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H. E. GRIESHABER

TORPEDO COMPENSATING SYSTEM

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Fig. 1.

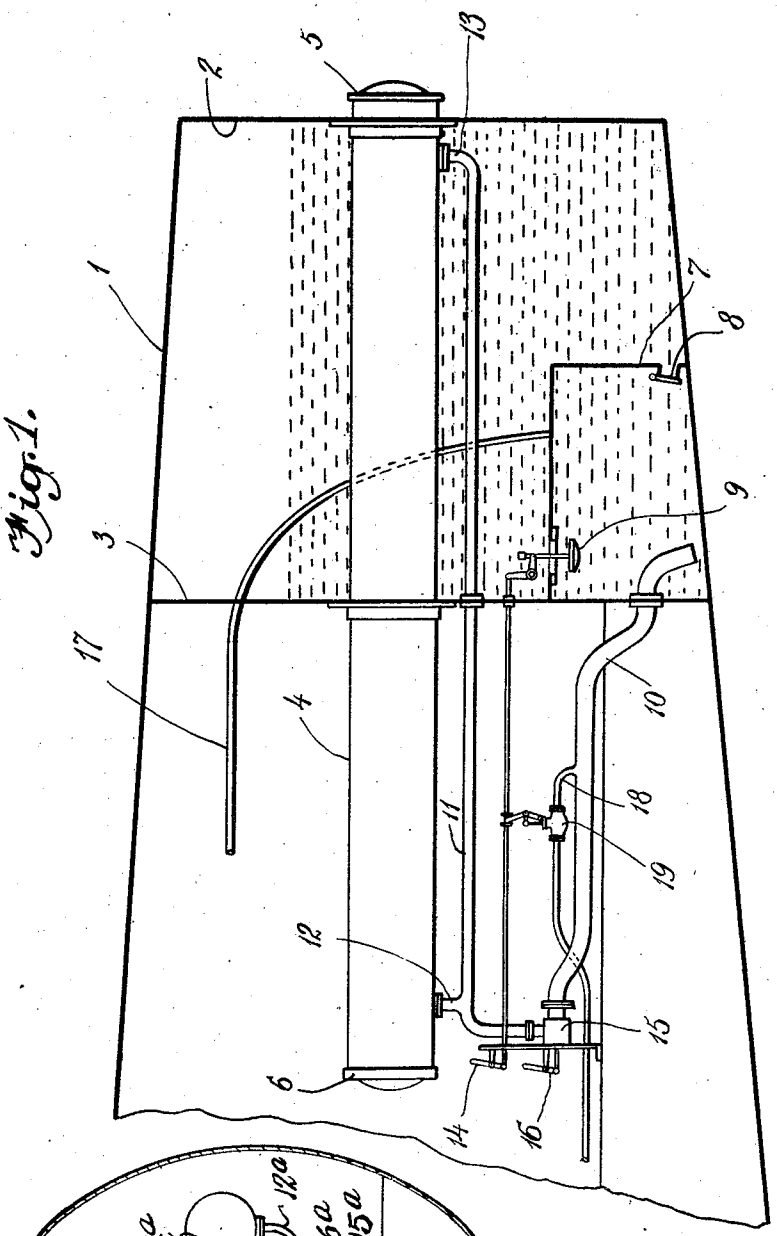
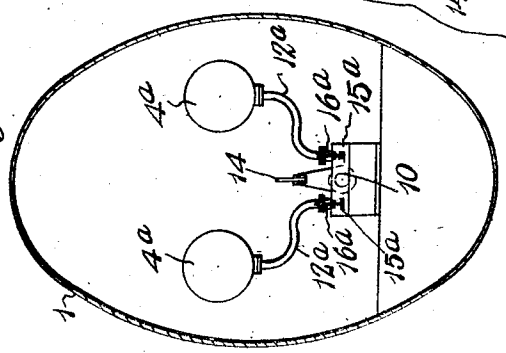


Fig. 2.



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TORPEDO COMPENSATING SYSTEM.

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This invention relates to a compensating system for maintaining the trim of a submarine or submersible torpedo boat, and, more specifically, is directed to the provision of means for maintaining the trim of such boats as torpedoes are fired therefrom.

