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(54) Title: AN IMAGING SYSTEM FOR A MOTOR VEHICLE

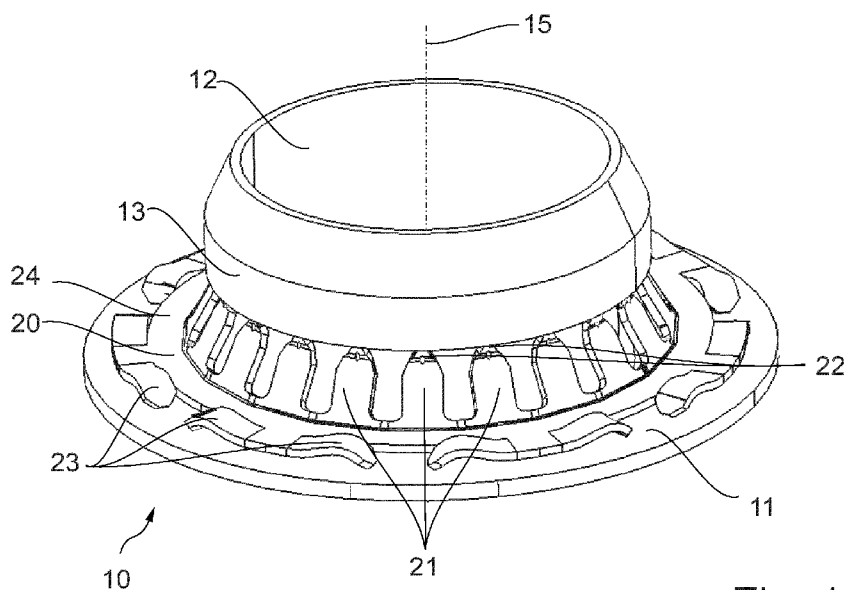


Fig. 1

(57) Abstract: An imaging system (10) for a motor vehicle, comprising a camera mounting part (11), at least one camera module (12) to be mounted to said camera mounting part (11) and a retainer ring (20). The camera module (12) is provided with at least one radially outwardly directed protrusions (13). The retainer ring (20) has multiple elastically deformable spring tongues (21), and the retainer ring (20) is attachable by pushing it over the at least one protrusions (13) under elastic deformation of the spring tongues (21) to an attachment position. Said spring tongues (21) clamp the camera module (12) radially in the attachment position, and the tips (22) of at least three spring tongues (21) axially adjoin a surface (14) of the at least one protrusion (13) in the attachment position. The retainer ring (20) has multiple spring elements (23) applying an axially spring force from said camera mounting part (11) to the tips (22) of the at least three spring tongues (21) in the attachment position.

(84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, KM, ML, MR, NE, SN, TD, TG).

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An imaging system for a motor vehicle

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The invention relates to an imaging system for a motor vehicle comprising the features of the preamble of claim 1.

An imaging system for a motor is known for example from the EP
10 2 942 939 A1, wherein the imaging system comprises a camera mounting part and at least one camera module to be mounted to said camera mounting part. The camera module comprises a lens objective, a lens holder holding said lens objective, an image sensor and a back plate holding said image sensor. The camera
15 module is attached by rotation locking means.

Another imaging system for a motor vehicle is known for example from the EP 3 379 330 A1, with a camera mounting part and a camera module mounted to said camera mounting part. The camera
20 module is provided with a radially outwardly directed protrusion and a retainer ring, wherein the retainer ring comprises a first ring element made from a rigid material and a second ring element made from a flexible material. The retainer ring is attached by pushing it over the protrusion under
25 elastic deformation of the second ring element made from the flexible material to an attachment position, wherein the camera module is attached to the camera mounting part by being clamped to the camera mounting part when the retainer ring is in the attachment position.

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With respect to the prior art, it is the object of this invention to provide an imaging system in which the attachment of a camera module to a camera mounting part is further improved.

The invention solves the problem with the subject matter of the independent claims.

5 According to the basic idea of the invention an imaging system for a motor vehicle is proposed, comprising a camera mounting part, at least one camera module to be mounted to said camera mounting part and a retainer ring. The camera module is provided with at least one radially outwardly directed protrusions. The retainer ring has multiple elastically deformable
10 spring tongues. Further, the retainer ring is attachable by pushing it over the at least one protrusions under elastic deformation of the spring tongues to an attachment position. Said spring tongues clamp the camera module radially in the attachment position, wherein the tips of at least three spring
15 tongues axially adjoin a surface of the at least one protrusion in the attachment position. The retainer ring has multiple spring elements applying an axially spring force from said camera mounting part to the tips of the at least three spring
20 tongues in the attachment position.

