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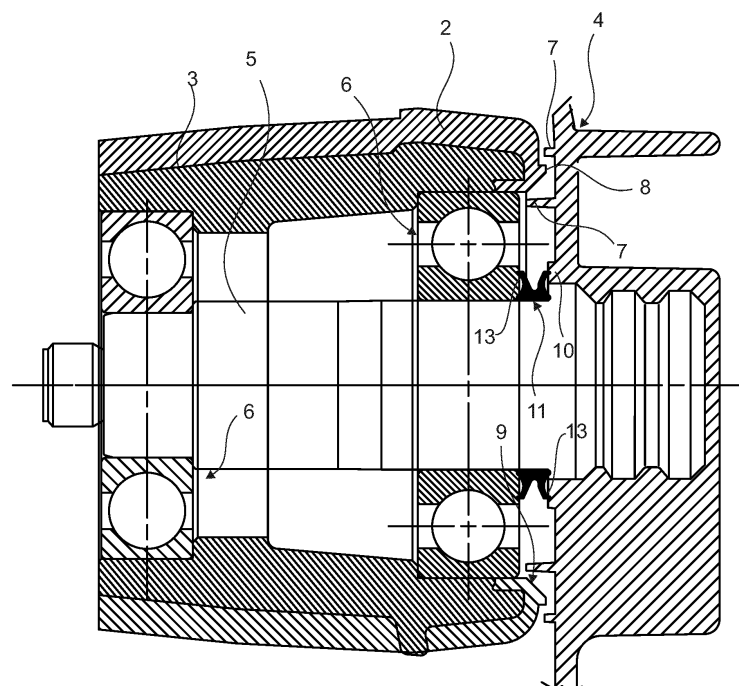
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(54) **A WASHING MACHINE COMPRISING A TUB**

(57) Washing machine comprising a tub (1); a circular rear cover (2) which forms the rear wall of the tub (1); a ball bearing housing (3) which is provided on the rear cover (2); at least one ball bearing (6) which is disposed in the ball bearing housing (3); a shaft (5) which is borne in the ball bearing (6); and a flange connection (4) where-in the end of the shaft (5) is borne. The washing machine

further comprising at least two ring-shaped, coaxial first protrusions (7) which extend from the flange connection (4) towards the ball bearing housing (3) and the ball bearing (6) and a sealing member (11) which is provided on the shaft (5) and which is positioned between the ball bearing (6) and the flange connection (4).

Figure 4



Description

[0001] The present invention relates to a washing machine having a drum wherein the ball bearing housing is positioned on the rear cover thereof.

[0002] Washing machines, especially front-loading washing machines, comprises a fixed drum and a drum which is disposed in the tub and which rotates in the horizontal axis. Various problems arise in the transfer of torque from the motor to the drum rotated at high speeds. During the washing process, as a result of the uneven distribution of the laundry in the rotating drum, the total center of gravity of the items rotating around the drum shaft axis in the washing machine moves away from the rotation axis of the drum. The resulting centrifugal effect adversely affects all the components of the washing machine, especially the tub and the drum rotating in the tub. Moreover, the drum-shaft connection should be strengthened such that the drum can be rotated clockwise and counterclockwise.

[0003] In the state of the art embodiments, the drive group which transmits the drive from the motor to the drum comprises a lubricant sealing ring, a bushing and a ball bearing. The main function of the ball bearings is to bear the forces occurring in the rotating group in the washing machine. In the state of the art embodiments, there are two ball bearings, large and small, in the drive group. Since the load on the drum side is greater due to the forces acting on the ball bearings, the ball bearing on this side is larger than the other. The drum shaft is positioned in the ball bearings and is borne on the ball bearings. The inner diameters of the ball bearings and the diameters of the drum shaft should match. It is also important to ensure that the ball bearings do not contact water. Therefore, a lubricant sealing ring is positioned in front of the larger ball bearing with a safe distance therebetween.

[0004] Another component used in the drive group of the state of the art washing machines is the bushing. The main function of the bushing is to ensure that the sealing lips of the lubricant sealing ring operate on a special surface. The bushing is grouped with the shaft.

