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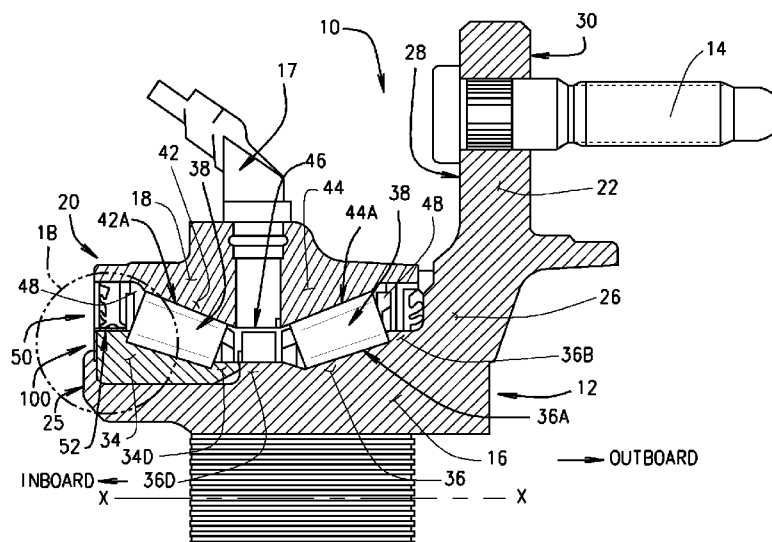


FIG. 1A

(57) Abstract: A hub and bearing assembly (10) with a seal and shield (100) which includes a sleeve portion (102) and an annular flange portion (104) arranged with an "L" shaped cross-section. The sleeve portion (102) is adapted to seat against an inner race seal engagement surface (52), between the inner race seal engagement surface and an inner diameter of the adjacent bearing seal (50). The integrated annular flange portion (104) projects radially inward from the sleeve portion, covering an exposed portion of the inner race backface surface (34C) and backface OD radius, and is entrapped between an attachment member (25) secured to a spindle supporting the inner race (34) and the inner race backface surface (34C).



METHOD AND APPARATUS FOR SEALING EXPOSED RACE BACKFACE SURFACES

RELATED APPLICATIONS

- 5 The present application is related to, and claims priority from, U.S. Provisional Patent Application Serial No. 61/221,635 filed on June 30, 2009, and which is herein incorporated by reference.

BACKGROUND ART

- 10 The present invention relates generally to an apparatus and method for preventing contaminants from entering a bearing assembly, such as a vehicle wheel hub assembly, and in particular to a seal for protecting exposed race backface surfaces and for excluding contaminants from the interior of the bearing assembly.

- 15 Various bearing assemblies for supporting a rotating member axially relative to a fixed or stationary member are known. Rolling elements in these bearing assemblies are disposed between inner and outer races fitted to the fixed or stationary members being supported, and provide rolling support between the two members. One common application for bearing assemblies is in mounting the road wheels of automotive vehicles
- 20 on the suspension systems of such vehicles. One such arrangement relies on a dead spindle which projects from the suspension system – usually from a steering knuckle – into a hub to which a road wheel is bolted. The hub rotates around the spindle on antifriction bearings that are located between the hub and the spindle. In another arrangement, the hub to
- 25 which the road wheel is bolted has a live spindle which projects into a housing which in turn is bolted to a steering knuckle or other suspension system component. An antifriction bearing located between the spindle and housing enables the spindle – and indeed the entire hub – to rotate relative to the housing.

- 30 The latter arrangement finds widespread use on four-wheel drive vehicles and on front-wheel drive vehicles, in as much as the spindle is

easily coupled to a constant velocity (CV) joint at the outer end of a drive shaft. Yet it operates just as well with non-driven wheels, particularly the front wheels of rear-wheel drive sport utility vehicles and light trucks. Thus, automobile manufacturers can offer four-wheel drive vehicles and rear-wheel drive only vehicles without changing the type of hub assembly and bearing arrangement used for the front wheels.

Irrespective of the arrangement, the bearings that are located around the spindle must have barriers of one type or another to exclude external contaminants from entering into them. With a dead spindle, typically a seal is fitted to the inboard end of the hub, to wipe against a wear surface on the spindle. An end cap is then pressed into the outboard end of the hub, enclosing the seal and spindle end. With a live spindle, such as used for a non-driven wheel, the outboard end of the bearing contains a live seal. Likewise, the inboard end of the bearing may be fitted with a live seal or the inboard end of the housing or the steering knuckle itself may be fitted with a cover that isolates inboard end of the bearing, but this increases the expense of hub assembly. On the other hand, when the live spindle is coupled to a drive shaft through a constant velocity (CV) joint, both the inboard and outboard ends of the bearing require live seals. Thus, to avoid variances between the front wheel hub assemblies for two- and four-wheel drive vehicles, some manufacturers choose to furnish all such hub assemblies with seals at the inboard ends of their bearings.

