

S. ELLIOTT.
SLIDING DOOR OPERATING DEVICE.
APPLICATION FILED APR. 27, 1918.

1,324,587.

Patented Dec. 9, 1919.
2 SHEETS—SHEET 1.

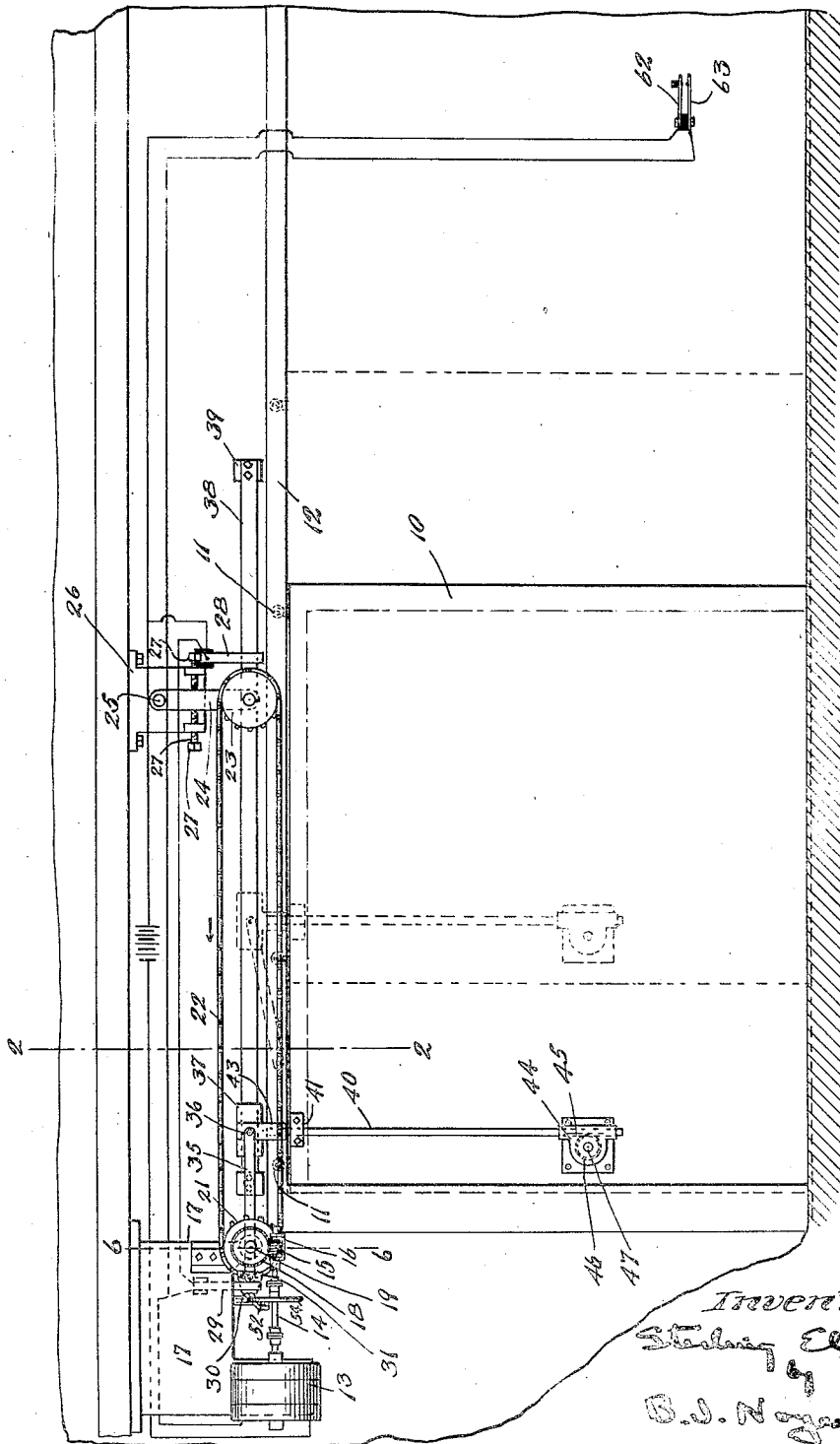


Fig. 1.

