Dec. 14, 1965 E. R. GLENN 3,223,402

DOOR CLOSER

Filed May 8, 1961 2 Sheets-Sheet 1

FIG. 1.

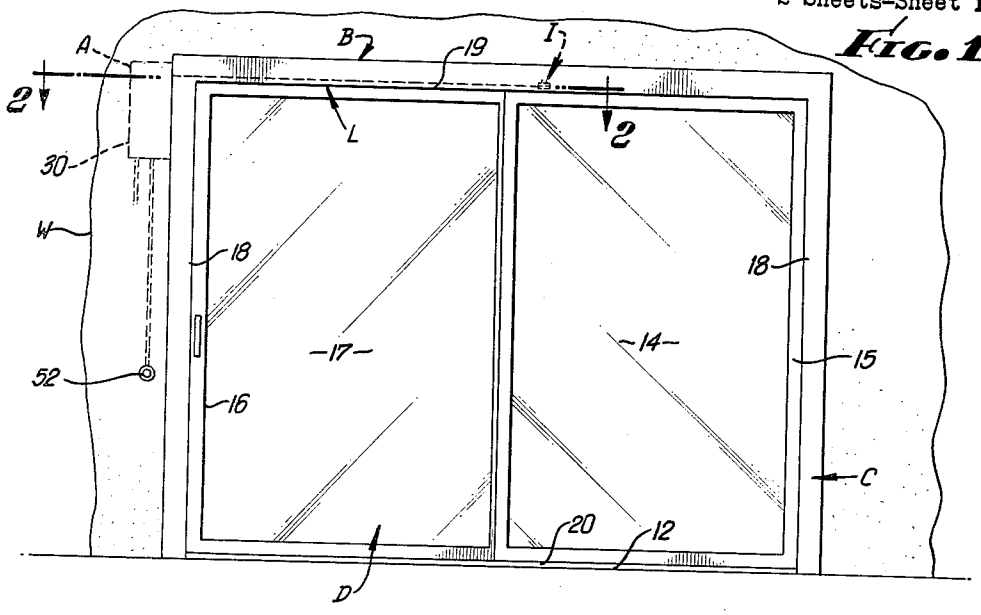


FIG. 2.

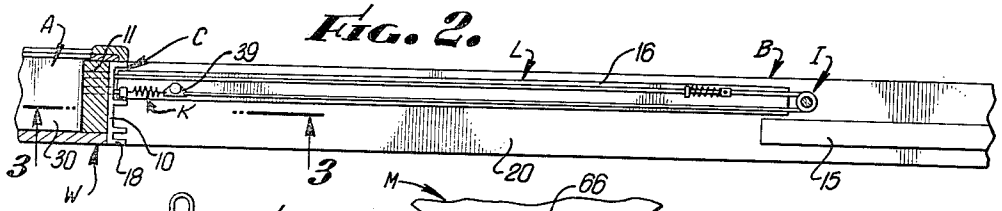


FIG. 6.

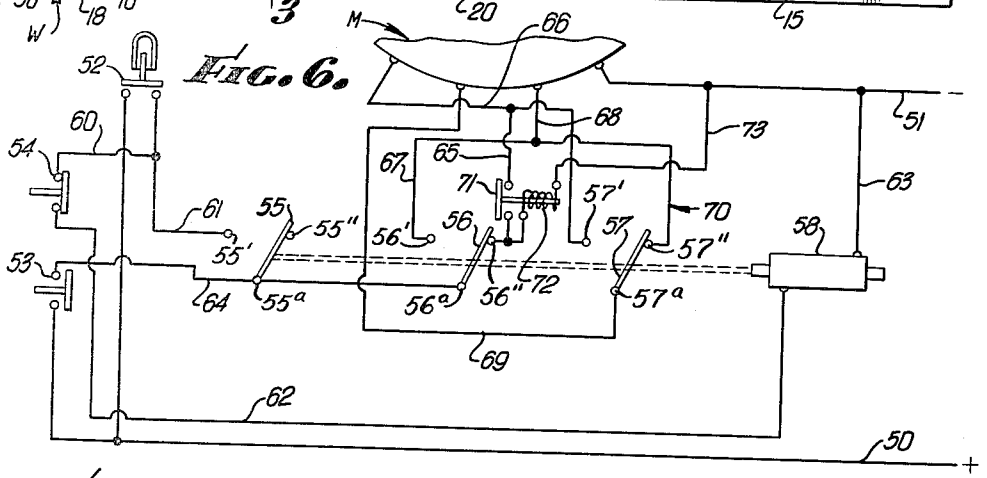
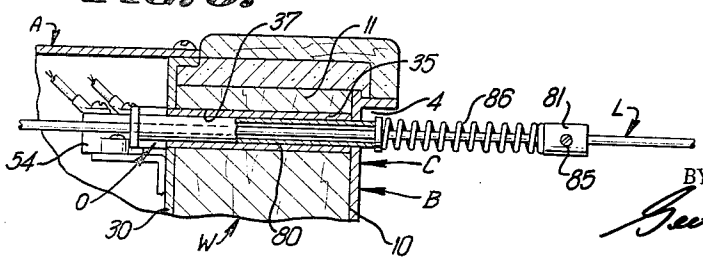


FIG. 5.



