Sept. 29, 1959 J. E. HANNIGAN 2,906,326

HATCHCOVER OPERATING SYSTEM

Filed Dec. 23, 1957 2 Sheets-Sheet 1

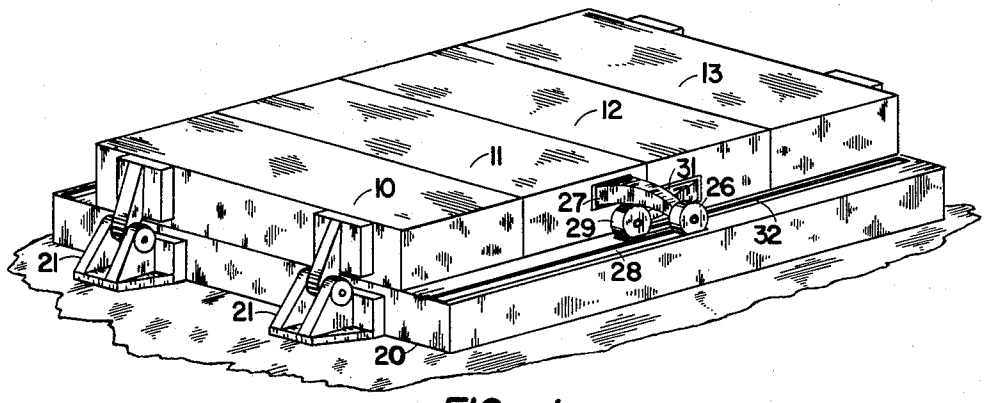


FIG. 1

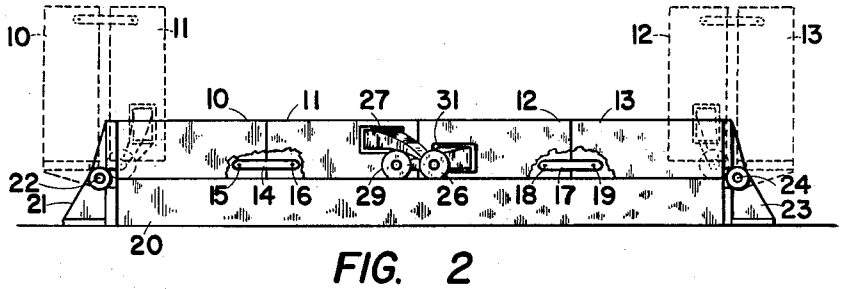


FIG. 2

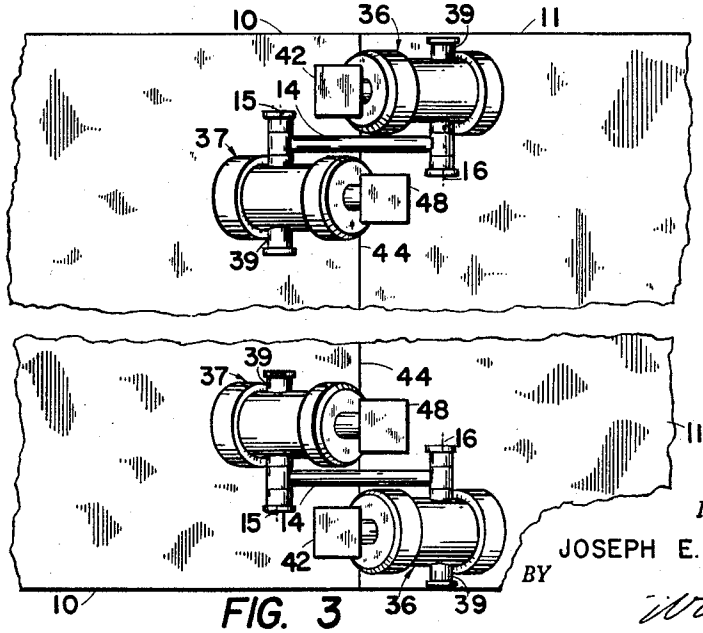


FIG. 3

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HATCHCOVER OPERATING SYSTEM

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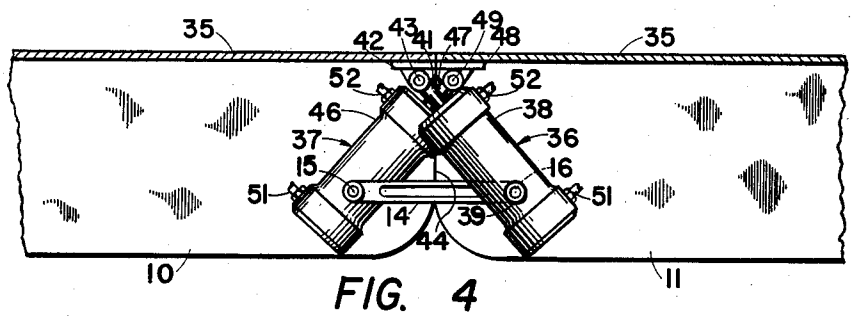


FIG. 4

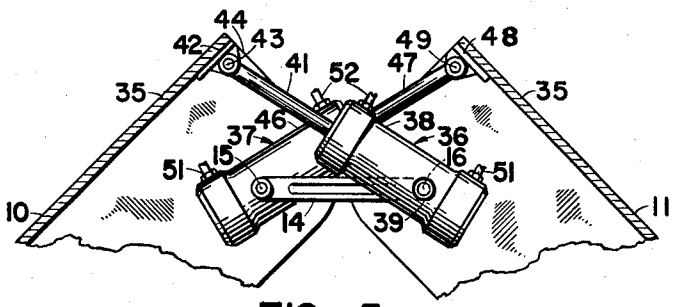


FIG. 5

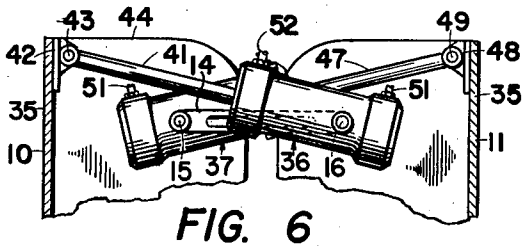


FIG. 6

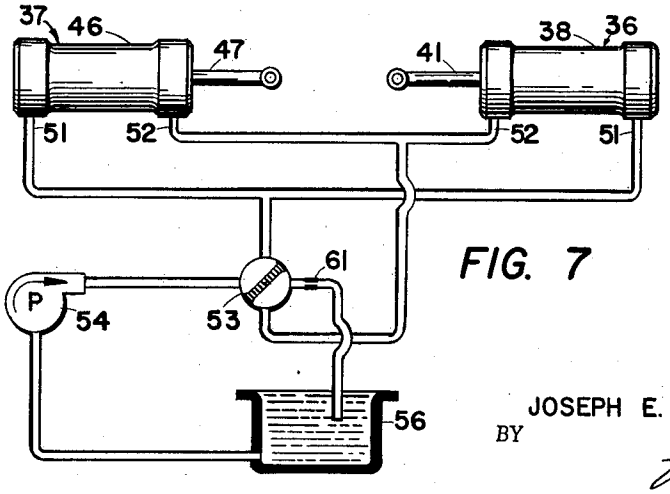


FIG. 7

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United States Patent Office 2,906,326 Patented Sept. 29, 1959

2,906,326

HATCHCOVER OPERATING SYSTEM

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Application December 23, 1957, Serial No. 704,748

10 Claims. (Cl. 160—188)

This invention relates to power actuating mechanisms and more particularly to a power actuated hatchcover system adapted to cover the hatchways of ships and the like.

It is an important object of this invention to provide a simplified mechanism for rotating two pivotally connected panels through 180° of relative rotation.

It is another object of this invention to provide a new and improved power actuated folding closure.

It is still another object of this invention to provide a power actuated hatchcover for use on ship's hatchways and the like.

