(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
17 November 2016 (17.11.2016)

WIPO | PCT

(10) International Publication Number
WO 2016/180874 A1

(51) International Patent Classification:
H04N 5/225 (2006.01) *G02B 7/02* (2006.01)

(21) International Application Number:
PCT/EP2016/060549

(22) International Filing Date:
11 May 2016 (11.05.2016)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:
10 2015 107 406.0 12 May 2015 (12.05.2015) DE

(71) Applicant: **CONNAUGHT ELECTRONICS LTD.** [IE/IE]; Dunmore Road, Tuam, County Galway (IE).

(72) Inventors: **CONNEELY, Peadar**; Dunmore Road, Tuam, County Galway (IE). **DENNY, Patrick Eoghan**; Dunmore Road, Tuam, County Galway (IE).

(74) Agent: **JAUREGUI URBAHN, Kristian**; CDA-IP, Laiernstr. 12, 74321 Bietigheim-Bissingen (DE).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BN, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IR, IS, JP, KE, KG, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PA, PE, PG, PH, PL, PT, QA, RO, RS, RU, RW, SA, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(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).

[Continued on next page]

(54) Title: CAMERA FOR A MOTOR VEHICLE WITH AT LEAST TWO OPTICAL FIBERS AND AN OPTICAL FILTER ELEMENT, DRIVER ASSISTANCE SYSTEM AS WELL AS MOTOR VEHICLE

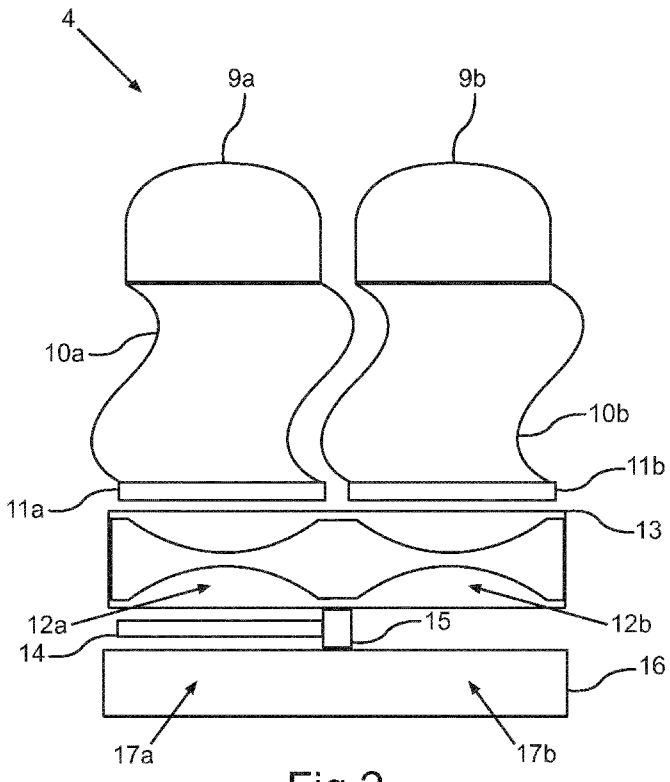

Fig.2

(57) Abstract: The invention relates to a camera (4) for a motor vehicle (1), including at least two lenses (9a, 9b), into which light from an environmental region (7) of the motor vehicle (1) can respectively be coupled, including at least two optical fibers (10a, 10b), wherein each one of the optical fibers (10a, 10b) is connected to one of the lenses (9a, 9b) for guiding the light coupled into the lens (9a, 9b), including at least two optical elements (12a, 12b), wherein each one of the optical fibers (10a, 10b) is connected to one of the optical elements (12a, 12b) such that the light guided by means of the optical fiber (10a, 10b) couples into the optical element (12a, 12b), and including an image sensor device (16) disposed on a side of the optical elements (12a, 12b) facing away from the optical fibers (10a, 10b), wherein the camera (4) has an optical filter element (14), which is disposed between the image sensor device (16) and a first one of the optical elements (12a), wherein the optical element (14) is adapted to filter the light coupled out of the first optical element (12a).