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DOOR CLOSER

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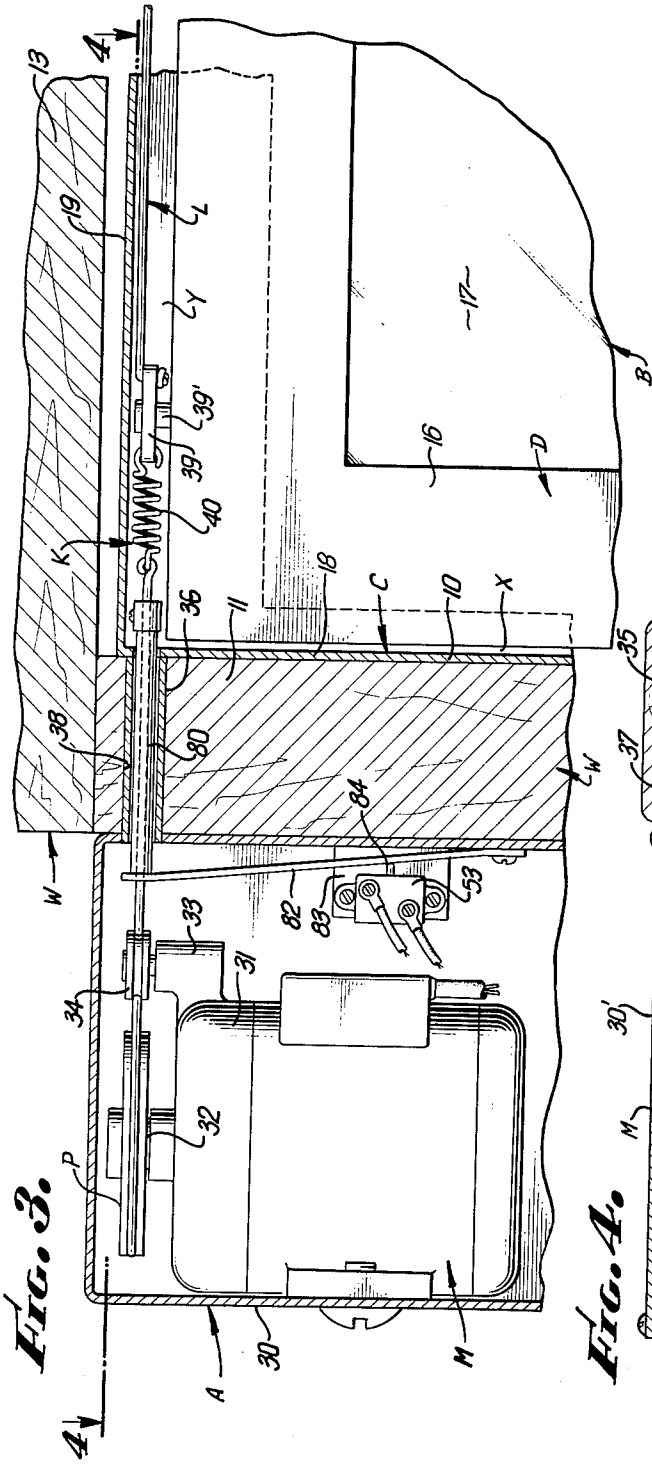


FIG. 3.

