April 10, 1945. F. M. LAMBERT 2,373,480

QUICK-ACTING DOOR

Filed Oct. 16, 1942 3 Sheets-Sheet 1

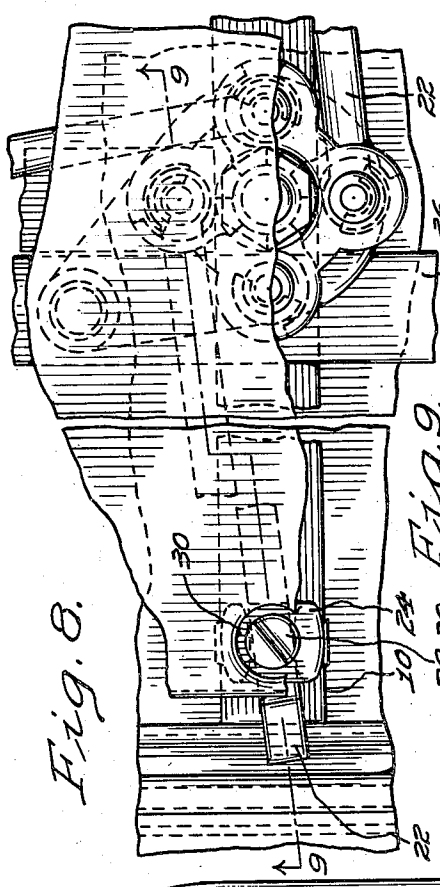


Fig. 8.

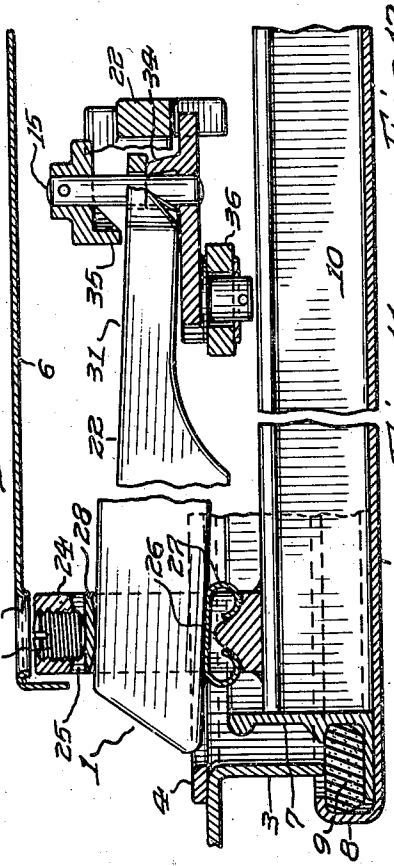


Fig. 9.

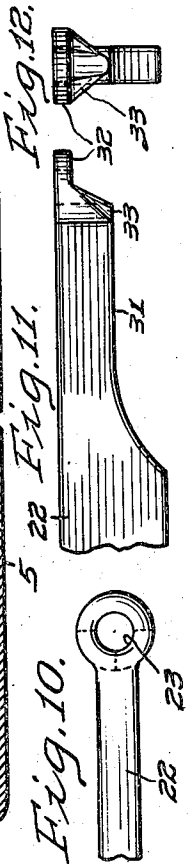


Fig. 11.

Fig. 12.

Fig. 10.

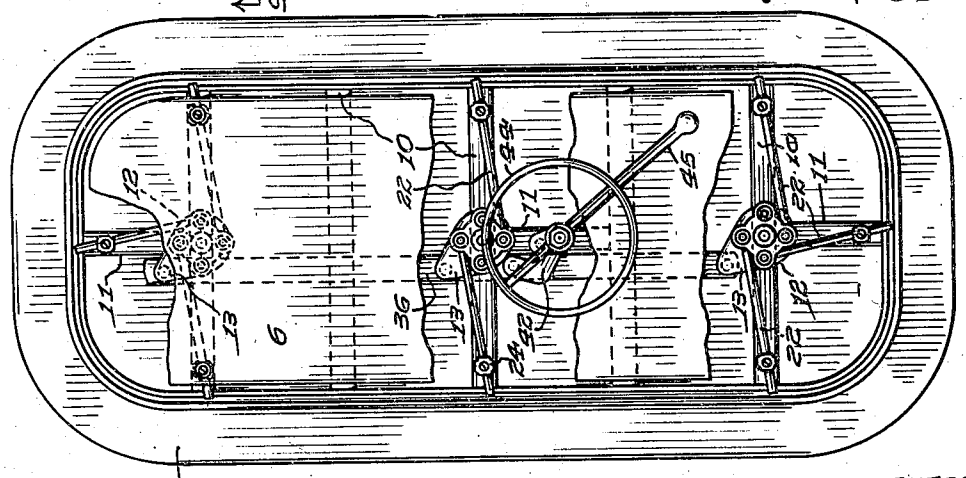


Fig. 1.

