Nov. 20, 1962 M. CARLSON 3,064,964

DOOR CLOSER MECHANISM

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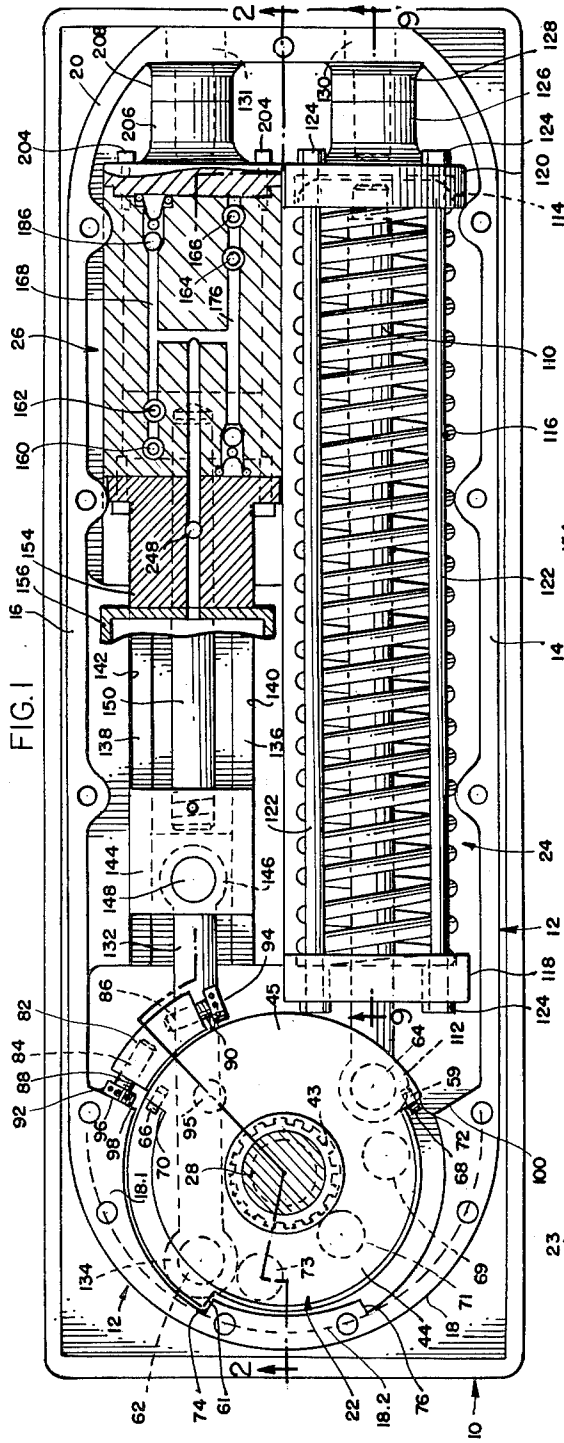


FIG. 1

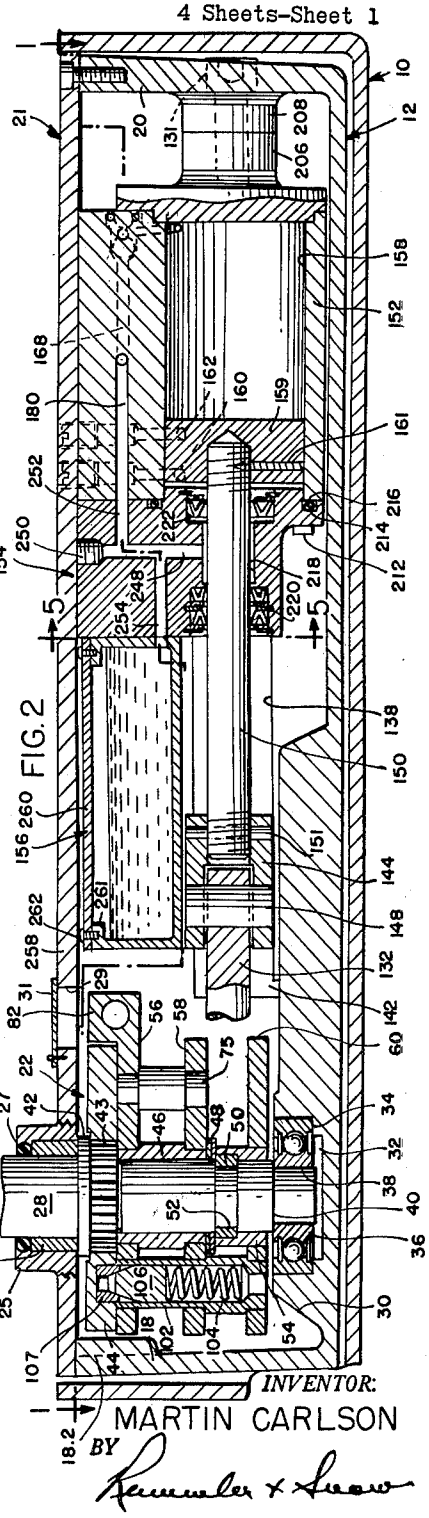


FIG. 2

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DOOR CLOSER MECHANISM

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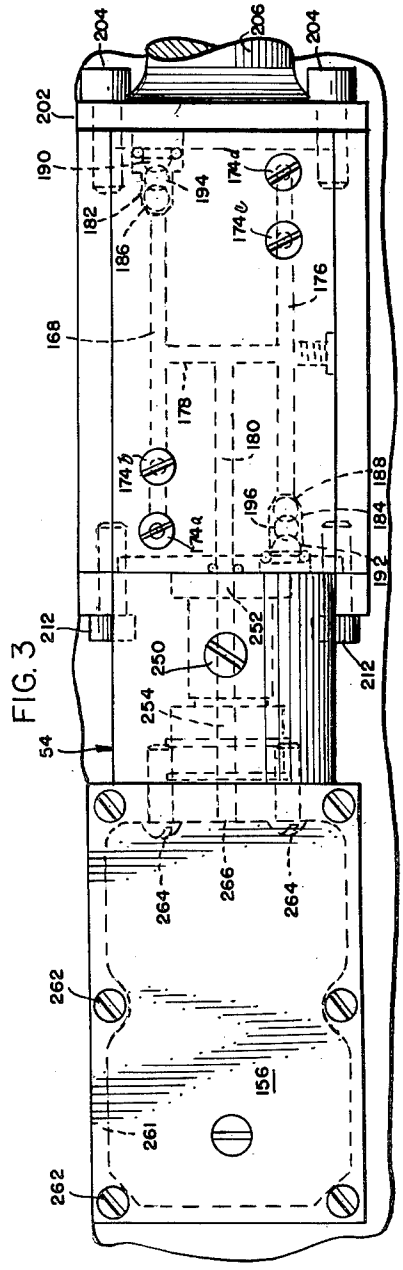


