Sept. 8, 1959 E. D. HOBSON 2,902,965

WATER COOLING SYSTEMS FOR STEAM CONDENSER UNITS OF MARINE STEAM PROPULSION INSTALLATIONS

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FIG. 1.

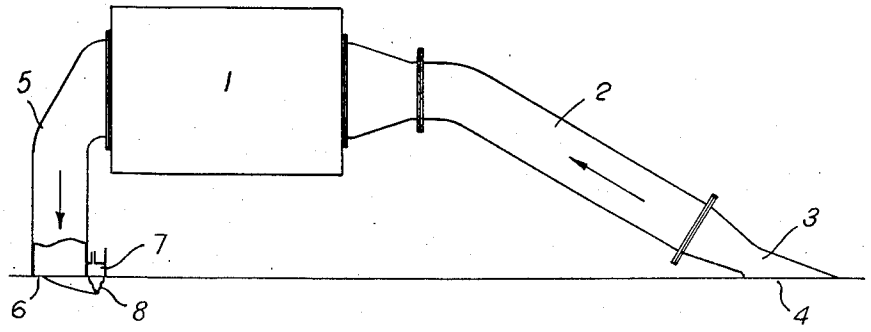
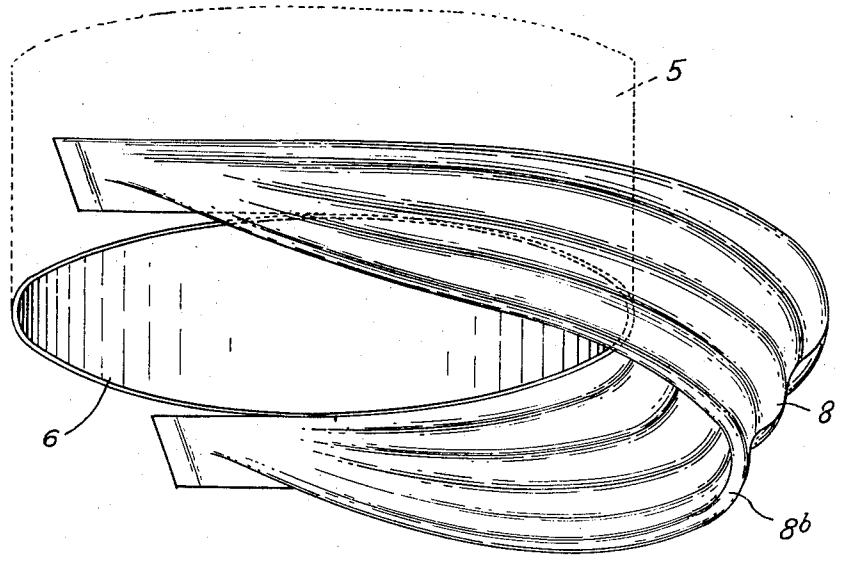


FIG. 2.



