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HYDRAULIC DRIVING MEANS FOR OPERATING HATCH COVERS

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3 Sheets-Sheet 1



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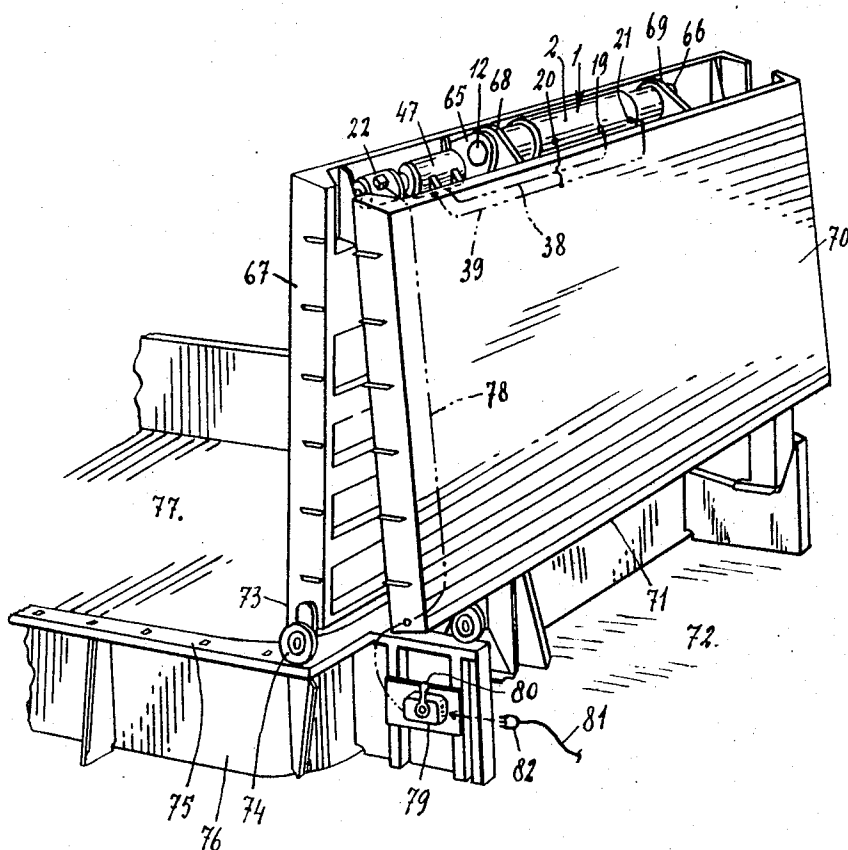


Fig-2

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HYDRAULIC DRIVING MEANS FOR OPERATING HATCH COVERS

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1 Claim. (Cl. 160—188)

The invention relates to a hydraulic driving mechanism for operating a hatchway cover or the like, provided with a reversible hydraulic motor drivingly connected with the cover and included in a hydraulic system which further comprises an oil tank and a hydraulic pump driven by a switch-controlled electromotor, one of the sides of the pump being connected with one of the sides of the hydraulic motor through a hydraulic conduit.

In a known hydraulic driving mechanism of this type use is made of a non-reversible hydraulic pump driven by a non-reversible electromotor. Between the hydraulic pump and the hydraulic motor, a hydraulic switching valve is arranged which valve may be controlled for connecting the pressure oil supply conduit leading from the pump with one side or the other of the hydraulic motor in order to operate the latter in one direction or the other as desired for moving the hatchway cover towards its closed or opened position.

It is an object of the invention to provide a hydraulic driving mechanism which may be controlled in an easier manner.

It is a further object of the invention to simplify a hydraulic driving mechanism incorporating a hydraulic motor of a type known under the name Hydraultorque hinge.

Another object of the invention is the provision of such hydraulic driving mechanism wherein no flexible oil hoses are needed between the hydraulic motor and the hydraulic pump.