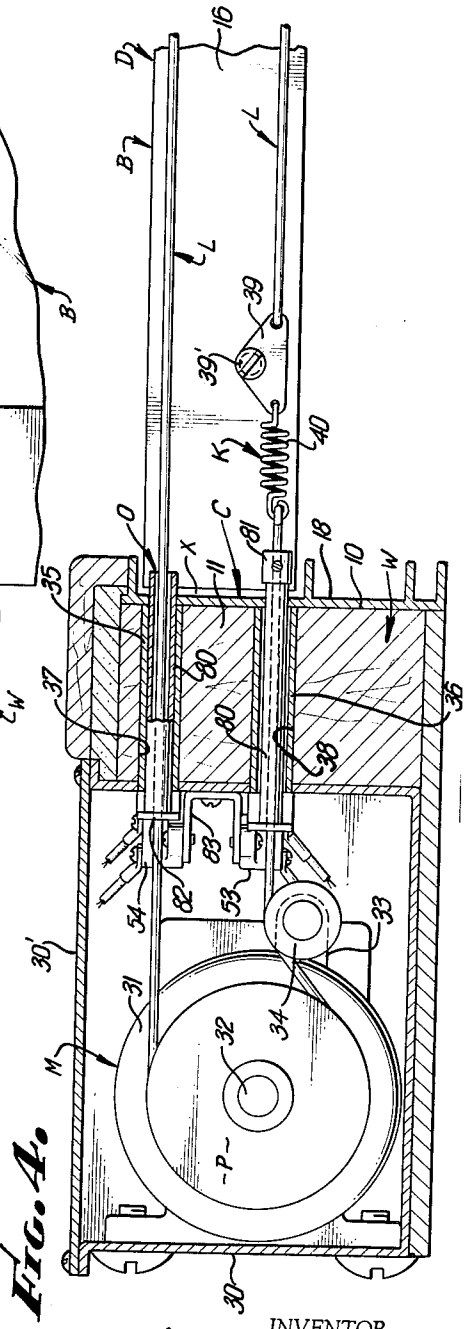


FIG. 4.

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3,223,402

DOOR CLOSER

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Filed May 8, 1961, Ser. No. 158,622
6 Claims. (Cl. 268—53)

This invention relates to a door closer and is more particularly concerned with an electrically operated closer mechanism for sliding doors. The use or employment of sliding doors is extremely old. However, in recent years the use of such doors having glass panels has increased materially.

The ordinary glass sliding door is, due to the fact that heavy plate glass must be used and such glass must be supported by a heavy frame, extremely heavy and, as a result requires the exertion of considerable force to slide it open and closed. Further, since the ordinary door of the character referred to slides laterally in the opening in which it is related, rather than in an arc transverse of the opening as in the case of the ordinary swinging door, it is often more awkward and inconvenient to operate a sliding door than an ordinary swinging door.

Due to the fact that a lateral force must be exerted to operate the ordinary sliding door, persons who are weak and/or crippled, find it extremely difficult and oftentimes impossible to operate such doors.

An object of this invention is to provide a novel electrically operated means for opening and closing a laterally shiftable or sliding door.

Another object of this invention is to provide a means of the character referred to which is set in motion by momentarily closing a manually operable switch and which shifts the door to an open position, and subsequently shifts the door to its closed position.

It is a further object of this invention to provide an operating means for a sliding glass door of the character referred to including means whereby the door dwells or stops momentarily in its open position before it commences to shift or return to its closed position.

A further object of this invention is to provide safety means whereby the door stops moving when it engages an object or person within the door opening, so as not to damage the object, person, or the door.

It is a further object of my invention to provide a closure mechanism of the character referred to which is such that it can be easily and conveniently adjusted so as to open the door to any desired extent.

It is another object of my invention to provide means of the character referred to which is such that the door can be easily and conveniently manually operated without setting the electrically operated means in motion.

It is an object of this invention to provide a door operating means of the character referred to which is easy and economical to manufacture, easy to install, service, and maintain, and such that it can be advantageously related to conventional sliding glass door constructions.

The various objects and features of my invention will be fully understood from the following detailed description of a typical preferred form of the application of my invention, throughout which description reference is made to and accompanying drawings, in which:

FIG. 1 is an elevational view of a sliding door construction showing my operator related thereto, in dotted lines;

FIG. 2 is a sectional view taken as indicated by line 2—2 on FIG. 1;

FIG. 3 is an enlarged detailed sectional view taken substantially as indicated by line 3—3 on FIG. 2;

FIG. 4 is a detailed sectional view taken as indicated by line 4—4 on FIG. 3;

FIG. 5 is a view similar to a portion of FIG. 4 showing the construction in another position;

FIG. 6 is a diagrammatic view of the electrical system that I provide.

The door operator A that I provide is adapted to be related to a sliding door construction B arranged in an opening 10 in a wall structure W.

In the case illustrated the opening 10 in the wall W is defined by a pair of laterally spaced vertically disposed wood studs 11 extending upwardly from a base or floor 12 and an elongate horizontally disposed header 13.

The door construction B is shown as including a frame C arranged in the opening 10, a glass panel 14 carried in a secondary frame 15, arranged in and closing one half of the frame C, and a door or closure D including a frame 16 and a glass pane 17 in the frame 16. The door D is slidably engaged in the frame C and is shiftable from a closed position where it overlies or closes the other half of the opening defined by the frame C to an open position where it occurs adjacent and overlies the fixed panel or pane 14.

