement is a single-phase alternating current induction motor having an auxiliary starting winding which is disconnected by a centrifugal switch when the motor reaches about two-thirds normal speed. This type of motor is widely used in

fractional horsepower sizes for various applications.

The preferred control system to be used in connection with my door operator is shown diagrammatically in Fig. 2. Included in the circuit of the main motor winding are the normally closed limit switches A and B, the switch A adapted to be opened by the cam 18 just before the doors reach their fully closed position, and the switch B adapted to be opened by the cam 19 just before the doors reach their fully open position, in each case, the momentum of the moving parts acting to carry them into final position. These switches may be of the single button spring depressed type in which they are momentarily unseated by their respective cams, or they may be of the two-button snap type in which their respective cams snap them to open position in approaching their final position and snap them to closed position in leaving their final position in a door operating cycle. The reversing switch R is included in the auxiliary motor field, and, as illustrated, is adapted to be operated by the cam 19 at some time between the operation of the two limit switches. Obviously, the reversing switch R might be placed in front of limit switch A and be operated by cam 18, if so desired. As stated above, this winding is energized only for a few seconds while the motor is coming up to speed, so that the switch R may be operated at any time after the motor has reached full speed, it only being necessary that it should be operated to reverse the auxiliary winding at some time during the operating cycle, so that upon subsequent energization, the motor will start in a direction reverse to that in which it last rotated.

For initiating the operation of the door operating mechanism, any number of control stations C, D, E, may be provided. The station C comprises a key operated normally open push button switch 21 adapted to momentarily short circuit the limit switch A, that is, an opening switch, and an ordinary normally open push-button switch 22 adapted to short circuit the limit switch B to initiate the closing of the doors. Preferably, one of such stations is located upon a post 23 within easy reach of a driver's seat near the approach to the garage, though any number of such stations may be located at any desired points, each station being connected in parallel as shown clearly in Fig. 2. Using a key operated switch for opening the doors in this manner prevents unauthorized entry into the garage. Control stations D comprise a single normally open push button switch 24 which is connected to short circuit both the limit switch A and B and thus initiate either an opening or a closing operation, dependent upon the position of the doors. Such a station is usually located inside the garage, as

shown in Fig. 1, or inside the house, or any place accessible only to the car owner. Control station E is similar to station D and may be used in lieu thereof or in addition thereto. Station E comprises a single normally open push button switch 25 which short circuits limit switch B; that is, it may be used only to effect a closing of the doors.

It is thought that from the above description, the operation of my door-operating mechanism will be apparent, but for the sake of clarity a cycle of operation will be described. With the parts in the position shown in Figs. 1 and 2, the closing of the doors can be effected by momentarily depressing either switch 22, 24, or 25. In case switch 22 or 25 is closed, a circuit is completed from the supply line 26, through the main motor field, contacts of switch A, contacts of switch 22 or 25, to supply line 27. In case switch 24 is closed, the circuit includes only switch 24 and the main motor field. It will be noted that the auxiliary starting winding is permanently connected to the main motor winding through the reversing switch and the centrifugal switch mentioned above, so that the auxiliary winding will be energized whenever the motor is at rest and the main winding is energized. The motor will now start, actuating the rack 14 to the right to close the doors, and within a second or two the cam 19 will disengage the limit switch B which is now closed, and the push button switch may be released. As soon as the motor has come up to speed, the starting winding will be disconnected and soon after the cam 19 engages the push button of reversing switch R to reverse the auxiliary motor field. Just before the doors reach their fully closed position, the cam 18 engages the limit switch A to open it and break the motor circuit at that point. It will be apparent to those skilled in the art that the doors may then be opened by momentarily depressing push-button switch 21 or 24, thus short circuiting limit switch A which has just been opened.

A modification of my control scheme is shown in Fig. 3 which is very simple in its arrangement and its operation, but is adaptable only to installations where a single control station is sufficient. In this arrangement, a two way switch 30 is movable to connect the common connection between the limit switches A and B with either contact 28 or 29 and thereby short circuit limit switch A or B respectively. In all other respects, the operation is exactly similar to that described in connection with Figs. 1 and 2, from which it is thought the operation of this arrangement will be clear.

