June 12, 1945. C. E. ARTHUR 2,378,119

CLOSURE ACTUATING AND LOCKING MECHANISM

Filed June 28, 1943 2 Sheets-Sheet 1

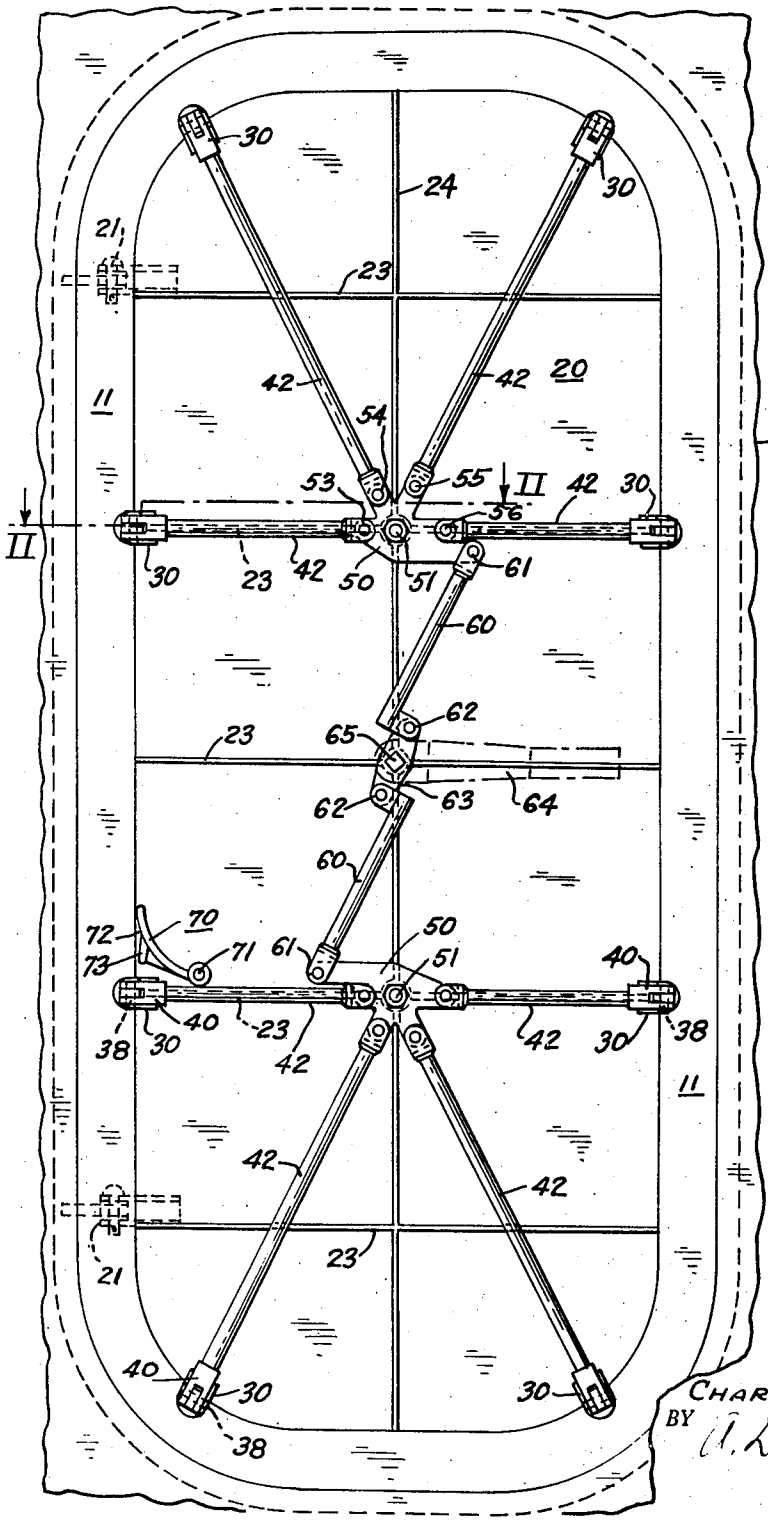


Fig. 1.

INVENTOR.
CHARLES E. ARTHUR
BY A. Duncan Owen
ATTORNEY.