WO 2016/180874 A1

Published:

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

Camera for a motor vehicle with at least two optical fibers and an optical filter element, driver assistance system as well as motor vehicle

The present invention relates to a camera for a motor vehicle including at least two lenses, into which light from an environmental region of the motor vehicle can respectively be coupled, including at least two optical fibers, wherein each one of the optical fibers is connected to one of the lenses for guiding the light coupled into the lens, including at least two optical elements, wherein each one of the optical fibers is connected to one of the optical elements such that the light guided by means of the optical fiber is coupled into the optical element, and including an image sensor device disposed on a side of the optical elements facing away from the optical fibers. In addition, the invention relates to a driver assistance system with such a camera. Finally, the present invention relates to a motor vehicle with such a driver assistance system.

Presently, the interest is in particular directed to cameras for motor vehicles. Such cameras can for example be a part of a driver assistance system, by which the environmental region of the motor vehicle can be captured. Herein, it is often desirable to capture images of the environmental region from a plurality of viewing angles. As is known, multiple cameras can be employed to this, wherein it becomes more and more usual nowadays to use a camera assembly with at least two cameras for a driver assistance system of a motor vehicle, which each capture an environmental region of the motor vehicle. For example, four cameras can be employed, which capture the entire environment around the motor vehicle. For example, an overall image representation can be provided from the images of all of the cameras, such as for example the so-called "bird eye view". This image representation represents a plan view of the motor vehicle as well as an environment from a bird's eye view, for example based on a reference point, which is located directly above the vehicle.

Stereo cameras are known from the prior art, by which a distance to an object can be determined. Furthermore, so-called plenoptic cameras or light field cameras are known from the prior art, which are additionally employed to capture objects in an environmental region of the motor vehicle. With such a camera, a light field can be captured such that not only the position and intensity of the light beam on the image sensor are known, but also the direction, from which this light beam has been incident. This information can for example be used to acquire the position of an object in the environmental region of the motor vehicle or to determine a distance between the object and the motor vehicle. These

cameras usually include a plurality of lenses, which can optionally have different focal lengths. In addition, these cameras usually have a plurality of image sensors, which can for example be disposed in an array. However, these cameras have the disadvantage that they are complexly constructed and entail high cost.

Further, cameras are known from the prior art, which have multiple lenses, wherein the lenses are each connected to an optical fiber. Hereto, US 2010/0110259 A1 for example describes a camera having a plurality of lenses, wherein each of the lenses is connected to an image sensor via an optical fiber.

It is the object of the present invention to demonstrate a solution, how in a camera for a motor vehicle of the initially mentioned kind, the range of application can be extended in simple manner.

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

A camera according to the invention for a motor vehicle includes at least two lenses, into which light from an environmental region of the motor vehicle can respectively be coupled. Moreover, the camera includes at least two optical fibers, wherein each one of the optical fibers is connected to one of the lenses for guiding the light coupled into the lens. Further, the camera includes at least two optical elements, wherein each one of the optical fibers is connected to one of the optical elements such that the light guided by means of the optical fiber couples into the optical element. Moreover, the camera includes an image sensor device disposed on a side of the optical elements facing away from the optical fibers. Finally, the camera has an optical element, which is disposed between the image sensor device and a first one of the optical elements, wherein the optical filter element is adapted to filter the light coupled out of the first optical element.

The camera can be disposed on or in a motor vehicle. The camera has at least two lenses, into which light from the environmental region of the motor vehicle can be coupled. Therein, the at least two lenses can be disposed in the intended installation position of the camera on the motor vehicle such that the light from the environmental region can couple into the lenses. The lenses can for example be configured such that a field of view of less than 60°can be captured by them in the environment al region of the motor vehicle.

Further, the camera has at least two optical fibers or optical waveguides, wherein each one of the optical fibers is connected to one of the lenses. Furthermore, at least two optical elements are provided, which are connected to the respective optical fibers. The optical elements can for example be lenses, by which light can be focused or scattered. In addition, an image sensor device is provided, which is for example formed as a CCD (Charged-Coupled Device) sensor or as a CMOS (Complementary Metal-Oxide-Semiconductor) sensor. In particular, the camera has a single image sensor device.