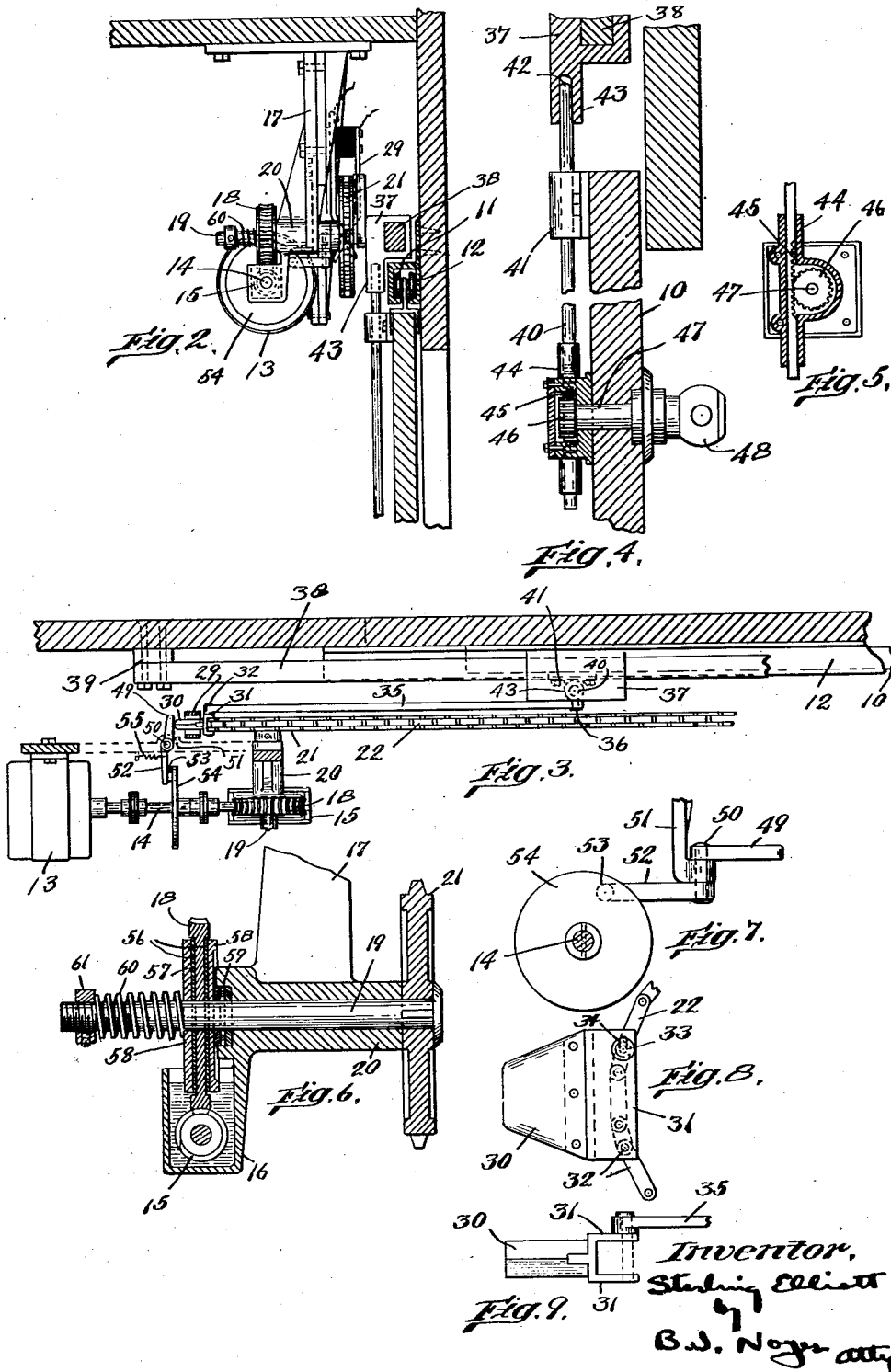
Inventor,
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UNITED STATES PATENT OFFICE.

STERLING ELLIOTT, OF NEWTON, MASSACHUSETTS.

