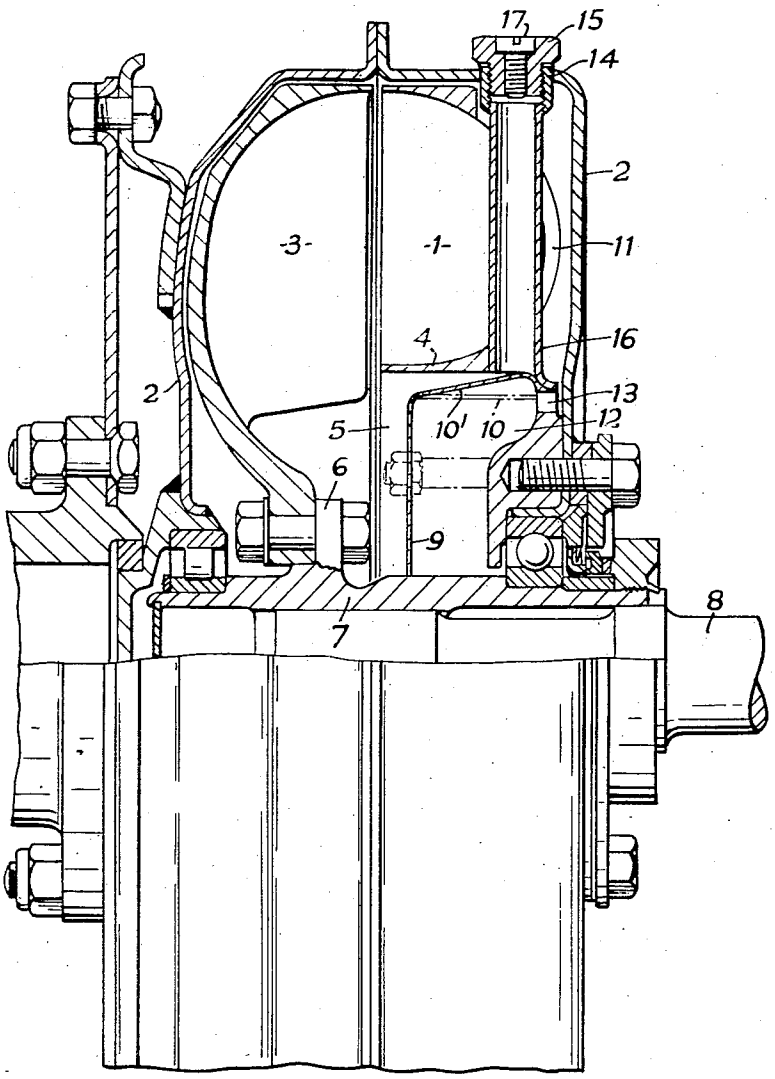
May 9, 1961 H. SINCLAIR 2,983,102

HYDRAULIC TURBO COUPLINGS

Original Filed Aug. 20, 1957 2 Sheets-Sheet 1

Fig. 1.



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Original Filed Aug. 20, 1957 2 Sheets-Sheet 2

Fig. 2.

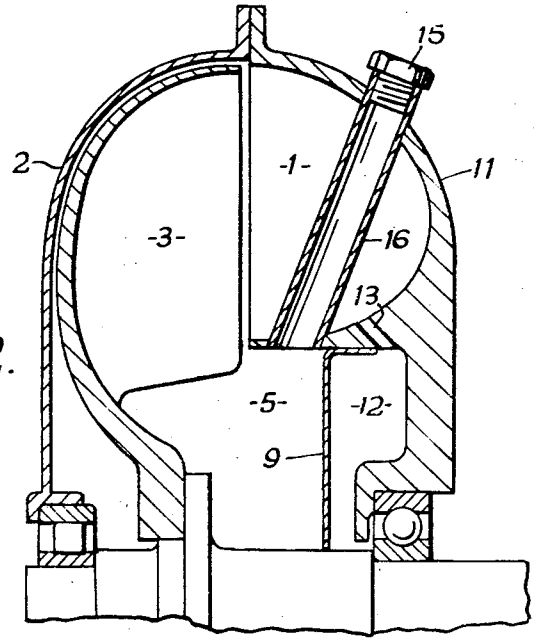
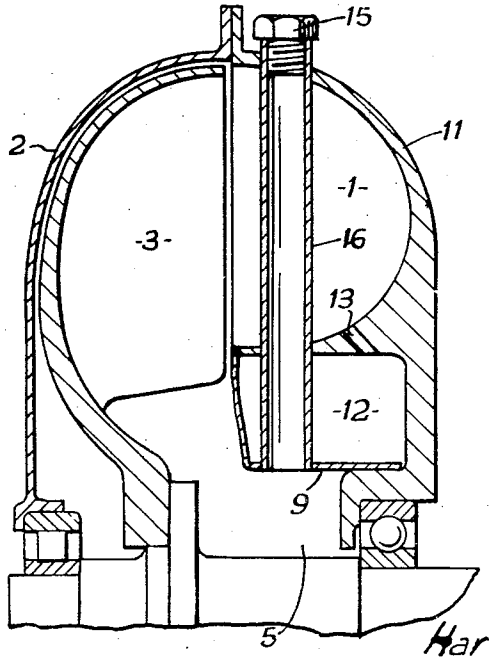