[0005] However, as a result of the use of the lubricant sealing ring and the bushing, excessive current is drawn from the motor, which decreases efficiency. Moreover, the distance between the ball bearings decreases such that the lubricant sealing ring can remain within a safe range. The friction between the sealing lips of the lubricant sealing ring and the bushing causes the motor to operate with high torque, which reduces energy efficiency.

[0006] In the state of the art European Patent Application No. EP1163388, a front-loading washing machine is disclosed, having a drum driven by a motor disposed in a bearing shell fixed to the rear wall of the tub.

[0007] In the state of the art European Patent Application No. EP1183415, a washing machine is disclosed, comprising a drum driven directly by an electric motor

mounted on the rear wall of the tub.

[0008] The aim of the present invention is the realization of a washing machine with improved energy efficiency.

[0009] The washing machine realized in order to attain the aim of the present invention, explicated in the first claim and the respective claims thereof, comprises a tub; a drum which is disposed in the tub and which moves around the horizontal axis; a circular rear cover which forms the rear wall of the tub; a motor; a shaft which is connected to the drum; a ball bearing housing which is positioned on the rear cover; at least one ball bearing which is disposed in the ball bearing housing and wherein the shaft is fitted; a flange connection wherein the end of the shaft is borne; at least two ring-shaped, coaxial first protrusions, one extending from the hub of the flange connection towards the ball bearing housing and the other towards the ball bearing; and a sealing member which is positioned on the shaft between the ball bearing and the flange connection.

[0010] In the embodiment of the present invention, the lengths of the first protrusions are different from each other, and in the preferred embodiment, the length of the first protrusion closest to the shaft is longer than the other.

[0011] In another embodiment of the present invention, the washing machine comprises a second protrusion which extends from the rear cover towards the flange connection so as to remain between the two first protrusions. The first and second protrusions act as a water barrier so as to prevent the water from reaching the shaft and the ball bearing. In the embodiment of the present invention, the second protrusion has an angled surface on the shaft side.

[0012] In another embodiment of the present invention, the flange connection comprises an extension at the part where the former contacts the shaft. By means of the extension, the occurrence of calcification and corrosion is prevented at the part where the flange connection contacts the shaft.

[0013] In another embodiment of the present invention, the sealing member is a ring-shaped gasket and comprises ring-shaped sets with a certain distance therebetween on the inner surface thereof in contact with the shaft. Thus, the friction between the shaft and the sealing member is minimized. Moreover, the sealing member comprises two arms on the upper surface thereof, which extend to the ball bearing on one side and the flange connection on the other so as to contact the ball bearing on one side and the flange connection on the other in order to provide sealing and prevent the water from reaching the shaft. In the preferred embodiment of the present invention, the arm contacts the extension. The sealing member completely closes the gap on the shaft between the ball bearing and the extension and prevents the water from reaching the shaft.

[0014] The water is prevented from reaching the ball bearing and the shaft by using the first and second protrusions and the sealing member. Since the water is pre-

vented from contacting the ball bearing, the ball bearing is manufactured from stainless material.

[0015] By means of the present invention, since the lubricant sealing ring and the bushing are not used in the present embodiment, the friction between the lubricant sealing ring and the bushing is eliminated. Thus, the need for operation with high torque is eliminated and the drum rotates more easily. As the current drawn by the motor decreases, the efficiency increases. Due to rotating with the shaft, the sealing member does not cause an increase in torque. Moreover, by means of the present invention, the distance between the ball bearings increases. Thus, while the force that the ball bearings can withstand increases, the safety coefficient also increases. Using stainless ball bearings provides advantages against water, heat and corrosion.

[0016] A washing machine realized in order to attain the aim of the present invention is illustrated in the attached figures, where:

Figure 1 - is the exploded view of the drive group related to an embodiment of the present invention.

Figure 2 - is the perspective view of the flange connection related to another embodiment of the present invention.

Figure 3 - is the perspective view of the sealing member related to another embodiment of the present invention..

Figure 4 - is the cross-sectional view of the rear cover, the ball bearing housing, the ball bearing, the shaft and the flange connection related to another embodiment of the present invention.