The inboard side of a vehicle wheel hub assembly and bearing, i.e., the side facing the center of the vehicle, is commonly exposed to a significant amount of environmental contamination in automotive applications. Environmental contamination may impact sealing performance and accelerate corrosion on exposed ferrous surfaces of the wheel hub assembly, such as the inboard inner race backface surfaces, i.e. those surfaces of the inboard inner race which are exposed to the inboard end of the bearing. Corrosion on the inboard inner race backface

surfaces and hoop stress levels present within the inner race structures have been linked to inner race corrosion cracking.

Additionally, installation of conventional package bearing seal assemblies having inner and outer diameters defined by annular steel members to seal the annular inboard gap between the wheel hub outer race and the spindle inner race may result in the scratching or grooving of the metallic surfaces of the outer race, the inner race, or inner and outer seal engagement surfaces. These scratches and grooves may provide contaminate leak paths into the bearing assembly, accelerating wear and corrosion. While the outer diameter of the package bearing seal assembly may incorporate rubber molded to the exterior surface of the seal to reduce the potential for contaminate and water ingress between the package bearing seal and the outer race surfaces, contaminate and water ingress between the package bearing seal and the inner race surfaces is more problematic.

Accordingly, for bearing assemblies in general, there is a need to provide improved sealing and protection against corrosion on exposed backface surfaces of the bearing races, and which facilitates the installation of seal assemblies by reducing the occurrence of surface scratches and grooves on the outer race, the inner race, and the inner and outer seal engagement surfaces.

SUMMARY OF THE INVENTION

Briefly stated, the present disclosure provides a bearing assembly with an elastomeric seal and shield which provides the dual purpose sealing properties of: (1) reducing seal contaminate ingress between the inner diameter of a bearing seal and the inner race large rib outer diameter surface facing the bearing seal; and (2) providing protection against inner race hoop-stress corrosion cracking due to contaminate pitting and corrosion on exposed inner race component surfaces. The elastomeric seal and shield includes sleeve portion and an annular flange portion arranged with a generally L-shaped cross-section. The sleeve portion is

adapted to seat against the inner race outer diameter surface, between the inner race outer diameter and an inner diameter of the adjacent bearing seal shield carried by an outer race or associated structure. The integrated annular flange portion projects radially inward from the sleeve portion, covering the exposed portion of the inner race backface surface, and is partially entrapped between a bearing attachment means such as a shoulder, formed end, or threaded member and the inner race backface surface.

In one embodiment, the present disclosure provides a vehicle wheel hub and bearing assembly with an inboard elastomeric seal and shield which provides the dual purpose sealing properties of: (1) reducing inboard seal contaminate ingress between the inner diameter of the bearing seal shield and the inboard inner race and seal engagement surface; and (2) providing protection against inboard inner race hoop-stress corrosion cracking due to contaminate pitting and corrosion on the inboard inner race backface surface, and backface outer diameter radius. The shield includes a sleeve portion and annular flange portion in an L-shaped configuration, and may be a separate component or integrated with the elastomeric seal. The sleeve portion is adapted to seat against the inboard inner race outer diameter surface, between the inner race seal engagement surface and an inner diameter of the adjacent bearing seal shield. The integrated annular flange portion projects radially inward from the inboard end of the sleeve portion, covering the exposed portion of the inboard inner race backface surface, and is entrapped within the outer diameter of a roll form or threaded member and the inner race backface surface.

In an alternate embodiment, the elastomeric seal and shield is defined by an annular ring of elastomeric material which is disposed to seat with an interference fit within an annular recess at the intersection of an inboard inner race backface surface and inner seal engagement surface, between a package bearing seal shield inner diameter and the inboard inner race seal engagement surface.

The foregoing features, and advantages set forth in the present disclosure as well as presently preferred embodiments will become more apparent from the reading of the following description in connection with the accompanying drawings.

5 **BRIEF DESCRIPTION OF THE DRAWINGS**

In the accompanying drawings which form part of the specification:

Figure 1A is a partial sectional view of a wheel assembly illustrating placement of the L-shaped bearing shield of the present disclosure;

Figure 1B is an enlarged view of the placement of the L-shaped bearing shield in Fig. 1A, as indicated at section 1B;

Figure 2 is a perspective view of the annular L-shaped bearing shield of the present disclosure;

Figure 3 is a cross-sectional view of an L-shaped bearing shield of Fig 2;

Figure 4 is a perspective view of the annular L-shaped bearing shield of Fig. 2 installed on an inboard end of a bearing assembly; and

Figure 5 is a sectional view of an alternate configuration for a bearing shield of the present disclosure.

Corresponding reference numerals indicate corresponding parts throughout the several figures of the drawings. It is to be understood that the drawings are for illustrating the concepts set forth in the present disclosure and are not to scale.

Before any embodiments of the invention are explained in detail, it is to be understood that the invention is not limited in its application to the details of construction and the arrangement of components set forth in the following description or illustrated in the drawings.

BEST MODE FOR CARRYING OUT THE INVENTION

The following detailed description illustrates the invention by way of example and not by way of limitation. The description enables one skilled in the art to make and use the present disclosure, and describes several embodiments, adaptations, variations, alternatives, and uses of the present

disclosure, including what is presently believed to be the best mode of carrying out the present disclosure.

