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[Continued on next page]

(54) Title: METHOD FOR MANUFACTURING A CAMERA FOR A MOTOR VEHICLE COMPRISING ELECTRICAL CONNECTING OF A CIRCUIT BOARD AND A LENS HOUSING, CAMERA, DRIVER ASSISTANCE SYSTEM AS WELL AS MOTOR VEHICLE

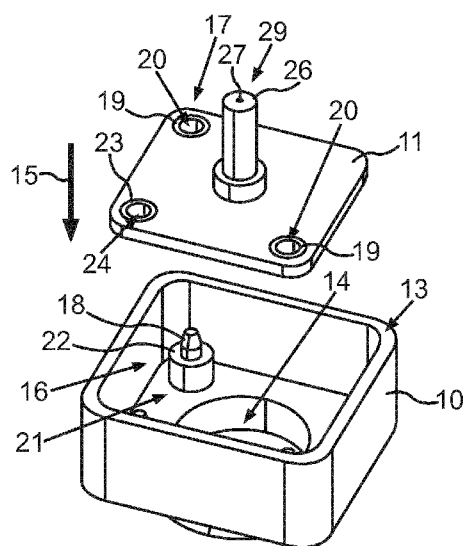


Fig.2

(57) Abstract: The invention relates to a method for manufacturing a camera (4) for a motor vehicle (1), in which a lens housing (10) and a circuit board (11) are provided, wherein the lens housing (10) has an electrically conductive base body (12) and an electrically insulating coating (13), and wherein the circuit board (11) is arranged in the lens housing (10) and is electrically connected with the base body (12) of the lens housing (10), wherein on the lens housing (10) a fastening device (16) and on the circuit board (11) a holding device (17), which corresponds to the fastening device (16) are arranged, wherein the fastening device (16) and the holding device (17) are connected in such a way that the coating (13) of the lens housing (10) is removed in an area of the fastening device (16) from the base body (12) at least in portions.



SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, **Published:**
GW, KM, ML, MR, NE, SN, TD, TG).

— *with international search report (Art. 21(3))*

Method for manufacturing a camera for a motor vehicle comprising electrical connecting of a circuit board and a Lens Housing, camera, driver assistance system as well as motor vehicle

The present invention relates to a method for manufacturing a camera for a motor vehicle, in which a lens housing and a circuit board are provided, wherein the lens housing has an electrically conductive base body and an electrically insulating coating, and wherein a circuit board is arranged within the lens housing and is electrically connected with the base body of the lens housing. The present invention further relates to a camera for a motor vehicle. In addition, the present invention relates to a driver assistance system comprising at least one such camera. Finally, the present invention relates to a motor vehicle with such a driver assistance system.

The interest is focused in particular on cameras for motor vehicles. Such cameras can, for example, be part of a driver assistance system of the motor vehicle, by means of which the environmental region of the motor vehicle can be captured. In this connection it can in particular be envisaged that several cameras are disposed distributed on the motor vehicle. The environmental region captured by the cameras or the video data provided by the cameras can be displayed for instance on a corresponding display device to the driver of the motor vehicle. In this way, the driver can be assisted in driving the vehicle.

Hitherto used cameras usually have a lens housing in which a lens of the camera is held. In this lens housing usually a circuit board with electronic components is arranged, which can generate electromagnetic interferences during operation. The lens housing can, for example, have a base body, which is formed from an electrically conductive material. Furthermore, the lens housing can have a coating, which is applied to the base body and is formed from an electrically insulating material. The coating serves for protecting the lens housing, which for example is formed from aluminum, against corrosion and external environmental influences. Moreover, the camera usually has a rear housing or a rear plate, which is formed from an electrically conductive material. In order to provide sufficient a shielding for electromagnetic interferences it is in particular envisaged that the lens housing is connected with a ground terminal of the camera. The lens housing can in particular be connected with a ground terminal that is arranged on the circuit board. In order to provide an electrical and mechanical connection between the circuit board and the lens housing commonly corresponding screw joints are used. In this connection the

screws, which are electrically connected with the circuit board, are screwed into a thread that is arranged in the base body of the lens housing.

It is object of the present invention to provide a solution how a camera of the initially mentioned kind can be manufactured in a simpler way and at the same time allows for reliable operation.

According to the invention, this object is solved by a method, by a camera, by a driver assistance system, and by a motor vehicle having the features of the respective independent claims. Advantageous embodiments of the invention are the subject matter of the dependent claims, of the description, and of the figures.

