Nov. 13, 1962 W. A. CALHOUN 3,063,086

DOOR HOLDING MECHANISM

Filed May 13, 1960

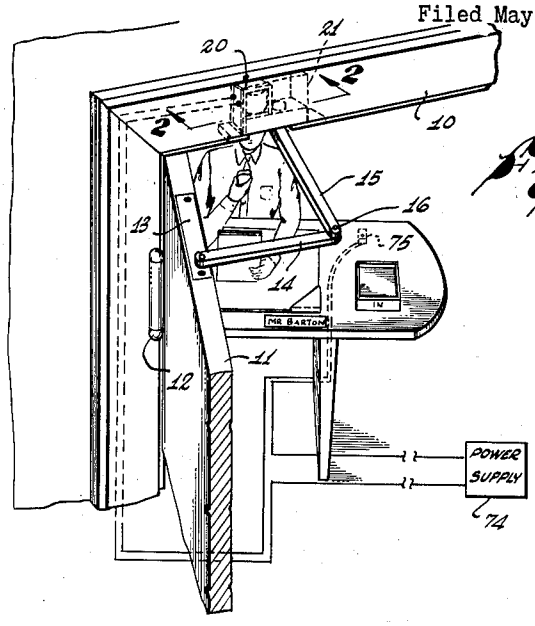


Fig. 1

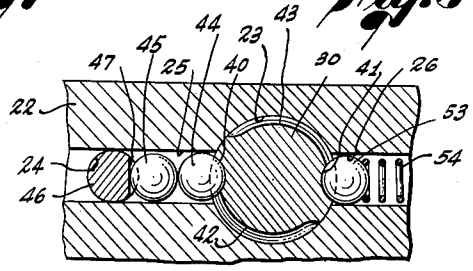


Fig. 3

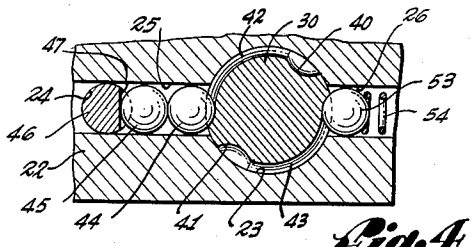


Fig. 4

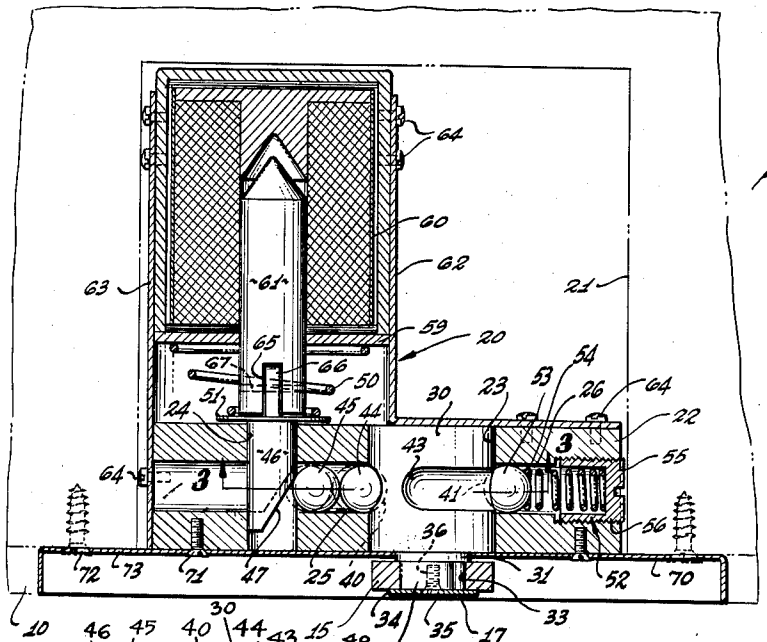


Fig. 2

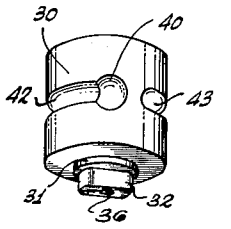


Fig. 5

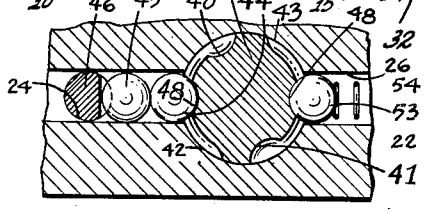


Fig. 6

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DOOR HOLDING MECHANISM

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This invention relates to holding mechanisms and more particularly to a remotely controlled holding mechanism of a type adapted to hold a hinged door in a desired position.