SLIDING-DOOR-OPERATING DEVICE.

1,324,587.

Specification of Letters Patent.

Patented Dec. 9, 1919.

Application filed April 27, 1918. Serial No. 231,286.

To all whom it may concern:

Be it known that I, STERLING ELLIOTT, a citizen of the United States, and a resident of Newton, county of Middlesex, and State of Massachusetts, have invented an Improvement in Sliding-Door-Operating Devices, of which the following is a specification.

My invention relates to a motor driven means for operating doors, and has particular reference to motor driven means for operating sliding doors.

An object of my invention is the provision of motor driven mechanism that may be remotely controlled to move a sliding door from closed position to fully opened position, and to move the door from open position into completely closed position and stop the door in either of said positions.

Another object of my invention is in the provision of means whereby, once the motor driven mechanism has been set in operation by the remote controlling means to either open or close the door, the said remote controlling means will be rendered inoperative to subsequently control the movement of the door, and the mechanism will operate to move the door into either fully opened or closed condition, and automatically stop with the door in such condition, whereupon the remote controlling means will be again effective to control the motor driven mechanism.

The means whereby I accomplish the above named objects of my invention, is in the provision of two electric switches controlling the motor circuit and connected in parallel, one of which, controlled by the motor mechanism, is normally biased to closed circuit condition, and the other of which, adapted to be placed in a position remote from the motor mechanism to initially set said mechanism in operation, is normally biased to open position. In the fully opened or closed position of the door, the motor mechanism operates to open the normally closed switch to thereby break the motor circuit and stop the motor with the door in either fully opened or closed position. The normally opened and remotely positioned switch is arranged in parallel with the normally closed switch, and when operated serves to complete the motor circuit around the opened mechanism controlled switch to thereby cause the motor to operate. By the operation of the mechanism, the motor mech-

anism controlled switch is adjusted to complete the motor circuit and the motor continues to operate until the door is moved into either completely opened or closed position, whereupon the motor controlled switch is again operated to open the motor circuit and the motor consequently stops with the door in either fully opened or closed position.

Another object of my invention is the provision of means whereby the remote motor controller or controlling switch, when initially operated, causes the door to be moved its entire length of travel in one direction, and when again operated, causes the door to move its entire length of travel in the opposite direction.

The means whereby this object of my invention is attained is in the provision of motor mechanism controlled switches adapted to be opened by the motor mechanism to break the motor circuit and thereby stop the motor when the door is in either fully opened or closed position, but to be closed to complete the motor circuit to cause the motor to operate when the door is in any intermediate position, and thereby to move the door into either fully opened or closed position.

Another object of my invention is in the provision of a door operating mechanism, whereby the door is caused to be reciprocated between open and closed positions upon the operation of a motor adapted for rotation in but one direction.

I accomplish this object of my invention by the provision of an endless belt or chain, arranged over pulleys or sprockets in the direction of movement of the door, which is adapted to be driven by the motor, and I provide a connecting rod pivoted to a point upon and connecting the belt or chain with the sliding door.

With this arrangement of belt or chain and connecting rod, the movement of that part of the belt or chain to which the connecting rod is pivoted in an outward direction from the motor operates to move the connecting rod also in an outward direction, and correspondingly to move the door in one direction; and that when that part of the belt or chain to which the connecting rod is pivoted passes around the pulley or sprocket and moves inwardly toward the motor, the direction of movement of the connecting rod is reversed and it and the

door consequently move in an inward direction.

A further object of my invention is in the provision of means whereby the door may be disconnected from the operating mechanism at will, and the door manually opened or closed independently of the operating mechanism.

When means are provided whereby the door may be disconnected from the operating mechanism for manual operating, it is very desirable that the motor operating mechanism is not disarranged in order that the door may be easily and quickly connected again with the operating mechanism.