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 the hatchcover shown in Figure 1 showing the cover elements in both the closed and open positions with parts broken away and the cylinders removed to show the location of the hinge links;

Figure 3 is a fragmentary plan view of the preferred actuating mechanism with the upper plate removed;

Figure 4 is an enlarged fragmentary side elevation showing the position of the actuator elements when the cover is in the closed position;

Figure 5 is a view similar to Figure 4 showing the position of the elements when the cover is in an intermediate position;

Figure 6 is a view similar to Figures 4 and 5 showing the mechanism in the fully opened position; and

Figure 7 is a schematic illustration of a suitable hydraulic control system.

A hatchcover incorporating this invention is normally formed with a plurality of panels and pontoons **10**, **11**, **12**, and **13** which are positioned in a side-by-side relationship and cover ship's hatchways when they are closed. In the illustrated hatchcover there are four panels, however, it should be understood that the size of the hatchway in the storage clearances adjacent thereto determines the number of panels used in a particular installation. In the embodiment shown the panels **10** and **11** are each connected to a hinge link **14** for rotation relative thereto around hinge axes **15** and **16** respectively and the panels **12** and **13** are similarly pivotally connected to a hinge link **17** for relative rotation about hinge axes **18** and **19** respectively. The panel **10** is hinged to the deck or coaming **20** of the ship by hinges **21** for rotation around a pivot axis **22** and similarly the panel **13** is connected to the deck **20** by hinges **23** for rotation around a pivot axis **24**. Thus the panels are divided into left and right pairs wherein the left pair comprises the panels **10** and **11** and the right pair comprises the panels **12** and **13**.

The panel **11** is provided with a support arm **27** on either side thereof on which is journalled a roller **26**. Each roller **26** rolls along a track **28** on the deck **20** to guide the right end of the left pair of panels in the horizontal plane of the hatchway. Similarly a roller **29** is mounted on either side of the panel **12** by a support arm **31** and

is arranged to roll along a track **32** mounted on the deck **20** offset from the track **28**. The opening of the hatchway is accomplished by producing relative rotation between the panels of each pair around their respective hinge links **14** and **17** which causes the rollers **26** and **29** to move along their respective tracks until the panels assume the phantom position of Figure 2. A comparison of the closed and open positions will show that the panels of each pair must rotate relative to each other through a full 180° between the closed and open positions so the mechanism for power operating the hatch system must be capable of producing this magnitude of rotation. As mentioned previously this structure is illustrative of one stowing arrangement and can be modified so that all of the panels move to one or the other end of the hatchway by simple re-arrangement of the hinge connections.

Each of the panels is formed with a relatively heavy upper plate **35** which is stiffened by beams and struts to give the panel sufficient structural strength. The upper plates **35** cooperate to form a continuous surface when the panels are closed so that it is not necessary to close the lower surface of the panels. Therefore, the lower side of the panel is open grid formed by stiffening beams and struts. It will be understood that these panels will have to be arranged to provide sufficient 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 it is not shown.

In order to provide the folding movement of the panels each pair of panels is provided with two or more actuating mechanisms best shown in Figures 4 through 6. Because the actuating mechanisms are similar only one of the mechanisms used to operate the panels **10** and **11** will be described in detail with the understanding that the description applies to the other mechanisms also. As described above the two panels **10** and **11** are pivotally connected to a hinge link for rotation relative thereto around the pivot axes **15** and **16** respectively between the aligned position of Figure 4 at which time the hatchway is closed and the position of Figure 6 which is the open position.