One useful application of the invention is in connection with a door closing device to releasably hold a hinged door in a predetermined open position. For illustrative purposes, the invention will be described in this environment. However, as will become apparent, the invention has other equally useful applications. For instance, the holding mechanism of the invention may be used to advantage in connection with a door opening device to releasably hold a door in a closed position. Thus, the detailed description of this application is not intended to limit the scope of the claims.

In the illustrative application to be described herein, a spring operated or hydraulically controlled door closer is mounted in the upper portion of the door. As is well known in the art, such door closers normally embody a pair of pivotal arms, one of which is secured to the door closer and the other to the door casing. In operation, a force is applied to the arm connected to the door closer to urge the door to its closed position.

To hold the door open against the action of the door closer, it has heretofore usually been necessary to either place a wedge or some other obstruction in the path of the door or to open the door to the extent that the pivotal arms of the door closer are axially aligned or "dead centered." The use of a wedge or the like is bothersome; moreover, opening the door the extent required to "dead center" the arms is frequently undesirable or impossible because of an obstruction.

The present invention has as a primary object to overcome prior disadvantages and to provide certain added advantages. To this end, a power-operated and remotely controlled holding mechanism is provided to releasably hold a door in a predetermined position.

A further object of the invention is to provide a holding mechanism of the type described incorporating means for limiting the extent of total movement of a door.

Another object of the invention is to provide a holding mechanism of the type described which may be manually overpowered without damage to the mechanism or without interfering with its subsequent automatic operation.

A still further object of the invention is to provide a sturdy and durable holding mechanism that is reliable in operation, yet which is relatively inexpensive to manufacture.

These and other objects and advantages of the invention will be better understood by referring to the following detailed description taken in conjunction with the accompanying drawings in which:

FIGURE 1 is a perspective view of a portion of a door casing and hingedly mounted door with an installed door closing device showing the holding mechanism of the invention installed for operation;

FIGURE 2 is a sectional view of the holding mechanism taken on the line 2—2 of FIGURE 1 showing the mechanism installed in the door casing;

FIGURE 3 is a partial section taken on the line 3—3 of FIGURE 2;

FIGURE 4 is a view similar to FIGURE 3, except that

certain members are shown in a different operating position;

FIGURE 5 is a perspective view of a rotatable shaft of the holding mechanism; and

FIGURE 6 is a partial section similar to FIGURES 3 and 4 of a slightly modified form of the mechanism of the invention.

In FIGURE 1 a portion of a door casing **10** is shown mounting a door **11** with a hinge and pin as at **12** in the usual manner. A standard door closing device **13** is mounted in the upper portion of the door **11** and is connected for operation by a pair of pivotal arms **14** and **15**. In order to apply a closing force to the door **11**, a pivotal force is applied to the arm **14** by the door closer at its connection with the arm. The arms **14** and **15** are pivotally joined with a pin **16** so that the closing force acts through the arms **15**, which in turn is pivotally mounted on the casing **10** as at point **17** (FIG. 2) in a manner which will later be explained in detail. The construction of the door closer is well known in the art and forms no part to the present invention, and therefore will not be described in further detail. However, it should be noted that if either of the arms **14** or **15** is held against pivotal movement, the door is held in a given position.

To hold the door in a given position, one of the pivotal arms is operatively connected to a rotatable shaft which, in turn, is adapted to be releasably held in a pretermined position. The rotatable shaft and a holding means are included in a holding mechanism **20**, constructed in accordance with the present invention.

The holding mechanism **20** is shown mounted in a recess **21** in the door casing **10** and is adapted to be operatively connected to the pivotal arm **15**. In operation, the mechanism **20** releasably locks the arm **15** against pivotal movement and thereby holds the door **11** in a given position against the action of the door closing device **13**.

