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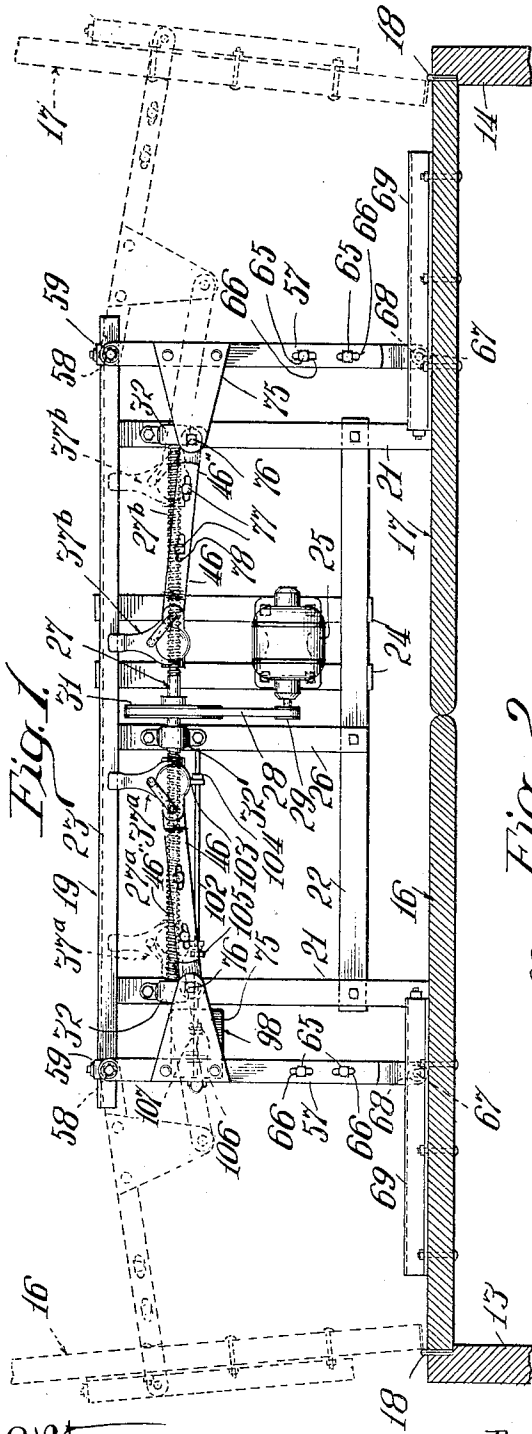
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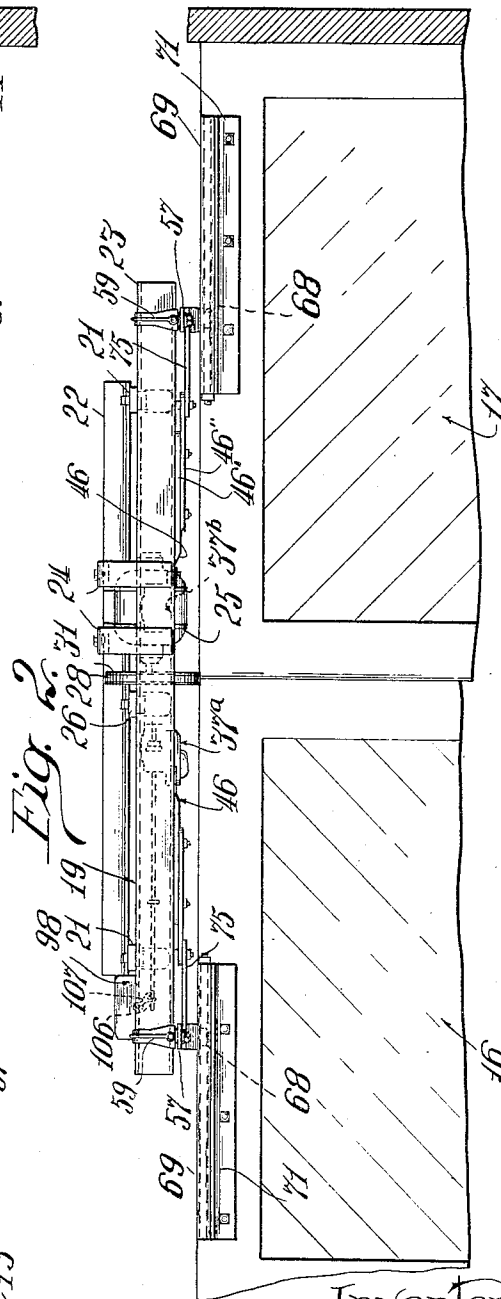
DOOR OPERATING MECHANISM