A comparison of the Figures 4 and 6 will show that each of the panels **10** and **11** rotates relative to the hinge link **14** through 90° and as a result rotate relative to each other through 180°. In order to produce the relative rotation between the panel **10** and the hinge link **14** a first fluid motor **36** is pivotally connected between the hinge link **14** and the panel **10**. Similarly relative rotation between the panel **11** and the hinge link **14** is produced by a second fluid motor **37** pivotally connected to the hinge link **14** and the panel **11**. The first fluid motor **36** includes a cylinder **38** formed with trunnions pivotally supported on bearing pads **39** mounted on the panel **11** for rotation relative thereto around the pivot axis **16**. As shown in Figure 3 the hinge link **14** extends to one side of the cylinder **38** and both the link and cylinder are pivoted for rotation around the same axis **16**. The fluid motor **36** also includes a piston **41** axially movable relative to the cylinder **38** under the influence of fluid under pressure. The piston **41** is pivotally connected to a bearing pad **42** for rotation relative thereto about a pivot axis **43**, and the bearing pad **42** is in turn mounted on the under side of the upper plate **35** of the panel **10** adjacent to the inner end **44** of the panel **10**. The second fluid motor **37** includes a cylinder **46** which is pivotally connected to the panel **10** for relative rotation around the pivot axis **15** and a piston **47** axially movable relative to the cylinder **37** under the influence of fluid under pressure. The piston **47** is pivotally connected to a bearing pad **48** for relative rotation around a pivot axis **49** and the bearing pad **48** is in turn mounted on the under side

of the upper plate **35** of the panel **11** adjacent to its inner end so the various elements are symmetrically located relative to the ends of the panels **10** and **11**.

Each of the cylinders **38** and **46** is provided with a pressure line connection **51** through which fluid under pressure can be supplied to the respective cylinders to produce extension of the fluid motors. Again each of the cylinders is provided with a second pressure line connection **52** through which fluid under pressure can be admitted to cause retraction of the fluid motors. Both of the pressure line connections **51** and **52** are connected to a 4-way valve **53** shown in Figure 7 and the 4-way valve **53** is in turn connected to a source of pressure such as a pump **54** and a reservoir **56**. The valve **53** is arranged so that it can be operated to simultaneously connect the pressure lines **51** to the pump **54** and the pressure line **52** to the reservoir **56** or be operated to reverse these connections.

If the 4-way valve **53** is operated to supply fluid under pressure to the connections **51** both of the pistons **41** and **57** then move axially out of the cylinders **38** and **46** respectively. This produces rotation of the two panels **10** and **11** relative to the hinge link **14** around their respective axes **15** and **16**. The effective torque arm, which is the perpendicular distance between the axis of the fluid motor **37** and the pivot axis **16** in the case of the fluid motor **37** and the perpendicular distance between the axis of the fluid motor **36** and the pivot axis **15** in the case of the fluid motor **36**, decreases as the panels move to the open position. Therefore, any tendency of one panel to rotate relative to the hinge link faster than the other is automatically eliminated because the torque arm of the lead panel reduces faster than the torque arm of the trailing panel and automatically causes the trailing panel to move faster and catch up. It should be noted that the amount of torque produced by a given pressure in each of the actuators is at a maximum when the elements are in the closed position of Figure 4 and the torque reduces as they approach the fully opened position. This is desirable because the torque necessary to open the panels is initially at a maximum when the panels are in the closed position of Figure 4 and drops off as the panels approach the open position of Figure 6.

In order to insure that there will be torque available as the elements approach the open position the various elements should be arranged so that the axes **15** and **16** are located at a point spaced from the adjacent ends of the panels by a distance greater than the spacing between the ends and the pivot axes **43** and **49**. If this arrangement is utilized the axes of the fluid motors will not pass through the opposite hinge axis in the open position and the motors will be capable of producing torque through the full cycle. In the illustrated embodiment both the hinge link **14** and the cylinder **46** are pivoted on the panel **10** for rotation around the same axis. Therefore, the cylinder **46** is in effect pivoted on the hinge link **14** and produces relative rotation between the hinge link **14** and the panel **11**. If it is desired the cylinder **46** can be pivoted on the hinge link **14** anywhere but at the axis **16** and the mechanism will function in substantially the same manner. Similarly the cylinder **46** can be pivoted on the panel **10** at a point spaced from the axis **15** by relatively small distances and still function. Whatever the arrangement used it is preferred to locate the pivots so that they are symmetrical relative to the adjacent ends of the panels and relative to the upper surfaces thereof.

