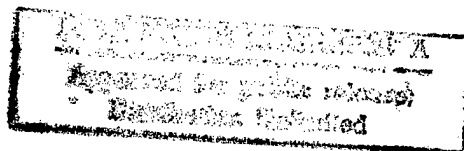


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Inventor Gus F. Plangetis

NOTICE

The above identified patent application is available for licensing. Requests for information should be addressed to:

OFFICE OF NAVAL RESEARCH
DEPARTMENT OF THE NAVY
CODE OCCC
ARLINGTON VA 22217-5660



DTIC QUALITY INSPECTED 1

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3 **ADJUSTABLE BEARING SYSTEM WITH SELECTIVELY**
4 **OPTIMIZED INSTALLATIONAL CLEARANCES**5 The present invention relates in general to rotational support for a shaft through a bearing
6 system which is selectively adjustable during assembly and installation to meet desired clearance
7 conditions.8 BACKGROUND OF THE INVENTION9
10 Cylindrical/spherical bearing systems of conventional types are limited to an extremely
11 small range of clearances within which to accommodate various operational conditions. Thus, a
12 very tight clearance is extremely difficult to achieve for certain installations or conditions such as
13 quiet submarine control surface operation and hydrodynamic film support/operating
14 environments. Also, in view of the foregoing referred to clearance requirements associated with
15 conventional bearing systems, removal and reinstallation of worn bearings, replacement of parts
16 thereof and centering of a bearing shaft within misaligned housing openings presents problems
17 that are very difficult and/or costly to solve.
1819 It is therefore an important object of the present invention to provide a bearing support
20 system for rotational shafts through which clearances between shaft and bearing surfaces may be
21 more readily or realistically optimized for desired operational conditions.
2223 SUMMARY OF THE INVENTION24 In accordance with the present invention a shaft is supported by angularly spaced bearing
25 elements that are adjustably positioned relative to the rotational axis of the shaft within a
26 cylindrical housing section through which the shaft extends, in order to achieve selectively
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desirable radial and axial clearances between radially inner bearing surfaces on the bearing elements and a bearing sleeve fixed to the shaft. Each of the bearing elements includes a flange portion through which screw fasteners extending parallel to the axis of the shaft to accommodate axial adjustment before attachment of the bearing elements to the housing.

Axially tapered portions of the bearing elements on which the radially inner bearing surfaces are formed are angularly aligned with overlying sectors of a bushing element extending axially from an annular mounting flange having screw fasteners extending therefrom parallel to the shaft axis to accommodate radial and angular adjustment of the bushing element before attachment to the housing. The ends of the bushing sectors opposite the mounting flange are provided with retention flanges limiting axial displacement of underlying wedge-shaped spacers positioned between each axially tapered portion of a bearing element and a bushing sector. Threaded studs extend perpendicular to the shaft axis from each tapered portion of the bearing elements through enlarged holes in the spacers, the bushing sectors and the cylindrical housing section before final attachment of the bearing elements to the housing by anchoring nuts threadedly applied to radially projecting ends of the studs on the housing section.

BRIEF DESCRIPTION OF DRAWING FIGURES

A more complete appreciation of the invention and many of its attendant advantages will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawing wherein:

FIG. 1 is a perspective view of a shaft bearing installation in accordance with one embodiment of the invention;

1 FIG. 2 is a partial section view taken substantially through a plane indicated by section
2 line 2-2 in FIG. 1;

3
4 FIGS. 3, 4 and 5 are partial section views taken substantially through planes indicated by
5 section lines 3-3, 4-4 and 5-5 in FIG. 2; and

6 FIGS. 6, 7 and 8 are perspective views of bearing, spacer and bushing elements,
7 respectively disassembled from the bearing assembly shown in FIGS. 1-5.

8 DETAILED DESCRIPTION OF PREFERRED EMBODIMENT

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10 Referring now to the drawing in detail, FIGS. 1 and 2 illustrate a cylindrical operating
11 shaft 10 extending into a housing 12 having a panel portion 14 from which a cylindrical section
12 16 extends forming an opening in the housing receiving the shaft 10. A plurality of stiffener
13 elements 18 interconnect the section 16 and panel portion 14 of the housing 12 and are angularly
14 spaced from each other about a rotational axis 20 of the shaft 10 supported within the housing
15 section 16 by a bearing assembly generally referred to by reference numeral 22.

