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HULL FITTING

Filed March 4, 1943

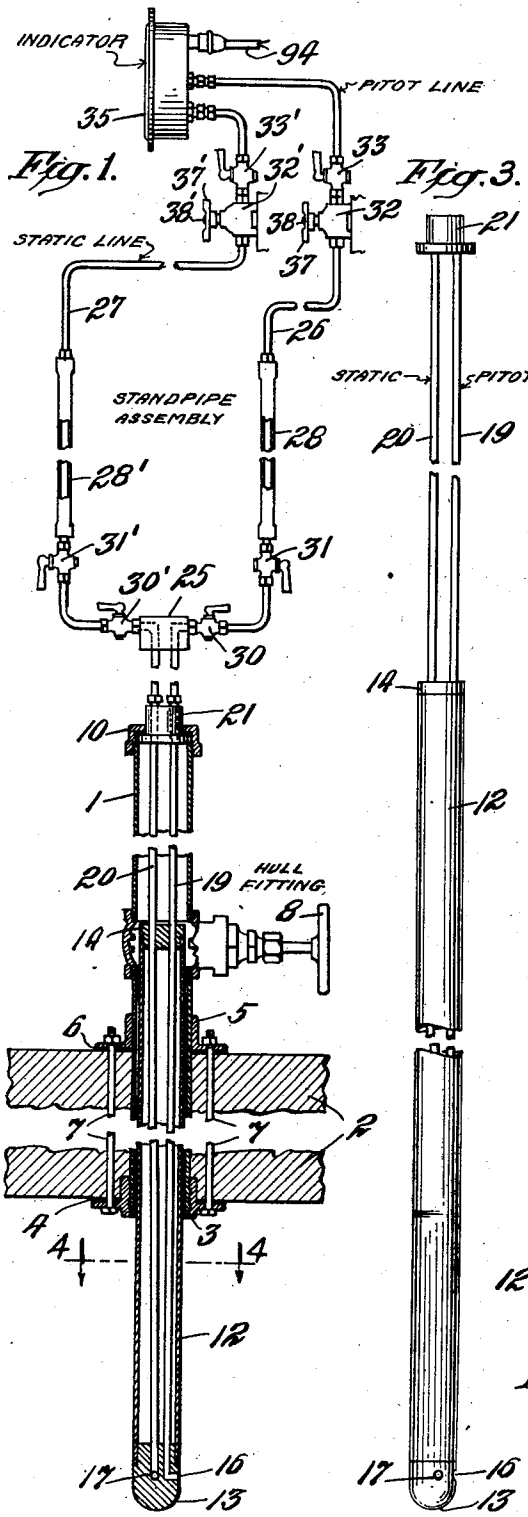


Fig. 1.

Fig. 3.

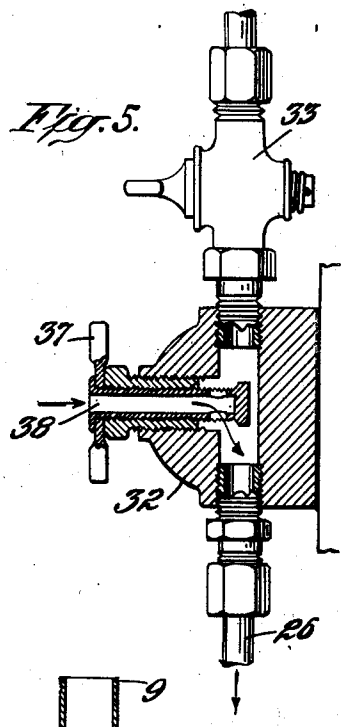


Fig. 5.

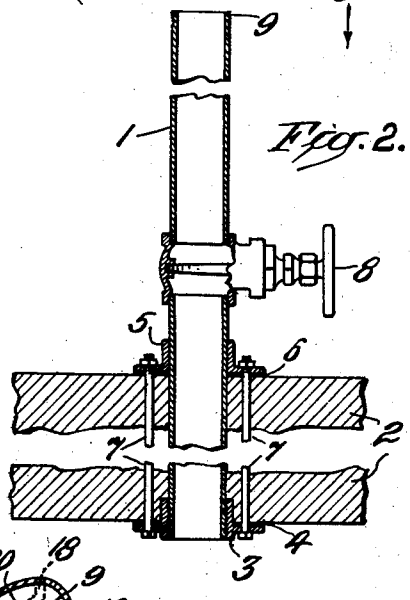


Fig. 2.