FIG. 3

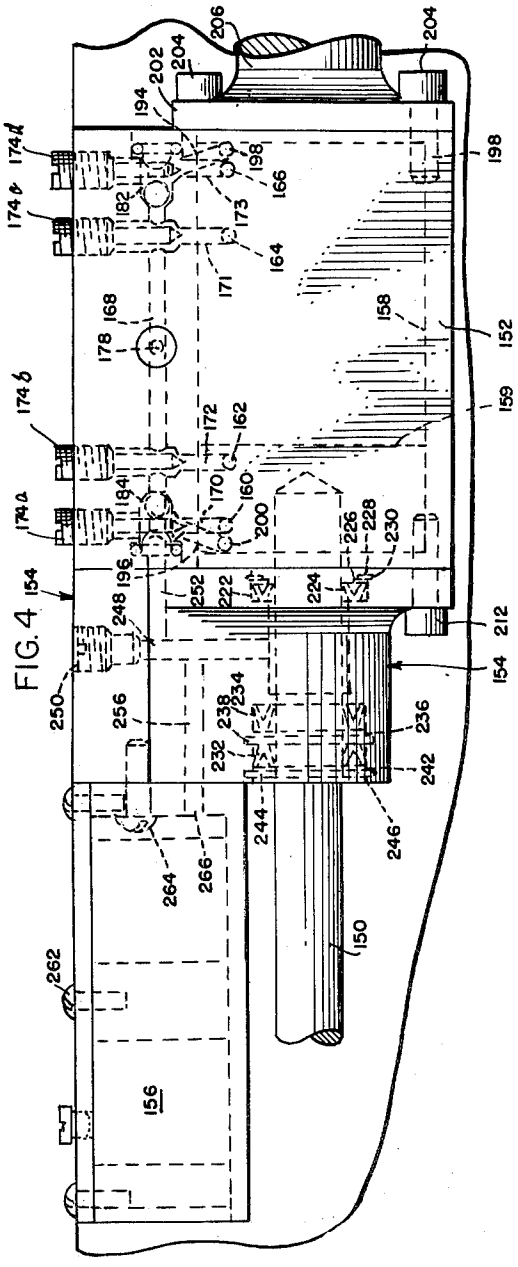


FIG. 4

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DOOR CLOSER MECHANISM

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FIG. 5

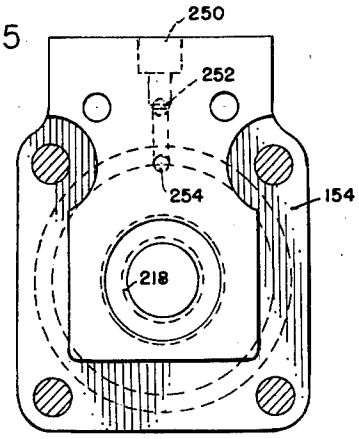


FIG. 6

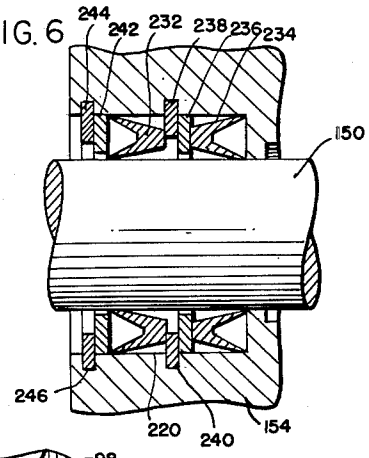


FIG. 7

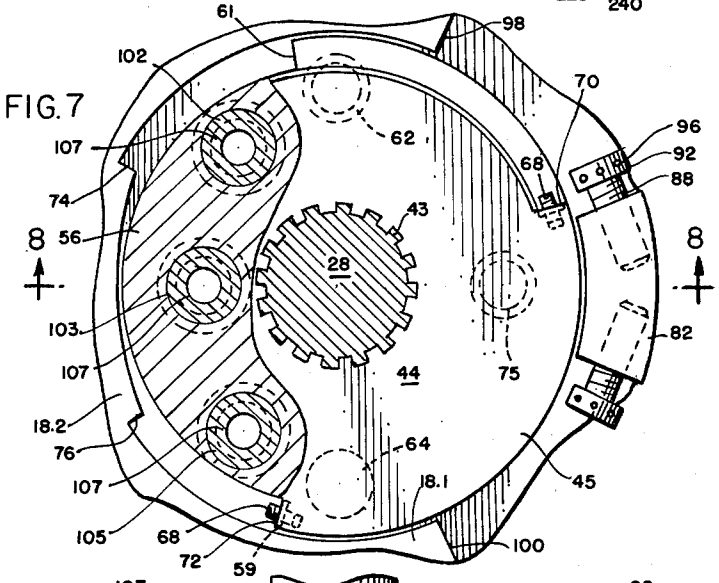
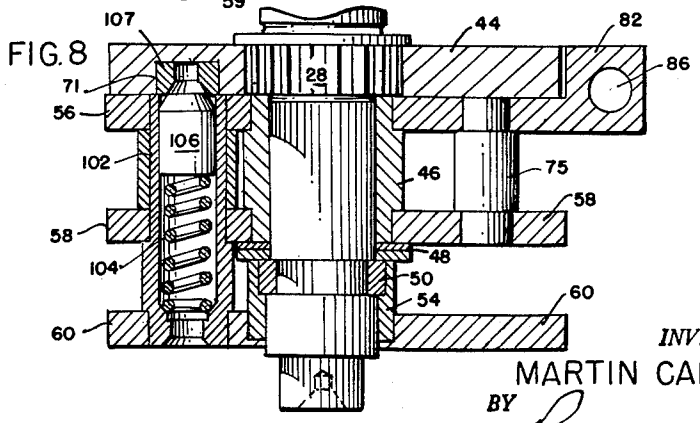


FIG. 8



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DOOR CLOSER MECHANISM

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FIG. 9

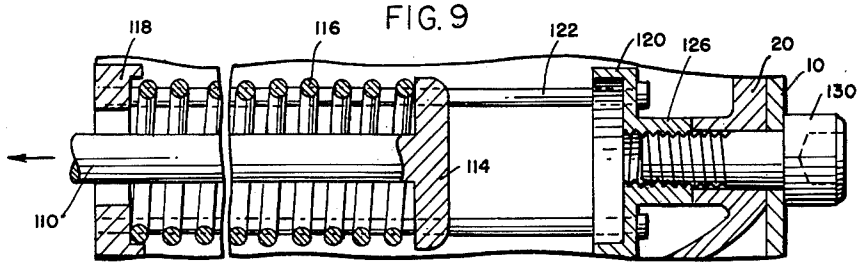


FIG. 10

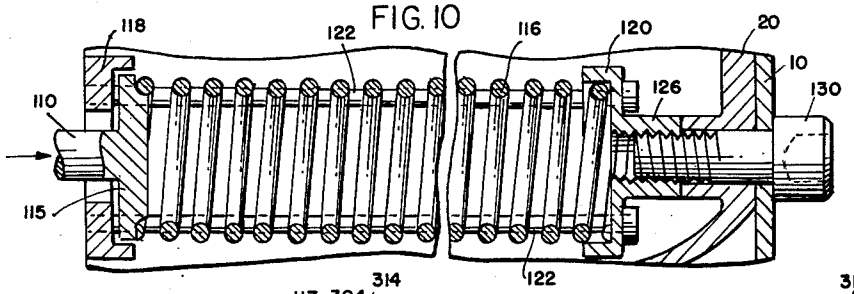


FIG. 11

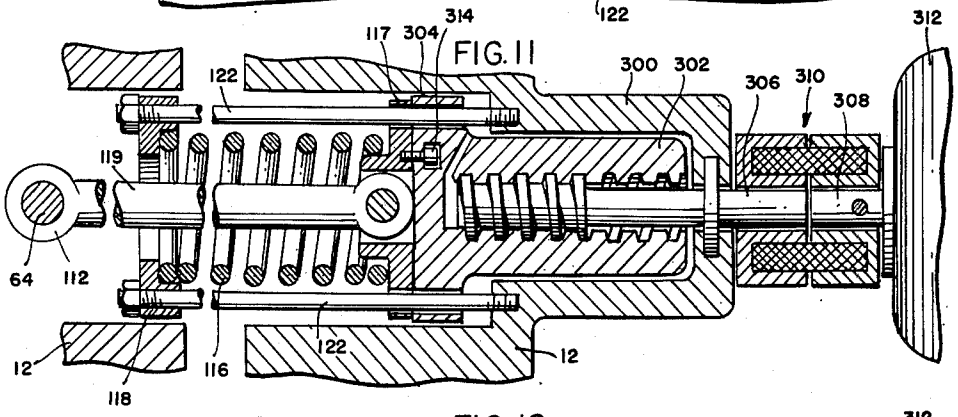
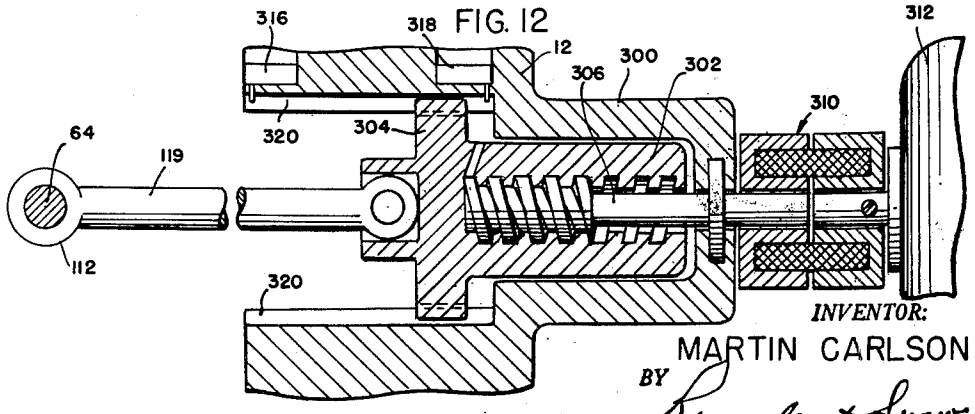


FIG. 12



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3,064,964

DOOR CLOSER MECHANISM

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Filed Dec. 31, 1959, Ser. No. 863,213
14 Claims. (Cl. 268—65)

This invention relates to an improved door closer mechanism and more particularly to an improved door closer including dampening means and energy storing means in which resistance to the initial and terminal, opening and closing movements may be adjusted. In particular this invention relates to an improved mechanism for controlling the opening and closing operation of a door which mechanism is related to that disclosed in my Patent No. 2,869,861 issued January 20, 1959.