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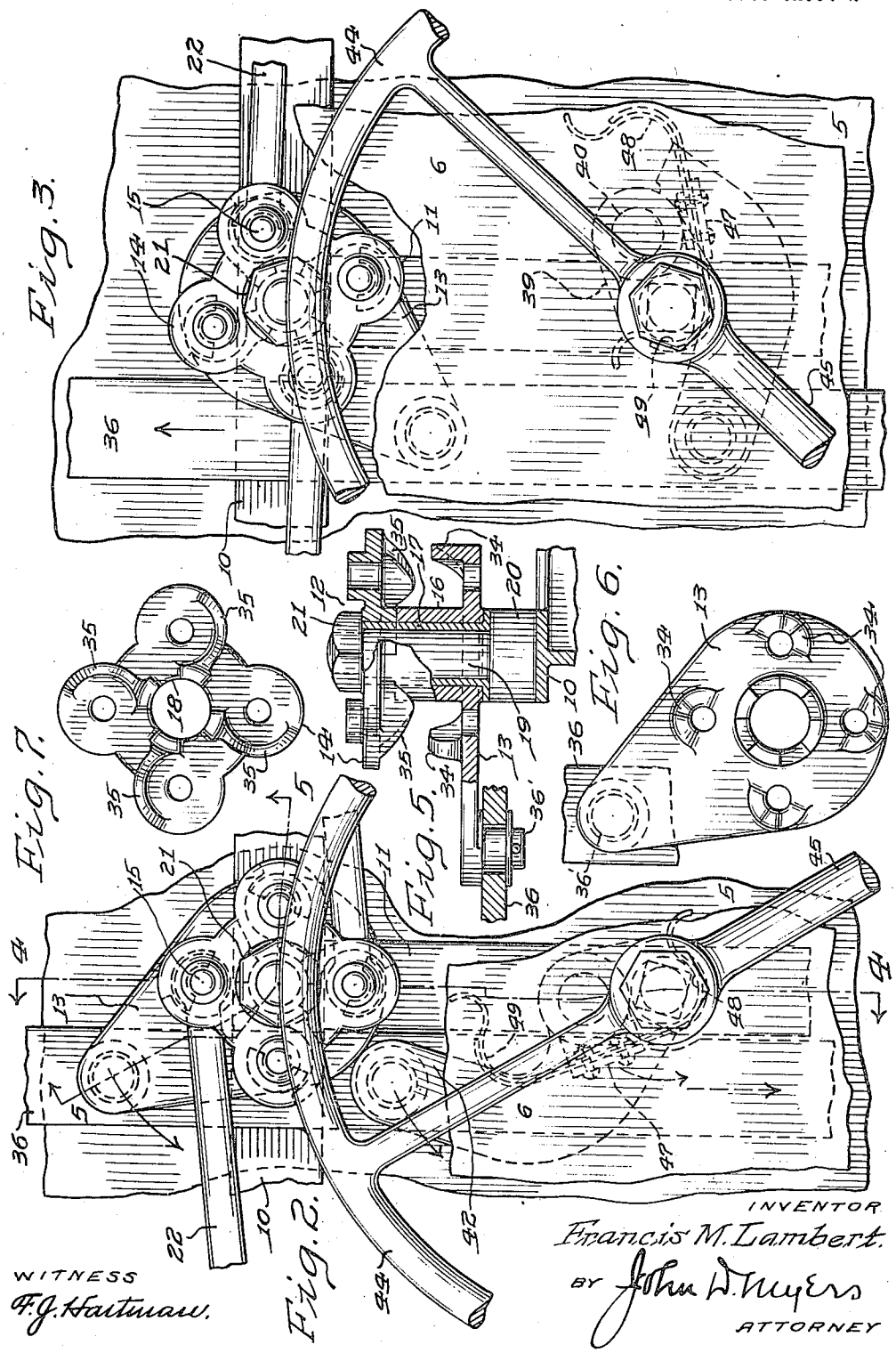
WITNESS