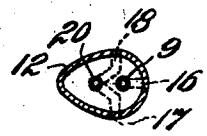


Fig. 4.

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HULL FITTING

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Application March 4, 1943, Serial No. 478,054

1 Claim. (Cl. 73—182)

This invention relates to a hull fitting for a marine speedometer and has for its object to provide an improved system and apparatus of the above type.

Another object is to provide a simple and efficient hull fitting for a marine speedometer, including a Pitot tube strut adapted to project beneath the hull of a boat, which is equipped with novel means for retrieving the tube through the hull for inspection, cleaning or repair, even when the boat is in motion.

A further object is to provide a hull fitting of the above type having novel and improved details of construction and features of operation.

Various other objects and advantages will be apparent as the nature of the invention is more fully disclosed.

The speedometer system of the present invention includes a strut which projects beneath the hull of the boat and contains a Pitot opening normal to the direction of travel for admitting water under pressure which varies with the speed of the boat; a connected standpipe assembly wherein the hydraulic pressure in the system, resulting from the movement of the boat, is converted to pneumatic pressure; and an indicator wherein variations in the air pressure in the standpipe are accurately translated to give a precise visual indication of the speed of the boat in knots.

Compensation for changes in draft, pitching, rolling and temperature is accomplished by the incorporation of a Static system in the device. This includes Static openings in the strut which are located at the same level and at right angles to the Pitot opening. The Static system is likewise connected through a standpipe assembly to the indicator, and is similar to the Pitot side of the system except for the location of the orifices in the bottom of the strut. The Static pressure side of the system produces a pressure equal and opposite to any positive pressures produced in the Pitot system which are due to causes other than the forward movement of the boat through the water, thus insuring a correct reading of the indicating instrument at all times.

The Pitot and Static sides of the system are connected by narrow tubes to individual upright standpipes of suitable dimensions which are so located as to span the normal waterline of the boat, and similar narrow tubing connects the upper ends of these standpipes through suitable blow-out and shut-off valves to the indicating instrument. These valves, and others employed in the system, enable the strut containing the Pitot and Static openings to be retrieved through the hull of the boat, or to be blown out and cleaned by the application of air pressure, even when the boat is in motion or at rest in the water. These and other novel features of construction, as hereinafter described, simplify the maintenance of the system and insure its faithful functioning under all conditions of use.

Although the novel features which are believed to be characteristic of the invention are pointed out more particularly in the claims appended hereto, the invention itself may be better understood by referring to the following description, taken in connection with the accompanying drawing in which a specific embodiment thereof has been set forth for purposes of illustration.

In the drawing,

Fig. 1 is an enlarged assembly, partly in section, showing the detailed construction of the speedometer system;

Fig. 2 is a vertical sectional view of the strut housing tube forming part of the hull fitting, with the strut removed from the tube;

Fig. 3 is a plan view of the strut, including the Pitot and Static tubes forming a part thereof;

Fig. 4 is a cross-sectional view of the strut, taken on the line 4—4 of Fig 1; and

Fig. 5 is a detail view illustrating the shut-off and blow-out valves, such as are connected to the Pitot and Static lines of the system, the blow-out valve being shown in section.

In order to simplify the description, the system embodying the present invention may be considered as being divided into three convenient parts, namely: the hull fitting including the strut which transmits the hydraulic pressure produced by the forward movement of the boat; the standpipe assembly wherein such hydraulic pressure is converted to pneumatic pressure; and the indicator which translates such pneumatic pressure to indicate the speed of the boat in terms of knots.

Hull fitting

The hull fitting comprises an elongated strut housing tube 1 which extends through the bottom of the hull or garboard 2 of the boat and is secured thereto as shown in Figs. 1 and 2. For this purpose the tube 1 is provided with an outboard flange 3 having a gasket 4, and an inboard flange 5 having a similar gasket 6. The lower end of tube 1 is threaded into flange 3, and flange 5 is slipped over the tube and the parts secured together by bolts 7 which extend through suitable holes in the flanges 3 and 5 as shown in Figs. 1 and 2. White lead may be used to bed the gas-

kets and flanges to further insure against leakage at this point.

