

- [54] **RUDDER ARRANGEMENTS FOR SHIPS**
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- [63] Continuation of Ser. No. 287,871, Sept. 11, 1972, abandoned.

Foreign Application Priority Data

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- [52] **U.S. Cl.**..... **114/169; 308/36.1**
[51] **Int. Cl.²**..... **B63H 25/38**
[58] **Field of Search** 114/162, 166, 165, 167,
114/169, 172; 308/36.1, 36.2, DIG. 12;
115/34 R

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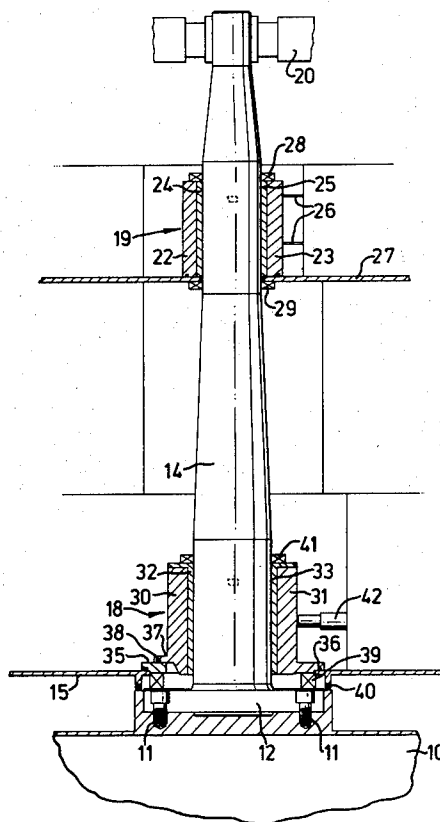
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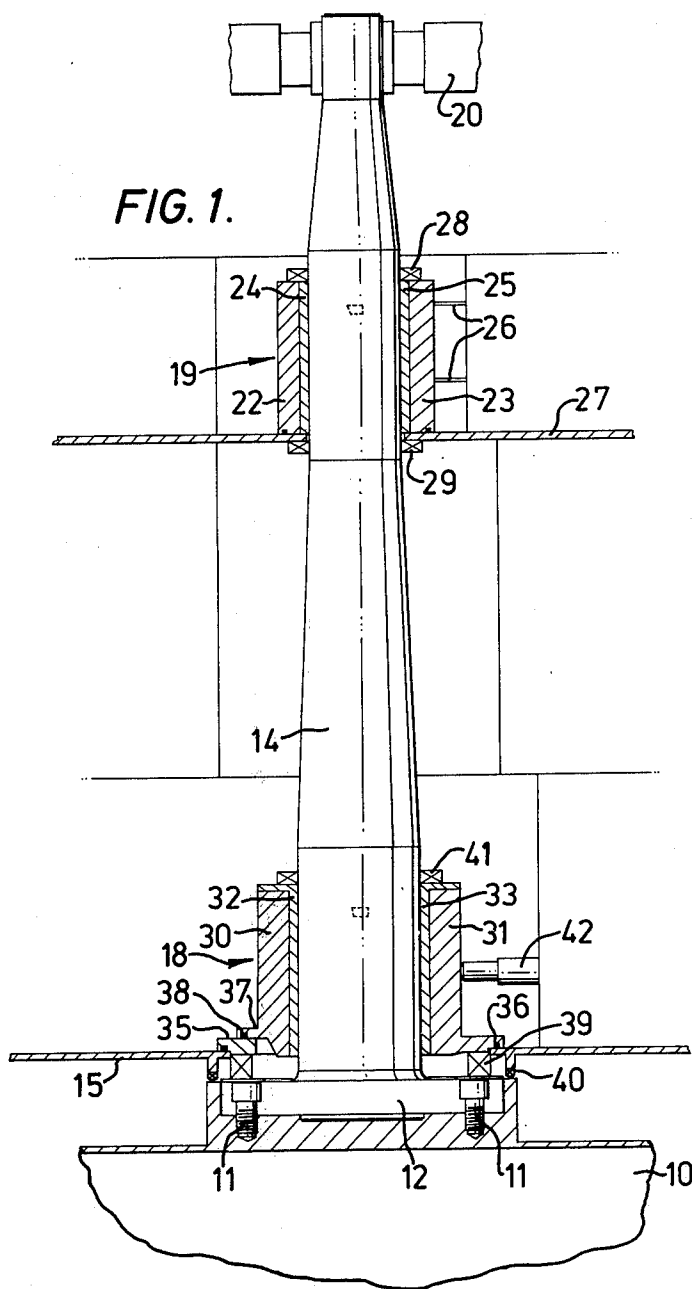
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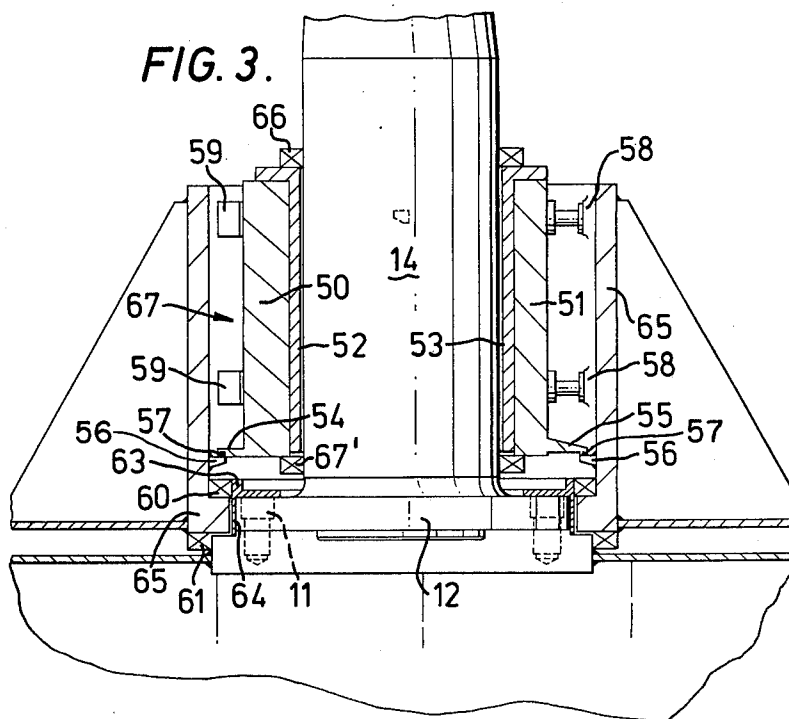
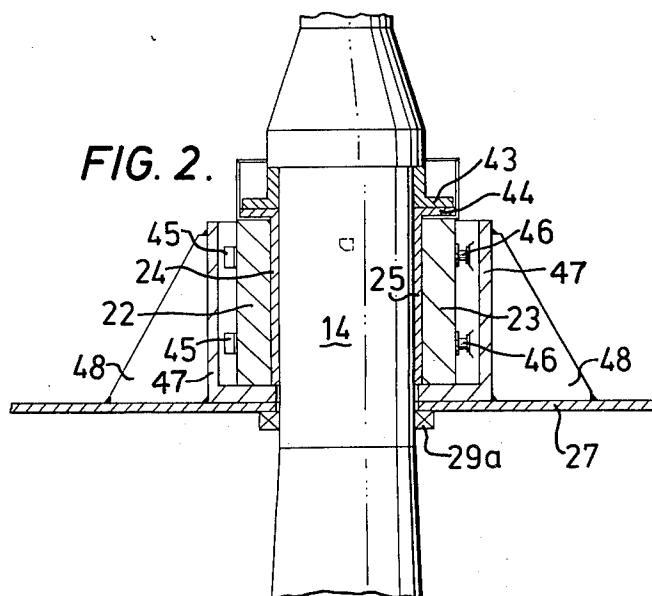
[57] **ABSTRACT**

