

Oct. 24, 1933.

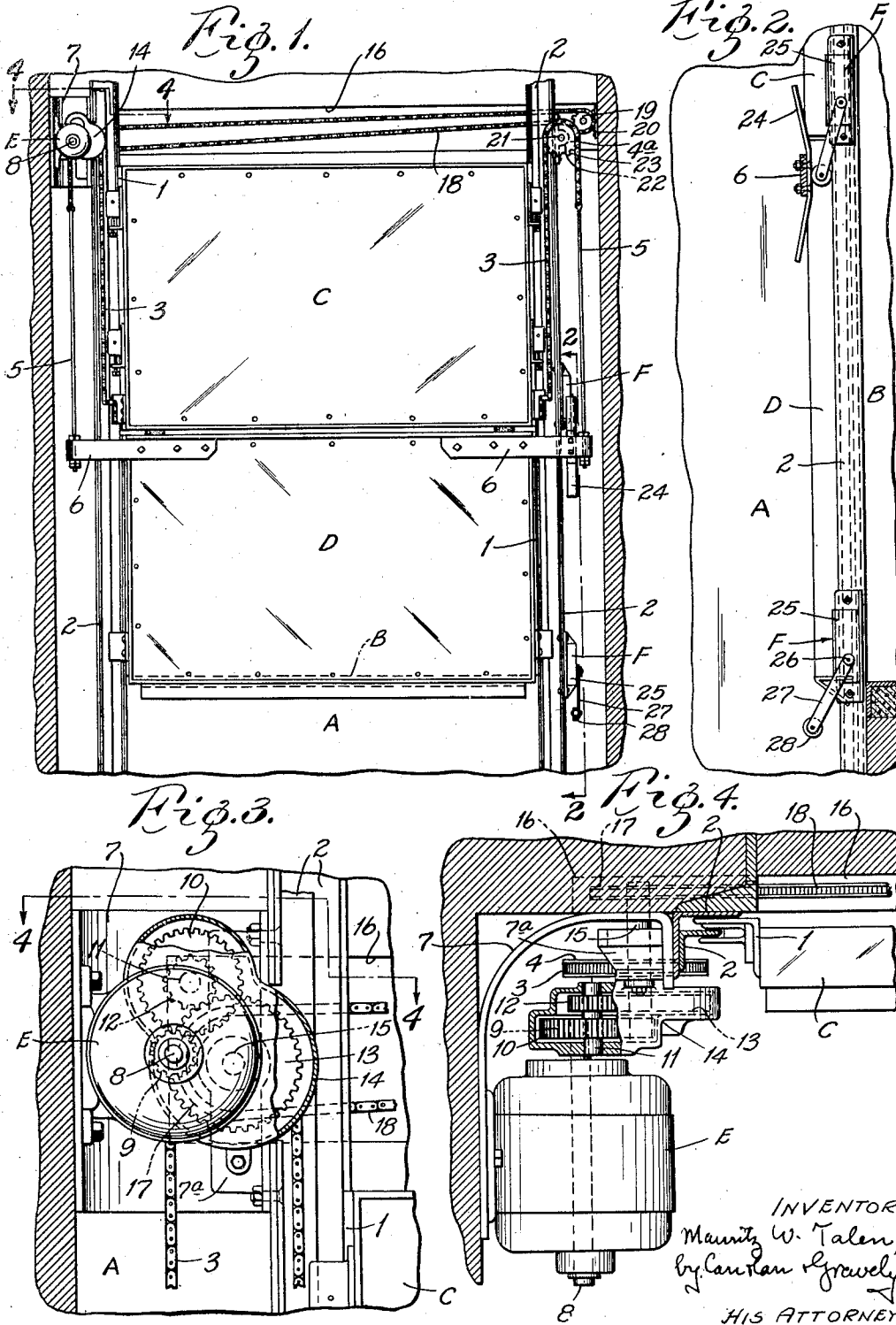
M. W. TALEN

1,932,198

DOOR OPERATING MECHANISM

Filed Dec. 15, 1930

3 Sheets-Sheet 1



Oct. 24, 1933.