Filed July 20, 1928

3 Sheets-Sheet 1



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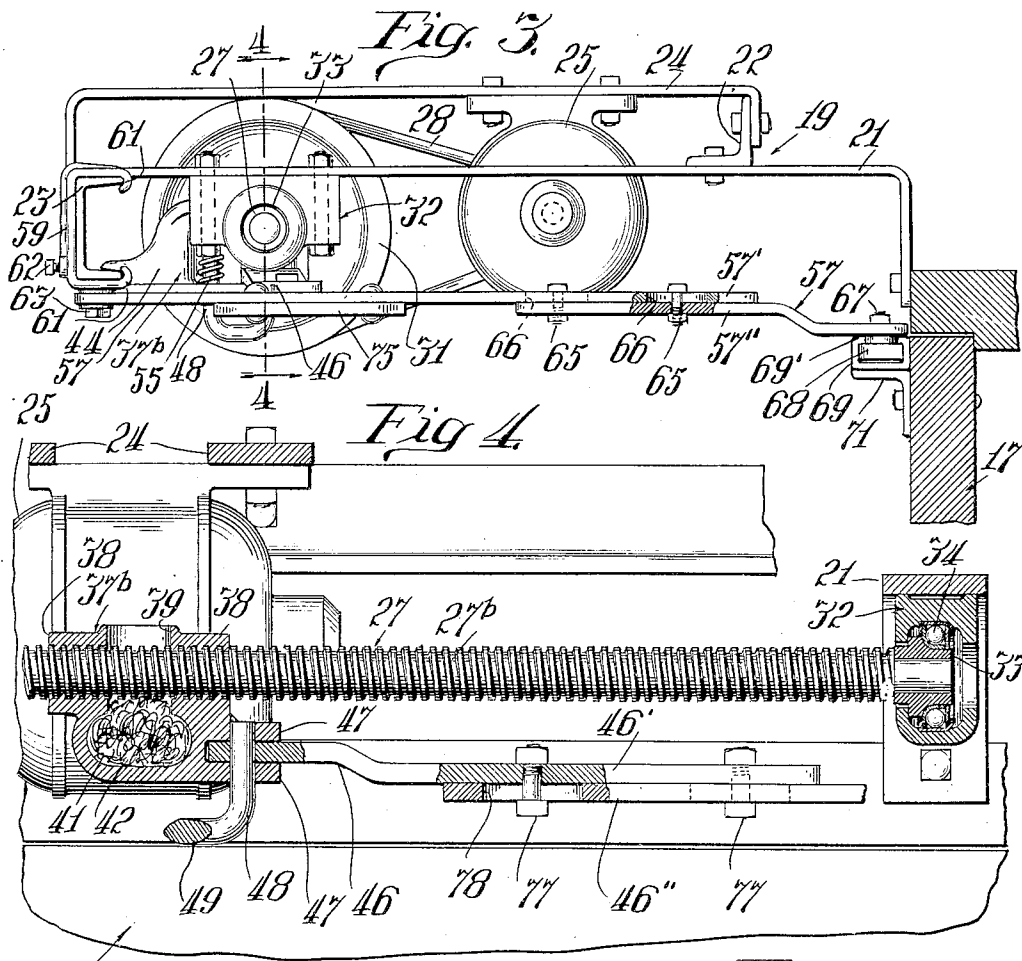
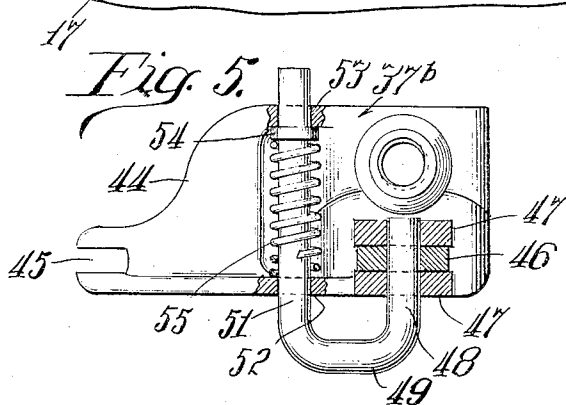
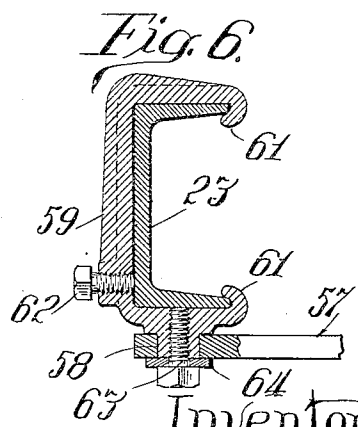
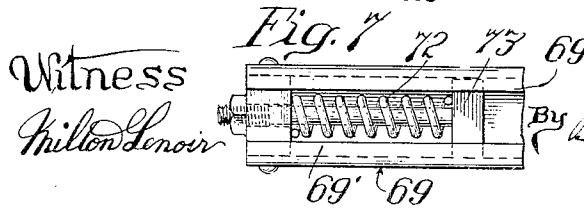
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3 Sheets-Sheet 3

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UNITED STATES PATENT OFFICE

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DOOR-OPERATING MECHANISM

Application filed July 20, 1928. Serial No. 294,159.

The present invention relates to door operating mechanisms of the power operated type such as are employed for opening and closing swinging doors, represented by garage doors and the like.

One of the objects of the invention is to provide an improved construction and arrangement of motion transmitting mechanism through which the power of the electric motor or other driving element is transmitted to the door, which motion transmitting mechanism establishes a positive lock for the door when closed, and which is simple and inexpensive to construct and easy to install.