Although described below in the exemplary context of a vehicle wheel hub and bearing assembly 10, it will be recognized that the features and concepts of the present disclosure are applicable generally to a wide range of bearing assemblies having at least one annular race member which is secured about a supported structure, such as a rotating shaft, and which is held in place by an attachment means such as a shoulder, formed region, or threaded member which applies an axially directed force against an annular portion of the race backface surface.

Turning to the Figures generally, and to Figure 1A specifically, an exemplary vehicle wheel hub and bearing assembly 10 is shown consisting of a rotating hub 12 onto which a vehicle wheel (not shown) is secured by multiple wheel lug bolts 14 on an outboard end. A hub and bearing assembly 10 enables a vehicle wheel and brake disk (not shown) to rotate about an axis X-X on a steering knuckle or other component of an automotive suspension system (not shown). The hub and bearing assembly 10 includes a spindle 16 to which the road wheel and brake disk are secured, a housing 18 which is mounted on the steering knuckle or other suspension component (not shown), and a bearing 20 which is located between the hub 16 and housing 18, and which enables the hub 16 to rotate relative to the housing 18 with minimum friction. Optional sensors 17 for measuring speed and/or forces on the hub and bearing assembly 10 may be mounted to the housing 18.

More specifically, the hub 16 includes a flange 22 and the spindle 16 which may be integral with the flange 22, and which projects from the flange 22 at a shoulder region 26 located on the back face 28 of the flange 22. Radially outward from the shoulder region, the flange 22 is fitted with the lug bolts 14 which project axially from its front face 30. The brake disk (not shown) seats against the flange front face 30, and the road wheel (not shown) in turn seats against the brake disk with the lug bolts 14 projecting

though both the brake disk and the wheel. Beyond the wheel, lug nuts (not shown) are threaded over the exposed ends of the lug bolts 14 to secure the brake disk and wheel to the hub flange 22.

An attachment member 25 is disposed at an inboard end 25A, remote from the hub flange 22. The attachment member 25 may be integrally formed where the spindle 24 is upset, that is, deformed radially outwardly in the provision of a roll-formed end having an abutment face 32 that lies perpendicular to the axis X-X and is presented toward the shoulder region 26. The bearing 20 is captured between the shoulder region 26 on the flange 22 and the abutment face 32 of attachment member or formed inboard end 25 of the spindle 24. Alternatively, the formed inboard end may be replaced by a threaded region on an outer diameter of the spindle 24, onto which a discrete attachment member such as a retaining nut (not shown) is threaded, capturing the bearing 20 between the abutted shoulder region 26 on the flange 22 and the threaded retaining nut.

The bearing 20 includes inboard inner race 34 and an outboard inner race 36 which fit around the outer diameter of the spindle 24, there being an interference fit between each of the inner races 34, 36 and the spindle 24. Optionally, as seen in Fig. 2A, the outboard inner race 36 may be integrally formed into the outer diameter surface of the spindle 24, adjacent the shoulder region 26. While the present disclosure is shown in the figures, and described herein as having a bearing 20 configured to utilize tapered rollers, those of ordinary skill in the art will recognize that the concepts presented herein may be readily utilized by one of ordinary skill in the art with a variety of different bearing configurations. Accordingly, the detailed description set forth herein with respect to tapered rollers should not be interpreted as limiting.

Each inner race 34, 36 of the bearing 20 have a tapered raceway 34A, 36A, that is presented outwardly away from the axis X-X. A thrust rib 34B, 36B is disposed at the large end of each tapered raceway 34A, 36A, and each discrete inner race 34, 36 includes a back face 34C, 36C which

is squared off with respect to the axis X-X at an end of the associated thrust rib 34B, 36B. A bearing 20, such as shown in Fig. 1A, which integrally forms the outboard inner race 36 with the spindle 24, lacks a back face 36C. The inboard inner race 34 abuts a small end of the outboard inner race 36 along the spindle 24, that is to say, the two inner races 34, 36 abut at their front faces 34D, 36D. The back face 36C of the outboard inner race 36 may abut the shoulder region 26 that lies along the flange 22 or, as shown in Fig. 2A, may be integrally formed therein.

In addition to the inner races 34, 36, the bearing 20 includes rolling elements 38, such as tapered rollers, arranged in two rows, there being a separate row around each of the inner races 34, 36. Preferably, the rolling elements 38 extend around the raceways 34A, 36A for each of the inner races 34, 36, and for cylindrical or tapered rollers, there being essentially a line contact between the faces of the rolling elements 38 and raceways 34A, 36A. For tapered rollers, the large-end faces of the rollers 38 are preferably disposed to bear against the thrust ribs 34B, 36B. The tapered rollers 38 of each row shown in Fig. 1A are essentially on apex, which means that the envelopes in which their tapered side faces lie have their apices located at a common point. Each row of rollers 38 has an associated cage 40 to maintain the proper spacing between the rollers 38 in that row.