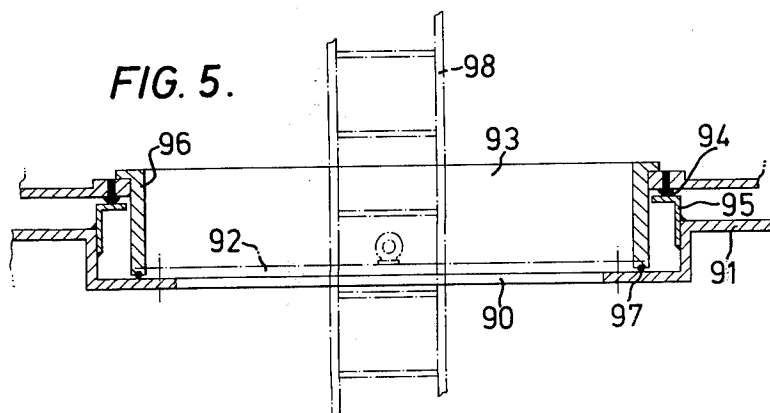
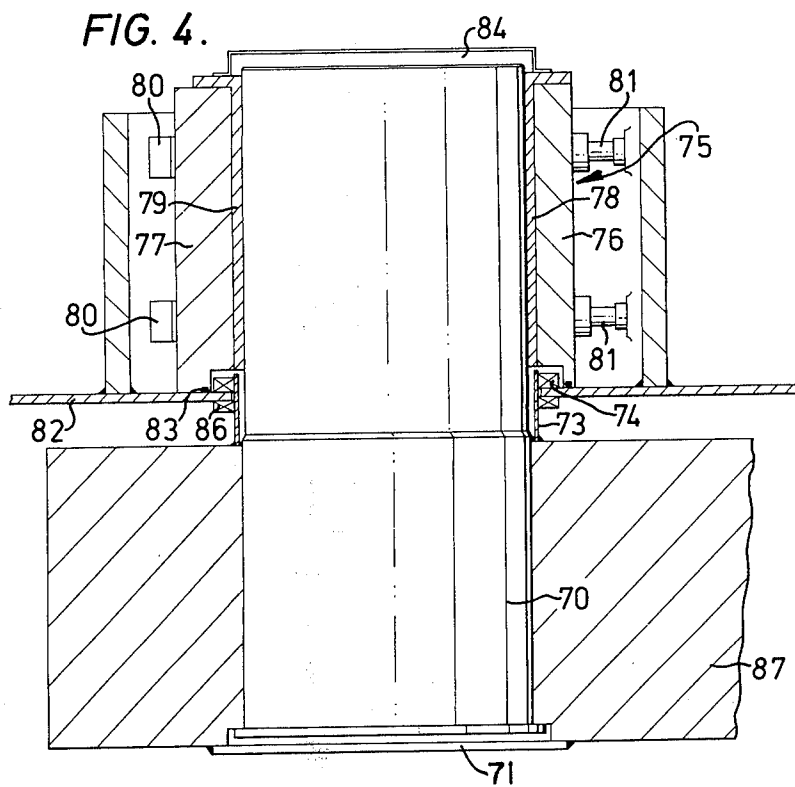
A ship rudder with a member associated therewith, such as a stern frame of a ship or a rudder barrel, has a shaft connected to the rudder or the member and a split bearing connected to the member or the shaft and in which the shaft is journaled for rotating, at least one part of the split bearing being mounted to be removable to allow inspection of the shaft. All parts of the bearing are preferably removable and the bearing is preferably adjustable both in position and alignment.