The strut housing tube 1 is provided with a gate valve 8 for a purpose hereinafter described, and the upper end of the tube is threaded at 9 to receive a cap 10 which has a circular opening therein as shown in Fig. 1. In the position shown in Fig. 1 the gate valve 8 is open, while in Fig. 2 said valve is closed.

The strut which is adapted to be inserted in housing tube 1, and to project beneath the bottom of hull 2, is shown in Fig. 3. This strut comprises an elongated tube 12 having its lower end 13 closed and its upper end fitted with a gasket or stopper 14. Strut 12 may be of circular cross section, or, if desired, it may have a streamlined cross section, as illustrated in Fig. 4, to reduce the drag of the strut in the water and to cause a nonturbulent flow over the Static openings to be described. The strut 12 may be disposed vertically, or it may be inclined rearwardly at an angle of approximately 45° to prevent same from being fouled by seaweed or other debris. Preferably, the strut 12 is made of molded Bakelite or other frangible material which will break upon grounding of the vessel or hitting a solid obstacle, thus removing the danger of hull damage by tearing out the strut assembly.

As shown in Figs. 1, 3 and 4 the lower end of strut 12 is provided with a Pitot opening 16 which is fairly large in diameter to prevent fouling by marine growth. This opening is fixed parallel to the fore and aft axis of the boat and is located so as to point directly forward. The two Static openings 17 and 18 are formed by a transverse hole which extends through the bottom of the strut at its maximum width at right angles to the Pitot opening. This Static opening is preferably located at the same distance below the waterline as the Pitot opening, and a perpendicular hole within the strut intersects in a T with the Static openings as shown in Fig. 4.

A pair of tubes or passages 19 and 20 extend through the strut 12, the former having its lower end connected to the Pitot opening 16 and the latter having its lower end connected to the Static openings 17 and 18, as shown in Figs. 1 and 4. The tubes 19 and 20 extend upwardly through gasket 14 at the top of strut 12 and through a ferrule 21 and have their upper ends secured to a valve block 25 by means of which said tubes are connected to the standpipe assembly of the system as hereinafter described.

The valve block 25 is spaced above the gasket 14 to permit the strut 12 to be extended through the hull of the boat or to be retracted to a point above gate valve 8 in the housing tube 1, gate valve 8 being closed after the strut has been retracted. The strut 12 is then withdrawn by removing cap 10 from the top of the strut housing tube 1. Fig. 2 shows the housing tube 1 with the strut removed therefrom and with gate valve 8 closed. Now, in order to reinsert the strut 12 into housing tube 1, the strut is lowered into tube 1 until it rests upon gate valve 8 which is closed at such time. Cap 10 and ferrule 21 are next drawn down to the top of tube 1 and the cap 10 is screwed in place, after which the gate valve 8 is opened and the strut is lowered in the tube 1 to the position shown in Fig. 1.

The position of the strut 12 and associated parts of the hull fitting is important and must be selected with regard to several factors. The strut must be in such a position as to insure its continual operation in solid water. It should also be located at a point between the bow and the maximum beam of the boat or approximately forty feet aft of the bow if the bow has an overall length in excess of eighty feet. The assembly should furthermore be in a location where the gate valve 8 will be accessible from within the boat. There should also be sufficient vertical height in the boat to permit retrieving or withdrawing the strut as previously described.

The arrangement of the Pitot opening 16 and the Static openings 17 and 18, as described above, is likewise important. In accordance with Bournelli's Theorem, the pressure created on either side of the Static openings is equal and opposite in direction. Thus, changes in pressure are produced in the Static side due only to a change of Static head on these openings. It is not affected by water velocity around the strut. If the strut has a stream-lined cross section, as illustrated in Fig. 4, the Static openings should be located at the point of maximum width. These holes should be of the same size as the Pitot opening, but this is not necessary if a smaller metering orifice is installed identical in size in each side of the system.