The holding means within the mechanism **20** includes detent and detent receiving means for releasably holding the rotatable shaft in a predetermined position. In addition, auxiliary detent and detent receiving means are included in the illustrative embodiment of the mechanism **20** for reasons that will later be explained.

A generally rectangularly shaped body **22** is provided for mounting the various elements of the holding mechanism **20**. The body **22** has a main bore **23** and a substantially parallel actuator bore **24** extending transversely through it. A detent bore **25** extends longitudinally from one end of the body and connects the main and actuator bores **23** and **24**. An auxiliary detent bore **26** intersects the main bore **23** preferably diametrically opposite from the opening to the auxiliary bore **25** and extends to the opposite end of the body. In the illustrative embodiment, the bore **26** may be a continuation of the bore **25**, although it is not necessary that their diameters be equal nor that their axes be aligned.

A shaft **30** is rotatably mounted in the main bore **23** with a portion projecting below the body **22** for connection to the pivotal arm **15**. The holding mechanism **20** functions to releasably lock the shaft **30** against rotation and thus holds the door **11** in a corresponding open position. The shaft **30** is preferably formed with an integral spacer **31** and an elongated key **32** on its lower end. The key **32** is adapted to be received in a mating slot or keyway **33** formed in the pivotal arm **15**, the two members being retained in assembly by washer **34** and a screw **35** entered in a threaded bore **36** in the key **32**. It will be noted that the elongated shape of the key **32** and its mating keyway **33** serves to preclude relative rotation of the shaft **30** and the arm **15**.

A pair of sockets **40** and **41** preferably with radii substantially equal to the radii of bores **25** and **26**, respec-

tively, are formed in the periphery of the shaft **30**. The sockets **40** and **41** are arranged to be simultaneously aligned with their respective bores **25** and **26**. Thus, in the present embodiment, socket **41** is diametrically opposite socket **40**. A pair of peripheral grooves **42** and **43** are formed on the shaft, the groove **42** extending from the socket **40** and the groove **43** extending from the socket **41**. In cross section the grooves **42** and **43** are preferably formed in the shape of segments of circles with radii substantially equal to the radii of the sockets **40** and **41**, respectively, and of a lesser depth than the sockets. As will be explained later, the angular extent of the grooves **42** and **43** around the shaft **30** determines the limits of rotation of the shaft with respect to the body **22**.

A detent ball **44** is movable in the detent bore **25**, its diameter being preferably just slightly less than the diameter of the bore **25** so that it is free to move axially but is held against radial movement. In the form of the mechanism **20** shown herein, a spacer ball **45** of the same size as ball **44** is also positioned in the bore **25**.

The detent ball **44** is adapted to ride in the groove **42** and to move into shaft-locking engagement with the socket **40**. Since the radius of the ball **44** is substantially equal to the radius of the socket **40**, the ball will completely fill the socket **40** when seated therein to firmly hold the shaft **30** against rotation. Likewise, since the radius of the ball **44** is also substantially equal to the previously defined radius of the groove **42**, the ball will fill the cross-sectional portion of the groove when it is riding therein. Therefore, when the ball **44** is riding in the groove **42**, the ball and groove cooperate to prevent axial movement of the shaft **30** and hence ensure that the socket **40** is longitudinally aligned with the detent bore **25** coincidentally with the angular aligning of the socket and bore.

An actuator **46** in the form of a shaft provided with a wedge surface **47** is longitudinally movable in the actuator bore **24**. The wedge surface **47** is arranged to engage the spacer ball **45** to urge the detent ball **44** into engagement with the shaft **30** as the actuator **46** is moved into the body **22**. The actuator **46** may engage the detent ball **44** directly, but in some cases greater separation is desired for design or other reasons.

A compression spring **50** acts on a stop plate **51** formed on the actuator **46** to yieldingly urge the latter into the body **22**. The actuator **46** is longitudinally movable in its bore **24** between the positions shown in full and phantom lines in FIGURE 2. When the shaft **30** is rotated to the position of FIGURE 3 corresponding to the open or held position of the door, the detent ball **44** is urged into the socket **40** by the spring-loaded actuator **46**. This causes the actuator to move to its extended position shown in full lines in FIGURE 2. When sufficient torque is applied to the shaft **30** to rotate it, the detent ball **45** is cammed out of its socket **40** into the groove **42**, causing the actuator **46** to be moved against the action of the spring **50** to its retracted position, shown in phantom lines in FIGURE 2.