In addition, the camera has an optical filter element disposed between a first optical element and the image sensor device. In particular, an optical filter element is not disposed between the second one of the optical elements and the image sensor device. Thus, the light from the environmental region, which impinges on the first lens, is guided to the first optical element by means of the first optical fiber and correspondingly refracted there. The light refracted by the first optical element is filtered by means of the optical filter element and subsequently impinges on the image sensor device. The light from the environmental region, which impinges on the second lens, is guided to the second optical element by means of the second optical fiber, by means of which is it refracted and subsequently impinges on the image sensor device. The light guided via the first lens, the first optical fiber, the first optical element and the optical filter element, can impinge on a first area of the image sensor device. The light from the environmental region, which is guided via the second lens, the second optical fiber and the second optical element can impinge on a second area of the image sensor device different from the first area. The first and the second optical fiber can in particular be flexibly formed. For example, the first and the second optical fiber can be light guiding fibers. The first and the second optical fiber can for example be fabricated of a corresponding plastic or glass. This has the advantage that the lenses of the camera can be simply and flexibly disposed on different locations of the motor vehicle. Presently, it is not required that the central image sensor device and the lenses have to be disposed one above the other. According to the camera according to the invention, both the arrangement of the lenses and the arrangement of the sensor can be more variably effected.

Preferably, the at least two optical fibers are each reversibly detachably connected to the at least two optical elements by means of a connecting element. The first optical fiber can be connected to the first optical element by means of a first connecting element and the second optical fiber can be connected to the second optical element by means of a second connecting element. The connecting elements can for example be corresponding connectors for the optical fibers or optical waveguides. Thus, the optical fibers, which are

for example fixedly connected to the respective lenses, can be simply attached to the optical elements and again be removed from them. This facilitates the assembly on the one hand and simple replacement upon damage can be effected on the other hand. This in particular proves advantageous if the camera is for example mounted on an exterior mirror of the motor vehicle and this part is damaged. In this case, repair would be very expensive with a usually used camera. With the camera according to the invention, it is possible that individual parts of the camera can be simply replaced and thus cost can be saved.

In an embodiment, the image sensor device is adapted to provide an image, wherein a first part of the image describes the light filtered by the filter element and a second part of the image describes the light coupled out of the second one of the optical elements. As previously explained, the light coupled into the first lens can impinge on a first area of the image sensor device and the light coupled into the second lens can impinge on a second area of the image sensor device. Thus, a first partial image can be provided, which describes the light coupled into the first lens, and a second partial image can be provided, which describes the light coupled into the second lens. This has the advantage that two different areas in the environmental region of the motor vehicle can be captured at the same time in only a single image.

In a further embodiment, the camera has an image processing device for processing the first and/or the second part of the image. The image processing device can for example separately or jointly process the first and the second part of the image. Presently, only the information of a single central image sensor device can be read out. Thus, fast image processing can be allowed.

In an embodiment, the first and/or the second part of the image describe an object in an environmental region of the motor vehicle and the image processing device is adapted to determine a distance between the motor vehicle and the object based on the first and/or the second part of the image. Different scenes from the environmental region of the motor vehicle can be captured at the same time by the camera. In that the first part of the image describes the light filtered by means of the optical filter element and the second part of the image describes the unfiltered light, different information can be taken from the two parts of the image. For example, the two lenses can be disposed in the manner of a stereo camera, whereby a relative position of the object to the motor vehicle can then be determined. Thus, the distance between the motor vehicle and the object can be determined in simple manner.

In a further configuration, the optical filter element includes a neutral density filter. The optical filter element can additionally be formed as a neutral density filter. By the neutral density filter, the amount of light incident on the image sensor device can be reduced. Therein, the so-called lengthening factor of the neutral density filter can be selected corresponding to the use of the camera. For example, the lengthening factor can be selected such that the dynamic range of the image sensor device can be adapted. The neutral density filter has the effect of increasing the f-number in decreasing light. Thus, details in brighter areas of a dynamic scene can be correspondingly captured by the image sensor device. In addition, darker details of the same scene can for example be captured via the second lens. In this manner, scenes can be captured with higher dynamic range with the same exposure by the neutral density filter.

In a further embodiment, the image processing device is adapted to provide a high-contrast image based on the first and/or the second part of the image. A high-contrast image or an HDR (High Dynamic Range) image presents a digital image, which reproduces great differences in brightness rich in detail. In addition, the two parts of the image can be captured at the same time by the camera. Thus, the effect of the temporal artifacts, which is usually present in high-contrast images, can be avoided. The temporal artifacts usually occur using HDR cameras if multiple captures of a moving scene are captured at different times and combined to make an image. If the identical exposure times are used for both areas of the image sensor device using the neutral density filter, both bright and dark areas can be captured in a scene with a common exposure time.