Standpipe assembly

The respective Pitot and Static tubes 19 and 20 of strut 12 are connected through valve block 25 to the Pitot line 26 and Static line 27, respectively, as shown in Fig. 1. The Pitot line 26 contains an upright standpipe 28, and the Static line 27 contains a similar standpipe 28'. The Pitot and Static lines also contain various valves as hereinafter described, and, since the various elements in these two lines are alike in all respects, they will be given corresponding reference numerals except that the numerals identifying the elements in Static line 27 will have primes affixed thereto.

The respective Pitot and Static lines 26 and 27 include shut-off cocks 30, 30' associated with valve block 25, shut-off cocks 31, 31' at the lower ends of standpipes 28, 28', blow-out valves 32, 32' connected to the upper ends of the standpipes, and shut-off valves 33, 33' which connect the respective pneumatic lines to the indicator 35. Standpipes 28, 28' are placed wherever convenient in the boat, but they must be arranged at such a height in the vessel that they will span or contain the normal waterline of the boat. They must also be located vertically with the shut-off cocks 31, 31' at their lower ends, and for convenience they should be located adjacent each other, in the same plane and at the same height. The blow-out valves 32, 32' and the shut-off valves 33, 33' should be located wherever conveniently accessible, and still be close to the indicator as shown in Fig. 1. The indicator 35 may be placed in any position and wherever desired in the boat. The above-enumerated elements of the Pitot and Static lines are connected by suitable piping or tubing, for example one-quarter inch soft rolled copper tubing such as is commonly used for automobile gasoline lines, oil lines, etc. Compression fittings may be furnished on all parts for tubing of this size, so that no soldering is necessary to install the system.

Care should be exercised when installing the Pitot and Static sides of the system to prevent the Pitot side of the strut 12 from being connected to the Static side of the indicating mechanism. To insure the correct connection, the Pitot and Static sides on both strut 12 and indicator 35

may be appropriately marked as with the letters "P" and "S" respectively.

The blow-out valves 32, 32' are provided with drain cocks 37, 37' which, when open, permit water to rise in the system to such a level as to be equal to the waterline of the boat. These drain cocks are also provided with orifices 38, 38' respectively, which permit a blow-out line to be connected to the system for blowing mud and other foreign accumulations from both the Pitot and Static lines as hereinafter described. During such blow-out operation, the shut-off valves 33, 33' must be closed to isolate the indicator 35 in order to prevent damage to the indicator. A cable 94 leads to a suitable light in the indicator 35.

Operation

If the installation of the marine speedometer is made with the boat out of water, the strut 12 should be drawn within the strut housing tube 1 before launching, to prevent damage to this part.

To accomplish this, the shut-off cocks 30, 30' on valve block 25 should be closed, and the tubing of the Pitot and Static lines 26 and 27 below standpipes 28, 28' should be disconnected from said shut-off cocks. Strut 12 may now be raised within its housing tube 1 by lifting valve block 25, the tubes 19 and 20 sliding through the ferrule 21. When launching has been completed, strut 12 should be forced out again to its normal operating position, and the tubing of the Pitot and Static lines should be reconnected to the shut-off cocks 30, 30' as shown in Fig. 2. Ferrule 21 may contain suitable packing to prevent leakage around tubes 19 and 20.

With the boat at rest in still water, all of the valves should be opened, and the drain cocks 37, 37' of blow-out valves 32, 32' should likewise be opened. Opening of drain cocks 37, 37' permits water to rise in the system to such a level as to be equal to the height of the waterline of the boat. Therefore, the height of the water in the system should terminate in standpipes 28, 28' since these standpipes contain the normal waterline of the boat. After a few seconds with all valves open, drain cocks 37, 37' should be closed tightly. The speedometer system is now ready for operation.

It may be desired from time to time to clear the system of an impediment. This may be accomplished by connecting blow-out lines to the orifices 38, 38' of drain cocks 37, 37'. The procedure for this operation is as follows: Close the shut-off valves 33, 33' between the indicator and the drain cocks, and open the drain cocks 37, 37'. Apply air pressure to the orifices 38, 38' of the drain cocks, which will blow the water from the lower half of standpipes 28, 28', as well as from the tubing which leads to strut 12, and from the strut itself. During this blowing-out operation the shut-off cocks 31, 31' at the lower ends of the standpipes, and the shut-off cocks 30, 30' at the upper end of the strut assembly must be in open position. Upon completion of this operation, the air lines should be disconnected from drain cocks 37, 37', and these drain cocks should be left open for a few seconds to permit the water to rise again in the system to the waterline in standpipes 28, 28', after which drain cocks 37, 37' should be closed tightly while leaving all of the various valves in open position.

