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DOOR OPERATING MECHANISM

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FIG. 1

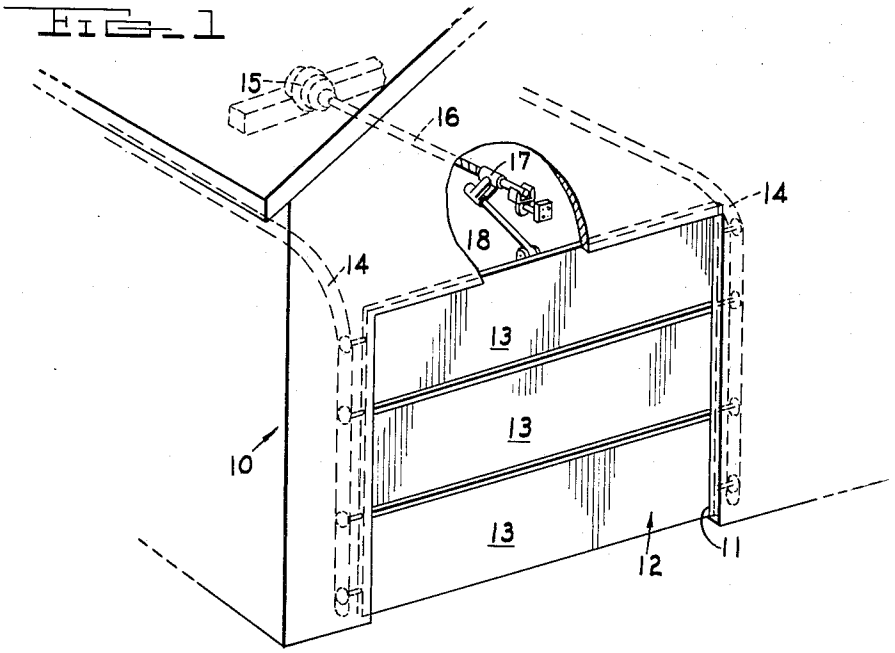
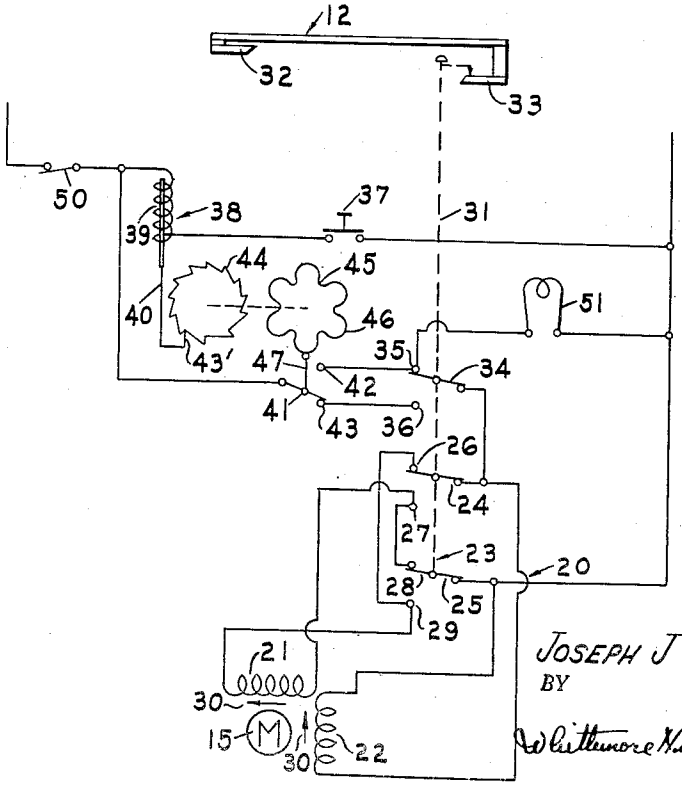


FIG. 2



INVENTOR.
JOSEPH J VAUGHN
BY
Whittemore, Hulbert & Belknap
ATTORNEYS

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DOOR OPERATING MECHANISM

Joseph J. Vaughn, Detroit, Mich., assignor, by mesne assignments, to McKee Door Company, Aurora, Ill., a corporation of Illinois

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1

This invention relates generally to closure operating means of the type embodying an electric motor connected to the closure for moving the latter to both its closed and open positions.