Fig. 3.



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HYDRAULIC TURBO COUPLINGS

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2 Claims. (Cl. 60—54)

This invention relates to hydraulic turbo couplings of the constant filling type comprising bladed impeller and runner elements with a casing rotating with one of the elements to form together with such element a working chamber wherein the working liquid is retained.

An important factor in the satisfactory operation of the coupling is that the total quantity of liquid in the coupling shall not be excessive. It is also a desirable feature in such turbo couplings to provide a fusible plug which operates at a predetermined temperature (which may be 285° or 361° F. with two well-known fusible metals) in order to discharge the working liquid from the coupling when overheated, for example, if the slip of the coupling is excessive or the runner is stalled for long enough to raise the temperature of the working liquid to an undesirable extent. It is furthermore desirable to ensure that the hole in which the fusible plug is screwed is not so situated that it can be used to fill up the coupling to an unsafe degree, i.e., much beyond the extent permitted by filling through the normal filling plug hole in accordance with the maker's instructions.

In accordance with the invention there is provided a hydraulic turbo coupling of the constant filling type, characterized by a filling duct with a plug and a fusible element therein, the said filling duct extending from the exterior of the coupling into the working chamber and having at the end within the working chamber an open mouth situated in a region where some of the working liquid leaving the runner near to its inner profile radius e.g., when the slip is excessive can enter said mouth and be expelled from the working chamber via said duct to the exterior of the coupling when said duct is open due to the fusing of said fusible element.

In the accompanying drawings,

Fig. 1 is a view in sectional elevation of one construction of turbo coupling according to the invention, and

Figs. 2 and 3 are diagrammatic sectional views illustrating respectively two other constructions of turbo coupling according to the invention.

Referring to Fig. 1, the impeller 1 is rotatable with a casing 2 that extends over the back of the runner 3. The inner profile diameter of the runner 3 is smaller that that of the impeller 1 which at its inner profile diameter forms an annulus 4 projecting axially towards the runner 3 and terminating just short of the inner edges of the runner blading, the annulus 4 constituting the radially outer boundary of an open-ended container 5. The runner 3 is bolted to a flange 6 on a sleeve shaft 7 journalled within hubs of the impeller 1 and the casing 2 and having internal splines for connection to the output shaft 8 of the coupling. Disposed in the central space within the inner profile diameter of the impeller 1 and bolted to the impeller hub is a partition consisting of a dished annular member having a first wall 9 which is normal to the coupling axis and a second wall which projects from the outer periphery of the wall 9 towards the impeller hub being, for example, parallel to the coupling axis as shown at 10 or inclined outwardly therefrom at

a small angle as shown at 10'. The outer periphery of the wall 9 is spaced a short distance radially inwardly of the annular projection 4 of the impeller 1, and the plane of the wall 9 is between the planes, normal to the coupling axis, that contain respectively the said inner edges of the runner blading and the axially outermost part of the portion of the casing 2 that encloses the impeller shell 11. The radially inner edge of the wall 9 projects towards the sleeve shaft 7 and is separated therefrom only by a running clearance so that effectively there are provided two mutually isolated chambers for containing liquid, one chamber 5 being open-ended and being outside the partition 9, 10 and the other being a storage chamber 12 enclosed within the partition. The open-ended chamber 5 is in free communication with the working circuit via the annular gap between the radially inner parts of the impeller 1 and runner 3. Under normal running conditions with low slip the working liquid is contained wholly within the working circuit, wherein it is considered to form a circulating vortex ring, the liquid passing continuously from the runner blading across the said gap to the impeller blading. When the slip increases, for example when the runner 3 is slowed in its rotation relative to the impeller 1 or is stalled, liquid is ejected from the working circuit through the said gap into the open-ended container 5, thereby reducing the torque transmitting capacity of the coupling. When the runner speed again increases relative to the impeller the liquid in the container 5 returns to the working circuit under the action of centrifugal force thereby increasing the torque transmitting capacity and further reducing the slip in the coupling.