In a further embodiment, the optical filter element is adapted to filter the light coupled out of the first optical element with respect to a predetermined wavelength. The optical filter element can for example have a filter for light in the red, blue, green or infrared wavelength range. The optical filter element can include a filter for a corresponding wavelength on the one hand and a neutral density filter on the other hand. Thus, the first part of the image can be provided corresponding to the case of application.

In an embodiment, the image sensor device includes a plurality of individual sensors and the image sensor device is adapted to activate all of the individual sensors at the same time for capturing the image. In other words, the image sensor device can be operated in the so-called global shutter mode. Thus, synchronized images can for example be provided in real time. Thus, in particular calculations performed based on the images can be improved.

In a further embodiment, the image sensor device includes a plurality of individual sensors, which are disposed in multiple rows, and the image sensor device is adapted to activate the individual sensors in the respective rows temporally offset to each other for capturing the image. In other words, the image sensor device can be operated in the so-called rolling shutter mode. Thus, storage space can for example be saved.

In a further embodiment, the camera has at least a third lens, at least a third optical fiber and at least a third optical element. In other words, the camera can have a plurality of lenses, optical fibers each associated with the lenses and optical elements each associated with the optical fibers. Herein, an individual area on the image sensor device can then be associated with each of the lenses.

In a further embodiment, the camera has a motor vehicle fixing device for fixing the camera to the motor vehicle. Thus, the camera can for example be disposed on a receiving device of the motor vehicle correspondingly provided hereto.

A driver assistance system according to the invention includes a camera according to the invention. The driver assistance system can for example serve for presenting information to the driver on a display device based on the images captured by the camera. The driver assistance system can also have multiple cameras according to the invention.

In an embodiment, the driver assistance system has a display device, wherein the second part of the image provided by means of the image sensor device of the camera is adjustable on the display device. The display device can for example include a corresponding screen disposed in the interior of the motor vehicle. Herein, it can also be provided that the light impinging on the second lens is directly guided to a display device of the motor vehicle via an optical fiber. Thus, the environmental region or a part thereof can for example be presented to the driver of the motor vehicle on the display device. Thus, the second part of the image can be provided for human vision.

In a further configuration, the at least one component of the driver assistance system is controllable based on the first part of the image provided by means of the image sensor device of the camera. As already mentioned, the first part of the image can represent the light filtered by means of a color filter, which is coupled into the first lens. The first part of the image can be provided for machine vision. Thus, the second part of the image can be used for capturing objects, for recognizing and classifying objects, respectively.

A motor vehicle according to the invention includes a driver assistance system according to the invention. The components of the camera can be located in different positions of the motor vehicle. For example the lens can be located in different positions of the motor vehicle. The image sensor device, the optical filter element, a retaining element for retaining the optical filter element, the optical device, the optical elements and/or the connecting elements can be placed in a central location and can be connected to the lens via optical fibers or wave guides.

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

Further features of the invention are apparent from the claims, the figures and the description of 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 figures and/or shown in the figures alone are usable not only in the respectively specified combination, but also in other combinations or alone, without departing from the scope of the invention. Thus, implementations are also to be considered as encompassed and disclosed by the invention, which are not explicitly shown in the figures and explained, but arise from and can be generated by separated feature combinations from the explained implementations. Implementations and feature combinations are also to be considered as disclosed, which thus do not have all of the features of an originally formulated independent claim.

With the statements of "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 and with an observer then standing in front of the camera and looking in the direction of the camera are specified.

Now, the invention is explained in more detail based on preferred embodiments as well as with reference to the attached drawings.

There show:

Fig. 1 a motor vehicle according to an embodiment of the present invention, which has a driver assistance system with multiple cameras; and

Fig. 2 a schematic illustration of one of the cameras in a sectioned side view.

In the figures, identical and functionally identical elements are provided with the same reference characters.

