

March 11, 1969

A. L. HENDRICKSON
METHOD AND APPARATUS FOR INSTALLING NEW
PACKING ON PROPELLER SHAFT

3,432,172

Filed Nov. 25, 1966

Sheet 1 of 3

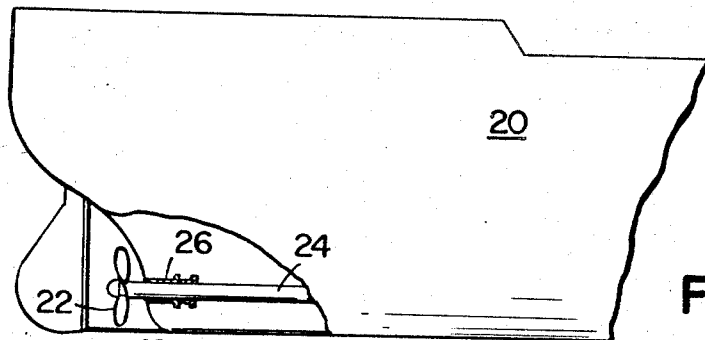


FIG_1

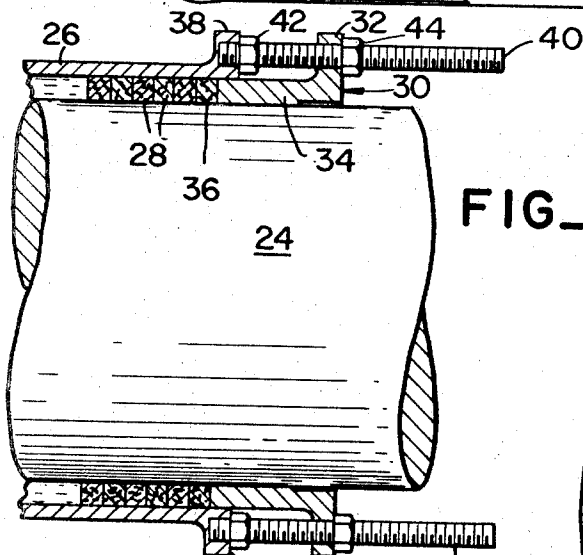


FIG_2

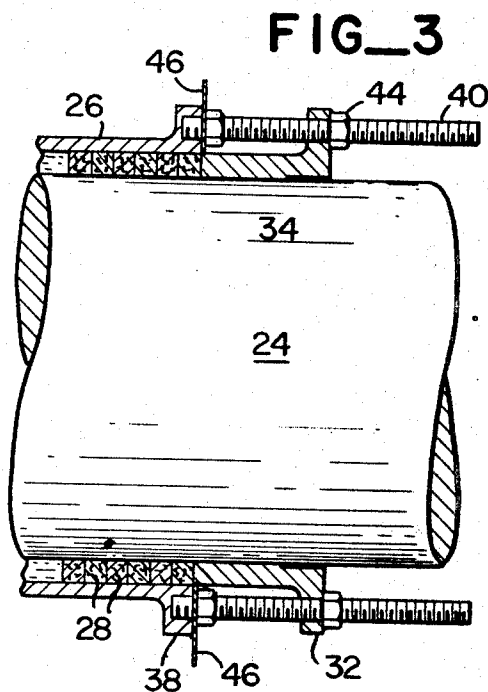


FIG_3

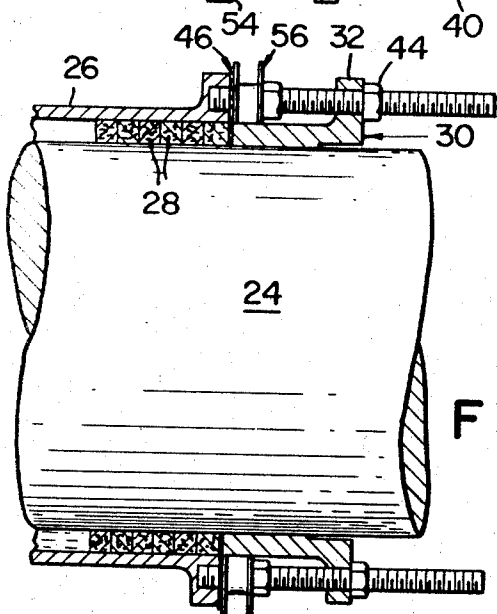


FIG_4

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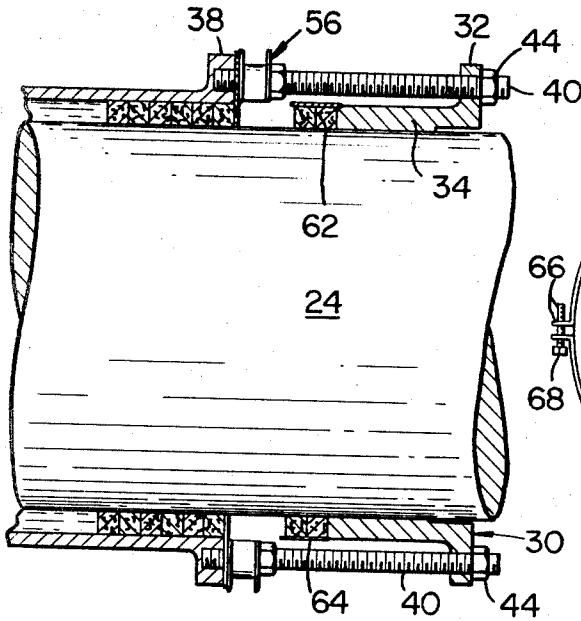