16
17 As shown in FIG. 2, the bearing assembly 22, which is adjustably secured to the housing
18 12 as hereinafter described in detail, journals the shaft 10 having a sleeve 24 fixed thereto for
19 bearing contact with four (4) bearing elements 26 of the bearing assembly 22 on which four (4)
20 wedge-shaped spacers 28 are positioned. Each of the bearing elements 26 and spacers 28 as
21 respectively illustrated in FIGS. 6 and 7 disassembled from the bearing assembly 22, are
22 interfitted with a single bushing element 30 shown disassembled in FIG. 8.

23
24 Referring now to FIGS. 2, 4 and 8, the bushing element 30 includes an annular mounting
25 flange 32 that is rearwardly attached to the cylindrical section 16 of the housing by screw
26 fasteners 34 extending parallel to the shaft axis 20. A cylindrical portion 36 of the bushing
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element extends from the mounting flange 32 in contact with the cylindrical surface of the opening formed in the housing section 16 as shown in FIG. 2. Four retention flanges 38 projects radially inwardly from portion 36 of the bushing element 30 between four angularly spaced sectors 40 thereof at the forward end of the bushing element opposite the mounting flange 32 to abut the four spacers 28. The spacers are adjustably positioned in axial directions on the bearing elements 26 by means of threaded tools inserted into threaded holes 41 formed in their radially larger axial ends as shown in FIG. 7. The bearing elements 26 and the wedge-shaped spacers 28 are thereby maintained in angularly spaced relation about the axis 20 of shaft 10 by the bushing sectors 40 which extend axially from the mounting flange 32 of the bushing element 30 and radially inward of the bushing portion 36. The screw fasteners 34 threadedly attached to the housing 12 as shown in FIG. 2, extend through angularly spaced holes in the mounting flange 32 of the bushing element 30, including circular holes 42 and threaded holes 43 as shown in FIG. 4 through which the screw fasteners 34 extend to secure and position the bushing element 30 in the housing 12. The threaded holes 43 in the flange 32 receive jacking type screws 34 to allow for easy removal and axial positioning in case the bushing element 30 gets misaligned during installation.

Each of the bearing elements 26 is also attached to the housing by two screw fasteners 44 extending parallel to the shaft axis 20 through a flange portion 46 from which an axially tapered portion 48 extends, as shown in FIGS. 2, 4 and 6. The radially inner surface of the tapered portion 48 has a projecting surface section 50 through which bearing contact is made with the shaft sleeve 24. The screw fasteners 44 extend through two enlarged holes 52 located between

1 two threaded holes 54 formed in the flange portion 46 of each bushing element 26, as shown in
2 FIG. 6, for adjusted attachment rearwardly to the panel portion 14 of the housing 12.

3
4 Once a proper setting is achieved by axial adjustment during installation of the bearing
5 elements 26 by use of jacking screws extending through the threaded holes 54, such jacking
6 screws are removed. Six threaded recesses 56 are formed in the tapered portion 48 of each
7 bearing element 26, as also shown in FIG. 6, for receiving the threaded ends of screw studs 58
8 extending perpendicular to the axis 20, as shown in FIGS. 2 and 5, through enlarged holes 60, 61
9 and 62 respectively formed in the wedge-shaped spacers 28 to accommodate its axial adjustment,
10 in the sector portions 40 of the bushing element 30 and in the housing section 16. The projecting
11 ends 64 of the studs 58 mount anchoring screw heads 66 that are threaded into abutment with the
12 housing section 16 for holding the elements 30, 26, and 28 of the bearing assembly 22 in adjusted
13 positions.
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16 It will become apparent from the foregoing description that before tightening of screw
17 fasteners, the enlarged holes 52 in the flange portion 46 of the bearing elements 26 allow for
18 radial adjustments while the enlarged holes 62, 60 and 61 respectively formed in the housing
19 section 16, wedge-shaped spacers 28, and the sector portions 40 of the bushing element 30 allow
20 for axial adjustments. The tapered portions 48 of the bearing elements 26 allows for a wedging
21 effect as needed to take up clearance with the shaft sleeve 24 during initial bearing installation.
22 The enlarged flange holes 52 aforementioned enable radial clearance reduction as needed before
23 bearing contact is made with the shaft sleeve 24. During final adjustment, the axially orientated
24 holes 60, 61 and 62 receive the studs 58 to which the anchoring nuts 66 are applied for secure
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fastening of the bearing assembly in its operational condition to the housing 12 after proper clearances have been verified.