A method according to the invention serves for manufacturing a camera for a motor vehicle. In this connection a lens housing and a circuit board are provided, wherein the lens housing has an electrically conductive base body and an electrically insulating coating, and wherein the circuit board is arranged within the lens housing and is electrically connected to the base body of the lens housing. Moreover, on the lens housing a fastening device is arranged and on the circuit board a holding device corresponding to the fastening device is arranged, wherein the fastening device and the holding device are connected in such a way that the coating of the lens housing is removed in an area of the fastening device from the base body at least in portions.

The camera serves for arrangement on the motor vehicle. For example the camera can have a motor vehicle fastening device for fastening the camera to the vehicle. The camera comprises a lens housing, which can have a corresponding recess, in which a lens of the camera can be fastened by a corresponding lens holder. The lens housing has a base body, which can be formed from aluminum. To this base body a coating is applied, which is formed from an electrically insulating material or an electrically non-conducting material. This coating serves for protecting the lens housing against corrosion and/or environmental influences. In addition the camera has a circuit board, on which electronic components are arranged. These electronic components can for example be an image sensor, an image processing unit, parts of the voltage supply of the camera, and the like. During operation of the camera the electronic components can generate electromagnetic interferences. In addition, the camera can include a rear housing, which can be connected with the lens housing, which can also be designated as front housing. By the lens housing and the rear housing the electromagnetic interferences can be shielded off.

In addition, the circuit board, in particular a ground terminal of the circuit board, is connected with the base body of the lens housing.

According to the invention it is envisaged that the lens housing has a fastening device and the circuit board has a holding device, which corresponds to the fastening device. When arranging the circuit board within the lens housing, the fastening device and the holding device are connected in such a way that the coating of the lens housing is removed in an area of the fastening device from the base body at least in portions. In other words, the fastening device and the holding device are configured in such a way that, when connecting the fastening device with the holding device, the coating arranged on the fastening device is removed or detached by the holding device. Thus, when connecting the fastening device with the holding device the coating or parts thereof are taken off the fastening device and thus an electrical connection between the circuit board and the lens housing is provided. Thus, for example a screw connection can be done without.

Preferably, as the fastening device a first contact pin is provided, which is coated with the coating, and as the holding device an element formed from an electrically conductive material is provided, which has a first through-opening corresponding to the contact pin. As the fastening device a first contact pin can be provided in the lens housing. On the circuit board at least one electrically conductive element is provided which has a through-opening. When arranging the circuit board within the lens housing, the through-opening is put on the contact pin. In this connection the coating is removed from the contact pin by the force effect of an area of the through-opening at least in portions. Thus, an electrical connection between the circuit board and the lens housing can be provided in a simple way.

Furthermore, when connecting the fastening device to the holding device advantageously the first contact pin is pressed into the first through-opening. In this connection the first contact pin can be designed in such a way that it is not deformed elastically upon being connected with the through-opening. Between the first contact pin and the through-opening a force-fit and/or a form-fit connection can be provided. Thus, it can be ensured that the circuit board is reliably retained in a mounting position within the lens housing. According to a further embodiment of the invention the first contact pin and the first through-opening are provided in such a way that an outer diameter of the first contact pin with the coating is larger than a diameter of the first through-opening. The outer diameter of the first contact pin can be for example at the maximum 0.5 mm larger than the

diameter of the first through-opening. Thus, it can be reliably achieved that the coating is removed from the first contact pin or its base body when connecting the first through-opening with the first contact pin.

Furthermore, advantageously as the fastening device two first contact pins are provided and as the holding device two electrically conductive elements with two respective second through-openings are provided, wherein the two electrically conductive elements are arranged on opposite sides of the circuit board. In other words, the circuit board can have several through-openings which serve as holding devices. The lens housing can have a plurality of first contact pins, which correspond to the first through-openings. Thus, it can for instance be achieved that the circuit board in the mounted state is reliably held within the lens housing.

According to a further embodiment, as the coating of the lens housing an anodized layer is provided. In particular, the coating can be effected by anodizing. The lens housing can for example be formed from an anodized aluminum. In this connection the coating can have a layer thickness of between 0.5 and 150 μm , preferably 10 to 15 μm . Such anodization provides reliable protection against corrosion and/or environmental influences. Furthermore, it can be achieved that this anodization is removed from the first contact pin when the first contact pin is connected with the first through-opening.

Preferably, an adjustment device is provided for adjusting the circuit board to the lens housing when arranging the circuit board within the lens housing. The adjustment device, on the one hand, can serve for mounting the circuit board in the correct position when arranging the circuit board within the lens housing. Further, the adjustment device can serve for providing a guidance when arranging the circuit board within the lens housing. Thus, the mounting of the circuit board within the lens housing can be effected in a simple easy and reliable way.