One of the objects of this invention is to provide a circuit for the motor embodying selectively operable means for opening the circuit to the motor at any time so that the closure may be stopped in any position intermediate the fully open and fully closed positions.

Another feature of this invention is to provide switch means in the motor circuit responsive to movement of the closure to either its open or closed position to open the circuit and to also reverse the terminals of the motor windings so that when the circuit is subsequently closed the motor revolves in the required direction.

A further object of this invention is to provide a motor circuit of the above general type wherein the selectively operable means operates independently of the switch means to open the motor circuit.

The foregoing as well as other objects will be made more apparent as this description proceeds, especially when considered in connection with the accompanying drawing, wherein:

Figure 1 is a perspective view partly broken away of a closure of one type capable of being operated by the operating means forming the subject matter of this invention; and

Figure 2 is an electric diagram of the circuit provided for operating the closure.

The closure operating means forming the subject matter of this invention is shown herein for the purpose of illustration as employed for opening and closing a garage door of the sliding overhead type. It will be understood as this description proceeds, however, that the operating means may be advantageously used to operate different kinds of closures either of the sliding, hinged or pivoted types.

With the above in view, reference is made to Figure 1 of the drawing, wherein the numeral 10 designates an enclosure, such for example, as a garage having an opening 11 of the required size in one wall. The opening 11 is adapted to be closed by a door 12 of the overhead type, composed of a plurality of individual sections 13 having the adjacent horizontal edges pivotally connected in a manner to enable sliding movement of the door from a vertical position within the door opening to a horizontal position within the garage adjacent the roof of the latter. The door is guided between the open and closed positions thereof by suitable tracks 14 respectively

2

supported on the garage structure at opposite sides of the opening 11. In accordance with conventional practice, rollers are supported at opposite side edges of the door 12 in positions to respectively engage the tracks 14.

The top section 13 of the door 12 is operatively connected to an electric motor 15 suitably supported within the garage adjacent the roof of the latter. The motor shaft is coupled to one end of a feed screw 16 having a travelling nut 17 thereon and having the opposite end suitably journalled on a support fixed to the garage frame structure. The nut 17 is connected to the top edge of the upper door section 13 by suitable linkage 18 in a manner such that rotation of the feed screw 16 in one direction by the motor 15 causes the nut to travel along the screw in a direction away from the door opening 11. In response to this movement of the nut 17, a pull is applied to the upper edge of the door 12 sufficient to move the latter along the tracks 14 to its open position. On the other hand, rotation of the screw 16 in the opposite direction by the motor 15 causes the nut 17 to travel along the screw in a direction toward the opening 11 and imparts an outward force on the top edge of the door 12 through the linkage 18 to move the door to its closed position.

The operation of the motor 15 is controlled by an electric circuit 20 adapted for connection with the available service outlet and including the motor windings 21 and 22. A two-pole double throw switch 23 is provided for connecting the terminals of the motor windings in the circuit. The two poles of the switch 23 are designated by the numerals 24 and 25. The pole 24 is electrically connected to one end of the coil 22 and the pole 25 is electrically connected to the opposite end of the coil 22. As shown in Figure 2 of the drawing the pole 24 of the switch 23 is adapted to selectively engage a pair of contacts 26 and 27 which are respectively electrically connected to opposite ends of the coil 21. The pole 25, of course, moves as a unit with the pole 24 between a pair of contacts 28 and 29. The contact 28 is electrically connected to the contact 27 and the contact 29 is similarly connected to the contact 26. The arrangement is such that when the switch poles are in the respective positions thereof shown in Figure 2 of the drawing, current flows through the motor windings in the direction of the arrows 30, and when the switch poles are operated to respectively engage the contacts 27 and 29, current flows in the opposite direction through the motor windings 21. Thus

manipulation of the switch 23 reverses the direction of rotation of the motor 15.

