H. W. CRANE.

OPERATING MEANS FOR DOORS.

APPLICATION FILED AUG. 16, 1917.

1,290,718.

Patented Jan. 7, 1919.

4 SHEETS—SHEET 1.

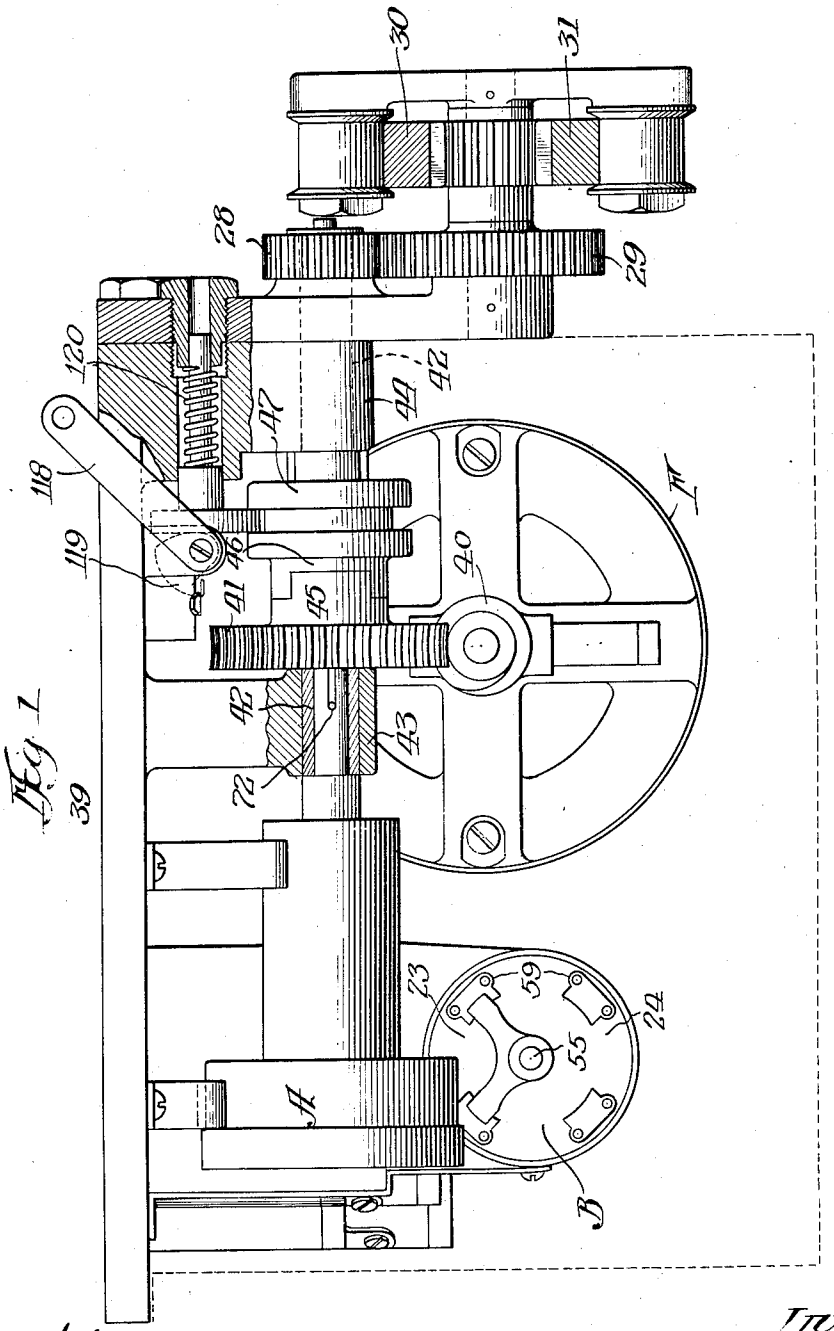


Fig. 1.

Witness!