To this end, the hydraulic driving mechanism according to the invention is characterized in that the electromotor and the hydraulic pump are reversible, one of the sides of the pump being connected with one of the sides of the hydraulic motor by a hydraulic conduit and the other side of the pump being connected with the other side of the hydraulic motor by a separate hydraulic conduit, the switch controlling the electromotor being a reversing switch.

For operating the hydraulic driving mechanism according to the invention, it suffices to switch on the reversible electromotor in the desired direction, which may be done in a simple manner with the aid of an electrical reversing switch provided for controlling the supply of electric current to the electromotor.

The invention will be further explained by reference to the drawings.

FIG. 1 schematically shows a preferred embodiment of the invention using a Hydraultorque hinge;

FIG. 2 is a perspective view showing the use of the Hydraultorque hinge according to FIG. 1 in a hatchway cover comprising two movable sections;

FIG. 3 schematically shows another embodiment of the invention using a double acting hydraulic cylinder.

The embodiment shown in FIG. 1 comprises a so-called Hydraultorque hinge 1, which constitutes the driving connecting member of a pivotable hatch cover, and mainly consists of a cylinder 2 in which two pistons 3 and 4 are slidably supported.

Each of the pistons 3 and 4 is connected with a sleeve 5, or 6 respectively, comprising an internal thread and external rectilinear splines. The internal thread of each

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of the sleeves 5 and 6 engages a corresponding external thread 7, 8 of an associated rotatable, non-slidably supported shaft 9, 10 of which either end is provided with rectilinear splines 11, 12. The external rectilinear splines of each of the sleeves 5 and 6 engage corresponding internal splines of an associated extension 15, 16 of the cylinder 2, so that the sleeves 5 and 6 may slide with respect to the extension 15 and 16, but cannot turn.

Furthermore, each of the extensions 15 and 16 is provided with external rectilinear splines 17, 18. The cylinder 2 is provided with three openings 19, 20 and 21 each having a nipple for connection with an oil conduit; the opening 19 debouches in the middle of the cylinder 2, whilst the two remaining openings 20 and 21 each debouch at one of the ends of this cylinder 2, in such manner that each piston 3, 4 is always located between the middle opening 19 and the associated outer opening 20 or 21.

By means of suitable fittings, the two sets of splines 11, 12 are attached to a cover section, and the other sets of splines 17, 18 are connected to another cover section or to a fixed part of the ship, so that the first-mentioned cover section may swing around the other cover section or around said fixed part to open or to close the access to a hold. After admitting oil under pressure to the cylinder 2 through the middle opening 19 between the pistons 3 and 4, the latter together with the sleeves 5, 6 are pressed outwardly from the position as shown in FIG. 1, whereby a rotation of the shaft 9, 10 and of the splines 11, 12 formed thereon relative to the cylinder 2 and its extensions 15, 16 with the splines 17, 18 is effected, so as to swing the first-mentioned cover section in a certain direction relative to said other section or said fixed part.

If oil under pressure is admitted to the cylinder 2 through the openings 20 and 21, the pistons 3 and 4 together with the sleeves 5, 6 are moved inwardly, whereby a relative rotation of the shaft 9, 10 in the opposite direction is effected, so as to move the cover section in the latter direction.

As shown in FIG. 2 the sets of rectilinear splines 11, 12 of the Hydraultorque hinge are fixed to a cover section 67 by means of fittings 66, 65, respectively, whereas the other sets of splines 17, 18 are fixed to a cover section 70 by means of fittings 69, 68 respectively so that the cover sections 67 and 70 are connected with each other for pivotal movement about the horizontal axis of the cylinder 2 of the Hydraultorque hinge 1.

The cover section 70 is journaled with respect to the fixed ship's structure 72 at its end 71 remote from the Hydraultorque hinge 1 for pivotal movement about an axis parallel to the axis of the cylinder 2. The end 73 of the cover section 67 remote from the Hydraultorque hinge 1 is provided with rollers 74 on both sides to run over the flat upper face 75 of the hatchway coaming 76 surrounding the hatchway opening 77 to be closed by the cover sections 67 and 70.

