Sept. 29, 1959 J. E. HANNIGAN 2,906,324

HATCH COVER ACTUATOR

Filed Nov. 5, 1957 2 Sheets-Sheet 1

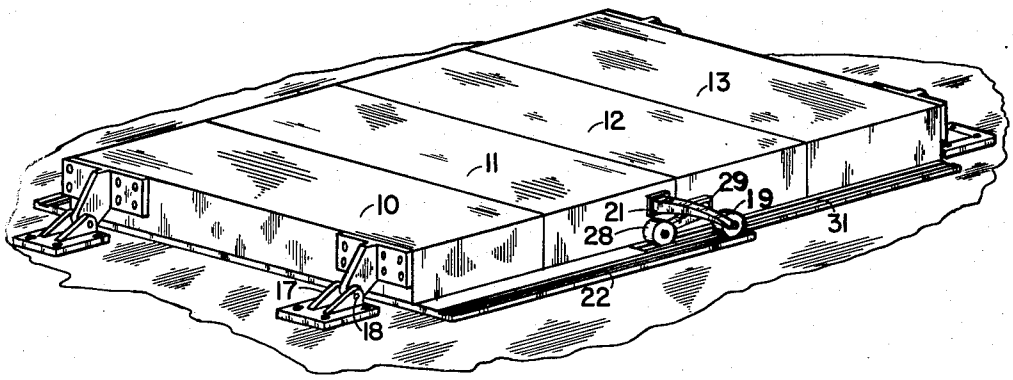


FIG. 1

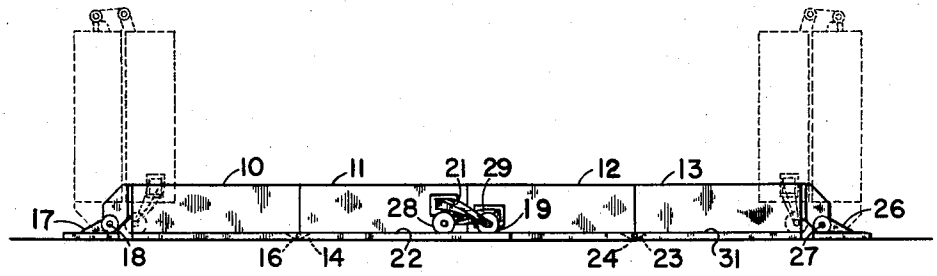


FIG. 2

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Sept. 29, 1959 J. E. HANNIGAN 2,906,324

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Filed Nov. 5, 1957 2 Sheets-Sheet 2