The housing 18 surrounds the spindle 24 as well as the two inner races 34, 36 and the two rows of rollers 38. The housing 18 forms part of the bearing 20, in that the housing includes raceways 42A, 44A which are presented inwardly toward the axis X-X. In that sense, the housing 18 provides the inboard and outboard outer races 42, 44 of the bearing 20. For tapered rollers 38, as shown in Fig. 1A, the raceways 42A, 44A on the housing 18 taper downwardly toward an intervening surface 46 which separates them. The rollers 38 likewise lie along the raceways 42A, 44A of the housing 18, essentially line contact between the raceways and the faces of the rollers 38. At their large ends, the raceways 42A, 44A open

into annular end bores 48 in which the thrust ribs 34B, 36B of the two inner races 34, 36 are located. Thus, each end of the bearing 20 has an annular space, with that space being between the thrust rib 34B, 36B at that end, and the surrounding surface which defines the end bores 48.

5 The annular spaces at the ends of the bearing 20 are closed with bearing seals 50 which fit into the end bores 48 of the housing 20 and around the thrust ribs 34B, 36B of the inner races 34, 36. United States Patent No. 5,022,659, herein incorporated by reference, discloses exemplary seals 50 for both locations.

10 As shown in Figures 1B, and in Figure 2, an embodiment of the present disclosure incorporates an inboard elastomeric seal and shield 100 which functions: (1) to reduce inboard seal contaminate ingress between the package bearing seal 50 inner diameter, defined by either the flexible seal element or a seal shield if present, and an inboard inner race seal engagement surface 52, associated with the rotating spindle 24; and (2) to provide protection against hoop stress corrosion cracking in the inboard inner race 34 due to contaminate pitting and corrosion on the surface of the inboard inner race backface 34C and backface outer diameter radius 34E. The elastomeric seal and shield 100 includes sleeve portion 102 and an annular flange portion 104 arranged with a radially inwardly directed "L" shaped cross-section, shown in Figs. 1B and 3. The sleeve portion 102 is adapted to seat against the inboard inner race seal engagement surface 52, preferably with an interference fit, between the outer diameter of the inner race large rib 34B and an inner diameter of the adjacent package bearing seal 50. The integrated annular flange portion 104 projects radially inward from the inboard end of the sleeve portion 102, covering the exposed surface portion of the inboard inner race backface 34C and backface OD radius (Fig. 4), and is entrapped within the outer diameter of the attachment member 25 such as the roll formed end of the spindle 24, against the surface of the inner race backface 34C (Figs. 2A and 2B) during assembly of the wheel hub assembly 10.

Other means may secure the annular flange portion 104 against the inboard inner race backface 34C. For example, the outer diameter of the inboard end of the spindle 24 may have threads and a discrete attachment member such as a nut (not shown) may be engaged with those threads and turned down against the surface of the annular flange 104 to entrap it against the surface of the inner race backface 34C.

In an alternate embodiment, shown in a simplified representation in Figure 5, the elastomeric seal and shield 100 is defined by an annular ring 200 of a polymer or elastomeric material which is either disposed to seat with an interference fit, or which is molded directly to the inner race backface surface 34C. The annular ring 200 is retained within an annular recess 54 at the intersection of a surface of an inboard inner race backface 34C and seal engagement surface 52, between the package bearing seal 50 inner diameter and the inboard inner race seal engagement surface 52. Axial entrapment of the annular ring 200 by the attachment member 25 on the spindle member 24 which overlaps the inboard surface of the annular ring 200 serves to further secure the annular ring 200 in place. By overlapping the inboard surface of the annular ring 200, the backface surface 34C and backface OD radius of the inboard inner race 34 is protected from direct exposure to environmental contaminants by the annular ring 200, while the molding or interference fit to the package bearing seal 50 inner diameter reduces contaminate ingress between the package bearing seal 50 and the inboard inner race seal engagement surface 52.

As various changes could be made in the above constructions without departing from the scope of the disclosure, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense. For example, while the present disclosure was described in association with the inner race 34 of an exemplary vehicle wheel hub and bearing assembly 10, it will be recognized that the seal and shield 100 may be adapted for

placement in association with a rotating outer race 36, to protect exposed backface surfaces 36C of the outer race 36. Similarly, it will be recognized by those of ordinary skill in the art that the specific material from which the elastomeric seal and shield 100 is formed need not be limited to an elastomeric material, and that a seal and shield 100 embodying the concepts and features of the present disclosure may be manufactured from any material suitable for the particular application in which it is to be utilized, without departing from the scope of the present disclosure. Specific dimensions or sizes of the elements of the seal and shield 100 are not limited to any sizes or configurations shown herein or in the Figures.