FIG_5

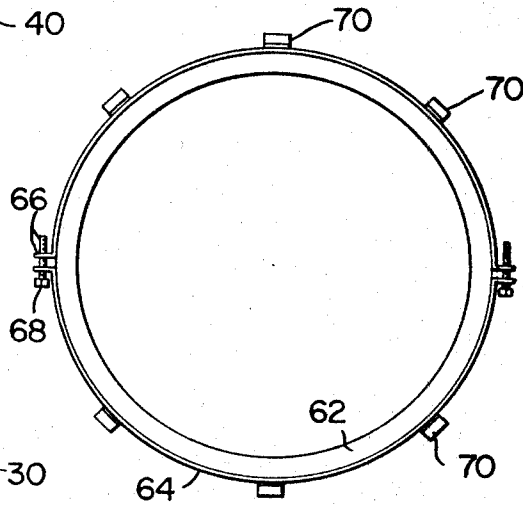


FIG_11

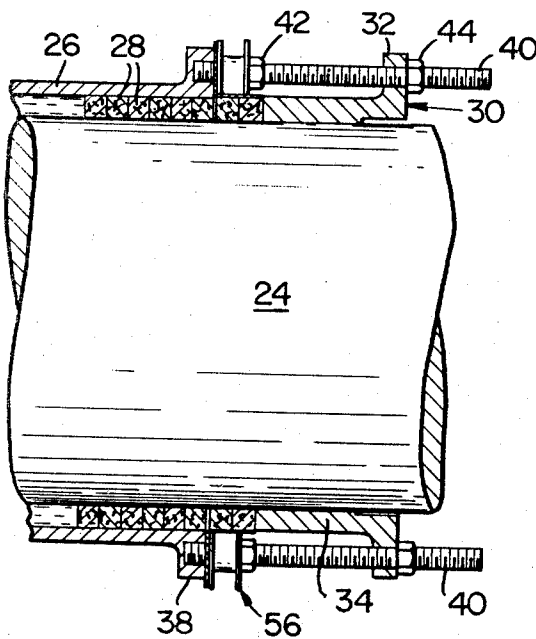


FIG_6

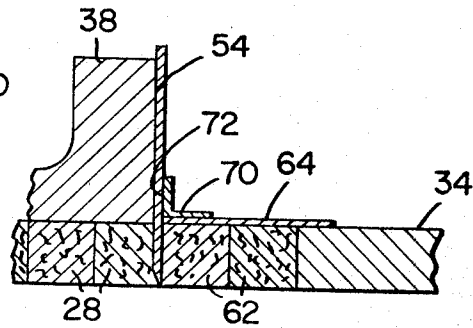


FIG_12

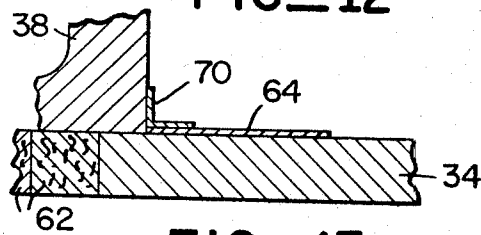


FIG_13

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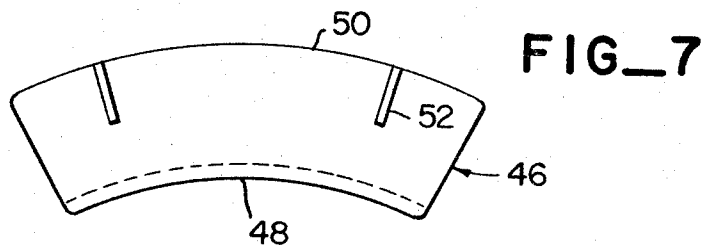


FIG_10

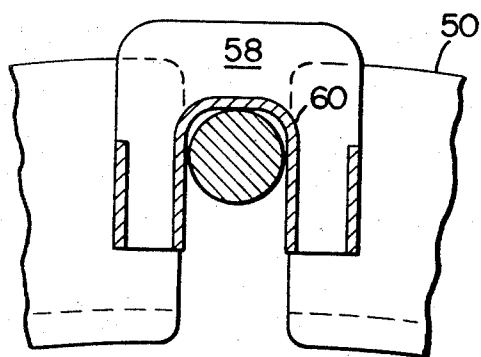
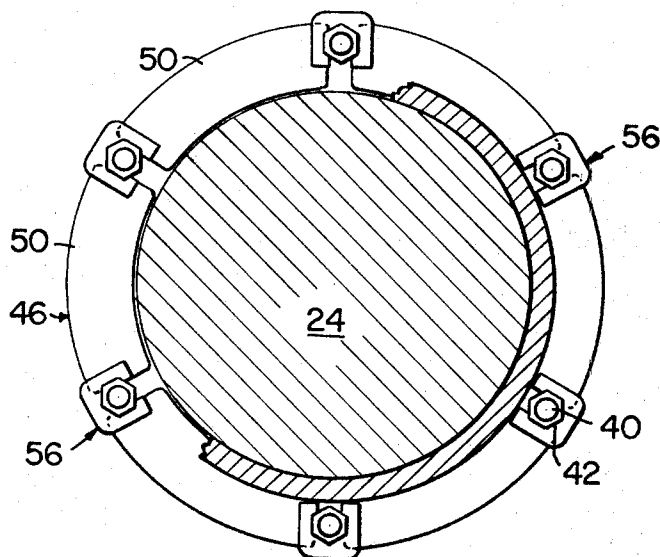


FIG_9

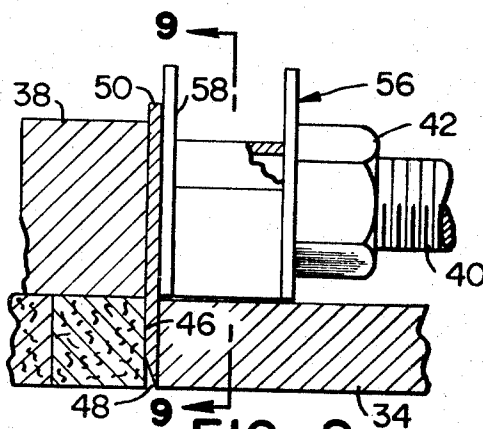


FIG_8

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3,432,172

METHOD AND APPARATUS FOR INSTALLING NEW PACKING ON A PROPELLER SHAFT

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7 Claims

ABSTRACT OF THE DISCLOSURE

A method and apparatus for adding new packing to the stern gland of a ship's propeller without drydocking the vessel. An apparatus is provided for temporarily securing the old packaging within the stern gland while the new packing is brought into engagement with the means holding the old packing in place. The temporary means is then removed, and the new packing is forced into the stern gland in contact with the old packing. No changes of any kind in the structure of the stern gland are required for using the method and apparatus of the invention.