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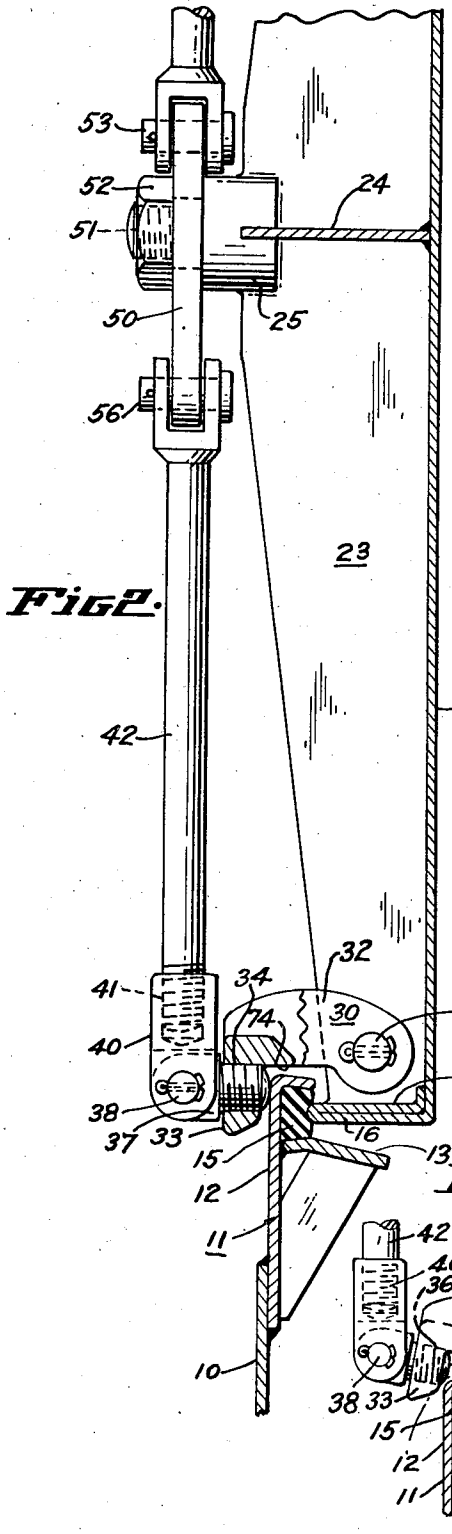


Fig 2.

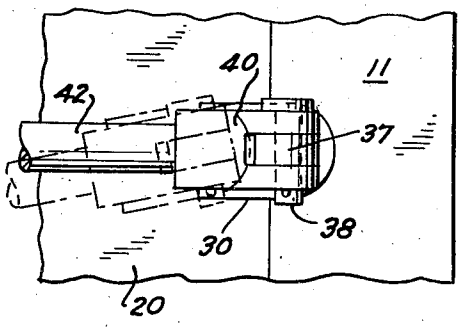


Fig 4.

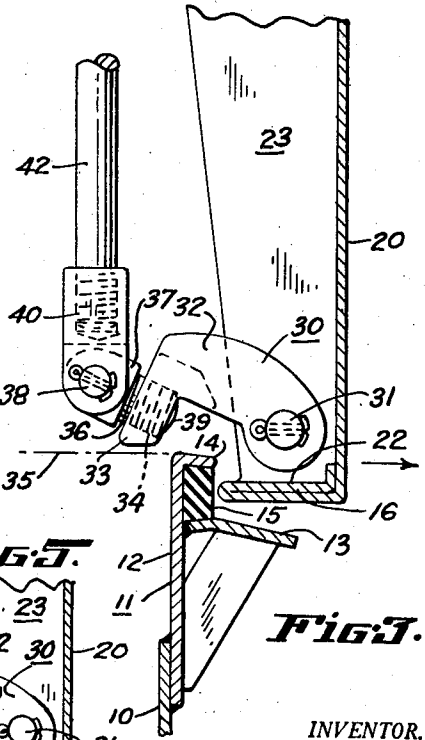


Fig 5.

Fig 6.

Fig 7.

INVENTOR.
CHARLES E. ARTHUR
BY A. Douham Owen
ATTORNEY.

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UNITED STATES PATENT OFFICE

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CLOSURE ACTUATING AND LOCKING MECHANISM

Charles E. Arthur, Napa, Calif.

Application June 28, 1943, Serial No. 492,561

10 Claims. (Cl. 292—7)

My invention relates to improvements in quick closing bulkhead closures.

One of the objects of my invention is to provide a quick acting, water tight door requiring a minimum of time for closing and a minimum of torque on the closing handle for the latching operation.

Another object of my invention is to provide a novel form of closing means which distributes the closing torque on the handle in a more even flow from the unlocked to the locked position.

Another object of my invention is to provide a multiple-locking dog type of closure means in which one or more of the locking dogs may be disconnected without interfering with the actuation and functioning of the remaining locking dogs by the closing handle.

Another object of my invention is to provide a locking mechanism by which the length of travel of the several locking arms may be varied with respect to each other.