10 Claims, 8 Drawing Figures









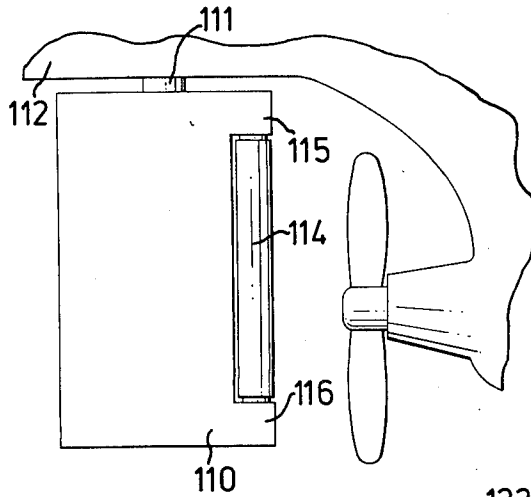


FIG. 6.

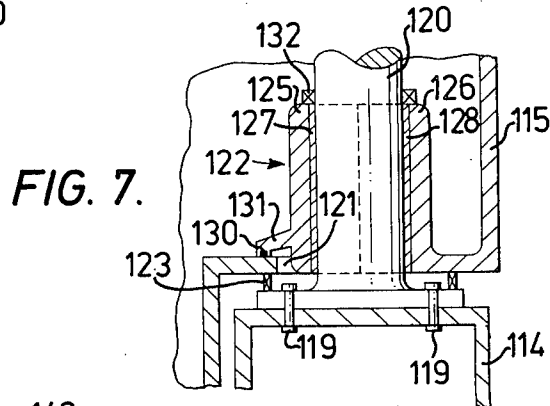


FIG. 7.