This invention relates to a method for installing packing around shafts and also to a unique apparatus for carrying out the method.

In large ocean-going ships a packing must be provided around the propeller shaft to prevent the influx of water into the ship along the shaft. Since the propeller in most large vessels is located at a substantial depth this packing is normally subjected to severe water pressure. Consequently, the packing must fit tightly around the shaft in order to seal it and counteract the environmental pressure. Usually, the packing is in the form of a series of circular members which are adjacent each other and extend longitudinally along the shaft within its bearing shell. Due to the tight seal that must be maintained and the constant rotation of the shaft, the packing is ordinarily subjected to considerable wear, and it is necessary to add new packing rings or members periodically to replace the worn out members.

Prior to the present invention the additional propeller shaft packing that is periodically required could be changed or installed only when the propeller was out of the water because there was no way to counteract the severe water pressure during the changing operation. This meant that either the ship had to be placed in dry-dock or its bow ballast tanks had to be filled temporarily so that the ship would tip forward and its stern extend upwardly with the propeller out of the water. Both of the foregoing procedures were extremely costly in money and in time.

A general object of the present invention is to overcome the aforesaid problem and to provide a method for changing or installing the packing around a propeller shaft of a ship while the propeller remains at its normal level below the water level and thus without putting the ship in dry-dock or raising its stern in any manner.

Another object of the present invention is to provide a method for installing new packing to a propeller shaft of a ship whereby the old packing can be restrained against the force produced by the water pressure around the propeller while the packing gland is removed and the new packing is installed around the propeller shaft.

Still another object of my invention is to provide a method for adding new packing around a shaft that counteracts the forces around the shaft tending to displace the packing and yet can be performed by one person, in a relatively short period of time, without the need for complicated and expensive equipment.

As will be apparent from the detailed description that

follows, my method steps for supplying additional packing around the propeller shaft of a ship while the propeller is at its normal depth is most effectively accomplished by a unique combination of relatively simple but unique tools or apparatus which thus provide another feature of the present invention. The latter solve the problem of restraining the remaining old packing and holding it in place against the axially directed force of the outside water pressure when the packing gland is removed in order to install more packing ring members.

It is thus a further object of my invention to provide an apparatus for use in installing new packing to a propeller shaft of a ship while its propeller is in the water and in particular that provides a barrier to restrain the old packing, that enables the barrier to be forced radially between the old packing and the packing gland, and that compresses the new packing around the shaft so that it can be moved into place adjacent the old packing.

Yet another object of my invention is to provide an apparatus for performing a method of installing new packing to a propeller shaft that is relatively inexpensive to manufacture as well as being easy to operate in performing the method.

Other objects and advantages of the invention will appear and the above ones will be explained more clearly and understood better from the following description of a preferred embodiment of the invention presented in accordance with the statutes.

In the drawings:

FIG. 1 is a fragmentary schematic view in side elevation showing a typical propeller and shaft installation on an ocean type vessel;

FIG. 2 is an enlarged fragmentary view in elevation and in section showing the propeller shaft of the ship in FIG. 1 with its packing in the normal sealing position;

FIGS. 3-6 are views similar to FIG. 2 showing progressively the steps of a method for adding new packing around the shaft according to the present invention;

FIG. 7 is an end view showing one of the barrier members according to my invention;

FIG. 8 is an enlarged fragmentary view showing a spacer member used in the method of the present invention;

FIG. 9 is a view in section taken along line 9-9 of FIG. 8;

FIG. 10 is a view in section of a propeller shaft showing barrier members and spacer members in position during the installation of new packing according to the present invention, a portion being broken away to show the packing;

FIG. 11 is a view in section of the propeller shaft of FIG. 10 showing a clamping band for use in installing additional packing;

FIG. 12 is an enlarged fragmentary view in elevation and in section of the clamping band around new packing being installed according to the invention;

FIG. 13 is a view similar to FIG. 12 after the packing gland and the new packing have been moved into their normal position.