M. W. TALEN

1,932,198

DOOR OPERATING MECHANISM

Filed Dec. 15, 1930

3 Sheets-Sheet 2

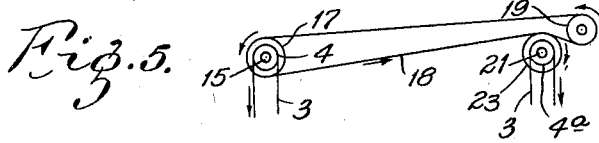


Fig. 6.

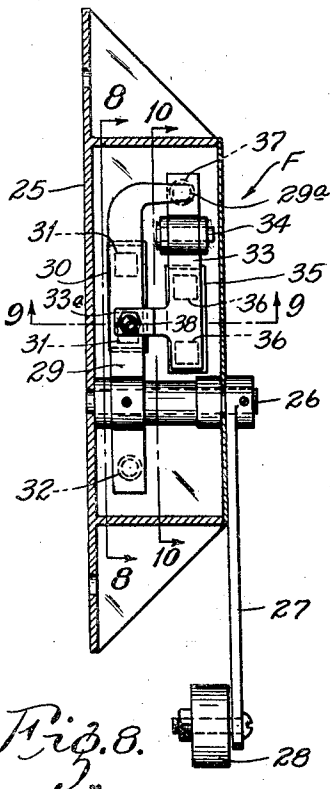


Fig. 7.

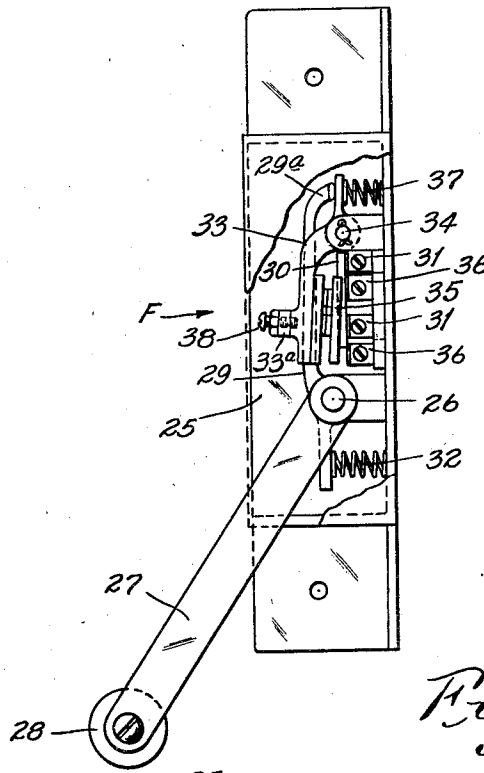


Fig. 8.

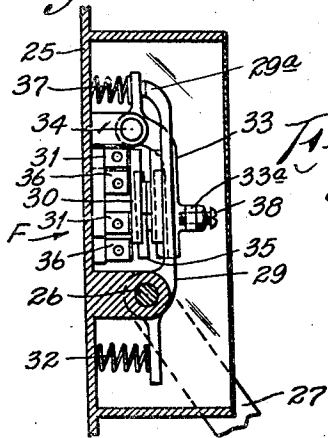


Fig. 10.

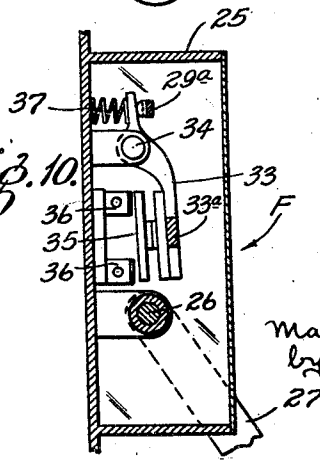
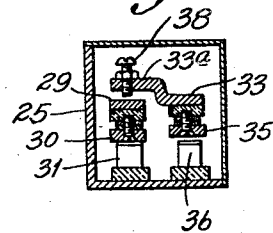


Fig. 9.



INVENTOR:
Maurice W. Talen,
by Can Ran Ogrevy,

HIS ATTORNEYS.