Preferably, for providing the adjustment device on the lens housing a second contact pin and on the circuit board a second through-opening, which corresponds to the second contact pin is provided. In this connection the second contact pin and the corresponding second through-opening can be configured in such a way that a diameter of the second through-opening is larger than an outer diameter of the second contact pin. The connection of the second contact pin with the second through-opening merely serves for guiding the circuit board when it is mounted within the lens housing. In this connection it can also be envisaged that the second contact pin is longer in comparison to the first

contact pin. Accordingly, when arranging the circuit board within the lens housing, to start with, a connection between the second contact pin and the second through-opening is provided and subsequently a connection between the at least one first contact pin and the at least one first through-opening is provided.

Furthermore, advantageously a rear housing is connected with the lens housing, wherein the rear housing has a limitation device for limiting a movement of the circuit board. The rear housing can also be formed from an electrically conductive material, for example aluminum. The rear housing and the lens housing can for example be connected with each other by means of a screw connection. In this connection in the rear housing at least one elevation is provided, which serves as a limitation device for limiting the movement of the circuit board. In this connection in particular the movement of the circuit board can be limited in a movement direction that is contrary to the mounting direction. The limitation device can in particular serve for holding the circuit board in the mounting position.

Preferably, the rear housing has an opening and an interface device of the camera is passed through the opening. On the circuit board a corresponding interface device can be arranged, by which the circuit board can be electrically connected with a vehicle data bus. The interface device can for example comprise a coaxial plug. This plug can be guided to the outside by a corresponding guidance in the rear housing of the camera.

In this connection, advantageously a sealing element is arranged between the opening of the rear housing and the interface device. The sealing element can for example be designed as O-ring. Thus, the rear housing and/or the clearance between the interface device and the rear housing can be sealed.

According to the invention, a camera for a motor vehicle comprises a lens housing and a circuit board, wherein the lens housing has an electrically conductive base body and an electrically insulating coating, and wherein the circuit board is arranged within the lens housing and electrically connected with the base body of the lens housing. On the lens housing a fastening device and on the circuit board a holding device, which corresponds to the fastening device, are provided, wherein the fastening device and the holding device are connected in such a way that the coating of the lens housing is removed in the area of the fastening device from the base body at least in portions.

According to the invention, a driver assistance system for the motor vehicle comprises at least one camera. The at least one camera serves in particular for providing image

sequences and video data, which describe the environmental region of the motor vehicle. These video data can for example be provided on a display device of the motor vehicle. Accordingly, the at least one camera can be used to assist the driver in reversing and/or parking. The at least one camera can also be part of a so-called electronic rearview mirror.

A motor vehicle according to the invention comprises a driver assistance system according to the invention. The motor vehicle is in particular designed as a passenger vehicle.

The preferred embodiments presented with respect to the method according to the invention and their advantages correspondingly apply to the camera according to the invention, to the driver assistance system as well as to the motor vehicle according to the invention.

Further features of the invention may be gathered from the claims, the figures, and the description of the figures. The features and feature combinations mentioned above in the description as well as the features and feature combinations mentioned below in the description of the figures and/or shown in the figures alone can be used not only in the respectively specified combination, but also in other combinations or alone, without departing from the scope of the invention. Thus, also embodiments are to be considered as comprised and disclosed by the invention that are not explicitly shown in the figures and explained, but derive from and can be generated by separated feature combinations from the explained embodiments. Also embodiments and feature combinations are to be considered as disclosed, which thus do not have all of the features of an originally formulated independent claim.

With the indications "top", "bottom", "front", "rear", "horizontal", "vertical", "depth direction", "width direction", "height direction" etc. the positions and orientations given with intended use and intended arrangement of the camera on the motor vehicle and with an observer then standing in front of the camera and looking in the direction of the camera are specified.

The invention is now explained in more detail with reference to preferred embodiments as well as to the attached drawings.

They show in:

- Fig. 1 a motor vehicle according to an embodiment of the present invention which shows a driver assistance system comprising four cameras;
- Fig. 2 a perspective view of a lens housing and a circuit board of the camera;
- Fig. 3 a top view of the lens housing, into which a circuit board is inserted;
- Fig. 4 a sectional side view of the lens housing, into which the circuit board is inserted; and
- Fig. 5 a sectional side view of the camera.

In the figures, same elements and elements having the same function are equipped with the same reference signs.

