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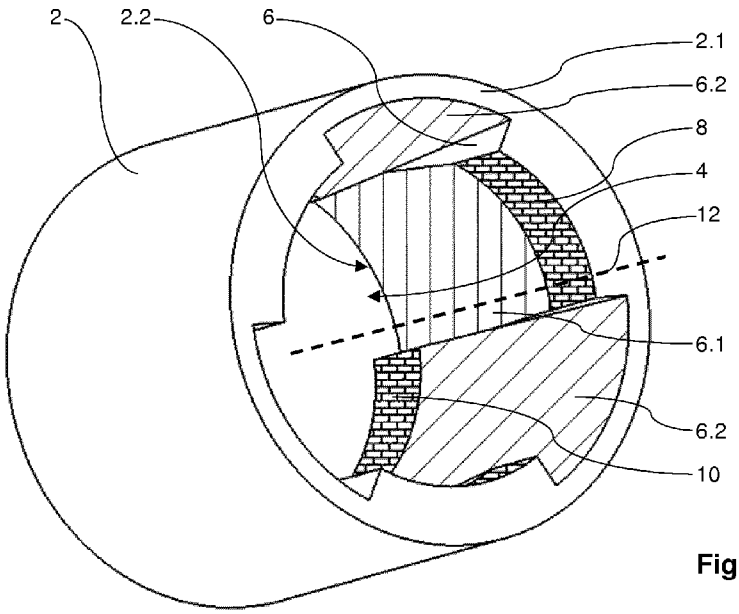


Fig. 1

(57) Abstract: The invention relates to a bearing shell, comprising a body (2) with a clearance hole (4) defined by an inner wall (6) of said body, and further comprising at least a first bearing surface (8) and at least a second bearing surface (10), whereat said first bearing surface is located on a first end (2.1) and said second bearing surface is located on a second end (2.2) of said body. In order to provide a bearing shell of simpler design said first bearing surface and said second bearing surface, particularly shaped out of said body, are offset to each other in radial direction. Furthermore, the invention relates to a device for molding a bearing shell according to the invention.

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Bearing shell and device for molding a bearing shell

Description

The present invention relates to a bearing shell according to the preamble of claim 1 and to a device for molding a bearing shell according to the preamble of claim 9.

Such bearing shells and devices for molding a bearing shell are already known in different embodiments.

From the DE 197 47 792 A1 a bearing shell, comprising a body with a clearance hole defined by an inner wall of the body, and further comprising a first bearing surface and a second bearing surface, whereat said first bearing surface is located on a first end and said second bearing surface is located on a second end of said body, is known.

Furthermore, a device for molding a bearing shell is known from the DE 197 47 792 A1, comprising a first mold core and a second mold core transferable between a working position inside a mold and a non-working position. In the working position of said first and said second mold core said mold cores are facing each other with at least one free end per mold core, whereat said free end of said first mold core is offset to said free end of said second mold core in radial direction and each of said mold cores is moveable in an opposite direction to its respective free end while transferred into said non-working position.

It is an object of the invention to provide a bearing shell of simpler design.

This object is solved by a bearing shell according to claim 1, wherein said first bearing surface and said second bearing surface, particularly shaped out of said body, are offset to each other in radial direction.

A main advantage of the bearing shell according to the invention is, that the bearing can be provided with two supporting points distanced from each other and, at the same time, can be manufactured more easily.

This is particularly true, if said first and said second bearing surfaces are shaped out of said body, because said bearing surfaces can be manufactured at the same time with said body.

A further object of the invention is to provide a device for molding such a bearing shell of less complexity.

This object of the invention is solved by a device for molding a bearing shell according to claim 9, wherein the radial distance of said outer contour of said free end of the respective mold core to a central axis of said mold core is less than the radial distance of said outer contour of the end of said mold core opposite to said free end to said central axis.

By using the device for molding a bearing shell according to the invention a main advantage is to enable a device of less complexity for the manufacturing of a bearing shell according to the invention. Only two mold cores and a two-part mold are necessary for manufacturing a bearing shell subject to the invention. No such things like slides are necessary.

Moreover, corrections are easy to achieve. For example, compared to a hole drilled afterwards.

Further advantageous developments of the bearing shell according to the invention and the device for molding a bearing shell according to the invention are apparent from the sub-claims as well as from the following description of exemplary embodiments of the bearing shell according to the invention by means of the attached Figures.

Basically, the body of the bearing shell can be of any material, outer and inner shape and dimension. Advantageously, said body is built like a bush, particularly with a circular or near-circular outer contour of the cross section of said bush. That way, the body can easily be inserted into other parts. Furthermore, a device for molding such a body is quite easy to manufacture.

In general, the first bearing surface and the second bearing surface can be of any material, shape, dimension and position relative to the body or to the rest of the body. Favorably, said first bearing surface and said second bearing surface are alternating to each other, substantially along a whole inner contour of the body defined by the clearance hole.

Thus, the projection of said first and said second bearing surfaces onto a projection plane parallel to a cross section of the bearing shell displays, that said first and said second bearing surfaces are positioned alternately around the inner contour of the body, preferably along the complete inner contour of the body.

