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W. DIETER

1,845,135

STOP VALVE FOR TORPEDOES

Filed May 29, 1928

Fig. 1.

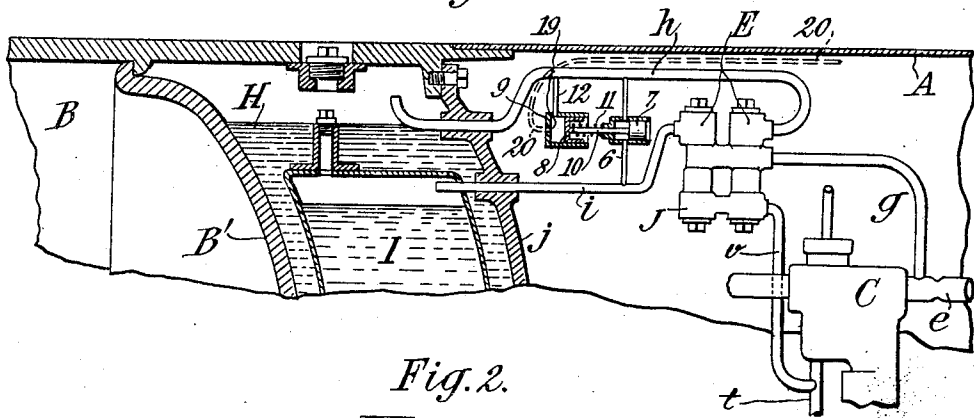


Fig. 2.

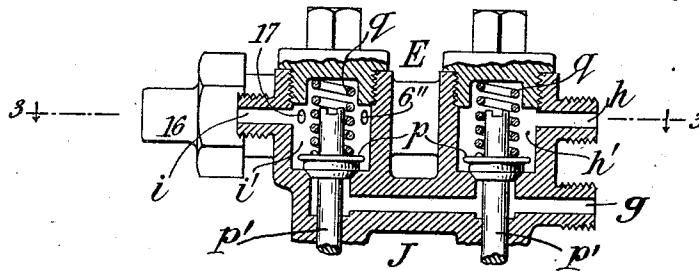


Fig. 3.

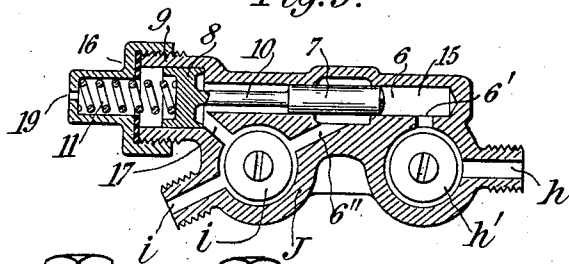
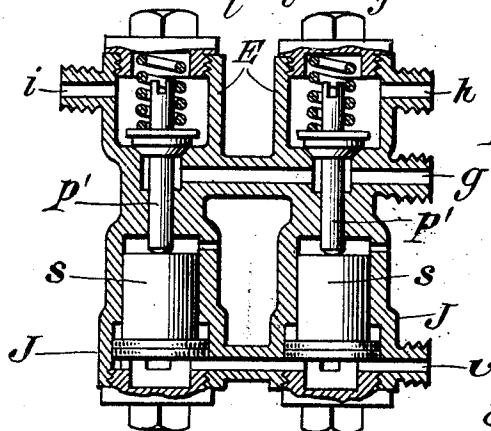


Fig. 4.



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STOP VALVE FOR TORPEDOES

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This invention relates to automobile torpedoes of which the Bliss-Leavitt torpedo, the standard of the United States Navy, is an example, in which compressed air from a flask or reservoir is passed at reduced pressure through a heater in which a combustible such as alcohol is burned, and into which water is sprayed, and the resulting mixture of combustion gases and steam is discharged to drive a turbine or other motor by which the torpedo is propelled.

The construction upon which the present invention is directly an improvement is that set forth in my United States Patent No. 1,656,269, granted January 17, 1928. Reference may also be made to my Patent No. 1,319,992, dated October 28, 1919, and patent to F. M. Leavitt, No. 1,022,486, dated April 9, 1912.