The method of the present invention for installing additional packing or replacing the packing around a rotatable shaft in a gland may be applied to various shaft installations. However, it is particularly useful where fluid pressure is present at the end of the shaft gland and constantly tends to push the packing out of its sealing position in the gland. Thus, it overcomes the problem of counteracting the environmental fluid pressure to hold the old packing in place and prevent leakage when the packing gland is retracted from its normal position. In broad terms, my method comprises the steps of moving the packing gland axially until its end is aligned radially with the flange of the shaft gland; providing a radially ex-

tending barrier extending circumferentially around the shaft and located between the end of the packing gland and the old packing; retracting the packing gland further to provide a space between its end and the end of the shaft gland to receive new packing material; confining the new packing material around the shaft and moving it against the temporary barrier; then removing the barrier and forcing the new packing and the packing gland into the normal sealing position within the shaft gland.

As a typical application, I will now describe my method in greater detail as it may be used to solve the problem of replacing the packing on the propeller shaft of a large ship.

Referring to the drawing, FIG. 1 shows schematically a stern end of a vessel 20 having a propeller 22 connected to a shaft 24 that extends through a stern gland 26 fixed to the ship's hull. As shown in FIG. 2, the shaft is sealed by a packing 28 between it and the stern gland which is retained by an annular packing gland 30 that is accessible from inside the hull. In the case of large ships, the depth of the propeller shaft below the waterline may normally be as much as 40-50 feet. At such depths the water pressure is substantial and constantly pushes inwardly along the shaft against the packing which is retained by the packing gland. In the typical installation shown in FIG. 2, the packing gland has a radial flange 32 at one end attached to a sleeve portion 34 that fits around the shaft and extends within the end of the stern gland with its end face 36 adjacent the packing. The stern gland also has a radial end flange 38 in which are mounted a series of circumferentially spaced apart studs 40. Threaded to the studs are a first set of nuts 42 that normally are taken up to be flush with the radial flange 38. The studs extend through aligned openings in the end flange 32 of the packing gland 30, and threaded to the ends of the studs is a second series of nuts 44. Any take-up of the latter nuts causes an axial movement of the packing gland on the shaft, and as the packing of a shaft gradually wears these nuts are periodically tightened.

Having described a typical shaft installation for a ship, I will now describe the detailed steps of my method for installing additional packing.

The first step of my method is to provide a temporary barrier around the shaft at the end of the sleeve to prevent axial movement of the packing when the packing gland is retracted. To accomplish this, I provide a series of rigid sectors 46 which may be made from a suitable metal. Each sector has arcuate shape in plan form with a curvature along one edge 48 that preferably approximates that of the shaft surface. (See FIG. 7.) This curved inner edge of each sector is preferably tapered in cross section to a sharp edge. The outer edge 50 of each sector is provided with spaced apart reinforcing members 52 that extend at right angles to the plane of the sector from its outer edge and provide a strengthened edge area that can withstand hammering when the sectors are installed.

As a preliminary to installing the sectors 46, as shown in FIG. 3, the first series of nuts 42 are backed off an amount sufficient to allow the ends of the sectors 46 to fit between them and the flange 38 of the stern gland. One sector is preferably provided between each adjacent pair of nuts 42 so that sectors extend circumferentially around the entire flange while being adjacent to its face. These sectors can now be driven inwardly to near the outer surface of the packing gland sleeve portion 34.

