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FLOW MEASURING MECHANISM

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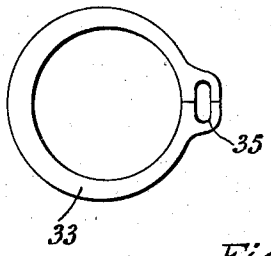


Fig. 2.

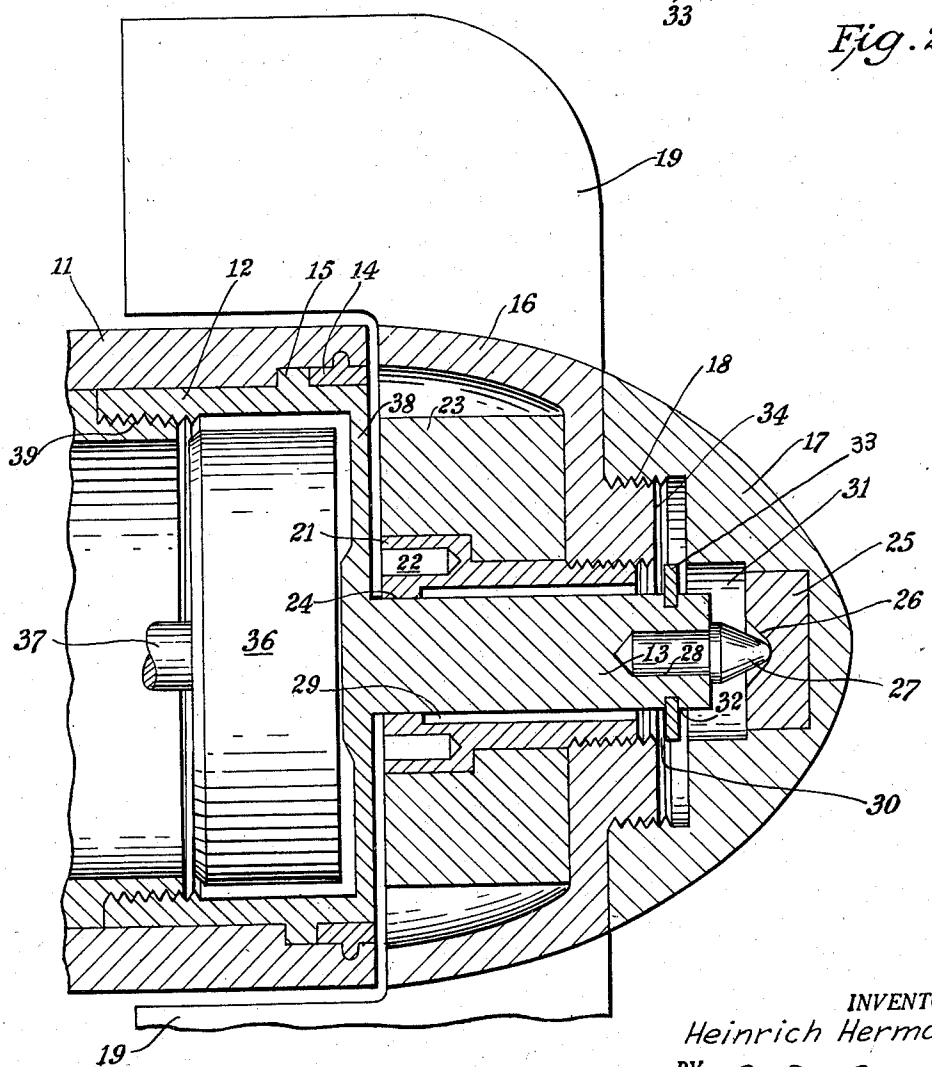


Fig. 1.

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FLOW MEASURING MECHANISM

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3 Claims. (Cl. 170—133)

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The present invention relates to liquid flow measuring devices, and is more particularly concerned with flow mechanisms of the character in which a submerged spinner or impeller is employed to transmit electric impulses to an indicator mechanism. Such devices are used to either indicate a ship's speed of travel, or to indicate the rate of liquid flow through a conduit. The invention is disclosed as applied to a ship's log, but it is not limited to such use.

The devices of this character which have been heretofore proposed have not proven altogether satisfactory because they are of such construction as to require lubrication, and it has been found that after they have been in service for some time, sea water finds its way into the lubrication chamber, thereby contaminating the lubricant and causing corrosion of the bearing parts, with resultant failure of the unit to give correct speed indications. Also, it has been found that the substantial oil film, or other means required for the purpose of forming an oil seal, imposes considerable resistance to rotation of the impeller, with the result that it is impossible to secure the desired ratio between impeller speed and the actual speed of the ship, in such prior devices.

It is accordingly the major object of this invention to provide a liquid-actuated impeller which requires no lubrication and yet is of simple, long-life construction.

Another important object is to provide an impeller which, when incorporated in a ship's log, will accurately respond to all speeds of the ship, and yield a speed of rotation which is substantially exactly proportional thereto, and which is so constructed that its response or sensitivity will not be impaired throughout its life, even when operated under extremely corrosive conditions.

Another object is to provide a unitary impeller mechanism embodying an impeller which is so supported that it will in effect "float" on a single pivot during operation, thereby minimizing wear and resistance to rotation.

A further object is to provide a novel assembly for restraining fluid flow-actuated impellers against removal from their supporting shafts, and yet which may readily be removed when desired.

Further objects will become apparent as the specification proceeds in conjunction with the annexed drawings, and from the annexed claims.

In the drawings:

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Fig. 1 is a vertical sectional view through the impeller mechanism of the invention, and

Fig. 2 is an elevational view, on a reduced scale, of the retainer employed to hold the impeller on its shaft.