Another object of my invention is to provide each locking arm with a locking dog, movable automatically therein as the locking arm moves into or away from the locked position.

Another object of my invention is to provide automatic means for latching and immobilizing the door locking means whenever the door is swung away from the bulkhead frame and for automatically freeing said locking mechanism as the door is swung back into closed position preparatory to being locked.

Another object of my invention is to provide locking dogs which relieve wear on the door frame as well as on each dog, by rotating said dog as it proceeds through the full locking or unlocking movement.

Another object of my invention is to so arrange the locking arms, their links and actuating spider member that when in locked position the lines of force are directly between centers so that the door cannot be unlocked except by movement of the handle.

Other objects and advantages of my invention will become clear from the following description taken in connection with the drawings. It is not intended that my invention shall be limited to the particular shape, form, or construction of any of the parts except as limited by the claims appended.

In the drawings,

Fig. 1 is a view in vertical elevation of the door in locked position looking from the inside;

Fig. 2 is a view partly in cross section taken on the line II—II Fig. 1 showing the door in locked position;

Fig. 3 is a similar view of one locking arm released and with the door free to open in the direction of the arrow;

Fig. 4 is a view of the parts shown in Fig. 3, looking at them from the left; and

Fig. 5 is a view like Fig. 3 on the hinge side of the door.

My invention is particularly applicable to doors used on destroyers and other battle craft where closing in split-second time is an essential, and with the minimum of torque required on the handle.

On a battleship, the bulkhead 10 is provided with a frame 11 having the face 12, stiffener 13 and inturned flange 14. Between the latter two parts a resilient gasket 15 is provided to take care of unevenness between the door frame and the door flange 16 and to make a water tight fit.

The door 20 is hinged to frame 11 at 21, 21. The door proper may be made in any form. For illustration, I have shown one formed up from a sheet of metal and having the main body portion 20 with the flanges 16 bent up to form a continuous rim and bent back on itself to provide the strengthening flange 22. Suitable ribs 23 give additional rigidity to the door as well as to provide bearing points for the locking arms 30. A vertical strengthening rib 24 provides a convenient place for attaching the bearing boss 25 to hold the actuating mechanism.

For purposes of description, I have illustrated a door having eight locking arms 30 pivoted on pins 31 at equally spaced points around the periphery of the door. On large doors there would be more of these locking arms, whereas on smaller doors or hatches there might be fewer.

Each locking arm 30 includes the arm portion 32 with the offset 33 having in it the threaded hole 34. The locking arm 30 shown in the drawings has the lower portion of arm 32 divided to embrace both sides of the rib 23 to which it is pivoted by the pin 31. In practice, it may or may not be made in exactly this way. As shown in Fig. 3, the locking arm and offset portion 33 should be pivoted at 31 so that it can swing into the position shown, thereby clearing the corner of flanges 12 and 14 on the door frame 11. Fig. 3 illustrates the clearance needed at the side of the door away from the hinges 21. On the hinged side it is not necessary that the locking arm 30 swing clear of the dotted line 35 (Fig. 3) because there the door 20 moves around the corner of flange 14 with the hinge pintle as its center. Fig. 5 shows the lesser movement required for locking arms 30 on the hinged side of the door.

This difference in arc of movement of locking arms 30 on the hinge side of the door as distinguished from the other edge of the door becomes important when we consider the matter of keeping the closing torque at a minimum and this purpose is facilitated by moving the locking arms 30 through different degrees of arc.

In the threaded offset 33 on each locking arm is threaded a locking dog 36 having a head 37 with a hole adapted to receive a pin 38 which also passes through the yoke 40 having a threaded end 41 adapted to receive link 42. The thread on the threaded locking dog 36 may be at a pitch chosen to give the desired clamping effect as its ball face end 39 rotates in contact with the door frame face 12. I have found that a thread which will give about ⅛ of an inch movement of the ball 39 in and out of the threaded offset 33 works satisfactorily.

In addition to providing a further tightening effect between the door and the door frame the movement of ball 39 as it rotates over face 12 relieves wear and minimizes the friction requiring less closing torque. The reason is that it is a rolling as well as a sliding engagement between these parts. The net result is that less push is required on link 42 in effecting the closing of the locking arm 30. Fig. 3 shows the ball end face 39 partially retracted into the threaded offset 33 with the locking arm in position to allow the door to open. Fig. 2 shows the ball end face 39 moved into full clamping fit. Fig. 4 shows the relative movement of link 42 which movement cooperates with the threads 36 to retract or extend ball face 39 during the opening or closing operation.