Fred. C. Dorsey

Inventor

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By Chas. F. Murray

Atty

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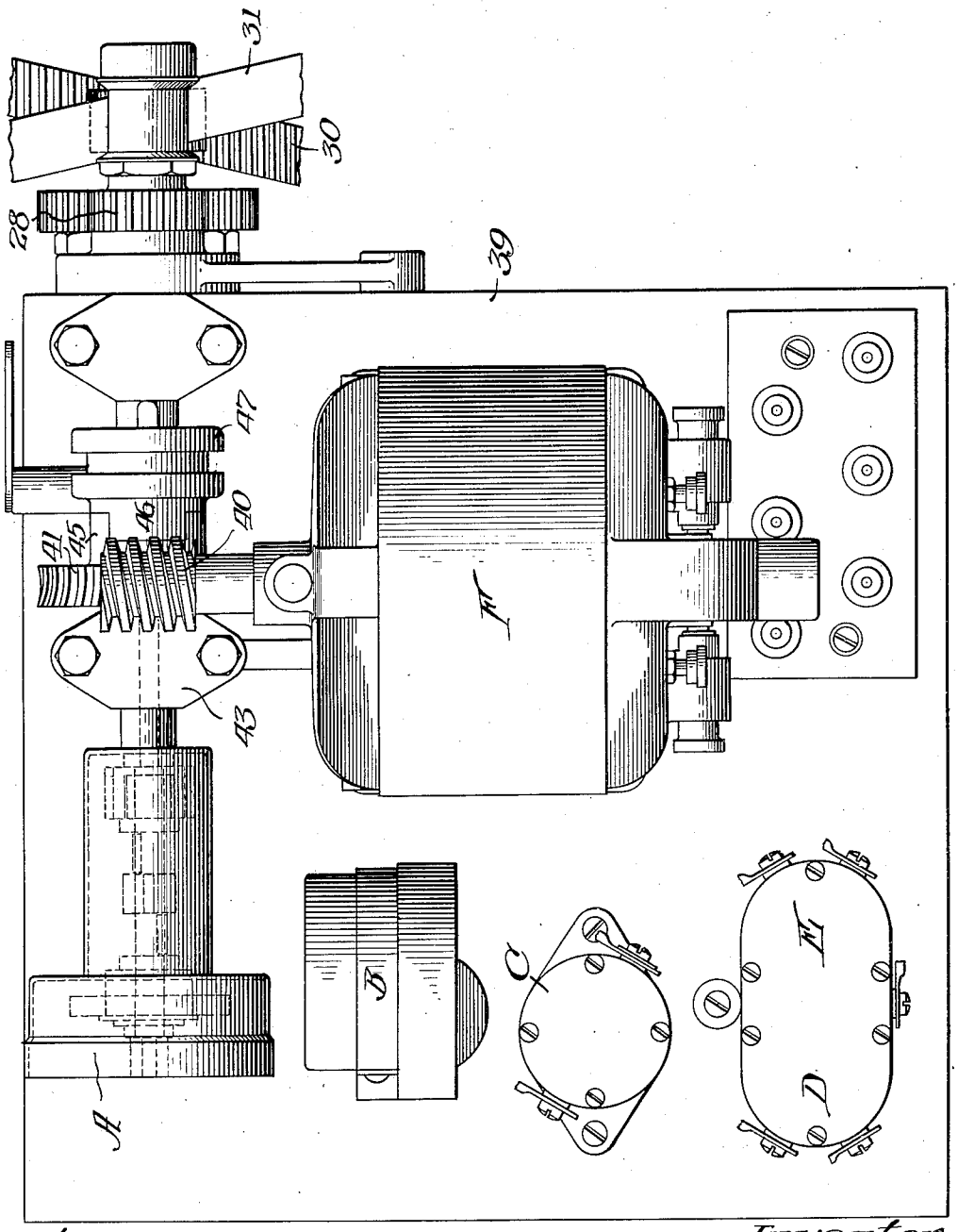
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4 SHEETS—SHEET 2.



Witness:
Geo. C. Davison

Fig. 2.

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4 SHEETS—SHEET 3.

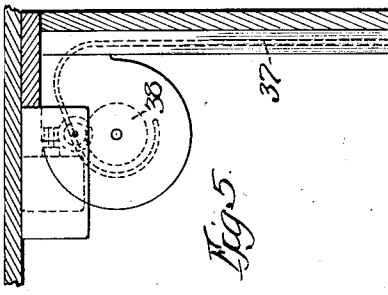


Fig. 5.

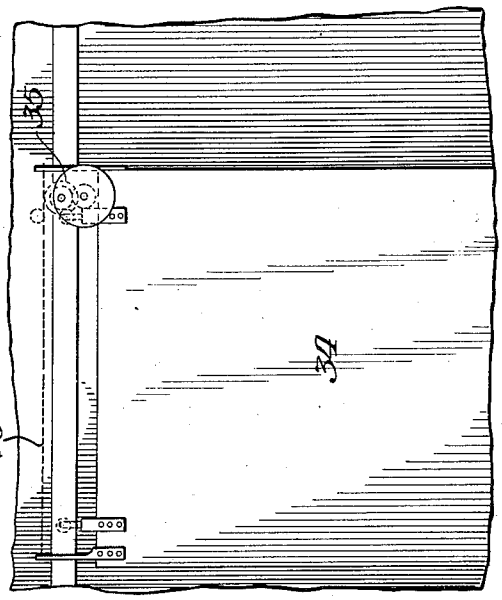


Fig. 4.