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QUICK-ACTING DOOR

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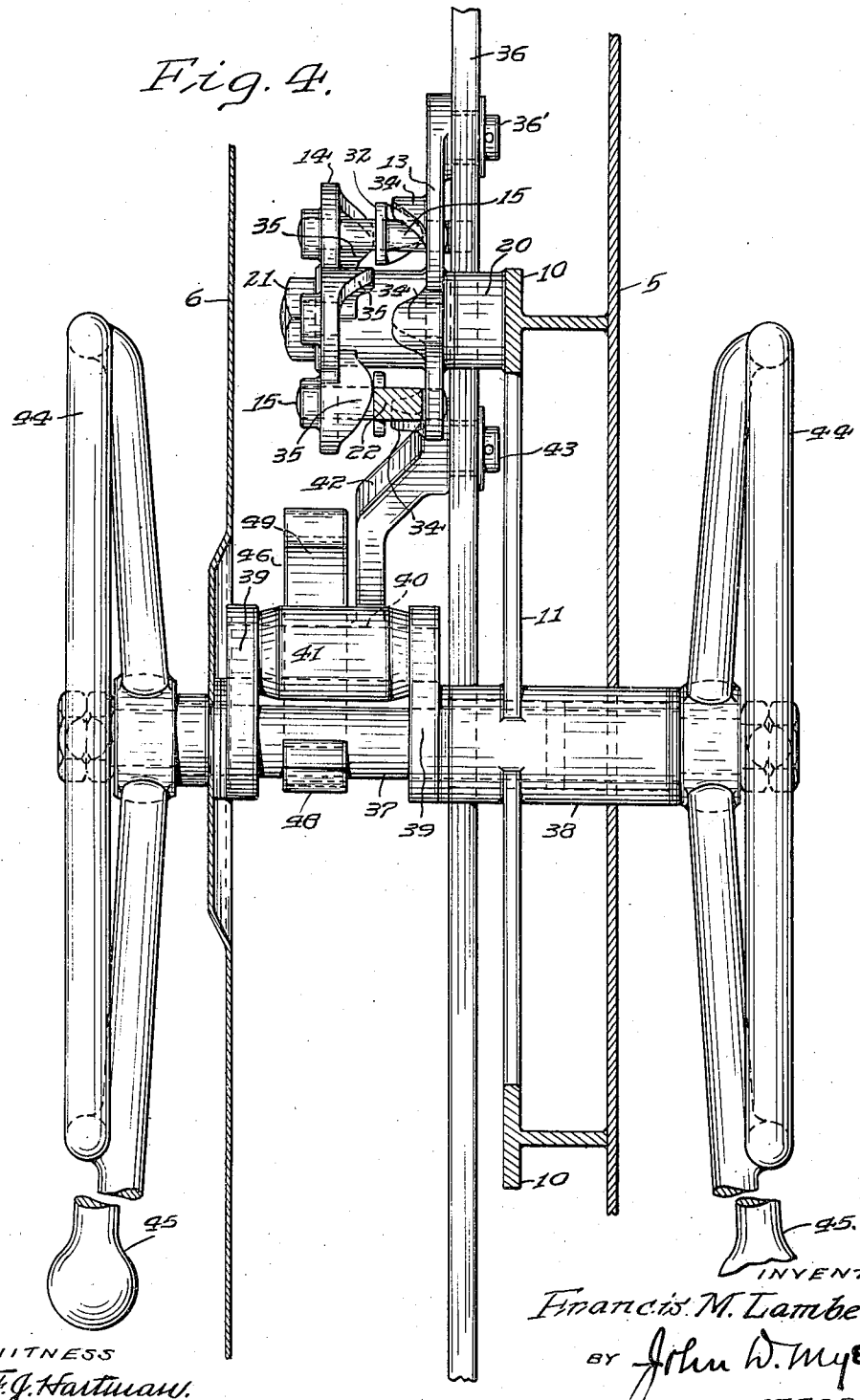


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QUICK-ACTING DOOR

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Fig. 4.



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2,373,480

QUICK-ACTING DOOR

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Application October 16, 1942, Serial No. 462,287

15 Claims. (Cl. 292—5)

The invention relates to quick-acting fastening means for ship doors, hatches and the like, and is directed specifically to fastening mechanism wherein a plurality of dogging bars on a closure member are operated simultaneously by a common control member to thrust the outer ends of the bars into overlapping relation with respect to the frame member and then move the outer ends transversely toward the frame member to thereby effect a sealing engagement between the edge of the closure member and the frame member.

