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STERN TUBE SAFETY RING ASSEMBLY

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2 Sheets-Sheet 1

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FIG-3

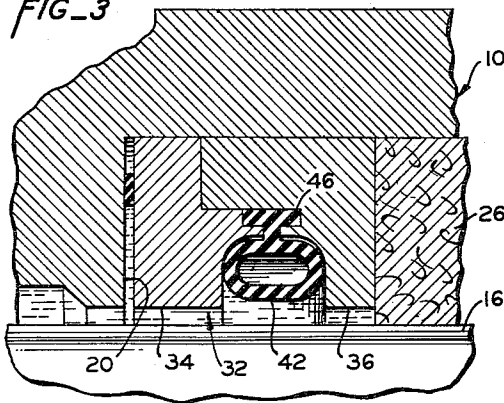


FIG-4

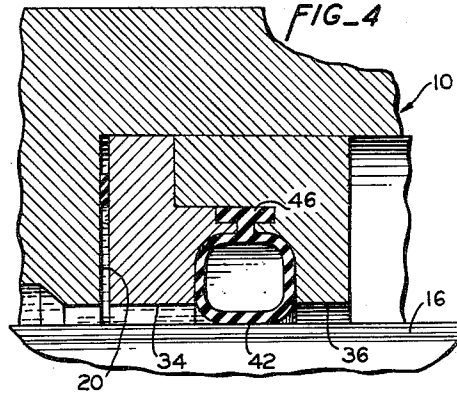


FIG-5

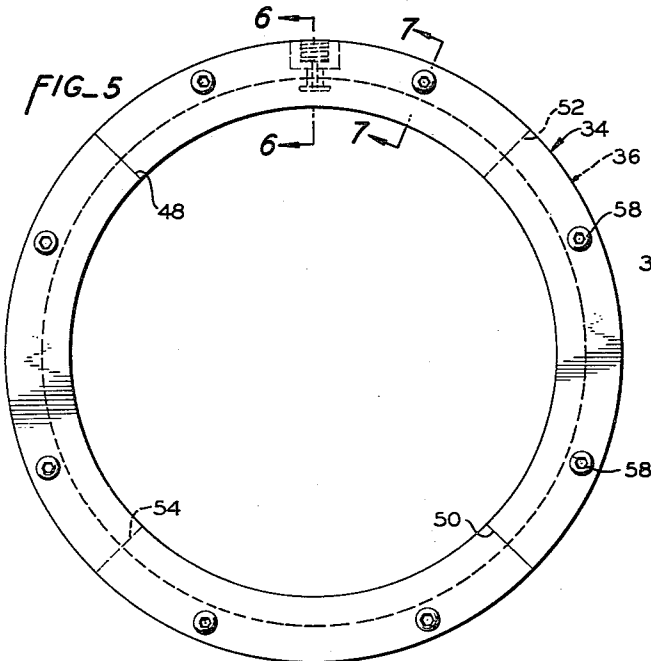


FIG-6

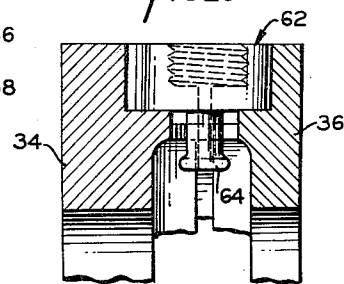


FIG-7

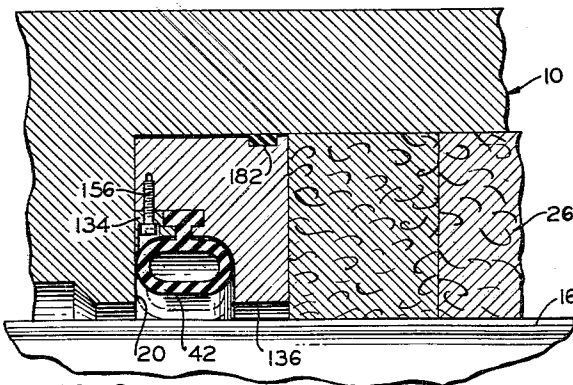
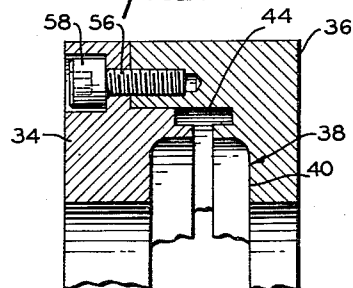


FIG-8

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STERN TUBE SAFETY RING ASSEMBLY

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This invention relates to propeller-driven seagoing vessels, and more particularly to a stern tube safety ring assembly adapted to be disposed within the stuffing box for the propeller shaft and to be pneumatically operated, when the propeller shaft is not in motion and while the ship is afloat, to seal the stuffing box against the influx of sea water and enable worn and leaking packing rings to be replaced.