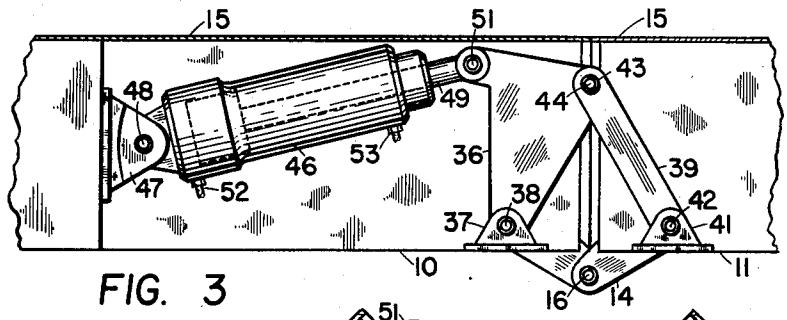


FIG. 3

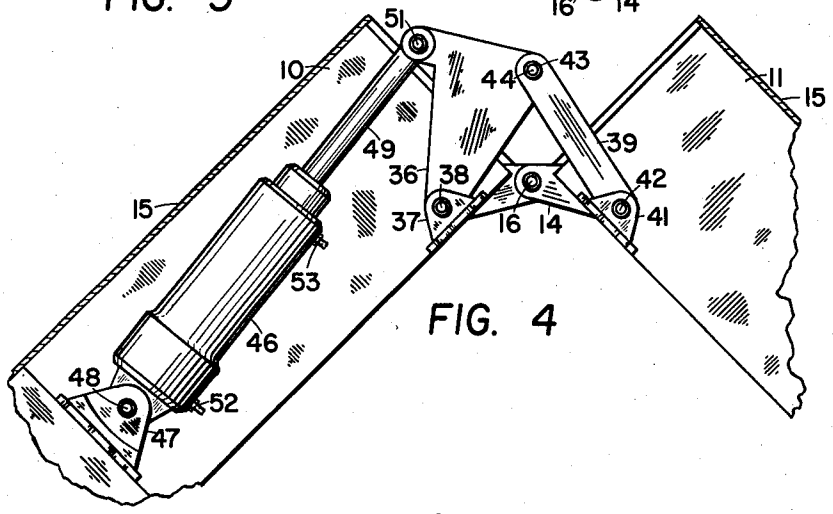


FIG. 4

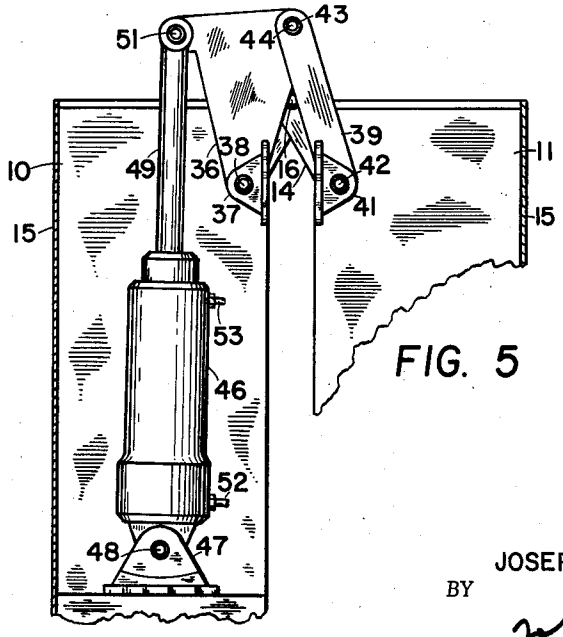


FIG. 5

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2,906,324

HATCH COVER ACTUATOR

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Application November 5, 1957, Serial No. 694,610

6 Claims. (Cl. 160—188)

This invention relates to power operated doors and more particularly to a power actuated folding door or hatch cover system adapted to cover the hatchways of ships and the like.

It is an important object of this invention to provide a new and improved power actuated folding door system.

It is another object of this invention to provide an actuating system suitable for use in operating folding hatch covers and the like.

It is still another object of this invention to provide a simple actuating system suitable for producing relative rotation between two panels through a 180° angle.

It is still another object of this invention to provide a new and improved power actuated hatch cover system for ship hatchways.

Further objects and advantages will appear from the following description and drawings, wherein;

Figure 1 is a perspective view of a typical hatch cover to which this invention is applicable;

Figure 2 is a side elevation of a hatch cover shown in Figure 1 showing the positions of the cover elements in both the opened and closed positions;

Figure 3 is an enlarged fragmentary view of the actuating mechanism for opening and closing the hatch cover showing the position of the elements when the hatch cover is closed;

Figure 4 is a view similar to Figure 3 showing the position of the elements when the hatch cover is in an intermediate partially opened position; and,

Figure 5 is a view similar to Figures 3 and 4 showing the position of the elements when the hatch cover is opened.

Referring to Figure 1 a hatch cover incorporating this invention is normally formed of a plurality of panels 10, 11, 12, and 13 which are positioned in a side by side relationship and cover a ship's hatchway when they are closed. The size of the hatchway and the clearances adjacent thereto determines the number of panels which are used to cover a given hatchway and the particular arrangement of opening the panels. In the embodiment shown there are four panels 10, 11, 12, and 13, two of which move to each end of the hatchway when it is opened. The particular structure shown in Figures 1 and 2 is merely used as an illustration of one type of arrangement which can be used but it should be understood that various arrangements can be operated by the actuating system according to this invention. Each of the panels 10 to 13 is provided with an upper relatively heavy plate 15 which is stiffened by beams and struts to give the panel sufficient structural strength. The upper plates cooperate to form a continuous upper surface when the panels are closed so it is not necessary to close in the lower surface of the panels. Therefore the lower side or surface of the panel is an open grid formed by the stiffening beams. It will be understood that these beams and struts will have to be arranged to provide adequate strength and in addition provide support for the actuating

mechanism described below. However, since the particular beam structure will vary widely with different applications and is not critical to this invention this structure is not shown in detail.

