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[Continued on next page]

(54) Title: METHOD FOR CAPTURING AN ENVIRONMENTAL REGION OF A VEHICLE/TRAILER COMBINATION WITH A MOTOR VEHICLE AND A TRAILER AS WELL AS CAMERA SYSTEM

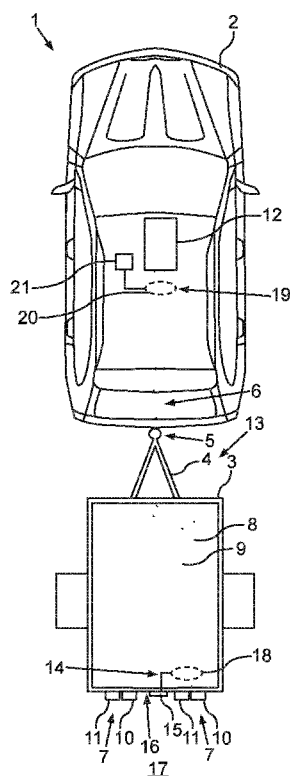


Fig.

(57) Abstract: The invention relates to a method for capturing an environmental region (17) of a vehicle/trailer combination (1) including a motor vehicle (2) and a trailer (3), which are electrically connected by a connecting cable (6) for voltage supply of rear lights (7) of the trailer (3), in which image data describing the environmental region (17) is provided by means of a camera (15) disposed on the trailer (3) and is transmitted to the motor vehicle (2), wherein the image data is transmitted to the motor vehicle (2) via at least one line (8, 9) of connecting cable (6) as a modulation signal.



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Method for capturing an environmental region of a vehicle/trailer combination with a motor vehicle and a trailer as well as camera system

The present invention relates to a method for capturing an environmental region of a vehicle/trailer combination including a motor vehicle and a trailer, which are electrically connected by a connecting cable for voltage supply of rear lights of the trailer. In the method, image data describing the environmental region is provided by means of a camera disposed on the trailer. Further, the image data is transmitted to the motor vehicle. Moreover, the present invention relates to a camera system for capturing an environmental region of a vehicle/trailer combination, which includes a motor vehicle and a trailer. Finally, the present invention relates to a vehicle/trailer combination with a motor vehicle and a trailer.

From the prior art, it is known to capture the environmental region of the motor vehicle with the aid of corresponding sensors to assist the driver in driving the motor vehicle. For example, a camera can be used to capture image data describing the environmental region. This image data can then be presented on a corresponding display device in the interior of the motor vehicle. It is also known that multiple cameras, for example four cameras, are disposed distributed on the motor vehicle to capture the entire environment around the motor vehicle.

Moreover, it is known from the prior art in a vehicle/trailer combination including a motor vehicle and a trailer coupled to the motor vehicle to capture the environmental region of the vehicle/trailer combination or the trailer with the aid of at least one camera. Therein, it can for example be provided that the environmental region behind the trailer is captured with the aid of a camera disposed on the trailer. Thus, a driver can be assisted in particular in reversing the vehicle/trailer combination. In order to transmit the image data captured by the camera of the trailer to the motor vehicle, it is provided according to the prior art that this is effected in wireless manner or via a corresponding radio link. For example, this is described in US 2015/172518 A1 and US 2014/340510 A1.

In the wireless transmission of the image data, the aspect is to be regarded as disadvantageous that usually delays in time occur in the data transmission. Moreover, in the wireless transmission of the image data, the required data link cannot always be reliably guaranteed.

Therefore, it is the object of the present invention to demonstrate a solution, how the environmental region of a vehicle/trailer combination can be reliably and more efficiently captured with the aid of a camera.

According to the invention, this object is solved by a method as well as by a camera system having the features according to the respective independent claims.

Advantageous developments of the present invention are the subject matter of the dependent claims, of the description and of the figures.

A method according to the invention serves for capturing an environmental region of a vehicle/trailer combination including a motor vehicle and a trailer, wherein the vehicle and the trailer are electrically connected by a connecting cable for voltage supply of rear lights of the trailer. In the method, image data describing the environmental region is provided by means of a camera disposed on the trailer. Further, the image data is transmitted to the motor vehicle. Moreover, it is provided that the image data is transmitted to the motor vehicle via at least one line of the connecting cable as a modulation signal.

With the aid of the method, an environmental region of a vehicle/trailer combination or of a trailer is to be captured. Therein, the vehicle/trailer combination includes the motor vehicle and the trailer coupled to the motor vehicle for example via a trailer coupling. Moreover, the motor vehicle and the trailer are electrically connected to each other via the connecting cable. The connecting cable can for example be connected to a light controller of the motor vehicle on the one hand, by means of which the exterior lighting of the motor vehicle is also controlled. Moreover, the connecting cable is electrically connected to the rear lights of the trailer. The rear lights of the trailer can be controlled or activated by means of the light controller via the connecting cable. Therein, the trailer can have two rear lights, which each include a tail light, a turn indicator and a brake light. Moreover, one or two rear fog lights can be provided. Therein, the electrical supply of the individual illuminants or of the individual lights of the rear lights is effected via the motor vehicle or the towing vehicle. The electrical connecting cable can for example be 7-pole or 13-pole formed. Further, the connecting cable can have a connector disposed in the area of the trailer coupling.