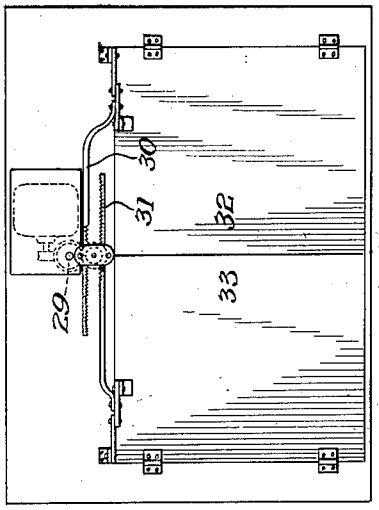


Fig. 3.

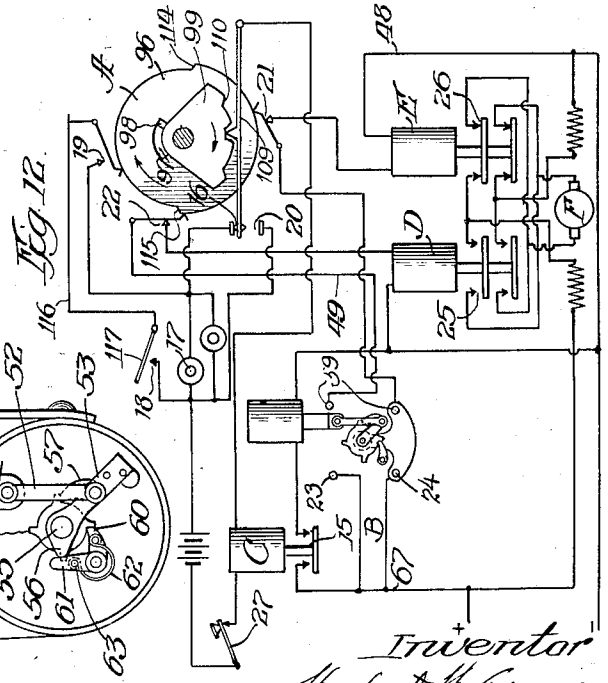


Fig. 12.

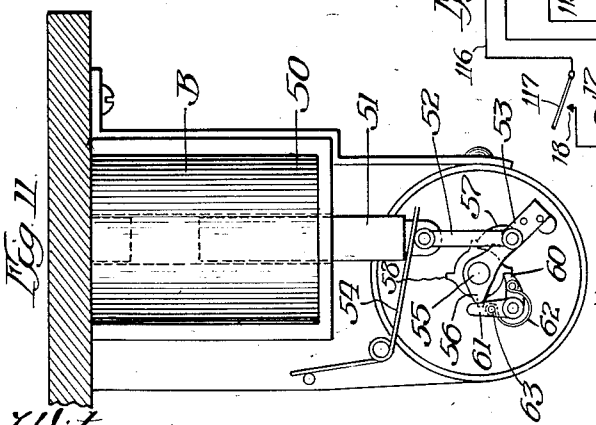


Fig. 11.

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OPERATING MEANS FOR DOORS.

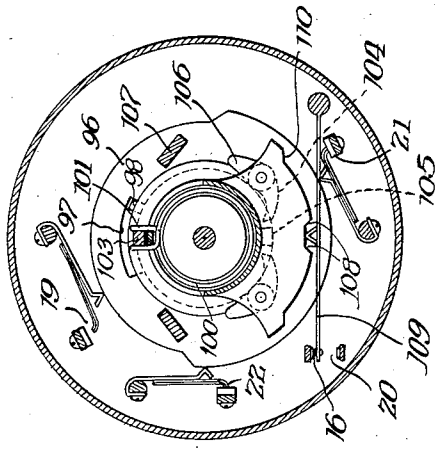
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Fig. 8.



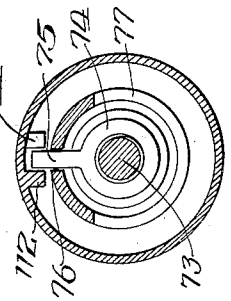


Fig. 7.