One of the principal objects of the invention is an increase in efficiency, or a reduction of the hand-wheel load, in a simplified mechanism for locking and sealing such doors in closed position. Another object of the invention is the provision of quick-acting mechanism which is so designed that, with slight movement of the control member, the locking elements are positively thrust into overlapping position with respect to the door and frame, and, by the same movement of the control member, leverage is positively applied to the locking means to seal the edge of the door against the frame. A still further object of the invention is the provision in quick-acting fastening means of rotating mechanism which, upon rotation in one direction, will operate during a part of the movement to thrust a plurality of dogging bars longitudinally into overlapping position with respect to the frame and, during the final rotational movement in the same direction, will operate to apply leverage to the dogging bars to seal the edge of the door to the frame, and, upon rotation in the reverse direction, will at first apply leverage to the dogging bars to relieve the pressure between the edge of the door and the frame and, upon continued rotation in the reverse direction, will withdraw the dogging bars from a position overlapping the frame to thereby permit the door to be opened in the customary manner. Other objects and advantages of the improvement will be apparent from the following description, taken with the accompanying drawings wherein:

Fig. 1 is a rear elevational view of a door and frame with the improved quick-acting fastening means incorporated therein, the rear door panel being partly broken away for purposes of clarity;

Fig. 2 is an enlarged detailed view taken near the middle of Fig. 1 and showing the actuating means for the fastening mechanism and one of the units of the mechanism, the latter being shown in undogged position;

Fig. 3 is a view similar to Fig. 2, but showing the parts in dogged position;

Fig. 4 is a vertical sectional view taken substantially on the line 4—4 of Fig. 2 and showing some of the parts of the device in elevation;

Fig. 5 is a transverse sectional view of one of the spiders which actuates the dogging bars, taken substantially on the line 5—5 of Fig. 2, and omitting the dogging bars and the crank pins to which their inner ends are connected;

Fig. 6 is a rear elevational view of the crank arm forming a part of each spider;

Fig. 7 is a front elevational view of the cam plate associated with the crank arm shown in Fig. 6;

Fig. 8 is an enlarged rear elevational view of a portion of the fastener unit shown at the top of Fig. 1;

Fig. 9 is a transverse sectional view taken substantially on the line 9—9 of Fig. 8; and

Figs. 10, 11 and 12 are views in rear elevation, plan, and end elevation, respectively, of the inner end of one of the dogging bars.

The improvements are disclosed herein in connection with a door 1 which forms a closure member cooperating with the frame 2 of a door opening, hatchway, or the like. The frame 2 is preferably of the type which is provided with a flange or coaming 3 which cooperates with the edge of the door 1 to seal the latter in closed position. Preferably the frame 2 is provided on the face opposite the flange 3 with a reinforcing or dogging strip 4. While no hinging means is shown, the door 1 may be hinged on the frame 2 in any suitable manner so that its edges are brought into over-lapping relation with the coaming 3 when it is in closed position.

The door proper comprises a front panel 5, a rear panel 6 and a marginal reinforcing member 7 on the inner face of the front panel, and the margin of the front panel 5 is preferably turned over, as shown at 8, to form a channel for a gasket 9 of rubber or the like clamped between the edge 8 and the reinforcing member 7. A suitable number of transverse reinforcing bars 10 and longitudinal reinforcing bars 11 may also be welded or otherwise secured to the front panel 5 and the marginal reinforcing member 7. As will appear hereinafter, the various reinforcing bars 10 and 11 also serve to support the door fastening mechanism within the space between the two panels.

While the fastening mechanism may be arranged otherwise on the door 1, as illustrated herein a fastener unit is associated with the upper, lower and middle reinforcing bars 10. Each fastener unit includes a spider 12 comprising a crank arm 13, a cam plate 14 associated there-

with, and a plurality of crank pins 15 interconnecting the crank arm 13 and the cam plate 14. The cam plate 14 may be integral with the crank arm 13, but as disclosed herein it is secured on the outer end of an axial hub 16 projecting from the rear face of the crank arm 13. When constructed in this manner the outer end of the hub 16 and the adjacent face of the cam plate 14 may be provided with interlocking clutch teeth in order that the crank arm 13 and the cam plate 14 may rotate together upon rotation of the crank arm. A bearing sleeve 17 extending through the hub 16 and through a central opening 18 in the cam plate 14 forms a bearing for the spider 12 and supports the same on a spindle 19. The enlarged head 20 on the spindle 19 is welded or otherwise secured to a transverse reinforcing bar 10, and the spider 12 is retained on the spindle by a nut 21 threaded thereon and engaging with the outer face of the cam plate 14.