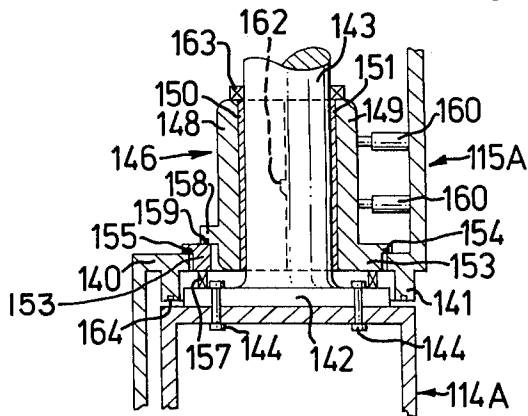


FIG. 8.

RUDDER ARRANGEMENTS FOR SHIPS

This is a continuation, of application Ser. No. 287,871, filed Sept. 11, 1972 and now abandoned.

This invention is concerned with rudder arrangements for ships.

It is an object of the invention to provide improved means for pivotally interconnecting a rudder with a ship and/or for pivotally interconnecting a rudder and a member, e.g. a rotatable rudder barrel, carried thereby.

According to the invention, a rudder arrangement for a ship comprises a rudder, a member associated therewith, and two relatively rotatable connecting means connected to the rudder and said member respectively, one of said means being a shaft and the other of said parts being a split bearing through which the shaft extends and at least one part of which is removable to allow inspection of the shaft.

Said member may be part of the ship, normally the stern frame of the ship. Preferably the bearing is connected to and disposed within the ship so that access to the bearing is facilitated. However, the bearing may be connected to and disposed within the rudder so that access can be had to it from within the rudder. More than one such split bearing will usually be provided. For example, with a balanced rudder two of the split bearings may be provided in the ship, the shaft being connected to the rudder. With a conventional hinged pintle-type rudder one split bearing may be provided above the top of the rudder in the stern frame and another split bearing may be provided in a footstep on the stern frame below the rudder, two short shafts or pintles being connected at the top and bottom of the rudder. Various other arrangements are possible and one split bearing may be mounted in the ship and another in the rudder.

As a ship moves through water, the flow of water past the rudder of the ship, and consequently the steering effect of the rudder, can be varied to a considerable extent by providing along the forward edge of the rudder a cylindrical member or barrel, which is rotated.

Accordingly, the aforesaid member associated with the rudder may be cylindrical member extending at least partly along the leading edge of the rudder. The bearing is preferably connected to and disposed within the rudder for ease of access.

A seal is normally provided extending around the shaft and between the rudder and said member, to prevent the passage of water therebetween. Preferably, a further seal is provided extending around the shaft and between the rudder and said member, said further seal being actuatable when desired to prevent the passage of water between the rudder and said member and thereby permit of inspection or removal of the first-said seal.

While the removable part of the bearing may cooperate with another part of the bearing which is fixed to the structure of the ship, it is preferred that the split bearing comprises parts which are all removable.

Means are preferably provided for adjustably locating the split bearing.

In a preferred arrangement, the split bearing comprises parts which are all removable and means are provided for releasably securing the parts in position round the shaft, said means being adjustable for adjustably locating the split bearing.

The following is a description, by way of example, of embodiments of the invention, reference being made to the accompanying drawings, in which

FIG. 1 is a broken-away view in section of a stern frame with part of a rudder, a rudder stock and upper and lower bearings around the rudder stock in one embodiment in a balanced rudder,

FIG. 2 is a sectional view of a modified construction of upper bearing for use in the arrangement of FIG. 1,

FIG. 3 is a sectional view of a modified construction of lower bearing for use in the construction of FIG. 1,

FIG. 4 is a sectional view of an embodiment in a hinged pintle-type rudder,

FIG. 5 is a sectional view illustrating means for obtaining access from the ship into the interior of the rudder;

FIG. 6 is a fragmentary side elevational view of a rudder having a rudder barrel and showing the adjacent parts of the ship;

FIG. 7 is an enlarged vertical section view of a bearing arrangement for use in the rudder of FIG. 6; and

FIG. 8 is an enlarged vertical section view of another bearing arrangement for use in the rudder of FIG. 6.