The frame C, in accordance with present day construction methods, includes a pair of laterally spaced vertically disposed columns or jambs 18 fixed to the studs 11 and a header 13. The jambs 18 are generally formed of aluminum extrusions, or the like, and are provided with or establish laterally inwardly opening longitudinal channels X to cooperatively receive the stiles of the door or closure frame related thereto. The stringer 19 is formed in the same or a similar manner as the jambs and defines longitudinal downwardly opening channel or guideway Y to cooperatively receive the upper edges of the door and closure panel related thereto.

The frame C further includes a threshold plate 20 extending between the lower ends of the jambs 18, which plate supports the lower ends of the fixed panel and is provided with a suitable rail or track upon which the door D rides.

Since the details of construction of the sliding door with which my new operator A can be related, can be varied widely in form and construction without in any way affecting the novelty of the invention, I will not burden this application with further unnecessary illustration and detailed description of the door construction.

The operator A that I provide includes, generally a prime mover or motor M arranged in fixed position at one side of the door opening, a drive pulley P driven by the motor M, an idler pulley I arranged in fixed position in the door opening remote from the motor and the drive pulley, and an endless tow-line L engaged about said pulleys and fixed to the door.

The operator A further includes a suitable electrical system for controlling the operation of the motor and resulting opening and closing of the door, and a suitable safety means K related to the line L and adapted to brake driving engagement between the line and the drive pulley when the door engages an object in the door opening.

The prime mover or motor M is a reversible electric motor suitably mounted in a sheet-metal box-like housing 30 suitably secured to the outer surface or side of the stud 11 adjacent the jamb 18 against which the door D stops when the door is in its closed position. The housing 30 is positioned at the upper end of the stud 11 with the axis of the motor M arranged therein, vertically disposed.

The upper end of the motor M is provided with a reduction gear box 31 from which a drive shaft 32 projects. The gear box 31 is further provided with a suitable radially projecting bracket 33 which bracket rotatably supports a guide pulley wheel 34.

The drive pulley wheel P is a simple disc-shaped V-type pulley wheel and is mounted on the shaft 32 to

occur in a horizontal plane within the housing **30**, as illustrated in the drawings.

The pulley wheels P and **34** occur in a common horizontal plane, which if extended, occurs between the top of the door frame **16** and the under side of the stringer **19** of the door frame C. Further, the pulley wheels P and **34** are positioned so that tangent lines extending laterally inwardly from a common side of each of said pulley wheels and parallel with the vertical plane of the door D, extend above the parallel with the top of the door frame **16** and within the channel or guideway Y in the stringer **19** in which the door slides, as clearly illustrated in FIGS. 3 and 4 of the drawings.

The idler pulley I is shown as a small horizontally disposed V-type pulley wheel and is rotatably mounted in the guideway Y in the stringer in which the door D slides, and is positioned in the said guideway to occur in a common horizontal plane with the pulleys P and **34**, and is spaced from the jamb **18** against which the door stops when it is in its closed position, a distance in excess of the lateral extent or width of the door.

The idler pulley I can be fixed to the stringer of the door frame C by means of a suitable vertically disposed axle member projecting upwardly from the pulley and fixed to the stringer, or in any other suitable or desired manner.

Since the particular manner in which the pulley wheel I is mounted to the stringer does not in any way affect the novelty of this invention, I will not burden this application with further unnecessary description thereof.

The housing **30** is provided with a pair of laterally inwardly projecting guide tubes **35** and **36**, which tubes are in axial alignment with the above-mentioned tangent lines extending from the pulley wheels P and **34**, and which project through suitable openings **37** and **38** provided in the stud **11** upon which the housing **30** is mounted, and through the adjacent jamb **18** of the frame, or to said jamb to communicate with suitable openings therein, as illustrated in the drawings.

The tubes **35** and **36** establish communication between the interior of the housing **30** and the confines of the frame C in which the door D is engaged, and serve to freely receive elements of the electrical system, as will hereinafter be described and the tow-line L. The tow-line L is a simple elongate cord-like element engaged about the several pulley wheels and through the guide tubes **35** and **36** and has its ends suitably coupled so as to provide an endless loop.

Engaged in the line L is a coupler **39**, which coupler is pivotally secured to the top of the frame **16** of the door D, adjacent the side or end of the door that engages the jamb **18** of the frame C when the door is closed.

In the case illustrated, the coupled **39** is a simple, flat, horizontally disposed plate-like element having apertures therein to facilitate coupling the line thereto and pivotally secured to the top of the frame **16** of the door D by a suitable pivot pine **39'**. In practice, the coupler **39** could be secured to the side of the top of the frame **16**, in which case it would occur in a vertical plane.