A further advantageous development of the bearing shell according to the invention is, that each of said at least two first bearing surfaces and said at least two second bearing surfaces define a circular or near-circular shaped seat and inner diameters of both circular or near-circular shaped seats are substantially equal to each other. That way, the manufacture of the bearing shell according to the invention as well as a bearing, comprising the bearing shell and a bearing shaft, are further simplified. Using a bearing shell and a bearing shaft with a simple circular cross section is possible, too.

Basically said first and said second bearing surfaces can be of any number. Advantageously, three first bearing surfaces and three second bearing surfaces are located on said body. This is, because three bearing surfaces on each end of said body of the bearing shell ensure to keep the counterpart, namely the bearing shaft, in place.

Particularly preferable is, that said bearing surfaces on each end of said body are equal distanced to each other.

In general, said first and said second bearing surface can be of any spatial orientation. Favorably, said first bearing surface and said second bearing surface are each substantially equal distanced to a central axis of said clearance hole. That way, an easy build bearing is further promoted.

A favorable development of the bearing shell according to the aforementioned embodiment is, that an inner width of said clearance hole at the radial position of said first bearing surface and at the radial position of said second bearing surface is smaller than at the opposite end of the body at the radial position of the respective first and second bearing surface. Hereby, the manufacture of the bearing shell according to the invention is further simplified.

An advantageous development of the aforementioned embodiment is, that sections of said inner wall of said body, linking said first bearing surface and said second bearing surface with said opposite end of the body at the radial position of the respective first and second bearing surface, run continuously. That way, a draft angle is easily realized.

Analog to the advantageous development of the bearing shell mentioned before, the sections of outer walls of said first and said second mold core, linking said free end and said opposite end at the radial position of said free end of the respective mold core, run continuously.

The Figures are schematic illustrations of bearing shells according to the present invention, wherein only the details necessary for the understanding of the invention are shown. Parts with the same function are marked by the same reference numbers.

It is shown by:

Fig. 1 a first embodiment of a bearing shell according to the invention in a perspective view;

Fig. 2 said first embodiment in a projection plane view;

Fig. 3 a second embodiment of a bearing shell according to the invention in a second projection plane view;

Fig. 4 a third embodiment of a bearing shell according to the invention in a third projection plane view;

Fig. 5 a fourth embodiment of a bearing shell according to the invention in a fourth projection plane view;

Fig. 6 two mold cores of a device for molding a bearing shell according to the invention in a non-working position and

Fig. 7 the two mold cores of Fig. 6 in a working position.

Fig. 1 displays a first embodiment of the bearing shell according to the invention comprising a body 2 out of a plastic material with a clearance hole 4 defined by an inner wall 6 of the body 2, and further comprising three first bearing surfaces 8 and three second bearing surfaces 10, whereat the first bearing surfaces 8 are located on a first end 2.1 and the second bearing surfaces 10 are located on a second end 2.2 of the body 2.

Said first bearing surfaces 8 and said second bearing surfaces 10 are shaped out of the body 2 and are offset to each other in radial direction, which can also be seen in Fig. 2.

The body 2 is built like a bush 2, comprising a circular outer contour of the cross section of the bush 2. See also Fig. 2.

In Fig. 1 and 2 it is also displayed, that the first bearing surfaces 8 and said second bearing surfaces 10 are alternating to each other. The first and second bearing surfaces 8, 10 are positioned along a whole inner contour of the bush 2 defined by the clearance hole 4.

This can be seen most easily with reference to Fig. 2, displaying a projection of the three first bearing surfaces 8 and the three second bearing surfaces 10 in a projection plane parallel to a cross section of the bush 2. After a first bearing surface 8 positioned on the first end 2.1 of the bush 2 a second bearing surface 10 follows, which is positioned on the second end 2.2 of the bush 2, and so on.

It is also visible from Fig. 2, that the three first bearing surfaces 8 define a circular shaped seat on the first end 2.1 of the bush 2 and the three second bearing surfaces 10 define a circular shaped seat on the second end of the bush 2. Inner diameters of both circular shaped seats are substantially equal to each other.

Said first bearing surfaces 8 and said second bearing surfaces 10 are each substantially equal distanced to a central axis 12 of said clearance hole 4. The central axis 12 is indicated by a broken line in Fig. 1 and an intersection of a cross in Fig. 2. Thus, the central axis 12 runs perpendicular to the drawing plane of Fig. 2.

In the first embodiment, the distances of the three first bearing surfaces 8 and of the three second bearing surfaces 10 to the central axis 12 are equal, too. Thus, a bearing shaft with a constant diameter can be used. The bearing shaft is not displayed.

In this embodiment, an inner width of said clearance hole 4 at the radial positions of said first bearing surfaces 8 and at the radial positions of said second bearing surfaces 10 is smaller than at the opposite end 2.1, 2.2 of the bush 2 at the radial positions of the respective first and second bearing surfaces 8, 10.