War vessels of the type referred to make use of the torpedo as their principal weapon of offense and are provided with a supply of such torpedoes and means for carrying and discharging them. These torpedoes are sometimes carried in firing tubes or other apparatus exterior to the hull proper, but the more common way is to provide the vessel with internal torpedo-discharge tubes, usually located in the bow although sometimes additional tubes are provided in the stern. Each of these tubes communicates at its outer end with the water of flotation, and is provided with a cap for closing the outer end of the tube and also with a breach cap on the inner end so that torpedoes may be successively introduced into the tube. In order that the operations of moving the torpedoes from the storage space into the tubes and of discharging them from the tubes may not interfere with the control and navigation of the vessel, it is necessary to provide a compensating system of some kind. This makes it possible to perform the operations referred to without materially changing the weight of the vessel or the position of its center of gravity. The system provided should not only compensate for the weight of the torpedoes discharged but should also be capable of counteracting the effect produced by moving the torpedoes into the tube.

Ordinarily a torpedo is contained within each tube and spare torpedoes are carried on racks within the vessel. When the vessel is trimmed for submergence, the space in the discharge tube around the torpedo is sometimes filled with water, but in most instances it is preferable to have the torpedo carried dry in the tube until just before it is desired to fire it. In either case, when the torpedo is to be fired the outer cap is opened thus affording a free passage from the tube to the sea. When the torpedo is fired the inrush of sea water completely fills the tube and then the outer cap is closed. As the weight of the torpedo is almost equal to the weight of the same volume of water no change in weight or position of the center of gravity of the vessel as a whole results from firing the torpedo. Thereafter, the entire contents of the torpedo tube is drained or blown into a storage tank, and a torpedo from one of the racks is introduced into the tube. As the torpedo is moved forward in the tube a certain quantity of water should be pumped aft to an auxiliary tank to off-set the effect of moving the torpedo since any failure to do this results in changing the trim of the boat.

It will be seen that in employing a compensating system of the type referred to it is necessary to provide storage tanks in the vicinity of the tubes and considerable quantities of water must be moved through the system to provide the desired compensation as outlined. As this water is usually moved by compressed air the operation of firing a torpedo is accompanied by the expenditure of large quantities of air, and such expenditure necessarily calls for the use of considerable power.

The principal object of this invention is to provide a compensating system adapted to perform the several operations above outlined without using nearly as much compressed air as is ordinarily required. In general, this object is accomplished by providing a special compensating tank associated with a trimming tank in such a manner that the compensating tank is normally filled with water, although there may be only a very small amount of water in the trimming tank.

Figure 1 is a diagrammatic vertical section view of a portion of a torpedo boat provided with my improved compensating system.

Figure 2 is a diagrammatic vertical section view of a torpedo boat provided with my improved system and showing its application to a number of torpedo tubes.

The accompanying drawing illustrates, more or less diagrammatically, a compensating system embodying the present invention. A torpedo tube is shown mounted in the bow of a submarine, the hull of which is designated by the reference character 1. In the extreme bow is located a trimming tank 2, through the wall 3 of which extends the torpedo tube 4, provided with a cap 5, on the outer end thereof. The inner end is provided with a breech cap 6 through

which the torpedoes may be successively introduced.

Located in close proximity to the tank 2 (preferably within this tank) is a small compensating tank 7 which has a capacity as large as or slightly larger than the space around the torpedo in the torpedo tube 4. A check valve 8 is located near the bottom of this compensating tank and near the top thereof is a vent valve 9. The valve 9 is ordinarily kept open, so that water from the trimming tank is admitted into the compensating tank either through the check valve 8 or through the vent valve 9. If the water in the trimming tank stands at a level higher than that of the top of the compensating tank, it will enter the compensating tank through valve 9. The purpose of this arrangement is to keep the compensating tank flooded at all times so that water may be transferred from this tank to the torpedo tube.

For the purpose of introducing water from the compensating tank 7 into the tube 4 there is provided a pipe 10, the inlet of which is located near the bottom of the compensating tank and communicates with a pipe 11, connected at 12 and 13 with the ends of the torpedo tube 4. A valve lever 14 controls the position of the vent valve 9 and a valve 15, provided with a handle 16, controls the flow of water through the pipe 10 to the tube.