The door closer of this invention has utility in conjunction with doors hung for pivotal movement about a generally vertical axis, the closer being completely concealed beneath the floor surface adjacent the door.

Door closer mechanism embody two major functions; namely, to provide resistance to the opening and closing movements of the door adjacent the ends of the respective operations and to provide means for automatically returning the door to the closed position after it has been opened.

To accomplish these functions yet have the device remain small enough to be inconspicuous and inexpensive in installation, the space allotted to the proper and efficient functioning of each of the elements of the device is necessarily limited.

Recently, public buildings such as super markets have utilized the door closer for manually operated entrance doors and the automatic power actuated door operator for exit doors. However, the fire laws of many states, and indeed public safety, requires that these doors be provided with safety break-away means to provide for panic exit if needed. Since most entrance doors open inwardly and exit doors open outwardly, door closer and door operator mechanisms have been designed particularly to accommodate such movement. In either case, however, to provide for panic exit, necessity requires that the doors be capable of being manually opened outwardly to permit rapid escape.

Therefore it is a primary object of this invention to provide a door closer mechanism having an improved break-away feature for permitting door movement in either direction, or through a total of 180 degrees of swing, while protecting the internal mechanism which is designed to accommodate a much smaller door swing.

Further, when a door closer is used, it is desirable to be able to adjust the internal mechanism to fairly precisely limit the opened and closed positions of the door. However, because of the complicity of the internal mechanism it is not desirable to have amateur repairmen removing the closer cover and unknowingly manipulating the internal mechanism.

Therefore, it is a further object to provide an improved door closer having an improved and readily accessible adjustable stop means for adjustment of the maximum opened and closed positions of the door and for protection of the operating mechanism in both normal and panic operation of the door.

Door closer mechanisms which utilize hydraulic principles are particularly plagued with the problem of fluid seepage which collects dirt and makes for a particularly unattractive appearance.

Therefore, it is a further object of this invention to provide a closer mechanism in which a hydraulic piston and cylinder dampening mechanism is employed and in which the hydraulic system comprises an independent fully sealed unit wholly apart from the spindle actuating

mechanism, although contained within the same casing, and in which a novel sealing means is used adjacent the piston rod to prevent fluid seepage from the hydraulic unit into the casing.

Further, it is desirable to have a basic door closer mechanism which may be simply and inexpensively adapted to either left or right handed door swing; which also may be used with power means as a door operator for actuating door movement; and which in either case has readily resettable panic break-away capability in either direction of door movement.

Therefore, it is still a further object of this invention to provide an improved basic closer mechanism having a bi-directional panic break-away feature and which may be simply and inexpensively adapted to either left or right handed door swing, and to provide such a device which may be readily adapted for use with power means as a door operator for actuating door movement.

Further objects of the invention are to provide an improved door closer which includes means for adjusting the initial and terminal hydraulic resistance to opening and closing door movement without removal of the closer cover; to provide an improved mechanism for conversion of rotary spindle movement to reciprocal piston movement; to provide an improved arrangement of parts which permits full utilization of casing space and yet provides maximum closer efficiency; to provide an improved self contained hydraulic dampening unit for door closers wherein the hydraulic fluid is completely confined and the door closer case is kept dry; and to provide an improved door closer which is simple in operation, manufacture, and repair and inexpensive to maintain.

A specific embodiment of this invention, together with several variations of the actuating mechanism, are shown in the accompanying drawings in which:

FIGURE 1 is a plan view of the subject door closer with the cover removed and partly in section to show the flow control passages of the hydraulic dampening unit;

FIG. 2 is a cross sectional view of the closer shown in FIG. 1 taken substantially on the line 2—2 in FIG. 1;

FIG. 3 is a plan view of the dampening unit subassembly showing the reservoir housing, header, and cylinder block;

FIG. 4 is a side elevational view of the dampening unit subassembly shown in FIG. 3.

FIG. 5 is an end elevational view of the header of the dampening unit as on line 5—5 of FIG. 2;

FIG. 6 is a fragmented enlarged cross sectional view of the front piston rod sealing means in the header of the dampening unit;

FIG. 7 is a plan view of the crank plate subassembly partly broken away;

FIG. 8 is a vertical sectional view of the crank plate subassembly as taken on line 8—8 of FIG. 7;

FIG. 9 is a cross sectional view of the energy storing actuating means taken substantially on the plane of line 9—9 in FIG. 1 and showing the same in tensioned position;

FIG. 10 is a cross sectional view of a modification of the energy storing subassembly of the subject closing device as adapted for use with a left handed door opening or swing;

FIG. 11 is a further modification of the energy storing subassembly of the subject closing device adapted for actuation both manually and by power means; and

FIG. 12 is an additional modification of the same providing for door operation entirely by power means.

Referring first to FIGS. 1 and 2, it is seen that the closing mechanism is contained within a housing 10 called a cement case since the case is ordinarily recessed within a concrete floor beneath the door when installed. The cement case has upwardly extending side and end walls

and is open at the top for reception of the door closer unit. When the unit is installed in the case a cover plate may be employed to provide a finished appearance.

Shown mounted within the interior of the cement case is an inner casing or housing **12** having upwardly extending side walls **14** and **16**, and end walls **18** and **20** formed integral therewith and being of arcuate configuration. One end wall **18** extends inwardly at its upper margin to form an arcuate radial flange portion **18.1** terminating in outer stop shoulders **98** and **100**, spaced substantially 120 degrees apart, and is provided further at the top center of the end wall **18** with an arcuate radially inwardly-extending flange-like segment **18.2** forming opposing inner stop shoulders **74** and **76** spaced substantially 300 degrees apart for a purpose to be described.

As is best seen in FIG. 1, the inner housing or casing **12** is provided with crank means **22** for converting the door spindle rotation into linear movement to actuate an energy storaging device **24** and hydraulic dampening means **26**.

More particularly, a spindle **28** is mounted in the casing **12** adjacent the end wall **18** and extends upwardly therefrom for supporting the bottom of a door, the spindle being keyed to the door to be rotated by the opening and closing movements of the door and serving as a bottom pivot therefor. The spindle **28** is mounted for rotation within the inner casing **12** as follows: The bottom of the inner casing **12** is provided with an upwardly rising boss **30**, adjacent end wall **18**, having a centrally disposed recess **32** formed with a counterbore adjacent its upper end to define an annular land or shoulder **34**. Positioned within the enlarged upper end portion of the recess is a thrust-bearing assembly **36** the outer race of which is seated on the land **34**, the inner race receiving the reduced lower end **38** of the spindle **28**. The spindle **28** is further provided with an integral collar portion adjacent its lower end forming a shoulder **40** which rests on the inner race of the bearing **36** and prevents downward movement of the spindle.

Spindle **28** extends through cover **21** and is supported for rotation by a bearing **23** within bearing housing **25** threadedly received within an opening in the cover. An O-ring **27** surrounds the spindle **28** at the upper end of the bearing housing **25** to provide a dirt seal. The cover is preferably provided with an opening **29** to permit adjustment of stop means to be later described, and this opening is preferably provided with a suitable closure plate **31**. Just beneath the cover of the closing device, the spindle is formed with an enlarged portion **42** which is formed with splines or teeth **43** which engage the corresponding teeth of a spindle flange **44**. The spindle flange, which is thus drivingly connected to the spindle **28** is formed with an arcuate outwardly extending segment **45** terminating in opposing stop shoulders **70** and **72** spaced approximately 240 degrees apart to abut the fixed inner stop shoulders **74** and **76** at opposite extreme ends of spindle rotation.

The stop shoulders **70** and **72** thus limit the maximum swing of the door, carried on the spindle **28**, independently of the operation of the closer mechanism. It is preferable, however, to provide for some adjustment of this maximum limit stop arrangement in order to accommodate special circumstances that might arise, such as a door handle hitting a wall adjacent the door opening or providing for clearance of the door, at maximum open position, from a projection on the adjacent wall, and to accomplish this adjustable abutment screws **66** and **68** are provided in the stop shoulders **70** and **72** respectively. Each of the screws **66** and **68** is threaded into a bore normal to the face of the shoulder and is adjusted to allow only a predetermined angular movement of the spindle **28** for each direction of rotation. Such adjustment is made with the cover **21** removed, preferably at the factory, and according to specification. Normally, and unless otherwise specified, the range of door swing provided is 90 degrees on each side of the center or door closed position.