Oct. 24, 1933.

M. W. TALEN

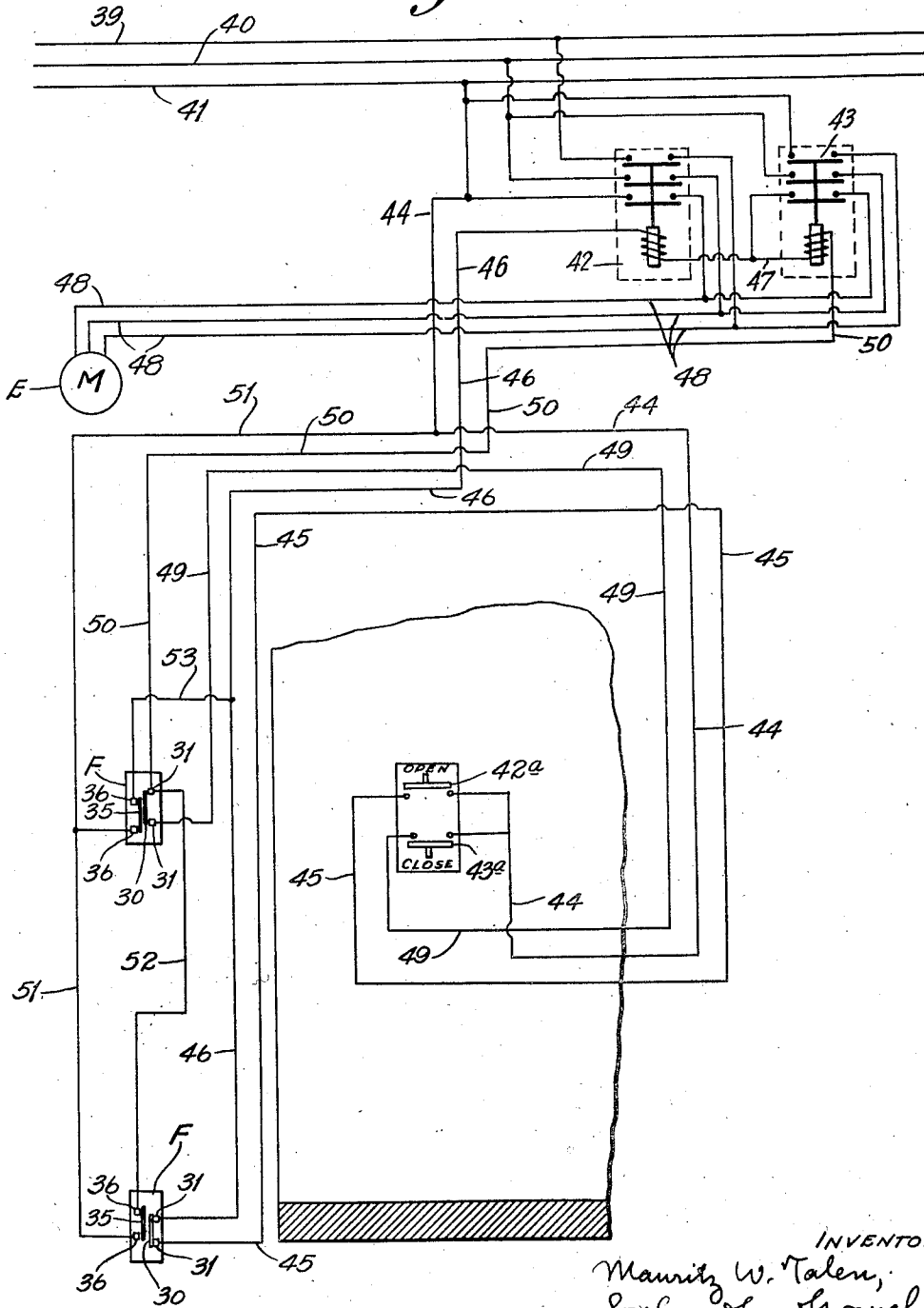
1,932,198

DOOR OPERATING MECHANISM

Filed Dec. 15, 1930

3 Sheets-Sheet 3

Fig. 11.