Associated with each spider 12 is a plurality of dogging bars 22. The inner end of each dogging bar 22 is provided with an enlarged opening 23 to receive one of the crank pins 15, and the outer end is arranged to be thrust into and out of overlapping position with respect to the frame member 2. The outer end portion of each dogging bar 22 is slidably supported in a guide post 24 secured on a reinforcing bar 10 or 11 near the outer edge of the door. As shown in Figs. 8 and 9 of the drawings, each guide post 24 is provided with a transverse slot 25 to receive the dogging bar. The inner end of the slot 25 is shaped to provide a transverse rib 26 and form a support for a spring 27 with which one edge of the dogging bar 22 is held in sliding engagement. The bar 22 is held on the spring 27 by a follower plate 28 in contact with the edge of the bar opposite the spring 27. The ends of the follower plate 28 are cut away to conform to the shape of the side walls of the slot 25, as shown by the dotted lines in Fig. 8, in order to retain the follower plate in the slot. A set screw 29 in the outer end of the guide post 24 and in alignment with an opening 30 in panel 6 has its inner end in contact with the follower plate 28 in order to control the extent of compression of the gasket 9.

In order to reduce the dimensions of the actuating means for the dogging bars in the direction of the thickness of the door, the inner portion of each dogging bar 22 is reduced in width as shown at 31, and the extreme inner end is flattened as shown at 32. The flat section 32 is joined to the reduced end portion 31 by a tapered edge portion 33 adjacent the crank pin opening 23, and the tapered part 33 serves as a cam face in the application of leverage to the dogging bar 22 in sealing the door in closed position. The enlarged opening 23 permits the inner end of the bar to move axially on the crank pin 15, without any binding action, as leverage is applied to the bar to fulcrum it in the guide post 24 and thereby seal and unseal the outer edge of the door.

As will be apparent from the above description, and from the arrangement of the parts as shown by Figs. 1, 2 and 9 of the drawings, counterclockwise movement of the spider 12 on the spindle 19 will operate to thrust each dogging bar 22 outwardly so as to force its outer end into overlapping engagement with the dogging strip 4 to thus effect a slight compression of the gasket 9 between the outer edge of the door and the flange 3 when the dogging bar is in substantial alignment with the axis of the spider. In order to apply leverage to the dogging bar when in this position, and thus complete the sealing action, one of the locking cams 34 on the rear face of the crank arm 13 cooperates with the tapered surface 33 to force the inner end of the dogging bar away from the crank arm 13, in the direction of the cam plate 14. The outer end of the bar is thus forced tightly against the dogging strip 4 and compresses the gasket 9 between the edge of the door and the flange 3. It is is desired to emphasize that the helix angle of each cam 34 is approximately 45° since this angle produces maximum efficiency and gives a great extent of travel for a slight rotation of the cam. As a consequence, a slight rotating movement of each spider 12 is sufficient to move the inner end of each dogging bar to a considerable extent in a direction to apply leverage to the bars when the door is being sealed. The particular location of the guide post or fulcrum 24 serves to convert the large leverage movement of the inner end of each dogging bar into a small movement of the outer end to produce the necessary compression of gasket 9. The locking cams or wedge elements are therefore associated with the spider instead of with the frame member, as is customary, in order that this higher wedge efficiency may be attained.

Upon rotation of the spider 12 in a reverse direction, cam 34 releases the inner end of each bar and one of the cams 35 on the cam plate 14, adjacent crank pin 15, moves the inner end of the dogging bar 22 away from the cam plate 14, in the direction of the crank arm 13, to thus relieve the pressure between the coaming 3 and the gasket 9 to permit withdrawal of the dogging bar upon continued rotation of the spider 12 in the reverse direction. The two cams 34 and 35 associated with each dogging bar are so arranged on the crank arm 13 and the cam plate 14, respectively, that one is in operative position when the other is in inoperative position. When so arranged the locking cam 34 on the crank arm retains the dogging bar in sealing position when the dogging bar is substantially in alignment with the axis of the spider, and the associated cam 35 on the cam plate retains the dogging bar in the unsealed position when the dogging bar is withdrawn and is substantially at right angles to a line joining its crank pin and the axis of the spider.

In order that the spiders 12 may be used interchangeably in the various positions as shown in Fig. 1, each is provided with four crank pins 15 and four sets of associated cams 34 and 35. With the arrangement of fastener units illustrated in Fig. 1 however, it will be understood that only three of the crank pins 15 are utilized with the upper and lower fastener units, and that only two of the crank pins 15 are utilized with the middle unit. With closure members of a different form or size, more or less of the crank pins and their associated cams may be utilized, and it will be understood that each spider may be provided with such number of crank pins and associated sets of cams as desired, dependent upon the number of dogging bars operated thereby. Each of the cams 34 is located adjacent a crank pin 15 and on the side of the pin opposite hub 16, while each cam 35 of the assembled spider is located between two consecutive crank pins and is thus offset circumferentially and radially inward from cams 34.