Thus, the inner width of said clearance hole 4 at the radial positions of the first bearing surfaces 8 is smaller than of the opposite end 2.2 of the bush 2 at the radial positions of the first bearing surfaces 8.

In other words, the inner width of sections of the clearance hole 4 at the second end 2.2 of the bush 2, which are covered in Fig. 2 by the first end 2.1 at the radial positions

of the first bearing surfaces 8 is taller than the inner width of the clearance hole 4 at the first end 2.1 at the radial positions of the first bearing surfaces 8.

The same is true for said second bearing surfaces 10 and the opposite end 2.1 of the bush 2 at the radial positions of the second bearing surfaces 10.

Furthermore, sections 6.1 and 6.2 of said inner wall 6 of said bush 2, linking said first bearing surfaces 8 and said second bearing surfaces 10 with said opposite end 2.2, 2.1 of the bush 2 at the radial positions of the respective first and second bearing surfaces 8, 10, run continuously.

This can be seen best from Fig. 1.

For example, the inner wall 6 is equally distanced to the central axis 12 of the clearance hole 4 with respect to the first bearing surfaces 8, which are part of the inner wall 6 of the bush 2.

Following the sections 6.1 of the inner wall 6 beginning at the ends of the first bearing surfaces 8, which are positioned opposite to the first end 2.1 of the bush 2 and running towards the second end 2.2 of the bush 2, it can be seen, that this sections 6.1 are descending in a constant angle. In Fig. 1 only one of sections 6.1 is visible.

The same is true with respect to the second bearing surfaces 10, but in the opposite direction compared to the previous explanation.

Thus, the inner wall 6 beginning at the ends of the second bearing surfaces 10, which are positioned opposite to the second end 2.2 of the bush 2 and running towards the first end 2.1 of the bush 2, it can be seen, that this sections 6.2 are descending in a constant angle, too. In Fig. 1 only two of sections 6.2 are visible.

Fig. 3 to Fig. 5 show three more embodiments of bearing shells according to the invention. In the following, only the differences between these embodiments and the first embodiment are discussed.

In Fig. 3 only two first bearing surfaces 8 and only two second bearing surfaces 10 are used. Unlike the first embodiment, in the second embodiment the neighboring first and second bearing surfaces 8, 10 are -with respect to the projection plane view of Fig. 3- not in contact with each other. There are gaps between neighboring first and second bearing surfaces 8, 10.

Fig. 4 shows a third embodiment with four first bearing surfaces 8 and four second bearing surfaces 10. Analog to the first embodiment, the neighboring first and second bearing surfaces 8, 10 are -with respect to the projection plane view of Fig. 4- in contact with each other.

Furthermore, Fig. 5 displays a fourth embodiment with an uneven number of first and second bearing surfaces 8, 10. Here, three first bearing surfaces 8 and four second bearing surfaces 10 are used.

The two second bearing surfaces 10, which are positioned on the upper side of the projection plane view of Fig. 4 are -with respect to said view- in contact with the neighboring first bearing surfaces 8, whereas the two second bearing surfaces 10, which are positioned on the lower side of said view, are not in contact with the neighboring first bearing surfaces 8.

The first and second bearing surfaces 8, 10 of the embodiment of Fig. 5 are not arranged at regular intervals, in order to take care of an asymmetrical load.

Thus, the arrangement of the first and second bearing surfaces 8, 10 could be of any useful kind, symmetrical or asymmetrical, with an even or uneven number of first and second bearing surfaces, with the same or different numbers of first and second bearing surfaces and with first and/or second bearing surfaces pooled in certain areas.

The four embodiments of bearing shells according to the invention are only examples.

The invention is not limited to the exemplary embodiments discussed before.

Of course, there are other arrangements of first and second bearing surfaces possible. The person skilled in the art will choose the right arrangement depending on the field of application.

Fig. 6 and 7 display a first mold core 14 and a second mold core 16 of a device for molding a bearing shell according to the invention and with respect to the bearing shell according to Fig. 1 and 2.

Even if a device for molding a bearing shell according to the invention is not displayed in the Fig., it can be explained with the above mentioned Fig. dealing with the bearing shell according to the invention and with the Fig. 6 and 7.

In order to manufacture a bearing shell according to the invention and with respect to the first embodiment of the bearing shell displayed in Fig. 1 and 2, the device for molding the bearing shell comprises the first mold core 14 and the second mold core 16 transferable between a working position inside a mold and a non-working position, whereas Fig. 6 shows the two mold cores 14, 16 in a non-working position and Fig. 7 shows the two mold cores 14, 16 in the working position.

The two mold cores 14, 16 are facing each other with three free ends 14.1 and 16.1 per mold core 14, 16 in said working position, whereat said free ends 14.1 of said first mold core 14 are offset to said free ends 16.1 of said second mold core 16 in radial direction and each of said mold cores 14, 16 is moveable in an opposite direction to its respective free ends 14.1, 16.1 while transferred into said non-working position.

For example, such an arrangement can also be seen from the mentioned DE 197 47 792 A1, Fig. 1 to 3 and Fig. 6 to 10.