A desirable but not essential feature of my invention is the provision of additional detent means **52** in the auxiliary detent bore **26**. An auxiliary detent ball **53** is yieldingly urged into engagement with the groove **43** or into shaft-locking engagement with the socket **41** coincidentally with like movements of the detent ball **44** into its groove **42** or socket **40**. A compression spring **54** is disposed in the bore **26** to so urge the ball **53**. A cap screw **55** in a correspondingly threaded end portion **56** of the bore **26** serves as means for adjusting the biasing force acting on the ball **53**.

Besides reducing the force necessary on the detent ball **44** to lock the shaft **30** against rotation, the auxiliary detent ball **53** helps to balance the detent forces acting on the shaft **30**. This is particularly true in the illustrative embodiment shown, where ball **53** acts in diametric opposition to the ball **44**. Balancing of the forces is desirable in order to insure even wearing of the shaft **30** and to keep it from binding as it rotates.

In order to selectively release the shaft **30** from its locked position of FIGURES 2 and 3, a remotely controlled solenoid **60** is provided. The solenoid **60** has a plunger **61** for moving the actuator **46** upwardly, against the urging of the spring **50** to, in effect, overcome the action of the spring. Such movement removes the force urging the detent ball **44** into the socket **40**, so that the previously ineffective torque exerted on the shaft **30** by the closing device **13** now becomes effective to rotate the shaft and to cam the detent balls **44** and **53** out of their respective sockets **40** and **41**.

The solenoid **60** is attached to the body **22** by a pair of brackets **62** and **63**, each of which is secured both to a housing **59** of the solenoid and to the body by any suitable means as with screws **64**. When so attached, the housing **59** serves as an abutment for the compression spring **50**.

The plunger **61** is formed with a slotted end portion **65**, which is adapted to receive an upstanding projection **66**, formed on the actuator **46**, when joining the plunger and actuator. A pin **67** is utilized to effect a loose fitting connection between the two members. A loose fitting connection is preferred in order to avoid binding of the plunger **61** as it moves longitudinally in the solenoid **60**.

In mounting the holding mechanism **20** for use with the door closing device **13**, the mechanism is supported in the recess **21** by a soffit plate **70**. The body **22** of the holding mechanism is secured to the plate **70** by any suitable means, as with screws **71**. The plate **70** is in turn secured to the casing **10** as with wood screws **72**.

As viewed in FIGURE 2, the plate **70** is preferably set in a recess **73** in the door casing **10**, the extent of the recess being substantially equal to the combined thickness of the assembly comprising arm **15**, spacer **31**, key **32**, and washer **34**. Thus, when the door **11** is closed, it clears the aforementioned assembly.

The solenoid **60** is connected by suitable leads to a power supply **74** and is adapted to be remotely actuated by a conveniently located switch **75**.

In describing a cycle of operation, it will be assumed that the cycle commences with the door **11** in its closed position. When the door **11** is so positioned, the shaft **30** is arranged to be in the relative angular position illustrated in FIGURE 4. The detent balls **44** and **53** are yieldingly urged into engagement in their respective grooves **42** and **43**.

As the door **11** is opened in opposition to the urging of the door closing device **13**, the arm **15** is pivoted, causing shaft **30** to rotate toward the position shown in FIGURE 3. When the door **11** is opened sufficiently wide to rotate shaft **30** to the position of FIGURE 3, the detent balls **44** and **53** automatically move into shaft-locking engagement with their respective sockets **40** and **41**. The door closing torque applied to the shaft **30** by the device **13** is insufficient alone to rotate the shaft to cam the detent balls **44** and **53** out of their respective sockets **40** and **41**. Thus, the door is held in a predetermined opened position. Should the movement of the door **11** stop short of its predetermined opened position, the door closing device **13** is effective immediately to close the door.

