April 16, 1968 J. BILTON 3,377,957

FUSIBLE PLUG ASSEMBLIES FOR HYDRAULIC TURBO-COUPLINGS

Filed Aug. 31, 1966

Fig. 1.

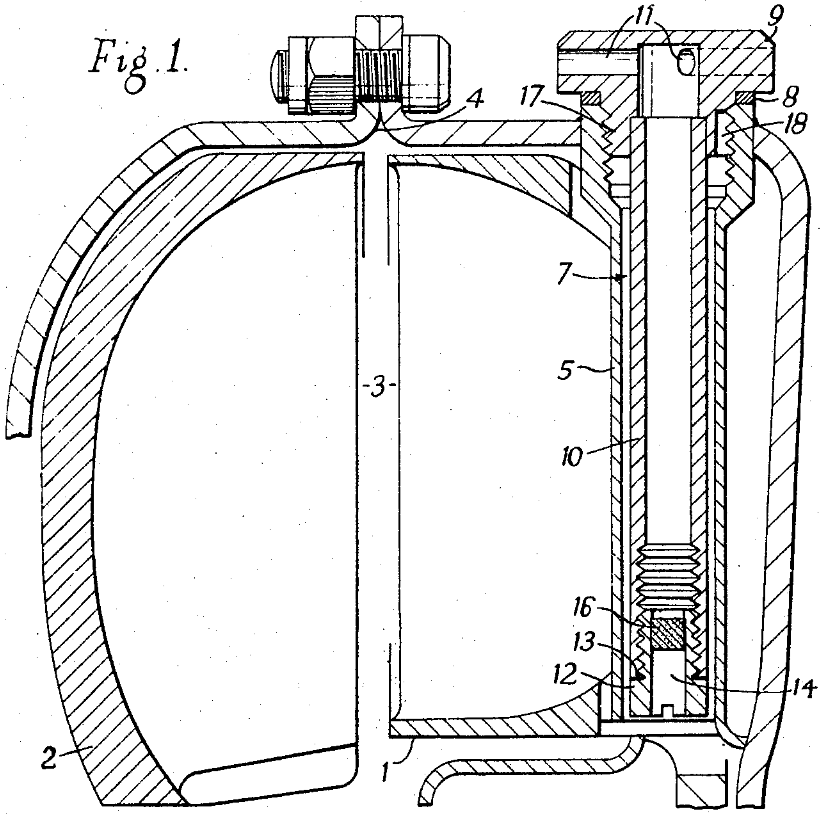


Fig. 2.

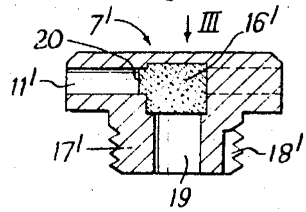
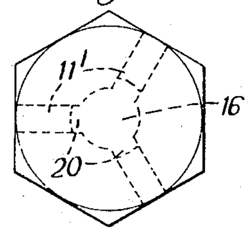


Fig. 3.



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United States Patent Office 3,377,957
Patented Apr. 16, 1968

3,377,957
FUSIBLE PLUG ASSEMBLIES FOR HYDRAULIC TURBO-COUPLINGS

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Filed Aug. 31, 1966, Ser. No. 576,470
Claims priority, application Great Britain, Sept. 3, 1965, 37,797/65
4 Claims. (Cl. 103—115)

ABSTRACT OF THE DISCLOSURE

A fusible plug assembly for a hydraulic turbo-coupling is formed with a discharge passage which is normally closed by a fusible plug and has its inlet in communication with the interior of the working circuit of the coupling. However, the discharge passage terminates in a plurality of discharge openings which extend transversely of the passage and are of sufficiently small cross section to prevent the fusible plug from being ejected therethrough when the fusible plug is released in substantially unmelted form.

The present invention relates to fusible plug assemblies for hydraulic turbo-couplings. Such fusible plug assemblies act as overload protective devices for the couplings and are formed with a discharge passage which is blocked by a body of a low melting-point alloy of predetermined melting point. When, as the result of an overload due for example to stalling of the driven load and the coupling runner, the temperature of the working liquid in the coupling exceeds the melting point of the alloy body, the latter melts and the working liquid is discharged by the centrifugal head within the coupling through the discharge passage. The filling of the coupling, and consequently the torque transmitted by the coupling, is rapidly reduced and the driving motor is relieved of virtually all its load.

To restore the coupling for normal use again, it is refilled with the appropriate amount of working liquid, a new fusible plug being fitted.

The fusible assembly usually consists of a threaded plug having a discharge opening extending through it, the body of low melting-point alloy being cast in the discharge opening, the head of the plug being accessible from the exterior of the coupling. Where however the exterior of the coupling is forcibly air-cooled, as for example by a separate fan or blower, the fusible plug is screwed into the radially inner end of a discharge tube which itself is screwed into the coupling and has a head accessible from the outside of the coupling, the fusible plug assembly in this case consisting of the fusible plug and the discharge tube.

A fusible plug assembly according to the present invention has a discharge passage extending axially of the assembly and terminating in a discharge outlet discharging substantially radially of the assembly.

This arrangement prevents the low-melting point alloy from being ejected as a single mainly solid body as may occur when the discharge passage discharges radially. In the latter case, on overheating, heat is transferred from the wall of the discharge passage into the body of alloy so that the periphery of the alloy tends to be the first part to melt and the whole body of alloy may become detached and be ejected in unmelted form as a dangerous projectile. Fusing of the fusible plug may be caused by prolonged running with the driven load stalled or when the motor is switched off after it is observed that the load has been stalled for some time whereupon the cooling effect is reduced as the casing slows down but further heat is being transferred to the fusible plug.