The left two panels 10 and 11 co-operate to form one pair of panels pivotally connected by a hinge 14 for relative rotation around pivot axis 16 adjacent to the lower side of the panel. The panel 10 is also pivotally mounted on its left edge to a hinge 17 which is in turn mounted on the structure of the ship's deck for rotation around a pivot axis 18. A roller 19 is mounted to the right side of the panel 11 by a support arm 21 and is adapted to roll along a track 22 best seen in Figure 1. Thus when the two panels 10 and 11 are rotated around the pivot axis 16 the roller 19 moves along the track 22 until the elements are in the open position shown in phantom. The right two panels 12 and 13 are similarly provided with a hinge 23 which connects them as a pair for relative rotation around a pivot axis 24. The panel 13 is also provided with a hinge 26 which pivotally connects it to the deck for rotation relative thereto around a pixot axis 27 and a roller 28 is supported on the left end of the panel 12 by a support arm 29 and fits into a track 21. When the panels 10 through 13 close the hatchway they are positioned in the alignment shown by the full line view of Figure 2 and when the hatch is to be opened the pair of panels 10 and 11 are folded to the dotted line position at the left end of the hatchway and the panels 12 and 13 are folded to the dotted line position at the right end of the hatchway.

In order to provide the folding movement of the panels each pair of panels is provided with an actuating mechanism shown in Figures 3 through 5. Because the actuating mechanisms are similar for each pair of panels only the system used to operate the panels 10 and 11 will be described in detail with an understanding that the panels 12 and 13 have a similar but opposite actuating mechanism. As described above the two panels 10 and 11 are pivotally connected by the hinge 14 for rotation around the pivot axis 16. Pivotally connected to the panel 10 is a first link 36 which is suppored by a pivot block 37 for rotation relative to the panel 10 around the pivot axis 38 longitudinally along the panel 10 from the pivot axis 16. A second link 39 is mounted on the panel 11 by means of a pivot block 41 for rotation relative thereto around a pivot axis 42 spaced from the pivot axis 16 by a distance equal to the spacing between the axes 16 and 38. The two links 36 and 39 are connected together by a pivot pin 43 for rotation around a pivot axis 44 equally spaced from the axes 38 and 42 and in effect co-operate with portions of the panels to form a 4-bar linkage wherein all of the links are pivoted for rotation relative to the adjacent links. In other words the portion of the panel 10 between the pivot axes 16 and 38 is in effect one link and the portion of the panel 11 between the pivot axes 16 and 42 is in effect another link. These two panel portions co-operate with the links 36 and 39 to form the 4-bar linkage.

A double acting fluid motor preferably of the piston and cylinder type is utilized to actuate the linkage and produce the relative rotation of the two panels 10 and 11 around the pivot axis 16. Preferably a cylinder 46 is pivoted on a mounting block 47 which is in turn mounted on the panel 10 for rotation around an axis 48. A co-operating piston 48 extends from the cylinder 46 and is connected to the first link 26 by a pivot pin 51. When the elements are in the position shown in Figure 3 the piston 49 is essentially bottomed within the cylinder so fluid under pressure is supplied to the cylinder 46 through a pressure line 52 in the conventional manner to cause extension of the piston 49 and opening of the

hatch. This produces clockwise rotation of the first link 36 around the pivot axis 38 and as a result relative rotation of the two panels 10 and 11 about the pivot axis 16 to the position of Figure 4 through the connection of the second link 39. Still further extension of the piston 49 produces relative movement of the various elements to the position of Figure 5 at which time the two panels 10 and 11 have rotated relative to each other through substantially 180°. When the hatch is to be closed fluid under pressure is supplied to the right end of the cylinder 46 through a pressure line 53 which produces compression of the fluid motor and movement of the piston 49 to the left. This will produce movement of the two panels back through the position of Figure 4 to the position of Figure 3 at which time panels are in their aligned position. A suitable 4-way valve may be utilized to connect the cylinder 46 to a source of fluid under pressure to control the action of the fluid motor. It should be noted that the first link 36 has a tri-angular shape because this link is subject to bending motion. However, the second link 39 can be of a simple bar type since it is subjected only to compression and tension loads. The cylinder 46 should be mounted on the outer panels, which in this case is the panel 10 whenever possible, since this arrangement minimizes the requirement for flexible hoses from the fluid pressure source on the ship.