In order that the various fastener units may be operated simultaneously, the outer end of each of the crank arms 13 is connected to a common link bar 36 by a pin 36' secured on the crank

arm and extending through an opening in the link bar. When so connected, rotational movement of one spider will effect rotation of the other spiders in unison therewith. The means provided for actuating the link bar 36 and thus effecting simultaneous rotational movement of the spiders 12 comprises a shaft 37 supported in a bearing 38 which is secured in the reinforcing bar 11 near the middle of the door. A pair of aligned crank arms 39 on the shaft 37 have a spindle 40 secured in their outer ends. A hub 41 is rotatably mounted on the spindle 40 and is integral with the inner end of a toggle arm 42. The outer end of toggle arm 42 is connected to the link bar 36 by a pin 43 secured on the toggle arm and extending through a suitable opening in the link bar.

As will be apparent from this construction, rotation of the shaft 37 in a counter-clockwise direction from the position shown in Figs. 1 and 2 will operate to swing the crank arms 39 and the hub 41 about the shaft 37 and thus move the link bar 36 downwardly, while rotational movement of the shaft 37 in the opposite direction, that is, clockwise from the position shown in Fig. 3, will serve to move the link bar 36 upwardly. As shown in Fig. 4, each end of shaft 37 is provided with manual means for rotating the same and, preferably, this means is in the form of a hand wheel 44 secured on the outer end of the shaft, one hand wheel being outside the front panel 5 and the other wheel being outside the rear panel 6. Auxiliary control means, such as a hand lever 45, is fixed to each hand wheel 44 for the purpose of giving additional leverage when such is desired in the operation of fastening and unfastening the door.

The hand lever 45 also serves as a gravity actuated device to retain the fastening means in both the dogged and undogged positions. When the various parts of the mechanism are in the undogged position, as shown in Figs. 1, 2 and 4 of the drawings, the hand wheel 44 has been rotated in a clockwise direction to an extent determined by the engagement of the lower end of arm 42 with shaft 37 as shown in Fig. 2. With the parts of the mechanism in the position shown in Figs. 1, 2 and 4, the lower end of the arm 42 engages with the shaft 37 to limit the movement of the hand wheel at a position in which the action of gravity upon the hand lever 45 tends to continue the movement of the hand wheel 44 in a clockwise direction. The parts will thus be retained in the undogged position until the hand wheel 44 is again rotated in a counter-clockwise direction.

Upon rotation of the hand wheel 44 in a counter-clockwise direction from that illustrated in Figs. 1 and 2, the parts of the mechanism will be moved into the dogged position as shown in Fig. 3. Movement of the hand wheel in the counter-clockwise direction is limited by the engagement of the concave edge of arm 42 with the shaft 37. When at its limit of movement in this direction, that is, when the parts are in dogged position, the hand lever 45 is so positioned that the action of gravity thereon tends to continue the movement of the hand wheel 44 in a counter-clockwise direction and thus retain the parts in dogged position.

A detent device, such as a spring 46, tends to retain the parts in their respective positions when the shaft 37 has been rotated to the limit of its movement in each direction. This spring is bolted to an overhanging bracket 47 on the hub 41, and one end is bent as shown at 48 for engagement with shaft 37 when the parts are in undogged position, and the other end is bent as shown at 49 for engagement with shaft 37 when the parts are in dogged position.

Inasmuch as the operation of the various features of the improvement has been described above in connection with the description of the structure of the parts, no further explanation of the operation is believed to be necessary. While a preferred form of the improvement has been disclosed, together with a certain arrangement of the different parts, it is to be understood that the invention is not intended to be limited to the precise form and arrangement of parts disclosed. The above description and the accompanying drawings are therefore to be regarded as illustrative only and it is to be understood that the invention is susceptible of other forms and arrangements so long as they come within the scope of the appended claims.

What I desire to claim is:

1. In a quick-acting door of the type in which the edges of a closure member are clamped to the edges of a frame member, the combination of a spider rotatably mounted on said closure member, a plurality of dogging bars fulcrumed on said closure member and having their outer ends movable into and out of position overlapping said frame member, a crank pin connecting the inner end of each dogging bar directly to said spider for thrusting the outer end of said bars outwardly into overlapping relation with respect to said frame member upon rotation of said spider to a predetermined extent in one direction, a cam on said spider for applying leverage to the inner end of each of said bars to move said outer ends transversely toward said frame member upon further rotation of said spider in the same direction, means for preventing such lever action of said bars when in withdrawn position, and means for rotating said spider.