Another object of the invention is to provide a releasable arrangement of parts between the door and the electric motor, whereby the door can be readily disconnected from the operative control of the motor when it is desired to open or close the doors manually.

Another object of the invention is to provide an improved arrangement of resilient means cooperating with the motion transmitting linkage for opposing a yielding pressure to the motion of such linkage as the door reaches either its closed or open position. Such yieldable means serves the purpose of preventing the motion transmitting linkage from over-running the desired limit of its movement, such as might otherwise happen through coasting of the electric motor after the limit switch had been opened to disconnect the motor. Such yieldable means also functions to release the dead center locking relation between the motion transmitting linkage and the door when the door is disconnected from the motor for manual operation.

Another object is to provide improved means for lubricating the traveling nuts and the feed screws along which they operate.

Another object is to provide an improved arrangement of adjustments associated with the operating mechanism whereby the same can be readily adapted to doors of different sizes, and doors having different degrees of movement.

Other objects and advantages of the invention will appear in the following de-

scription of a preferred embodiment thereof. In the accompanying drawings illustrating such embodiment:

Fig. 1 is a plan view of the door operating mechanism, being an inverted plan looking upwardly under the mechanism;

Fig. 2 is a side elevational view of the same;

Fig. 3 is an end elevational view of the operating mechanism on a slightly larger scale;

Fig. 4 is a longitudinal sectional view through one of the traveling nuts and the feed screw on which it is mounted, corresponding to a section taken approximately on the plane of the line 4—4 of Fig. 3;

Fig. 5 is an end elevational view of one of the traveling or operating nuts, illustrating the releasable pivot by which the nuts may be readily disconnected from the motion transmitting linkage;

Fig. 6 is a vertical sectional view through one of the adjustable pivot clamps on which the inner end of each main operating lever is mounted;

Fig. 7 is a detail view illustrating the yieldable spring means which opposes the motion of said main operating lever as the door reaches either one of its extreme positions;

Fig. 8 is a view similar to Fig. 1, illustrating a modified construction wherein the guideway in which the swinging end of the main lever operates is disposed substantially at right angles to the door, such having particular application to outwardly swinging doors, and

Fig. 9 is a diagram of a typical circuit for controlling the electric motor.

Referring to Figures 1 and 2, the doorway in which the door operates is defined between two vertical supports 13 and 14 constituting the side jambs of the doorway. The door structure comprises two swinging doors 16 and 17 which are hinged at 18 to the sides of the doorway and which are adapted to have their swinging edges come together at the center of the doorway. In some instances each door 16, 17 would be constructed of two hingedly connected folding panels and wherein the inner panel of each door is controlled

in its swinging and folding movement by a cooperating track and roller. Such construction is old and well known, and to avoid obscuring the illustration, I have not shown the same.

5 The door operating mechanism is mounted on a suitable supporting frame 19 which is stationarily mounted in a plane above the upper edges of the doors 16, 17, see Fig. 2. Such frame comprises two forwardly extending bars 21 which have their front ends se-
10 curred to the frame of the building above the doorway. Extending transversely between the bars 21, parallel with the plane of the doorway, is a front supporting bar 22. Also
15 extending transversely between bars 21 at the rear ends thereof is a channel bar 23. Two parallel bars 24 extend between the front and rear bars 22 and 23 to form a support for the electric motor 25, and a third bar 26
20 extends parallel to the bars 24 to form a support for one of the bearings of the threaded shaft or feed screw.

This threaded shaft, which is designated
25 27, extends from side to side of the frame 19 parallel with the doorway. The shaft is preferably driven from the motor 25 through a belt 28 passing around a relatively small sheave 29 on the motor shaft and around a
30 relatively large sheave 31 on the screw shaft. The end portions of the shaft are formed with feed screws 27a and 27b of opposite pitch or lead so that rotation of the shaft causes
35 the two traveling nuts mounted thereon to move in opposite directions with respect to each other. As shown in Figures 3 and 4, each end of said shaft extends into a bearing box 32 which is bolted to depend from the
40 corresponding one of the end frame bars 21, 21. Mounted on the end of the shaft is a flanged collar 33, and interposed between said collar and the interior of the bearing box is an anti-friction bearing 34 adapted to carry the radial and thrust loads of the shaft.
45 The bearing at the other end of the shaft faces in the opposite direction so that these two bearings, acting conjointly, carry thrust loads acting in either direction in the shaft. Mounted on the intermediate frame bar 26
50 is a third bearing box 32' having an anti-friction bearing therein for supporting the intermediate portion of the shaft adjacent to the driving sheave 31.

Mounted on the opposite threaded portions
55 27a and 27b of the shaft are the two door actuating elements consisting of nuts 37a and 37b which travel along the threaded portions of the shaft in the rotation thereof. Referring to Figures 4 and 5, each nut comprises
60 two spaced threaded bosses 38 through which the threaded portion of the shaft screws.