CLAIMS

1. A seal and shield (100) for a hub and bearing assembly (10) having a bearing seal (50) carried by a housing (18) supporting an outer race, and disposed adjacent to a seal engagement surface (52) on an inner race (34) and an attachment member (25) abutting an annular portion of a backface (34C) of the inner race, wherein the seal and shield (100) is characterized by:

a sleeve portion (102);

an annular flange portion (104) contiguously formed with said sleeve portion (102) to define a radially inwardly projecting "L" shaped cross-section;

wherein said sleeve portion (102) is adapted to seat against the inner race seal engagement surface (52), between the inner race seal engagement surface and an inner diameter of the adjacent bearing seal (50); and

wherein said integrated annular flange portion (104) projects radially inward from the sleeve portion (102), adjacent an axially exposed portion of the inboard inner race backface surface (34C) and backface radius surface, and adjacent the abutted annular portion of the backface (34C), said annular flange portion (104) entrapped between the attachment member (25) and the inner race backface surface (34C) within the abutted annular portion.

2. The seal and shield (100) of Claim 1 wherein said sleeve portion (102) and said annular flange portion (104) are unitarily formed from a polymer material.

3. The seal and shield (100) of Claim 1 wherein said sleeve portion (102) is configured to reducing seal contaminate ingress between the inner diameter of the bearing seal (50) and the inner race seal engagement surface (52).

4. The seal and shield (100) of Claim 1 wherein said annular flange portion (104) is configured to provide protection against hoop stress

corrosion cracking in the inner race (34) due to contaminate pitting and corrosion on the inner race backface surface (34C) and backface OD radius.

5 **5.** The seal and shield (100) of Claim 1 wherein the hub and bearing assembly (10) is a vehicle wheel hub and bearing assembly, wherein said inner race (34) is an inboard inner race, and wherein said attachment member (25) is a roll formed end of a rotating spindle (24).

10 **6.** A seal and shield (100) for a bearing assembly (20) supporting a rotating spindle (24) and having a bearing seal (50) disposed adjacent to an inner race seal engagement surface (52) and an attachment member (25) abutting a backface surface (34C) of an inner race (34), characterized by:

15 a first portion (102) fitted between the inner race seal engagement surface (52) and an inner diameter of the adjacent bearing seal assembly (50); and

a second portion (104) entrapped between an exposed portion of the inner race backface surface (34C) and the attachment member (25).

7. The seal and shield (100) of Claim 6 wherein said first and second portions have a molded fit to said inner race surfaces.

20 **8.** The seal and shield (100) of Claim 6 wherein said first portion (102) has an interference fit to said inner race.

9. The seal and shield (100) of Claim 6 wherein said first and second portions (102, 104) are integrally formed as a unitary polymer annular member; and

25 wherein said unitary polymer annular member is disposed within an annular recess (54) at the intersection of the inner race seal engagement surface (52) and the inner race backface surface (34C).

10. The seal and shield (100) of Claim 6 wherein said first portion (102) reduces seal contaminate ingress between the inner diameter of the bearing seal shield (50) and the inner race seal engagement surface (52).

30

11. The seal and shield (100) of Claim 6 wherein said second portion (104) shields the inner race backface surface (34C) from external contaminants, and provides protection against inner race hoop stress corrosion cracking due to contaminate pitting and corrosion on the inner
5 race backface surface (34C) and backface OD radius surface (34E).

12. The seal and shield (100) of Claim 6 wherein the attachment member (25) is a roll form end of said rotating spindle (24).

13. The seal and shield (100) of Claim 6 wherein the attachment member (25) is a threaded member secured to a threaded end of said
10 rotating spindle (24).

14. A seal and shield (100) for a hub and bearing assembly (10) supporting a rotating spindle (24) and having a bearing seal (50) carried by a first race (42) disposed adjacent to a seal surface (52) of a second race (34) rotating with the rotating spindle (24), and an attachment member (25)
15 abutting a backface surface (34C) of the second race, the seal and shield characterized by:

a first portion (102) having an interference fit between the rotating race seal surface (52) and the adjacent bearing seal (50); and

a second portion (104) disposed perpendicular to the first portion
20 (102), said second portion entrapped between an exposed portion of the rotating race backface surface (34C) and the attachment member (25).

15. The seal and shield (100) of Claim 14 wherein the attachment member (25) comprises at least one of a roll formed end, a threaded nut, or a shoulder portion associated with the rotating member
25 (24).

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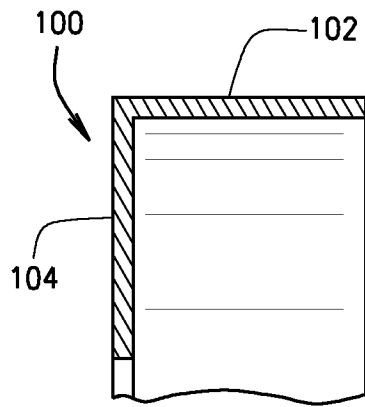