The means whereby this object of my invention is attained is in the provision of a guide rod extended in the direction of travel of the sliding door, and a cross head slidably arranged on said guide rod connected, by means of the connecting rod, to the traveling belt or chain. The cross head has an extension in which a bolt, secured to the sliding door, is adapted to be movably arranged. The operation of the motor mechanism serves to reciprocate the cross head upon its guide rod, and when the door is connected through its bolt with the cross head, to also reciprocate the door. When, however, the bolt is removed from the cross head, the door may be operated independently of the motor, and the position of the relative parts of the motor driven mechanism is not disarranged by the removal of the bolt, and the door may be at any time instantly reconnected with the motor mechanism.

Another object of my invention is in the provision of a brake associated with the motor, and adapted to be moved into engagement with a moving part of the door operating mechanism when the door has been moved into a fully opened or closed position, to stop the mechanism with the door in said position.

The means whereby I accomplish this object of my invention is in the provision of a brake adapted to bear upon a disk connected with the motor shaft, which brake is controlled by the means connected with the traveling belt or chain arranged to control the motor circuit, and the brake is arranged adjacent the motor mechanism controlled switch and adapted to be applied coincidentally with the opening of the motor circuit.

Many of the features described in this application, but not claimed, are described and claimed in my application, Serial No. 113,555, filed August 7th, 1916, for electrically operated doors.

Figure 1 is a view in elevation of a motor mechanism for operating a sliding door, embodying the features of my invention.

Fig. 2 is a sectional view along lines 2—2 of Fig. 1.

Fig. 3 is a partial plan view of the motor end of the door operating mechanism.

Fig. 4 is a fragmental sectional view of the bolt detachably connecting the door operating mechanism with the door.

Fig. 5 is a partial sectional detail of the bolt of Fig. 4.

Fig. 6 is a partial and enlarged sectional view of the clutch and chain drive shaft along lines 6—6 of Fig. 1.

Fig. 7 is an enlarged detail of the brake.

Figs. 8 and 9 are an elevation and plan view respectively of the controlling means for the motor switch.

As here shown, the sliding door 10 is hung from rollers 11, and movable upon a track 12, into a closed position indicated by the full lines, Fig. 1, and to the right into an open position. A partially open position of the door is shown in the dotted lines.

The door operating mechanism includes an electric motor 13 connected through a shaft 14 to a worm 15, partially inclosed by and immersed in the oil contained in the casing 16, which forms a part of the motor supporting bracket 17. The motor supporting bracket 17 is or may be attached to or suspended from the ceiling of the building. The worm 15 is in engagement with a worm gear 18, which is connected through friction disks to the sprocket shaft 19. The friction connection between the gear 18 and the shaft 19 is hereinafter to be more fully described.

The shaft 19 is rotatably disposed in an extension or bearing 20 of the motor supporting frame 17, and has secured at its end, adjacent the sliding door, the sprocket 21. A chain 22 passes over the sprocket 21 and extends above and in the direction of movement of the sliding door and passes over a similar sprocket 23, arranged adjacent the other end of travel of the door. The length between the two sprockets is, or may be, substantially equal to the distance that the door moves between fully opened and fully closed positions.

Sprocket 23 is rotatably mounted upon an arm 24, which is pivoted at 25 to a supporting bracket 26 and depends therefrom between two adjustable stops or set screws 27 arranged in extended lugs of the bracket 26. Said supporting bracket 26 may be secured to the ceiling of the building, as is the motor supporting bracket or frame. Such disposition of pivoted arm and adjustable stop provides means whereby the distance between sprockets may be varied to compensate for wear in the chain.

Two sets of motor controlled switches, comprising fingers 28 and 29, normally arranged to be in contact, are disposed adjacent the sprockets 23 and 21 respectively,

and the contacting portions of the switches are arranged in the plane of the sprockets. Said switches, as here shown, are supported upon the bracket 26 and the motor supporting bracket 17 respectively. The switches are adapted to be connected in series with the motor circuit and are arranged to be opened by a component part of the door operating mechanism to thereby open the motor circuit to cause the motor to stop when the door is approximately in either fully opened or fully closed position; one of the switches 29 being arranged to stop the motor when the door is in closed position and the other switch 28 being arranged to stop the motor when the door is in open position.

The means whereby the switches may be opened to thereby open the motor circuit when the door is moved into one of its two positions comprises an insulating block or wedge 30 secured to a U-shaped member 31 fastened to the chain 22. One link 32 of the chain 22 is pivotally connected with the member 31 carrying the insulated strip, and another pin 33 is arranged in the slot in said member 31.