Extending down in the nut between said bosses is a well or opening 39 through which the threaded portion of the shaft passes.
65 The lower end of said opening communicates

with a lubricant reservoir 41 consisting of an enlarged pocket cored out in the base of the casting. Such reservoir is adapted to contain a quantity of waste or other oil impregnated fabric, which wipes constantly against
70 the underside of the feed screw 27b in the travel of the nut along the shaft. Thus this oil impregnated material 42 wipes all grit and dirt from the surface of the feed screw and continuously supplies a film of oil there-
75 to in the operation of the device. Additional lubricant or waste may be supplied to the reservoir 42 down through the opening 39 around the sides of the shaft.

Each nut is held against rotating with the shaft by an arm 44 extending rearwardly therefrom and having a slotted end 45 which embraces the lower flange of the rear frame channel 23. For transmitting movement to its respective door each traveling nut has
80 pivotal connection with a link 46 constituting part of motion transmitting linkage which will be presently described. Extending outwardly from the lower portion of each
85 nut are two spaced lugs 47 defining a pivot socket for receiving the inner end of the link 46. The link is normally held in said pivot socket by a spring pressed latch or pivot 48 which extends upwardly through aligned
90 apertures in the two pivot ears 47 and in the link 46, the latter having freedom of swinging movement around the pivot 48. Such
95 pivot member is U-shaped, comprising a transverse bottom portion 49 and an upwardly extending portion 51 which passes up through two apertured flanges 52 and 53 at
100 the rear side of the traveling nut.

Secured to this latter portion 51 is a collar 54 which normally bears against the under-
105 side of the apertured flange 53 and which has a compression spring 55 confined below the same and bearing against the lower apertured flange 52. The spring 55 normally holds the pivot end 48 of the U-shaped mem-
110 ber up in operative position extending through the pivot lugs 47 and the end of the link 46, the engagement of the collar 54 against the underside of the flange 53 hold-
115 ing the transverse handle portion 49 spaced from the underside of the traveling nut. To disconnect the motion transmitting linkage from the traveling nut it is only necessary to grasp the handle portion 49 and to pull down-
120 wardly thereon, whereupon the pivot portion 48 is withdrawn from the pivot aperture in the link 46, permitting the latter to be swung out from between the pivot lugs 47. It will be understood that the left hand traveling
125 nut 37a has this same releasable spring pressed pivot member for detachably connecting its motion transmitting linkage thereto.

The motion transmitting linkage also com-
prises a lever or arm 57 associated with each door, which lever has its rear end pivotally
130

mounted on the frame 19 and has its front end operatively connected with its respective door through a roller and guideway associated with the door. The fixed pivot about which said lever swings is indicated at 58, the same being mounted on a clamp 59 which is adjustable along the projecting end of the rear channel bar 23. Referring to Fig. 6, it will be seen that the clamp is also of channel formation, having hook lugs 61 which embrace the flanges of the frame channel, permitting the clamp to be shifted endwise along the channel but preventing disengagement of the clamp therefrom.

A set screw 62 is adapted to engage the frame channel to hold the clamp or bracket 59 in any adjusted position. The pivot 58 consists of a boss depending from the lower part of the clamp 59 and receiving the apertured end of the operating lever 57. A screw 63 threads up into the pivot boss 58 and holds a washer 64 against the lower end of said boss for preventing displacement of the lever 57.

Referring to Fig. 3, it will be seen that the lever is constructed of two sections 57' and 57'' which are adjustable relatively to each other so that the effective length of the lever can be increased or decreased. The two sections are joined together by bolts 65, and one of the sections is provided with longitudinal slots 66 through which the shanks of the bolts extend, whereby upon loosening said bolts the two sections can be shifted to lengthen or shorten the lever. The front end of the lever carries a pivot bolt 67 on which is mounted a roller 68. The latter tracks in a guideway 69 in the form of a channel which extends along the upper inner edge of the door. Said guideway is preferably mounted on an angle bar 71 which is bolted to the door. The upper edges of the guideway are formed with inwardly turned flanges 69' for holding the roller in the guideway. The front end of the lever is disposed in a plane to clear the upper edge of the door in the swinging movement thereof, and the lever has an offset portion, as illustrated in Fig. 3, so that the bolts 65 will also clear the upper edge of the door. Referring to Fig. 7, it will be seen that a compression spring 72 is disposed in the guideway 69 to abut the closed inner end thereof, such spring being either of circular formation or of polygonal formation to conform to the channel shape of the guideway.

If desired, a sliding block 73 may be mounted in the channel at the free end of the spring. The spring 72 is so proportioned that when the door is in either its entirely closed or entirely open position, with the operating lever 57 substantially at right angles thereto (Fig. 1) said spring is under compression tending to force the roller 68 toward the other end of the guideway 69.

The operative connection between the link 46 and lever 57 is established through a plate 75 which is riveted to the underside of the lever 57 adjacent to the pivot end 58 thereof. Such plate carries a pivot bolt 76 on which the outer end of the link 46 is mounted. As shown in Figures 1 and 4, the link 46 also comprises two relatively adjustable sections 46' and 46'' which are joined by bolts 77, one of the sections having longitudinal slots 78 therein through which the bolts pass. By releasing said bolts, the two sections can be shifted relatively to each other for increasing or decreasing the effective length of the link 46. It will be understood that the construction and arrangement of the motion transmitting linkage for the other door is a duplicate of that just described.