The packing gland 30 is now moved out of its normal position within the stern gland 26 by backing down the front nuts 44 on the studs 40 adjacent its flange 32. This movement is terminated when the face 36 of the inner end of the packing gland moves slightly past the end face 54 of the stern gland flange so that the old packing is visible, and is also a distance sufficient to prevent the sectors 46 from engaging the end of the packing gland

when they are driven inwardly. Now, as shown in FIG. 4, the rear nuts 42 are backed off a further amount until enough space is provided over each stud to accommodate a spacer 56. As shown in FIGS. 8-10, these spacers each comprise a pair of spaced apart inverted U-shaped end members 58 joined together by channel-shaped connector 60 extending between the members 58 and having flanges that are spaced apart a distance slightly greater than the diameter of the studs 40.

With the spacers in position so that a stud is seated in the channel-shaped connector of each, the nuts 42 are now taken up to bear against the spacers and cause them to hold the sectors against the stern gland flange.

The sectors 46 which are now held and guided at their ends by the spacers are driven radially inwardly between the end face 36 of the packing gland and the old packing 28 and almost into contact with the shaft. This forms the circumferential barrier around the shaft that holds the old packing in place and resists the outside water pressure along the shaft. (See FIG. 10.)

In the next step, as shown in FIG. 5, the packing gland is now retracted even further by backing off the front nuts 44 on the studs 40. When this is done a space is provided at the end of the packing gland where new packing material 62 can be placed in position around the shaft. As much packing as the space available will allow may be placed around the shaft. This packing material may be of any suitable type that is commercially available so long as it is flexible and adaptable to be wrapped around the shaft.

With the new packing around the shaft the next step in my method is to compress it circumferentially so that this material can be moved axially along the shaft and into the end of the stern gland. To accomplish this I utilize a band device 64 that fits temporarily at the end of the packing gland around the packing material, completely covering it. Preferably, the band is made in two semi-circular pieces in order to facilitate its installation. The ends of the adjoining band pieces are turned up to form flanges 66 through which bolts 68 are placed to draw the band tightly around the packing material on the shaft. (See FIG. 11.) Spaced apart circumferentially along one edge of both band pieces are a series of stop members 70 each having a radially extending face 72 extending out from the band edge.

As shown in FIGS. 6 and 12 the front nuts 44 on the studs are now taken up to move the packing gland 30 axially along the shaft together with the new packing material 62 which is retained by the band 64. As the packing gland is moved, the new packing material moves under the spacers and the stop members 70 of the band eventually bear against the blocking sectors. (see FIG. 12.)

The barrier forming sectors 46 are now moved radially outwardly to allow passage of the new packing material into the stern gland. Following this the front nuts 44 are taken up fully to cause the packing gland to move forward and push the new packing material into place and to move partially into the end of the stern gland. (See FIG. 13.)

The nuts 42 holding the spacers are now backed off slightly so that both the spacers 56 and the sectors 46 can be removed. These nuts are now fully taken up to bear against the flange of the stern gland.

From the foregoing it should be apparent that my method and the apparatus used in carrying it out provides a unique solution to the problem of installing new packing to the propeller shaft of a ship. It eliminates the need for any dry-docking or tipping of the ship heretofore required to overcome the problem of seawater pressure during the old repacking procedure and enables this repair to be performed efficiently and rapidly with a minimum of labor and expense.

To those skilled in the art to which this invention relates, many changes in construction and widely differ-

ing embodiments and applications of the invention will suggest themselves without departing from the spirit and scope of the invention. The disclosures and the description herein are purely illustrative and are not intended to be in any sense limiting.

I claim:

1. For use on a ship having a propeller shaft in a stern gland, a packing and a packing gland around said shaft, the latter being movable within said stern gland to retain the packing therein, a method for adding new packing around the shaft when the propeller shaft is below the water level but without water leaking into the ship, said method comprising the steps of:

installing a circumferential barrier extending radially outwardly from the shaft between the radial end face of the stern gland and the end of the packing gland with a portion of said barrier in engagement with the packing in said stern gland;

holding said barrier with sufficient strength to overcome the force tending to push the packing out of the stern gland;

retracting the packing gland far enough away from the stern gland to expose an open space on the shaft adjacent the end of the packing gland;

placing a quantity of new packing material around the shaft adjacent the end of the packing gland;

circumferentially compressing the new packing material to minimize its outside diameter on the shaft; moving the packing gland and the new packing up against the barrier;

removing the barrier; and

moving the end of the packing gland partially into the stern gland with the new packing in contact with the old packing.