Rotatably mounted on the spindle **28** beneath the spindle flange **44** is a hub **46** constrained against axial movement with respect to the spindle by a thrust bearing **48** resting axially on a split collar **50** extending radially outwardly from an annular recess **52** formed in the spindle. The split collar **50** is held in place by a retaining collar **54** which is also rotatably mounted on the spindle **28** and is provided with a counterbore adjacent the upper end to receive the split collar **50**. Mounted on the hub **46** and extending radially therefrom are three axially spaced parallel crank plates **56**, **58** and **60**. Two diametrically opposed crank pins **62** and **64** are secured to and extend through the three crank plates for connection with the dampening mechanism **26** and the energy storing means **24** respectively.

The upper crank plate **56** is preferably integrally connected with hub **46**, as by welding, for rotational movement therewith. As shown, the upper crank plate **56** is substantially circular and is formed with an arcuate segment of its periphery cut away to provide opposed radial stop shoulders **59** and **61** spaced substantially 150 degrees apart for contacting the aforementioned stop shoulders **74** and **76** at opposite ends of spindle rotation. This allows a maximum clockwise rotation of 90 degrees for the spindle, in the arrangement shown in FIG. 1, and serves to protect the closer mechanism against damage from override. At this point adjustment of the stop means is also desired, and for the same reasons as in the case of the spindle flange **44**, and in order to provide such limit stop adjustment an arcuate mounting block **82**, extending radially outward from the circumference of crank plate **56**, is integrally formed on the crank plate **56** to overhang the periphery of the spindle flange **44**. As shown, the mounting block **82** is provided with oppositely threaded bores **84** and **86** to receive respectively adjustment screws **88** and **90** which are provided with enlarged heads **92** and **94** having circumferentially spaced bores **96** extending radially inwardly to permit an appropriate tool to be inserted from above the mechanism to turn the screw with respect to the mounting block. The respective adjustment screw heads **92** and **94** abut stops **98** and **100** respectively at opposite ends of the desired rotation of the spindle **28**, thus determining the position of the door at the end of the opening and closing movements. Adjustment of the screws **92** and **94** is made through the cover plate opening **29** which may be opened by removing the closure **31**.

The intermediate crank plate **58** and the lower crank plate **60** are generally circular in plan view. The intermediate crank plate **58** is formed integrally with, welded, or splined to rotate with hub **46**. The lower crank plate **60** is carried by the crankplates **56** and **58** and is held thereto by the crank pins **62**—**64**, a spacer pin **75** and the housings **102** for the break-away pins to be now described.

As is best seen in FIG. 2, the upper crank plate **56**, intermediate crank plate **58**, and lower crank plate **60** are each appropriately formed with aligned spaced apertures for receiving pin housings **102**, **103**, and **105** extending through and firmly secured to the respective crank plates. Each pin housing is hollow and provided with a lower annular tapered shoulder forming a seat for the helical spring **104** which bares against an axially movable break-away pin **106** which is normally urged upwardly against the surface of the spindle flange **44**.

As shown the pin housings **102**, **103** and **105** are spaced angularly about the axis of the spindle **28**, between the diametrically opposed crank pins **62**—**64**, and on the side adjacent the casing end wall **18**. The pin housings **102** and **105** are radially equidistant from the spindle axis and the pin housing **103**, which is located angularly midway between the pin housings **102** and **105**, is on a different or shorter radius. Also the pin housings **102** and **105** are spaced apart approximately 110 degrees, and

each is approximately 35 degrees inwardly from the adjacent crank pin for a purpose to be later described. To coact with the break-away pins **106** the underside of the spindle flange **44** is provided with three angularly spaced recesses **69**, **71** and **73** located to register coaxially with the pin housings **105**, **103** and **102**, respectively, when the spindle flange is in its centered, or door closed, position and the crank plate assembly is likewise at its door closed position, as shown in FIG. 1. Each recess in the spindle plate is provided with a bushing **107** having a frusto-conical upper end on the break-away pins **106** and hence when the pins **106** are engaged with the bushings **107**, under the action of the spring **104**, the spindle plate **44** is firmly and drivingly engaged with the crank plate assembly.

The purpose of the break-away pin assemblies is to provide a means for permitting manual operation of the door, to open it in case of fire or other emergency, even though the internal mechanism secured to the crank plates were to be frozen or otherwise inoperative. Thus, in the arrangement shown, with three break-away assemblies spaced apart as before explained, the door carried by the spindle **28** can be forced to overcome the retentive action of the pins and once break-away of the spindle flange from the crank plate assembly occurs the door can be easily moved to its full open position. Also, because the angular movement of the spindle flange is limited to approximately 90 degrees in either direction by the coacting limit stops **66—68** and **74—76**, and because of the spacing arrangement of break-away pins relative to the spindle axis, once break-away of the spindle flange **44** from the crank plate assembly occurs the door can be freely moved in either direction until it is returned to its fully closed position at which driving engagement of the flange and crank plates is automatically re-established.

Because the spring actuated break-away pins are located on one side of a line diametrically intersecting the spindle axis and the crank pin centers, the crank plate assembly is balanced by a spacer pin **75** located diametrically opposite the middle break-away pin housing **103**, as shown in FIG. 8.

From the foregoing description it will be understood that when it is desired to open a door mounted on and appropriately keyed to the spindle **28**, the spindle flange **44** and the crank plates **56**, **58** and **60** will be rotated by the spindle in a clockwise direction as viewed in FIG. 1, moving crank pins **62** and **64** in the same direction.

To appropriately store the energy provided by the opening movement of the door and to provide a smooth opening and closing movement for the door, the closing device is provided with an energy storing means **24** and a hydraulic dampening means **26** appropriately connected to the crank pins **64** and **62** respectively.

The energy storing device **24** is pivotally connected to the crank pin **64** by an elongated cylindrical spring rod **110** having an eyelet **112** pivotally secured to crank pin **64** between the intermediate and lower crank plates **58—60**. The far end of the spring rod **110** is provided with a cup shaped spring seat **114** which may be formed integrally with spring rod **110**, welded thereto, or threadedly secured as illustrated. The purpose of the seat **114** is to cause the spring **116** to be compressed when the crank plates are rotated in a clockwise direction thereby storing a reactive force to close the door when it is released.

The helical spring **116** is of a compression type and is held in longitudinal position around the spring rod **110** by a spring cage structure. This spring cage structure, as shown, includes two longitudinally spaced retainer blocks **118** and **120** appropriately formed with four spaced apertures for receiving four rods **122** spaced equi-angularly around the periphery of the helical spring **116**, to form a guide therefor, and these rods are secured to the retainer blocks by means of hexagonal nuts **124**. Each of the interior portions of the respective spring retaining blocks **118** and **120** may be recessed as shown to provide a seat for the spring and for the spring seat **114** respectively. Further, the spring retainer block **120** is formed with an axially projecting boss **126** which abuts a spacing boss **128** formed on the interior of the arcuate end wall **20** of the case **12**. The spring retainer block **120** is secured to the end wall boss **126** by means of a bolt **130** which is threadedly received in spacing bosses **126** and **128** to hold them securely together. The retaining block **118**, which is fixedly supported by suitable means on the casing structure, is provided with a relatively large central opening for passage of the spring rod **110** to permit angular movement of the spring rod as it swings to follow the arcuate movement of the crank pin **64**. Thus, the retaining block **118** provides a firm seat receiving the thrust of the helical spring **110** when the spring seat **114** compresses the spring, within the guideways provided by the cage rods **122**, in response to the movement of the spindle flange **44** in a clockwise or opening direction. When the door is released, expansion of the spring against the fixed block **118** will pull the connecting rod **110** by means of the spring seat **114** and turn the crank plates in the counterclockwise direction to automatically return the door to closed position.

Working concurrently with the energy storing device just described is the hydraulic means **26** which is actuated by a connecting rod **132** formed with an eyelet **134** at one end pivotally secured on the crank pin **62** between intermediate crank plate **58** and lower crank plate **60**. The other end of the connecting rod **132** is pivotedly connected to a cross head or slide block **144** mounted to slide longitudinally of the casing **12** on suitable longitudinally extending guideways **136** and **138**, and between vertical parallel guide walls **140** and **142** formed in the casing **12**. The slide block **144** is substantially rectangular in configuration, the front portion being recessed laterally to form a yoke receiving the eyelet **146** formed on the said other end of the connecting rod **132**. The upper and lower arms of the yoke are provided with apertures aligned to receive retaining pin **148** which extends through these arms and through the eyelet **146** to pivotally secure connecting rod **132** and permit the connecting rod **132** to pivot horizontally to accommodate the arcuate motion of the crank pin **62**. The rear portion of the guide block **144** threadedly receives one end of a piston rod **150**. A pin **151** may be inserted through an appropriate aperture in the guide block and through the end of the piston rod **150** to secure the rod in place within the block.