When the panels are to be closed it is merely necessary to reverse the 4-way valve **53** and supply fluid under pressure to the connections **52** and at the same time connect the connections **51** to the reservoir. This will cause the pistons **41** and **47** to move toward their compressed position and cause the panels to return to the closed position of Figure 4. In practice once the panels have moved away from the fully opened position their weight will assist the actuators in moving to the closed position.

Therefore, a metering orifice **61** should be connected in the reservoir return line to control the rate of movement of the panels.

The fluid motors assume a position completely within the envelope of the panels when they are in both the opened and closed positions so they are protected against damage from impacts during cargo loading and the like. The hinge link **14** should be spaced from the lower surface of the panels so that the panels will be close together when in the open position and thereby use less space. It should be noted that the hinge link **14** is not subjected to any bending moments and is merely a tension member when the maximum loads are applied. Also the piston and cylinders of the fluid motors are not subjected to any bending motion so wear will not be troublesome. Generally small hatchcovers will be operated by two actuator assemblies symmetrically located along the inner ends and three or more assemblies will be used for larger heavier covers.

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 are determinative of the scope of the invention.

I claim:

1. A folding closure comprising a pair of panels, a hinge link connected at a first pivot to one panel and at a second pivot spaced from said first pivot to the other panel, and a pair of motors pivotally connected between said panels in diagonal opposite directions each including cylinder and piston elements linearly movable relative to each other.

2. A folding closure comprising a pair of panels, a hinge link connected at a first pivot to one panel and at a second pivot spaced from said first pivot to the other panel, a pair of fluid motors each having piston and cylinder elements linearly movable relative to each other, pivots connecting one motor between said hinge link and one panel and the other motor between the hinge link and the other panel, and fluid control means connected to each motor operable to supply fluid pressure thereto and produce relative rotation between said panels and said link.

3. A folding closure comprising a pair of panels, a hinge link connected at a first pivot to one panel and at a second pivot spaced from said first pivot to the other panel, first and second fluid motors each having piston and cylinder elements linearly movable relative to each other, one element of said first motor being connected to said first pivot and one element of said second motor being connected to said second pivot, a third pivot connecting the other element of said first motor to said other panel, a fourth pivot connecting the other element of said second motor to said one panel, and fluid control means connected to each motor operable to supply fluid pressure thereto and produce relative rotation between said panels and said link.

4. A folding closure comprising a pair of panels, a hinge link connected at a first pivot to one panel and at a second pivot spaced from said first pivot to the other panel, first and second fluid motors each having piston and cylinder elements linearly movable relative to each other, one element of said first motor being connected to said first pivot and one element of said second motor being connected to said second pivot, a third pivot connecting the other element of said first motor to said other panel, a fourth pivot connecting the other element of said second motor to said one panel, said third and fourth pivots being spaced from each other by a distance less than the spacing of said first and second pivots when said panels are aligned, and fluid control means con-

nected to each motor operable to supply fluid pressure thereto and produce relative rotation between said panels and said link.

5. A power actuated hatchcover for covering a horizontal hatchway comprising first and second panels movable between a horizontal closed position and an open position 180° of relative rotation from said closed position, each panel having an upper surface cooperating with the upper surface of the other panel to form a continuous surface when said panels are in said closed position, a hinge link pivotally connected to said first and second panels for rotation relative thereto around first and second axes respectively, said axes being spaced from the adjacent ends and upper surfaces of said panels, first and second fluid motors each including piston and cylinder elements linearly movable relative to each other, one element of each motor being pivotally connected to said hinge link and the other element of each motor being pivotally connected one to each panel at points adjacent to said upper surfaces and said adjacent ends, and control means connecting said motors in parallel and operable to supply fluid pressure thereto.