Moreover the fusible plug assembly has more than one discharge outlet discharging radially of the assembly. This makes it more difficult to thwart the operation of the assembly by hammering plugs into the outlets as compared with the case where the assembly has only a single outlet discharging axially of the assembly and thus radially of the coupling.

Where internal pressure is likely to be generated within the coupling in operation, especially where the working liquid has vapour pressure which increases appreciably with increasing working temperature (for example water and invert emulsions of water and oil), it is advantageous to provide a pilot vent which is normally closed when the fusible plug assembly is screwed fully home and which is uncovered as the assembly is unscrewed and before there is any risk of the assembly becoming separated from the coupling. The pilot vent may conveniently be in the form of an axial groove cut in the screw threads of the fusible plug assembly. Preferably the groove does not extend to the root of the screw-threaded portion of the assembly, so that when the latter is screwed fully home, the co-operating threads in the coupling casing substantially blank off the pilot vent. Thus as the assembly is unscrewed, a progressively increasing tell-tale escape of vapour occurs if the coupling is under internal pressure.

Embodiments of the invention will now be described by way of example with reference to the accompanying drawings, in which:

FIG. 1 shows in axial section part of a traction coupling which is forcibly air-cooled by an external fan,

FIG. 2 is an axially sectional view of a fusible plug assembly for mounting in the periphery of the casing of a traction coupling which is not forcibly air-cooled but runs in a free atmosphere, and

FIG. 3 is a view in the direction of the arrow III in FIG. 2.

The traction coupling shown in FIG. 1 comprises vaned impeller and runner members **1** and **2** which together define a toridal working circuit **3** for the working liquid. An impeller casing **4** surrounds both the elements **1** and **2** and is secured to the impeller **1** for rotation therewith.

Welded to the impeller casing **4** is a filling tube **5**, the outlet end of which is normally closed by a fusible plug assembly **7** with a sealing washer **8** under the hexagon head **9** of the fusible plug assembly **7**.

The head **9** carries a discharge tube **10** extending radially of the coupling and is formed with three discharge outlets **11** perpendicular to the tube **10** and lying at angles of 120° to each other. Alternatively, there may be an even number of outlets **11** arranged in diametrically opposed pairs to permit the passage of a tommy bar therethrough.

A fusible plug **12** is screwed into the threaded inner end of the tube **12** with a sealing washer **13** between the head of the fusible plug and the inner end of the tube **10**. A bore **14** extends through the plug **12** and is normally blocked by a body **16** of low melting-point alloy. The body **16** may be press fitted in the bore which may then be tapered in the direction such that centrifugal force urges the body towards the narrower end of the bore. As can be clearly seen from the drawing, the fusible plug **12** is of larger dimensions than the cross section of the outlets **11** and is therefore incapable of passing through any of these outlets in substantially unmolten form.

It is found in practice that there is no risk of the molten alloy blocking all the outlets **11** even though the temperature of the head **9** will be below the melting point of the alloy.

The screw-threaded portion of the shank **17** of the head **9** is formed with an axial groove **18** acting as a pilot vent which is normally sealed off from the outside by the sealing washer **8** but allows a slow discharge of any gas or vapour under pressure in the coupling when the head **9** is unscrewed about a turn.

The fusible plug assembly **7'** shown in FIGS. 2 and 3 can replace the fusible plug assembly shown in FIG. 1 when the exterior of the casing **4** is not forcibly air-cooled. Parts of the assembly **7'** corresponding to parts of the assembly **7** are indicated by the same reference numeral primed.

The assembly **7'** has an axial discharge passage **19'** terminating in three discharge outlets **11'**. The body **16'** of low melting-point alloy is cast in the region of the junction of the passage **19** and outlets **11'** and extends at **20** a short distance into the outlets **11'** to provide a firm anchorage for the body **16'** against accidental displacement.

Alternatively, the body **16'** may be pressed into the passage **19** until it begins to extrude at **20** into the outlets **11'** to provide firm anchorage for the body **16'** against accidental displacement but without affecting the eutectic properties of the fusible metal. The passage **19** may be tapered to provide a wedging action further securing the body **16'**. Clearly the body **16'** cannot pass through the outlets **11'** in the unmolten state.

In an embodiment not shown, the outlets could be arranged in diametrical alignment with the fusible body **16'** spaced from the outlets so as to enable a tommy bar to be passed right through the outlets.

I claim:

1. In a hydraulic turbo-coupling comprising relatively rotatable impeller and runner members defining a toroidal working circuit, a casing rotatable with one of the members and forming a substantially closed working chamber for containing a working fluid, a duct extending from the exterior of the working chamber into the interior of the working chamber, the improvement which comprises a fusible plug assembly for obturating the duct, said assembly comprising a body having a head and shank, said body being formed with a discharge passage leading from an inlet in said shank at the end thereof remote from said head, said head being formed with a plurality of discharge outlets extending transversely from the outlet end of said passage to discharge orifices in the peripheral surface of said head, a plug of fusible material in said discharge passage between said inlet and said discharge outlets, said plug fusibly obturating said passage, said plug being of dimensions rendering it incapable of passing through any of said discharge outlets in substantially unmolten form.

2. A hydraulic turbo-coupling according to claim **1**, in which said shank and said discharge passage are elongated and said fusible plug is adjacent said inlet whereby to lie near the inner portion of said coupling working circuit.

3. A hydraulic turbo-coupling according to claim **1**, in which said shank has a screw-threaded portion adjacent said head and securing said assembly in a correspondingly threaded portion of said duct, said screw-threaded portion of said shank being formed with a cutout extending in an axial direction to form a pilot vent in the partially unscrewed position of said assembly.

4. A hydraulic turbo-coupling according to claim **1**, in which said fusible plug is located adjacent and extends partway into at least one of said discharge outlets.

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