[0017] The elements illustrated in the figures are numbered as follows.

1. Tub
2. Rear cover
3. Ball bearing housing
4. Flange connection
5. Shaft
6. Ball bearing
7. First protrusion
8. Second protrusion
9. Surface
10. Extension

11. Sealing member

12. Barrier

5 13. Handle

[0018] The washing machine comprises a tub (1); a circular rear cover (2) which forms the rear wall of the tub (1); a ball bearing housing (3) which is provided on the rear cover (2); at least one ball bearing (6) which is disposed in the ball bearing housing (3); a shaft (5) which is borne in the ball bearing (6); a flange connection (4) wherein the end of the shaft (5) is borne; at least two ring-shaped, coaxial first protrusions (7) which extend from the flange connection (4) towards the ball bearing housing (3) and the ball bearing (6); and a sealing member (11) which is provided on the shaft (5) and which is positioned between the ball bearing (6) and the flange connection (4) (Figure 1).

20 **[0019]** In the embodiment of the present invention, the lengths of the first protrusions (7) are different from each other, and in the preferred embodiment, the length of the first protrusion (7) closest to the shaft (5) is longer than the other.

25 **[0020]** In another embodiment of the present invention, the washing machine comprises a second protrusion (8) which is provided on the rear cover (2) and which extends from the rear cover (2) towards the flange connection (4) so as to remain between the two first protrusions (7). The first and second protrusions (7 and 8) act as a water barrier so as to prevent the water from reaching the shaft (5) and the ball bearing (6). In the embodiment of the present invention, the second protrusion (8) has an angled surface (9) on the shaft (5) side. In the preferred embodiment of the present invention, the surface (9) extends in an inclined manner from the rear cover (2) towards the flange connection (4) (Figure 2).

[0021] In another embodiment of the present invention, the washing machine comprises an extension (10) on the flange connection (4), at the part where the former contacts the shaft (5). By means of the extension (10), the occurrence of calcification and corrosion is prevented at the part where the flange connection (4) contacts the shaft (5).

45 **[0022]** In another embodiment of the present invention, the sealing member (11) is a ring-shaped gasket and comprises one or more than one ring-shaped set (12) with a certain distance therebetween on the inner surface thereof in contact with the shaft (5). Thus, the friction between the shaft (5) and the sealing member (11) is minimized. Moreover, the sealing member (11) comprises two arms (13) on the outer side thereof, which extend to the ball bearing (6) at one side and to the flange connection (4) at the other side. Thus, the arms (13) contact the ball bearing (6) at one side and the flange connection (4) at the other side so as to provide sealing and prevent the water from reaching the shaft (5). In the preferred embodiment of the present invention, the arm (13) con-

tacts the extension (10). The sealing member (11) completely closes the gap on the shaft (5) between the ball bearing (6) and the extension (10) and prevents the water from reaching the shaft (5) (Figure 3 and Figure 4).

[0023] The water is prevented from reaching the ball bearing (6) and the shaft (5) by using the first and second protrusions (7 and 8) and the sealing member (11). Since the water is prevented from contacting the ball bearing (6), the ball bearing (6) is manufactured from stainless material.

[0024] By means of the present invention, since the lubricant sealing ring and the bushing are not used in the present embodiment, the friction between the lubricant sealing ring and the bushing is eliminated. Thus, the need for operation with high torque is eliminated and the drum rotates more easily. As the current drawn by the motor decreases, the efficiency increases. Due to rotating with the shaft (5), the sealing member (11) does not cause an increase in torque. Moreover, by means of the present invention, the distance between the ball bearings (6) increases. Thus, while the force that the ball bearings (6) can withstand increases, the safety coefficient also increases. Using stainless ball bearings (6) provides advantages against water, heat and corrosion.