Practically every ship's engineering officer has been faced at one time or another with the problem of dealing with excessive leakage of sea water through the ship's stern tube gland. Minor leakage which can be handled by the ship's pumps presents merely an inconvenience problem. But leakage to a degree beyond the capacity of the pumps results in the flooding of shaft tunnels or machinery spaces and other casualties unless steps are promptly taken to stop the influx of water. At the present time, there is only one way of replacing worn and leaking packing rings with complete safety, and this is by dry docking the ship and then making the packing ring change. However, it quite frequently happens that time, distance and operational requirement factors make immediate dry docking impossible. Moreover, dry docking amounts to a considerable item in operational expense.

When certain types of vessels are in still water, it is possible to shift weights forward, thus causing the vessel's propeller to be lifted out of the water to prevent leakage through the stern gland while packing is being replaced, but this is done at great risk to the stability of the vessel and also at the further risk of subjecting the vessel to damaging stresses and strains. Furthermore, the occasions when all weather and sea conditions are appropriate for the use of this method of packing replacement are so infrequent as to prevent this method from being employed in the course of usual operations.

A further method which has been employed to stop the influx of sea water and enable packing replacement while the vessel is at sea involves the sending of a diver over the stern to wrap a rubber boot, or mattress, about the propeller shaft where it enters the hull. The use of this method not only requires diver personnel and sea conditions appropriate for underwater work by the diver, but the shape of the shaft and the bearing housing must be such as to enable the rubber boot to satisfactorily accomplish its sealing function.

The stern tube safety ring assembly of the present invention fully solves all of the problems involved in replacing stern tube packing while a ship is afloat, and enables the same degree of safety to be attained as is attained by way of a dry docking operation.

Among the objects and advantages of the invention are the following: to provide a safety ring assembly which is readily installable in the stern tube of any ship and without requiring stern tube alterations for installation; to provide a safety ring assembly which is compact to the point of occupying the space of only a single ring of packing; to provide a stern tube assembly which is substantially foolproof and simple in structure and mode of

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operation, e.g. the assembly has but one moving part and requires only one gauge and one valve for operation; and to provide a stern assembly which cannot damage the propeller shaft, stern tube, or bearing of a ship; and to provide a safety ring assembly which may be used in bulkhead flange stuffing boxes through which the propeller shaft passes to prevent leakage from adjacent flooded compartments.

Other objects and advantages of the invention will be apparent from the following description taken in conjunction with the drawings forming part of this specification, and in which:

Figure 1 is a view in elevation of the stern tube and propeller shaft of a ship, with a portion thereof being broken away to show the safety ring assembly of the invention in place therein;

Figure 2 is an enlarged detail view of the sectional showing of the safety ring assembly of Figure 1;

Figure 3 is a sectional view of the safety ring assembly, taken at a point other than the air line connection region shown in Figures 1 and 2 and showing the inflatable safety ring in a non-inflated condition;

Figure 4 is a view similar to that of Figure 3, but showing the ring element in an inflated condition;

Figure 5 is a view in side elevation of the safety ring housing portion of the assembly;

Figure 6 is an enlarged detail view in section taken along lines 6—6 of Figure 5;

Figure 7 is an enlarged detail view in section taken along lines 7—7 of Figure 5;

Figure 8 is a view in section showing a modified form of the safety ring assembly; and

Figure 9 is a view in perspective of a single length split-type inflatable safety ring.

With initial reference to Figure 1, the stern tube assembly of a ship comprises a stuffing box tube 10 having a rearwardly disposed annular flange 12 secured to hull 14 in surrounding and sealing relation to a hull opening for propeller shaft 16 and having a forwardly disposed flange 18 and an inwardly disposed annular shoulder 20, a follower ring 22 having an annular flange 24, a plurality of packing rings 26 disposed within the stuffing box tube 10 in surrounding relation to shaft 16 and adapted to be conventionally pressed against shoulder 20 to effect a water seal along the propeller shaft, and a plurality of bolts 28 extending through flanges 18 and 24 and adapted to maintain the end of the follower ring 22 in pressing relation with the packing rings 26 by nuts 30.