With the structure thus far set forth, it will be apparent that when the motor M is energized and rotates the pulley wheel P in one direction, the tow-line is moved about the several pulleys so as to slide the door D from its closed position to its open position in the frame C. It will be further apparent that upon reversing the direction of the motor M the line L is moved in the opposite direction about the pulleys so that the door is returned or shifted back to its closed position in the frame C.

The safety means K that I provide includes a resilient member, such as a tension spring **40**, or the like engaged in the tow-line L. The member or spring **40** is of sufficient strength so that a desired tension is maintained on the line L to assure sufficient frictional drive with the pulley wheel P to open and close the door, but is such

that when the door reaches its fully open or fully closed position and is stopped, or, where it is stopped by a foreign object in the door opening, as, for instance, a person, the member stretches or elongates by virtue of the added resistance afforded by the door. Upon becoming elongated proper tension and resulting frictional drive with the pulley P is lost and the line slips relative to the pulley wheel P, thereby preventing overloading and/or stalling of the motor and preventing damage to the door and the object engaged in the door.

In the case illustrated, the spring **40** of the means K is shown as a simple, helical tension spring and is shown engaged between one end of the tow-line L and the coupler **39**.

The electrical system for controlling the operation of the motor M is responsive to a manually operable switch and to the position of the door D in the frame C.

Referring to the electrical diagram in FIG. 6 of the drawings, the system includes positive and negative lines **50** and **51** extending from a suitable source of electricity, and adapted to supply current to the motor M, a manually operable switch **52**, mechanically operated stop and reverse switches **53** and **54**, first, second and third three-pole, double throw relay switches **55**, **56** and **57** each having one primary and two secondary poles, and a solenoid actuator **58**, mechanically coupled with the relay switches **55**, **56** and **57** and under control of the switches **52** and **54**, adapted to reverse the motor M.

The line **51** connects directly with one side of a primary field of the motor M. The line **50** connects with one side of the control switch **52**. The other side of the control switch **52** is connected with one side of the reverse switch **54** by a line **60** and to the secondary hole **55'** of the relay switch **55** by a line **61**. The reverse switch **54** is normally closed and the relay switch between lines **61** and **64** is normally open, the reverse switch being responsive to the position of the door D in the frame C, as will hereinafter be described.

The other secondary pole **55** of the relay switch **55** is dead, while the other side of the reverse switch **54** is connected with one side of the solenoid **58** by a line **62**. The other side of the solenoid **58** is connected with the line **51** by a lead **63**.

With the circuit thus far described, it will be apparent that the solenoid **58** is normally not energized and the several relay switches **55**, **56** and **57** are in the position shown in FIG. 6 of the drawings. It will be apparent that when the switch **52** is closed, the solenoid **58** is energized, throwing the switches to their actuated position.

The line **50** also connects with one side of the stop switch **53**, which switch is normally open and is responsive to the position of the door D in the frame C, as will hereinafter be described. The other side of the switch **53** connects with a lead **64** connected with the primary poles **55***a* and **56***a* of the relay switches **55** and **56**.

With this relationship of parts, it will be apparent that when the solenoid **58** is energized by closing the switch **52**, and the relay switch **55** is thrown to its actuated or closed position, the circuits between line **61** and line **50** and between lines **61** and **64** is closed, and that upon closing of the stop switch **53**, the solenoid **58** will remain energized when the switch **52** is allowed to open and until the reverse switch **54** is opened and breaks the circuit to the solenoid.

The secondary pole **56''** of relay switch **56** is connected with a line **65** (through delayed switch **71** hereinafter described) which line **65** is connected with line **66** which leads to one end of the secondary field of the motor. When the relay switch **56** is actuated it breaks connection with the line **65** and establishes connection with a line **67** connected with the secondary pole **56'** and with the line **68** which connects with the other end of the secondary motor field.

The primary pole **57***a* of relay switch **57** connects with the line **69** leading to the other end of the primary motor

field, and normally establishes connection with a line 70 which connects with the primary pole 57" and the line 68 connected with the other end of the secondary motor field and, when actuated, breaks connection with the line 68 and establishes connection with the line 66 which connects with secondary pole 57'.

When the relay switches 56 and 57 are in their normal unactuated position, as shown in the drawings, the motor runs in reverse, that is, in a direction so as to close the door D in the frame C. When the relay switches are actuated by the solenoid 58 the motor runs forward, that is, in a direction so as to open the door D.

The stop switch 53 is normally held open by switch operating means related to the door, when the door is closed, and closes as soon as the door starts to open.

The reverse switch 54 is normally closed and is opened by suitable operating means related to the door when the door reaches its fully opened position.