Fig. 1 is a top view of a motor vehicle 1 according to an embodiment of the present invention. The motor vehicle 1 in the present case is designed as a passenger vehicle. The motor vehicle 1 includes a driver assistance system 2. The driver assistance system 2 in turn comprises a control device 3, which can be formed for example from an electronic control unit of the motor vehicle 1. Furthermore, the driver assistance system 2 comprises at least one camera 4. In the present embodiment the driver assistance system 2 comprises four cameras 4, which are disposed distributed on the motor vehicle 1. In the present case, one of the cameras 4 is arranged in a rear area 5 of the motor vehicle 1 and one of the cameras 4 is arranged in a front area 8 of the motor vehicle 1. The remaining cameras 4 are arranged in a respective lateral area 6, in particular in the area of the side-view mirrors. The number and arrangement of the cameras 4 of the driver assistance system 2 in the present case is to be taken as merely exemplary.

By the cameras 4 an environmental area 7 of the motor vehicle 1 can be captured. The four cameras 4 are preferably of an identical construction design. In particular an image sequence or video data describing the environmental area 7 can be provided by the cameras 4. These video data can be transmitted by cameras 4 to the control device 3. By the control device 3 a display device 9 of the motor vehicle 1 can be controlled so that the video data of the cameras 4 can be displayed to the driver. The driver assistance system 2 thus serves for assisting the driver of the motor vehicle 1 in driving the motor vehicle 1.

Fig. 2 shows a perspective view of a lens housing 10 and a circuit board 11 of the camera 4. The lens housing 10 has a base body 12 (which cannot be seen in Fig. 2) and a coating 13, which is applied to the base body 12. The base body 12 can be manufactured from an electrically conductive material, for example aluminum. The coating 13 can be an anodization which protects the base body 12 against environmental influences. The lens housing 10, which can also be referred to as a front housing, serves for holding a lens of the camera 4. For this purpose the lens housing has a corresponding through-opening 14, into which the lens of the camera 4 can for example be inserted by a corresponding lens holder.

The circuit board 11 comprises at least parts of the electronics of the camera 4. On the circuit board 11 electronic components (not shown here) can be arranged. The circuit board 11 now is to be inserted into the lens housing 10 and to be connected with the lens housing 10. A mounting device 15, along which the circuit board 11 is inserted into the lens housing 10, in the present case is illustrated by the arrow. The lens housing 10 has a fastening device 16 and the circuit board 11 has a holding device 17 corresponding to the fastening device 16. The fastening device 16 of the lens device comprise at least one first contact pin 18. This first contact pin 18 is also equipped with the coating 13. The holding device 17 of the circuit board 11 comprises at least one element 19 of an electrically conductive material. In this element 19 a corresponding through-opening 20 is installed.

In this connection the first through-openings 20 and the first contact pins 18 are configured in such a way that a diameter of the first through-openings 20 is smaller than the outer diameter of the first contact pins 18. When inserting the circuit board 11 into the lens housing 10, the first contact pin accordingly is pressed into the corresponding first through-opening 20. Consequently, the coating 13 that is arranged on the first contact pin 18 can be removed from the first contact pin 18 by the element 19 and/or by the through-opening 20. Furthermore, in the interior space 21 of the lens housing 10 below the first contact pin 18 a stop 22 is provided, which limits the movement of the circuit board 11 along the mounting direction 15.

The circuit board 11 moreover comprises a further element 23, which is formed in particular from an electrically conductive material. In this second element 23 a second through-opening 24 is installed. The diameter of the second through-opening 24 can be larger than the diameter of the first through-opening 20. The second through-opening 23 is part of an adjustment device 25.

In addition, an interface device 29 is arranged on the circuit board 11. In the present embodiment the interface device 29 comprises a coaxial plug, which comprises an external conductor 26 and an internal conductor 27. By the interface device 25 the circuit board 11 and/or the camera 4 can be connected with a vehicle data bus of the motor vehicle 1.

Fig. 3 is a top view of the circuit board 11, which is arranged within the lens housing 10. In this connection the circuit board 11 is in the mounting position in the interior space 21 of the lens housing 10. Presently it can be seen that the first contact pins 18 are pressed into the first through-openings 20 and/or the first elements 19. Further, it can be seen that the adjustment device 25 has a second contact pin 28, which is arranged in the second through-opening 24 and/or within the second element 23.