The strut 12 may be removed while the boat is in operation by first closing the shut-off cocks 30, 30', and then disconnecting the tubing of the Pitot and Static lines from said shut-off cocks as previously described. The strut 12 is then raised in its housing tube 1 to a height which will permit closing of gate valve 8. With the gate valve closed, no water can enter the hull. Using a pipe wrench, cap 10 is detached from strut housing tube 1, after which strut 12 with the ferrule 21 and cap 10 may be lifted out of said housing tube. The strut may now be cleaned of any foul growth or corrosion and its tubes 19 and 20 blown out.

To replace the strut 12, simply reverse the procedure outlined above, placing the strut in its tube 1, allowing the strut to rest on gate valve 8 which is still closed. Replace cap 10 and ferrule 21 on the tube 1. Then open gate valve 8 and push strut 12 downwardly in tube 1 until valve block 25 is in the proper position. Next, attach the tubing of the Pitot and Static lines 26 and 27 to the respective shut-off cocks 30, 30' and then open both of said shut-off cocks. This final operation of securing the tubes should be done with care so as not to confuse the Pitot and Static sides of the system, and to avoid possible confusion the respective sides of valve block 25 may be appropriately marked with suitable indicia. With all valves in open position, drain cocks 37, 37' should now be opened for a few seconds to permit water to rise again in both lines to its normal waterline in the standpipes 28, 28'. Drain cocks 37, 37' may then be tightly closed, whereupon the system is again in condition for operation. As in all pneumatic and hydraulic systems, absolute tightness of the system must be achieved if satisfactory operation is to be obtained. In normal operation, as previously described, drain cocks 37, 37' remain tightly closed, while all of the other valves and shut-off cocks will be in open position.

When the boat is in operation and the speedometer system functioning, the forward speed of the boat produces a positive pressure on the Pitot opening 16 on the forward side of strut 12. The pressure exerted here is transmitted through the water in Pitot tube 19 and the associated tubing of the Pitot line to standpipe 28 where a conversion from hydraulic to pneumatic pressure occurs, as previously described. The pressure is thence transferred by air pressure through the upper tubing of Pitot line 26 to the instrument 35 to indicate the speed of the boat in knots.

Compensation for changes in draft, pitching, rolling and temperature is accomplished by variations in pressure in the Static side of the system. The Static openings 17 and 18 of strut 12 are located at the same level and at right angles to Pitot opening 16, hence the Static pressure side of the system produces a pressure equal and opposite to any positive pressures produced in the Pitot line which are not caused by a forward movement of the boat through the water. This correcting pressure compensates for the change of pressure resulting from changes in draft, large waves, pitching, rolling and temperature. The Static system is in all respects the same as the Pitot system except that the former terminates in orifices at right angles to the direction of the motion of the boat.

Although a specific embodiment of the invention has been shown for purposes of illustration, it is to be understood that the invention is capable of various adaptations and that changes and modifications may be made therein as will be readily apparent to a person skilled in the art. Certain specific terms are used for convenience only and not as a limitation of the scope of the

invention. The invention is only to be limited in accordance with the scope of the appended claim.

The invention claimed is:

A hull fitting for a marine speedometer comprising an elongated strut having at its lower end Pitot and Static openings, a pair of tubes extending upwardly from said strut and communicating respectively with said openings, a strut housing tube to be attached to a hull and open to the outside water, a gate valve in said housing tube within said hull having an opening to pass said strut and spaced below the top of said housing tube to provide space for said strut to be entirely retracted in said housing tube above said valve, a removable top closure for said housing tube, said pair of tubes extending through said top closure for axial movement for retracting or extending said strut and maintaining a water tight seal to prevent leakage from said tube into said hull, and a valve block attached to the free ends of said pair of tubes and having means to receive external connections, said valve block being positioned to provide clearance above said housing tube to permit said strut to be extended or retracted.

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