With reference to the drawings, in which like reference characters have been employed to designate similar parts throughout the several views, the unit is carried by a cylindrical support 11 which is supported on the ship's hull below the water line in well-known manner, so as to subject the impeller to the force of the water in response to forward travel of the ship.

Tightly fitting within support 11, is a flanged support 12, having a cylindrical forwardly directed shaft portion 13. Support 12 may be secured in place in any well-known manner, as for instance by means of a fusible ring 14, coacting with flange 15 of the support, which forms a water-tight seal between the parts.

The novel impeller of the invention is made up of two mating streamlined parts 16 and 17 threadedly connected together at 18. Part 16 is provided with any suitable number of impeller blades 19 (preferably 4) having the desired pitch. Tightly threaded into impeller section 16 is a bushing 21, having a plurality of openings 22 for application of a spanner wrench. Secured in place within impeller section 16, by means of the flange of sleeve 21 is a magnetic ring 23 for a purpose that will presently appear. As seen in Fig. 1, bushing 21 is provided with a narrow face 24 having journalled engagement with shaft portion 13 of the support. This affords the sole support for the aft end of the impeller. However, due to the novel manner in which the assembly is made, most of the bearing load during operation is taken by the forward bearing, which will now be described.

The forward or cap portion of the impeller is provided with a recess into which a special corrosion-resistant bearing 25 is tightly fitted. The latter is provided with a generally conical bearing socket 26, which cooperates with a post or spindle bearing 27, which is also constructed of corrosion and wear-resistant material. Bearing 27 is of shouldered form and has its shank tightly fitted into a bore 28 in the end of support 13.

Bearings 25 and 27 may be constructed of any suitable material which has the requisite resistance to corrosion, and the ability to resist wear when exposed to the action of salt water in the absence of all lubrication. I have found that bearings constructed of tungsten carbide have proved very satisfactory. It is to be under-

stood however, that other hard and corrosion-resistant materials such as glass, and the like may be used. As seen in Fig. 1, the walls of bearing recess 26 diverge to a materially greater extent than the walls of bearing 27, and the radius of pivot 27 is also somewhat smaller than the radius of bearing recess 26, with the result that the area of contact is localized over a very small portion of the end of bearing 27, and friction is accordingly minimized.

I have found that by constructing an impeller unit in the manner disclosed, and freely permitting the ingress of sea water along passage 29 into space 31, a perfectly performing construction is achieved and one in which the sea water apparently functions as a lubricant for the bearings.

The impeller may be restrained against tendencies for it to be displaced from support 13, as for instance when the ship is proceeding astern, by any suitable means. However, I have found that the novel means which will now be described has proven very satisfactory, and is of simple and efficient form. Support 13 is provided, adjacent its free end, with an annular recess 32 into which a split snap ring 33 is fitted. The latter bears against the hub section 34 of impeller section 15 and limits forward travel of the impeller unit. A slight amount of end-play 30 is provided to insure against binding of the parts.

When it is desired to disassemble the unit, all that is necessary is to unscrew cap 17 from hub 34, remove snap ring 33, by shifting it radially and slide the impeller off the end of the shaft, an opening 35 in the snap ring permitting insertion of a tool, in well-known manner.

Rotation of the impeller is transmitted to the indicating mechanism by means of a magnetic member 36 carried by a shaft 37 and disposed in flux linking relationship with magnetic member 23 through a wall 38 of support 12. A second support 39, threaded into support 12, carries a contact make and break assembly actuated by shaft 37 (not shown).

While any suitable corrosion-resistant materials may be used for the other parts of the device, I have found that very satisfactory results are obtained when support 12 is made of stainless steel; bushing 21 of Phosphor bronze; the impeller of nickel silver or high nickel-copper alloys and retainer 33 of beryllium copper. The remaining parts may be made of bronze.

From the foregoing detailed disclosure of the invention, it is apparent that an impeller mechanism is provided which is of simple but yet efficient and rugged form, and one which does not require the use of sealing devices to exclude the ingress of sea water, and at the same time the bearing assembly is of such construction that the sea water is apparently capable of functioning as a lubricant, and friction is reduced to such a small value that accurate rotational response of the impeller in response to speed of the ship is achieved. Also, the force of the water maintains bearing 25 and 27 in engagement, so that the impeller in effect "floats," and there is negligible radial load on the aft end of the bushing.

The invention may be embodied in other specific forms without departing from the spirit or essential characteristics thereof. The present embodiment is therefore to be considered in all respects as illustrative and not restrictive, the scope of the invention being indicated by the appended claims rather than by the foregoing description, and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced thereby.

What is claimed is:

1. In an impeller mechanism, a cylindrical member supported at one end and having an annular recess adjacent its free end; a two part impeller including an aft part journalled on said member and a cap portion fitting over the free end of said member and embodying thrust bearing means; and retainer means associated with said aft section and cooperating with said recess to prevent removal of said impeller from said member, said retainer means being housed by said cap portion.

2. The impeller mechanism defined in claim 1, wherein said retainer means is removable by shifting it radially, and said cap, when in place on said aft section, is operable to prevent such removal.

3. In an impeller mechanism for a ship's log or the like, a generally cylindrical member supported at its aft end; a two-part impeller unit comprising an aft section journalled on said member and having external impeller vanes, and a cap section tightly secured to said aft section and enclosing the free end of said member; thrust bearing means provided in said cap section for limiting aft movement of said impeller unit on said member; and retainer means coacting with said member and said impeller unit for limiting fore movement of said impeller assembly along said member, said retainer means being removable to permit said aft section to be slid off of the free end of said member, and said cap section, when in place on said aft section, being operable to enclose and prevent removal of said retainer means.

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