Accordingly, the spring force applied by the retainer ring in the attachment position pushes the surface of the protrusion of the camera module away from the camera mounting part. This
25 spring force pushes axially, thus preferably in alignment with the optical axis of the camera module. The axial spring force is preferably mainly generated through elastic deflection of the spring elements, wherein the spring tongues have far less deflection in this direction due to axial loads respectively
30 due to the axial spring force. Thus, in the attachment position the spring tongues apply a radially inward directed spring force, which is perpendicular to the optical axis, in order to clamp preferably a barrel shaped part of the camera

module and transfer the axial spring force from the spring elements towards the at least one protrusion of the camera module.

5 In order to transfer the axial spring force, the tips of at least three spring tongues are adjoin to a surface of the at least one protrusion, preferably a surface of the at least one protrusion facing the surface of the camera mounting part, and are in contact. Having three tips in contact with the at least
10 one protrusion allows a stable positioning in the attachment position without tilting the camera module.

It is further suggested that all tips of the spring tongues axially adjoin a surface of the at least one protrusion. This
15 allows a wider spread load transfer area of the axial spring load and an easier mounting process.

Preferably, the part of the camera module with the protrusion is put through a hole in the camera mounting part before push-
20 ing the retainer ring over the at least one protrusion. Accordingly, the part of the camera module without said protrusion is preferably not put through the hole of the camera mounting part and remains on the side of the camera mounting part opposite to the side designated for the retainer ring.
25 Preferably, the remaining part of the camera module abuts the camera mounting part, and provides a counter bearing.

The assembly of the imaging system, which locks the camera module in place, can be inspected and verified easily, e.g.
30 through visual inspection. Furthermore, the dimensions of the retainer ring can be verified in advance of the assembly. The retainer ring can be preferably made of one material only, which reduces complexity and costs of the imaging system. In

general, a more robust design of an imaging system can be achieved.

The risk of deforming or damaging the spring elements during assembly, for example, is reduced by limiting the maximum deflection of the spring element by a limit stop when the base ring comes into contact with the camera mounting part.

It is further suggested that the spring tongues have an angle to the optical axis of the camera module smaller than 45° , preferably smaller than 30° in the attachment position. This reduces the deflection of the spring tongues due to axial loads, so that the axial spring loads can be provided by the spring elements in a more precise way.

Furthermore, it is preferred that the retainer ring is made of an electrically conductive material. Such a retainer ring can provide an electromagnetic shielding between the camera mounting part and camera module, achieving a second function besides ensuring pressure between the camera module and the camera mounting part. This further improves the attachment of a camera module to a camera mounting part.

It is further preferred that the retainer ring forms an electrical connection between the camera module and the camera mounting part. This ensures a tight electromagnetic shielding of the imaging system and removes the need for an electric contact elsewhere. The connection is made over the entire circumference, with the openings in the retainer ring, e.g. between spring tongues and/or spring elements, being so small that the relevant electromagnetic radiation is contained or shielded. To ensure sufficient connection between these parts

the connection area is minimized thus ensuring a higher surface pressure.

According to a further preferred embodiment said electrically
5 conductive material is a metal and/or an alloy, preferably a spring steel. This way the imaging system has a very low sensitivity to aging, to different temperatures and to temperature changes. Further on, the imaging system is enabled with a stable performance over time and over the normal usage temperatures.
10 atures. A low sensitivity to humidity changes can be achieved as well and the retainer ring has very low variations in dimensions over its lifetime.

It is further proposed that the spring tongues are arranged at
15 an inner diameter of a basis ring of said retainer ring. This enables the use of low-cost manufacturing techniques, like stamping.

Further on, it is proposed that the spring elements are arranged at an outer diameter of a basis ring of said retainer ring. This also enables the use of low-cost manufacturing techniques, like stamping.

Furthermore, it is preferred that said spring tongues extent
25 axially to a first side of the retainer ring. Axially refers to the optical axis of the camera module or an axis parallel thereto, wherein the retainer ring is preferably provided around said optical axis in the attachment position.

30 In a preferred embodiment said spring elements extent axially to a second side of the retainer ring. Thus, the mechanical connection between the camera module and the camera mounting part can be spring loaded axially in the attachment position.