The dampening mechanism is comprised generally of the following elements: a piston **159**, a cylinder block **152**, a header **154** and a reservoir **156**.

The piston **159** threadedly receives the end of the connecting rod **150** (FIG. 2). Preferably the respective threads are loose to accommodate slight misalignment of the rod with respect to the piston, a pin **161** preventing detachment during use.

The cylinder block **152** is a generally rectangular block formed with a cylinder bore **158**, for slidably receiving the piston **150**, and the cylinder bore is provided at each end with a pair of longitudinally spaced ports **160**, **162**, **164** and **166**, respectively, the innermost ports **162** and **164** being spaced not further inwardly than the width of the piston at the respective ends of travel. The ports **160** and **162** communicate with a longitudinally extending horizontal passage **168** through valve bores **170** and **172** extending upwardly through the cylinder block and each formed at the upper end to receive a needle valve as shown at **174***a* and **174***b* in FIG. 4. These needle valves **174***a* and **174***b* act to control the rate of fluid flow through the respective ports. The ports **164** and **166** communicate with a second longitudinal extending horizontal passage **176** through valve passages **171** and **173** respectively also formed to receive needle valves **174***c* and **174***d*. The two passageways **168** and **176** are substantially parallel and are inter-connected by means of a centrally located transverse passage or bore **178**. Parallel to the first two

mentioned passages and communicating with the transverse passageway 178 is a reservoir passage 180.

The end of each of the respective passages 168 and 176, nearest the needle valves, terminate short of the end of the cylinder block. However, the other end of each of the passages, 168 and 176, extends through to the (opposite) end of the cylinder block 152 and each is formed with a counterbore, 182 and 184 respectively, which tapers inwardly to meet the respective passages 168 and 176 and to provide a seat for check valve balls 186 and 188, urged against the respective seats by springs 190 and 192. The counterbores 182 and 184 are respectively provided with passages 194 and 196 communicating with the cylinder bore through ports 198 and 200. Passages 194 and 196 and the ports 198 and 200 are larger than the passages 170, 171, 172, and 173 in order to provide a more rapid flow into the cylinder bore behind the piston, as the piston moves forwardly, than the speed of flow outwardly from the cylinder bore in front of the piston as controlled by the respective valves 174. This fluid entering behind the piston through the respective passages 198 and 200 obviates any danger of a vacuum forming behind the piston upon very rapid operation of the door in either direction.

The far end of the cylinder block 152 is sealed by a cap plate 202 secured thereto by bolts 204. Cap plate 202 is formed with a generally cylindrical axially projecting boss 206 which abuts spacing boss 208, formed on the end wall 20 of case 12, and to which boss 202 is secured by a bolt 131.

The opposite end of the cylinder block 152 is closed by the header 154 which is secured to the block 152 by means of bolts 212. As shown, the header 154 is provided with an annular recess 214 containing an O-ring 216 which provides a seal between the header and the cylinder block. Further, the header 154 is provided with a piston bore 218 for receiving the piston rod 150 and two counterbores 220 and 222 formed at opposite ends of the header concentrically with the piston rod bore 218. The counterbore 222 is provided with an annular sealing ring 224 being generally V-shaped in cross section with one of the extending lip portions contacting the counterbore 222 and the innermost extending lip wiping the surface of the piston rod 150. Since this seal will be exposed to the relatively high pressures of the fluid contained in the cylinder bore 158 the two extending lips face toward the cylinder bore, the pressure tending to spread the lips to assure good sealing contact. The ring is held in position by a washer 226 which is held against the annular sealing ring 224 by means of a snap ring 228 inserted within the snap ring groove 230.

The counterbore 220 in the header 154 is provided with a pair of annular sealing rings 232 and 234 which are formed with the same V-shaped configuration described before, the innermost annular sealing ring 234 being inserted with the lips projecting toward the cylinder bore, or high perssure side, while the annular sealing ring 232 is positioned with the lips extending in the opposite direction toward the low pressure side. This is shown in detail in FIG. 6. Between the two annular sealings rings 232 and 234 a washer 236 is positioned and held in place by a snap ring 238 secured within the snap ring groove 240. Likewise the sealing ring 232 is held in position by a washer 242 and a snap ring 244 secured within groove 246.

Thus, it will be seen that the piston rod 150 is provided with a sealing ring 224 which opposes the high pressure within the cylinder 158 and a pair of opposing sealing rings 232 and 234 spaced from the first sealing ring to provide a double seal against leakage along the piston rod, the seal 232 being a back seal at atmospheric pressure. Piston bore 218 in the header is also formed with a central portion sliightly larger in diameter than the piston rod 150 to provide a pressure relieving chamber between the high pressure seal 224 and the low pressure seal 234. This chamber connects with a vertical passage extending downwardly through the header and closed at its top with a cap or plug 250. Passage 248 communicates with passage 252 which leads into passage 180 in the cylinder block. Further, passage 248 communicates with passage 254 which leads to the bottom of the reservoir 156. Thus, the enlarged bore 218 is under the relatively low pressure of the reservoir head and any leakage of high pressure fluid past the seal 224 will be immediately relieved to the reservoir. The low pressure seal 234 and the back seal 232 are thus free to insure that there will be no leakage of fluid from the cylinder bore outwardly along the piston rod 150 and into the casing 12.

As shown, the reservoir 256 has an inwardly extending flange 261 around its top periphery provided with threaded apertures which receive screws 262 to secure the top 260 thereto. The depth of the reservoir is such as to provide clearance for movement of the cross head 144 and the reservoir body is suported from the cylinder block header 154 by bolts 264 extending through the end wall of the reservoir and into the header body, as shown in FIGS. 3 and 4. Further the reservoir is formed with an aperture 266 aligned and communicating with passage 254 for passage of fluid to and from the reservoir. The purpose of this reservoir is to assure sufficient fluid supply for efficient operation of the hydraulic unit and to provide space for fluid expansion and to accommodate the volumetric differential between the two ends of the cylinder due to the piston rod 150. It will now be seen that the hydraulic unit 26 is a complete sub-assembly, independent of the other components of the closer, except for the connection of the piston rod to the crank plate assembly, and independently mounted and removable in the casing 12. Also the hydraulic system is wholly self contained so that the interior of the casing is always dry.

To install the subject door closer for use, the outer housing or cement case 10 is usually set in place and suitably secured beneath the door opening on that side of the opening from which the door is to pivot, the case 10 being dimensionally located relative to the predetermined pivot axis of the door. The inner housing 12 containing the closer mechanism is then positioned within the outer housing and secured by the bolts 130. The door is then mounted directly on the spindle 28, and suitably keyed thereto, after which the door is pivotedly connected to the door frame header by an axially adjustable pivot in the usual and well known manner. As seen in FIG. 1 the closer mechanism is arranged for a right hand swing or opening movement of the door, as viewed from the spindle axis, which turns the spindle clockwise as shown in this figure. As will be explained further, this particular door closer is quite versatile in being easily adapted for use with a left hand opening movement or for use with a left hand opening movement or for use wtih automatic actuating mechanisms.

In the initial or closed position, the adjustment screw head 92, on the upper crank plate 56, abuts the fixed stop 98 on the casing 12 to retain the door in the centered closed position and against any further movement in the left hand direction. With the door in place and the cover secured, an elongated tool may be inserted through the cover plate aperture 20 and progressively inserted into the adjustment bores 96 of the screw head and the screw thereby rotated to achieve an exact alignment of the door with the frame when in the closed position. The door may then be moved to the open position and the elongated adjustment tool inserted to adjust the other screw 94 for engagement with the stop 100 to achieve an exact terminal opening position such that the door will not strike a wall or other obstruction that might be present. Since the fixed stop shoulders 98 and 100 are at least 120 degrees apart and the mounting block 82 somewhat less than 30 degrees between faces, a fairly wide

range of adjustment may be had to obtain a variety of terminal door positions in each direction of door movement. Further, since such adjustments are made with the cover **21** in place, the danger of inadvertent damage to the remainder of the closer mechanism by amateur repairmen is obviated.

When the door is pushed open and the spindle **28** is rotated in a clockwise direction as viewed in FIG. 1, the spindle flange **44** also rotates in a clockwise direction and through the break-away pins **106** drives the crank plate assembly to move the diametrically opposed crank pins **62** and **64** in the same direction.

As the energy storing crank pin **64** rotates in a clockwise direction, the spring rod **110** is moved from right to left as viewed in FIG. 1 and the spring seat **114** moved from right to left thereby compressing spring **116** axially within the confines of the spring case proportionately to the angularity of door opening movement as shown in FIG. 9.