With the electrical system set forth above, it will be apparent that when the door D is closed, the switches 52 and 53 are open. Upon closing the manually operable switch 52, the solenoid 58 is energized through lines 50 and 60, switch 54 and line 62 and is actuated upon actuation of the solenoid the relay switches 55, 56 and 57 are shifted to their actuated position, so that the primary field of the motor is energized through relays 56 and 57 and lines 66 and 67 related thereto and so as to open the door. As soon as the door starts to open the stop switch 53 closes, closing the circuit between lines 50 and 64, whereupon the switch 52 can be released and allowed to open and the motor will continue to run and open the door. When the door reaches its open position, the normally closed reverse switch 54 is opened, breaking the circuit between lines 60 and 62, deenergizing the solenoid 58 and causing the relay switches to return to their normal position. The stop switch 53 still being closed, and the circuit between lines 50 and 64 being closed, the secondary field of the motor is energized through relay switches 56 and 57 and lines 65 and 70 and runs in reverse until such time as the door reaches its closed position, whereupon the stop switch 53 opens and the circuit to the motor is broken, thereby completing the opening and closing cycle of the door and leaving the circuit set and prepared for recycling.

The circuitry that I provide is suitably arranged and mounted in the housing 30. Since the manner in which the said circuitry is arranged and mounted can vary widely in practice, I have chosen to avoid showing the circuitry in the housing and will not burden this application with further detailed description thereof.

In the preferred carrying out of the invention and as illustrated in FIG. 6 of the drawings, the circuit is provided with a delay switch 71 to cause the door to stop or dwell momentarily in its open position, before it starts to close.

The delay switch 71 is engaged in the line 65 and is shown as a normally open thermal responsive time delay switch having a resistant heating coil 72 having one end connected with the secondary pole 56" of the relay switch 56 and its other end connected with the line 51 by a lead 73. With the switch 71 included in the circuit, it will be apparent that when the relay switch 56 returns to its normal position the circuit to the motor is broken by the switch 71 and is not made until the coil 72 heats sufficiently to close the switch 71, thereby resulting in a delay or dwell of the door in its open position.

In the preferred carrying out of the invention the motor M, in addition to being reversible, is preferably such that it runs forward at a considerably greater speed than it does in reverse, so that the door opens rapidly and closes slowly.

The stop and reverse switches 53 and 54 are simple, like, micro switches and each is operated by a novel operating means O.

The operating means O for the switches 53 and 54

include elongate tubular slides 80 slidably engaged in the guide tubes 35 and 36 to project from the opposite ends thereof and freely receive the tow-line L, stops 81 fixed to the tow-line L and adapted to be shifted into and out of engagement with the outer ends of the slides 80, and a pressure arm 82 fixed to and projecting from the inner end of each slide and engageable with the switch related therewith.

In the preferred carrying out of the invention, the arms 82 of the operating means O are elongate leaf springs, each having one end fixed to its related slide and its other end fixed to the housing 30 and biased so as to normally yieldingly urge the slide related thereto outwardly in the tube in which it is engaged.

The micro switches 53 and 54 are supported on suitable brackets or, as in the case illustrated, a single bracket 83, to occur inwardly and intermediate the ends of the arms 82 related thereto, and with their operating pins 84 in engagement with the arms.

With this relationship of parts, it will be apparent that installation of my device is extremely simple, in that it only requires the provision of two holes or openings 37 and 38 in the stud 11 and door frame C to receive the guide tubes 35 and 36.

It will also be apparent that with the operating means that I provide, the micro-switches 53 and 54 can be made to operate in response to a substantial amount of movement by the door, so that adjustment is not critical. Further, due to the resilient nature of the arms 82 the micro switches 53 and 54 are not subject to being damaged or jammed should the door open or close too rapidly and so as to impart a severe jolt or shock through the construction.

The stops 81 are simple metal or plastic spool-like members slidably engaged on the tow-line L and are secured in fixed position thereon by means of a set-screw 85. In practice and if desired, a suitable buffer compression spring 86 can be engaged about the line L to occur between the stops 81 and the slides 80, as illustrated in FIG. 5 of the drawings.

The stop 81 related to the stop switch 53 is positioned on the tow line L so that it engages the outer end of the slide related to the switch 53, just before the door reaches its closed position, the arm 82 related thereto has shifted and/or flexed sufficiently to operate, that is, to open the switch 53.

The stop 81 related to the reverse switch 54 is positioned on the tow-line L so that it engages the outer end of the slide related thereto just before the door reaches its open position, and so that when the door reaches its fully open position the arm 82 related thereto has shifted and/or flexed sufficiently to operate, that is, open the switch 54.

By shifting the stop 81 related to the reverse switch 54 longitudinally of the tow-line L, the extent to which the door opens can be easily and conveniently adjusted and controlled.