2. In a quick-acting door of the type in which the edges of a closure member are clamped to the edges of a frame member, the combination of a spider rotatably mounted on said closure member, a plurality of dogging bars fulcrumed on said closure member and having their outer ends movable into and out of position overlapping said frame member, a crank pin connecting the inner end of each dogging bar directly to said spider for thrusting the outer ends of said bars outwardly into overlapping relation with respect to said frame member upon rotation of said spider to a predetermined extent in one direction, a cam on said spider for applying leverage to each bar to move its inner end endwise on said crank pin and its outer end transversely toward said frame upon further rotation of said spider in the same direction, means for preventing such lever action of said bars when in withdrawn position, and means for rotating said spider.

3. In a quick-acting door of the type in which the edges of a closure member are clamped to the edges of a frame member, the combination of a spider rotatably mounted on said closure member, a plurality of dogging bars fulcrumed on said closure member and having their outer ends movable into and out of position overlapping said frame member, a pin connecting the inner end of each dogging bar to said spider for thrusting the outer ends of said bars outwardly into overlapping relation with respect to said frame member upon rotation of said spider to a

predetermined extent in one direction, a locking cam on each spider for applying leverage to each bar to move its outer end transversely toward said frame member upon further rotation of said spider in the same direction, means actuated upon reverse rotation of said spider to a predetermined extent to move the outer ends of said bars transversely away from said frame member prior to their movement out of position overlapping said frame member, and means for rotating said spider.

4. In a quick-acting door of the type in which the edges of a closure member are clamped to the edges of a frame member, the combination of a spider rotatably mounted on said closure member, a plurality of dogging bars fulcrumed on said closure member and having their outer ends movable into and out of position overlapping said frame member, a pin connecting the inner end of each dogging bar to said spider for thrusting the outer ends of said bars outwardly into overlapping relation with respect to said frame member upon rotation of said spider to a predetermined extent in one direction, a locking cam on each spider for applying leverage to each bar to move its outer end transversely toward said frame member upon further rotation of said spider in the same direction, a cam associated with each pin for resisting leverage movement of each bar during its outward thrust and for releasing each bar for leverage movement during the operation of said locking cam, and means for rotating said spider.

5. In quick-acting fastening means for a door of the type in which the edges of a closure member are clamped to the edges of a frame member, a spider rotatably mounted on said closure member, a plurality of dogging bars fulcrumed near the outer edge of said closure member and having endwise movement into and out of overlapping position with respect to said frame member, connecting means between the inner ends of said dogging bars and said spider for thrusting the outer ends of said dogging bars into and out of overlapping position with respect to said frame member upon rotation of said spider in opposite directions, cam means operatively connected to said spider for applying leverage to said dogging bars to move the outer ends thereof transversely toward said frame member at the completion of the rotational movement of said spider in one direction and transversely away from said frame member at the beginning of the rotational movement of said spider in the opposite direction, and means for rotating said spider.

6. In quick-acting fastening means for a door of the type in which the edges of a closure member are clamped to the edges of a frame member, a spider rotatably mounted on said closure member, a plurality of dogging bars fulcrumed near the outer edge of said closure member and having endwise movement into and out of overlapping position with respect to said frame member, connecting means between the inner ends of said dogging bars and said spider for thrusting the outer ends of said dogging bars into and out of overlapping position with respect to said frame member upon rotation of said spider in opposite directions, a cam operatively connected to said spider for applying leverage to said dogging bars to move the outer ends thereof transversely toward said frame member at the completion of the rotational movement of said spider to thrust said dogging bars outwardly, a cam operatively connected to said spider for applying leverage to said dogging bars to move the outer ends thereof transversely away from said frame members at the beginning of the rotational movement of said spider to retract said dogging bars, and means for rotating said spider.

7. In quick-acting fastening means for a door, a crank arm pivotally mounted on said door and having a crank pin thereon, a guide post mounted near the edge of said door, a dogging bar having its outer end slidably supported in said guide post and its inner end connected to said crank pin for movement lengthwise thereon, means on said crank arm for moving the inner end of said dogging bar in one direction on said crank pin as said crank arm is rotated in one direction to bring said crank pin and the axis of said crank arm into alignment with said dogging bar, and means on said crank pin for moving the inner end of said dogging bar in the opposite direction on said crank pin as said crank arm is rotated in the opposite direction with said crank pin and the axis of said crank arm out of alignment with said dogging bar.