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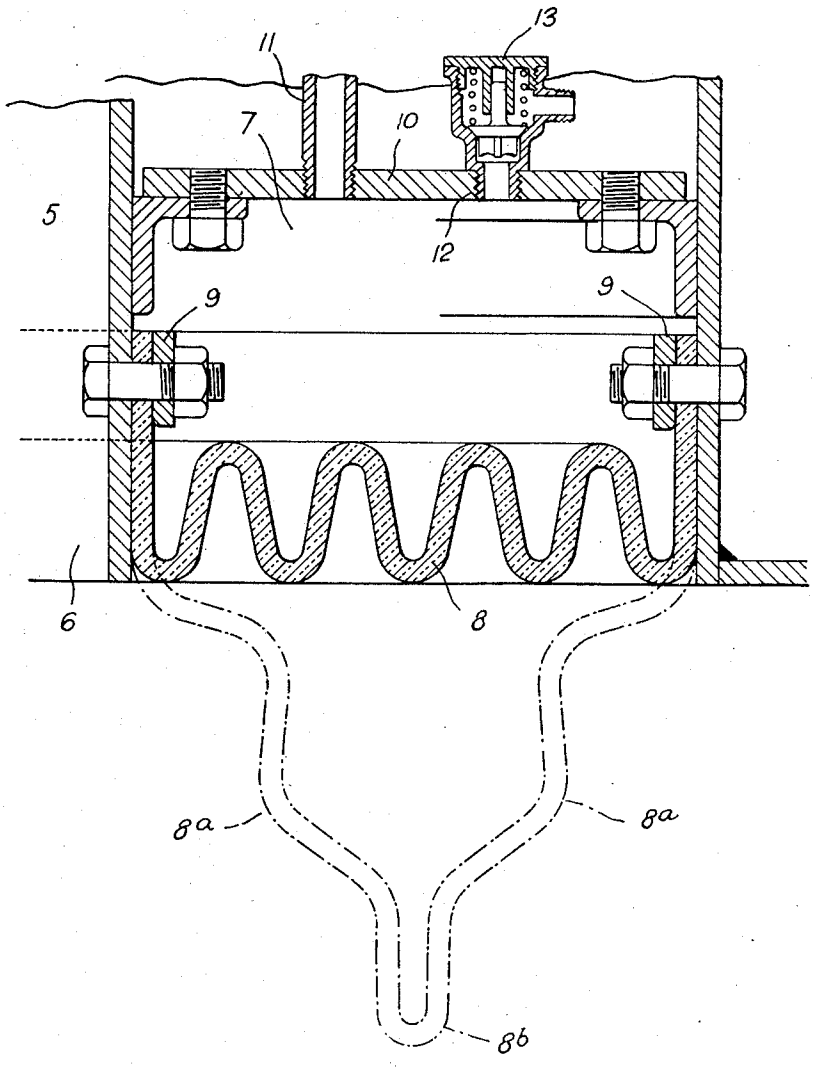
By Watson, Cole, Grindle & Watson
ATTORNEYS

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FIG. 3.



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WATER COOLING SYSTEMS FOR STEAM CONDENSER UNITS OF MARINE STEAM PROPULSION INSTALLATIONS

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Claims priority, application Great Britain September 13, 1954

9 Claims. (Cl. 114—185)

This invention relates to sea water cooling systems for heat exchangers, steam condenser units or the like of marine propulsion installations of the kind including conduit means having an inlet and outlet located at suitable positions in the hull structure of the ship so that the movement of the ship through the water in an ahead direction is adapted to generate the whole or part of the "head" necessary to promote the circulation of sea water through the cooling system.

In such cooling systems it is known to provide means projecting outwardly of the hull adjacent to and forwardly of the said outlet for the purpose of deflecting sea water flowing past the outlet when the ship is moving ahead so as to create a partial vacuum at the outlet for the purpose of reducing the pressure against which the water in the cooling system must be discharged. In the known arrangement, however, the projecting means has comprised a fixed rigid abutment which, while assisting in promoting circulation through the system, could not control or vary the circulation to meet changing conditions, for example when the circulation needs to be varied to take into account different temperatures of sea water at any given ship's speed. As in order to achieve maximum overall thermal efficiency from the marine steam propulsion installation it is necessary to provide for a wide variation in the cooling system of the heat exchanger or condenser, it has been essential heretofore, to meet changing demands, to provide a pumping unit capable of augmenting the normal circulation of sea water through the system. As, however, the pumping unit provided the only means of controlling or varying the circulation through the system, it has in the past, had to be powerful enough to meet all demands and in consequence it was relatively heavy and bulky and occupied a not inconsiderable amount of space in the ship.

It is an object of the present invention to provide improved means for controlling or varying the flow of sea water through the cooling system thereby obviating the necessity for the additional pumping unit, or enabling its size and power to be substantially reduced.

According to the present invention the circulation of sea water through the sea water cooling system of a heat exchanger, steam condenser unit or the like of a ship is controlled by means comprising an expansible or inflatable member positioned at the outer surface of the ship's hull adjacent to the outlet opening of the said system, the member being adapted to be expanded or inflated to project outwardly of the hull and thereby serve to divert sea water flowing past the hull away from the opening so as to create an area of reduced pressure at the said opening.

To enable the invention to be fully understood it will now be described with reference to the accompanying drawings, in which:

Fig. 1 is a diagrammatic view representing a sea water cooling system of a steam condenser unit of a ship;

Fig. 2 is a perspective view showing one form of expansible member for controlling the circulation of water through the system, the member being shown in its fully expanded or operative position; and

Fig. 3 is a sectional view of the member shown in Fig. 2 and the compartment in which it is mounted.