INVENTOR:
Mauritz W. Talen,
by Carl Van Gravelly,
HIS ATTORNEYS.

UNITED STATES PATENT OFFICE

1,932,198

DOOR OPERATING MECHANISM

Mauritz W. Talen, St. Louis, Mo., assignor to
Security Fire Door Company, St. Louis, Mo., a
corporation of Missouri

Application December 15, 1930
Serial No. 502,364

12 Claims. (Cl. 268—59)

This invention relates to door operating mechanisms, and more particularly to motor actuated operating mechanisms for sliding elevator doors.

The invention has for its principal object to provide means for reducing the speed of the elevator door near the end of its travel and for stopping it at the end of its travel, thereby preventing damage to the door and the parts of the elevator associated therewith, and eliminating noise due to slamming of the door. Other objects are simplicity and cheapness of construction, fewness of parts, and compactness of design.

The invention consists in utilizing the door operating motor for checking the speed of the door near the end of its opening and closing movements and for stopping it at the end of such movements. It also consists in the combination reversing and limit switches for controlling the door operating motor. It also consists in arranging said switches so as to be operated by the movement of the door; and it also consists in the construction, combinations and arrangements of parts hereinafter described and claimed.

In the accompanying drawings, which form part of this specification and wherein like symbols refer to like parts wherever they occur,

Fig. 1 is an interior side elevation of the door side of an elevator shaft, showing a door on one of the floors equipped with a motor actuated operating mechanism embodying my invention,

Fig. 2 is a vertical section through the door side of the shaft on the line 2—2 of Fig. 1,

Fig. 3 is an enlarged fragmentary interior side view of the door side of the shaft, showing the bracket for supporting the motor and gearing for driving the door sprocket wheel on one side of the door,

Fig. 4 is a horizontal cross-section on the line 4—4 of Fig. 3,

Fig. 5 is a diagrammatic view showing the sprocket chain layout for driving the door sprocket wheels,

Fig. 6 is a vertical cross-section through the combined reversing and limit switches for checking the speed of the door near the end of its opening movement and for stopping it at the end of such movement.

Fig. 7 is a side view of said switch, parts of the switch box being shown broken away,

Fig. 8 is a vertical cross-section on the line 8—8 in Fig. 6,

Fig. 9 is a horizontal cross-section on the line 9—9 in Fig. 6,

Fig. 10 is a vertical cross-section on the line 10—10 in Fig. 6; and

Fig. 11 is a wiring diagram showing the location of the combined reversing and limit switches in the electric circuit for controlling the door operating motor.

Referring to the accompanying drawings, my

invention is shown in connection with an ordinary freight elevator comprising a shaft A having a door opening B at each floor that is closed by means of a door preferably of the vertical-sliding, center-parting, counterbalanced type. As shown in the drawings, said door comprises upper and lower sliding sections C and D, respectively, that are provided along each vertical edge with an angle bar side frame member 1 slidably arranged in angle bar door guides 2 that are rigidly secured to each other and to the wall of the elevator shaft A. The upper and lower door sections are hung on sprocket chains 3 that pass over wheels, preferably sprocket wheels 4 and 4a, located within the elevator shaft A adjacent to the upper corners of the upper door section C. One end of each door chain 3 is suitably connected in the adjacent lower corner of the upper door section C, and the other end of said chain is connected to the upper end of an upright rod 5, whose lower end is secured to the outer end of an arm 6 that projects horizontally from the adjacent upper corner of said lower door section. By this arrangement, one door section serves to balance the other door section, and the two sections are adapted for simultaneous movement towards and away from each other. The elevator construction thus far described is well known and is considered unnecessary to illustrate it in detail.