The retainer ring is preferably provided around said optical axis in the attachment position, and axially refers to the optical axis of the camera module or an axis parallel thereto.

5 According to a preferred embodiment, the tips of the spring tongues have backbends directed radially outward. The backbends provide rounded surfaces of the spring tongues which are in contact with the camera module during assembly and in the attachment position. The rounded surface minimizes the risk of
10 scratches on the camera module due to sharp edges. Further on, the tips of spring tongues are thus in a better position for locking with the surface of the at least one protrusion.

In a further preferred embodiment beads are provided in the
15 backbends of said tips of the spring tongues. The beads increase the stiffness of the tips of the spring tongues, which can be especially beneficial under compression loads in the attachment position.

20 Furthermore, it is proposed that the retainer ring is a one-piece design. This allows an easy and cost-efficient production of the retainer ring with reduced complexity of the imaging system.

25 In a preferred embodiment the retainer ring is a closed ring. The closed ring enables higher clamping forces of the spring tongues to the camera module. A higher dimensional stability of the retainer ring can be achieved.

30 Furthermore, the retainer ring is preferably formed as a stamped sheet. The retainer ring can therefore be made rapidly out of sheet metal.

In the following the invention shall be illustrated on the basis of preferred embodiments with reference to the accompanying drawings, wherein:

- 5 Fig. 1 shows an imaging system with a camera mounting part, a camera module and a retainer ring;
- Fig. 2 shows an imaging system in a cross-sectional view;
- 10 Fig. 3 shows a retainer ring in a cross-sectional view;
- Fig. 4 shows a camera mounting part and a camera module in a cross-sectional view;
- 15 Fig. 5 shows a retainer ring during an assembly process.

In Fig. 1 a preferred embodiment of an imaging system 10 for a motor vehicle is shown, wherein the figure is simplified and only a part of the imaging system 10 is shown.

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The imaging system 10 comprises a camera mounting part 11 and a camera module 12 mounted to said camera mounting part 11. The camera module 12 has an optical axis 15 and extends through a hole 16, see Fig. 2, in the camera mounting part 11.

25 The camera module 12 has a circular outwardly directed protrusion 13. The protrusion 13 has a slope and/or bevel in the direction pointing away from the camera mounting part 11. The protrusion 13 has a surface 14, which is facing towards the camera mounting part 11.

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A retainer ring 20 has been pushed over the protrusion 13 and is shown in an attachment position. In the attachment position the camera module 12 has a fixed position with respect to the

camera mounting part 11. The retainer ring 20 has a basis ring 24, wherein multiple spring tongues 21 extend radially inward and axially away from the camera mounting part 11 from the basis ring 24. Further on, multiple spring elements 23 are provided radially outward of the basis ring 24 and extend axially towards the camera mounting part 11 from the basis ring 24. The spring elements 23 have a bow which is bent away from the camera mounting part 11. The spring elements 23 further extend along the circumference, wherein two spring elements 23 share the same basis and form a pair in this embodiment.

The spring tongues 21 clamp the camera module 12 below the protrusion 13 in the attachment position. The tips 22 of the spring tongues 21 are in contact with the lower surface 14 of the protrusion 13 which faces the camera mounting part 11. Thus, an axial spring force pushes the protrusion 13 of the camera module 12 upward, which is countered by a counter bearing below the hole 16 of the camera mounting part 11, not shown. The spring elements 22 are also in contact with a lower barrel shaped part of the camera mounting part 11 and are elastically deflected in the attachment position.

The retainer ring 20 is a closed ring which is clipped between the protrusion 13 and the camera mounting part 11. The retainer ring 20 is made of spring steel in a one-piece design. Therefore, the retainer ring 20 can be made from a metal sheet in a cost-effective way. An electromagnetic shielding can be provided by the retainer ring 20, increasing the electromagnetic compatibility of the imaging system 10. An electric connection, e.g. ground, between the camera module 12 and the camera mounting part 11 is provided by the retainer ring 20 in this embodiment.

In Fig. 2 a cross-sectional view of the imaging system 10 is shown. The basis ring 24 and the camera mounting part 11 are spaced apart, wherein the spring elements 23 are in contact with the camera mounting part 11.

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The spring tongues 21 are bent away from the camera mounting part 11 and clamp the cylindrical part of the camera module 12 in the attachment position. In this position the spring tongues 21 have an angle α to the optical axis 15 of the camera module 12 smaller than 45° , for example 30° .