As shown in the accompanying drawings a water cooling system of a condenser unit 1 includes a conduit 2 connected with a scoop like member 3 having an open end 4 disposed on the outer surface of the ship's hull. On the outlet side of the system there is provided an outlet pipe 5 having an open end 6 also disposed on the outer surface of the ship's hull. This part of the apparatus is well known and in operation when the ship is moving ahead, sea water will be induced to flow in through the open end 4 and after circulating through the condenser unit will be discharged through the outlet pipe 5.

Adjacent to the open end 6 of the outlet pipe there is provided a recess or compartment 7 (see particularly Fig. 3). The open end of this compartment is sealed by a diaphragm 8 of natural or synthetic rubber or like material which as shown, is secured by clamping its edges to the opposed walls of the compartment by clamping plates 9 secured by nuts and bolts. The inner wall 10 of the compartment is provided with an inlet 11 for supplying air or gas under pressure and a bore 12 in which a suitable relief valve 13 is mounted.

The recess or compartment 7 extends across the forward part and along part of the opposed sides of the open end 6. In Figure 3 the diaphragm 8 is shown in full lines in collapsed or inoperative position and it will be noted that in this position it assumes a corrugated like condition extending across the open end of the compartment, the outer convolutions of the corrugations lying substantially flush with the said open end. Accordingly no part of the diaphragm extends outwardly of the ship's hull to offer resistance to the flow of sea water past it. When the diaphragm is in this position the sea water circulating through the cooling system will be discharged through the open end 6 against the full back pressure of the sea water flowing past said open end. While the rate of flow of sea water through the system under these conditions may be adequate for normal cooling, if the temperature of the sea water is relatively high an increased rate of flow will be necessary. In this case gas or liquid under pressure is supplied to the compartment 7 through the inlet 11 and the increase in pressure in the compartment will cause the diaphragm 8 to flex outwardly into the position shown in dot-dash lines in Fig. 3 and form a projection at the forward and side parts of the open end 6 of the outlet pipe 5 and serve to divert sea water flowing past the ship's hull and thereby create a partial vacuum or area of reduced pressure in the region of the said open end. The pressure against which the water circulating in the cooling system has to be discharged is accordingly reduced with the result that the rate of flow through the system will be increased.

The diaphragm is shown in dot-dash lines in Fig. 3 in its maximum expanded position for producing the maximum reduction in pressure at the open end of the cooling system and thereby the maximum rate of flow through the system. It will be understood, however, that by regulating the pressure in the compartment 7 the diaphragm may be caused to project varying extents thereby enabling the flow rate through the cooling system to be varied over a relatively wide range.

It will be noted that when in expanded condition the diaphragm has smoothly curved side walls 8*a* and a double thickness ridge 8*b* formed by adjacently positioned portions of the diaphragm. The pressure in the compartment will obviously have to be sufficient not only to expand the diaphragm to the desired extent but also to sup-

port it against the pressure of the sea water set up by the movement of the ship and this will naturally vary with the speed at which the ship is moving.

As an alternative to a diaphragm such as 8, a closed hollow moulding may be provided adapted to be inflated to cause part or parts thereof to project outwardly of the ship's hull adjacent to the open end of the outlet of the water cooling system and if desired the moulding may be so formed that when inflated the said projecting part or parts will have a similar configuration to the expanded diaphragm as illustrated in Figs. 2 and 3.

The expansible or inflatable member is positioned forwardly of the open end 6 so as to divert the flow of sea water when the ship is moving ahead, but if desired a further and similar member may be positioned rearwardly of the outlet for use when the ship is moving astern.

If desired a pumping unit may be provided for augmenting the effect of the expansible or inflatable member but as the latter will serve to control the flow rate through the cooling system to a very large extent, the size and the power requirements of the pumping unit may be much less than would be required if the expansible or inflatable member was not provided. As a result there will be an important saving in space, weight and power consumption.