2. For use on a ship having a propeller shaft in a stern gland, a packing, and a packing gland around said shaft, the latter being movable within said stern gland to retain the packing therein, a method for adding new packing around the shaft when the propeller shaft is below the water level while preventing water from leaking into the ship, said method comprising the steps of:

installing a plurality of circumferential barrier elements extending radially outwardly from the shaft between the radial end face of the stern gland and the end of the packing gland with a portion of said barrier in engagement with the packing in said stern gland;

holding said barrier elements at their ends with sufficient strength to overcome the force tending to push the packing out of the stern gland;

retracting the packing gland far enough away from the stern gland to expose an open space on the shaft adjacent the end of the packing gland;

placing a quantity of new packing material around the shaft adjacent the end of the packing gland; temporarily restraining the new packing material circumferentially to minimize its outside diameter on the shaft;

moving the packing gland until the new packing is located against the barrier;

removing the barrier; and

moving the packing gland until its end extends partially within the stern gland and the new packing is contacting the old packing.

3. For use on a ship having a propeller shaft in a stern gland, a packing and packing gland around said shaft, the latter being movable within said stern gland to retain the packing therein, a method for adding new packing around the shaft when the propeller shaft is below the water level while preventing water from leaking into the ship, said method comprising the steps of:

retracting the packing gland until its end is moved a short distance from the flange of the stern gland; driving a plurality of flat barrier members inwardly to-

ward the shaft between the radial end face of the stern gland and the end of the packing gland at circumferentially spaced apart intervals with a portion of each of said barrier members in engagement with the packing in said stern gland;

holding said barrier members with sufficient strength to overcome the force tending to push the packing out of the stern gland;

further retracting the packing gland far enough away from the stern gland to expose an open space on the shaft adjacent the end of the packing gland;

placing a quantity of new packing material around the shaft adjacent the end of the packing gland;

temporarily restraining the new packing material circumferentially to minimize its outside diameter on the shaft;

moving the packing gland until the new packing is located against the barrier members;

removing the barrier members; and

moving the packing gland until its end extends partially within the stern gland and the new packing is contacting the old packing.

4. For use on a ship provided with a propeller shaft in a stern gland having an end flange and studs mounted therein, a packing, and a packing gland around the shaft having one end movable within the stern gland and a flange at the other end with openings alignable with said studs,

an apparatus for installing new packing around the shaft and locating it within the stern gland adjacent the end of the packing gland in the retracted position, comprising:

a plurality of rigid sectors each having a curved inner knifelike edge located adjacent the surface of the shaft at the end of the stern gland and extending circumferentially around the shaft;

means for holding said sectors against the flange of the stern gland and thereby holding the old packing within the stern gland when the packing gland is retracted;

said sectors being removable when said packing gland is moved axially to press the new packing against the sectors after which said packing gland is movable to extend partially within said stern gland.

5. The apparatus as described in claim 4 wherein said means for holding said sectors against the stern gland flange include a spacer on each stud located between the stern gland flange and a nut on the stud for retaining and guiding the ends of said sectors when they are driven radially into place.

6. The apparatus as described in claim 5 wherein each said spacer comprises a pair of spaced apart U-shaped plates interconnected by a tunnel-shaped connector, one of said plates overlapping the ends of circumferentially adjacent sectors and the opposite plate forming a bearing surface for a takeup nut on the stud.

7. The apparatus as described in claim 4 including a flexible band around said new packing material, means to tighten said band to decrease its diameter, and a plurality of spaced apart projecting members extending outwardly from one side of the band.

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70 SAMUEL ROTHBERG, *Primary Examiner.*

U.S. Cl. X.R.

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