The two switch poles are successively moved between the two positions aforesaid thereof in response to movement of the door 12 to its open and closed positions. This operative connection between the door 12 and switch 23 may either be mechanical or electrical. In the present instance a mechanical connection is diagrammatically shown in Figure 2 of the drawing as comprising an operating link 31 and a pair of cams 32 and 33 movable as a unit with the door 12. The cams are so positioned that when the door assumes its open position, the cam 32 engages the link 31 and when the door assumes its closed position, the cam 33 engages the link 31. The link 31 is connected to the motor reversing switch 23 and is alternatively moved in opposite directions by the cams to respectively move the double throw switch 23 to both its operative positions. As a result when the door is moved to either its open or closed position, the motor 15 for operating the door is reversed.

The cams also operate a single pole double throw limit switch 34 mechanically connected to the link 31 and electrically connected in the circuit 20 in series with the motor 15. If desired this switch may be incorporated in the switch 23 in which event the latter, instead of being a double pole, double throw type, is a three pole double throw design. In any case the movable contact of the switch 34 is electrically connected to the motor windings, and is adapted to successively engage a pair of fixed contacts 35 and 36 upon movement of the link 31 in opposite directions by the cams. As will be more fully hereinafter described, the arrangement is such that when the movable contact of the switch 34 is in engagement with one of the contacts, the other contact is disconnected from the circuit so that when the switch 34 is subsequently operated by one of the cams, the movable contact is engaged with the disconnected or "dead" contact and the circuit to the motor, although reversed insofar as the motor windings are concerned, is open. Thus movement of the door to either its open or closed position not only operates the switch 23 to reverse the direction of current flow through the motor windings, but in addition, opens the circuit to these windings.

The operation of the motor 15 is manually controlled by a push button switch 37 and a ratchet type relay 38. The push button switch 37 is connected in the circuit 20 in shunting relation to the switch 34 and the coil 39 of the relay is connected in series with the switch 37. In addition to the coil 39 the relay comprises an armature or plunger 40 and a single pole double throw switch 41 mechanically connected to the plunger 40. The switch 41 is electrically connected in the circuit 20 in series with the limit switch 34. In other words the contact 42 of the switch 41 is connected to the contact 35 of the switch 34 and the contact 43 of the switch 41 is connected to the contact 36. Actually one end of the plunger 40 is provided with an arm 43 engageable with a ratchet wheel 44 to rotate the latter with a step by step movement as the coil 39 of the relay is successively energized. The wheel 44 is connected to an indexing wheel 45 for correspondingly rotating the latter, and the peripheral portion of the wheel 45 is scalloped to form a plurality of equally spaced cams 46. As shown in Figure 2 of the drawing the switch 41 has an arm 47 engageable at the free end with the periphery of the wheel 45 for movement by the latter to operate the switch 41. The arrangement is such that when the free end of the arm 47 is in engagement with one of the valleys on the wheel 45 between adjacent cams 46, the contact 42 is engaged by the switch 41. On the other hand when the free end of the arm 47 is in engagement with one of the cams 46, the switch 41 is moved to engage the contact 43.

With the circuit arrangement shown in Figure 2, it will be noted that the relay switch 41 is operated to make and break the circuit 20 independently of the limit switch 34. Thus the operation of the motor may be discontinued at any time by manipulation of the switch 37 and the door may be stopped at any position intermediate its fully open and closed positions.