Fig. 4 is a sectional side view of the circuit board 11, which is arranged in the interior space 21 of the lens housing 10, according to the intersection line drawn in Fig. 3. In the sectional side view the base body 12 of the lens housing 10 can be seen. Further, it can be seen from Fig. 4 that the second contact pin 28 of the adjustment device 25 has a larger extension along the mounting direction 15 in comparison to the first contact pin 18. The second contact pin 28 serves for guiding the circuit board 11 during mounting. In the present case, between the second contact pin 28 and the second through-opening 24 a distance is provided. In comparison thereto the first contact pin 18 is pressed into the first through-opening 20.

Fig. 5 is a sectional side view of a camera 4. In this connection the lens housing 10 is connected with the rear housing 30. The rear housing 30 can equally be formed from an electrically conductive material, for example aluminum. The rear housing 30 has a through-opening 31, through which the interface device 29 is passed. Moreover, on top of the rear housing 30 a plug sheath 32 is arranged. Between the interface device 29 and the opening 31 of the rear housing a sealing element 33 in the form of an O-ring is arranged. The rear housing 30 further comprises at least one limitation element 34, by which a movement of the circuit board 11 contrary to the mounting direction 15 is limited. In the present embodiment the rear housing 30 comprises two limitation devices 34.

Claims

1. Method for manufacturing a camera (4) for a motor vehicle (1), in which a lens housing (10) and a circuit board (11) are provided, wherein the lens housing (10) has an electrically conductive base body (12) and an electrically insulating coating (13), and wherein the circuit board (11) is arranged within the lens housing (10) and connected to the base body (12) of the lens housing (10), characterized in that
on the lens housing (10) a fastening device (16) and on the circuit board (11) a holding device (17), which corresponds to the fastening device (16), are arranged, wherein the fastening device (16) and the holding device (17) are connected in such a way that the coating (13) of the lens housing (10) is removed in an area of the fastening device (16) from the base body (12) at least in portions.
2. Method according to claim 1, characterized in that
as the fastening device (16) a first contact pin (18) is provided, which is coated with the coating (13), and as the holding device (17) an element (19) made of an electrically conductive material is provided, which has a first through-opening (20) that corresponds to the first contact pin (18).
3. Method according to claim 2, characterized in that
when connecting the fastening device (16) and the holding device (17), the first contact pin (18) is pressed into the first through-opening (20).
4. Method according to claim 2 or 3, characterized in that
the first contact pin (18) and the first through-opening (20) are provided in such a way that an outer diameter of the first contact pin (18) with the coating (13) is larger than a diameter of the first through-opening (20).
5. Method according to any one of the claims 2 to 4, characterized in that

as the fastening device (16) two first contact pins (18) are provided and as the holding device (17) two electrically conductive elements (19) with respective second through-openings (20) are provided, wherein the two electrically conductive elements (19) are arranged on opposite sides of the circuit board (11).

6. Method according to any one of the preceding claims, characterized in that as the coating (13) of the lens housing (10) an anodization is provided.
7. Method according to any one of the preceding claims, characterized in that an adjustment device (25) for adjusting the circuit board (11) to the lens housing (10) is provided when arranging the circuit board (11) within the lens housing (10).
8. Method according to claim 7, characterized in that for providing the adjustment device (25) on the lens housing (10) a second contact pin (28) and on the circuit board (11) a second through-opening (24) corresponding to the second contact pin (28) is provided.
9. Method according to any one of the preceding claims, characterized in that a rear housing (30) is connected to the lens housing (10) wherein the rear housing (10) has at least one limitation element (34) for limiting a movement of the circuit board (11).
10. Method according to claim 9, characterized in that the rear housing (30) has an opening (31) and that an interface device (29) of the camera (4) is passed through the opening (31).
11. Method according to claim 10, characterized in that a sealing element (33) is arranged between the opening (31) of the rear housing (30) and the interface device (29).

12. Camera (4) for a motor vehicle (1) comprising a lens housing (10) and a circuit board (11), wherein the lens housing (10) has an electrically conductive base body (12) and an electrically insulating coating (13), and wherein the circuit board (11) is arranged within the lens housing (10) and electrically connected with the base body (12) of the lens housing (10),
characterized in that
on the lens housing (10) a fastening device (16) and on the circuit board (11) a holding device (17) corresponding to the fastening device (16) is provided, wherein the fastening device (16) and the holding device (17) are connected in such a way that the coating (13) of the lens housing (10) is removed in an area of the fastening device (16) from the base body (12) at least in portions.
13. Driver assistance system (2) for a motor vehicle (1) comprising at least one camera (4) according to claim 12.
14. Motor vehicle (1) comprising a driver assistance system (2) according to claim 13.