In the course of normal operation of the ship, the packing rings 26 become worn due to the wear imparted thereto by rotation of shaft 16, and thus it becomes necessary to continually adjust the follower ring 22 inwardly of stuffing box tube 10 to maintain a sealing pressure of the packing rings against the shaft and stuffing box tube. When the follower ring has been adjusted inwardly of the stuffing box tube to the maximum amount possible, the packing rings are thereafter no longer pressable. Further wear of the packing rings leads to the influx of sea water along shaft 16, thus requiring that new or additional packing rings be added in order that a sealing pressure may be maintained. However, any backing off of the follower ring leads to increased leakage, and thus it is not feasible for new or additional packing rings to be installed when the stern tube is located below the surface of the water.

The safety ring assembly of the invention makes it possible, as above stated, for new or additional packing rings to be installed, once the rotation of shaft 16 has been stopped, while the ship is at sea or afloat.

The safety ring assembly 32 of the invention, which is adapted to be disposed between the shoulder 20 of stuffing box tube 10 and the endmost packing 26, comprises

a pair of annular ring members 34 and 36 which, when they are disposed in mating relation, as shown in Figures 3, 4 and 7, define therebetween an annular recess indicated generally at 38, said recess having a portion 40 adapted to receive and contain an inflatable rubber tube 42, and having a T-shaped portion 44 adapted to receive and contain a T-shaped fin 46 which is formed integral with or secured around the tube 42, as by being vulcanized thereto. As is indicated in Figures 5 and 7, the ring 34 is formed of two semi-circular parts 48 and 50 and ring 36 is formed of two semi-circular parts 52 and 54, with the joiner lines between the ring parts 48 and 50 and 52 and 54 being offset from each other 90 degrees. Screws 56 having their heads 58 recessed within the ring 34 serve to secure rings 34 and 36 together. The split form of rings 34 and 36 enables them to be placed over the propeller shaft 16 without necessitating the removal of a section of the shaft in order that the safety ring assembly may be placed within the stern tube, and the offsetting of the joiner lines of the parts, or sections, of each ring enables, in effect, a strong one-piece housing for tube 42 to be obtained when the rings 34 and 36 are secured together, as by screws 56.

The safety ring assembly is secured to the stuffing box tube 10 and in concentric spaced relation to shaft 16, as by a plurality of bolts 60 (Figure 1) which extend through drill holes formed in stuffing box tube 10 and are threaded into ring member 36 of the assembly. The ring assembly is thereby held against axial movement and radial movement with respect to shaft 16. The outside diameter of the safety ring assembly fits the stuffing box tube 10 with minimum clearance, while the inside diameter of the ring assembly is such that it clears the shaft 16 with the same or slightly greater clearance than the inside diameter of the stuffing box tube shoulder 20. This clearance prevents wear on the shaft 16 and damage to the safety ring assembly in the event of a vibrating or eccentrically rotating propeller shaft.

The tube 42 is provided with a heavy oval-shape cross-section, with the size and shape of the tube being adapted to prevent contact between the tube and the shaft when the tube is in a non-inflated condition. The T-shaped fin 46 of tube 42 is slightly larger in cross-section than the portion 44 of annular recess 38 in which the tube is received. Thus, when the two ring sections 34 and 36 are brought into mating relation and enveloping relation with respect to the T-shaped fin 46, the fin is slightly compressed, and the resultant substantial degree of frictional engagement between the fin and the metal ring assembly is such as to prevent any rotative movement therebetween because of rotation of the propeller shaft and the water around the shaft.

Means for inflating tube 42 to move it from its deflated and relaxed position of Figures 1 and 3, wherein it is disposed fully inwardly of the metal ring assembly and yieldingly retained in this fully inward position by the retractive force applied thereto by T-shaped fin 46, to the inflated condition of Figure 4, wherein the tube presses against the stationary shaft 16 and prevents the influx of sea water along the shaft while the packing 26 is being removed and replaced comprises: a plug 62 seated within a counterbore formed in the metal ring assembly, said plug having a tipped portion 64 which extends through a short tubular extension 66 formed on the tube 42, and said plug having an axial passageway 68; a stem member 70 having an axial passageway 72, said stem member extending through a bore formed in the stuffing box shell 10 and having its lower end in threaded engagement with plug 62 and having its upper end in threaded engagement with a T 74 which in turn is connected to both a pressure gauge 76 and through a control valve 78 to an air line 80; and a nut 82 in threaded engagement with stem 70 and adapted to press sealing washer 84 against the stuffing box shell to prevent the passage of water through the bore in the stuffing

box shell in which the stem 70 is disposed. The line 80 is connected to a source of pressurized air, not shown, such as the ship's air system, or even a hand pump. The gauge 76 measures the air pressure within tube 42 when the tube is inflated, and provides, once the tube has been inflated and valve 78 has been closed, an indication as to whether the proper sealing pressure is being maintained within the tube during use.