The door on each floor is opened and closed preferably by means of a separate door operating mechanism comprising an electric motor, preferably a reversible torque motor E, which can be stalled under load for several minutes without injury. The motor E is mounted on a bracket 7 that is rigidly secured to the door guides 2 adjacent to the door supporting sprocket wheel 4. The electric motor E is disposed with its armature shaft 8 horizontal; and a pinion 9 is fixed to the outer end of said armature shaft and meshes with a gear 10 fixed to one end of a horizontal shaft 11, whose opposite end has a pinion 12 fixed thereto which drives a spur gear 13 fixed to the door supporting sprocket wheel 4. The gearing just described is enclosed within a suitable lubricant containing housing 14 mounted on the motor supporting bracket 7. The door supporting sprocket wheel 4 is fixed to a shaft 15 that is journaled in suitable antifriction bearings provided therefor in the gear housing 14 and in a bracket 7a formed integral with the motor supporting bracket 7.

The shaft 15 of the door supporting sprocket wheel 4 extends through the motor supporting bracket 7 into a horizontal channel 16, which is formed in the interior surface of the front wall of the elevator shaft A just above the top of the door opening B, and has a sprocket wheel 17 fixed thereto which drives an endless sprocket chain 18. The sprocket chain 18 extends across

the elevator shaft to the opposite side of the door opening B where it passes around an idler sprocket wheel 19 mounted in a bracket 20 secured to the adjacent side wall of said shaft adjacent to the door supporting sprocket wheel 4a. The door supporting sprocket wheel 4a is mounted on a horizontal shaft 21 supported in a bracket 22 fixed to the adjacent door guide 2 and has a sprocket wheel 23 secured thereto which is located below and is driven by the lower stretch of the endless sprocket chain 18.

Mounted on one of the door guides at one side of the door opening B are two combined reversing and limit switches F that are located in the circuit for controlling the motor E and are operated by a cam plate 24, which is fastened to the door arm 6 of said lower door section D and is provided with inclined upper and lower end portions connected by a vertical middle portion. The two combination switches F are of similar construction and are located one just above the door sill and the other opposite the door cam 24 when the door is closed. Each switch F comprises a box or casing 25, in which is journaled a horizontal shaft 26 having an arm 27 which projects into the path of the door cam 24 and carries a roller 28 at its free outer end adapted to be engaged by said door cam. Fastened to the shaft 26 is an upright lever 29, whose upper arm carries an insulated contact bar 30, which forms one element of a limit switch. The other element of the limit switch comprises two vertically spaced contact posts 31 that project horizontally from the wall of the switch box 25. A suitable coil spring 32 is interposed between the wall of the switch box 25 and the lower arm of the lever 29 and normally tends to force said lever in a direction that will maintain the contact bar 30 in contact with the two contact posts 31.

Another upright lever 33 is pivotally mounted in the switch box 25, as at 34, for vertically swinging movement alongside of the lever 29. The lower arm of the lever 33 is provided with an insulated contact bar 35, which forms one element of a reversing switch. The other element of the reversing switch comprises two vertically spaced contact posts 36 that project horizontally from the switch box 25. Interposed between the upper arm of the lever 33 and the adjacent wall of the switch box 25 is a coil spring 37 that normally tends to force said lever in a direction that will cause its contact plate 35 to engage the contact posts 36.

The upper arm of the lever 29 has a lateral extension 29a which overlaps the upper arm of the lever 33; and the coil spring 32 is made considerably stronger than the coil spring 37 and thus forces the lateral extension of the lever 29 against the upper arm of the lever 33 with a force sufficient to hold the contact plate 35 of the reversing switch out of contact with the two fixed contact posts 36 thereof. The lower arm of the lever 33 is also provided with a lateral extension 33a that overlaps the upper arm of the lever 29 and is provided with a screw 38 adapted to bear against the lever 29. This screw may be adjusted to vary the space between the end of said screw and the lever 29.

When the door is closed, the limit switch in the lower switch box is held closed and the reversing switch in said switch box is held open by the action of the spring 32; and both the limit switch and the reversing switch in the upper switch box are held open by the pressure of the door cam 24 on the operating arm 27 on said upper switch box.

When the door is open the pressure on the operating arm 27 of the upper switch box is released and the spring 32 operates to close the upper limit switch and open the upper reversing switch; and the door cam 24 is in engagement with the operating arm 27 of the lower switch box and thus serves to overcome the action of the spring 32 and open both the limit switch and the reversing switch.