Referring first to FIG. 1, the upper part of a rudder 10 is secured by bolts 11 to a flange 12 of a rudder stock 14. The rudder stock 14 extends from the rudder 10 up through an opening in a plate 15 at the underside of the stern frame of a ship and through lower and upper bearings indicated generally by reference numerals 18 and 19, the upper end of the stock 14 being connected to a steering mechanism 20. The upper bearing 19 comprises two bearing halves 22, 23 with bearing liners 24, 25. The bearing half 23 is fixedly connected to the ship by welded plates 26 and by being joined to a platform 27. The bearing half 22 is secured in position on the shaft 14 by being connected to the bearing half 23 by mechanical or hydraulic locking means (not shown) as hereinafter described with reference to FIGS. 2, 3 and 4, e.g. nuts and bolts or jacks, and can be removed from the stock 14 to allow inspection of the stock without disturbance of the stock. Mechanical seals 28 and 29 are provided for sealing the ends of the bearing 19 to the stock 14 for preventing leakage of lubricating oil.

A thrust collar (not shown) split in halves is fitted to the stock 14 to allow the rudder weight to be supported on the split bearing liners 24, 25 which have a thrust face (not shown). This face may be of the plain or tilting pad type.

The lower split bearing comprises bearing halves 30, 31 with bearing liners 32, 33. The bearing half 31 is provided with a ring member 35, which may be formed in one piece with the bearing half 31 or may be split, and which rests on the plate 15, with a sealing ring 36 interposed between the ring member 35 and the plate 15. The bearing half 30 is secured to the bearing half 31 by hydraulic or mechanical locking means (not shown) as hereinafter described with reference to FIGS. 2, 3 and 4 e.g. nuts and bolts or jacks, and has a radially projecting portion 37 which abuts the ring member 35 and is sealed to the ring member 35 by a seal 38, a radial spacing being provided between the bearing half 30 and the ring member 35 below the radial projection 37 to allow the bearing half 30 to be removed without disturbing the bearing half 31. The bearing is secured in an axial direction by means of hydraulic or mechanical locking devices (not shown), e.g.

jacks, wedges, chocks, nuts and bolts. A mechanical seal 39 extends around the shaft 14 and seals the flange 12 to the ring member 35 thus preventing ingress of sea water. To allow the bearing half 31 with the ring member 35 (which in this case must be separate from the bearing half 31) and also if required the mechanical seal 39, to be removed, e.g. for inspection, and if required replaced while the ship is afloat, a further seal 40 is provided radially outwardly of the mechanical seal 39 for sealing the plate 15 to the top of the rudder. The seal 40 may be an inflatable seal or a hydraulically operable mechanical seal so that it can be brought into operation when required. A mechanical seal 41 seals the upper end of the bearing 18 to the stock 14 to prevent leakage of lubricant.

The bearing half 31 is adjustably held in position by a number of hydraulic jacks, of which one is shown and indicated by reference numeral 42, and/or mechanical locating means, such as mechanical jacks or wedges.

It will be appreciated that, instead of being secured to the plates 26, the bearing half 23 of the upper bearing 19 could likewise be adjustably located in position by means of adjustable chocks, jacks or wedges (see FIG. 2). Also, the bearing half 31 and the ring member 35 could be replaced by a bearing half fixed to the structure of the ship, e.g. to the plate 15 and therefore not removable while the ship is afloat.

The seal 40 may be omitted if it is not required that the mechanical seal 39 be removable while the ship is afloat.

FIG. 2 represents a modified arrangement of the upper bearing and shows a thrust collar 43 made in two halves and fitted to the stock 14 to allow the rudder weight to be supported on a thrust face 44 of the split bearing liners 24, 25. Both bearing halves are removable and are held in place by hydraulic or mechanical locking means 45, 46, e.g. jacks, wedges, chocks, nuts and bolts acting in a rigidly mounted housing 47 fixed to the platform 27 and braced by webs 48.