FIG. 3

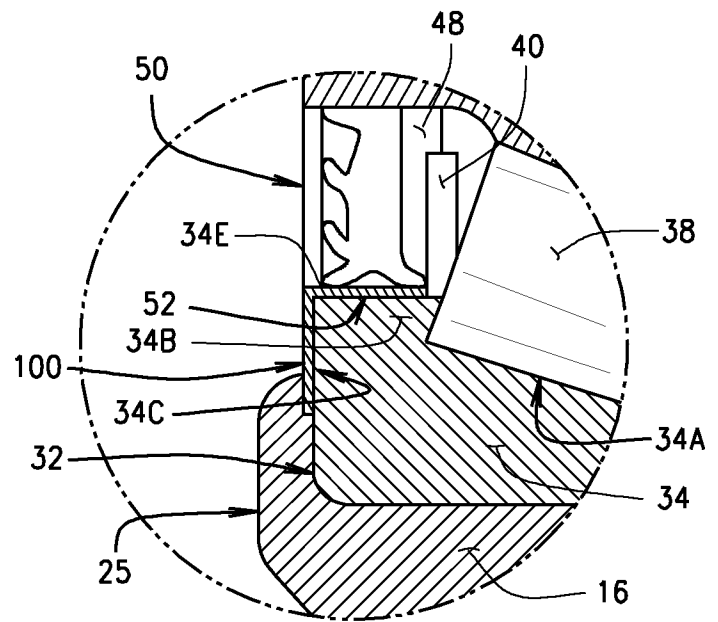


FIG. 1B

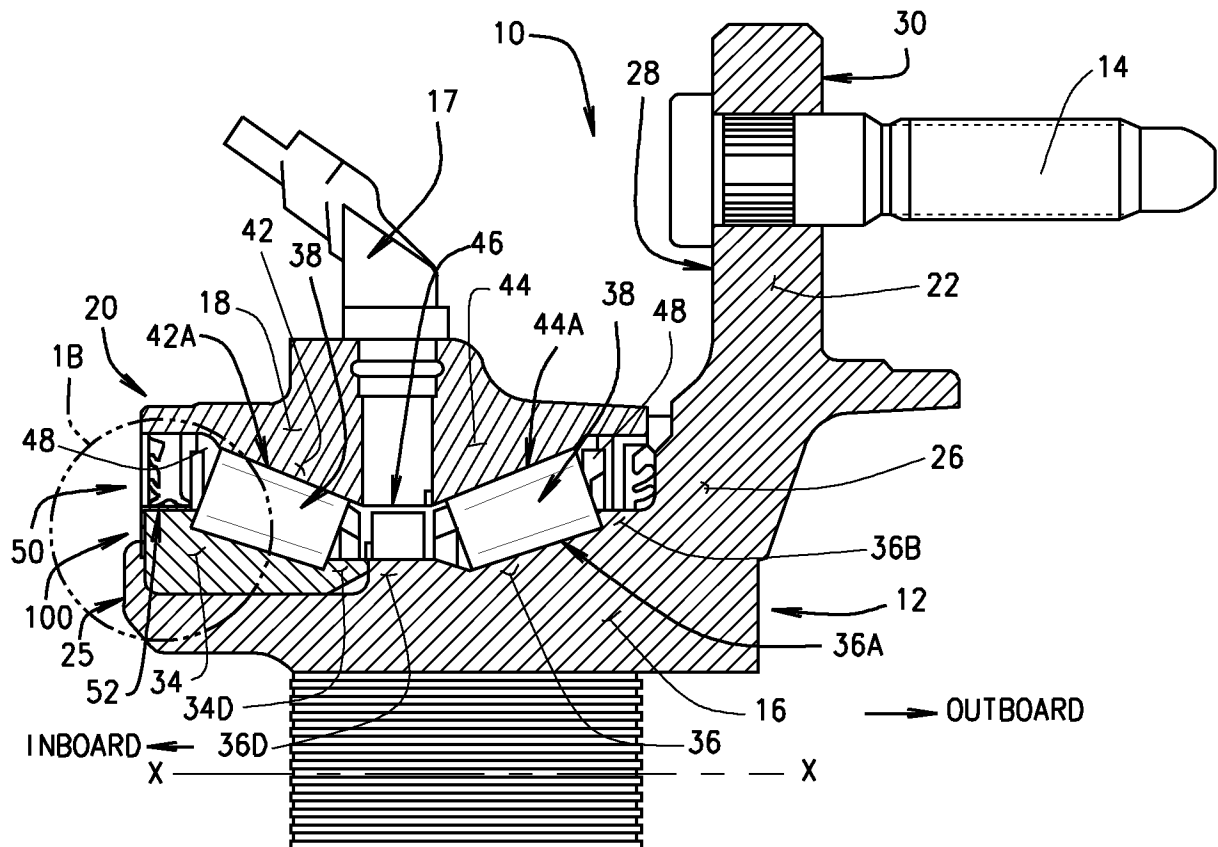


FIG. 1A

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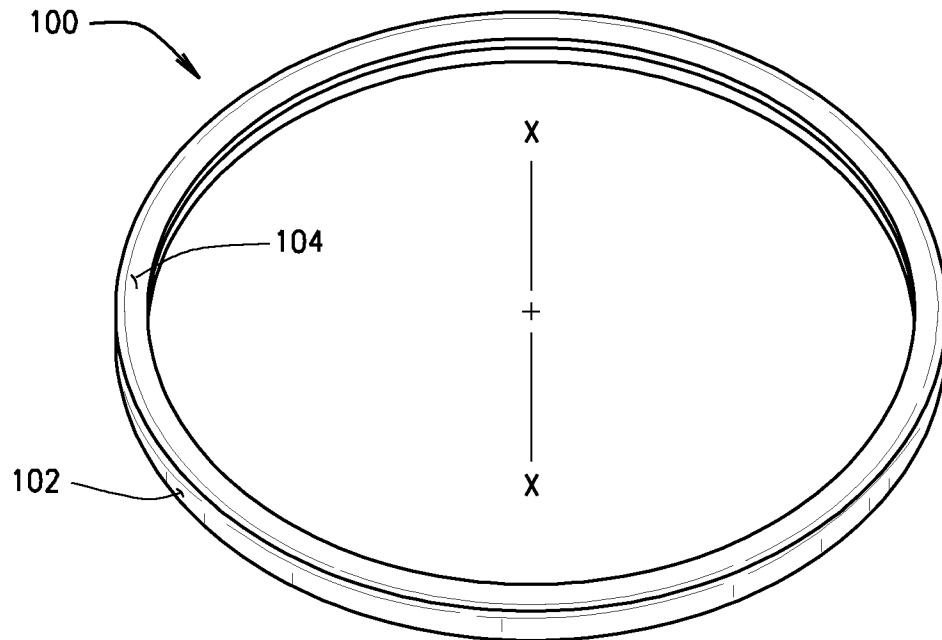