Simultaneously dampening crank pin **62** is moving in a clockwise direction to move the connecting rod **132** from left to right, as viewed in FIG. 1, moving the connecting rod **132**, the piston rod **150**, and piston **159**, from left to right.

As the piston **159** moves forwardly in the cylinder **158** the fluid completely filling the cylinder **150** is pushed out through the ports **164—166** and through passages **176**, **184** and **200**, to the rear end of the cylinder behind the piston **159**, excess fluid going through passages **180**, **252**, **248**, and **254** into the reservoir tank **258**. The rate of fluid flow into the passage **176** is effectively controlled by adjusting the respective needle valves **174***c* and *d* from the upper side of the cover through which they project. This then controls the initial and terminal speed of the door opening movement. As the piston **159** progresses forwardly expelling fluid from the cylinder a large proportion of the fluid passing through passage **176** will force check valve **188** open permitting this fluid to go freely through passage **196** through port **200** into the space behind the piston thereby minimizing back pressure that would otherwise obstruct free operation of the door. When the piston moves in the opposite direction, upon closing movement of the door, the opposite flow of fluid is controlled by the needle valves **174***a* and *b*, as will be apparent from FIGS. 3 and 4, and in this case make up fluid will be drawn from the reservoir to compensate for the greater volume in the cylinder on the forward side of the piston. The reservoir thus assures that the space behind the moving piston will always be filled with fluid regardless of the direction of piston movement. When the piston **159** approaches the end of its stroke in either direction it covers one or the other of the ports **162** and **164** and the fluid being expelled by the piston escapes only through the remaining ports **162** and **166** respectively, thus slowing the rate of piston movement significantly during the final portion of door movement to prevent the door from slamming at the terminal position.

When the door is released after being manually opened the compressed spring **116** acts against the spring seat **114** pushing the spring rod **110** from left to right, as viewed in FIG. 1, causing rotation of the upper crank plate assembly spindle flange **44** and spindle **28** in a counter clockwise direction thereby swinging the door automatically toward the closed position.

When it is desired to change the rate of opening or closing movement of the door, the appropriate needle valves **174***a*, *b*, *c*, or *d*, may be adjusted from the top of the cover to effect the desired rate of speed.

The safety break-away mechanism is particularly designed to provide panic escape through the door in the event that the internal mechanism becomes jammed or it is desired to force open the door oppositely to the closer swing, and yet to provide protection for the internal mechanism to prevent damage by just such panic exits or forced openings.

In operation the break-away mechanism functions as follows: When the door is in the closed position with the closer mechanism in the position shown in FIG. 1, whether the mechanism is jammed or it is desired to open the door oppositely to the close swing, the door is pushed manually in either direction with sufficient force to cam the breakaway pins **106** from the respective recesses **107** permitting the spindle **28** and spindle flange **44** to rotate independently of crank plate assembly and hence, independently of the internal mechanism and the adjustable stop devices **92** and **94** on the upper crank plate **56**. Since the spindle flange stop shoulders **70** and **72** are spaced substantially 240 degrees apart, and there is approximately 90 degrees between the stop shoulders **70—72** and the abutments **74—76** when the door is in the closed position, the spindle and door may be rotated through an angle to achieve about 90 degrees of opening in either direction in an emergency. Since the internal closing mechanism will not tolerate a movement much greater than 90 degrees in the opening direction, the adjustable stop and the fixed stops are on the upper crank plate to prevent excessive operation of the internal mechanism and obviate the possibility of damage thereto during emergency forcing of the door.

It will thus be seen that the adjustable limit or stop means provided on the spindle flange **44** and on the upper crank plate **56** serves the dual purpose of not only providing for positive limiting of the door movement during normal and emergency operation, to prevent possibility of breakage of glass and other damage to the door, but also serves as a positive protection against damage to the internal mechanism of the closer during emergency or panic opening of the door. Also, because the coacting stop shoulders **74—76** and **98—100** are integral on the casting forming the casing **12**, they are fixed stops of the greatest strength and are most readily and conveniently formed, requiring no separate mounting or attachment.

One of the most salient advantages of the subject closing mechanism is its versatility in being adaptable for use with either a left hand or right hand door swing; and further its adaptability for use with either combined manual and power actuation, or total power actuation.

As has been noted before in this disclosure, the entire mechanism, with the exception only of the spindle flange **44** and the energy storing apparatus, is entirely symmetrical and hence, useable for either right or left hand door swing. Thus to adjust the closer for use with a left hand swing the spindle flange **44** is replaced by one having its break-away pin recesses located 90 degrees clockwise from the location shown in FIGS. 1 and 7, and the spindle **28** is rotated until adjustment screw **94** abuts the stop shoulder or abutment **100** in the centered or closed position of the door. As seen in FIG. 10, the same spring cage is used, with the compression spring **116** abutting the retainer block **120**. The connecting rod **110** is much shorter, however, only just protruding through the opening in the forward retaining block **118** and terminating in a movable spring seat **115** located close to the block **118**. The spring will then be compressed to the right, as seen in FIG. 10, by counterclockwise movement of the spindle **28** into a left handed open position of the door.

As seen in FIG. 11, the closer mechanism may be simply and easily adapted for use with a power actuating means to provide alternate actuation by manual means or by the power means. To adapt the closer mechanism for this use, the casing **12** is provided with an extension as shown at **300** forming a generally cylindrical bore for receiving a piston stud **302** of the drive piston **304**. The piston stud **302** is provided with a threaded bore for receiving the threaded drive shaft **306**. The drive shaft **306** is connected for rotation with motor shaft **308** through a slip clutch indicated at **310**. Motor shaft **308** is driven by a reversible motor **312**.

Piston head **304** is generally square in configuration and

is provided with four bores for slidably receiving the guide bars 122 of the spring cage. The spring cage shown in FIG. 11 is similar to that shown in FIG. 1 in that the compression spring 116 abuts the fixed retaining block 118. The spring seat 117 is formed to pivotally connect with an end eyelet of the connecting rod 119, and also is formed with bores to receive slidably the guide bars 122 of the spring cage. Preferably a spring opened micro-switch 314 is mounted in the piston head, on the side adjacent the spring seat 117, to be normally held closed by engagement with the spring seat 117 and is connected in the motor circuit to stop the motor should be door meet with resistance during the closing movement causing the piston head 304 and spring seat 117 to separate. In operation, the door may be opened manually in the usual manner, causing the connecting rod 119 to move from right to left compressing spring 116, at which time the motor is, of course, inoperative because of separation of the spring seat 117 from the piston head 304, or the door may be opened by operation of the reversible motor 312 in one direction causing piston 304 to move from right to left compressing spring 116. In manual operation, the compression spring 116, when the door is released, returns the door to the closed position. In the case of power operation the motor 312 is reversed to close the door. In this last case suitable limit switch means, not shown, will be provided to stop the motor when the door reaches closed position.

In the embodiment shown in FIG. 12 the spring cage is omitted and the reversible motor 312 directly opens and closes the door through the piston 304 and the connected rod 119 pivotally secured thereto. The same thing could be accomplished in the embodiment shown in FIG. 11 by securing the spring seat 117 to the piston 304. In the embodiment shown in FIG. 12 limit switches 316 and 318 are provided at each end of piston travel to cause the motor to stop and to set up circuitry for reactivation of the motor by conventional means such as electric eye devices or electric foot mats. Also, in the arrangements of FIG. 11 this function is accomplished by the guide rods 122.

Wherefore, it is seen from the foregoing description and drawings that an improved door closing mechanism has been provided which utilizes a panic break-away arrangement permitting door movement in either direction, through a total of 180 degrees, while protecting the internal mechanism which is designed to accommodate a much smaller door swing; which permits precise adjustment of the full opened and closed positions of the door; in which an improved hydraulic mechanism, comprising a self-contained sub-asembly, completely separates the fluid and mechanical operations of the closer to minimize possibility of oil leakage around the door spindle; which is simply and inexpensively adapted for use with either a left or right handed door swing and which may be also used with power means for actuating door movement; and which is simple in operation, manufacture and repair and inexpensive to make and maintain.