In their opened position as shown in FIG. 2, the cover sections 67 and 70 stand up side by side leaving the hatchway opening 77 unobstructed. In this position, the Hydraultorque hinge 1 is in the condition wherein the pistons 3, 4 have been moved outwardly. By supplying pressure oil to the cylinder 2 of the Hydraultorque hinge 1 through the openings 20 and 21 the Hydraultorque hinge 1 may be caused to swing the cover sections 67, 70 from the position shown in FIG. 2 into a closed position (not shown) wherein the cover sections 67, 70 lie up on the upper face 75 of the hatchway coaming 76 aligned with each other to keep the hatchway opening 77 closed. In this position, the Hydraultorque hinge 1 is in the condition shown in FIG. 1 wherein the pistons 3, 4 are ad-

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jacent each other. By supplying pressure oil to the cylinder 2 of the Hydraultorque hinge 1 through the middle opening 19, the Hydraultorque hinge 1 may be caused to swing the cover sections 67, 70 back again from their closed position into their opened position as shown in FIG. 2.

It is pointed out that the amount of oil contained in the Hydraultorque hinge 1 is independent of the position of the pistons 3 and 4, so that the oil supply or discharge through the middle opening 19 is always equal to the oil discharge or supply through the openings 20 and 21.

It will be understood that a considerable number of Hydraultorque hinges 1 is required on a ship to operate all cover sections.

As shown in FIG. 1, each of these Hydraultorque hinges 1 is included in a separate hydraulic system, comprising a reversible electromotor 22, coupled with a reversible hydraulic pump 23, symmetrically connected through conduits 24, 25 with a symmetrical pair of back pressure valves 26, 27. The valves 26 and 27 are loaded by springs 28, 29 tending to press the valves on their seats in the partitions 30, 31 so as to close the bores 32, 33 in these partitions. A piston 34 is slidable in both directions within a cylindrical bore 35, which is connected to the conduits 24 and 25 on both sides of the piston 34. The piston 34 is provided on each side with a pin 36, 37 extending through an associated bore 32, 33.

By means of a sufficient pressure difference between the conduits 24 and 25, the piston 34 may be shifted in either direction, so that one of the pins 36, 37 engages the associated valve 26, 27 and lifts the same from its seat against the action of the spring 28, 29, so that the bore 32, 33 in the partition 30, 31 remote from the conduit 24, 25 with the higher pressure is opened.

The valve 26 is connected through a conduit 38 with the middle opening 19, while the valve 27 is connected through a conduit 39 with the two outer openings 20 and 21 of the Hydraultorque hinge 1.

The conduits 24 and 25, further, comprise non-return section valves 40 and 41 connected with an oil tank 47.

The conduits 38, 39 are each connected through a conduit 42, 43 with an adjustable safety valve 45, 44, which is opened when a predetermined pressure in the conduits 38, 39 is surpassed, so as to allow the oil to flow back into the tank 47 through a common discharge conduit 46.

The rectangle 47, drawn in dot-and-dash lines, indicates the oil tank; all components surrounded by this rectangle may be combined with the tank to a unit mounted on one of the cover sections.

In FIG. 2 the reversible electromotor 22 and the hydraulic tank 47 within which the reversible hydraulic pump 23 has been enclosed, as well as the hydraulic conduits 38, 39 (indicated in dot-and-dash lines) are all mounted on the cover section 70. It is to be noted that the hydraulic tank 47 needs only a very small oil capacity since the amount of oil contained by the Hydraultorque hinge 1 is constant as mentioned above. An electric cable 78 extends between the reversible electromotor 22 and an electrical reversing switch 79 mounted on the fixed ship's structure and provided with a handle 80 for controlling the supply of electrical current to the reversible electromotor 22 so as to have the electromotor 22 driving the hydraulic pump 23 in one direction or the other or to stop the motor 22 as desired.