On the hinge edge of the door as shown in Fig. 5, the locking arms 30 are moved a less distance and therefore there is less rotation of threaded locking dog 36 on that edge of the door; therefore, there is less in and out movement of ball end face 39 with relation to its threaded offset 33. This is desirable because the edge of the door on the hinge side must move bodily toward the frame 12 a proportionately less distance than the opposite swinging edge of the door, since the latter is on so much longer a radius from the hinges 21.

Because the locking arms 30 on the hinge edge of the door move a less distance than those on the swinging edge of the door they will be moved into contact with face 12 of the door frame ahead of those on the swinging edge of the door and the torque required to close them will be called for before any torque is required in closing the locking arms 30 on the outer edge of the door. Also, because these locking arms on the hinge edge of the door move a lesser distance, they will be driven by the spider drive plate 50 with a shorter radius and therefore require less torque on the handle 64 to move them than will those on the swinging edge of the door. The net result thus will be that the torque required in closing the door is minimized and is spread over a more continuous period so that it does not reach as high a point as if all the locking arms took effect on the door frame at about the same time, and had to be moved about the same distance. In other words, by varying the length of movement of the locking arms 30 on the different sides of the door my invention makes it possible to avoid a peak torque on handle 64 and to make it more gradual.

The spider drive plate 50 is pivotally mounted on the boss 25 and held thereon by the stud 51 and a nut 52 so that it rotates in a plane substantially parallel with the face of the door. On a door such as illustrated where there are eight locking arms two spiders may be used. The number of spiders is a matter of the mechanic's choice in laying out a particular door. The principle of operation is the same whether one spider, two spiders or three or more spiders are used.

As shown in Fig. 1, each spider pivots around stud 51 and has the bearing holes for the several links 42 spaced at varying distances from its center. For example, the top spider 50 shown in Fig. 1 has the bearing hole to receive pin 53, a lesser distance from stud 51 than the holes to receive pin 54 or pin 55 or pin 56. This means that when spider plate 50 is rotated around stud 51, locking arm 30 and link 42 connected by pin 53 will move a lesser distance and with less torque than will the locking arm 30 and link 42 connected by pin 56. The same is true with respect to the links 42 and locking arms 30 connected to spider plate 50 by pins 55 and 54. While the spider plate is shown of an irregular shape, it could be a disc or any other shape providing the holes to receive the pins 53, 54, 55 and 56, or any group of pins set at different distances from its center of rotation.

The distance between the hole for pin 53 and stud 51 is best laid out so that when the spider plate is moved through its full intended arc the lock arm 30 secured by link 42 to pin 53 will have moved into the position shown in Fig. 5, whereby the threaded offset 33 and locking dog ball 39 will swing clear of door frame 11. The same is true in laying out the radius or radii from stud 51 for the other pins 54, 55, and 56.

Where the door has more locking arms 30 than can be handled from one locking plate 50, the arrangement is shown in Fig. 1 which proves very practical. The lower spider plate 50 is a duplicate of the upper one and these are each actuated by links 60, secured by pins 61 to each spider plate and at their other ends by pins 62 to a lever plate 63 attached to the handle 64. The distance between the handle shaft 65 and the holes to receive pins 62 is laid out so as to give sufficient movement to the spider drive plates 50 so that they will move the locking arms the requisite distance. The handle 64 preferably moves through a 180 degree arc between its opened and closed positions. It is also the practice to provide a handle both on the inside and on the outside of the door. In Fig. 1 the handle on the inside of the door has been omitted for purposes of clarity.

In order to prevent accidental movement of the locking arms before the door is swung against its frame preparatory to locking, I provide a self-actuating gravity latch 70 pivoted to the door on a horizontal stud 71 secured to the door adjacent its hinged edge. The latch has a cam face 72 and a detent 73 which is adapted when its adjacent locking arm 30 is moved to an unlocked position and the door is opened to fall down into the recess 74. Thus it holds the locking arm against any outward swinging movement and through its link 42 and the spider plate 50 the link 60 the lever plate 63, it securely holds the handle 64 against movement whenever the door is swung open. Assuming the gravity latch detent 73 is in locking engagement with face 74 of its adjacent locking arm 30, as the door is swung closed the cam face 72 will rub against door frame 11 and will lift detent 73 into the position shown in Fig. 1, thus freeing all the locking arms so that they can be actuated by the handle to lock the door. If the door is unlocked and

pulled open, cam face **72** will allow the detent **73** to drop into locking position against locking arm **30**, and all the locking parts will be immobilized until the door is again swung closed against the door frame **11**.