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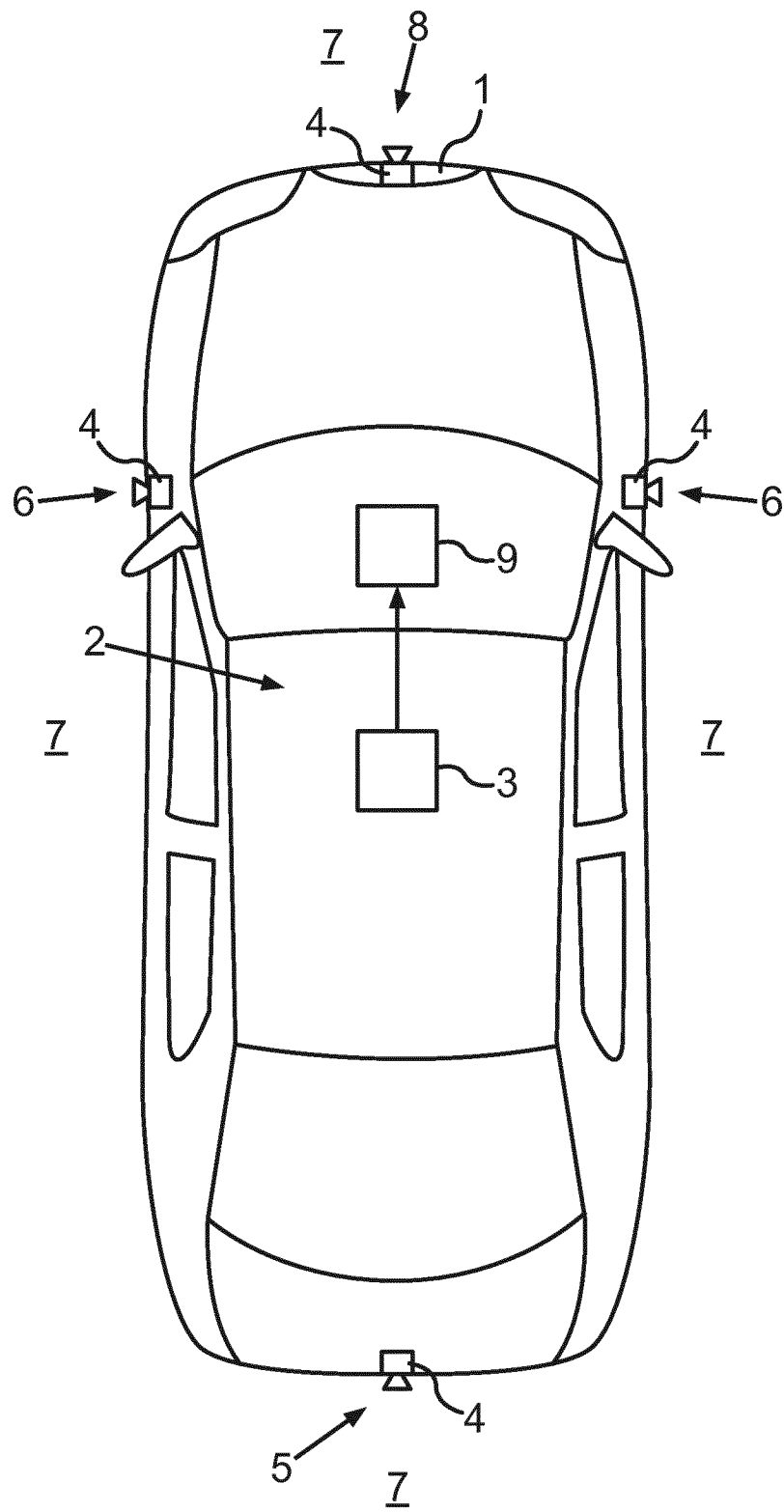