Someone has just to imagine the two mold cores 14, 16 inserted in a mold for molding the bearing shell displayed in Fig. 1. The two mold cores 14, 16, which are displayed, are inserted in the mold, which is not displayed, in order to build the bush 2 with the clearing hole 4 after the material is inserted into the mold.

Thus, the two mold cores 14, 16 are the negative form of the bush 2 of the first embodiment and the three free ends 14.1 of the first mold core 14 correspond to the three first bearing surfaces 8 of the bush 2 and the three free ends 16.1 of the second mold core 16 correspond to the three second bearing surfaces 10 of the bush 2.

Each of the two mold cores 14, 16 contain a dome 17 in its center. The domes 17 stabilize the mold cores 14, 16.

Firstly, each dome 17 reinforces the finger-like projections 14.3, 16.3 of the mold core 14, 16, linking the free end 14.1, 16.1 and the end 14.2, 16.2 of the mold core 14, 16 opposite to the free end 14.1, 16.1 and at the same radial position of the respective free end 14.1, 16.1.

Secondly, each dome 17 supports the finger-like projections 14.3, 16.3 of the other mold core 14, 16 during the transformation of the two mold cores 14, 16 in the working position displayed in Fig. 7. Thus, the finger-like projections 14.3, 16.3 are guided and positioned by the dome 17 of the other mold core 14, 16.

The three free ends 14.1 of the first mold core 14 are placed at the radial and axial positions of the later first bearing surfaces and the three free ends 16.1 of the second mold core 16 are placed at the radial and axial positions of the later second bearing surfaces.

After the hardening of the material in the mold, the two mold cores 14, 16 are withdrawn from the bush 2 by pulling each mold core 14, 16 parallel to the central axis 12

and in the direction opposite to the three free ends 14.1, 16.1 of the respective mold core 14, 16 out of the clearance hole 4 of the bush 2.

This is possible, because of the fact, that unlike the DE 197 47 792 A1, the device for molding a bearing shell according to the invention also comprises, that the radial distance of an outer contour of said free ends 14.1, 16.1 of the respective mold core 14, 16 to a central axis 18 of said mold core 14, 16 is less than the radial distance of an outer contour of an end 14.2, 16.2 of said mold core 14, 16 opposite to and at the radial position of said free ends 14.1, 16.1 to said central axis 18. This can be derived from Fig. 1 as well as from Fig. 6 and 7.

In order to enhance the transfer into the non-working position, sections of outer walls of said two mold cores 14, 16, linking said free ends 14.1, 16.1 and said opposite ends 14.2, 16.2 at the radial positions of said free ends 14.1, 16.1 of the respective mold core 14, 16, run continuously. The sections ascend at a constant angle from the three free ends 14.1, 16.1 of each mold core 14, 16 to the opposite end 14.2, 16.2 at the radial positions of said free ends 14.1, 16.1.

Instead of using a plastic material for the bearing shell other suitable materials can be used, too. The same is true for the counterpart, the bearing shaft. For example, plastic materials, ceramics, glass, compound materials, metals and alloys are possible.

Instead of casting or injection molding, sintering as well as materials used for sintering would be possible, too.

The bearing shell and the bearing shaft have not to be manufactured from the same material or group of materials. For example, the bearing shell can be made from a plastic material and the bearing shaft can be made from a metal, e.g. steel.

Furthermore, the space between the first and the second bearing surfaces can be used for sealing, e.g. by inserting an O-ring gasket.

Moreover, the bearing shell according to the invention can be designed with different kinds of lubrication, namely using lubricants from an external source, like oil or grease, using lubricants contained by the bearing shell, like bronze or graphite, or using bearing shells made of materials that are the lubricant.

For example, if using lubricants from an external source the bearing shell comprises channels for delivering oil or another lubricant to the relevant position of the bearing shell.

The first and second bearing surfaces have not to be equal distanced to each other as well as to the bearing surfaces on the opposite end of the bearing shell.

A smaller number of first and second bearing surfaces, for example two first and two second bearing surfaces or less, is maybe suitable for bearings with only a smaller degree of rotation and not a 360° rotation of the bearing shaft.

The first and second bearing surfaces have not to be shaped out from the body of the bearing shell, but can be molded separately. This is advantageous, if there is a need for having different materials for the body and the first and/or second bearing surfaces.

The bearing shaft and therefore the first and second bearing surfaces have not to define a circular or near-circular shaped seat and the inner diameters of both circular or near-circular shaped seats have not to be substantially equal to each other. Polygon shaped and other non-circular shaped seats built by the first and second bearing surfaces are possible, too.

The bearing shell and device for molding a bearing shell according to the invention are especially advantageous for high volume production, because of no reworking of the bearing shell is necessary.

The invention is favorable for all kinds of bearing shells and devices for molding a bearing shell which require a kind of draft angle.