Fig. 6

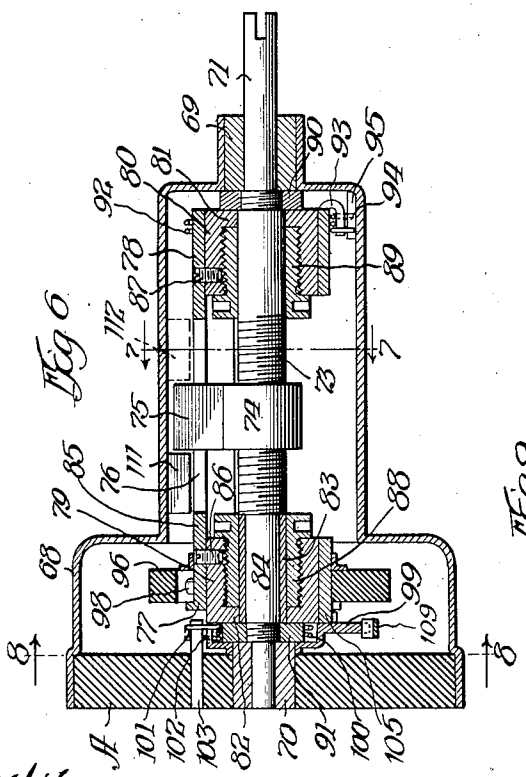


Fig. 10.

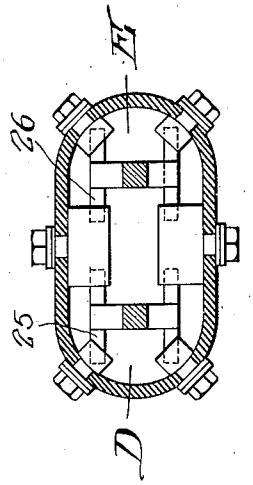
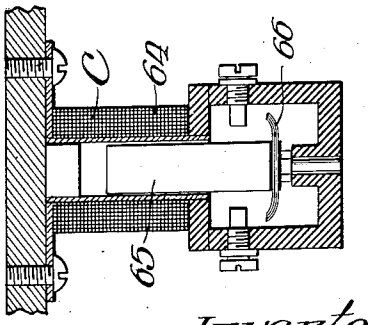


Fig. 9.



Witness:

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UNITED STATES PATENT OFFICE.

HERBERT W. CRANE, OF CHICAGO, ILLINOIS.

OPERATING MEANS FOR DOORS.

1,290,718. Specification of Letters Patent. Patented Jan. 7, 1919.

Application filed August 16, 1917. Serial No. 186,518.

To all whom it may concern:

Be it known that I, HERBERT W. CRANE, a citizen of the United States, and resident of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Operating Means for Doors, of which the following is a specification.

My invention relates to door operating devices and particularly to an improvement on the construction shown in my prior Patent No. 1,194,482, of August 15, 1916.

A general object of the present improvement is to provide door operating mechanism which shall be adaptable to different types of doors now in common use without modification in the operating element. In order to arrive at this result, the different features of the apparatus have been associated and combined in such manner as to provide a self-contained unit which may be installed by any mechanic without the use of more than ordinary skill and which is so simple in operation as to make it valuable and desirable in any but the most unusual situations.

One of the principal objects of the invention is to provide means operating independently of the travel of the door for stopping the motor at predetermined limits of travel. This avoids the necessity for providing exposed stops, exposed switches, etc., for the shutting off of the power, all of which necessitated the installation of expensive high voltage switches.

A further object is to provide door operating switches at various distant points and for connecting these switches through a low voltage circuit to the high voltage switches contained within the well insulated and protected casing of the device. By reason of this provision the wiring for the operating switches may be installed cheaply and without regard to fire insurance restrictions. This materially reduces the cost of installation and enables the application and general use of the device in many situations where it would otherwise be undesirable.

A further object is to provide means for automatic operation of the door opening mechanism together with means arranged to prevent operation by such automatic means in all except certain specified situations. For instance, the parts are arranged in such manner that if the garage door is closed a car may be driven onto a plate placed in the pathway outside of the door and the door will open. If, however, the door is open or partly open, the presence of a car or other weight on the plate will have no effect on the mechanism.

A further object is the provision of mechanism so arranged that the door may be opened, closed, or stopped at any point in its opening and closing movement by the operation of a single push-button.