In such torpedoes it is customary to construct the fuel or alcohol tank as a vessel which is located within the water tank, and which, for economizing weight, is made with relatively thin walls. In order to avoid any liability of either bursting or collapsing the alcohol tank by reason of any inequality of pressures in the respective alcohol and water chambers, it is important to insure that the pressures in the two chambers shall be kept uniform, or so nearly so as to be well within the resistance of the thin metal walls of the alcohol tank. The object of the present invention is to provide improved means for accomplishing this result.

The invention will be explained with reference to the accompanying drawings which illustrate its preferred embodiment, and in which:

Figure 1 is a fragmentary longitudinal vertical mid-section of the mid-portion of the torpedo, corresponding to the upper part of Fig. 1 in said Patent No. 1,656,269.

Fig. 2 is a fragmentary vertical mid-section through the upper part of the stop valves, the view corresponding to Fig. 3 in said patent.

Fig. 3 is a horizontal section in the plane of the line 3—3 in Fig. 2.

Fig. 4 is a vertical section of the stop valves.

Referring to Figure 1, A is a part of the hull of the torpedo; B is a fragment of the compressed air flask; C is a fragment of the valve group, including the pressure-reducing valve, by which the flask pressure (or high-pressure air) is reduced to a working pressure of usually approximately 400 pounds per square inch, (herein called low-pressure air) and E designates the usual stop valves. From the low pressure conduit *e* conducting working pressure from the reducer to the super-heater and motor, leads a tube *g* conducting low-pressure air to the stop-valves E, and when these valves are opened the low-pressure air is conveyed through ducts or tubes *h*, *i*, to the upper parts of the respective liquid tanks. These are shown as of the usual construction, the water tank H being formed within a prolongation of the pressure flask shell and enclosed by a head *j*; and the fuel or alcohol tank I being mounted concentrically within it. The tubes *h*, *i*, open into the upper parts of these tanks above the liquid levels therein, and the pressure thereby put upon the liquids causes an outflow from the bottoms of the respective tanks through ducts which convey fuel and water to the super-heater in a manner well understood. High-pressure air is led from the high-pressure side of the valve group C through a tube *v* to the lower part of the valve shell J, as shown in Figs. 1 and 4.

So far as described the construction is the same as shown in my said Patent No. 1,656,269, in which the parts are designated by the same letters of reference here used.

According to the present invention communication is afforded between the interiors of the tanks H and I whenever one of them contains an excess pressure of air, so that the pressure in the two tanks shall be automatically equalized or sufficiently so to avoid risk of injury. For this purpose a by-pass 6 (Fig. 1) is connected between the upper parts or air chambers of the respective tanks, this connection being most conveniently made by causing it to bridge across between the tubes *h* and *i*, as shown somewhat diagrammatically in Fig. 1. It is desirable that this by-pass should be closed, except when the

torpedo has been launched, and for this purpose it is provided with any suitable cut-off valve 7, with means for operating it so that when the torpedo is in storage or being handled, and at any time before the turning on of compressed air from the air flask, it will normally close the by-pass and thereby prevent any possible outflow of either water or alcohol through their connecting ducts and the by-pass, which might result in a mixture of alcohol and water. The construction is such that upon the occurrence of an excess pressure in one of these tanks the cut-off valve 7 shall be automatically opened, so that the pressures in the two tanks shall be thereby substantially equalized. A suitable construction for this purpose is the provision of a piston or equivalent pressure-operated part 8 movable in a shell or cylinder 9 and connected by a stem 10 to the cut-off valve 7, a spring 11 being applied to hold the cut-off valve normally closed. The cylinder 9 is connected by a duct to either of the tubes *h* or *i*; in Fig. 1, it is shown as connected by a duct 12 to the tube *h* communicating to the water tank. In Fig. 3 it is shown connected by duct 17 to tube *i* communicating with fuel tank I. On the admission of pressure to the water tank, or upon the occurrence of pressure therein by reason of any leakage, this pressure when sufficient to overcome the stress of the spring 11, will open the valve 7 and thereby open the by-pass.