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Fig. 3 shows a retainer ring 20 in a cross-sectional view. The tips 22 of the spring tongues 21 have backbends 25, so that the edges of the spring tongues 21 are not in a radial contact with the camera module 12 reducing the possibility of scratching during the mounting process or assembly process. The backbends 25 are further provided with a bead 26 each which stabilizes the backbends 25.

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Fig. 4 and Fig. 5 show an imaging system 10 during an assembly process. In Fig. 4 the part of the camera module 12 with the protrusion 13 has been put through the hole 16 of the camera mounting part 11 from below. The lower part of the camera module 12 below the camera mounting part 11 is not shown. The protrusion 13 has a circular shape with a diameter smaller than the hole 16 which has also a circular shape in this embodiment.

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Fig. 5 shows the assembly of the imaging system 10, wherein the retainer ring 20 is pushed down with a cylindrical mounting tool 27 over the protrusion 13 until the retained ring 20 is clipped below the protrusion 13 and the tips 22 of the spring tongues 21 are in contact with the surface 14 of the

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protrusion 13. The spring elements 23 are compressed during the assembly and when releasing the mounting tool 27 the spring elements 23 create a spring force between the camera module 12 and the camera mounting part 11 in the direction of the optical axis 15. Then, the spring tongues 21 act as a locking mechanism. During assembly the retainer ring 20 can be pressed down by the mounting tool 27 until the base ring 24 and the camera mounting part 11 are in contact. Thus, it is not possible to press the retainer ring 20 too hard and plastically deform the spring elements 23. When the mounting tool 27 is removed the base ring 24 and camera mounting part 11 are spaced apart in the attachment position.

Claims:

1. An imaging system (10) for a motor vehicle, comprising
 - a camera mounting part (11), at least one camera module
 - 5 (12) to be mounted to said camera mounting part (11) and a retainer ring (20), wherein
 - the camera module (12) is provided with at least one radially outwardly directed protrusions (13), characterized in that
 - 10 - the retainer ring (20) has multiple elastically deformable spring tongues (21), and
 - the retainer ring (20) is attachable by pushing it over the at least one protrusions (13) under elastic deformation of the spring tongues (21) to an attachment position,
 - 15 wherein
 - said spring tongues (21) clamp the camera module (12) radially in the attachment position, wherein
 - the tips (22) of at least three spring tongues (21) axially adjoin a surface (14) of the at least one protrusion
 - 20 (13) in the attachment position, and wherein
 - the retainer ring (20) has multiple spring elements (23) applying an axially spring force from said camera mounting part (11) to the tips (22) of the at least three spring tongues (21) in the attachment position.
 - 25
2. An imaging system (10) according to claim 1, characterized in that,
 - the spring tongues (21) have an angle (α) to an optical
 - axis (15) of the camera module (12) smaller than 45° in
 - 30 the attachment position.
3. An imaging system (10) according to any one of the preceding claims, characterized in that,

- the retainer ring (20) is made of an electrically conductive material.

4. An imaging system (10) according to claim 3, characterized in that,

- the retainer ring (20) forms an electrical connection between the camera module (12) and the camera mounting part (11).

5. An imaging system (10) according to claim 3 or 4, characterized in that,

- said electrically conductive material is a metal and/or an alloy, preferably spring steel.

6. An imaging system (10) according to any one of the preceding claims, characterized in that,

- the spring tongues (21) are arranged at an inner diameter of a basis ring (24) of said retainer ring (20).

7. An imaging system (10) according to any one of the preceding claims, characterized in that,

- the spring elements (23) are arranged at an outer diameter of a basis ring (24) of said retainer ring (20).

8. An imaging system (10) according to any one of the preceding claims, characterized in that,

- said spring tongues (21) extend axially to a first side of the retainer ring (20).

9. An imaging system (10) according to any one of the preceding claims, characterized in that,

- said spring elements (23) extend axially to a second side of the retainer ring (20).

10. An imaging system (10) according to any one of the preceding claims, characterized in that,
- the tips (22) of the spring tongues (21) have backbends
5 (25) directed radially outward.
11. An imaging system (10) according to claim 10, characterized in that,
- beads (26) are provided in the backbends (25) of said
10 tips (22) of the spring tongues (21).
12. An imaging system (10) according to any one of the preceding claims, characterized in that,
- the retainer ring (20) is a one-piece design.
15
13. An imaging system (10) according to any one of the preceding claims, characterized in that,
- the retainer ring (20) is a closed ring.
- 20 14. An imaging system (10) according to any one of the preceding claims, characterized in that,
- the retainer ring (20) is formed as a stamped sheet.