List of reference numbers

2	body, built like a bush
2.1	first end of body 2
2.2	second end of body 2
4	clearance hole
6	inner wall of body 2
6.1	section of inner wall 6, linking the first bearing surface 8 and the opposite end 2.2 of body 2 at the radial position of the respective first bearing surface 8
6.2	section of inner wall 6, linking the second bearing surface 10 and the opposite end 2.1 of body 2 at the radial position of the respective second bearing surface 10
8	first bearing surface
10	second bearing surface
12	central axis of clearance hole 4
14	first mold core
14.1	free end of the first mold core 14
14.2	end of first mold core 14 opposite to free end of first mold core 14
14.3	finger-like projection of first mold core 14
16	second mold core
16.1	free end of the second mold core 16
16.2	end of second mold core 16 opposite to free end of second mold core 16
16.3	finger-like projection of second mold core 16
17	domes
18	central axis of the mold cores 14, 16

Bearing shell and device for molding a bearing shell

Claims

1. Bearing shell, comprising a body (2) with a clearance hole (4) defined by an inner wall (6) of said body (2), and further comprising at least a first bearing surface (8) and at least a second bearing surface (10), whereat said first bearing surface (8) is located on a first end (2.1) and said second bearing surface (10) is located on a second end (2.2) of said body (2),
wherein
said first bearing surface (8) and said second bearing surface (10), particularly shaped out of said body (2), are offset to each other in radial direction.

2. Bearing shell according to claim 1,
wherein
said body (2) is built like a bush (2), particularly with a circular or near-circular outer contour of the cross section of said bush (2).

3. Bearing shell according to claim 1 or 2,
wherein
said first bearing surface (8) and said second bearing surface (10) are alternating to each other, substantially along a whole inner contour of the body (2) defined by the clearance hole (4).

4. Bearing shell according to one of the claims 1 to 3,
wherein
each of said at least two first bearing surfaces (8) and said at least two second bearing surfaces (10) define a circular or near-circular shaped seat and inner diameters of both circular or near-circular shaped seats are substantially equal to each other.

5. Bearing shell according to one of the claims 1 to 4,
wherein
three first bearing surfaces (8) and three second bearing surfaces (10) are located on said body (2).

6. Bearing shell according to one of the claims 1 to 5,
wherein
said first bearing surface (8) and said second bearing surface (10) are each substantially equal distanced to a central axis (12) of said clearance hole (4).

7. Bearing shell according to claim 6,
wherein
an inner width of said clearance hole (4) at the radial position of said first bearing surface (8) and at the radial position of said second bearing surface (10) is smaller than at the opposite end (2.1, 2.2) of the body (2) at the radial position of the respective first and second bearing surface (8, 10).

8. Bearing shell according to claim 7,
wherein
sections (6.1, 6.2) of said inner wall (6) of said body (2), linking said first bearing surface (8) and said second bearing surface (10) with said opposite end (2.1, 2.2) of said body (2) at the radial position of the respective first and second bearing surface (8, 10), run continuously.

9. Device for molding a bearing shell according to one of the claims 1 to 8, comprising a first mold core (14) and a second mold core (16) transferable between a working position inside a mold and a non-working position and facing each other with at least one free end (14.1, 16.1) per mold core (14, 16) in said working position, whereat said free end (14.1) of said first mold core (14) is offset to said free end (16.1) of said second mold core (16) in radial direction and each of said mold cores (14, 16) is moveable in an oppo-

site direction to its respective free end (14.1, 16.1) while transferred into said non-working position,
wherein
the radial distance of an outer contour of said free end (14.1, 16.1) of the respective mold core (14, 16) to a central axis (18) of said mold core (14, 16) is less than the radial distance of an outer contour of an end (14.2, 16.2) of said mold core (14, 16) opposite to and at the radial position of said free end (14.1, 16.1) to said central axis (18).

10. Device according to claim 9,
wherein
sections of outer walls of said first and said second mold core (14, 16), linking said free end (14.1, 16.1) and said opposite end (14.2, 16.2) at the radial position of said free end (14.1, 16.1) of the respective mold core (14, 16), run continuously.