Obviously, other modifications and variations of the present invention may be possible in light of the foregoing teachings. It is therefore to be understood that

the invention may be practiced otherwise than as specifically described.

1 Navy Case No. 78,325

2
3 ADJUSTABLE BEARING SYSTEM WITH SELECTIVELY
4 OPTIMIZED INSTALLATIONAL CLEARANCES

5 ABSTRACT OF THE DISCLOSURE

6 Angularly spaced sector portions of a bushing element attached by its annular flange to a
7 housing, adjustably positions angularly spaced bearing elements and wedge-shaped spacers for
8 bearing support of a shaft with desired radial and axial clearances maintained by fasteners
9 extending into the housing parallel to the shaft axis from the flanges of the bushing and the
10 bearing elements to accommodate radial adjustment, while fastener studs extending perpendicular
11 to the shaft axis through enlarged holes in all of the elements of the bearing assembly
12 accommodate axial adjustment before attachment of the bearing elements in their adjusted
13 positions to the housing is finalized.
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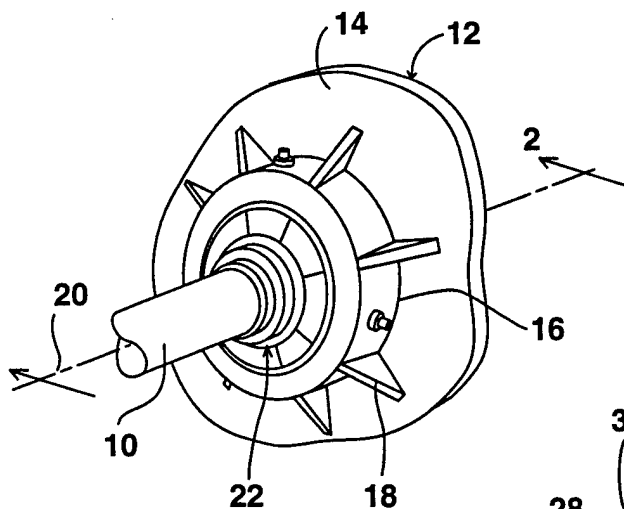