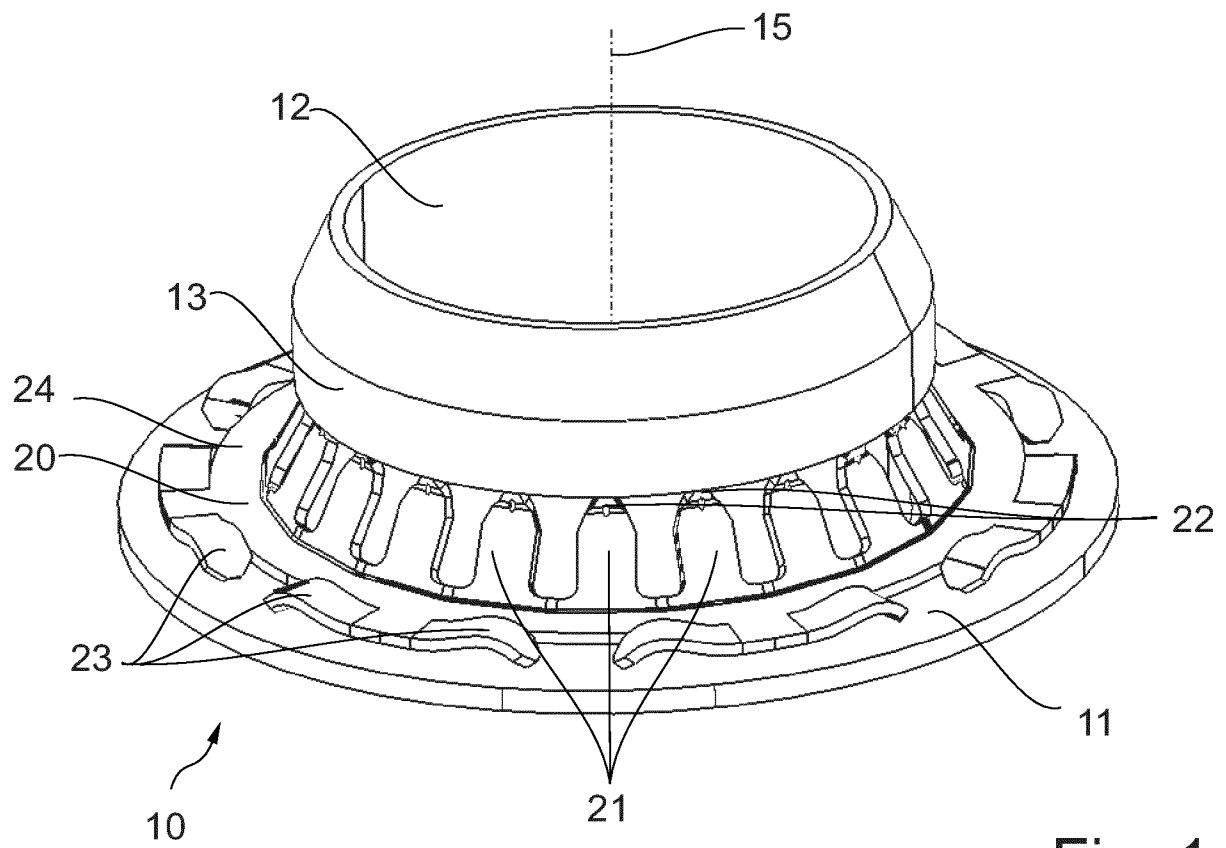


Fig. 1

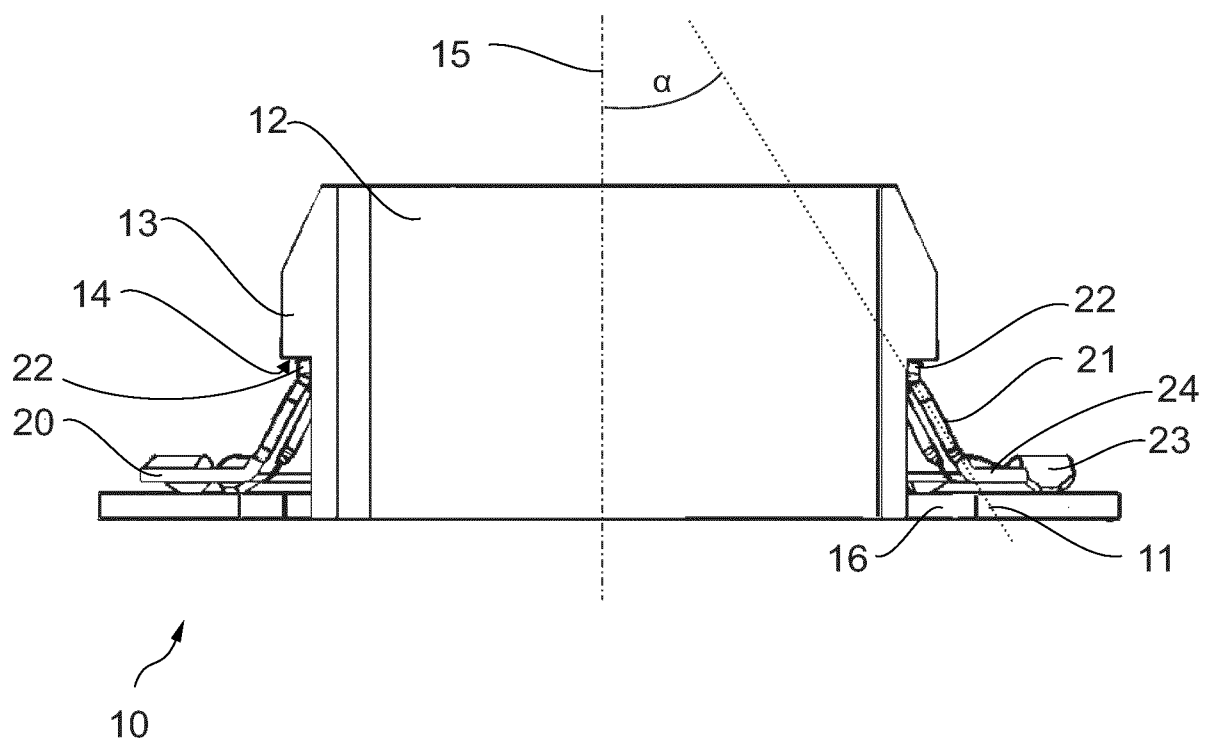


Fig. 2

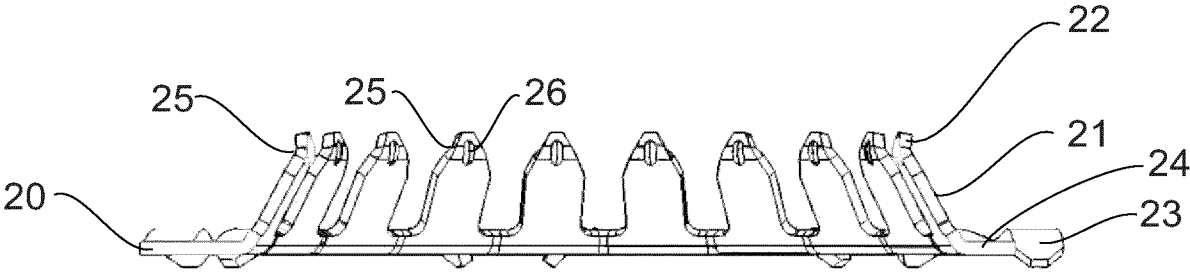


Fig. 3

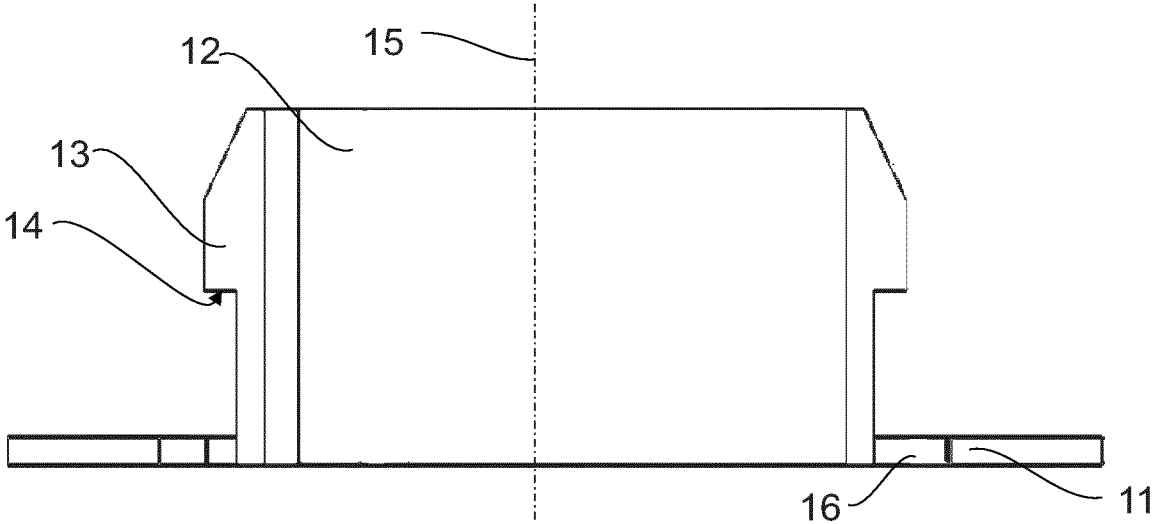


Fig. 4

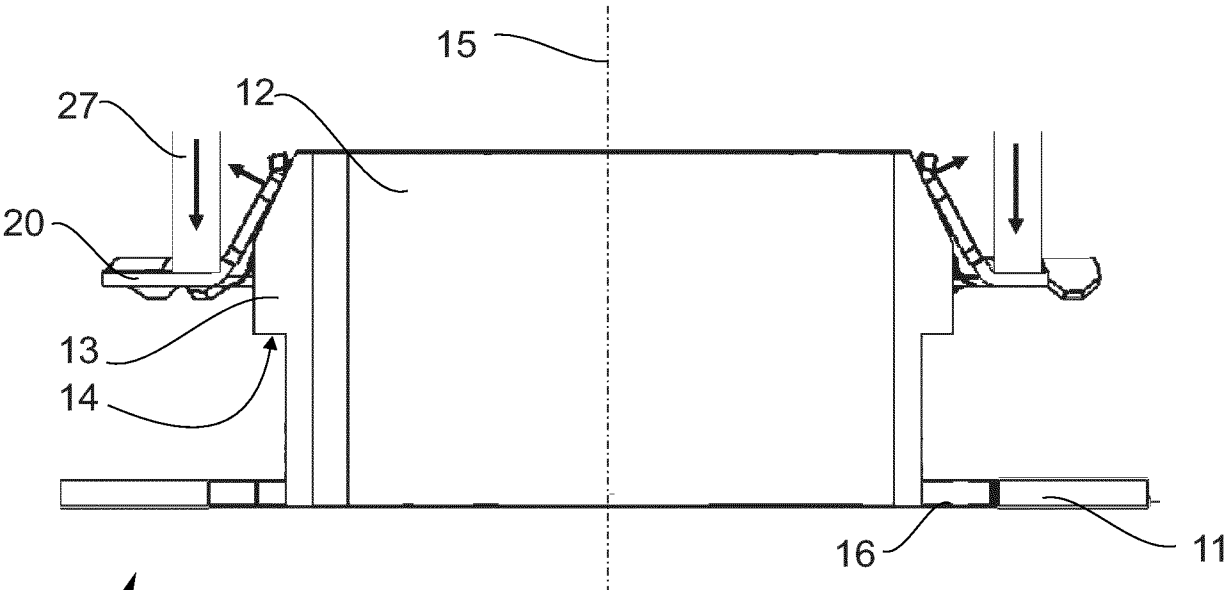


Fig. 5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2022/063173

A. CLASSIFICATION OF SUBJECT MATTER

INV. H04N5/225 B60R11/04
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)

H04N B60R

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.
A	EP 3 379 330 A1 (VEONEER SWEDEN AB [SE]) 26 September 2018 (2018-09-26) cited in the application paragraphs [0019] - [0023]; claim 5 -----	1-14
A	US 2018/287306 A1 (GRIMES CAROL [IE] ET AL) 4 October 2018 (2018-10-04) paragraphs [0057] - [0058]; figures 6,7 -----	1-14



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

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

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"Y" document of particular relevance;; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2022/063173

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 3379330	A1	26-09-2018	NONE	
US 2018287306	A1	04-10-2018	DE 102015121396 A1	14-06-2017
			EP 3386802 A1	17-10-2018
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			WO 2017097658 A1	15-06-2017