An annular gasket 86 is provided between the safety ring assembly and the shoulder 20 of the stuffing box shell to prevent any leakage of water therebetween when the tube 42 is inflated to seal off the space between the safety ring assembly and the propeller shaft.

With respect to the tube 42, the short tubular extension 66 thereof constitutes the only interruption of the continuity of the T-shaped fin 46. In order to adapt the tube 42 to be placed over a propeller shaft which is already in place, the tube is initially formed in one length, and then it is placed around the shaft and the ends thereof are then vulcanized together. The same is true with respect to gasket 86. The tube 42 may be also made in the form of a single length of tubing having two closed ends, the closed ends being adapted to press against each other when the tube is inflated, as illustrated in Figure 9.

A modified form of the safety ring assembly is shown in Figure 8, wherein parts identical with those previously described are designated by the same reference numerals and wherein parts corresponding to the parts previously described are identified by corresponding numerals plus 100. In this particular modification, the ring member 136 overlies the ring member 134 which is secured thereto by bolts 156, the arrangement being such that the side of tube 42 is in engagement with the stuffing box shell shoulder 20 both when the tube is inflated and non-inflated. The tube 42, when inflated, serves to seal off the space between the safety ring assembly and shaft 16 and to also seal off the space between the safety ring assembly and the stuffing box shell 10. As a precautionary measure, a sealing gasket 182 fitted within a groove formed in the periphery of ring member 136 may be employed to insure that no leakage will occur between the safety ring assembly and the stuffing box shell when the tube 42 has been inflated and the worn packing is being replaced.

From the foregoing description, it will be clearly seen that the simplicity of the safety ring assembly, from the standpoint of construction, installation and mode of operation, render it trouble-free in maintenance and operation. While specific embodiments of the invention have been shown and described, it is to be understood that all substantial equivalents thereof are considered to be within the spirit and scope of the invention.

While the stern tube embodiment of the invention for use in ships is perhaps the most important single use of the invention which we presently contemplate, it will be appreciated that the invention is not limited to such application and may be readily employed in such shore installations as oil wells, industrial plants, and so forth, i.e. wherever there may be a need to temporarily seal off one area of shaft-surrounding space from another.

What is claimed is:

1. A safety ring assembly adapted to be disposed within the stuffing box shell of a conventional stern tube of a ship and around the ship's propeller shaft and against the internal annular shoulder of said shell, said assembly comprising an annular air tight expandable tube, an annular fin formed on the outer periphery of said tube, means to hold and house said tube comprising a ring assembly formed of two mating rings adapted to be fixedly secured together and to grippingly enclose said annular fin and to laterally and freely enclose said tube, and conduit means extending through said shell and ring assembly and into said tube adapted to introduce pressurized fluid into said tube to expand the same into pressing engagement with the periphery of said shaft to pre-

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vent the influx of sea water along said shaft when the packing rings of said stuffing box are being removed and replaced, said tube being initially adapted to be wrapped around the shaft and said mating rings being each formed of a plurality of complemental arcuate sections, with the sections of one ring being staggered with respect to the sections of the other ring, whereby said tube and ring assembly may be positioned around the shaft while said shaft remains in place.

2. A safety ring assembly adapted to be fixedly disposed within the stuffing box shell of a conventional stern tube of a ship immediately adjacent an annular shoulder formed in said shell and in spaced concentric relation to the ship's propeller shaft, said assembly comprising an annular air tight expansible tube, an annular fin formed on the outer periphery of said tube, means to hold and house said tube comprising a ring assembly formed of major and minor mating rings adapted to be fixedly secured together to grippingly enclose said annular fin, and conduit means extending through said shell and ring assembly and into said tube adapted to introduce pressurized fluid into said tube to expand the same into pressing engagement with the periphery of said shaft to

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prevent the influx of sea water along said shaft when the packing rings of said stuffing box are being removed and replaced, said major ring being disposed in forward shielding relation with said tube and normally having said packing rings in pressing relation therewith, and said minor ring being disposed adjacent said fin and the outer periphery of said tube whereby said tube when expanded may also press against said annular shoulder and effect a water seal between said ring assembly and said stuffing box shell.

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