Referring now to the operation of the mechanism, it will be seen from Fig. 1 that when the two doors are closed, the two traveling nuts or actuating elements 37a and 37b are disposed adjacent to the inner ends of their threads on the shaft 27. Energization of the motor 25 at this time results in the shaft 27 being rotated in a direction such as will feed the two traveling nuts outwardly in opposite directions toward the ends of the shaft.

Each nut transmits thrusting movement through the link 46 to the pivot 76, and the latter in turn compels the operating lever 57 to swing about its pivot 58 in a direction toward the side of the doorway. The roller 68 in swinging outwardly and rearwardly with said lever moves along in the guideway 69 and compels the door to swing rearwardly around its hinge axis 18 concurrently with the rearward movement of the lever. This continues until the door and lever have each swung through approximately 90°, at which time the door is in its completely open position with the lever extending approximately at right angles thereto, as indicated in dotted lines in Fig. 1. The other door has, of course, been moved to its open position concurrently therewith. Substantially at the time when the parts reach this position a suitable limit switch is thrown to interrupt the circuit of the electric motor 25 and to reverse the circuit connections thereto. To close the doors the motor 25 is again energized through these reversed circuit connections, and the shaft 27 is driven in the opposite direction. This feeds the two traveling nuts 37a and 37b inwardly along the shaft 27 which, operating through the links 46 and pivots 76 swing the operating levers 57 forwardly and inwardly for returning the two doors to closed position. When the doors reach such position, with the levers 57 substantially at right angles thereto, as indicated in full lines in Fig. 1, this same limit switch is again actuated to interrupt the circuit to the motor 25 and reverse the electrical connections thereto.

Attention is directed to the fact that by having the threaded shaft 27 rotate on a fixed axis extending substantially parallel with the doorway and by connecting the two
 5 traveling nuts with their respective doors in the manner shown, the reaction stresses of screwing both nuts outwardly along the shaft, or inwardly thereof, balance each other in the shaft so that no material thrust is estab-
 10 lished in the shaft for either direction of door operating movement. Moreover, no end thrust need be borne by the armature shaft of the motor 25.

It will be observed that by having the op-
 15 erating lever 57 occupy a position substantially at right angles to the door when the latter is in closed position such lever is in a dead center relation with respect to the door so that it functions as a rigid locking strut for preventing unauthorized forcible open-
 20 ing of the door from the outside. Moreover, by having the lever move to this position in the closing of the door the latter part of the lever movement exerts a slow powerful toggle
 25 action on the door for moving the same completely to its closed position. Such movement of the lever between the open and closed positions of the door is obtained by locating the fulcrum pivot 58 substantially
 30 on or in proximity to a line bi-sectioning the angle subtended between a line drawn from the hinge axis 18 to the inner portion of the guideway 69 when the door is in closed position and a line drawn from this hinge axis to
 35 the same portion of the guideway when the door is in open position. Attention is also directed to the fact that the crank pivot 76 on the lever 57 is so disposed that a line drawn from this pivot to the fulcrum pivot 58
 40 is displaced approximately 45° from a line perpendicular to the line of thrust exerted on said lever and passing through the fulcrum pivot 58. This results in the crank pivot 76 swinging in the most effective part of
 45 its arc with reference to the line of force transmitted thereto in the movement of the door between its two positions. The particular movement of the lever 57 relatively to the door also results in the buffer spring
 50 72 being compressed by the roller 68 as the door moves into either of its extreme positions.

The opposing pressure of this buffer spring results in a more accurate stopping of the
 55 door operating mechanism, it being noted that as soon as the circuit of the motor 25 is interrupted the reacting pressure of the buffer spring will prevent the motor and
 60 shaft 27 from coasting and over-running the predetermined limit of operation of the door operator. Such results in the lever 57 always moving to substantially the same position with the door either open or closed, and
 65 prevents the possibility of the traveling nuts

37a and 37b running off the ends of their threads 27a and 27b. The pressure stored up in said spring when the door is at either limit of its movement also serves
 70 the purpose of breaking the dead center lock between the operating lever 57 and the door when it is desired to operate the door or doors manually. For example, with the door in its closed position, pulling down on the handle portion 49 of the
 75 latch pivot 48 will release the link 46 and instantly therewith the buffer spring will force the roller end 68 of the lever inwardly along the guide 69, thereby breaking the dead center relation between the door and the lever
 80 and permitting the door to be swung open manually. The same is true in reverse relation if the door at this time is in its open position, the buffer spring forcing the roller end of the lever forwardly in the guideway and
 85 freeing the door from its dead center or over center lock. In the power driven operation of the door, the pressure of said spring also aids the motor 25 in initiating the movement of the door toward either of its two positions.
 90