Although several embodiments of this invention have been herein shown and described it will be understood that numerous details of the constructions shown may be altered or omitted without departing from the spirit of my invention as defined by the following claims:

I claim:

1. In a door controlling mechanism, a casing having upwardly extending side and end walls, a spindle rotatably supported in said casing on a vertical axis for controlling the opening and closing movement of a door carried by the spindle, a radial flange drivingly secured to said spindle within said casing, a crank plate rotatably mounted on said spindle within said casing, break-away means extending between said flange and said crank plate to provide a driving connection therebetween for predetermined conditions of torque and permitting relative rotation therebetween when said torque is exceeded, two diametrically opposed crank pins on said crank plate, means pivotally attached to one of said crank pins for drivingly rotating said spindle from the open to the closed position of the door, means pivotally attached to the other crank pin for resisting rotating of said spindle adjacent the end of its angular movement, means for adjustably limiting the rotation of said crank plate in either direction, and means for adjustably limiting the rotation of said spindle independently of said crank plate in either direction.

2. In a door controlling mechanism, a casing having upwardly extending side and end walls, a spindle rotatably supported in said casing on a vertical axis adjacent one end wall for controlling the opening and closing movement of a swinging door carried by the spindle, a radial flange drivingly carried by said spindle within said casing, a crank plate rotatably mounted on said spindle within said casing, break-away means extending between said flange and said crank plate to provide a driving connection therebetween for determined conditions of torque and automatically releasable to permit relative movement therebetween when said torque is exceeded, two diametrically opposed crank pins on said crank plate, means pivotally attached to one crank pin for drivingly rotating the spindle from the open to the closed position, means pivotally attached to the other crank pin for resisting rotation of said spindle adjacent the end of its angular movement, means for adjustably limiting the rotation of said crank plate, means for adjustably limiting the rotation of said spindle independently of the crank plate, and a cover for said casing having openings permitting adjustment of said limiting means through said cover.

3. In a door controlling mechanism, a casing having upwardly extending side and end walls, a spindle rotatably supported vertically within said casing adjacent one end wall for controlling the opening and closing movement of a swinging door carried on the spindle, a radial flange drivingly carried by said spindle within said casing, a crank plate rotatably carried by said spindle within said casing, break-away means extending between said spindle flange and said crank plate to provide a driving connection therebetween for determined conditions of torque and automatically releasable to permit relative movement therebetween when said torque is exceeded, two diametrically opposed crank means on said crank plate, means attached to one of said crank means for drivingly rotating the spindle from the open to the closed position of the door, means attached to the other crank means for resisting the rotation of said spindle adjacent the end of its angular movement, stop means on the one end wall of said casing and coacting means on said crank plate for limiting the rotation of said crank plate in both directions of rotation, and coacting stop means on said radial flange and said casing for limiting the rotation of said spindle independently of said crank plate and in either direction, said stop means including adjustment means for varying the rotational limits of the crank plate and the spindle flange, and a cover for said casing including a radial bearing for supporting said spindle and having an opening permitting adjustment of the crank plate stop means through said cover.

4. In a door controlling mechanism, a casing having upwardly extending side and end walls, a vertical spindle rotatably supported within said casing adjacent one end wall for controlling the opening and closing movement of a swinging door carried on the spindle, a radial flange drivingly carried by said spindle within said casing, a crank plate rotatably carried by said spindle within said casing, break-away means extending between said flange and said crank plate to provide a driving connection therebetween for determined conditions of torque and releasable to permit relative movement therebetween when said torque is exceeded, two diametrically opposed crank means on said crank plate, power means attached to one of said crank means for rotating the spindle from the open to the closed position, hydraulic dampening

means attached to the other crank means for resisting the rotation of said spindle in either direction, adjustment means for controlling the initial and terminal hydraulic resistance to spindle rotation during both the opening and closing movements of the door, coacting stop means on said casing and on said crank plate for limiting the movement of said crank plate in each direction of spindle rotation, coacting stop means on said radial flange and on said casing for limiting the rotation of said spindle independently of said crank plate, said stop means including adjustment means for varying independently the rotational limits of the crank plate and the spindle, and a cover for said casing including a radial bearing for supporting said spindle and an opening to permit adjusting said adjustment means through said cover.

5. In a door controlling mechanism, a casing having upwardly extending side and end walls, a vertical spindle rotatably supported within said casing adjacent one end wall for controlling the opening and closing movement of a door carried on the spindle, a radial flange drivingly carried by said spindle within said casing, a crank plate rotatably carried by said spindle within said casing, breakaway means extending between said flange and said crank plate to provide a driving connection therebetween for determined conditions of torque and permitting relative movement therebetween when said torque is exceeded, two diametrically opposed crank pins on said crank plate, a spring guide means secured to the other end of said casing adjacent one side wall and including a fixed spring seat, a helical compression spring within said spring guide means, a spring rod projecting into one end of said spring guide means and having one end connected to one of said crank pins, a movable spring seat secured to the other end of said spring rod and mounted for reciprocation within said guide means for compressing the spring when the crank plate is rotated in one direction by manual operation of the door and for drivingly rotating the crank plate in the opposite direction when the door is released, and hydraulic means pivotally attached to the other crank pin for resisting the rotation of said crank plate in either direction.

6. In a door controlling mechanism, a casing having upwardly extending side and end walls, a vertical spindle rotatably supported within said casing adjacent one end wall for controlling the opening and closing movement of a door carried on the spindle, a radial flange drivingly carried by said spindle within said casing, a crank plate rotatably carried by said spindle within said casing, breakaway means extending between said flange and said crank plate to provide a driving connection therebetween for determined conditions of torque and permitting relative movement therebetween when said torque is exceeded, two diametrically opposed crank pins on said crank plate, a spring guide means secured to the other end of said casing adjacent one side wall and including a fixed spring seat, a helical compression spring within said spring guide means, a spring rod projecting into one end of said spring guide means and having one end connected to one of said crank pins, a movable spring seat secured to the other end of said spring rod and mounted for reciprocation within said guide means for compressing the spring when the crank plate is rotated in one direction by manual operation of the door and for drivingly rotating the crank plate in the opposite direction when the door is released, a piston projecting into the other end of said cage for reciprocation therein to engage said movable spring seat axially, power means for actuating said piston in both directions, switch means for stopping said power means when said piston has moved a predetermined distance in either direction, and hydraulic means pivotally attached to the other crank pin for resisting the rotation of said crank plate in either direction.

7. In a door controlling mechanism, a casing having upwardly extending side and end walls, a vertical spindle rotatably supported within said casing adjacent one end wall for controlling the opening and closing movement of a door carried on the spindle, a radial flange drivingly carried by said spindle within said casing, a crank plate rotatably carried by said spindle within said casing, breakaway means extending between said flange and said crank plate to provide a driving connection therebetween for determined conditions of torque and permitting relative movement therebetween when said torque is exceeded, two diametrically opposed crank pins on said crank plate, a spring guide means secured to the other end of said casing adjacent one side wall and including a fixed spring seat, a helical compression spring within said spring guide means, a spring rod projecting into one end of said spring guide means and having one end connected to one of said crank pins, a movable spring seat secured to the other end of said spring rod and mounted for reciprocation within said guide means for compressing the spring when the crank plate is rotated in one direction by manual operation of the door and for drivingly rotating the crank plate in the opposite direction when the door is released, hydraulic means pivotally attached to the other crank pin for resisting the rotation of said crank plate in either direction, coacting stop means on said casing and on said crank plate for limiting the angular movement of said crank plate, and coacting stop means on said radial flange and said casing for limiting the rotation of said spindle, said stop means including adjustment means for varying the rotational limits of the crank plate and the spindle flange.

8. In a door controlling mechanism, a casing having upwardly extending side and end walls, a vertical spindle rotatably supported within said casing adjacent one end wall for controlling the opening and closing movement of a door carried on the spindle, a radial flange drivingly carried by said spindle within said casing, a crank plate rotatably carried by said spindle within said casing, breakaway means extending between said flange and said crank plate to provide a driving connection therebetween for determined conditions of torque and permitting relative movement therebetween when said torque is exceeded, two diametrically opposed crank pins on said crank plate, a spring guide means secured to the other end of said casing adjacent one side wall and including a fixed spring seat, a helical compression spring within said spring guide means, a spring rod projecting into one end of said spring guide means and having one end connected to one of said crank pins, a movable spring seat secured to the other end of said spring rod and mounted for reciprocation within said guide means for compressing the spring when the crank plate is rotated in one direction by manual operation of the door and for drivingly rotating the crank plate in the opposite direction when the door is released, a piston projecting into the other end of said cage for reciprocation therein to engage said movable spring seat axially, power means for actuating said piston in both directions, switch means for stopping said power means when said piston has moved a predetermined distance in either direction, hydraulic means pivotally attached to the other crank pin for resisting the rotation of said crank plate in either direction, coacting stop means on said casing and on said crank plate for limiting the angular movement of said crank plate, and coacting stop means on said radial flange and said casing for limiting the rotation of said spindle, said stop means including adjustment means for varying the rotational limits of the crank plate and the spindle flange.