In practice, and as illustrated in the drawings, the housing 30 is open at one side and is provided with a suitable closure plate 30' so that access can be readily had to the interior of the housing for servicing of the mechanism therein.

It will be apparent that the structure that I provide is such that it can be advantageously engaged in a masonry or frame wall structure and is such that no unsightly or objectionable structure is in view or is exposed.

Having described only a typical preferred form and application of my invention, I do not wish to be limited or restricted to the specific details herein set forth, but wish to reserve to myself any variations or modifications that may appear to those skilled in the art and fall within the scope of the following claims:

Having described my invention, I claim:

1. A closer for a sliding door arranged in an elongate

frame including, a housing fixed to the exterior of the frame at one end thereof, a pair of laterally inwardly extending guide tubes carried by the housing and projecting through the frame to establish communication between the interior of the frame and the housing, a reversible electric motor mounted within the housing, a driven pulley within the housing and driven by the motor, an idler pulley carried by the frame remote from the housing, an endless tow-line engaged about said pulleys, through the guide tubes and fixed to the door, and electrical control means for the motor including a manually operable starter switch accessible at the exterior of the housing and frame and to start the motor and to move the door from its closed to its open position, a reversing switch in the housing to reverse the motor when the door reaches its open position, a stop switch in the housing to stop the motor when the door is closed, and operating means for the reversing and stop switches including a tubular slide slidably engaged in and projecting from the opposite end of each guide tube, an operating arm fixed to the inner end of each slide and operatively related to one of said switches, and a pair of stops fixed to the tow-line, one stop to engage and shift the slide related to the reversing switch inwardly when the door reaches its open position and to actuate the reversing switch, the other stop to engage and shift the slide related to the stop switch inwardly when the door returns to its closed position and to actuate the stop switch.

2. A closer for a sliding door arranged in an elongate frame including, a housing fixed to the exterior of the frame at one end thereof, a pair of laterally inwardly extending guide tubes carried by the housing and projecting through the frame to establish communication between the interior of the frame and the housing, a reversible electric motor mounted within the housing, a driven pulley within the housing and driven by the motor, an idler pulley carried by the frame remote from the housing, an endless tow-line engaged about said pulleys, through the guide tubes and fixed to the door, and electrical control means for the motor including a manually operable starter switch accessible at the exterior of the housing and frame to start the motor and to move the door from its closed to its open position, a reversing switch in the housing to reverse the motor when the door reaches its open position, a stop switch in the housing to stop the motor when the door is closed, and operating means for the reversing and stop switches including a tubular slide slidably engaged in and projecting from the opposite end of each guide tube, an operating arm fixed to the inner end of each slide and operatively related to one of said switches, and a pair of stops fixed to the tow line, one stop to engage and shift the slide related to the reversing switch inwardly when the door reaches its open position and to actuate the reversing switch, the other stop to engage and shift the slide related to the stop switch inwardly when the door returns to its closed position and to actuate the stop switch, said tow-line having a resilient member engaged in it, whereby the tow-line extends when the door is stopped and driving engagement of the line with the driven pulley is released.

3. A closer for a sliding door arranged in an elongate frame including, a housing fixed to the exterior of the frame at one end thereof, a pair of laterally inwardly extending guide tubes carried by the housing and projecting through the frame to establish communication between the interior of the frame and the housing, a reversible electric motor mounted within the housing, a driven pulley within the housing and driven by the motor, an idler pulley carried by the frame remote from the housing, an endless tow-line engaged about said pulleys, through the guide tubes and fixed to the door, and electrical control means for the motor including a manually operable starter switch accessible at the exterior of the housing and frame to start the motor and to move the door from its closed to its open position, a reversing switch in the housing to reverse the motor when the door reaches its open position, a stop switch in the housing to stop the motor when the door is closed, and operating means for the reversing and stop switches including a tubular slide slidably engaged in and projecting from the opposite end of each guide tube, an elongate resilient operating arm fixed to the inner end of each slide and operatively related to one of said switches, each arm having one end fixed to its related tube and its other end fixed to the housing and biased to normally yieldingly urge the tube laterally inwardly, and a pair of stops fixed to the tow-line, one stop to engage and shift the slide related to the reversing switch inwardly when the door reaches its open position and to actuate the reversing switch, the other stop to engage and shift the slide related to the stop switch inwardly when the door returns to its closed position and to actuate the stop switch, said reverse and stop switches being micro switches with axially shiftable operating stems projecting therefrom and mounted in the housing with their stems engaging the inner sides of the operating arms related thereto intermediate the ends thereof.