The chain 22 is arranged to be within the arms of the member 31. The length of said member 31, along the chain, is such that one or more links are included in the length of chain between the pin 32 and the pin 33, arranged in the slot 34 of said member. By this arrangement the insulating block 30 is securely disposed upon the chain 22 and a sufficiently flexible coupling between the member 31 and the chain 22 is provided to permit the chain to be flexed around the sprockets.

The means whereby the motion of the chain is transmitted to the sliding door includes the connecting rod 35 pivotally connected at one end, by means of pin 32, to the chain 22. The other end of said connecting rod is pivoted at 36 to a cross head 37, slidably arranged along the guide rod 38, which extends above the sliding door, and has its extremities secured against movement in supports 39.

The guide rod 38, as here shown, is made rectangular in cross section, and the cross head 37 is formed with a correspondingly rectangular opening therethrough, in which the guide shaft is disposed. With this arrangement the cross head is restricted from any but a movement along the shaft.

The means whereby the door may be disconnected from the operating mechanism includes the bolt or rod 40 which is carried by the sliding door 10 and passes at the top of the door through the bearing 41, and is adapted to enter a recess 42 in the extension 43 of the cross head 37. The lower end of said rod 40 passes through a casing 44, and is formed within said casing with a plurality

of rack teeth 45. A spur gear 46 is arranged to be in mesh with the teeth of said rack, and is secured to a shaft 47, which passes through and is rotatably arranged within the sliding door 10 and terminates in a knob 48, which is adapted to be rotated to disengage the bolt or rod 40 from the cross head 37 to permit operation of the door independently of the operating mechanism.

The specific arrangement of bolt or rod 40 and knob 48, and the specific construction of the knob 48 and whereby it may be locked to prevent undesirable rotation of the shaft 47, is illustrated in the above named patent application.

When rod 40 is connected with the cross head 43, the movement of said cross head will correspondingly move the door, and when the rod 40 is withdrawn from connection with the cross head by the proper operation of the knob 48, the door may be operated independently of the door operating mechanism. As the cross head is maintained in position upon the guide rod, the door may be easily and quickly reconnected with the door operating mechanism, by merely moving the door along its track until the opening 42 within the extension 43 of the cross head registers with the rod 40 connected with the door; whereupon the rod 40 may be moved into the extension, and the door and door operating mechanism are connected for simultaneous operation.

The brake mechanism, adapted to be applied to the motor shaft to retard and arrest its motion when the motor circuit is interrupted, includes the arm 49 fixed to the pin 50 journaled in a bracket 51, secured to the motor supporting frame 17.

Another arm 52 is fixed to said pin 50 upon the other end of said supporting bracket 51, and has secured to its end a disk 53 of suitable friction material adapted to be moved into contact with a disk 54 fixed to and rotating with the motor shaft 14. The arm 52, with its disk 53, is normally maintained away from contact with the disk 54 by means of the spring 55. The arm 49 is arranged adjacent the sprocket 21, and is adapted to be engaged by the end of the insulating wedge 30 secured to the chain 22, when said wedge approaches the center line between the two sprockets 21 and 23, to thereby engage the contacts 29 in the motor circuit to move the arm 52 carrying the disk of friction material 53 into engagement with the disk 54 secured to the motor shaft 14, to consequently retard and finally stop the motion of said motor.

It is desirable that yielding means be interposed between the motor and the sliding door, whereby, if the sliding door is prevented from movement into fully opened or closed position, as for instance, because of the interposition of an obstruction in the

path of movement of the door, that the motor may continue to operate without causing the breaking of a part of the door operating mechanism, or in causing a disturbance in the motor circuit, as may happen if such a yielding connection is not inserted at some point in the door operating mechanism. The yielding mechanism, as here shown, is applied between the worm gear 18 and the sprocket shaft 19.