In the modification of FIG. 3 the lower split bearing 67 comprises halves 50 and 51 with bearing liners 52, 53. Each bearing half has a flange formed at one end (54, 55) which rests on a ring member 56 with a sealing ring 57 interposed between the flanges 54 and 55 and the ring member 56. The bearing half 51 is secured to the bearing half 50 by hydraulic or mechanical locking means, e.g. jacks, nuts and bolts 58, and can be inspected and/or renewed without disturbing the bearing half 50. The bearing half 50 is adjustably held in position by hydraulic jacks of which two are shown 59 and/or mechanical locating means such as mechanical jacks, chocks or wedges. A rigidly mounted housing 65 contains the bearing and the means 58 and 59. A mechanical seal 60 extends around the shaft 14 and seals the inner face of the flange 12 from the sea and retains oil or grease in the bearing. Alternatively, an additional seal 67' may be used for this latter purpose. A split sealing plate 63 and 64 covers the bolts 11 and the circumference of flange 12. A mechanical seal 66 seals the upper end of the bearing 67 to the stock 14 to prevent leakage of lubricating oil or grease. To allow the bearing half 51 and if required the seal 60 to be removed, e.g. for inspection and if necessary to be replaced whilst the ship is afloat, a further seal 61 is provided on the outboard side of the seal 60 for sealing the housing 65 to the rudder.

The bearing is secured in an axial direction by means of hydraulic or mechanical locking devices (not shown) e.g. jacks, wedges, chocks, nuts and bolts.

Another method of supporting a rudder is by two or more pintles, secured either to the stern frame or rudder, which rotate in bearings situated in the stern frame or rudder. On high tonnage vessels these pintles are large and it is difficult and a costly procedure which involves docking the vessel to examine them and repair them. In many instances the bearing surfaces are open to the sea and thus subject to corrosion and erosion effects as well as lack of lubrication.

In the arrangement of FIG. 4, the pintles 70 are secured into the stern frame 87 by means of freezing, stretching hydraulically or mechanically or by a tapered portion with a screw securing nut. The outer end of each pintle is protected from the effects of the sea by a plate 71 which is either welded or bolted to the stern frame. The inner end of the pintle is isolated from the sea by a weir 73 and a mechanical seal 74. The inner end of the pintle forms a journal for a bearing 75. This bearing comprises two bearing halves 76 and 77 with bearing liners 78, 79. The bearing half 77 may be rigidly fixed to the interior of the rudder plating 82 or alternatively adjustably held in position by hydraulic jacks, two of which are shown 80 and/or mechanical locating means such as mechanical jacks or wedges. The bearing half 76 is secured in position by being connected to the bearing half 77 by mechanical or hydraulic locking means 81, e.g. nuts, bolts or jacks, and can be removed from the pintle 70 to allow inspection of the pintle without disturbance of the pintle. The bearing 75 is loaded against the rudder plating 82 by mechanical or hydraulic means not shown. A sealing ring 83 is interposed between the bearing 75 and the rudder plating 82 to prevent the leakage of lubricant from the bearing. Leakage of lubricant from the inner part of the bearing is prevented by a plate 84 which is mechanically attached to the bearing. To allow inspection of the pintle the bearing half 76 and the liner 78 can be removed without disturbing the bearing half 77 and the liner 79. Alternatively both halves of the bearing can be removed to allow complete inspection of the pintle. The mechanical seal 74 can be removed and examined by operating a seal 86 which may be an inflatable seal or a hydraulically operable mechanical seal.

To allow the pintles to be examined whilst the vessel is afloat an access opening may be provided in the top of rudder. Means may be provided to form a seal between the top of the rudder and the overhanging portion of the stern of the ship around a further access opening in this overhanging portion and the access opening in the top of the rudder, so that access can be obtained to the interior of the rudder from the interior of the ship whilst the ship is afloat.

To enable the weight of the propeller to be supported one pintle has attached to it a thrust collar in halves (not shown) which transmits the load to a thrust face attached to the bearing liners 78 and 79.

FIG. 5 shows an arrangement for obtaining access to the interior of a rudder when the ship is afloat, so that bearings and shafts and pintles can be inspected. A manhole 90 in rudder plating 91 is normally closed by a cover 92 which is removed for access purposes. An access opening 93 in the overhanging portion of the stern of the ship is normally closed by a blanking plate (not shown). The manhole 90 and the opening 93 are

brought into register and a hydro-mechanical or other expansible seal 94 around the opening 93 is brought into operation to seal against a ring 95 fixed round the manhole. A flanged sleeve 96 fits into the opening 93 and carries a sealing ring 97 which engages the rudder plating round the manhole and provides secondary protection against entry of sea water. A telescopic ladder 98 may be used to obtain entry through the manhole.