Fig.1

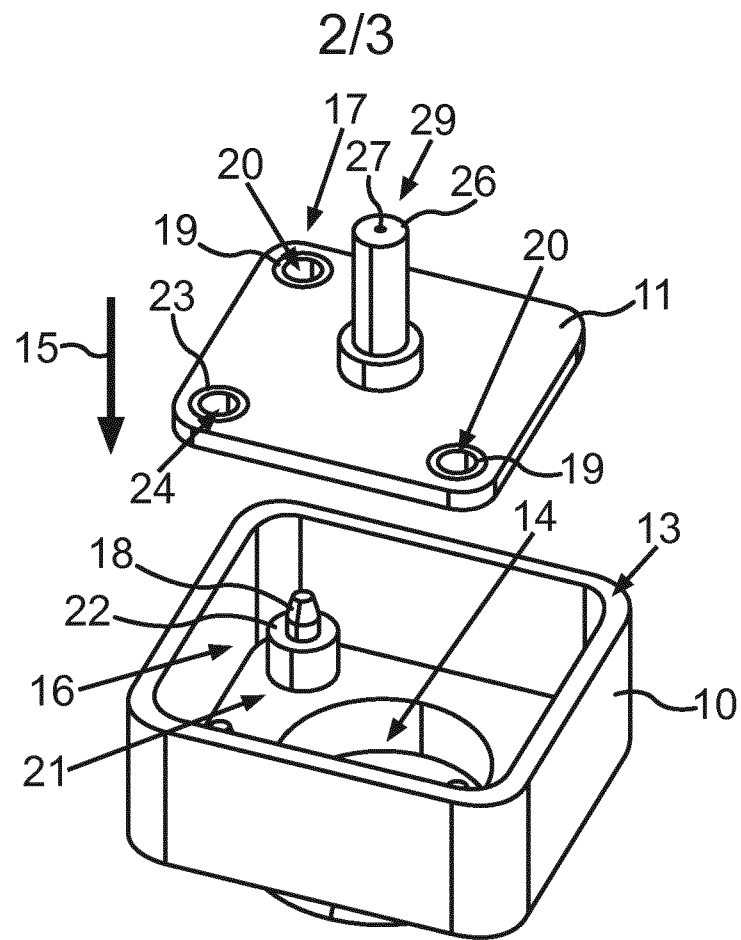


Fig.2

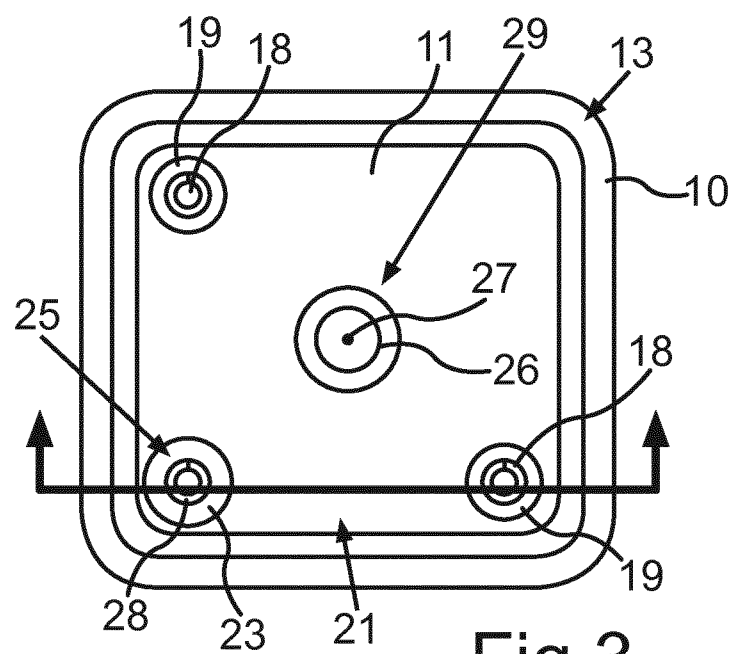


Fig.3

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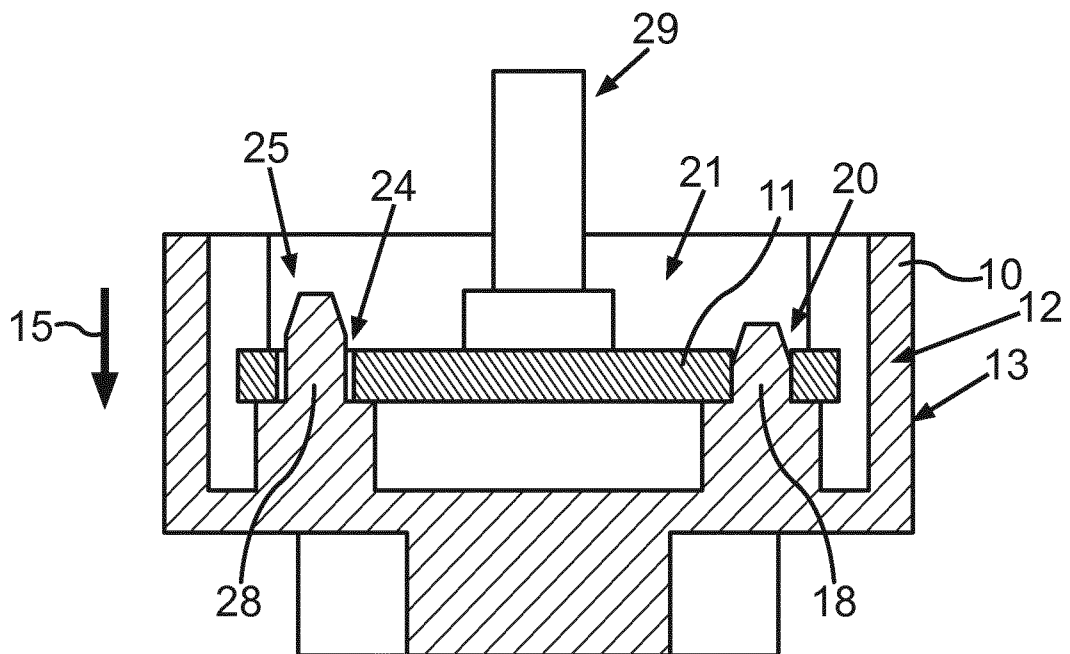