In Figure 2, I have shown in diagrammatic form one embodiment of my invention as applied to a number of expulsion tubes. In this figure the tubes are shown at 4^a. These tubes 4^a communicate with the liquid connection 10 through valves 15^a controlled by levers or handles 16^a. It will be understood that the embodiment of my invention shown in Figure 2 includes a trimming tank and a compensating tank substantially the same as those illustrated in Figure 1. The pipe 10 in Figure 2 communicates with the compensating tank and the handle 14 controls the valve connection between the compensating tank and the trimming tank.

A high pressure air line 17 communicates with the top of the compensating tank, and when the torpedo has been placed in the tube and the breech cap closed, the valve 14 is moved to close the vent valve 9. The tank 7 is then sealed and the compressed air, admitted through the pipe 17, forces the water through the pipes 10 and 11 into the tube 4, under the control of the valve 15, as previously described. The air in the tube 4 is vented into the interior of the vessel. When the tube is completely flooded the valve 15 is closed and the valve 9 again opened so as to permit water from the trimming tank 2 to enter the compensating tank 7. The air in the compensating tank 7 escapes through the port in the top of this tank, into the trimming tank 2. The air used to force the liquid out of the compensating tank 7 may be discharged into the trimming tank 2 a number of times without discharging the air from the trimming tank. When it becomes necessary to discharge the air from this tank, it is discharged into the interior of the vessel or overboard in accordance with the usual practice. The fact that it is not necessary to discharge the air from the compensating tank directly into the interior of the vessel every time the compensating tank is filled, is of importance because this discharge of the air into the vessel has a serious effect on the personnel. As the torpedo moves forward in the torpedo tube, a quantity of water in the tank 2 is pumped aft to offset the moment of the moving torpedo. This water is withdrawn from the tank 7 through the pipe 10 and thence through the pipe 18 to an auxiliary tank or to an after trimming tank not shown. The pipe 18 is provided with a valve 19 which is controlled by the movement of the lever 14. During this withdrawal of water the valve 15 remains closed. As the water is removed from the tank 7, however, it will be immediately replaced by water from the tank 2 which enters through the valves 8 and 9. After the torpedo has been fired, water from outside the hull of the vessel enters the torpedo tube through the open cap 5, and when this cap is again closed, the entire contents of the tube is drained or blown into the tank 7, from which it overflows through the open valve 9 into the tank 2. Accordingly, this insures that the tank 2 will be completely filled at all times.

The essential feature of the invention resides in providing means for segregating a portion of the liquid in the trimming tank, and using only the segregated portion in connection with performing the usual compensation operations. This arrangement makes it possible to use a quantity of air much smaller than that ordinarily required in systems of this type. With the ordinary system, it is necessary to admit compressed air into the large trimming tank in order to force the water from this tank, thus making it necessary to use a relatively large amount of air to displace a small quantity of water. The material saving in compressed air effected by the use of my invention is due to the fact that the air is used in the most efficient manner. It is used to force water out of the compensating tank which is always completely filled at the time when it is necessary to supply water from this tank to the expulsion tube. As a practical matter it is impossible to maintain the trimming tank 2 completely full of water and accordingly if air is admitted to the

trimming tank for the purpose of forcing water therefrom into the expulsion tube, a considerable amount of energy in the compressed air would be utilized in increasing the pressure of the air which was within the trimming tank when the compressed air was supplied to this tank. The energy employed in increasing the pressure of this quantity of air in the trimming tank is necessarily lost when the air in the trimming tank is vented into the interior of the vessel. Where my invention is employed, the compressed air is admitted into a tank completely filled with water and accordingly all of the energy in the compressed air is employed in forcing the water from the tank, none of the energy being dissipated in increasing the pressure of a volume of air already in the tank.