9. In a door controlling mechanism, a casing having upwardly extending side and end walls, a vertical spindle rotatably supported within said casing adjacent one end wall for controlling the opening and closing movement of a door carried on the spindle, a radial flange drivingly carried by said spindle within said casing, a crank plate rotatably carried by said spindle within said casing, breakaway means extending between said spindle flange and said crank plate to provide a driving connection there-

between for determined conditions of torque and to permit relative movement therebetween when said torque is exceeded, two diametrically opposed crank pins on said crank plate, a spring guide means extending along one side wall of the casing and secured to the other end of said casing, said guide means having a fixed spring seat adjacent one end, a helical compression spring confined by said guide means and having one end bearing axially on said fixed seat, a spring rod projecting axially of the spring and having one end pivotally connected to one of said crank pins, a movable spring seat secured to the other end of said rod and axially engaging the other end of said spring for compressing the spring where the crank plate is rotated in one direction upon manual operation of the door and for drivingly rotating the crank plate in the opposite direction when the door is released, and hydraulic means pivotally attached to the other crank pin for resisting the rotation of said crank plate, said hydraulic means including adjustment means for controlling the hydraulic resistance during the initial and terminal movement of the crank plate in both the opening and closing movements of the door.

10. In a door controlling mechanism having hydraulic dampening means, including a cylinder block having a bore forming a cylinder, a piston in said cylinder, and a connecting rod projecting from said piston through a connecting rod bore at one end of said cylinder block, a sealing means for said connecting rod comprising a counter-bore at each end of said rod bore, an annular first sealing ring in the counter-bore adjacent said cylinder bore and having a generally V-shaped configuration in cross section, one leg of said ring engaging the surface of the said counter-bore and the other leg wiping surface of the cylinder rod, said legs extending toward said cylinder bore, means for retaining said sealing ring axially within said counter-bore, second and third sealing rings each having a generally V-shaped cross sectional configuration in the counter-bore farthest removed from said cylinder bore, one leg of each of second and third rings engaging the counter-bore and the other leg wiping the connecting rod, the second sealing ring being nearest said cylinder bore and havin its legs extending toward said cylinder bore, the legs of the third sealing ring extending away from said cylinder bore, and means for retaining said second and third rings axially within the last named counter-bore and in fixed back to back relation with each other.

11. In a door closing mechanism for controlling the opening and closing speed and for positively closing a door, a casing having upwardly extending side and end walls, a vertically extending spindle rotatably supported in said casing adjacent one end thereof for controlling the opening and closing movement of a swinging door pivotally carried on said spindle, a radial flange drivingly carried by said spindle and having an outwardly projecting arcuate segment terminating at opposite ends in radial stop shoulders, a crank plate rotatably carried by said spindle, break-away means carried by said crank plate and having a driving connection with said radial flange during predetermined conditions of torque and releasable to permit separation from said flange when said torque is exceeded, said crank plate having a radially extending arcuate segment forming a pair of opposite radial stop shoulders, a fixed abutment integral on the adjacent end wall of said casing for engaging the radial stop shoulders of said spindle flange and the crank plate to limit the angular movement of said flange and crank plate at a predetermined position of each, a mounting block extending radially from said crank plate segment and including two oppositely extending internally threaded tangential bores, an adjustment screw thread into each of said bores, an inwardly projecting flange portion on each side wall of said casing terminating in a radial stop shoulder facing a respective bore of said mounting block, the heads of said adjustment screws abutting the last named stop shoulders at opposite ends of crank plate rotation to adjustably limit and control the opened and closed positions of the door turning with said spindle during normal operation, the angular spacing of the segment stop shoulders on said spindle flange being such as to permit substantially 90 degree rotation thereof in either direction from the closed door position of the spindle, the angular spacing of the stop shoulders on the crank plate being such as to permit substantially 90 degrees of maximum rotation of the crank plate from closed to full open position of the door in one direction only independently of said adjustment screws in said mounting block, diametrically opposed crank pins secured to said crank plate, means secured to one of said crank pins for returning the door to the closed position after the door has been opened, and hydraulic dampening means secured to the other of said crank pins for resisting the terminal portions of the opening and closing movements of the door.

12. In a door controlling mechanism comprising, a casing having upwardly extending side and end walls, a vertical spindle rotatably supported within said casing adjacent one end wall for pivotally supporting a swinging door, a radial flange fixed to and carried by said spindle within said casing, a crank plate rotatably mounted on said spindle within said casing, break-away means on said crank plate and releasably engaging the spindle flange for providing a driving connection therebetween within a predetermined limit of torque applied to the spindle and permitting relative movement of the spindle flange and crank plate when said torque is exceeded, diametrically opposed crank means on said crank plate, means pivotally connected to one of said crank means for drivingly rotating the spindle from the open door position to the closed door position, and hydraulic means pivotally connected to the other crank means for resisting the rotation of said spindle during the terminal portions of its rotation in either direction, said hydraulic means including a cylinder block having a cylinder bore closed at one end, a header closing the other end of said bore and having a piston rod guide bore, a piston in said cylinder having a piston rod extending outwardly through said guide bore, a cross head connected to the outer end of said piston rod, means connecting said cross head to said other crank means, fluid filling said cylinder bore on both sides of said piston, a pair of longitudinally extending passages in said cylinder block and communicating with the cylinder adjacent each end thereof, one of said passages having a pair of axially spaced inlet ports leading from one end of the cylinder and an adjustable needle valve controlling each port, a check valve adjacent the other end of said one passage for permitting fluid flow into said cylinder only, the other of said passages having spaced inlet ports leading from the opposite end of the cylinder and needle valves controlling said ports, said other passage having a check valve in its opposite end to permit fluid flow into said cylinder only, a cross passage in said cylinder block connecting said pair of passages intermediate their ends, a reservoir mounted on said cylinder block header and extending therefrom parallel with said piston rod, and a passage leading from said reservoir into said cylinder block and communicating with said cross passage, said hydraulic means comprising a self-contained unitary component of the door controlling mechanism whereby the said casing is at all times clear of free flowing hydraulic fluid.

13. In a mechanical door controlling mechanism, a self-contained hydraulic checking unit having a closed fluid circuit, comprising a cylinder block having a cylinder bore therein closed at one end, a header on said cylinder block closing the other end of said bore and having a piston rod guide passage coaxial with said bore, a piston in said cylinder bore and a piston rod extending from the piston and through the guide passage of said header, said cylinder block having a pair of parallel fluid

passages at one side of the cylinder bore extending from end to end thereof, one of said fluid passages having a pair of axially spaced inlets leading from the said bore adjacent one end thereof and an outlet leading into the bore at the opposite end thereof, the other of said fluid passages having a pair of axially spaced inlets leading from the said opposite end of the cylinder bore and an outlet leading into the said bore at the said one end thereof, an adjustable needle valve extending thorugh the adjacent wall of said cylinder block from the exterior thereof and into each of said inlets to said fluid passages, a check valve in the outlet of each fluid passage to permit fluid flow into the cylinder bore only, a cross passage in said cylinder block connecting said fluid passages intermediate their ends, a reservoir mounted rigidly on said header and extending outwardly therefrom parallel with said piston rod, said reservoir and header and cylinder block having mutually connecting passages communicating with said cross passage to provide fluid flow between said reservoir and the first mentioned fluid passages, axially spaced shaft seals in the piston rod guide passage of said header, and a fluid passage in said header leading from the piston rod guide passage between said shaft seals to the mutually connecting passages of said reservoir and header.

14. A door controlling mechanism comprising a casing, a spindle rotatably supported in said casing for controlling the opening and closing movement of a swinging door carried on the spindle and having driving connection therewith, a crank plate carried by said spindle within said casing, means for providing a driving connection between said crank plate and the spindle, a pair of diametrically opposed crank pins on said crank plate, a spring guide means forming an elongate cage secured in said casing and extending lengthwise thereof, said guide means including a fixed spring seat, a helical compression spring within said guide means having one end bearing axially on said fixed seat, a connecting rod having one end connected to one of said crank pins and its other end extending into one end of said guide means, a movable spring seat secured to the said other end of said connecting rod and bearing axially on the other end of said spring, said movable spring seat being mounted for reciprocation within said guide means for compressing the spring against the fixed spring seat when the crank plate is rotated in one direction by manual operation of the door and for drivingly rotating the crank plate in the opposite direction when the door is released, a piston projecting into the other end of said guide means for reciprocation therein to engage said movable spring seat axially, power means for actuating said piston in both directions, switch means for stopping said power means whenever said piston becomes disengaged from said movable spring seat, and hydraulic means connected to the other crank pin for resisting the rotation of said crank plate in either direction.

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