Fig.4

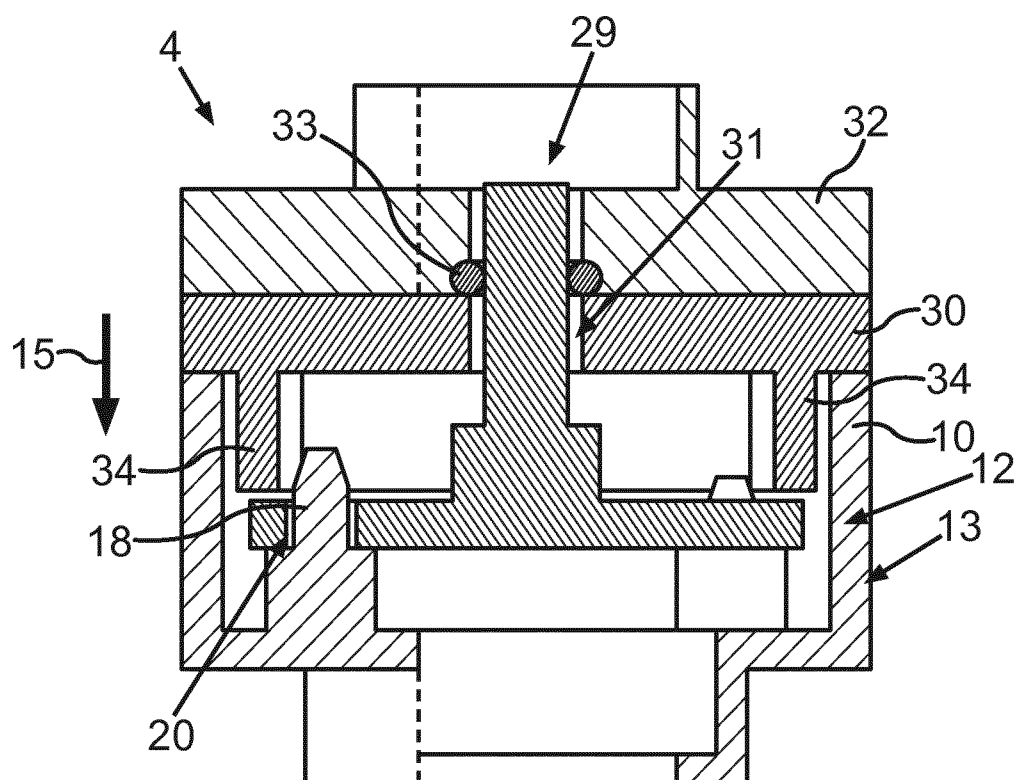


Fig.5

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/060553

A. CLASSIFICATION OF SUBJECT MATTER

INV. H04N5/225 B60R11/04 G03B17/02 H05K5/00
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 G03B H05K

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	US 2010/097519 A1 (BYRNE STEVEN V [US] ET AL) 22 April 2010 (2010-04-22) abstract; figures 1-3 -----	1-14
A	DE 28 26 092 A1 (OLYMPUS OPTICAL CO) 21 December 1978 (1978-12-21) claim 1; figures 1-4 -----	1-14



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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"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

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Date of the actual completion of the international search

21 July 2016

Date of mailing of the international search report

26/08/2016

Name and mailing address of the ISA/

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Authorized officer

Schinnerl, Arnold

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

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