Fig. 1 shows a motor vehicle 1 according to an embodiment of the present invention in a plan view. The motor vehicle 1 is formed as a passenger car in the present case. The motor vehicle 1 includes a driver assistance system 2. The driver assistance system 2 in turn includes a control device 3, which can for example be constituted by an electronic control unit of the motor vehicle 1. Moreover, the driver assistance system 2 includes at least one camera 4. In the present embodiment, the driver assistance system 2 includes three cameras 4, which are disposed distributed on the motor vehicle 1. Presently, one of the cameras 4 is disposed in a rear area 5 and the remaining two cameras 4 are disposed in a respective lateral area 6, in particular in an area of the wing mirrors. Presently, the number and the arrangement of the cameras 4 of the driver assistance system 2 are to be purely exemplarily understood.

An environmental region 7 of the motor vehicle 1 can be captured by the cameras 4. Preferably, the three cameras 4 are formed identical in construction. In particular, an image sequence of a plurality of images or video data can be provided by the cameras 4, which describes the environmental region 7. This video data can then be transmitted from the cameras 4 to the control device 3. A display device 8 of the motor vehicle 1 can then be controlled by means of the control device 3 such that the image data of the cameras 4 can be presented or displayed to the driver on the display device 8. Thus, the driver assistance system 2 serves for assisting the driver of the motor vehicle 1 in driving the motor vehicle 1. The driver assistance system 2 can for example be a so-called electronic rearview mirror.

Fig. 2 shows one of the cameras 4 in a sectioned side view. In the present embodiment, the camera 4 has a first lens 9a and a second lens 9b. The lenses 9a, 9b can be configured such that they have a field of view of less than 60°. The lenses 9a, 9b are disposed on the motor vehicle 1 such that light from the environmental region 7 can be coupled into the lenses 9a, 9b. Moreover, the first lens 9a is connected to a first optical

fiber 10a. On the side of the first optical fiber 10a opposing the lens 9a, a first connecting element 11a is disposed. Further, a second optical fiber 10b is provided, which is connected to the second lens 9b on a first side and to the second connecting element 11b on a second side. The first and the second optical fiber 10a, 10b can be reversibly detachably connected to the optical elements 12a, 12b or to an optic device 13 by the respective connecting elements 11a, 11b.

The optic device 13 of the camera 4, which has a first optical element 12a and a second optical element 12b in the present embodiment, can for example be produced on wafer level. The optical elements 12a, 12b can be formed as micro-lenses. Moreover, the camera 4 has an optical filter element 14, which is disposed between the first optical element 12a and an image sensor device 16. The optical filter element 14 is retained in the clearance between the image sensor device 16 and the first optical element 12a by means of a retaining element 15. The image sensor device 16 can for example be a CCD sensor or a CMOS sensor. Presently, the camera has a single image sensor device 16.

The light from the environmental region 7, which is coupled into the first lens 9a, is transmitted to the first optical element 12a via the first optical fiber 10a and correspondingly refracted by the first optical element 12a. Subsequently, the light is filtered by means of the optical filter element 14 and then impinges on a first area 17a of the image sensor device 16. The light from the environmental region 7, which is coupled into the second lens 9b, is transmitted to the second optical element 12b by means of the second optical fiber 10b and correspondingly refracted by it. The refracted light then impinges on a second area 17b of the image sensor device 16. Thus, a single image can be provided by the image sensor device 16, which has two parts. Therein, a first part of the image is associated with the first area 17a of the image sensor device 16 and the second part of the image is associated with the second area 17b of the image sensor device 16.

Each of the cameras 4 can have an image processing device, by which the respective images captured by the cameras 4 can be processed. Therein, it can also be provided that a central image processing device of the control device 3 is present. Based on the first part and the second part of the image, a distance to an object in the environmental region 7 of the motor vehicle 1 can for example be acquired. In this case, the camera 4 can be operated according to a stereo camera.

In an embodiment, the optical filter element 14 can include a neutral density filter. Thus, based on the first part of the image, which is associated with the part of the image sensor device 16, which is by the neutral density filter, and by means of the second part of the image, different captures of a scene can for example be provided. Thus, multiple of the areas of a dynamic scene can for example be captured by the first part, while darker areas of a scene can be captured by the second part. Thus, high-contrast images can also be provided.

Alternatively or additionally to the neutral density filter, the optical filter element 14 can have corresponding color filters. For example, it can have a filter for light in the red wavelength range, in the green wavelength range, in the blue wavelength range or in the infrared wavelength range. Thus, different color ranges can be captured by the first and the second part of the image. The first part of the image can for example be used for machine vision. The first part of the image can be used to capture objects in the environmental region 7 and for example to control individual components of the driver assistance system 2 hereby. The second part of the image can be used to provide the display on the display device 8. Thus, it serves for human vision.