In some cases it is desirable that the doors swing outwardly to their open position, and Fig. 8 illustrates the adaptation of the present door operating mechanism to this situation. Each guideway 69 is extended approxi-
 95 mately at right angles to its respective door so that when the door is in closed position, indicated in full lines in Fig. 8, the guideway 69 extends back into the building and when the door is in open position, indicated in
 100 dotted lines in Fig. 8, the guideway is swung forwardly approximately into the plane of the doorway. Each guideway is mounted on its respective door by a bar 81 which is bent at an angle and has its opposite ends secured to the guideway and to the door. A diagonal brace bar 82 also extends between the guide track and the door. The operation of this embodiment is substantially the same as that of the preceding embodiment, except
 110 that in this form the positions occupied by the traveling nuts 37a and 37b are reversed with reference to the positions of the doors. That is to say, when these nuts are at the outer ends of their threads
 115 the doors are in closed position and when the nuts are caused to travel to the inner ends of their threads, the doors are swung outwardly to open position. Substantially the same relation between the piv-
 120 otal swing of each lever 57 and the guideway 69 obtains in this embodiment as in the preceding embodiment.

Fig. 9 diagrammatically illustrates a typical circuit and arrangement of switches for
 125 controlling the electric motor 25. Three conductors 83, 84 and 85 lead from the motor and are so connected to the windings thereof that by switching one side of the supply circuit selectively to either of the conductors
 130

84 and 85 the motor can be driven in either direction.

The two supply circuit wires are indicated at 86 and 87, one of these leading to a three-point switch 88 having a switch arm 89 adapted to be moved from one position to the other, to place the wire 86 in circuit with either of the wires 91 or 92. This switch may be located inside the garage, or it may be located adjacent to the driveway outside of the garage for manual or automatic operation by the driver of the car or by the weight of the car, both of which practices are well known. In some instances, it is desirable to locate one switch inside the garage and the other switch outside thereof adjacent to the driveway, as above described, and in such case a second control switch 93 is interposed in the conductors 91 and 92. Such switch comprises four contacts with two movable switch arms 94 and 95 adapted to move from the position indicated in full lines to the position indicated in dotted lines, both switch arms moving together. The two conductors 91 and 92 connect to two diametrically opposite terminals of said switch, and leading from the other two diametrically opposite terminals are conductors 96 and 97 which extend to the reversing limit switch indicated in its entirety at 98. Such switch comprises two switch arms 99 and 100 which move together from the positions indicated in full lines to the positions indicated in dotted lines. The movement of the arm or blade 99 between its two positions alternately connects the conductors 96 and 97 in circuit with the conductor 83 leading to the motor. The movement of the other arm or blade 100 between its two positions alternately connects the supply wire 87 to the motor wires 84 and 85 selectively.

The reversing limit switch 98 is mounted on the supporting frame 19 and is arranged to be under the control of one of the traveling nuts. To this end, a switch actuating rod 102 is extended from the housing of the switch 98 and is disposed alongside the feed screw 27a. The traveling nut 37a has an apertured lug 103 projecting therefrom through which extends the rod 102. Two stop collars 104 and 105 are adjustably mounted on the rod 102, being positioned thereon so that the lug 103 will engage the collar 104 for shifting the rod in one direction when the doors reach one position, and so that said lug will engage the opposite stop collar 105 for shifting the rod in the opposite direction when the doors reach their other position. Referring to Fig. 2, the rod 102 carries a pin 106 which is adapted to engage in the forked end of a switch actuating lever 107. Such arrangement permits the pin 106 to move out of the end of the lever and beyond the same if the movement of the pin should exceed the range of move-

ment of the actuating lever, while still insuring that the pin will reengage the lever and actuate the same when the pin is moved in the opposite direction. The lever 107 is operatively connected with the two switch arms 99 and 100 to move the same between the two positions illustrated in Fig. 9.

In many installations it is necessary to make adjustments for different sizes of doors, for different degrees of movement of the doors and for different mountings of the frame 19 relatively to the doorway, etc. The present construction of door operating mechanism enables all of these adjustments to be quickly and easily made.

It will be observed that by releasing the set screws 62 and shifting the pivot brackets 59 the fulcrum pivots 58 of the operating lever 57 can be shifted inwardly or outwardly along the channel bar 23. By releasing the nuts 65 each operating lever 57 can be lengthened or shortened to take care of different installation requirements. Similarly, by releasing the nuts 77 each link 46 can be lengthened or shortened to compensate for shifting of the fulcrum pivot 58 and to adapt the mechanism to other dimensional requirements. Moreover, by adjusting the stop collars 104 and 105 on the switch actuating rod 102, the points in the door movement at which the motor circuit is interrupted can be varied, as desired.

While the foregoing construction constitutes the preferred embodiment of my invention, nevertheless it will be understood that such embodiment is merely exemplary and that numerous modifications and rearrangements may be made therein without departing from the essence of the invention.

I claim:

1. In door operating mechanism, the combination with a doorway and a door mounted to swing into and out of said doorway, of a door operator comprising an electric motor, motion transmitting mechanism driven by said motor comprising a lever pivotally mounted to swing about a fixed axis and operative to swing said door to both its open and closed positions, and yieldable means opposing the operation of said motion transmitting mechanism as said door approaches one of its extreme positions.