FIG. 2

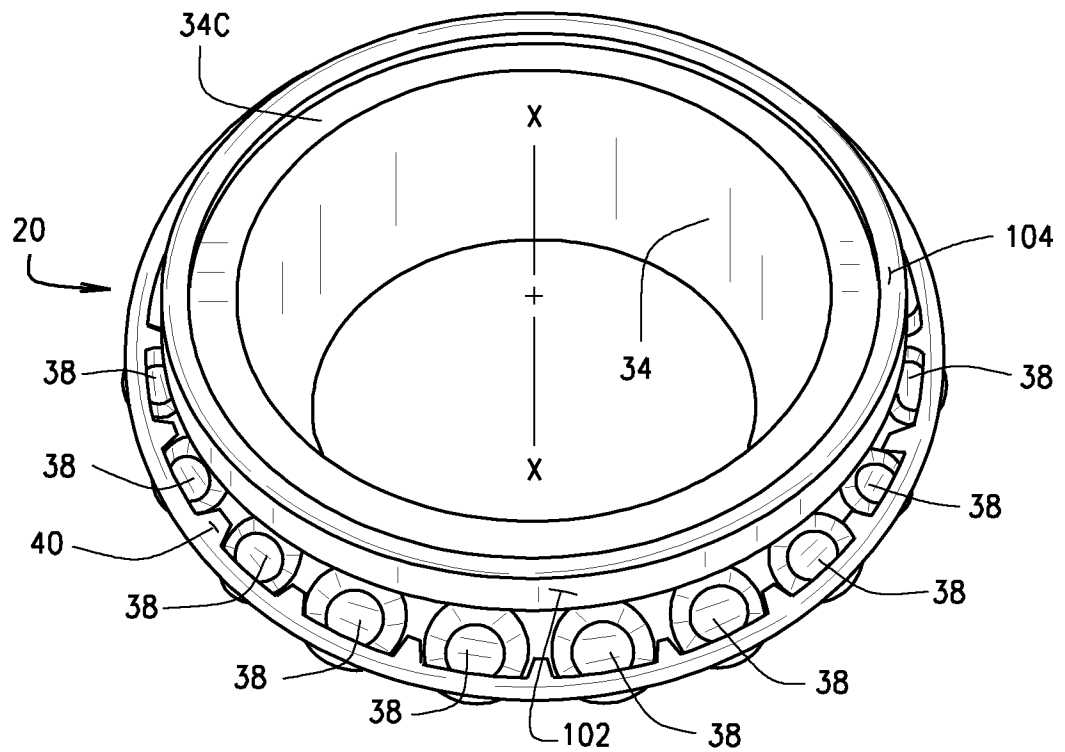


FIG. 4

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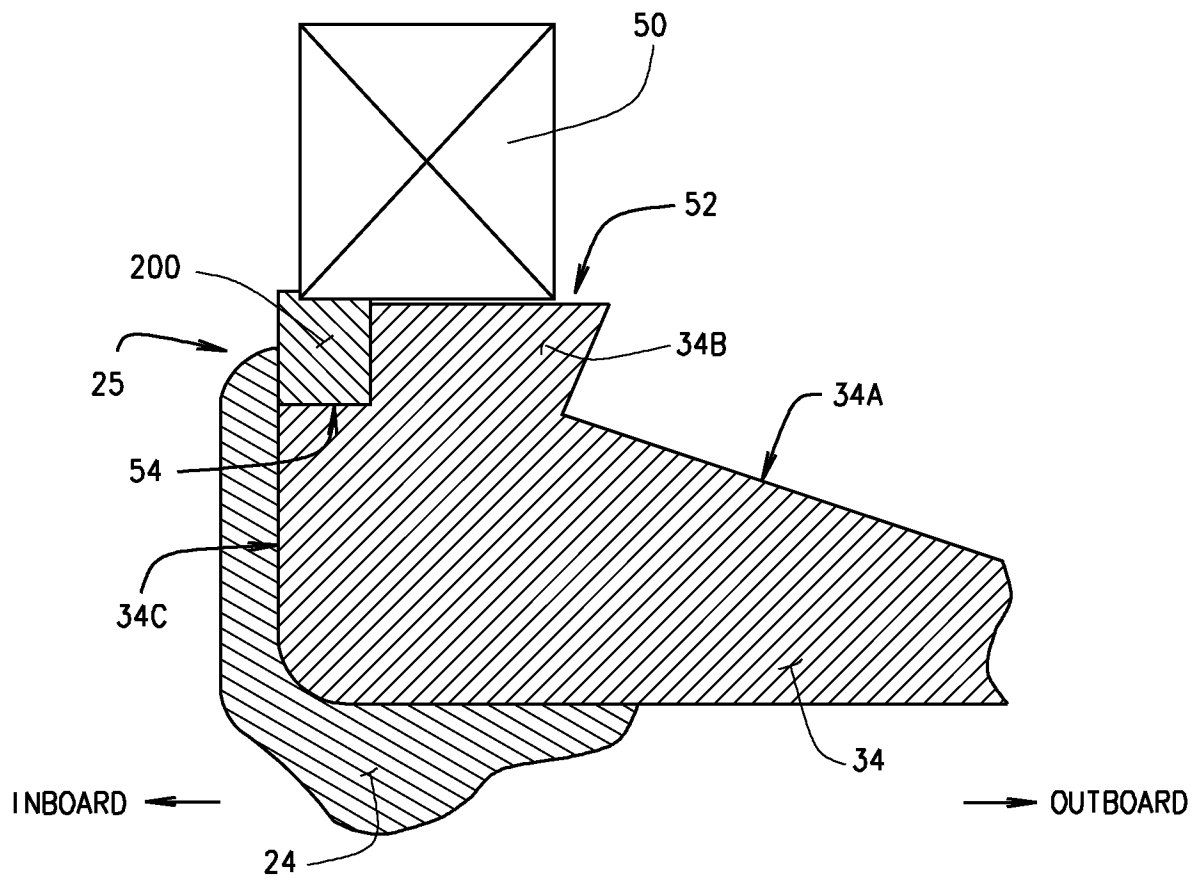


FIG. 5

INTERNATIONAL SEARCH REPORT

International application No

PCT/US2010/040323

A. CLASSIFICATION OF SUBJECT MATTER

INV. F16C19/38 F16C33/78 F16J15/32
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F16C F16J B60B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2008/006339 A1 (SCHAEFFLER KG [DE]; NIEBLING PETER [DE]; LANGER ROLAND [DE]; MASUR ERN) 17 January 2008 (2008-01-17)	1,3-15
Y	page 15, line 6 - page 16, line 28 figures 5,5a	2
Y	----- US 6 561 559 B1 (SKILLER JOHN VINCENT [NL] ET AL) 13 May 2003 (2003-05-13) column 3, line 29 - line 43 figures 3,4	2
X	----- US 2004/228556 A1 (OHTSUKI HISASHI [JP] ET AL) 18 November 2004 (2004-11-18)	14,15
Y	paragraph [0052] - paragraph [0054] figure 4	1
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Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents:

"A" document defining the general state of the art which is not considered to be of particular relevance