When power is applied to the motor E to open the door, the lower door section D will move downwardly until the inclined lower end of the door cam 24 engages the roller 28 on the operating arm 27 of the lower combination switch F and thus forces said arm to swing outwardly. This swinging movement of the arm 28 rotates the rock shaft 26 and the lever 29 thereon in a direction that will cause the contact bar of the limit switch to be disengaged from the fixed contacts 31 thereof. At the same time, the lateral extension 29a of the lever 29 will swing away from the upper arm of the second rock lever 33 and permit the compression spring 37 to swing the lever 33 in a direction that will cause the contact bar 35 of the reversing switch to contact with the fixed contacts 36 and thus close said switch and reverse the motor. This reversing of the motor will check the opening movement of the door sections until the rock lever 29 strikes the screw 38 carried by the lateral extension 33a of the rock lever 33 and thus rocks the latter in a direction that will disengage the contact bar of the reversing switch from the fixed contacts 36 thereof, thereby opening said reversing switch and stopping the motor. The length of time that the reversing switch remains closed may be varied by adjusting the screw 38 to increase or decrease the space between said screw and the rock lever 29. When the door is closed, the upper combination switch F will be operated by the door cam 24 in the same manner as the lower combination switch.

The two door actuated combination switches F are located in a three-phase alternating current circuit E for controlling the reversible torque door-operating motor, which circuit is shown diagrammatically in Fig. 11 of the accompanying drawings. The control circuit for the motor E is supplied with current through power lines 39, 40 and 41 and is provided with the usual three-contact forward and reverse electromagnetic switches 42 and 43 that are operated by the usual push-button switches 42a and 43a. When it is desired to open the elevator door, the operator closes the push switch 42a, which completes a circuit through the power lines 39 and 41, line 44, switch 42a, line 45, elements 30, 31 of the normally closed limit switch of the lower combination switch F, line 46, magnetic coil of magnetic switch 42, and line 47, whereby the current flowing through said magnetic coil will connect the three contacts of said magnetic switch with the three power lines and allow the current to pass to the motor through the three lines 48 and open the door.

When it is desired to close the door, the operator closes the push-button switch 43a to close the circuit between the power lines 39 and 41, line 44, switch 43a, line 49, elements 30, 31 of the normally closed upper limit switch of the upper combination switch F, line 50, magnetic coil of magnetic switch 43 and line 47, whereby the current flowing through the magnetic coil will connect the three contacts of said magnetic switch with the three power lines to make contact and allow the current to pass to the motor in a reverse direction through the three lines 48.

When the door nears the end of its opening movement, the cam 24 thereon engages the operating arm 27 of the lowermost combination switch, which action disengages the elements 30, 31 of the lower limit switch and thus opens the circuit therethrough and thus causes the coil of the forward magnetic switch 42 to become deenergized and open the three contacts thereof and cut off the motor. It is noted that when the lower limit switch is opened by the disengagement of the elements 30, 31, the elements 35, 36 of the lower reversing switch will be engaged, thereby completing the circuit between the power lines 39 and 41 through lines 44 and 51, elements 35, 36 of lower reversing switch, lines 52 and 50, magnetic coil of reversing magnetic switch 43, and line 47, the current flowing through said magnetic coil causing the three contact points of the magnetic switch 43 to make contact and allow the current to pass to the motor in a reverse direction over the lines 48. The current flowing through the magnetic switch 43 reverses the motor which acts as a brake to check the speed of the door in its downward travel until the circuit is opened at the lower reversing switch by the outward movement of arm 27.

It will be noted that three different actions take place when the arm 27 of the combination switch is swung outwardly by the door cam 24. The first action is that of stopping the motor and is brought about when the limit switch is opened. The second action is that of reversing the motor, which action is brought about when the reversing switch is closed. The third action is that of stopping the motor, which action is brought about by the opening of the said reversing switch just before the door has reached its fully opened position.