8. In quick-acting fastening means for a door, a crank arm, a spindle on which said crank arm is rotatably mounted, a cam plate spaced from said crank arm and rotatable therewith on said spindle, a crank pin interconnecting said crank arm and said cam plate, a dogging bar having its inner end mounted on said crank pin and movable thereon toward and away from said crank arm and said cam plate, a fulcrum in which the outer end of said dogging bar is slidably supported, a cam on said crank arm for moving the inner end of said dogging bar toward said cam plate during the final rotational movement of said crank arm in one direction, a cam on said cam plate for moving the inner end of said dogging bar toward said crank arm during the initial rotational movement of said crank arm in the reverse direction, and means for rotating said crank arm.

9. In a quick-acting door of the type in which the edges of a closure member are clamped to the edges of a frame member, the combination of a plurality of spiders rotatably mounted on said closure member, a plurality of dogging bars fulcrumed near the outer edge of said closure member and having their outer ends slidable into and out of position overlapping said frame member, a crank pin connection between the inner end of each dogging bar and one of said spiders for thrusting the outer ends of said dogging bars outwardly into overlapping relation with respect to said frame member upon rotation of said spiders to a predetermined extent in one direction a cam on said spider for applying leverage to each of said dogging bars to move their outer ends transversely toward said frame member upon further rotation of said spiders in the same direction, means for preventing such lever action of said bars when in withdrawn position, interconnecting means between said spiders for rotating the same in unison, and means for actuating said interconnecting means to rotate said spiders.

10. In quick-acting fastening means for a door, a plurality of crank arms pivotally mounted on said door, a crank pin on each of said crank arms, a plurality of guide posts mounted near the edge of said door, a dogging bar associated with each of said crank arms with its outer end fulcrumed and slidably supported in one of said guide posts and its inner end connected to one of said crank pins and movable lengthwise there-

on, cam means actuated by the rotation of said crank arms to move the inner end of each dogging bar in one direction on its crank pin when said crank arms are rotated to bring the axis of each into alignment with the dogging bars associated therewith and move the inner end of each dogging bar in the opposite direction on its crank pin when said crank arms are reversely rotated so that the axis of each crank arm is out of alignment with the dogging bar associated therewith, and means for actuating said crank arms in unison.

11. In quick-acting fastening means for a door, the combination of a spider rotatably mounted on said door, a plurality of dogging bars fulcrumed adjacent the edge of said door and slidable toward and away from the edge of said door, connecting means between the inner ends of said bars and said spider for thrusting said bars outwardly toward the edge of said door upon rotation of said spider to a predetermined extent in one direction, means actuated upon further rotation of said spider in the same direction to move the outer ends of said bars transversely toward said door, means actuated upon reverse rotation of said spider to a predetermined extent to move the outer ends of said bars transversely away from said door, said connecting means operating to withdraw said bars inwardly away from the edge of said door upon further reverse rotation of said spider, and means for rotating said spider in opposite directions.

12. In quick-acting fastening means for a door, a plurality of dogging bars mounted on said door for endwise movement toward and away from the edge of said door, rotatable means on said door for thrusting said bars outwardly upon rotation thereof to a predetermined extent in one direction, means actuated upon further rotation of said rotatable means in the same direction for moving the outer ends of said bars transversely toward said door, means actuated by reverse rotation of said rotatable means to a predetermined extent to move the outer ends of said bars transversely away from said door, said rotatable means operating to retract said bars inwardly upon further reverse rotation thereof, and means for actuating said rotatable means.

13. In quick-acting fastening means for a door, a plurality of crank arms rotatably mounted on said door, a dogging bar associated with each crank arm and having its outer end fulcrumed and slidably supported adjacent the outer edge of said door, means on said crank arms and actuated upon rotation of said arms in one direction to thrust said bars outwardly with respect to the edge of said door and move the outer ends thereof transversely toward said edge and upon reverse rotation to move the outer ends of said bars transversely away from the edge of said door and withdraw said bars inwardly with respect to said edge, a link bar connecting said crank arms for operating the same in unison and means for actuating said link bar.

14. In quick-acting fastening means for a door, a crank arm, an axial hub on one face thereof, a plurality of cams arranged on said face concentrically with respect to said hub and equally spaced from each other, a cam plate secured on the outer end of said hub, and a plurality of cams on the face of said plate adjacent said crank arm and arranged concentrically with respect to said hub and offset radially and circumferentially with respect to said first named cams.

15. In quick-acting fastening means for a door, a crank arm, an axial hub on one face of said arm, a crank pin on said face, a cam on said face spaced outwardly from said crank pin, a cam plate on the outer end of said hub, and a cam on the face of said cam plate adjacent said crank arm and offset circumferentially and inwardly with respect to the cam on said crank arm.

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