Operation

When the door 12 is in its closed position, the various instrumentalities of the operating circuit 20 assume the relative positions shown in Figure 2 of the drawing. It will be noted from Figure 2 of the drawing that although the limit switch 34 is closed, nevertheless, the switches 34 and 41 are so positioned with respect to one another that the circuit 20 to the motor 15 is open. When it is desired to open the door 12, the operator merely manipulates the switch 37 to close the circuit through the relay coil 39. Energization of the relay coil 39 imparts an upward movement to the plunger 40 and causes the arm 43 to advance the ratchet wheel 44 throughout one step of its movement. The angular movement of the ratchet wheel 44 is sufficient to rotate the indexing wheel 45 the required extent to enable movement of the switch 41 from a position in engagement with the contact 43 to a position in engagement with the contact 42. Inasmuch as the limit switch 34 is in a position wherein it engages the contact 35, it follows that the circuit 20 to the motor 15 is closed. This operation is effected without disturbing the reversing switch 23 which has previously been operated by the cam 33 to direct current through the motor windings in a direction to cause rotation of the motor 15 in the required direction to open the door 12.

When the door 12 approaches its uppermost position, the cam 32 simultaneously operates the limit switch 34 to open the circuit, and the switch 23 to reverse the terminals of winding 21 on the motor so that when the circuit is again closed by manipulation of the push-button switch 37, the motor 15 revolves in the reverse direction to close the door. In this connection it is pointed out that closing of the switch after the door is opened again energizes the relay coil 39 and moves the switch 41 back into engagement with the contact 43. Inasmuch as the limit switch is in engagement with the corresponding contact 36, the circuit 20 is again closed and the motor is operated to move the door to its closed position.

In the event it is desired for some reason or another to stop movement of the door 12 in any intermediate position, the switch 37 is closed by the operator. As soon as the switch 37 is closed, the relay coil 39 is energized and the switch 41 is operated to open the circuit 20 independently of the limit switch 34. Thus the door is under complete control of the operator at all times, and this feature is highly desirable from a safety point of view.

If desired the circuit 20 may be protected by a switch 50 connected in series in the circuit 20 and preferably of the thermal overload type.

Also for convenience a lamp 51 is incorporated in the circuit 20 in a position where it will be illuminated when the door is moved or is moving to its open position.

What I claim as my invention is:

1. A control system for a closure supported for movement to open and closed positions and having operating means for moving the closure to open and closed positions including an electric motor, said system comprising an electric circuit including the motor, a pair of single pole double throw switches electrically connected in series in the motor circuit, means for operating one of the switches in response to movement of the closure to either of the two positions aforesaid thereof, a reversing switch connected in the circuit and operated by said means for reversing the direction of rotation of the motor as the closure assumes either its open or closed position, and selectively operable means for operating the other single pole double throw switch independently of the said one single pole double throw switch.

2. A control system for a reversible electric motor connected to door-opening and closing mechanism, said system comprising a motor circuit, a motor reversing switch in said circuit, a double throw limit switch in series with said reversing switch having spaced contacts, a double throw control switch in series with said limit switch having spaced contacts each of which is connected to one of the spaced contacts of said limit switch, a starting switch, a solenoid controlled by said starting switch, a control switch actuator operated by said solenoid in a step-by-step manner by said solenoid, and effective to close the circuit to one or the other of the contacts of said control switch, and means mechanically operated by the door upon completion of opening or closing movement to simultaneously operate said reversing and limit switches.

3. A system as defined in claim 2 in which said control switch actuator comprises a ratchet device operated by said solenoid and a rotatable cam having alternate high and low points, a cam follower on said control switch, said cam being designed to bring high and low points successively into engagement with said cam follower upon successive energization of said so enoid.

JOSEPH J. VAUGHN.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
941,777	Hart	Nov. 30, 1909
1,222,090	Findley	Apr. 10, 1917
1,745,999	Goldman	Feb. 4, 1930
2,000,515	Gross	May 7, 1935
2,001,416	Freezzolini	May 14, 1935
2,037,780	Gross	Apr. 21, 1936
2,262,719	Collins	Nov. 11, 1941
2,435,440	Graham	Feb. 3, 1948