When the door nears the end of its closing movement, the cam 24 thereon engages the arm 27 of the upper combination switch F, thereby disengaging the elements 30, 31 of the upper limit switch and opening the circuit thereof. This action causes the magnetic coil of the electromagnetic reversing switch 43 to become de-energized, thus opening the circuit through said magnetic switch and cutting out the motor. As the upper limit switch is being opened, it will permit the contact elements 35, 36 of the upper reversing switch to close, thereby making a complete circuit between power lines 39 and 41 through the line 51, said upper reversing switch, lines 53 and 46, magnetic coil of the switch 42 and line 47. The current flowing through the magnetic coil of the switch 42 will connect the three contacts thereof with the power lines and allow the current to flow to the motor over the lines 48 and thus rotate it in a direction that will retard the upward travel of the door. This flow of the current to the motor continues until the arm 27 on the upper combination switch moves outward far enough to open the upper reversing switch and stops the motor.

Obviously, the hereinbefore described door controlling arrangement admits of considerable modification without departing from the invention. Therefore, I do not wish to be limited to the precise construction and location of the combination switches, door operating mechanism and motor control circuit shown and described.

What I claim is:

1. In a door operating mechanism, a door, an electric motor operatively connected to said door to open and close the same, an electric circuit containing said motor and means for controlling

the direction of rotation of said motor in one direction to open the door and in the opposite direction to close said door, and two combined reversing and limit switches in said circuit operable respectively near the end of the opening movement and near the end of the closing movement of said door for momentarily reversing and then cutting off said motor current.

2. In a door operating mechanism, a door, an electric motor operatively connected to said door to open and close the same, an electric circuit containing said motor and means for controlling the direction of rotation of said motor in one direction to open the door and in the opposite direction to close said door, and means in said circuit for momentarily reversing and then cutting off the motor current during the opening and closing movements, respectively, of said door, said means comprising two combined reversing and limit switches operable respectively by said door as it approaches the end of its opening movement and as it approaches the end of its closing movement.

3. In a door operating mechanism, a door, an electric motor operatively connected to said door to open and close the same, an electric circuit containing said motor and means for controlling the direction of rotation of said motor in one direction to open the door and in the opposite direction to close said door, a combined reversing and limit switch in said circuit, and means on said door operable as the door nears the end of its opening movement to open the limit switch, close the reversing switch, and open the reversing switch in the order named.

4. In a door operating mechanism, a door, an electric motor operatively connected to said door to open and close the same, an electric circuit containing said motor and means for controlling the direction of rotation of said motor in one direction to open the door and in the opposite direction to close said door, a combined reversing and limit switch in said circuit, and means on said door operable as the door nears the end of its closing movement to open the limit switch, close the reversing switch, and open the reversing switch in the order named.

5. In a door operating mechanism, a door, an electric motor operatively connected to said door to open and close the same, an electric circuit containing said motor and means for controlling the direction of rotation of said motor in one direction to open the door and in the opposite direction to close said door, two combined reversing and limit switches in said circuit operable respectively to momentarily reverse and then cut off the motor current during the opening movement and during the closing movement of said door, and a single means on the door for operating both reversing and limit switches, one as the door approaches the end of its opening movement and the other as the door approaches the end of its closing movement.

6. In a door operating mechanism, a door, an electric motor operatively connected to said door to open and close the same, an electric circuit containing said motor and means for controlling the direction of rotation of said motor in one direction to open the door and in the opposite direction to close said door, means in said circuit operable by the movement of said door for reversing the motor current and then cutting off said current as the door nears the end of its opening and closing movements, respectively, and means for varying the duration of length of flow of such

reverse flow of motor current independently of the speed of the motor.

7. In a door operating mechanism, a door, an electric motor operatively connected to said door to open and close the same, an electric circuit containing said motor and means for controlling the direction of rotation of said motor in one direction to open the door and in the opposite direction to close said door, and means in said circuit operated by the movement of said door for reversing the motor current and then cutting off said current when the door nears the end of its opening and closing movements respectively, said means comprising two combined reversing and limit switches operable one by the door as it approaches the end of its opening movement and the other by the door as it approaches its closing movement.