2. In door operating mechanism, the combination with a doorway and a door mounted to swing relatively thereto, of a lever rotating about a fixed pivot and having one of its ends slidably connected with said door, a motor, motion transmitting mechanism operatively connecting said motor with said lever, and spring means opposing the sliding movement of said lever relatively to said door as said door approaches one of its extreme positions.

3. In door operating mechanism, the combination with a doorway and a door mounted

to swing into and out of said doorway, of a guideway mounted on the door, a lever having one of its ends slidably connected with said guideway, a motor driven threaded member, a traveling nut engaging with said threaded member, means for transmitting door operating movement from said traveling nut to said lever, and a spring associated with said guideway for yieldingly opposing the movement of said lever relatively thereto as said door approaches either its open or closed position.

4. In door operating mechanism, the combination with a doorway and a door mounted to swing relatively thereto, of an electric motor, a threaded shaft driven thereby, a nut traveling along said shaft, motion transmitting mechanism for transmitting door operating movement from said nut to the door, and manually actuated releasing means for disconnecting said motion transmitting mechanism from said traveling nut to permit of manual operation of the door.

5. In door operating mechanism, the combination with a doorway and a door mounted to swing into and out of said doorway, of a guideway mounted on said door, a lever having one of its ends slidably connected with said guideway, an electric motor, motion transmitting linkage operatively connecting said electric motor with said lever, and a spring pressed pivot interposed in said motion transmitting linkage, said pivot being manually releasable to disconnect said lever from said electric motor whereby said door may be manually operated.

6. In door operating mechanism, the combination with a doorway and a door mounted to swing into and out of said doorway, of a lever having one of its ends slidably connected with said door, said lever comprising two relatively adjustable parts whereby said lever can be lengthened or shortened, a mounting pivot for the other end of said lever, movable means supporting said pivot for adjustment in a plane substantially parallel with the plane of the doorway, a threaded shaft, an electric motor operatively connected to drive said shaft, a traveling nut engaging with said shaft, and a motion transmitting link pivotally connected between said traveling nut and said lever, said link comprising two relatively movable sections capable of adjustment for increasing or decreasing the length of said link.

7. In door operating mechanism, the combination with a doorway and a door mounted to swing relatively thereto, of a swinging guideway mounted on said door, a lever having one of its ends slidably engaging with said guideway, a motor, and motion transmitting mechanism operatively connected to transmit door operating movement from said motor to said lever, said guideway extending at a considerable angle from said

door so that when said door is in proximity to the doorway the guideway is removed therefrom, and vice versa.

8. In door operating mechanism, the combination with a doorway and a pair of doors hinged to the opposite sides thereof for swinging into and out of said doorway, of an operating lever for each of said doors having one end mounted on a stationary pivot, a roller track of channel section mounted on each of said doors, a roller mounted on the swinging end of each operating lever and engaging in its associated roller track, buffer springs in the inner ends of said roller tracks engaged by said rollers when the doors approach their extreme open or closed positions, a shaft extending substantially parallel with said doorway, the opposite end portions of said shaft having separate screw threads of opposite lead, an electric motor operatively connected to revolve said shaft, two traveling nuts screwing over the opposite threads on said shaft, means for holding said nuts against rotation while permitting longitudinal movement thereof along said shaft, links pivotally connected between each of said nuts and its corresponding operating lever, a limit switch for interrupting the circuit of said electric motor and reversing the electrical connections thereof, a switch actuating lever comprising a forked portion, a switch actuating rod having a pin movably engaging with said forked portion for operating said limit switch, means responsive to the movement of one of said nuts for shifting said rod when the doors reach either of their extreme positions, and a separate switch for initiating the operation of said motor.

9. In door operating mechanism, the combination with a doorway and a pair of doors mounted to swing into and out of said doorway of an individual actuating lever for each door, each of said levers being mounted on a stationary pivot and having its swinging end slidably connected with its associated door, a threaded shaft rotating on a fixed axis extending substantially parallel with said doorway and having threads of opposite lead on opposite ends thereof, a motor for driving said shaft, a pair of traveling nuts screwing over the opposite threads of said shaft, and link means connecting said nuts with said door actuating levers, the end thrusts set up in moving the two nuts inwardly or outwardly along said shaft in the door operating movements substantially balancing each other through said shaft.

10. In door operating mechanism, the combination with a doorway and a pair of doors mounted to swing into and out of said doorway of an individual actuating lever for each door, two stationary pivots for said levers spaced inwardly from said doorway, means slidably connecting the swinging ends of said levers with their associated doors, a threaded

shaft rotating on a fixed axis extending substantially parallel with said doorway between the plane of the doorway and the vertical plane of said fixed pivots, the opposite ends of said shaft having threads of opposite lead thereon, a motor for driving said shaft, a pair of traveling nuts screwing over the opposite threads of said shaft, and link means connecting said nuts with said door actuating levers, the end thrusts set up in moving the two nuts inwardly or outwardly along said shaft in moving the doors between their open and closed positions substantially balancing each other through said shaft.