The invention will be more readily understood by reference to the accompanying drawings, wherein,

Figure 1 is a side elevation of a door operating apparatus constructed in accordance with my invention;

Fig. 2 is a bottom plan view thereof with the protecting casing or cover removed;

Fig. 3 shows the manner in which the device is applied to a pair of swinging doors;

Fig. 4 shows the application to a sliding door;

Fig. 5 shows the same associated with a vertically rolling or curtain type of door;

Fig. 6 is a longitudinal sectional view through a multiple switch which I prefer to employ;

Fig. 7 is a sectional view on the line 7—7 of Fig. 6;

Fig. 8 is a sectional view on the line 8—8 of Fig. 6;

Fig. 9 is a vertical sectional view through a relay switch;

Fig. 10 is a transverse sectional view through a double solenoid reversing switch;

Fig. 11 is a side elevation of a high voltage solenoid switch for controlling the reversing switches, and,

Fig. 12 is a wiring diagram.

The device is intended for application as a unit, all of the operating parts including the motor, low voltage and high voltage switches being mounted on a base inclosed within a suitable housing and adapted for application by means of suitable brackets to all forms of doors.

For instance, in Fig. 3, the device is shown as applied to a pair of swinging doors, the drive pinion 28, engaging through suitable gears 29, with a pair of oppositely disposed rack bars 30, 31, secured to the two doors 32, 33. The connection between the rack bars and the doors is of novel form and is the basis for a co-pending application,

Serial No. 186,519, filed of even date herewith.

In Fig. 4 the device is shown as applied to a sliding door 34. In that case a sprocket 35, replaces the drive pinion and engages a chain 36, secured to the door.

In Fig. 5, the door 37, is shown as of the vertically sliding curtain-type, adapted to be wound upon a drum 38. The pinion 28, of the drive shaft, engages the cylindrical roller in a suitable manner, as shown.

In each instance it will be noted that the motor and operating devices are applied as a unit, the only modifications for different types of doors being in the connections between the doors and the drive pinion. This serves to adapt the device for general commercial use, it being manufactured as a unit and applied with only the necessary modifications to suit different conditions. The only adjustments necessary are those which serve to limit the extent of movement of the parts in opening and closing.

The different elements which coöperate have been lettered A, B, etc., in the drawings and in the wiring diagram. The motor F, is mounted on a suitable base 39, and may be of any well known form. A worm 40, is carried by the armature shaft and engages a worm gear 41, which is loosely mounted on a shaft 42, supported in suitable bearings 43, 44, which depend from the base plate 39. The worm gear 41, carries one member 45, of a clutch, the other member 46, being carried by a slotted collar 47, which is splined to the shaft 42. On the outer end of the shaft 42, a pinion 28, is mounted which engages through suitable gears 29, with the rack bars 30, 31, heretofore referred to. The form of the door operating mechanism will determine the type of power transmitting mechanism which is applied to the outer end of the shaft 42.

The motor is of the reversing type and is intended for high voltage operation. The wiring shown in Fig. 12 is that necessary for a D. C. motor, two solenoid switches D, E, being employed in order to secure the desired result. The solenoid switches D, E, are controlled through the circuits 48, 49, by means of the step-by-step switch B, best shown in Fig. 11, and in the diagram. This switch comprises a solenoid 50, the core 51, of which engages through a link 52, with the arm 53. A spring 54, accentuates the action of gravity in retaining the core in the lower position shown. The arm 53, is fulcrumed on the switch shaft 55, and carries a latterly projecting cam 56. A pawl 57, is secured to the arm 53, and engages successive lugs 58, on the ratchet which is fixed to the shaft 55. Upward movement of the solenoid tends to rotate the switch shaft through 90°, and if the contact-bar of the switch was in the position shown in Fig. 12, thus closing the contacts 24, 59 it would be moved 90° counter-clockwise and occupy the dead points 59. The next actuation of the solenoid will cause the contact member to move 90° and close the circuit 23, 59 thereby serving to energize the solenoid D, in the event the contact 22, was closed. Further explanation as to this point will appear hereinafter.

Referring again to Fig. 11, in order to avoid over-throw or reverse movement I provide two pawls 60, 61, both of which are held in proper position by the spring 62. The pawl 60, serves to prevent return movement of the ratchet as the arm 53, and its pawl are returning to their lowermost position. The pawl 61, is firmly held in the position shown by means of the cam 56, but as the arm 53 is rotated the cam will permit the pawl 61, to move toward the center of the ratchet which will serve to project the pin 63, into the arc of rotation of the lugs 58, and thus prevent overthrow of the switch. As the arm returns to its original position the pawl 61, is moved outwardly so that it will not interfere with the rotation of the ratchet.