In Fig. 4 is illustrated diagrammatically an arrangement for obtaining an unequal opening of the doors, in case there is an obstruction in the path of one of the doors or in case the wall of the garage abuts the property

line along one side. In this case, the line of action of the rack 14 is displaced from the center line of the doors, and necessarily the link 12a is made somewhat longer than the link 12b as illustrated. It is thought that the diagram makes this arrangement sufficiently clear without further explanation.

In accordance with the patent statutes, I have described what I now consider to be the preferred embodiment of my invention, but I do not wish to be limited thereto, but aim in the appended claims to cover all modifications and variations within the true spirit and scope of my invention.

What I claim is new and desire to secure by Letters Patent of the United States is:

1. In a door operating mechanism, a reciprocating member for operating said mechanism, a reversible electric motor having an auxiliary starting winding, for actuating said member, a control circuit for said motor including a plurality of normally closed switches in circuit with the motor and a reversing switch in circuit with said auxiliary winding, said switches being mounted at spaced points in the line of motion of said member, and engaging means attached to said member and adapted to operate said switches at points in the travel of said member dependent on their spacing.

2. In a door operating mechanism, a reciprocating member for operating said mechanism, a reversible electric motor having an auxiliary starting winding, for actuating said member, a control circuit for said motor including a plurality of normally closed switches in circuit with said motor and a reversing switch in circuit with said auxiliary winding, and engaging means attached to said member adapted to open one of said normally closed switches at the limit of travel of said member in either direction and to operate said reversing switch at a point between the limits of travel of said member.

3. In a door operating mechanism, an operating member reversibly movable in a fixed path, an electric motor having a reversible auxiliary starting winding, for actuating said member, a control circuit for said motor including a plurality of normally closed switches in circuit with said motor and a reversing switch in circuit with said auxiliary winding, and engaging means attached to said member adapted to open one of said normally closed switches at the limit of travel of said member in either direction and to operate said reversing switch at a predetermined point in the travel of said member.

4. In a door operating mechanism, an operating member reversibly movable in a fixed path, an electric motor having a reversible auxiliary starting winding, for actuating said member, a control circuit for said motor including a plurality of normally closed switches in circuit with said motor and a re-

versing switch in circuit with said auxiliary winding, engaging means attached to said member adapted to open one of said normally closed switches at the limit of travel of said member in either direction and to operate said reversing switch at a predetermined point in the travel of said member, and a manually operable switch adapted to render one of said normally closed switches ineffective and to initiate the operation of said motor in a direction opposite to that in which it last operated.

5. In a door operating mechanism, an operating member reversibly movable in a fixed path, an electric motor having a reversible auxiliary starting winding, for actuating said member, a control circuit for said motor including a plurality of normally closed switches in circuit with said motor and a reversing switch in circuit with said auxiliary winding, engaging means attached to said member adapted to open one of said normally closed switches at the limit of travel of said member in either direction and to operate said reversing switch at a predetermined point in the travel of said member, and a plurality of manually operable switches, each adapted to short circuit one of said normally closed switches, when opened by said means, to initiate the operation of said motor in a direction opposite to that in which it last operated.

6. In a door operating mechanism, an operating member reversibly movable in a fixed path, an electric motor having a reversible auxiliary starting winding, for actuating said member, a control circuit for said motor including a plurality of normally closed switches in circuit with said motor and a reversing switch in circuit with said auxiliary winding, engaging means attached to said member adapted to open one of said normally closed switches at the limit of travel of said member in either direction and to operate said reversing switch at a predetermined point in the travel of said member, and a plurality of manually operable switches, each adapted to short circuit momentarily certain of said normally closed switches when opened by said means, to initiate the operation of said motor in a direction opposite to that in which it last operated.

7. In a door operating mechanism, an operating member reversibly movable in a fixed path, an electric motor having a reversible auxiliary starting winding, for actuating said member, a control circuit for said motor including a plurality of normally closed switches in circuit with said motor and a reversing switch in circuit with said auxiliary winding, engaging means attached to said member adapted to open one of said normally closed switches at the limit of travel of said member in either direction and to operate said reversing switch at a predetermined point in the travel of said member, a key con-

trolled manually operable switch adapted to short circuit momentarily the normally closed switch opened by said means when said member reaches the limit of its travel corresponding to the closed position of the door, and a second manually operable switch adapted to short circuit momentarily another of said normally closed switches when opened by said means, the operation of either of said manual switches initiating the operation of the motor in a direction opposite to that in which it last operated.

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