11. In door operating mechanism, the combination with a doorway and a pair of doors mounted to swing into and out of said doorway, an individual actuating lever for each door, fixed pivots for the inner ends of said levers, guide means slidably connecting the outer ends of said levers with their respective doors, a threaded shaft rotating on a fixed axis extending substantially parallel with the doorway between the plane of the doorway and the vertical plane of said fixed pivots, the opposite ends of said shaft having threads of opposite lead thereon, a motor for driving said shaft, a pair of traveling nuts screwing over the opposite threads of said shaft, link means pivotally connected with said nuts, and crank pivots fixedly mounted on said levers at points intermediate their fixed pivots and their respective doors, said links being operatively connected with said crank pivots.

12. In door operating mechanism, the combination with a doorway and a pair of doors mounted to swing into and out of said doorway, an individual actuating lever for each door, stationary pivots on which the inner ends of said levers are mounted, guideways mounted on said doors, means on the outer swinging ends of said levers engaging with said guideways for sliding movement, a threaded shaft rotating on a fixed axis extending substantially parallel with said doorway between the plane of the doorway and the vertical plane of said stationary pivots, the opposite ends of said shaft having threads of opposite lead, a motor for driving said shaft, a pair of traveling nuts screwing over the opposite threads of said shaft, links pivotally connected with said nuts, and a crank pivot fixedly mounted on each of said levers between the ends thereof at a point whereby a line extending through the crank pivot and associated stationary pivot is displaced approximately 45° from a line extending between the ends of the lever, said links being operatively connected with said crank pivots.

13. In door operating mechanism, the combination with a doorway and a pair of doors mounted to swing into and out of said doorway, an individual actuating lever for each door, a fixed pivot for the inner end of each

lever disposed on a line approximately bisecting the angle subtended between the extreme open and closed positions of its respective door, guideways mounted on said doors, means on the outer swinging ends of said levers slidably engaging in said guideways, a threaded shaft rotating on a fixed axis extending substantially parallel with said doorway and having threads of opposite lead on opposite ends thereof, a motor for driving said shaft, a pair of traveling nuts screwing over the opposite threads of said shaft, links pivotally connected with said nuts, and a crank pivot fixedly mounted on each of said levers between the ends thereof at a point whereby a line extending through the crank pivot and associated fixed pivot is displaced approximately 45° from a line extending through the ends of the lever, said links being pivotally connected with said crank pivots.

14. In door operating mechanism, the combination with a doorway and a pair of doors mounted to swing into and out of said doorway, an individual actuating lever for each door, a frame bar extending substantially parallel with said doorway, shiftable members adapted for mounting in different adjusted positions on said frame bar, pivots carried by said shiftable members, the inner ends of said actuating levers being mounted on said pivots, guideways mounted on said doors, the outer ends of said levers slidably engaging with said guideways, a threaded shaft rotating on a fixed axis extending substantially parallel with said doorway and having threads of opposite lead on opposite ends thereof, a motor for driving said shaft, a pair of traveling nuts screwing over the opposite threads of said shaft, and links pivotally connected between said nuts and said door actuating levers.

15. In door operating mechanism, the combination with a doorway and a pair of doors mounted to swing into and out of said doorway, an actuating lever for each door operatively connected therewith, a supporting member, mounting members adapted for adjustable location at different points on said supporting member, means pivotally connecting said actuating levers with said mounting members, threaded shaft means, means for driving the same, traveling nuts engaging with said threaded shaft means, and means operatively connecting said traveling nuts with said door actuating levers.

16. In door operating mechanism, the combination with a doorway and a pair of doors mounted to swing into and out of said doorway, individual actuating levers for said doors pivotally mounted on stationary axes to swing horizontally and having their swinging ends operatively connected with said doors, a motor driven threaded shaft, traveling nuts screwing over said shaft, means op-

eratively connecting said traveling nuts with
said actuating levers, a guide member extend-
ing substantially parallel with said threaded
shaft, and means on said traveling nuts hav-
ing sliding engagement with said guide mem-
ber for preventing rotation of said nuts with
said shaft.

17. In door operating mechanism, the com-
bination with a doorway and a pair of doors
mounted to swing into and out of said door-
way, actuating levers swinging on stationary
axes and operatively connected with said
doors, a motor driven threaded shaft, travel-
ing nuts screwing over said shaft, means op-
eratively connecting said traveling nuts with
said levers, and spring means cooperating
with said levers whereby the latter move to-
ward and away from said spring means in
the door operating movement and only stress
said spring means adjacent to the limits of
movement of said levers.

18. In mechanism for operating garage
doors and the like, the combination with a
doorway and a pair of doors mounted to
swing horizontally in opposite directions as
they move into or out of said doorway, of
an individual actuating lever for each door,
guideways secured to each of said doors, each
of said levers having its swinging end slid-
ably connected with the guideway of its as-
sociated door, shaft means having fixed axial
mounting and extending substantially paral-
lel with said doorway, means for rotating said
shaft means, threads on the opposite ends of
said shaft means, threaded members engag-
ing said threads, and means for transmitting
motion from said threaded members to said
levers.

In witness whereof, I hereunto subscribe
my name this 17th day of July, 1928.

HARRY G. AINSWORTH.

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