If the trimming tank were used for compensating purposes, it would be necessary to vent this tank each time the water was passed from the tube to the trimming tank and when the water was again passed around the torpedoes it would be necessary to build up this pressure. This would mean considerable waste of air. The segregation referred to is best effected by providing a compensating tank communicating directly with the trimming tank, since by such an arrangement the passage of water from one to the other may easily be controlled. Furthermore, it will be understood that, while the invention has been described in connection with its use with a single tube, it is equally applicable to a system including several tubes. In the latter case the compensating action remains the same, but the liquid withdrawn from the compensating tank is directed to the proper tube by the valves 15[a] which control the connections for all the tubes. Locating the compensating tank in the bottom of the trimming tank permits the system to operate according to the improved method while occupying no more space within the vessel than the systems formerly used. Also by using the construction shown, the trimming tank can be kept full continuously by gravity and it is not necessary to expend power in conveying liquid from one tank to the other.

I claim:

1. In a torpedo boat provided with an expulsion tube and a trimming tank, a compensating tank normally in communication with the trimming tank and arranged so as to be automatically filled with liquid from said tube, connections between the compensating tank and the tube and means for controlling communication between this tank and the tube.

2. In a torpedo boat provided with an expulsion tube and a trimming tank, a compensating tank normally in communication with the trimming tank and arranged so as to be automatically filled with liquid from said tube and from said trimming tank, means for interrupting such communication, connections between the compensating tank and the tube, and means for controlling communication between the compensating tank and the tube.

3. In a torpedo boat provided with an expulsion tube and a trimming tank, a compensating tank normally in communication with the trimming tank and arranged so as to be completely filled by gravity with liquid, from said trimming tank, means for interrupting such communication and means for supplying liquid from the compensating tank to the said tube.

4. In a torpedo boat provided with an expulsion tube and a trimming tank, a compensating tank normally in communication with the trimming tank and with said tube, and arranged so as to be completely filled by gravity with liquid from said tube, means for admitting fluid under pressure into said compensating tank to force liquid therefrom into said tube.

5. In a torpedo boat provided with an expulsion tube and a trimming tank, a compensating tank normally in communication with the trimming tank and with said tube, and arranged so that air in said compensating tank can be discharged into said trimming tank, and so as to be completely filled by gravity with liquid from said tube.

6. In a torpedo boat provided with an expulsion tube and a trimming tank, means for segregating a portion of the liquid contained in the trimming tank, and means for forcing said segregated portion into said tube by means of compressed gas coming in contact with said portion only.

7. In a torpedo boat provided with a plurality of expulsion tubes and a trimming tank, means for segregating a portion of the liquid contained in the trimming tank, means for applying compressed gas to this segregated portion alone, to transfer the same to an expulsion tube, and means for determining into which of the tubes the liquid will be transferred.

8. In a torpedo boat provided with an expulsion tube and a trimming tank, a compensating tank normally connected with the trimming tank and arranged so as to be completely filled by gravity with liquid from said trimming tank, valved connections between the compensating tank expulsion tube and trimming tank, and means for supplying compressed gas to the compensating tank to force liquid therefrom into said tube.

9. In a torpedo boat provided with an expulsion tube and a trimming tank, a compensating tank within the trimming tank and adapted to segregate a portion of the liquid in this tank, means for controlling communication between the tanks, valved

connections between the compensating tank and the tube, and means for admitting gas under pressure into the compensating tank to force liquid therefrom into said tube.

10. In a torpedo boat provided with an expulsion tube and a trimming tank, a compensating tank connected to said tube and to said trimming tank and arranged so that fluid supplied to the compensating tank overflows into the trimming tank when the compensating tank becomes full.

11. In a torpedo boat provided with an expulsion tube and a trimming tank, a compensating tank interconnected between said tube and said tank and arranged so that liquid flowing into said compensating tank fills the same and then overflows into the trimming tank, means for closing the communication between the compensating tank and the trimming tank, and means for forcing liquid out of the compensating tank into said tube.

12. In a torpedo boat provided with an expulsion tube and a trimming tank, a compensating tank, a liquid connection between said compensating tank and said tube, an air connection between said compensating tank and said trimming tank, said compensating tank having a check valve connection near the bottom thereof and a liquid connection near the top thereof, the said compensating tank and trimming tank being arranged so that liquid in the trimming tank can flow into the compensating tank through said check valve connection and liquid in said compensating tank can overflow therefrom into the trimming tank.

In testimony whereof I affix my signature.

HUGO EUGENE GRIESHABER.