The arrangements of FIGS. 1 to 4 have the following advantages:

1. The shafts or pintles are fully protected from the corrosive and erosive effects of the sea.
2. The bearings can be adequately lubricated.
3. The journal part of each shaft or pintle can be examined without docking the vessel.
4. The bearings can be examined and repaired or replaced without docking the vessel.
5. The alignment of the bearings can be adjusted and therefore ease the fitting of the rudder.

With regard to point 5, the hydraulic and/or mechanical locking devices, e.g. jacks, wedges, chocks, nuts and bolts, hereinbefore described for securing the bearing parts in position are such that the position and alignment of the bearings can be adjusted. The bearings are nevertheless very rigidly supported.

It is easier and more accurate to bore out and machine the stern frame prior to erection on the slipway. Ideally all main shell and structural steelwork is completed before finally aligning the rudder. During this period it is not unusual to support the stern frame with temporary support struts and when these are removed alterations in alignment occur due to the weight of steel which has been added. At this stage a saving in time and cost can be made if the bearings are adjustable as hereinbefore described. Similarly, with a balanced and semi-balanced rudder any alterations in alignment due to weight increases or other causes can be corrected.

Referring now to FIGS. 6, 7 and 8, a rudder 110 is carried by a stock 111 from the stern frame 112 of a ship. Along and parallel to the leading edge of the rudder there is provided a cylindrical member 114 which is mounted between upper and lower forwardly projecting portions 115 and 116 of the rudder 110.

In operation, the cylindrical member 114 is rotated to vary the flow of water past the rudder 110 as the ship moves through the water. In this way, the steering effect of the rudder 110 can be considerably modified, which may be of assistance e.g. when maneuvering the ship in confined waters or when slowing down the forward motion of the ship by disposing the rudder at an angle to the center line of the ship.

A vertical flanged shaft 120 secured by bolts 119 to the upper end of the cylindrical member 114 extends through an opening 121 in the underside of the upper projecting portion 115 and is surrounded by a bearing indicated generally by reference numeral 122. A mechanical seal 123 between the underside of the projecting portion 115 and the flange of the shaft 120 extends around the shaft 120 and prevents the entry of water through the opening 121 into the interior of the rudder 110. The bearing 122 is a split bearing comprising two bearing halves 125 and 126 provided with bearing liners 127, 128. The bearing half 126 is integral with the projecting portion 115 and may be formed in one piece therewith as shown in FIG. 7 or may be secured to the projecting portion, e.g. by welds and plates welded to the bearing half 126 and to the wall of the projecting

part 115. The other bearing half 125 is secured in position by adjustable securing means comprising, for example, bolts or hydraulic jacks (not shown) which can be released from within the rudder to allow removal of the bearing half 125 and its bearing liner 127. The shaft 120 can then be inspected from within the rudder, while the ship is afloat, as far as the mechanical seal 123. A seal 130 between a projection 131 on the bearing half 125 and the plate forming the underside of the projecting portion 115, a mechanical seal 132 between the upper end of the bearing 122 and the shaft 120, and the mechanical seal 123 prevent the escape of oil lubricating the bearing.

In the embodiment illustrated in FIG. 8, upper forwardly projecting part 115A of the rudder, corresponding to the part 115 of FIG. 7, has an underside formed by a plate 140 which has a depending annular skirt 141 extending around and radially spaced from the flange 142 of a flanged shaft 143. The flange 142 is secured by bolts 144 to the upper end of a cylindrical member 114A corresponding to the cylindrical member 114 of FIG. 7. A split bearing 146 around the shaft 143 within the forwardly projecting portion 115A has two bearing halves 148, 149 with bearing liners 150, 151. The bearing half 149 is formed in one piece with a flanged ring member 153 which extends through an opening in the plate 140 and which has a flange 154 sealed to the plate 140 by a sealing ring 155. The ring member 153 is sealed to the flange 142 by a rotary mechanical seal 157. The bearing half 148 has on its outer side a projection 158 which is sealed by a seal 159 to the top of the ring member 153. The bearing half 149 is located in position in the forwardly projecting portion 115A by hydraulic jacks 160 and/or other suitable locating means such as wedges, bolts or mechanical jacks. The bearing half 148 is secured to the bearing half 149 by bolts, hydraulic or mechanical jacks or other suitable means (not shown), a wedge 162 on the bearing half 149 being provided for wedging the bearing half 148 downwardly into sealing contact with the ring member 153.