4. A closer for a sliding door arranged in an elongate frame including, a housing fixed to the exterior of the frame at one end thereof, a pair of laterally inwardly extending guide tubes carried by the housing and projecting through the frame to establish communication between the interior of the frame and the housing, a reversible electric motor mounted within the housing, a driven pulley within the housing and driven by the motor, an idler pulley carried by the frame remote from the housing, an endless tow-line engaged about said pulleys, through the guide tubes and fixed to the door, and electrical control means for the motor including a manually operable starter switch accessible at the exterior of the housing and frame to start the motor and to move the door from its closed to its open position, a reversing switch in the housing to reverse the motor when the door reaches its open position, a stop switch in the housing to stop the motor when the door is closed, and operating means for the reversing and stop switches including a tubular slide slidably engaged in and projecting from the opposite end of each guide tube, an elongate resilient operating arm fixed to the inner end of each slide and operatively related to one of said switches, each arm having one end fixed to its related tube and its other end fixed to the housing and biased to normally yieldingly urge the tube laterally inwardly, and a pair of stops fixed to the tow-line, one stop to engage and shift the slide related to the reversing switch inwardly when the door reaches its open position and to actuate the reversing switch, the other stop to engage and shift the slide related to the stop switch inwardly when the door returns to its closed position and to actuate the stop switch, said reverse and stop switches being micro switches with axially shiftable operating stems projecting therefrom and mounted in the housing with their stems engaging the inner sides of the operating arms related thereto intermediate the ends thereof, said tow-line having a resilient member engaged in it, whereby the tow-line extends when the door is stopped and driving engagement of the line with the driven pulley is released.

5. A closer for a sliding door arranged in an elongate frame including, a housing fixed to the exterior of the frame at one end thereof, a pair of laterally inwardly extending guide tubes carried by the housing and projecting through the frame to establish communication between the interior of the frame and the housing, a reversible electric motor mounted within the housing, a driven pulley within the housing and driven by the motor, an idler pulley carried by the frame remote from the housing, an endless tow-line engaged about said pulleys, through the guide tubes and fixed to the door, and electrical control means for the motor including a manually operable starter switch accessible at the exterior of the

housing and frame to start the motor and to move the door from its closed to its open position, a reversing switch in the housing to reverse the motor when the door reaches its open position, a stop switch in the housing to stop the motor when the door is closed, and operating means for the reversing and stop switches including a tubular slide slidably engaged in and projecting from the opposite end of each guide tube, an operating arm fixed to the inner end of each slide and operatively related to one of said switches, and a pair of stops having laterally outwardly extending coil buffer springs secured thereto fixed to the tow line, with the buffer springs surrounding said line and opposing the slide related thereto, one stop and buffer spring being adapted to engage and shift the slide related to the reversing switch inwardly when the door reaches its open position and to actuate the reversing switch, the other stop and buffer spring to engage and shift the slide related to the stop switch inwardly when the door returns to its closed position and to actuate the stop switch.

6. A closer for a sliding door arranged in an elongate frame including, a housing fixed to the exterior of the frame at one end thereof, a pair of laterally inwardly extending guide tubes carried by the housing and projecting through the frame to establish communication between the interior of the frame and the housing, a reversible electric motor mounted within the housing, a driven pulley within the housing and driven by the motor, an idler pulley carried by the frame remote from the housing, an endless tow-line engaged about said pulleys, through the guide tubes and fixed to the door, and electrical control means for the motor including a manually operable starter switch accessible at the exterior of the housing and frame to start the motor and to move the door from its closed to its open position, a reversing switch in the housing to reverse the motor when the door reaches its open position, a stop switch in the housing to stop the motor when the door is closed, and operating means for the reversing and stop switches including a tubular slide slidably engaged in and projecting from the opposite end of each guide tube, an elongate resilient operating arm fixed to the inner end of each slide and operatively related to one of said switches, each arm having one end fixed to its related tube and its other end fixed to the housing and biased to normally yieldingly urge the tube laterally inwardly, and a pair of stops having laterally outwardly extending coil buffer springs secured thereto fixed to the tow-line, with the buffer springs surrounding said line and opposing the slide related thereto, one stop and buffer spring to engage and shift the slide related to the reversing switch inwardly when the door reaches its open position and to actuate the reversing switch, the other stop and buffer spring to engage and shift the slide related to the stop switch inwardly when the door returns to its closed position and to actuate the stop switch, said reverse and stop switches being micro switches with axially shiftable operating stems projecting therefrom and mounted in the housing with their stems engaging the inner sides of the operating arms related thereto intermediate the ends thereof, said tow-line having a resilient member engaged in it, whereby the tow-line extends whtn the door is stopped and driving engagement of the line with the driven pulley is released.

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