It should be understood that the hatch cover for the weather deck will require seals between the adjacent panels and the deck or coaming around the hatchway. It is preferable to form the roller supports 21 and 29 so that the rollers 19 and 28 are beyond the ends of their respective panels 11 and 12 so that the initial opening of the covers will produce vertical movement of the adjacent edge of the panels to prevent sliding of the seal between the hatch and the panel during the initial opening operation. If the cover is to be used between decks normally seals are not provided. Again when the hatch covers are to be used between decks it is normal to arrange the panels so that the upper surface thereof is flush with the deck. If this is done the tracks and hinges will be mounted slightly below the deck surface. However, on the weather deck normally the tracks 22 and 31 are mounted on the surface of the coaming around the hatch and the hatches extend above the deck surface.

Depending upon the width of the panels and their structural weight two or more similar actuating mechanisms of the type shown in Figures 3 through 5 can be symmetrically spaced along the joint between the panels 10 and 11 and the hinges 14 are positioned laterally along the panels to one side of the actuating mechanism so that there will be no interference between the hinge and the links 36 and 39 when the covers move to the open position. Those skilled in the art will recognize that by utilizing the 4-bar type link shown it is possible to use a single fluid motor to produce relative rotation between the panels through substantially 180°. It is necessary to arrange the link so that the pivot axes 38 and 42 are both above the axis 16 of the hinge when the hatchway is closed so that the system will not go through a dead center during the operation. I prefer to utilize a 4-bar linkage where the distance between the axes 38 and 16 is equal to the distance between the axes 16 and 42 and wherein the distance between the axes 38 and 44 is equal to the distance between the axes 44 and 42. It is also desirable to arrange the mechanism so that the effective lengths of the links 26 and 29, that is the distance of each of the axes 38 and 42, from the the axis 44 is greater than their spacing from the axis 16. If a structure is utilized wherein all of these conditions are met, the link 36 will be rotated through less than 90° when the panels are rotated through 180° relative to each other. In addition the proportions should be arranged so that the line of action of the fluid motor is perpendicular to a line connecting the axis 38 with the axis of the pivot pin 51 when the panels are in the closed position of Figure 3 so that the torque produced by the fluid motor will be at a maximum at this time. With this structure the available torque is at a maximum when the panels start to open and drops to a lower value as the panels approach the open position of Figure 5. Therefore the available torque follows the load requirements of operation which starts at a maximum and drops off as the panels open. Since the available torque tends to match the required torque an efficient system is provided wherein the minimum amount of oil is used to power the device through a cycle. This has the advantage of permitting the use of a smaller pump or accumulator, as the case may be, in a given system.

If all the panels are to be stowed at one end of the hatchway the two pairs of panels can be pivotally connected between the panels 11 and 12 and the panel 13 would not be hinged to the deck but rather would be provided with a roller which moves along a track.

Those skilled in the art will recognize that the use of the simple actuating system described above permits rotation of each panel through 90° and rotation between adjacent panels of 180° relative to each other with the use of a single piston and cylinder type motor. It also permits the use of links having simple pin-type connections which are relatively immune to damage which is of utmost importance for marine installations where a long, trouble free service life is necessary.

Although the preferred embodiment of this invention is illustrated, it will be realized that various modifications of the structural details may be made without departing from the mode of operation and the essence of the invention. Therefore, except insofar as they are claimed in the appended claims, structural details may be varied widely without modifying the mode of operation. Accordingly, the appended claims and not the aforesaid detailed description is determinative of the scope of the invention.