A mechanical seal 163 between the upper end of the split bearing 146 and the shaft 143 prevents the leakage of lubricating oil at the top of the bearing 146. To allow inspection of the shaft 143, and, if required, the bolts 144, the bearing half 148 can be removed while the bearing half 149 remains in position. If it is also required to remove the bearing half 149 and/or the mechanical seal 157, the part of the flanged ring member 153 associated with the bearing half 148 is made separable from the part attached to the bearing half 149 and a seal 164 in the underside of the skirt 141 is operated to provide a seal between the skirt 141 and the top of the cylindrical member 114A. The seal 164 may e.g. be an inflatable seal or a hydraulically operated mechanical seal. When in use, the seal 164 prevents the entry of water between the skirt 141 and the cylindrical member 114A so that the entire bearing 146 and/or the mechanical seal 157 can be removed and, if required, replaced from within the rudder while the ship is afloat.

In each of the above-described embodiments, the lower projecting portion 116 of the rudder may be provided with a split bearing and seal arrangement similar to that in the upper projecting portion 115 or 115A. Suitable thrust arrangements are provided in known manner to accommodate the axial loads.

To provide access to the interior of the rudder, an arrangement as shown in FIG. 5 may be used.

The advantages of the constructions shown in FIGS. 1 to 4 are also obtained with those of FIGS. 6, 7 and 8, in which the means for securing the removable bearing halves are also such that the position and alignment of the bearings can be adjusted.

I claim:

1. A rudder arrangement for ships, which arrangement comprises two associated members, one of said associated members being the rudder of the ship, a substantially vertically disposed shaft connected to a first of said associated members, a plurality of bearing parts together comprising a vertically disposed split bearing in which said shaft is journaled for rotation, said split bearing being split axially, support means connected with said shaft to axially support one of the two associated members, means operable to connect each of said plurality of bearing parts to the second of said associated members, and said means operable to remove at least one of said bearing parts in vertically disposed position radially outwardly from said shaft to enable inspection of said shaft while the ship is afloat.

2. A rudder arrangement for ships, which arrangement comprises two associated members, one of said associated members being the rudder of the ship, a substantially vertically disposed shaft connected to a first of said associated members, a plurality of bearing parts together comprising a vertically disposed split bearing in which said shaft is journaled for rotation, said split bearing connected with said shaft to axially support one of the two associated members and being split axially, means operable to connect each of said plurality of bearing parts to the second of said associated members, and said means operable to remove at least one of said bearing parts in vertically disposed position radially outwardly from said shaft to enable inspection of said shaft while the ship is afloat.

3. An arrangement as set forth in claim 2 in which each of the plurality of bearing parts is removable.

4. An arrangement as set forth in claim 3 in which said means operable to connect the bearing parts to the second of said associated members are laterally adjustable to enable adjustment of the position of the bearing parts.

5. An arrangement as set forth in claim 4 including a seal connected around the shaft between the two associated members operable to prevent passage of water therebetween.

6. An arrangement as set forth in claim 5 including a further seal connected around the shaft outwardly of said first mentioned seal and between the two associated members, said further seal being actuatable to prevent passage of water therebetween, whereby after actuation of said further seal said first mentioned seal may be exposed for inspection or removal.

7. An arrangement as set forth in claim 6 in which said shaft is connected to the rudder of the ship, the other of said two associated members being the stern frame of the ship, and each of said plurality of said bearing parts connected to the stern frame of the ship.

8. An arrangement as set forth in claim 7 in which the plurality of bearing parts comprising said split bearing are housed within the stern frame of the ship.

9. An arrangement as set forth in claim 8 in which the other of the two associated members is the stern frame of the ship, said shaft connected to the stern frame of the ship, and each of said plurality of said bearing parts connected to the rudder of the ship.

10. An arrangement as set forth in claim 9 in which the plurality of bearing parts comprising said split bearing are housed within the rudder of the ship.

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