However, the switch member B, will not be operated unless the solenoid switch member C, has been actuated and the contacts 15, closed. The switch member C, is shown in Fig. 9, and comprises a solenoid 64, core 65, and a contact bar 66, adapted to make the contact and close the circuit 67, when the solenoid is energized. This is a high voltage switch and is wholly inclosed. The circuit 67, serves to control the solenoid 50, of the switch B.

Furthermore, no actuation of any of the described parts will take place unless the switch member A, is in such position that one or the other of the contacts 21, 22, is closed.

The multiple switch A, is intended as the limit control for the motor. The device is shown in detail in Figs. 6, 7 and 8, and comprises a casing 68, suitably connected to the base plate 39 of the machine. Mounted within the casing in suitable bearings 69, 70, is a shaft which is rigidly connected to the shaft 42; as best shown in Fig. 1, that is, the reduced end 71, is fitted within an axial opening in the shaft 42, and a pin 72, firmly connects them. The intermediate portion 73, of the shaft is of larger size than the ends and is threaded to accommodate a reciprocating nut 74, having an upwardly projecting portion 75, best shown in Fig. 7, which occupies a slot 76, formed in a frame, best shown in Fig. 6. This frame comprises cylindrical end portions 77, 78, which fit over the cylindrical sleeves 79, 80. The inwardly projecting peripheral flange 81, on the part 80, has a bearing on the enlarged portion 73, of the shaft. At the opposite

end the corresponding inwardly projecting flange 82, bears on the sleeve 83, which fits over the reduced portion 84, of the shaft. The frame which comprises the cylindrical ends 77, 78, and the intermediate arcuate connecting web 85, is rigidly connected to the sleeve 79, 80, by means of set-screws 86, 87. The inner portions of the sleeves 79, 80 are threaded and accommodate the threaded male portions or plugs 88, 89. The enlarged heads of these plugs are adapted to accommodate a spanner wrench or similar tool for adjusting the same longitudinally. When properly adjusted the set-screws 86, 87, are employed for securing them in adjusted position. These plugs serve to define the permissible longitudinal reciprocation of the nut 74. The parts just described are firmly held against movement longitudinally on the shaft by means of the nuts 90, 91, which engage threaded portions of the shaft at a point contiguous to the enlarged portion thereof.

Inasmuch as the shaft just described is rigidly connected to the shaft 42, which carries the drive pinions for the door, it will be seen that any motion of the door is imparted to the mechanism just described and that there can be no change in the relation between the position of the door and the switch operating mechanism.

It will be seen from the description thus far that the shaft 73, is freely rotatable without imparting movement to the frame or adjusting nuts. However, the switches which control the operation of the different elements are actuated by rotation of the frame and this rotation is effected in the following manner. It will be understood that the frame and associated parts are maintained in a fixed position by reason of the spring 92, the ends of which overlap parts of a lug 93, formed as a backwardly bent hook on the cylindrical end 78, of the frame. The ends 94, of the spring lie on opposite sides of a lug 95, mounted on the shell. Thus the frame and its associated parts are held in a fixed position but are permitted to rotate in either direction against the resistance of the spring. The resistance offered by the nut 74, to the rotation of the shaft is not sufficient to overcome the resistance of the spring and thus the nut 74, is caused to reciprocate in a straight line. When, however, the nut has traveled to the limit permitted by the plugs 88, 89, it is jammed against the same and all the parts then rotate in unison. The switch members are caused to be actuated in this manner. Mounted upon the cylindrical end portion 77, of the frame is a cam plate 96, shown in section in Fig. 6, and in elevation in Fig. 8. This plate has freedom for limited angular movement relative to the frame to the extent of the arcuate slot 97, best shown in Fig. 8, with which a pin 98, carried by the cylindrical portion 77, engages. Thus the frame, as it is rotated by the nut 74, is permitted a certain degree of movement before movement is imparted to the cam plate. Three contacts 19, 21, 22, are controlled by the cam plate 96. The order of their actuation and the necessity for certain clearance as permitted by the pin and slot 97, 98, will be described hereinafter. Mounted on the inwardly extending portion of the bearing member 70 is a second cam plate 99. A spring 100, mounted similarly to the spring 92, serves to retain the cam member 99, in a relatively fixed position. The two ends 101, of the spring, as best shown in Fig. 8, are overlapped and lie on opposite sides of a lug 102, which projects from the upper edge of the cam member 99. The ends also lie on opposite sides of a pin 103, which is fixed in the base. A pair of pawls 104, are pivoted to the cam member 99, the ends of the pawls normally lying in spaced relation to a lug 105, carried by the cylindrical end portion 77, of the carriage. The lug 105, and the pawls serve as the means of connection between the portion 77 of the carriage and the cam member 99. As the carriage is rotated, the lug will contact one of the pawls 104, and carry the cam member 99 along until the opposite end 106 of the pawl contacts with a projection 107, from the base member, whereupon the pawl will be tripped and the cam member 99 will return to its original position. The first motion of the carriage is without effect. However, as it continues the cam 108 on the cam 99 will contact with the projection on the spring tongue 109, and break the contact 16. Continued rotation of the cam member 99, will cause the projection to contact one or the other of the cams 110, thus forcing the spring contact member downwardly and making the contact 20.