I claim:

1. A cover assembly comprising a pair of panels, each having an outer face and an inner face, a hinge connecting adjacent edges of said panels for relative rotation about an axis adjacent to said inner faces, first and second links pivoted on said first and second panels respectively at points spaced longitudinally from said axis and laterally spaced from said hinge, a pivot interconnecting said links, and a motor operably connected to one of said links operable to rotate said one link relative to its associated panel effecting relative rotation of said panels around said axis between a first position in which said panels are aligned and a second position in which each panel is rotated 90° from said first position, said outer faces of said panels co-operate to form a continuous surface when said panels are in said first position.

2. A cover assembly comprising a pair of panels, each having an outer face and an inner face, a hinge connecting adjacent edges of said panels for relative rotation about an axis adjacent to said inner faces, first and second links pivoted on said first and second panels respectively at points spaced longitudinally from said axis and laterally spaced from said hinge, a pivot interconnecting said links at a point spaced from the pivots connecting the links to the panels, and a motor operably connected between said first link and said first panel operable to rotate said one link relative to its associated panel effecting relative rotation of said panels around said axis between a first position in which said panels are aligned and a second position in which each panel is rotated 90° from said first position.

3. A cover assembly comprising a pair of panels, each having an outer face and an inner face, a hinge connecting adjacent edges of said panels for relative rotation about an axis adjacent to said inner faces, first and second links pivoted on said first and second panels respectively at points spaced longitudinally from said axis and laterally spaced from said hinge, a pivot connecting said links

at a point spaced from the pivots connecting the links to the panels, and a motor operably connected between said first link and said first panel operable to rotate said one link relative to its associated panel effecting relative rotation of said panels around said axis between a first position in which said panels are aligned and a second position in which each panel is rotated 90° from said first position, said outer faces of said panels co-operate to form a continuous surface when said panels are in said first position.

4. A hatch cover for closing a horizontal hatchway comprising first and second panels, a hinge connecting one of said panels to said hatchway, a pivot connecting adjacent edges of said panels for relative rotation around a first axis, a first link pivoted on said first panel for rotation relative thereto about a second axis, a second link pivoted on said second panel for rotation relative thereto about a third axis spaced from said first axis by a distance equal to the spacing between said first and second axes, means interconnecting said links for relative rotation around a fourth axis equally spaced from said second and third axes, and a fluid motor including piston and cylinder elements axially movable relative to each other under the influence of fluid under pressure, one of said elements being pivotally mounted on said first panels and the other elements pivotally connected to said first link.

5. A hatch cover for closing a horizontal hatchway comprising first and second panels, a hinge connecting one of said panels to said hatchway, a pivot connecting adjacent edges of said panels for relative rotation around a first axis, a first link pivoted on said first panel for rotation relative thereto about a second axis, a second link pivoted on said second panel for rotation relative thereto about a third axis spaced from said first axis by a distance equal to the spacing between said first and second axes, means interconnecting said links for relative rotation around a fourth axis equally spaced from said second and third axes, the distance between said second axis and said first axis being less than the spacing between said second axis and said fourth axis, and a fluid motor including piston and cylinder elements axially movable relative to each other under the influence of fluid under pressure, one of said elements being pivotally mounted on said first panels and the other elements pivotally connected to said first link.

6. A hatch cover for closing a horizontal hatchway comprising first and second panels, a hinge connecting one of said panels to said hatchway, a pivot connecting adjacent edges of said panels for relative rotation around a first axis, a guide on the edge of the other panel opposite to said pivot movable along a horizontal plane, a first link pivoted on said first panel for rotation relative thereto about a second axis, a second link pivoted on said second panel for rotation relative thereto about a third axis spaced from said first axis by a distance equal to the spacing between said first and second axes, means interconnecting said links for relative rotation around a fourth axis equally spaced from said second and third axes, the distance between said second axis and said first axis being less than the spacing between said second axis and said fourth axis, and a fluid motor including piston and cylinder elements axially movable relative to each other under the influence of fluid under pressure, one of said elements being pivotally mounted on said first panel and the other element pivotally connected to said first link for rotation relative thereto around a fifth axis, the axis of movement of said piston being substantially perpendicular to a line connecting said fifth axis and said second axis when said panels close said hatchway.

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