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Date of the actual completion of the international search

8 September 2010

Date of mailing of the international search report

15/09/2010

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INTERNATIONAL SEARCH REPORT

International application No
PCT/US2010/040323

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	JP 2006 200708 A (NTN TOYO BEARING CO LTD) 3 August 2006 (2006-08-03) paragraph [0016] - paragraph [0028] figures 1,2 -----	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/US2010/040323

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 2008006339 A1	17-01-2008	DE 102006032159 A1 EP 2043880 A1 JP 2009543009 T KR 20090038012 A	24-01-2008 08-04-2009 03-12-2009 17-04-2009
US 6561559 B1	13-05-2003	AU 742290 B2 AU 3057799 A CN 1297407 A DE 69911385 D1 DE 69911385 T2 EP 1064185 A1 JP 4338116 B2 JP 2004500518 T NL 1008681 C2 WO 9948742 A1 ZA 200004986 A	20-12-2001 18-10-1999 30-05-2001 23-10-2003 15-07-2004 03-01-2001 07-10-2009 08-01-2004 24-09-1999 30-09-1999 19-10-2001
US 2004228556 A1	18-11-2004	DE 602004009851 T2 EP 1469239 A2	28-08-2008 20-10-2004
JP 2006200708 A	03-08-2006	NONE	