Two independent means are provided for releasing the door from its held position. As previously discussed, the solenoid **60** may be remotely actuated by the switch **75** to overcome the action of the spring **50**. The torque applied to the shaft **30** by the door closing device **13** is then sufficient itself to rotate the shaft **30** to cam the detent balls **44** and **53** out of their sockets. The door **11** is then free to be closed by the operation of the door closing device **13**.

The door **11** may also be released manually from its

held position by merely applying a slight closing force to it. Such a force, in effect, overpowers the holding mechanism and supplies the additional torque necessary to rotate the shaft **30** to cam the balls **44** and **53** out of their sockets. Once the door is released, it, of course, closes under the influence of the door closing device **13**.

In addition to receiving the detent balls for locking shaft **30** to hold door **11** in a predetermined position, sockets **40** and **41** also serve to limit the maximum angular opening of the door. In order to open the door wider than its held position, it would be necessary to further rotate the shaft **30** to cam the detent balls **44** and **53** out of their respective sockets **40** and **41** onto the peripheral surface of the shaft. To further rotate the shaft in this manner requires an unreasonable amount of force on the door and it is obvious to a person opening the door **11** that it is intended to open no wider than the held position.

The extent of angular opening of the door **11** in its held position may be varied with certain limits by appropriate adjustment of the shaft **30** relative to the arm **15** at their connection. Thus, the door **11** can be held at any predetermined angle of opening within certain limits by suitable adjustment of the arm and shaft. When the shaft **30** and arm **15** are operatively connected to initially position the shaft in the closed door position illustrated in FIGURE 4, the held position will be at a maximum opening of the door. The angular opening of the door **11** in its held position may be suitably reduced by connecting the shaft **30** and arm **15** to initially establish the closed door position of the shaft intermediate the extreme positions of FIGURES 3 and 4.

My invention contemplates certain modifications in the number and positioning of the sockets and grooves in the shaft **30** to vary the operating characteristics of the mechanism. For example, as illustrated in FIGURE 6, additional sockets **48** may be provided intermediate the ends of grooves **42** and **43**. In this case the door **11** has more than a single held position. To close the door **11** from a maximum held position necessitates actuating the solenoid **60** a number of times corresponding to the number of intermediate sockets **48** or continuously actuating it until the shaft has rotated sufficiently for all the sockets to pass the detent bores. Likewise, in releasing the door manually, it has to be independently released from each intermediate held position.

The holding mechanism of the invention is readily adapted for use in a system where a plurality of doors mounting door closing devices are to be remotely closed from a central point. In a manufacturing plant or hotel, for example, it may be desirable to provide both individual remote switches for each door in the immediate area and an additional individual switch or a gang switch at a central point.

It will be understood that the particular embodiment of my invention described herein is merely illustrative of one form of my invention, and that numerous changes in the construction and arrangement of the various members may be made without departing from the spirit and scope of the invention, as defined by the appended claims.

I claim:

1. A holding mechanism of the type described, comprising: a body; shaft means rotatably supported by said body; detent receiving means on said shaft means; detent means supported by said body and operatively associated with said shaft means, said detent means being adapted to seat in shaft-locking engagement with said detent receiving means; means effective upon rotation of said shaft means to a predetermined position to urge said detent means into said engagement with said detent receiving means and hold said shaft means against rotation under the influence of a predetermined torque on said shaft, said urging means being adapted to be overpowered to permit said detent means to move out of shaft-locking engagement with said detent receiving means upon a torque greater than said predetermined torque being applied to said shaft means; and remotely controllable means selectively operable and adapted for repeated operation for overcoming the action of said urging means.

2. A holding mechanism of the type described, comprising: a body having a main bore and a detent bore intersecting said main bore; a shaft rotatable in said main bore, said shaft being formed with a socket in its periphery and with a peripheral groove communicating with said socket; a detent located in said detent bore, said detent riding in shaft-guiding engagement with said groove during rotation of said shaft and movable into shaft-locking engagement with said socket when said socket is aligned with said detent bore; means yieldingly urging said detent in a direction toward said shaft; and remotely controllable means operable to overcome the action of said last-mentioned means.