In the preferred construction the by-pass valve and its operating means are built into the same shell as the stop valves E, for convenience, and this construction is shown in Figs. 2 and 3. The stop valves E are or may be of the usual construction shown in my said patent and comprising a valve shell J having openings connected to and forming parts of the respective ducts *g*, *h*, *i*, already described, and having two chambers *h'*, *i'*, enclosing two stop valves *p* normally pressed to their seats by springs *q* and lifted to open communication upon the turning on of air at high pressure at the starting of the torpedo through pipe *v*, which admits the high-pressure air into a chamber beneath two plungers *s* which are forced up by this pressure and lift the stems *p'* of the two valves *p*, *p*, as explained in my said patent. The construction therein shown is now modified according to my present invention only to the extent that the same valve shell is enlarged to form a chamber 15 for the cut-off valve, the latter consisting of a plunger 7 movable in this chamber and connected by a rod or stem 10 to the piston 8, the valve shell forming also the cylinder 9 for this piston. This cylinder 9 is completed by a head 16 within which is enclosed the spring 11 which acts upon the piston 8 to press the cut-off valve to its closed position. The main valve shell is also formed with a port 6', and an-

other port 6'', these two ports and the intervening valve chamber 15 constituting the by-pass 6 shown in Fig. 1, which by-pass is opened upon the movement of the plunger valve 7 to the left in Fig. 3. From either of the valve chambers *h'*, *i'*, leads a duct 17 which has the function of the duct 12 in Fig. 1, of admitting compressed air into the cylinder 9 to operate the piston 8; this duct is shown in this instance as leading from the chamber *i'* which communicates with the alcohol vessel I.

When upon the launching of the torpedo the starting valve is opened, admitting compressed air at high pressure from the air flask to the reducing valve, and at reduced pressure from the latter to the superheater and motor, and also through the duct *g* to the stop valves E and thence through the tubes *h*, *i*, to the respective liquid tanks, the occurrence of such pressure in the valve chamber *i'* is accompanied by a flow through the duct 17 into the cylinder, thereby displacing the piston 8 and withdrawing the plunger valve 7, so that the by-pass 6 is opened. So long as any pressure is maintained in the chamber *i'* sufficient to overcome the stress of the spring 11, the valve 7 will be held open and the by-pass will permit any excess of pressure to flow from either chamber into the other, and will thereby equalize the pressures in the water and alcohol tanks. This condition will continue not only during the run of the torpedo, but subsequently, so long as any such pressure continues in the respective tanks.

One advantage of the present invention is that it enables the alcohol tank to be made of thinner sheet-metal than heretofore without danger of collapse or bursting.

When the torpedo is first charged, the compressed air is confined to the air flask and does not extend beyond the starting valve; so that there is no air pressure in the valve chambers *h'*, *i'*, and the piston 8 receiving the pressure of its spring 11 holds the cut-off valve 7 in position to close the by-pass 6. Consequently the torpedo may be rolled and otherwise handled, and may be oscillated by the rolling of the ship, without any communication being established between the interiors of the two tanks under normal conditions, so that there can be no intermixing of the liquids.

If, however a leakage of compressed air should occur into the water tank H during this period, the by-pass will become operative to equalize the pressures within the two tanks. Such leakage might and sometimes does occur by reason of a slight leakage in the joint between the flask head B' and the outer wall of the flask, such leakage admitting air into the water tank H. When by reason of such leakage the pressure in the water tank sufficiently exceeds that in the alcohol tank to en-

danger the thin metal shell or wall of the latter, the piston 8 responding to such pressure overcomes the stress of its spring and opens the valve 7, thereby equalizing the pressures.

5 If the cylinder 9 is connected to the tube h , as shown in Fig. 1, this pressure will be effective directly against the piston; if, however, the construction is as shown in Figs. 2 and 3, this pressure entering the valve chamber 10
10 h' will act against the end of the valve 7 and will similarly displace the valve and piston against the stress of the spring 11.

In the event of leakage occurring in the valve system of the torpedo, whereby compressed air would be communicated through the duct g to the stop valves p , if this pressure were sufficient to overcome the stress of the springs q , air would leak past these stop valves into one or both of the liquid tanks; if
15 such leakage occurred through only one valve, the pressure within the corresponding liquid tank would soon preponderate over that in the other; a similar result might occur if the leakage occurred through both valves at such
20 rates respectively that by reason of the different capacities of the respective tanks, the pressure in the smaller one would in time exceed that in the other. In any such event the occurrence of such pressure opens the cut-off
25 valve and thereby makes the by-pass effective to substantially equalize the pressures in the two tanks.