FIG. 1

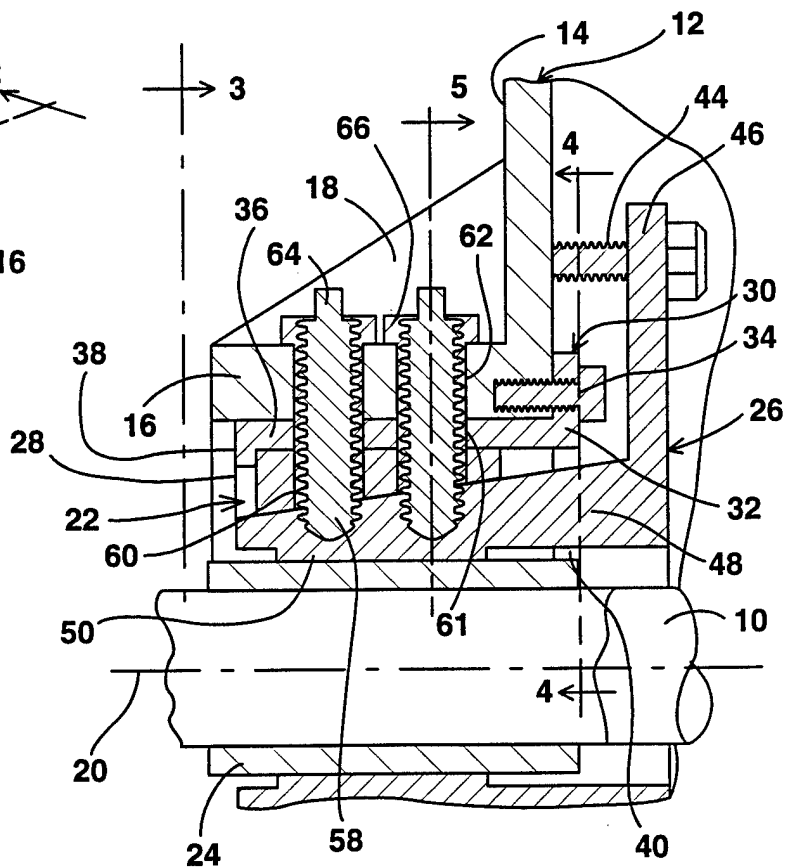


FIG. 2

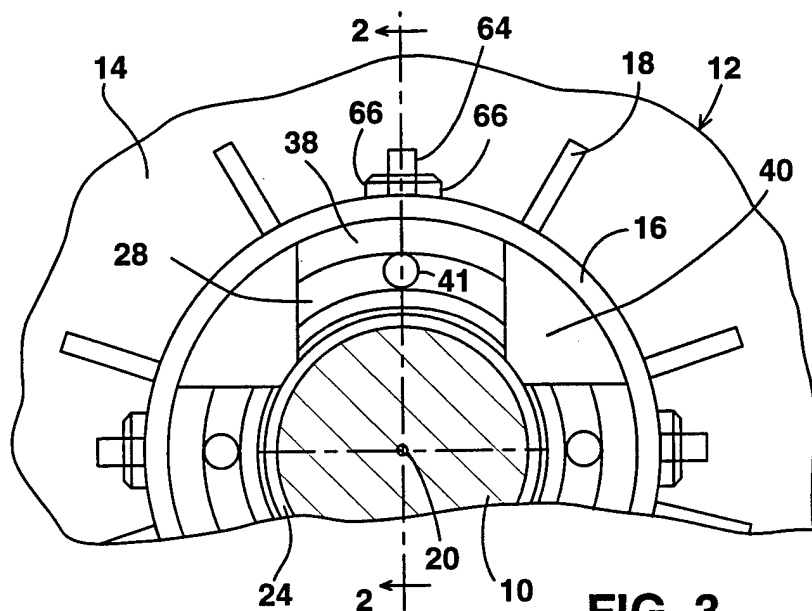


FIG. 3

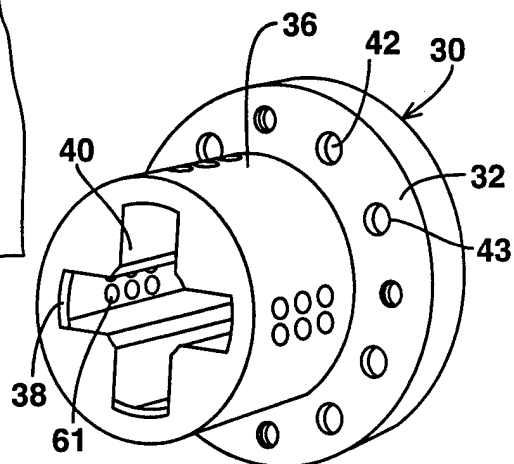


FIG. 8