In capturing the respective image, the image sensor device 16 can be operated in the so-called global shutter mode or in the so-called rolling shutter mode. In the global shutter mode, all of the individual sensors of the image sensor device 16 capture light at the same time. In the rolling shutter mode, individual rows of individual sensors capture light in sequence.

Claims

1. Camera (4) for a motor vehicle (1), including at least two lenses (9a, 9b), into which light from an environmental region (7) of the motor vehicle (1) can respectively be coupled, including at least two optical fibers (10a, 10b), wherein each one of the optical fibers (10a, 10b) is connected to one of the lenses (9a, 9b) for guiding the light coupled into the lens (9a, 9b), including at least two optical elements (12a, 12b), wherein each one of the optical fibers (10a, 10b) is connected to one of the optical elements (12a, 12b) such that the light guided by means of the optical fiber (10a, 10b) couples into the optical element (12a, 12b), and including an image sensor device (16) disposed on a side of the optical elements (12a, 12b) facing away from the optical fibers (10a, 10b),
characterized in that
the camera (4) has an optical filter element (14) which is disposed between the image sensor device (16) and a first one of the optical elements (12a), wherein the optical filter element (14) is adapted to filter the light coupled out of the first optical element (12a) wherein
the image sensor device (16) is adapted to provide an image, wherein a first part of the image describes the light filtered by the optical filter element (14) and a second part of the image describes the light coupled out of a second one of the optical elements (12b),
the camera (4) has an image processing device for processing the first and/or the second part of the image and
the first and/or the second part of the image describe an object in the environmental region (7) of the motor vehicle (1) and the image processing device is adapted to determine a distance between the motor vehicle (1) and the object based on the first and/or the second part of the image.

2. Camera (4) according to claim 1,
characterized in that
the at least two optical fibers (10a, 10b) are each reversibly detachably connected to the at least two optical elements (12a, 12b) by means of a connecting element (11a, 11b).

3. Camera according to claim 1 or 2,
characterized in that
the optical filter element (14) includes a neutral density filter.

4. Camera (4) according to any one of the preceding claims,
characterized in that
the image processing device is adapted to provide a high-contrast image based on the first and/or the second part of the image.

5. Camera (4) according to any one of the preceding claims,
characterized in that
the optical filter element (14) is adapted to filter the light coupled out of the first optical element (12a) with respect to a predetermined wavelength.

6. Camera (4) according to any one of the preceding claims,
characterized in that
the image sensor device (16) includes a plurality of individual sensors and the image sensor device (16) is adapted to activate all of the individual sensors at the same time for capturing the image.

7. Camera (4) according to any one of the preceding claims,
characterized in that
the image sensor device (16) includes a plurality of individual sensors, which are disposed in multiple rows, and the image sensor device (16) is adapted to activate the individual sensors in the respective rows temporally offset to each other for capturing the image.

8. Camera (4) according to any one of the preceding claims,
characterized in that
the camera (4) has at least a third lens, at least a third optical fiber and at least a third optical element.

9. Driver assistance system for a motor vehicle (1) with a camera (4) according to any one of the preceding claims.

10. Driver assistance system according to claim 9,
characterized in that
the driver assistance system (2) has a display device (8), wherein the second part of the image provided by means of the image sensor device (16) of the camera (4) can be presented on the display device (8).

11. Driver assistance system (2) according to claim 9 or 10,
characterized in that
at least one component of the driver assistance system (2) is controllable based on the first part of the image provided by means of the image sensor device (16) of the camera (4).