The inner chamber 12, which constitutes the storage chamber, communicates with the working circuit via ports 13 in the impeller hub and through the annular space between the peripheral edges of the impeller 1 and runner 3. When the impeller 1 is stationary some working liquid flows under gravity through the ports 13 to more or less fill the storage chamber 12, so that starting up of the coupling occurs with a reduced filling of the working circuit and the impeller 1 is enabled to approach its full speed more rapidly under the somewhat reduced load. As the impeller 1 accelerates, liquid starts to leave the storage chamber 12 via the ports 13 under the action of centrifugal force and to pass into the working circuit so that the working circuit becomes full to the extent determined by the degree of filling of the coupling as a whole, after a short time delay determined inter alia by the size of the ports 13.

The filling duct comprises a socket 14 and a tube 16. The socket 14 is mounted on a hole in the part of the casing 2 enclosing the back of the impeller 1 and is internally screw-threaded. A filling plug 15, with a fusible plug 17 screwed into it, is screwed into the outer end of the socket 14, and one end of the radially arranged tube 16 is screwed into the inner end thereof, the tube 16 projecting through the impeller shell 11 at two places and terminating at the radially inner side of the annular projection 4. When filling the coupling initially, e.g., with the axis horizontal, the filling plug 15 is unscrewed and the coupling is set with the tube 16 at an appropriate angle to the vertical in accordance with the manufacturer's instructions, e.g., between 0° and 75° in a coupling having the proportions shown. The maximum quantity of liquid that can be introduced through the filling duct is limited by the air trapped in the space above the level of liquid and is determined by the angle to which the tube 16 is set. The filling plug 15 is then screwed into the outer end of the tube 16.

When the slip in the coupling is excessive and the runner is partially or completely stalled the liquid that is ejected from the working circuit into the open-ended

container 5 can reach the open mouth of the tube 16, and when the excessive slip or stalled condition persists for a long time the liquid temperature rises and the point may be reached when the fusible plug 17 fuses and working liquid is ejected through said duct, this ejection of liquid continuing while the coupling is in operation under high slip conditions since the open-ended container 5 is fed with liquid ejected from the working circuit until the torque transmitting capacity of the coupling is so greatly reduced that it becomes inoperative. It is then necessary to remove the cause of the overload or operation at high slip to replace the fusible plug 17 and to refill the coupling to the specified degree.

In Fig. 2 the partition 9 is arranged so that the open-ended container 5 and the storage chamber 12 are side by side. In this case casing 2 does not have a portion that extends over the back of the impeller shell 11, and the ports 13 lead directly from the storage chamber 12 to the working circuit. The filling tube 16 is inclined to the axis of the coupling, and extends inwards to the periphery of the open-ended container; this tube 16 has a filling plug 15 screwed into it, which plug 15 may be the same as that shown in Fig. 1, i.e., has a fusible plug 17.

In Fig. 3 the open-ended container 5 is radially within the storage chamber 12, and the filling tube 16 extends inwards to the periphery of the open-ended container within the part of the partition 9 parallel to the coupling axis. In this case also the tube 16 has a filling plug 15 screwed into it, which plug 15 is the same as that shown in Fig. 1.

I claim:

1. In a hydraulic turbo coupling of the type comprising a vaned impeller element and a vaned runner element defining a toroidal working circuit, with a casing rotatable with one of said elements and forming a substantially closed working chamber for containing a constant volume of working liquid during normal operation of the coupling, the provision of a filling duct extending from the exterior of said working chamber into the interior of said working chamber, a plug in said duct, a fusible element in said plug, said duct having at its end within said working chamber an open mouth situated in a region where some of the working liquid leaving the runner near to its inner profile radius under high slip conditions can enter said mouth and be expelled from said working chamber via said duct to the exterior of the coupling when said duct is open due to the fusing of said fusible element.

2. In a hydraulic turbo coupling of the type comprising a vaned impeller element and a vaned runner element the inner profile diameter of which is smaller than the inner profile diameter of said impeller element whereby there is provided an annular space radially inwardly with respect to the radially inner part of said impeller element, said impeller and runner elements defining a toroidal working circuit and a casing being provided which is rotatable with one of said elements and forms a substantially closed working chamber for containing a constant volume of working liquid during normal operation of the coupling, the provision of a filling duct extending from the exterior of said working chamber at least as far as said annular space, said duct having an open mouth at its end nearest said space, a plug in said filling duct, and a fusible element in said plug.

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