Claims

1. A washing machine **comprising** a tub (1); a circular rear cover (2) which forms the rear wall of the tub (1); a ball bearing housing (3) which is provided on the rear cover (2); at least one ball bearing (6) which is disposed in the ball bearing housing (3); a shaft (5) which is borne in the ball bearing (6); and a flange connection (4) wherein the end of the shaft (5) is borne, **characterized by** at least two ring-shaped, coaxial first protrusions (7) which extend from the flange connection (4) towards the ball bearing housing (3) and the ball bearing (6) and a sealing member (11) which is provided on the shaft (5) and which is positioned between the ball bearing (6) and the flange connection (4).
2. A washing machine as in Claim 1, **characterized by** the two first protrusions (7) of which the lengths are different from each other.
3. A washing machine as in Claim 2, **characterized by** the two first protrusions (7) wherein the length of the first protrusion (7) closest to the shaft (5) is longer than the other.
4. A washing machine as in any one of the above claims, **characterized by** a second protrusion (8) which is provided on the rear cover (2) and which extends from the rear cover (2) towards the flange connection (4) so as to remain between the two first protrusions (7).

5. A washing machine as in Claim 4, **characterized by** the second protrusion (8) which has an angled surface (9) on the side of the shaft (5).
6. A washing machine as in Claim 5, **characterized by** the surface (9) which extends in an inclined manner from the rear cover (2) towards the flange connection (4).
7. A washing machine as in any one of the above claims, **characterized by** an extension (10) on the flange connection (4), at the part where the former contacts the shaft (5).
8. A washing machine as in any one of the above claims, **characterized by** the sealing member (11) which is in the shape of a ring.
9. A washing machine as in any one of the above claims, **characterized by** the sealing member (11) comprising one or more than one ring-shaped set (12) with a certain distance therebetween on the inner surface thereof in contact with the shaft (5).
10. A washing machine as in any one of the above claims, **characterized by** the sealing member (11) comprising two arms (13) on the outer side thereof, which extend to the ball bearing (6) at one side and to the flange connection (4) at the other side.
11. A washing machine as in Claim 10, **characterized by** the arm (13) which extends to the extension (10).