Electrical current may be supplied to the reversing switch 79 by means of an electrical cable 81 comprising a connector 82 to be plugged into the housing of the switch 79.

When the reversible pump 23 is driven in a certain direction, the pressure in conduit 24 is higher than in conduit 25, so that the piston 34 is moved to the right from its central position and the valve 27 is opened against the action of the spring 29 to connect the conduit 39 with the conduit 25 having the lower pressure. At the same time, the higher pressure in conduit 24 opens the valve 26

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against the action of the spring 28 in order to connect the conduit 38 with the conduit 24 having the higher pressure. As a consequence, the pump 23 supplies oil to the Hydraultorque hinge 1 through the conduit 24, the valve 26, the conduit 38 and the middle opening 19, while an equal amount of oil is discharged and returned to the pump through the outer openings 20, 21, the conduit 39, the valve 27 and the conduit 25; thus, the Hydraultorque hinge 1 is operated in one direction. If the electromotor 22 and the pump 23 are reversed, the conduit 25 will have a higher pressure than the conduit 24, so that the valve 27 is opened to connect the conduit 25 with the conduit 39, and the piston 34 is moved to the left to open the valve 26 in order to connect the conduit 24 with the conduit 38. As a consequence, the pump 23 supplies oil to the outer openings 20, 21 of the Hydraultorque hinge 1 through the conduit 25, the valve 27, and the conduit 39, and an equal amount of oil is returned to the pump 23 through the opening 19, the conduit 38, the valve 26 and the conduit 24, whereby the Hydraultorque hinge 1 is operated in the opposite direction.

It is pointed out that the hydraulically operated back pressure valves 26 and 27 allow the pump 23 to drive the Hydraultorque hinge 1 in either direction, but prevent the pump 23 from being driven by the Hydraultorque hinge 1 under the influence of the weight of one or more cover sections, although both the pump 23 and the Hydraultorque hinge 1 are reversible. Thus, it is impossible that an entirely or partially open hatch cover is closed by its own weight. This applies to both driving directions of the Hydraultorque hinge 1.

In the embodiment shown in FIG. 3, use is made of a double acting hydraulic cylinder 48, in which a piston 49 is slidably supported; the piston 49 is attached to the end of a piston rod 50 projecting out of the cylinder 48.

Openings 51 and 52 are formed at the two ends of the cylinder 48, so that the piston 49 is always located between these openings. Each opening 51, 52 is provided with a nipple for the connection of a conduit 24 and 25, respectively. Each of the conduits 25, 24 leads to a side of the reversible hydraulic pump 23 respectively, which pump 23 is driven by the reversible electromotor 22.

The cylinder 48 is mounted between a cover section and a fixed part of the ship (not shown).

By admitting oil under pressure to the cylinder 48 through the opening 51, the piston 49 and its rod 50 may be moved to the right from the position as shown in FIG. 3 for driving the cover section; by admitting oil to the cylinder 48 through the opening 52, the piston 49 and the rod 50 may be moved in the opposite direction to return the cover section to its initial position.

It is pointed out that the amount of oil contained in the hydraulic cylinder 48 is dependent on the position of the piston 49, so that the oil supply or discharge through the left-hand opening 51 is always larger than the oil discharge or supply through the right hand opening 52. The difference is equal to the amount of oil displaced by the piston rod 50.