6. A power actuated hatchcover for covering a horizontal hatchway comprising first and second panels movable between a horizontal closed position and an open position 180° of relative rotation from said closed position, each panel having an upper surface cooperating with the upper surface of the other panel to form a continuous surface when said panels are in said closed position, a hinge link pivotally connected to said first and second panels for rotation relative thereto around first and second axes respectively, said axes being spaced from the adjacent ends and said upper surfaces of said panels, first and second fluid motors each including piston and cylinder elements linearly movable relative to each other, one element of each motor being pivotally connected to said hinge link and the other element of each motor being pivotally connected one to each panel at points adjacent to said upper surfaces and said adjacent ends, a hinge pivotally connecting said first panel to one side of said hatchway, a guide on said second panel movable along said hatchway, and control means connecting said motors in parallel and operable to supply fluid pressure thereto.

7. A power actuated hatchcover for covering a horizontal hatchway comprising first and second panels movable between an aligned closed position and an open position 180° of relative rotation from said closed position, said panels having an imperforate upper surface and a lower surface, a hinge link pivotally connected to said first and second panels for rotation relative thereto around first and second axes respectively, said axes being spaced from the adjacent ends of said panels, first and second fluid motors each including piston and cylinder elements linearly movable relative to each other, one element of each motor being pivotally connected to said hinge link and the other element of each motor being pivotally connected one to each panel, said fluid motors being completely contained between said upper and lower surfaces when said panels are in said closed position and between said upper surfaces when said panels are in said open position, a hinge pivotally connecting said first panel to one side of said hatchway, a guide on said second panel movable along said hatchway, and control means connecting said motors in parallel and operable to supply fluid pressure thereto.

8. A folding closure comprising first and second panels relatively movable from a first position wherein they are aligned with an end of one panel adjacent to an end of the other panel to a second position 180° of relative rotation from said first position, each panel being formed with an imperforate outer surface which cooperates with the outer surface of the other panel to form a continuous surface when said panels are in said first position, a hinge link, pivots connected to said first and second panels to said hinge link for rotation relative thereto about first and second axes respectively, first and second fluid motors each having piston and cylinder elements linearly movable relative to each other under the influence of fluid under pressure, said first fluid motor cylinder being pivoted on said first panel for rotation relative thereto around said first axis and said first motor piston being pivoted on said second panel for rotation relative thereto about a third axis, said second motor cylinder being pivoted on said second panel for rotation relative thereto about said second axis and said second motor piston being pivoted on said first panel for rotation relative thereto about a fourth axis, said axes being symmetrical relative to said adjacent ends, and fluid control means connecting said motors operable to supply fluid pressure thereto.

9. A folding closure comprising first and second panels relatively movable from a first position wherein they are aligned with an end of one panel adjacent to an end of the other panel to a second position 180° of relative rotation from said first position, each panel being formed with an imperforate outer surface which cooperates with the outer surface of the other panel to form a continuous surface when said panels are in said first position, a hinge link, pivots connected to said first and second panels to said hinge link for rotation relative thereto about first and second axes respectively, first and second fluid motors each having piston and cylinder elements linearly movable relative to each other under the influence of fluid under pressure, said first fluid motor cylinder being pivoted on said first panel for rotation relative thereto around said first axis and said first motor piston being pivoted on said second panel for rotation relative thereto about a third axis, said second motor cylinder being pivoted on said second panel for rotation relative thereto about said second axis and said second motor piston being pivoted on said first panel for rotation relative thereto about a fourth axis, said axes being symmetrical relative to said adjacent ends, said first pivot being spaced from its associated end by a distance greater than the spacing between said third pivot and its associated adjacent end and said first pivot being spaced from its associated upper surface by a distance greater than the spacing between said third pivot and its associated upper surface, and fluid control means connecting said motors in parallel and operable to supply fluid pressure thereto.

10. A folding closure comprising a pair of panels, a hinge link connected at a first pivot to one of said panels and at a second pivot spaced from said first pivot to the other panel, and a pair of motors mounted between said panels in diagonal opposite directions, one of said motors pivotally connected to said first pivot and one of said panels and the other of said motors pivotally connected to said second pivot and the other of said panels, each motor including cylinder and piston elements linearly movable relative to each other.

References Cited in the file of this patent

FOREIGN PATENTS

402,591	Great Britain	Dec. 7, 1933
55,607	France	May 14, 1952
	(1st addition to Pat. 971,979)	