The supply of gas or liquid to the compartment 7 may be derived from a power or manually operated pump connected with a gas or liquid container having a capacity sufficient to expand the diaphragm or inflate the moulding to its maximum extent. This arrangement has the advantage that over-expansion or over-inflation will be prevented.

The relief valve 13 is provided to ensure that in the event of the expanded or inflated member striking an obstruction there will be an automatic release of pressure permitting partial collapse of the member so that damage thereto will be avoided.

It will be noted that the diaphragm or moulding involves no external mechanical parts subject to wear or requiring maintenance or likely to be adversely affected by marine growth.

If desired the diaphragm or hollow moulding may be formed of a sheet of textile fabric impregnated with natural or synthetic rubber like material or alternatively of two or more layers of textile fabric impregnated with, or united by such rubber like material. The textile fabric may comprise a square woven fabric composed of yarns or cords, of cotton, linear polyamide such as that commonly known as nylon or a mixture of cotton and nylon yarns. Alternatively the fabric may be prepared from a spun staple cut from synthetic linear polyamide filaments.

I claim:

1. In a ship having a heat exchanger and a sea water cooling system therefor, the hull of the ship having an opening located below the water line for discharging the sea water circulating in said system, an inflatable deflector positioned adjacent said opening at the forward side thereof, and means for inflating said deflector to project a predetermined amount outwardly of the hull so as to deflect sea water flowing past the hull away from the opening.

2. In a ship having a heat exchanger and a sea water cooling system therefor, the hull of the ship having an opening located below the water line for discharging the sea water circulating in said system, an outwardly opening recess in said hull located adjacent to said opening at the forward side thereof, an expansible diaphragm extending over and closing said recess, and means for expanding said diaphragm to cause it to project a predetermined amount outwardly of the hull so as to deflect sea water flowing past the hull away from the opening.

3. In a ship having a heat exchanger and a sea water cooling system therefor, the hull of the ship having an opening located below the water line for discharging the sea water circulating in said system, an outwardly opening recess in said hull located adjacent to said opening at the forward side thereof, an expansible diaphragm extending over and closing said recess, and means for supplying fluid under pressure to said recess to expand said diaphragm to project outwardly of the hull for the purpose of deflecting sea water flowing past the hull away from said opening.

4. A ship as claimed in claim 3 wherein a pressure relief valve is provided for said recess.

5. In a ship having a heat exchanger and a sea water cooling system therefor, the hull of the ship having an opening located below the water line for discharging the sea water circulated in said system, means being provided for controlling the flow rate of the water discharged through said opening comprising a hollow flexible moulding expanded by fluid pressure to project outwardly of said hull, said moulding being located adjacent to and forwardly of said opening to form deflector means for diverting sea water flowing past the hull away from said opening.

6. A ship as claimed in claim 5 wherein said hollow moulding extends round the forward and along at least part of the side portions of said opening.

7. In a ship having a heat exchanger and a sea water cooling system therefor, the hull of the ship having an opening located below the water line for discharging the sea water circulating in said system, an outwardly opening recess in said hull located adjacent to said opening at the forward side thereof, an expansible corrugated diaphragm disposed in said recess and forming a fluid tight closure therefor and means for supplying fluid pressure to said recess to expand said diaphragm into a position wherein it projects a predetermined amount outwardly of the hull so as to serve as deflector means for diverting sea water flowing past the hull away from the opening.

8. In a ship having a heat exchanger and a sea water cooling system therefor, the hull of the ship having an opening located below the water line for discharging the sea water circulating in said system, an outwardly opening recess in said hull extending round the forward and along part of the sides of said opening, an expansible diaphragm extending over said recess and forming a fluid tight closure therefor, and means for supplying fluid pressure to said recess to expand said diaphragm to project a predetermined amount outwardly of the hull so as to form deflector means for diverting sea water flowing past the hull away from the opening.

9. In a ship having a heat exchanger and a sea water cooling system therefor, the hull of the ship having an opening located below the water line for discharging the sea water circulated in said system, means for controlling the flow rate of the water discharged through said opening comprising a hollow extensible and retractable deflector positioned adjacent to and at the forward side of said opening for extension and retraction toward and away from the hull of the ship, and means operatively associated with the interior of said hollow deflector for selectively extending or retracting same.

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