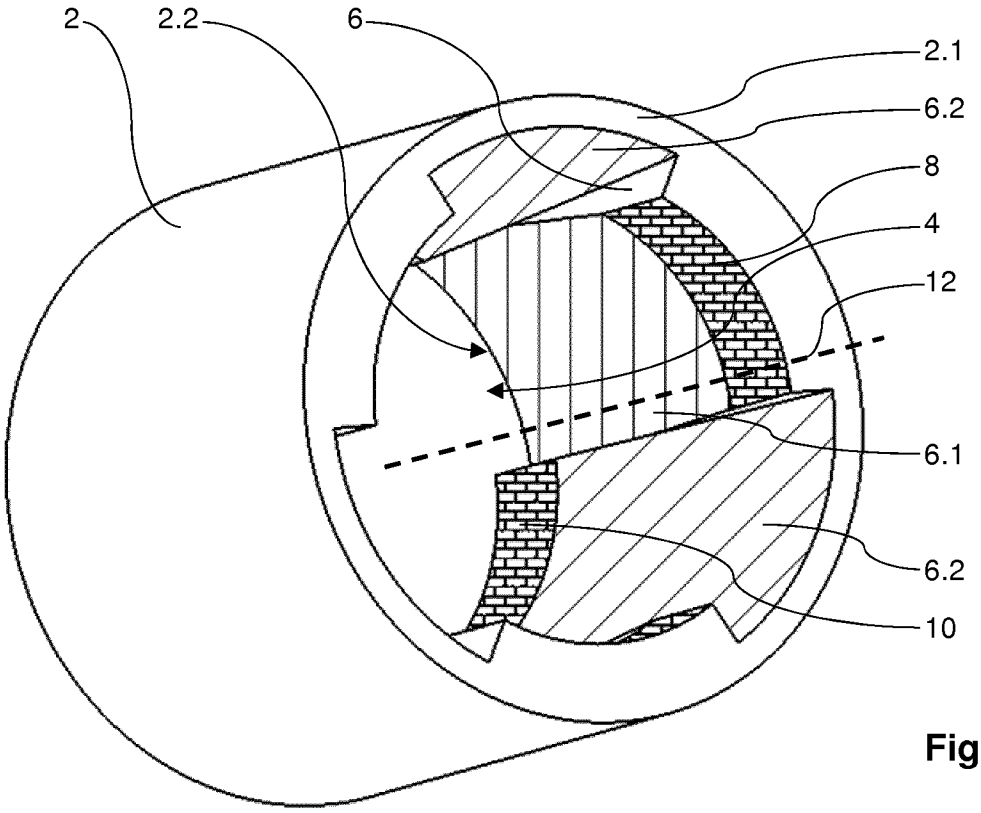


Fig. 1

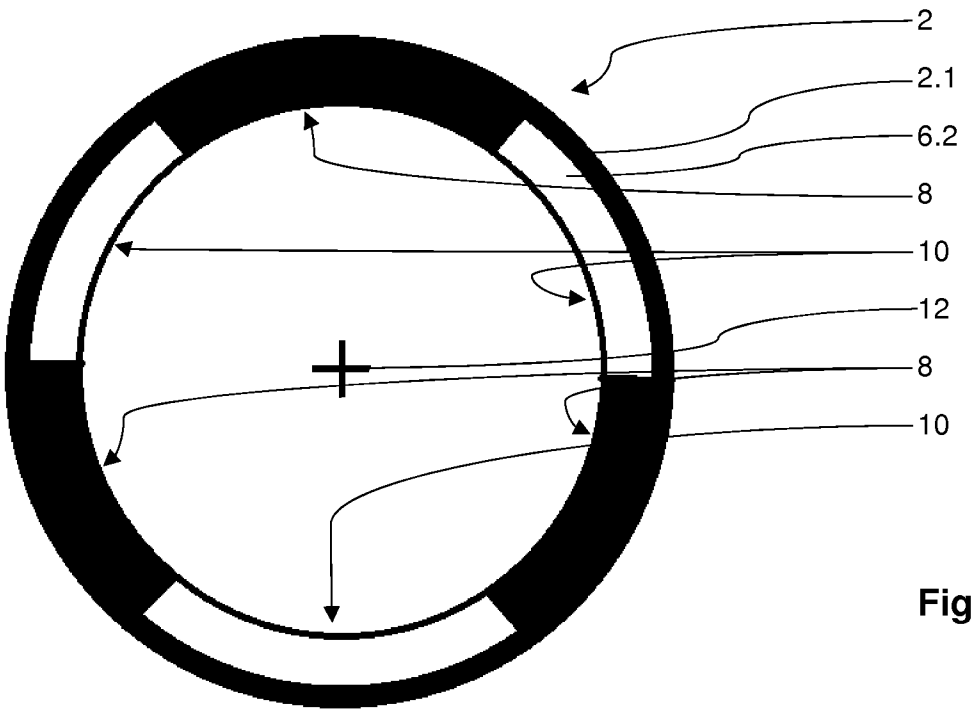


Fig. 2

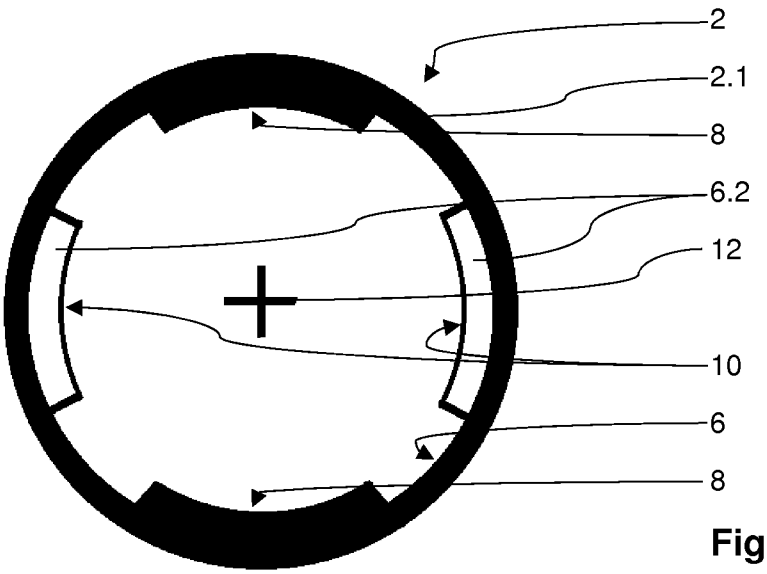


Fig. 3

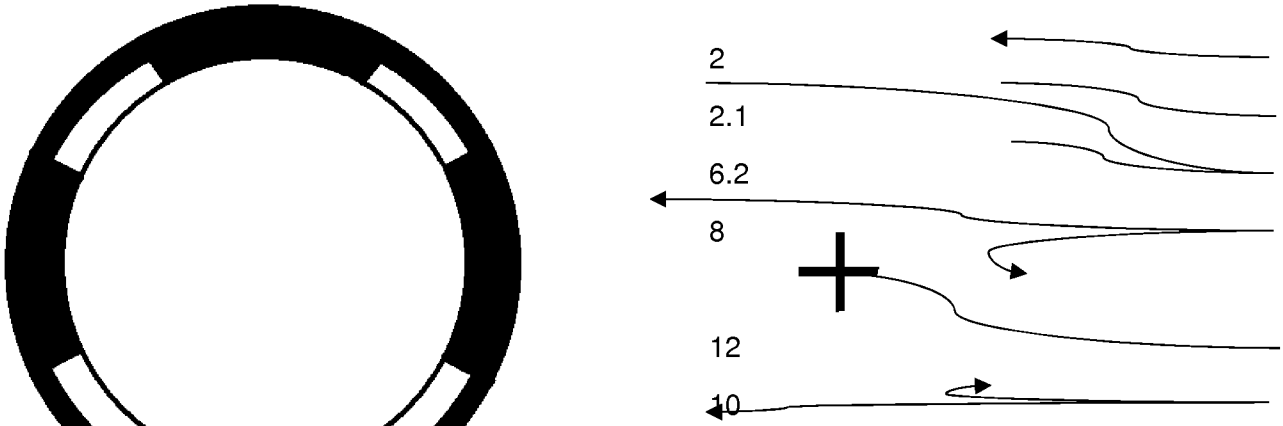


Fig. 4

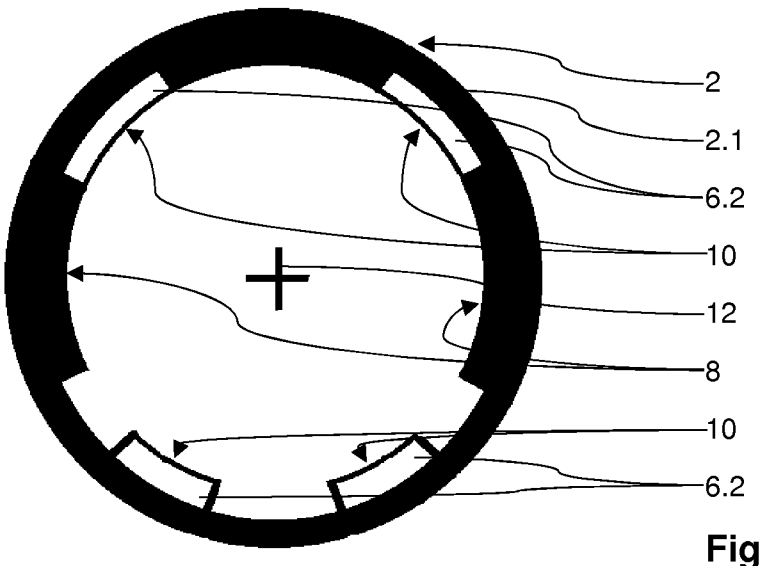


Fig. 5

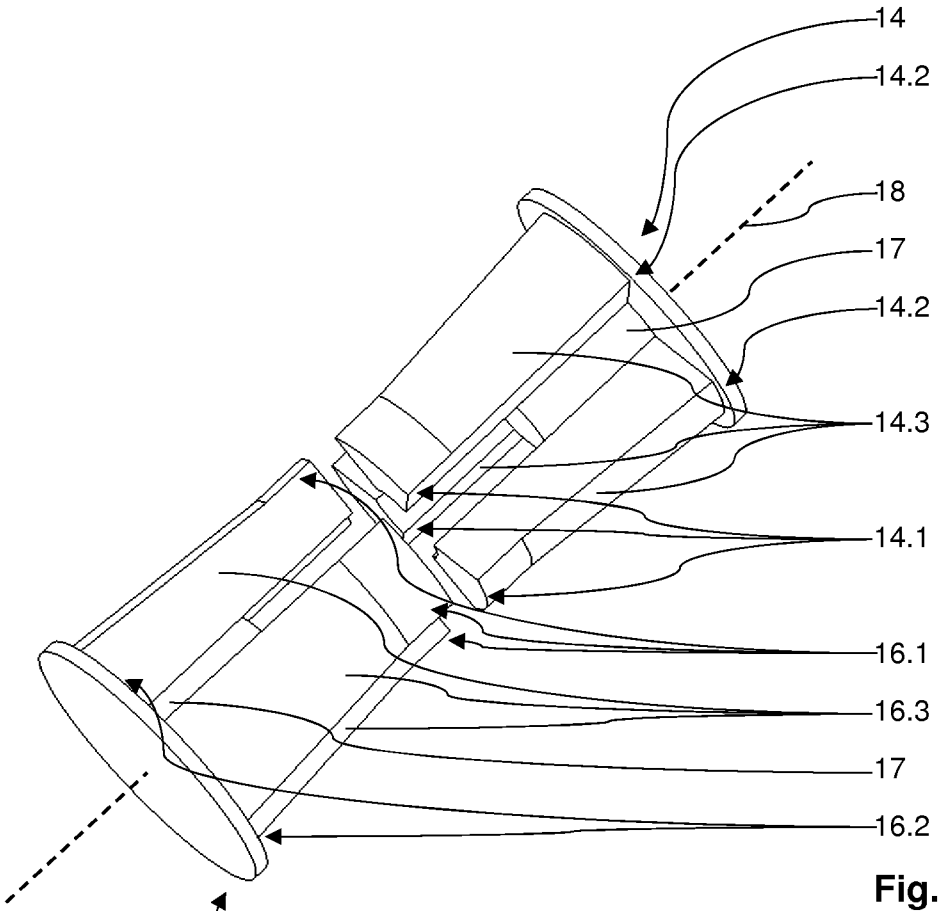

14
14.2
18
17
14.2
14.3
14.1
16.1
16.3
17
16.2

Fig. 6

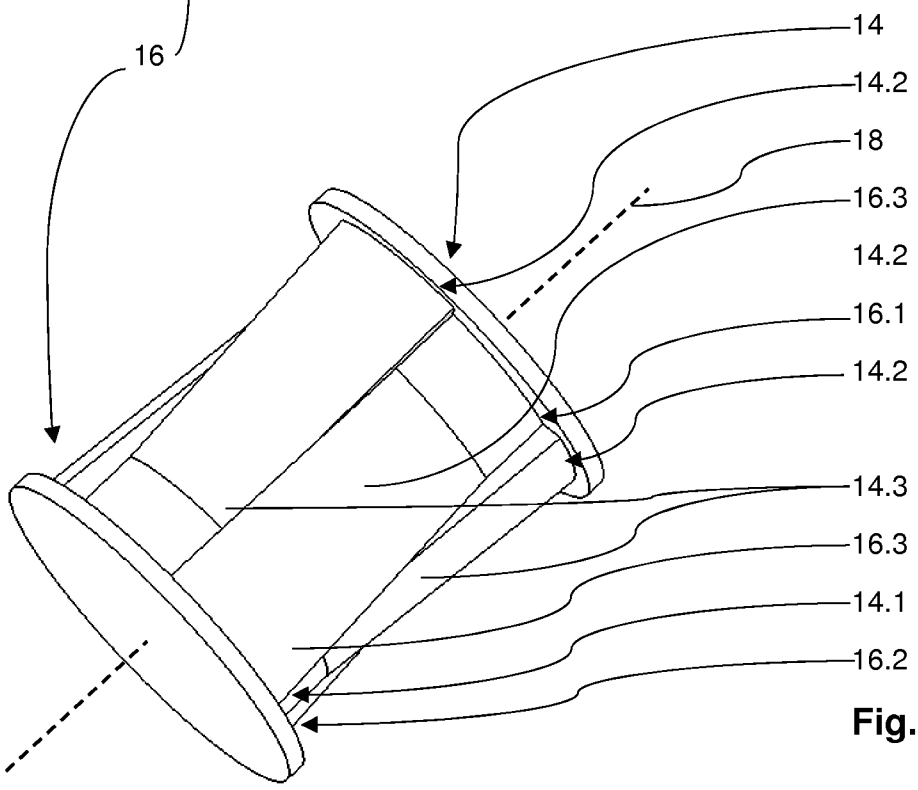

16
14
14.2
18
16.3
14.2
16.1
14.2
14.3
16.3
14.1
16.2

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/070941

A. CLASSIFICATION OF SUBJECT MATTER
INV. F16C33/20 B29C45/44
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 B29C B29L

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 practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2009/103840 A1 (HIBI KENJI [JP] ET AL) 23 April 2009 (2009-04-23) figure 26	1,2,4-6
X	US 4 208 075 A (TEMPLETON WILLIAM B [US]) 17 June 1980 (1980-06-17)	1-6
A	figures 1-4	7,8
X	US 2008/144984 A1 (VOGT ANDREAS [DE] ET AL) 19 June 2008 (2008-06-19)	1-8
A	figures 1-8	9,10
A	DE 197 47 792 A1 (RAPP ERICH [DE]) 6 May 1999 (1999-05-06) cited in the application figures 1-10	9,10

☐ 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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"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
26 May 2017	09/06/2017

Name and mailing address of the ISA/	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Fax: (+31-70) 340-3016	Hutter, Manfred

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2016/070941

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DE 19747792 A1	06-05-1999	NONE	