The rotation of the frame and connected parts due to the jamming of the nut 74, will, due to the operation of the cam members referred to, cause the stoppage of the motor and consequently the interruption of operation of the shaft 21. Upon the reversal of operation of the motor, the shaft which carries the nut will be rotated reversely and the nut and associated parts will be carried around with it. This will continue until the projection 75 on the nut contacts one or the other of the lugs 111, 112, whereby the nut will be forced free, the rotating parts will be properly centered by the action of the spring 92, and the nut is free to travel oppositely to the other limit of its movement when the motions described are repeated.

The mechanism having been described, the operation will be discussed in connection with the diagram of Fig. 12.

The wiring arrangement is shown for a

direct current. In the event that single phase alternating current is utilized some modifications will be necessary in the high voltage solenoid switches. In that event split phase coils will be employed in order to avoid chattering.

The parts are shown in the diagram in the position they will assume when the motor is operating and the door is being moved toward its closed position. It will be seen that in this condition current is flowing past the contacts 24, 59 through the circuit 48, to the solenoid switch E, and that the contact 26 is closed. This will cause operation of the motor and rotation of the worm shaft of the multiple switch A. If the motor is permitted to continue its operation the nut 74 will reach the limit of its travel and cause rotation of the cam plate 96 in the direction indicated by the arrow. As will be recalled, motion is imparted to the cam 96 by engagement therewith of the pin 98, which is at that time at the right hand end of the arcuate slot 97. The cam plate 99 then begins to rotate as heretofore described, the first action following its motion being to break the contact 16 and thereby break the low voltage line and prevent actuation of the parts by operation of the push button 17 at this stage in the operation. However, this interruption is only momentary, for as the cam plate 99 continues to rotate, it will bring the projection 110 into engagement with the projection on the spring tongue 109 and force the tongue downwardly thus reestablishing the low voltage circuit through the contact 20. The solenoid C is then energized, which closes the contact 15, which in turn actuates the switch member B, rotating the switch blade to the dead points 59. The circuit through the solenoid E will be broken, thus stopping the motor. It is necessary to break the contact 16 to avoid the possibility of actuation by the push button just at this stage.

Immediately following this action the contacts 21 will be opened by passing off the high point 114 of the cam 96. This serves as a safety feature and prevents reestablishing the circuit through the solenoid E until the motor has been reversed. At the same time the contacts 19 will be closed by engagement with the projection 115 of the cam 96. In this position the door will be fully closed and the motor stopped. The circuit 116 which contains the floor plate 117 and the contacts 18 will be in condition for operation. At this point it will be well to explain that just after the stoppage of the motor, the cam plate 99 will have been tripped and have returned to the position shown in Fig. 12.

Now, assuming that the door is to be opened, one of the plurality of push buttons 17 is closed or the contacts 18 are closed by weight applied to the floor plate 117. This closes the low voltage circuit, energizes the solenoid switch C, causes a 90° degree movement of the switch B and closes the contacts 23, 59 thereby energizing the reversing solenoid switch D and starting the motor into reverse operation. Inasmuch as the pin 98 is at that time at the right hand end of the slot 97, no motion will be imparted to the cam 96 until the pin has traveled to the opposite end of the slot, whereupon the cam will be moved sufficiently to close the contact 21 and open the contact 19, thereby breaking the circuit which may have been formed by the floor plate 117. When the carriage has returned to its normal position, it will be freed from the nut 74 and remain in the proper position. It will be seen that at any point, except the fully closed position of the door, the contacts 19 are open and the mechanism will be unaffected by the floor plate. The operation at the completion of the opening movement is the same as that just described and need not be further dwelt upon.