12. Motor vehicle (1) with a driver assistance system (2) according to claim 9.

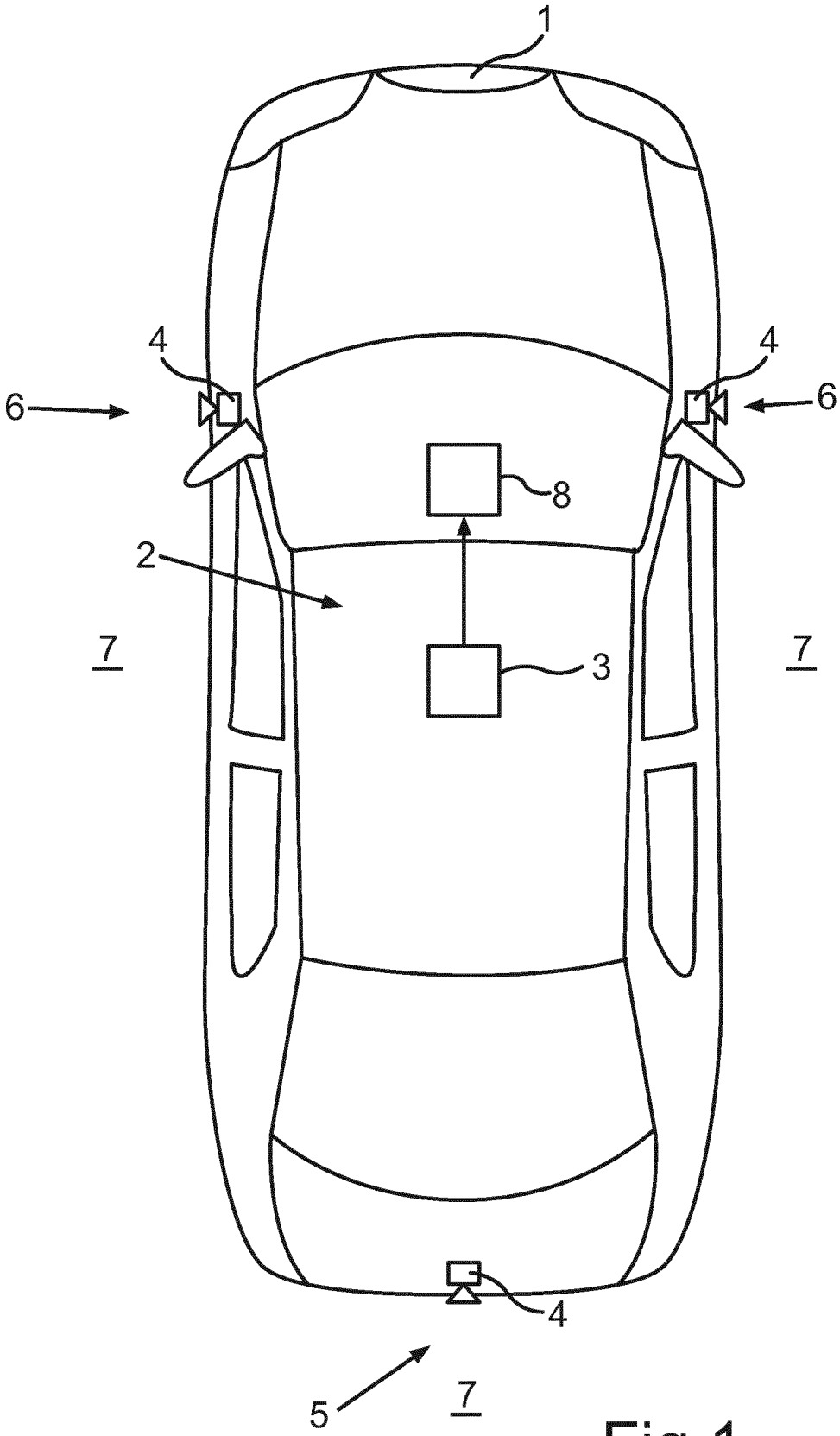

Fig.1

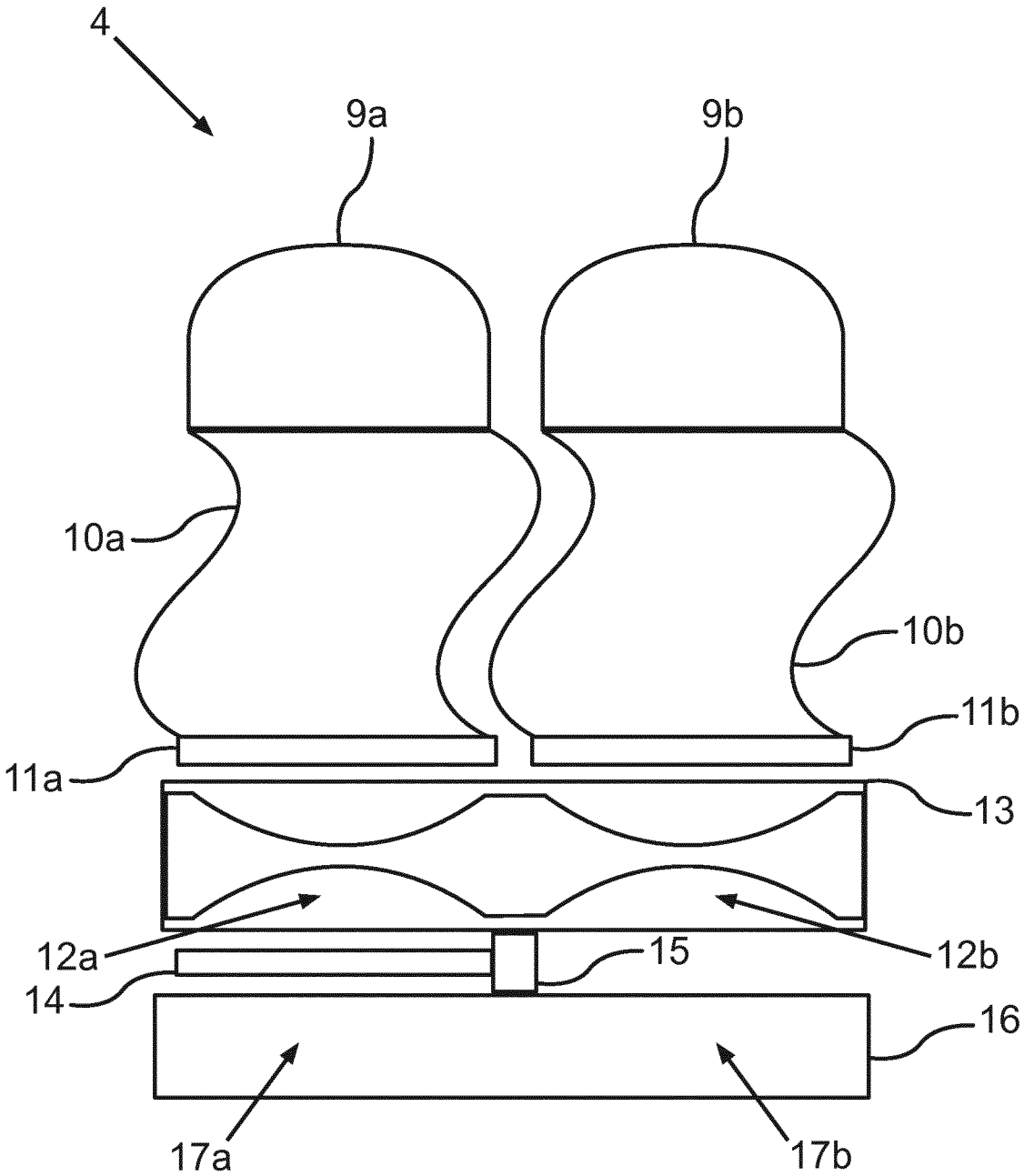

Fig.2

INTERNATIONAL SEARCH REPORT

International application No
PCT/EP2016/060549

A. CLASSIFICATION OF SUBJECT MATTER
INV. H04N5/225 G02B7/02
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 G02B 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.
Y	US 2010/110259 A1 (HSU WEI [TW]) 6 May 2010 (2010-05-06) cited in the application paragraphs [0023] - [0033]; figures 1-3	1-12
Y	DE 10 2006 014504 B3 (FRAUNHOFER GES FORSCHUNG [DE]) 8 November 2007 (2007-11-08) paragraphs [0022], [0023], [0047], [0048], [0052]; figures 1,2	1-12
A	US 2013/201391 A1 (OGASAHARA TAKAYUKI [JP] ET AL) 8 August 2013 (2013-08-08) paragraphs [0063], [0064]; figures 1,2	1,9,12

☐ 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

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"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

"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	Date of mailing of the international search report
26 July 2016	05/08/2016

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	Schinnerl, Arnold

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No
PCT/EP2016/060549

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 2010110259 A1	06-05-2010	NONE	
DE 102006014504 B3	08-11-2007	NONE	
US 2013201391 A1	08-08-2013	JP 5701785 B2	15-04-2015
		JP 2013162291 A	19-08-2013
		US 2013201391 A1	08-08-2013