At the end of a run, when the working pressure ceases, the stop valves p are closed
30 by their springs to thereby confine in the water and alcohol tanks whatever air pressure then exists; if afterward leakage occurs, the by-pass, by remaining open so long as any pressure exists in either tank, insures the substantial equalization of pressure in the two
35 tanks.

After a practice run, when the torpedo is to be recharged, the removal of the top plug from the water tank permits any residual air
40 pressure to blow out therefrom, and if a similar pressure were retained in the alcohol tank, this might result in the bursting of the walls of this tank; this also is prevented by the operation of the by-pass, since even if the
45 cut-off valve 7 was not open, it will be opened instantly upon the occurrence of any pressure sufficient to overcome the stress of spring 11.

The present invention adds to the advantage otherwise inherent in the construction
50 of my said Patent No. 1,656,269, in that it enables the exact amount of alcohol used in a practice run to be ascertained. It will be understood that according to that patent the stop valves E and F are both operated by
55 high-pressure air, which enables their respective poppet valves p to be seated by much stronger springs q than previously, whereby to make practically ideal tight closure which prevents ordinarily any leakage of liquid past
60 these valves; upon the shutting off of pressure

at the end of a run the respective valves are thus strongly seated, so that any subsequent escape of liquid through either the upper or lower valves is prevented; consequently the amount of alcohol remaining in the tank
65 after the run may be measured and subtracted from the amount originally charged in, whereby to ascertain exactly the amount of fuel consumed during the run.

To insure the proper operation of the cut-off valve it is desirable to vent the interior
70 of the piston chamber or cylinder 9 to the exterior, and for this purpose a small vent opening 19 is provided. It is desirable to discharge any air vented through this vent into the afterbody, in order to guard against the admission of salt water or grit into the piston chamber; for this purpose a small tube or
75 duct 20 (Fig. 1) is desirably led from the vent 19 rearwardly into the afterbody.

It is desirable in practice to make the plunger valve 7 a free working fit, so that a very slight leakage (imperceptible in Fig. 3) exists between the plunger valve and the walls of the valve chamber 15, so that in
80 case of an excess pressure in the chamber h' this will not only act upon the area of the valve 7, but also will leak past this valve and act upon the larger area of the piston 8. This very slight leakage does not in-
85 capacitate the valve 7 from cutting off communication through the by-pass such as will prevent leakage of liquid from either tank to the other.

The invention may be otherwise applied
90 than by the precise construction herein set forth, it being understood that it may be modified by the exercise of mechanical skill within the scope of the appended claims.

What I claim is:—

1. In a torpedo having a source of high-pressure and low-pressure air, and fuel and water tanks, and valves operated by high-pressure air and admitting low-pressure air to said tanks during the run; means for preventing excess pressure in one tank over the other while said valves are closed, comprising a by-pass providing communication between said tanks and a pressure-operated valve therein.
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2. In a torpedo according to claim 1, the pressure-operated valve responsive to an excess pressure in either tank and operating thereupon to open the by-pass.
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3. In a torpedo having an air-inlet pipe and fuel and water tanks, with intervening valves for admitting air pressure from said pipe to the tanks to expel their liquids, a by-pass providing communication between the tanks, and a separate valve controlling said
115 by-pass adapted to open communication therethrough upon the existence of excess pressure in one of said tanks.

4. In a torpedo having an air-inlet pipe and fuel and water tanks, with valves for ad-
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mitting air pressure from said pipes to said tanks to expel their liquids, a by-pass operative when said valves are closed for providing communication between the tanks, a valve
5 controlling said by-pass, and pressure-responsive means in communication with at least one of said tanks for operating such valve.

5. In a torpedo having fuel and water
10 tanks with means for admitting air pressure to them to expel their liquids, valves for controlling such pressure admission, a by-pass providing communication between the tanks,
15 a separate valve in said by-pass, a spring tending to close said valve, and a pressure-responsive means receiving pressure from one of said tanks to open said by-pass valve.

In witness whereof, I have hereunto signed
20 my name.

WILLIAM DIETER.

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