The worm gear 18 is formed with two parallel radial faces 56, which are adapted to be engaged by frictional surfaces 57 secured to disks 58 connected to the sprocket shaft 19 for rotation therewith, and also arranged for axial movement along said shaft. A thrust bearing 59 is interposed between one of said disks 58, and the extension 20 of the motor supporting frame 17. Said disks 58 are arranged to be pressed into yielding engagement with the worm gear 18 by means of a spring 60 disposed over the end of the sprocket shaft 19, and maintained in adjustable engagement with one of said disks 58 by means of the nut 61 threaded upon the end of said sprocket shaft 19.

The adjustment of the spring 60 maintaining the disks 58 in frictional engagement with the worm gear 18 may be such that when the resistance to rotation of said sprocket shaft 19 is above a predetermined amount, the worm gear 18 will slip between its driven disks 58 without transmitting any rotation thereto, and therefore the motor may continue to operate without causing the breaking of a part of the door operating mechanism.

It is desirable that the motor circuit be interrupted and the motor cease to rotate when the connecting rod is approximately in line with the axis of the two sprocket wheels 21 and 23. In said position, the door operating mechanism offers but small resistance to starting, and therefore, the motor draws but a small current from the line, which is very desirable.

As here shown, the insulating wedge member 30 and the connecting rod 35 are secured to the same part of the chain 22 and the switches 28 and 29 are arranged adjacent the sprockets 21 and 23, to be operated by the wedge member 30 when said member passes around said sprockets to thereby stop the operating mechanism with the connecting rod on the center line between the sprockets, yet it is obvious that the motor controlled switches 28 and 29 may be arranged in other positions adjacent the traveling chain and the wedge shaped member, and the connecting rod be connected to separate points of the chain to cause the motor to be stopped when the door is in its fully opened or closed position.

But one wedge shaped member 30 is here

shown, which, with the provision of two motor switches 28 and 29, is sufficient to completely control the movements of the motor between the open and closed positions of the door, and the motor brake is designed to be operated by the wedge member only in the closed position of the door and not to be operated when the door is moved into its opened position, although it is conceivable that the brake may be operated to also retard and stop the door operating mechanism with the door in fully opened position.

The remote motor controlling means includes the normally opened switch having contacts 62 and 63, which are so connected with the motor circuit as to shunt the motor controlled switches 28 and 29 when the contacts thereof are pressed into engagement. In the position of the motor operating mechanism corresponding to the fully closed position of the door and as here shown by the full lines, Fig. 1, the wedge member 30 is interposed between the contacts 29, to thereby separate the contacts and open the motor circuit. When it is desired to cause the door to be moved into open position, the contacts of the remote motor controlling switch are pressed into engagement. This operation serves to shunt the open switch 29 to thereby complete the motor circuit and cause the motor to operate and to move the chain 22. Such movement of chain 22 causes the wedge member 30 to be moved from engagement with the switch 29, and the contact members of said switch are thereby permitted to move into engagement to thereby close the motor circuit independently of the remote controlling switch and the motor consequently operates to open the door.

When the door approaches its fully opened position, the wedge shaped member forces apart the contacts of the switch 28 and thereby opens the motor circuit and the door operating mechanism stops with the door in fully opened position. Any operation of the remote motor controlling switch while the door is being moved from the said closed to open position, is ineffective in controlling the door operating mechanism because the motor circuit is maintained closed by the contacts 28 and 29. When, however, the door operating mechanism is in its fully opened position and the switch 28 is opened, and the motor circuit is thereby opened, then the closing of the remote motor controlling switch operates to complete the motor circuit independently of the opened motor controlled switch 28, and the door operating mechanism again operates, this time to return the door to fully closed position, in which position it remains until the remote motor controlling switch is again operated.

I claim:—

1. Operating mechanism for sliding doors



including a motor arranged for uni-directional rotation, an endless chain operated by the motor extended in the direction of movement of the sliding door, and means
5 connecting the chain with the door to cause a movement of said door between open and closed positions upon a uni-directional movement of said chain.

2. Operating mechanism for sliding doors
10 including a motor arranged for uni-directional rotation, an endless chain adapted to be uni-directionally driven by the motor extended in the direction of movement of the sliding door and means connected with said
15 chain adapted to be reciprocated by said chain during uni-directional movements thereof to correspondingly reciprocate the sliding door.