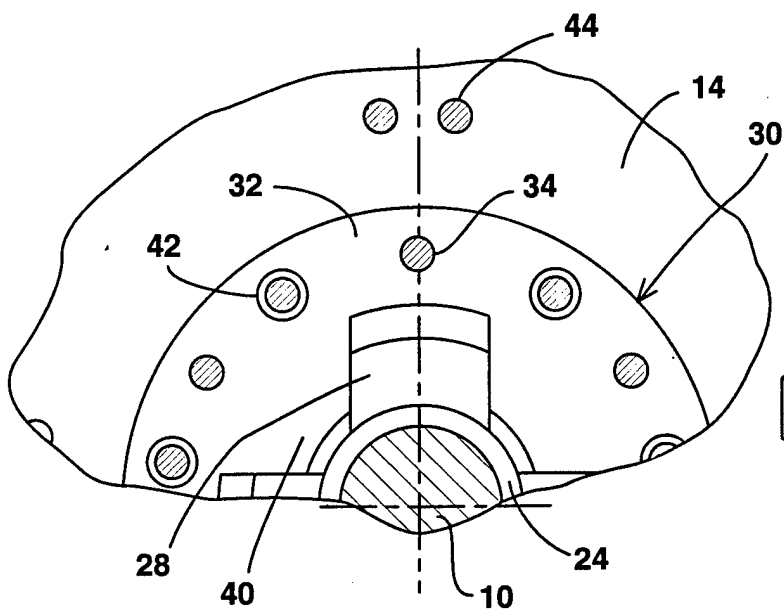


FIG. 4

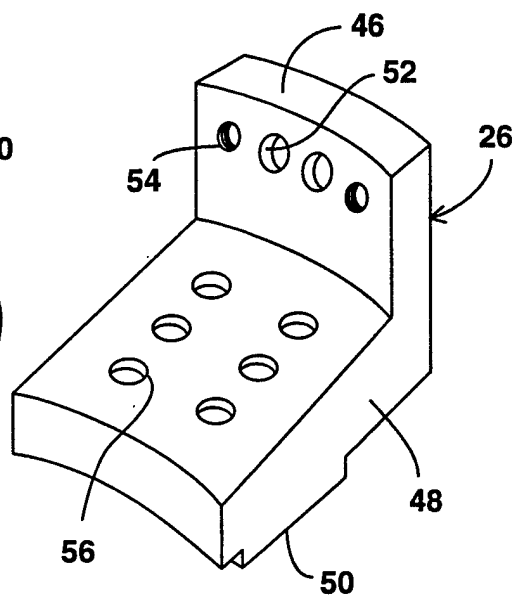


FIG. 6

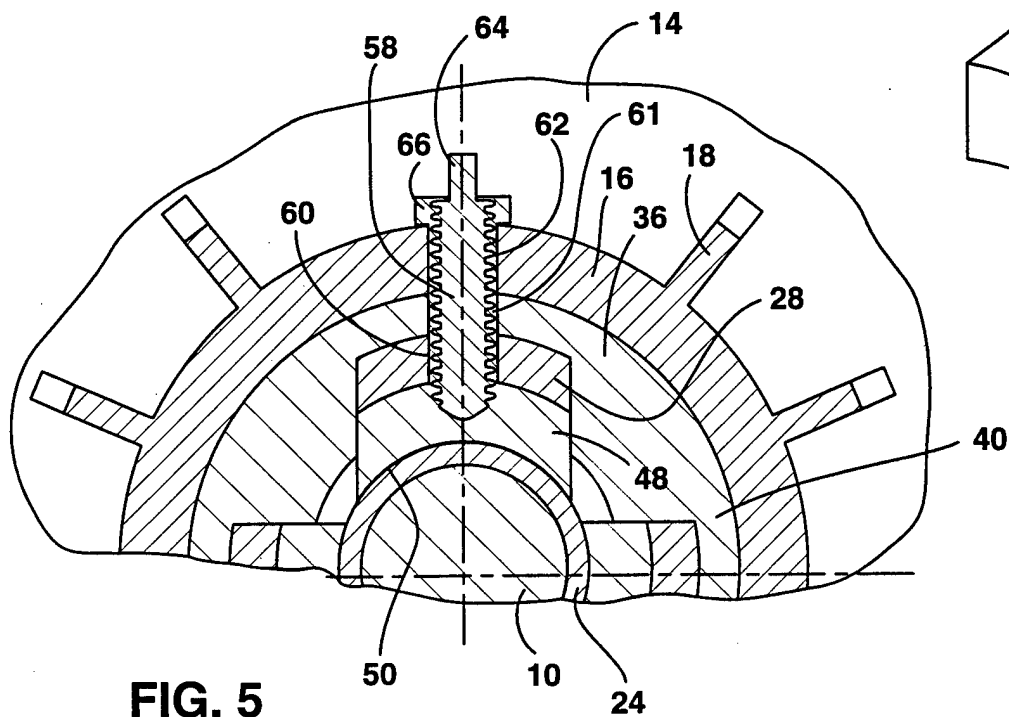


FIG. 5

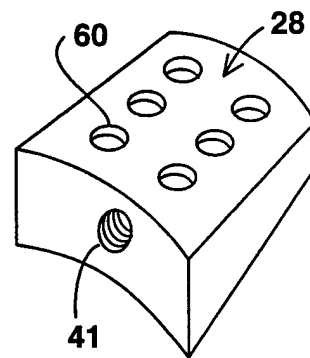


FIG. 7