The switch 27 in the low voltage circuit is normally closed. It is controlled by the clutch operating member, best shown in Fig. 1, the clutch being disengaged by means of an arm 118 to which a chain may be secured. A cam 119 operated by the arm serves to disengage the clutch members 45, 46 against the resistance of the spring 120. The switch 27 is held in closed position by the heel of the cam 119 and any movement of the cam serves to break the low voltage circuit and prevent any actuation of the motor. The clutch provides for disengaging the motor and operating the door manually if desired, and at the same time, serves to disconnect the operating line. This disengagement of the motor from the door has no effect in changing the relation of the parts of the limit switch A to the door, and when the clutch is again thrown in the operation will continue properly without regard to the position of the door at that time.

It will be found to be desirable to employ a motor brake, but in view of the necessity for a lapse of time between the operation of the opening of the motor circuit and the stopping of the motor, a brake having the capacity of permitting a predetermined number of revolutions of the motor before coming into action should be employed. This will permit the time or multiple switch to be properly positioned for reversal of operation. Such a brake has been devised, but is not specifically disclosed or claimed herein.

I claim:

1. In door operating means, the combination with the door, of a motor operatively connected thereto, high and low voltage circuits, a low voltage circuit closer, and means operable by a single circuit closer in the low

voltage circuit for opening and closing said door and for starting and stopping the door closing motor at any point in its operation.

2. In door operating means, the combination with a door, of a shaft, a timing switch directly connected to the shaft, high and low voltage circuits controlled by said switch, a motor also connected to said shaft, a normally open low voltage solenoid switch, and means in the high voltage circuit operable by successive actuations of said low voltage switch for alternately stopping and reversing said motor at any point in the travel of the door.

3. In door operating means, the combination with the door, of a shaft for operating the same, a motor connected to the shaft, a timing switch directly connected to the shaft, a high voltage circuit for operating the motor, high voltage solenoid switches for reversing the motor, a three-point high voltage switch for successively starting, stopping and reversing the motor, a low voltage circuit, and means operable by successively closing the low voltage circuit for actuating said three-point switch.

4. A unitary door closing device, comprising in combination a motor, a shaft actuated thereby, a timing switch connected to the shaft, a high voltage circuit connected to the motor, reversing switches, a sequentially operated three-point high voltage switch for alternately starting, stopping and reversing said motor, a low voltage circuit, means operable by the closing of said low voltage circuit for actuating said sequentially operated switch, all of said parts being contained within a single housing, and distant low voltage switches for closing said low voltage circuit.

5. In door operating means, the combination of a motor adapted to be operatively connected with a door, a high tension motor actuating circuit including a circuit opening and pole controlling switch, and a single low tension switch actuating circuit, including a plurality of circuit closers and a solenoid connected to said switch, whereby upon successive actuations of a single circuit closer, said switch is operated to alternately open and cause the changing of the poles of said motor actuating circuit.

6. In door operating means, the combination with the door, of a shaft for operating the same, a motor connected to the shaft, a timing switch positively connected to the shaft, a high tension solenoid for operating the motor, solenoid switches for reversing the motor, a low tension circuit for operating said solenoid switches, and means operable by said timing switch for momentarily breaking the low tension circuit at extreme positions of the door.

7. In door operating means, the combination with the door, of a shaft for operating the same, a motor connected to the shaft, a timing switch positively connected to the shaft, a motor-operating circuit, solenoid switches for reversing the motor, a separate circuit by means of which said solenoid switches are successively actuated, and means operable by said timing switch for momentarily rendering the separate circuit inoperative to actuate said solenoid switches at the extreme positions of the door.

8. In door operating means, the combination with the door, of a motor for operating the same, a timing switch directly connected to and operable by the door, high voltage and low voltage circuits having connections adapted to be made and broken in different positions of the timing switch, the position of the parts of the timing switch determining the direction of rotation of the motor, the arrangement being such that none of the high voltage connections controlled by said timing switch can be broken while current is passing through said connections, and means operable by successive closings of the low voltage circuit for stopping, starting and reversing the motor.

9. In door operating means, the combination with the door, of a motor, a high voltage circuit for operating the motor, a reversing switch adapted for successive actuations whereby the switch blades are successively in the positions of supplying current in one direction, then in a dead position, then supplying current in another direction, and then in dead position, a low voltage circuit having means therein adapted to cause the successive actuations of said switch, and means operable by the travel of the door for making and breaking the connections which render such operation possible.

Signed at Chicago, Ill., this 14th day of Aug., 1917.

HERBERT W. CRANE.

Witness:
L. J. CHASE.