It sometimes happens that in battle or in a severe storm, doors or door frames will become sprung so that complete closing of all the locking arms **30** cannot be effected. By means of my invention wherein the actuation of one locking arm is not dependent upon the actuation of any other locking arm, it is possible, by simply removing any one of the pins **53**, **54**, **55** or **56** connecting a locking arm which cannot be actuated, to leave the other locking arms free to effect their purpose.

What I claim is:

1. In a closing and locking mechanism for doors the combination of a frame, a door hinged thereto, a plurality of locking arms carried by said door around its edges and movable thereover, a handle journaled in said door, spider drive means actuated thereby and pivoted links connecting said drive means to said locking arms, the pivoting points of said connections between said drive means and said links being at different radial lengths from the center of rotation of said drive means.

2. A closing and locking mechanism for a door including a frame, a door hinged thereto, a plurality of locking arms mounted on said door for movement into contact with said frame, rotatable drive means for effecting said movement, links connecting said means to said locking arms, means for varying the length of said links, a handle pivotally mounted in said door, and means connecting said handle to said rotatable drive means, the pivoting points of said connections between said drive means and said links being at different radial lengths from the center of rotation of said drive means.

3. A closing and locking mechanism for a door including a frame, a door hinged thereto, a plurality of locking arms mounted on said door for movement into contact with said frame, rotatable drive means for effecting said movement, links connecting said means to said locking arms, a handle pivotally mounted in said door, and means connecting said handle to said rotatable drive means, the connection of said links to said means being at varying radii, depending upon the distance of each locking arm from the hingeline of the door, whereby some of said locking arms move over and engage said door frame in different timing from others.

4. A closing and locking mechanism for a door including a frame, a door hinged thereto, a plurality of locking arms secured to said door, a handle, a spider drive plate connected to said handle, and pivoted links connecting said plate to said locking arms, said links connecting said locking arms nearest the hinge line being connected nearer the center of rotation of said drive plate than the locking arms farthest from the hinge line.

5. A closing and locking mechanism for a door including a frame, a door hinged thereto, a plurality of locking arms secured to said door, a handle, a spider drive plate connected to said handle, and pivoted links connecting said plate to said locking arms, the pivotal connection of said links to said drive plate being at varying radii, whereby some of said locking arms move over and engage said door frame in different timing from others.

6. A closing and locking mechanism for a door including a frame, a door hinged thereto, a plurality of locking arms secured to said door, a handle, drive means operatively connected to said handle, and pivoted links connecting said drive means to said locking arms, the pivotal connection of said links to said drive means being at varying radii, whereby some of said locking arms move over and engage said door frame in different timing from others.

7. A closing and locking mechanism for a door including a frame, a door hinged thereto, a plurality of locking arms secured to said door, a handle, a spider drive plate connected to said handle, and pivoted links connecting said plate to said locking arms, the pivotal connection of said links to said drive plate being at varying radii, depending upon the distance of each locking arm from the hinge line of the door, whereby some of said locking arms move over and engage said door frame in different timing from others.

8. A bulkhead closure comprising a bulkhead frame, a closure member hinged thereto, a plurality of locking arms hinged at spaced intervals around the rim of said closure means, a spider drive member pivoted to said closure means, a threaded locking dog secured in each locking arm and adapted to engage said bulkhead frame to secure the closure means therein, means connecting said threaded locking dog with said spider drive member whereby upon rotation of the latter said locking arm will be moved toward or away from said bulkhead frame and said threaded locking dog will move relatively to said locking arm toward or away from said bulkhead frame, and means for varying the length of said connecting means.

9. A bulkhead closure comprising a bulkhead frame, a closure member hinged thereto, a plurality of locking arms hinged at spaced intervals around the rim of said closure means, a spider drive member pivoted to said closure means, a threaded locking dog secured in each locking arm and adapted to engage said bulkhead frame to secure the closure means therein, and means connecting said threaded locking dogs with said spider drive member whereby upon rotation of the latter each locking arm will be moved toward or away from said bulkhead frame and each threaded locking dog will move relatively to its locking arm toward or away from said bulkhead frame.

10. A bulkhead closure comprising a bulkhead frame, a closure member hinged thereto, a plurality of locking arms hinged at spaced intervals around the rim of said closure means, drive means pivoted to said closure means, a threaded locking dog secured in each locking arm and adapted to engage said bulkhead frame to secure the closure means therein, and means connecting said threaded locking dogs with said drive means whereby upon rotation of the latter each locking arm will be moved toward or away from said bulkhead frame and each threaded locking dog will move relatively to its locking arm toward or away from said bulkhead frame.

CHARLES E. ARTHUR.