Figure 1

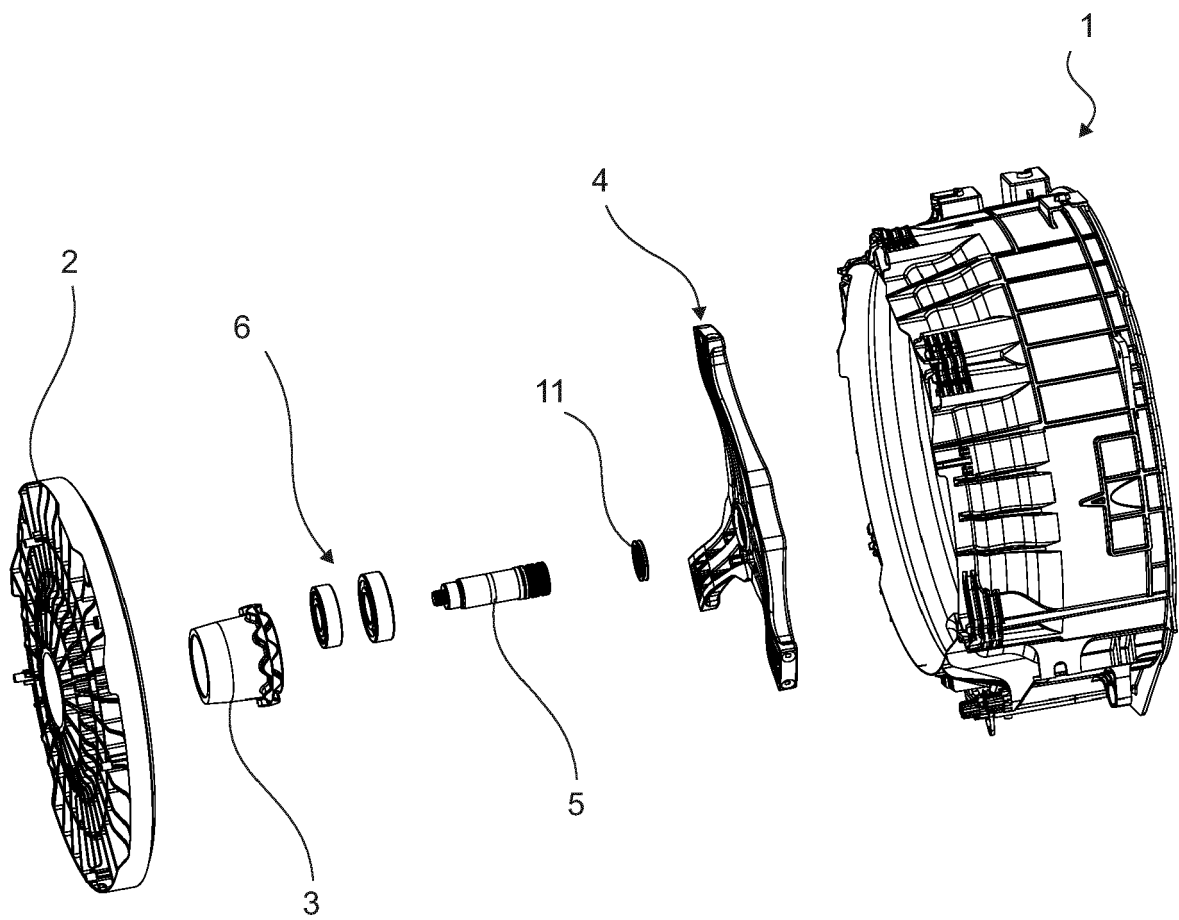


Figure 2

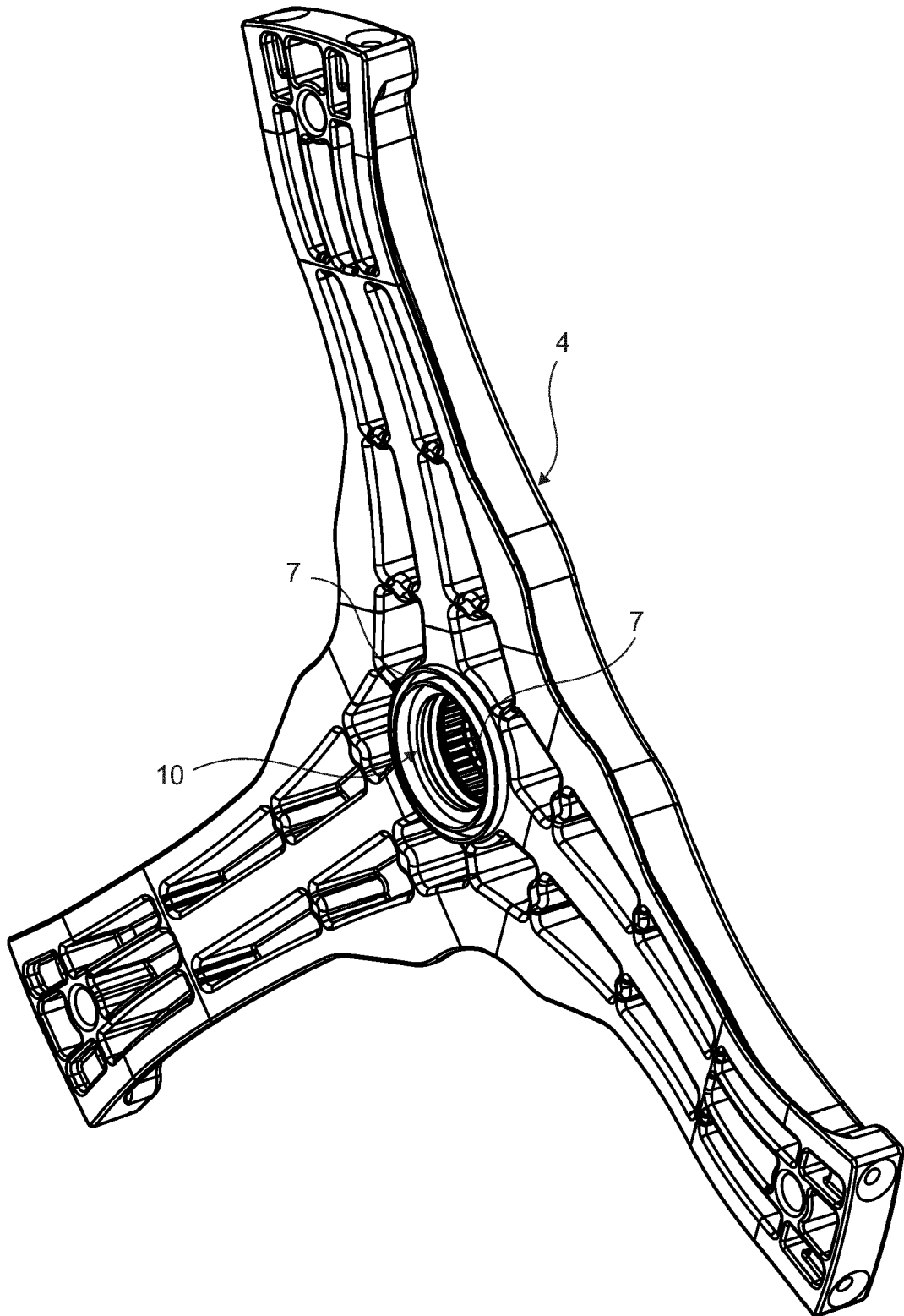


Figure 3

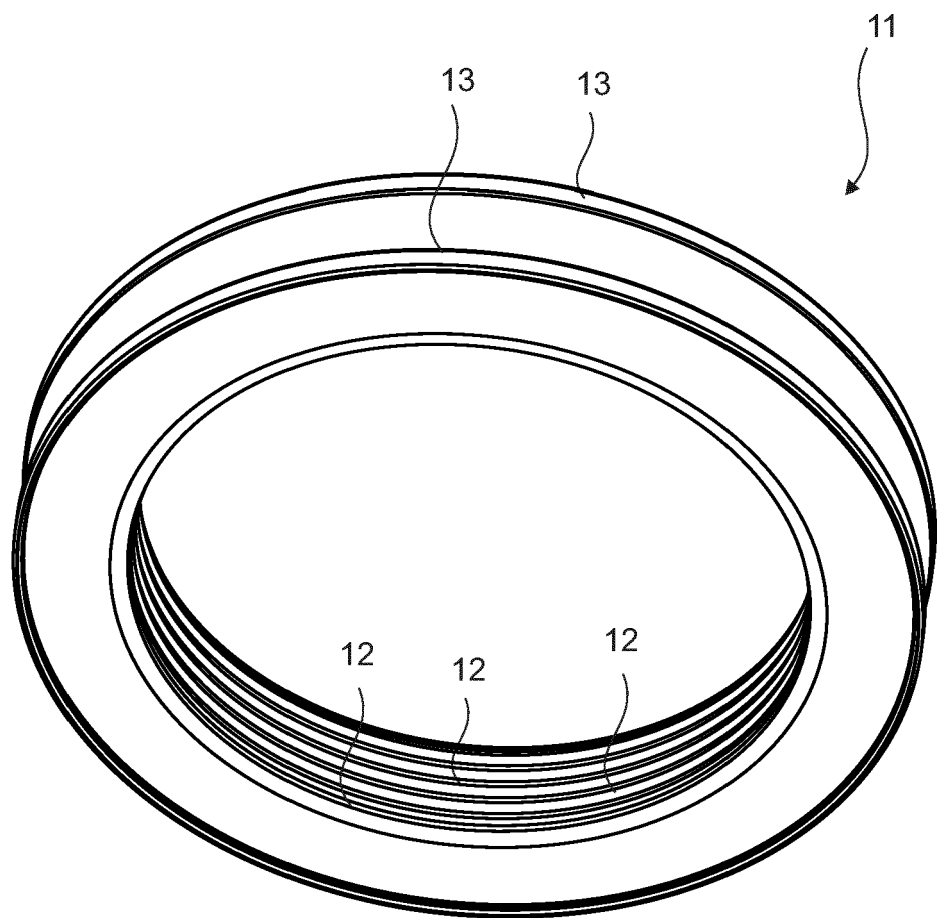
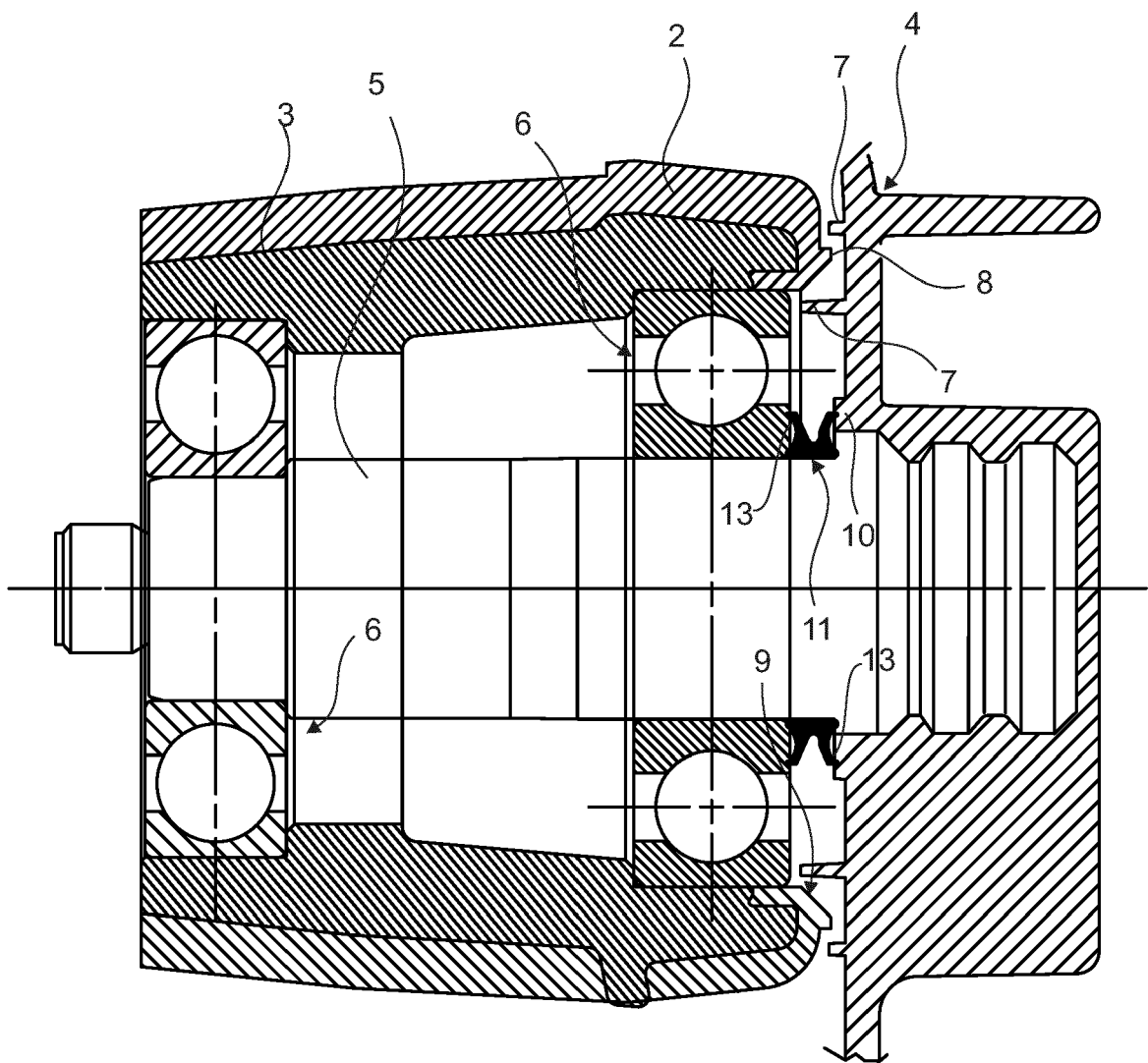


Figure 4





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Application Number

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Y	* column 5, line 31 - column 12, line 25;	4	
A	figures * -----	5, 6, 9-11	ADD. D06F37/04
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A	* paragraph [0043] - paragraph [0103]; figures * -----	1-3, 5-11	
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The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 16 April 2024	Examiner Sangiorgi, Massimo
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO.

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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