3. Operating mechanism for sliding doors
20 including a motor arranged for uni-directional rotation, an endless chain extended in the direction of movement of the sliding door and adapted to be uni-directionally driven by the motor, means connecting said
25 chain and the door for simultaneous movement and means controlled by the chain to stop the mechanism with the door in a predetermined position.

4. Operating mechanism for sliding doors
30 including a motor arranged for uni-directional rotation, an endless chain extended in the direction of movement of the sliding door and adapted to be uni-directionally driven by the motor, means connecting said
35 chain and door for movement of the door between open and closed positions, and dual means to stop the mechanism with the door in opened or closed position.

5. Operating mechanism for sliding doors
40 including a motor arranged for uni-directional rotation, an endless chain extended in the direction of movement of the sliding door and adapted to be uni-directionally driven by the motor, means connecting said
45 chain and door for movement of the door between open and closed positions, a motor control circuit and means connected with the chain operable to control the motor circuit from two independent points to cause the
50 door to be stopped in opened or closed position.

6. Operating mechanism for sliding doors
including a motor arranged for uni-directional rotation, an endless chain extended in
55 the direction of movement of the sliding door adapted to be uni-directionally driven by said motor, and a connecting rod extending from said chain to the door whereby the movement of said chain is transmitted to the
60 door.

7. Operating mechanism for sliding doors
including a motor arranged for uni-directional rotation, an endless chain extended
65 between pulleys in the direction of movement of the sliding door uni-directionally

driven by said motor, and a connecting rod connected between a point of said chain and the door, said mechanism operable to move said connecting rod from one to the other
70 side of said pulleys to reciprocate said door from one to the other position and back again in a complete uni-directional movement of said chain.

8. Operating mechanism for sliding doors
including a motor arranged for uni-directional rotation, an endless chain extended
75 in the direction of movement of the door and adapted to be uni-directionally driven by the motor, and means connecting the chain and the door whereby the chain, during part of its uni-directional travel, causes the door
80 to move in one direction and whereby the chain during the other part of its uni-directional travel causes the door to move in the opposite direction.

9. Operating mechanism for sliding doors
including a motor, an endless chain extended between sprockets in the direction of movement of the door, means operably connecting
90 the motor with one of said sprockets, a guide shaft extended in the direction of movement of the door, a cross-head slidably arranged thereon, a connecting rod extended between said cross-head and said chain and means connecting said cross-head with the
95 door.

10. Operating mechanism for sliding doors including a motor, an endless chain extended between sprockets in the direction of movement of the door, means operably
100 connecting the motor with one of said sprockets, a guide shaft extended in the direction of movement of the door, a cross-head slidably arranged thereon, a connecting rod extended between said cross-head
105 and said chain and means detachably connecting said cross-head with the door.

11. Operating mechanism for sliding doors including a motor, an endless chain extended between pulleys in the direction of
110 the movement of the door, means operably connecting the motor with one of said pulleys, a guide shaft extended in the direction of movement of the door, a cross-head slidably arranged thereon, a connecting rod
115 connected between said cross-head and a point on said chain operable upon a uni-directional rotation of the motor to move said cross-head in two directions and means connecting said cross-head with said door
120 for corresponding movement.

12. Operating mechanism for sliding doors including a motor, an endless chain extended between sprockets in the direction of movement of the door arranged to be
125 driven by the motor, means connecting said chain with the door whereby the travel of said chain causes a movement of the door between open and closed positions, two motor circuit controllers arranged adjacent

said chain, and means connected with said chain arranged to control one of said controllers to stop the door in open position and to control the other of said controllers to stop the door in closed position.

13. Operating mechanism for sliding doors including a motor, an endless chain extended between pulleys in the direction of movement of the door arranged to be driven by the motor, means connecting said chain with the door whereby the travel of said chain causes a movement of the door between open and closed positions, brake

mechanism for the door operating mechanism, a motor circuit controller arranged adjacent said chain, and means connected with said chain to control said controller and to operate said brake mechanism.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

STERLING ELLIOTT.

Witnesses:

T. T. GREENWOOD,
H. B. DAVIS.