3. A holding mechanism of the type described, comprising: a body having formed therein, a main bore, an actuator bore, and a detent bore connecting said main and actuator bores; a shaft rotatably mounted in said main bore, said shaft being formed with a socket in its periphery; detent means movable in said detent bore and adapted to seat in shaft-locking engagement in said socket when said socket is aligned with the opening to said detent bore; an actuator movable in said actuator bore and having a wedge surface operatively engaging said detent means, said actuator being movable in a first direction to move said detent means toward said shaft and in a second direction to permit said detent to move away from said shaft; means yieldingly urging said actuator in said first direction, whereby said detent means is moved into shaft-locking engagement with said socket when said socket is aligned with said detent bore; and means operable to overcome the action of said yieldingly urging means.

4. A holding mechanism of the type described, comprising: a body having formed therein, a main bore, an actuator bore, and a detent bore connecting said main and actuator bores; a shaft movable in said main bore, said shaft being formed with a socket in its periphery and with a peripheral groove of a predetermined angular extent communicating with said socket; a detent movable in said detent bore to ride in engagement in said groove and to seat in shaft-locking engagement in said socket; an actuator longitudinally movable in said actuator bore and having a wedge surface operatively engaging said detent, whereby movement of said actuator in one direction moves said detent toward said shaft and movement in an opposite direction permits said detent to move away from said shaft; means yieldingly urging said actuator in said one direction; and power-operated means for overcoming the action of said last-mentioned means.

5. A holding mechanism of the type described, comprising: a body having a main bore, a detent bore and an auxiliary detent bore, said detent bore and said auxiliary detent bore intersecting said main bore at spaced positions; a shaft rotatable in said main bore, said shaft having a first socket on its periphery positioned to be in alignment with said detent bore substantially coincidentally with the aligning of a second socket with said auxiliary detent bore; detents located in said detent and auxiliary detent bores and movable into shaft-locking engagement with said sockets; means yieldingly urging said detents in directions to engage in said sockets to prevent rotation of said shaft when urged by a predetermined torque on said shaft; and means operable to overcome the action of said last-mentioned means to permit a torque less than said predetermined torque to rotate said shaft.

6. A holding mechanism of the type described, comprising: a body having a main bore and an actuator bore interconnected by a detent bore, and an auxiliary detent bore intersecting said main bore; a shaft rotatable in

said main bore, said shaft having at least two angularly spaced sockets in its periphery, one of said sockets being located to be in alignment with said detent bore substantially coincidentally with the aligning of another of said sockets with said auxiliary detent bore, said shaft additionally having at least two peripheral grooves each extending from a corresponding one of said sockets; a detent and an auxiliary detent located in said detent and auxiliary detent bores respectively, and movable into shaft-guiding engagement with said grooves and into shaft-locking engagement with said sockets when said sockets are aligned with said detent and auxiliary detent bores; an actuator longitudinally movable in said actuator bore and having a wedge surface operatively engaging said detent, whereby movement of said actuator in one direction moves said detent toward said shaft and movement in the opposite direction permits said detent to move away from said shaft; first spring means yieldingly urging said actuator in said one direction; second spring means yieldingly urging said auxiliary detent into engagement with said shaft; and power-operated and remotely controllable means for overcoming the action of said first spring means.

7. A holding mechanism for use in conjunction with door-moving means of a pivotally mounted door, comprising: a body having a main bore and a detent bore intersecting said main bore; a shaft rotatable in said main bore and operatively connected to said door-moving means; detent receiving means formed on the periphery of said shaft, said detent receiving means arranged to be in alignment with said detent bore when said door is in a predetermined position; a detent in said detent bore and movable into shaft-locking engagement with said detent receiving means when said door is in said predetermined position; means yieldingly urging said detent to move in a direction to engage in said socket, whereby said door is held in said predetermined position in opposition to the force of said door-moving means; and remotely controllable means for overcoming the action of said yieldingly urging means and thereby releasing the door from its predetermined held position.

8. A holding mechanism of the type described, comprising: a body; a shaft rotatably supported by said body; means carried by said body and cooperable with said shaft for releasably locking said shaft against movement under the influence of a predetermined torque on said shaft, said shaft being released upon a torque greater than said predetermined torque being applied to said shaft; and remotely controllable means selectively operable and adapted for repeated operation for overcoming the action of said locking means to permit a torque less than said predetermined torque to rotate said shaft.

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