A hydraulic operated valve member is provided, consisting of a casing 53 with a bore 54, in which two plungers 56, 57, interconnected by an intermediate rod 55, are slidably supported. The plungers 56 and 57 may be moved in downward direction from the position shown in FIG. 3 against the action of a spring 58, interposed between the plunger 57 and the end wall 60 of the casing 53, which end wall 60 is provided with a bore 59; this movement of the plungers 56, 57 may be brought about by the oil pressure in the conduit 25, which is connected for this purpose through a conduit 61 with the bore 54 above the plunger 56, provided that the pump 23 rotates in the appropriate direction. The plunger 57 then releases an annular groove 62, connected with a conduit 63 leading to the oil tank 47, so that the conduit 63 is brought into communication with the part of the bore 54 between the plungers 56 and 57. This part of the bore 54 is connected to the conduit 24 through a conduit 64,

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so that the oil to the left of the piston 49 may escape through the conduit 24, the conduit 64, the space of the bore 54 between the plungers 56 and 57, the annular groove 62 and the conduit 63 to the tank 47, in order that the piston 49 and the rod 50 may move to the left. When the pump 23 is stopped, so that the pressure in the conduit 25 disappears, the plungers 56 and 57 are returned to their initial position by the spring 58, so that the annular groove 62 is shut off by the plunger 57, and the oil can no longer escape through conduit 24 to the tank 47. In this case, the piston 49 and the rod 50 are blocked against any movement to the left, because there is no possibility to discharge the oil which the rod 50 tends to displace on its inward movement, as the non-return suction valves 40, 41 prevent this oil from being discharged to the tank 47.

If the pump 23 is driven in the opposite direction, so that the conduit 24 is brought under pressure, the piston 49 and the rod 50 are moved to the right. The valve member 53, 56, 57, 62 remains inoperative in this case, in the position as shown in FIG. 3.

The difference between the amount of oil supplied to the cylinder 48 by the pump 23 through the conduit 24 and the opening 51, and the smaller amount of oil returned from the cylinder 48 to the pump 23 through the opening 52 and the conduit 25, is taken from the tank 47 through the non-return suction valve 41.

The conduits 24 and 25 are connected with adjustable safety valves 45 and 44, provided with a common return conduit 46 to the tank 47.

In the embodiment as shown in FIG. 3, the cylinder 48 has to be arranged in such manner that the piston rod 50 in its inward position is not subjected by the cover section to an outwardly directed force.

When a plurality of hatch covers are each provided with one or more hydraulic motors 1 or 48, an extensive hydraulic conduit system throughout the ship is avoided, since each hydraulic motor 1 or 48 is inserted in a separate hydraulic system, of which the oil tank 47, the electromotor 22, the hydraulic pump 23 and the hydraulically operated valve member 26, 27 or 57, 62 are arranged in the vicinity of the associated hydraulic motor 1 or 48, as shown in the drawings.

I claim:

An hydraulic operating mechanism for a hatchway cover or the like having first and second cooperating sections movable in relation to a fixed structure, comprising, in combination,

a double-acting hydraulic motor fixed to said first cover section and to said second cover section in such a manner that it constitutes a hinge between said two cover sections;

a generally cylindrical tank for a supply of hydraulic

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liquid, said tank having substantially the same diameter as, and being arranged coaxially with, said hydraulic motor;

a reversible hydraulic pump enclosed within said tank;

a reversible electric motor driving said pump;

a cable supplying current to the electric motor;

a switch in the cable to reverse the direction of current to the electric motor;

a first hydraulic connection between one side of said pump and one side of said hydraulic motor and a second hydraulic connection between the other side of said pump and the other side of said hydraulic motor to constitute a self-contained hydraulic circuit in which either of said hydraulic connections may convey fluid to the motor while the other connection returns fluid therefrom;

a spring-loaded non-return valve in each of said first and second hydraulic connections adapted to be opened under the influence of hydraulic liquid pressure;

a common valve housing for said valves;

a bore in said housing;

a piston slidably disposed in said bore between the valves;

each of said first and said second hydraulic connections from the pump being connected to the housing between the pertaining valve and the piston in such a manner that hydraulic pressure produced by the pump in either of said hydraulic connections causes the pertaining non-return valve to open and shifts the piston in the bore so as to open also the non-return valve in the other hydraulic connection which acts as return flow connection, said hydraulic operating mechanism being such that all operating parts are readily accessible when the hatch covers are open but are well protected when the hatch covers are closed.

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