8. In a door operating mechanism, a door, an electric motor operatively connected to said door to open and close the same, an electric circuit containing said motor and means for controlling the direction of rotation of said motor in one direction to open the door and in the opposite direction to close said door, and means in said circuit operable by the movement of said door for reversing the motor current and then cutting off said current as the door nears the end of its opening and closing movements, said means comprising combined reversing and limit switches located adjacent to the ends of the opening and closing movements respectively of said door, an operating arm for opening the limit switch and closing the reversing switch of each combination switch in the order named, and means carried by said door for actuating the operating arm of one of said combined switches when the door nears the end of its opening movement and for operating the other of said combined switches when the door nears its closing movement.

9. In a door actuating mechanism, a door, an electric motor operatively connected to said door for opening and closing the same, an electric circuit containing said motor and means for controlling the direction of rotation of said motor to open and close said door, two combined reversing and limit switches in said circuit, said switches being located adjacent to the opposite ends of the line of travel of the door, and a cam on said door for actuating said combination switches near the end of the opening and closing movements respectively of said door to open the limit switch, close the reversing switch, and open the reversing switch in the order named and means for automatically closing the limit switch of each combination switch when the door cam is disengaged therefrom.

10. In a door operating mechanism, a door, an electric motor operatively connected to said door to open and close the same, an electric circuit containing said motor and means for controlling the direction of rotation of said motor in one direction to open the door and in the opposite direction to close said door, means in said circuit for reversing the motor current near the end of the opening and closing movements respectively of said door, said reversing means being operable by the movement of said door, and means for varying the duration of such reverse flow of the motor current independently of the speed of the motor.

11. In a door operating mechanism, a door, an electric motor operatively connected to said door to open and close the same, an electric circuit containing said motor and means for controlling

the direction of rotation of said motor in one direction to open the door and in the other direction to close said door, and combined reversing and limit switches in said circuit operable near the end of the opening and closing movements respectively of said door for reversing and then cutting off said motor current, the reversing switch and the limit switch of each combination switch each comprising a contact plate cooperating with a pair of fixed contacts, a lever supporting the contact plate of the limit switch, an operating arm for the limit switch lever, a lever supporting the contact plate of the reversing switch, said reversing switch lever having an extension disposed in the path of movement of said limit switch lever, said limit switch lever having an extension disposed in the path of movement of said reversing switch lever, a spring tending to move said reversing switch lever in a direction that will cause the contact plate thereon to contact with the fixed contacts therefor, a stronger spring operating to swing said limit switch lever in a direction that will cause the contact plate thereon to contact with the fixed posts therefor and force the extension of said limit switch lever against said reversing switch lever with a force sufficient to hold said reversing switch lever in a position with its contact plate disengaged from the fixed contact posts therefor, and a cam on said door adapted near the end of the opening and closing movements thereof to actuate the operating arm of said limit switch lever to open the limit switch, and to close and then open the reversing switch.

12. In a door operating mechanism, a door, an electric motor operatively connected to said door to open and close the same, an electric circuit containing said motor and means for controlling the direction of rotation of said motor in one direction to open the door and in the other direction to close said door, and combined reversing and limit switches in said circuit operable near the end of the opening and closing movements respectively of said door for reversing and then cutting off said motor current, the reversing switch and the limit switch of each combination switch each comprising a contact plate cooperating with a pair of fixed contacts, a lever supporting the contact plate of the limit switch, an operating arm for the limit switch lever, a lever supporting the contact plate of the reversing switch, said reversing switch lever having an extension disposed in the path of movement of said limit switch lever, a screw mounted on said extension in abutting relation to said limit switch lever, said limit switch lever having an extension disposed in the path of movement of said reversing switch lever, a spring tending to move said reversing switch lever in a direction that will cause the contact plate thereon to contact with the fixed contacts therefor, a stronger spring operating to swing said limit switch lever in a direction that will cause the contact plate thereon to contact with the fixed posts therefor and force the extension of said limit switch lever against said reversing switch lever with a force sufficient to hold said reversing switch lever in a position with its contact plate disengaged from the fixed contact posts therefor, and a cam on said door adapted near the end of the opening and closing movements thereof to actuate the operating arm of said limit switch lever to open the limit switch, and to close and then open the reversing switch.