In addition, a camera is disposed on the trailer, by means of which image data or video data can be provided, which describes the environmental region of the vehicle/trailer combination or of the trailer. In particular, the image data characterizes an area in direction of travel behind the trailer and/or laterally besides the trailer. For example, the

camera can be disposed at a rear of the trailer. Thus, the camera can be disposed on a side of the trailer facing away from the motor vehicle. In order to be able to present this image data to the driver on a corresponding display device in the interior of the motor vehicle, it is required to transmit this image data from the camera to the motor vehicle. In particular, the image data is to be transmitted to a control device, by means of which a corresponding display can then be provided.

According to the invention, it is now provided that the image data is modulated onto at least one line of the connecting cable. As already explained, the connecting cable can for example have 7 or 13 lines, which serve for voltage supply of the rear lights. Therein, each line can be connected to an illuminant or an individual light of the rear lights. These illuminants can for example be associated with the tail light, the brake light, the turn indicator or the rear fog light. Further, one of the lines can be associated with the ground terminal. These lines of the connecting cable used for voltage supply of the respective illuminants of the rear lights are now additionally also used to transmit the image data provided by the camera. In particular, the image data is thereto modulated onto at least one of the lines. For this purpose, a modulation signal is determined from the image data. Preferably, it is provided that the image data is modulated onto two of the lines. Then, the transmission of the image data to the motor vehicle, in particular to the control device of the motor vehicle, can be effected via these lines. Thus, the lines of the connecting cable are used for transmitting the image data, which are already present to supply the rear lights of the trailer with electrical energy. By the wired transmission of the image data via the connecting cable or the at least one line of the connecting cable, reliable data transmission can be realized. Further, transmission of the image data can be allowed without delay in time.

Preferably, the modulation signal has a higher frequency compared to a supply voltage transmitted via the at least one line. In other words, the image data is transmitted via the at least one line in a predetermined high-frequency range. This frequency range or high-frequency range can for example be in a range of several Megahertz. The electrical voltages, which are additionally applied to the lines of the supply cable for voltage supply of the rear lights, represent DC voltage signals or signals with a relatively low frequency. Thus, clear separation of the transmitted image data and supply voltage can be ensured. Overall, a data transmission technique can thus be used, which is for example known from the so-called powerline communication. Thus, it can additionally be achieved that the image data is transmitted to the motor vehicle without delays or without latency times.

In a further embodiment, the supply cable includes a first conductor and a second conductor, which are associated with one of the rear lights of the trailer, the modulation signal is transmitted to the motor vehicle via the first and the second line. The image data provided by the camera can be transmitted to a first communication unit and to the two connecting lines from it. The first communication unit can for example be formed in the manner of a splitter. The first and the second line, onto which the image data is modulated, are preferably associated with one of the two rear lights. For example, the first line can be associated with the tail light and the second line can be associated with the turn indicator. Basically, the first and the second line are selected such that they usually are passed next to each other in the trailer. Thus, the first communication unit or the splitter can be disposed on these two lines in particularly installation space saving manner.

In a further embodiment, the first line and the second line of the connecting cable are provided as a twisted pair of lines at least in certain areas for transmitting the modulation signal. As already explained, the first and the second line are preferably associated with one of the rear lights and disposed next to each other within the trailer. If these two lines are formed as a twisted pair of lines, the data transmission can be prevented from being disturbed by exterior interferences, for example electromagnetic radiation. The two lines can in particular be formed as a twisted pair of lines within the trailer. It can also be provided that the first and the second line are formed as a twisted pair of lines within the motor vehicle. Thus, reliable transmission of the image data from the camera to the motor vehicle can be allowed.

In a further configuration, the modulation signal transmitted to the motor vehicle is demodulated and the image data is transmitted to a control device of the motor vehicle. In the motor vehicle, a second communication unit can be provided, which serves to again demodulate the modulated image data transmitted via the lines. This second communication unit can also be formed in the manner of a splitter. Thus, the image data transmitted via the lines of the supply cable can be received by the second communication unit and be transmitted to the control device of the motor vehicle. This control device can then serve to cause a corresponding output to the driver. Thus, the lines of the connecting cable present in the motor vehicle can also be used for data transmission.

In a further embodiment, a display device of the motor vehicle for presenting a display is controlled by means of the control device depending on the image data. The control

device can in particular be a controller, which is also used in the motor vehicle itself for processing the image data of the cameras of the motor vehicle. The image data provided by the camera disposed on the trailer can be evaluated with the aid of the control device. In addition, the evaluated image data can then be transmitted to a display device, for example a corresponding screen in the interior of the motor vehicle. Thus, based on the image data of the camera of the trailer, a display can be provided. For example, the image data of the camera itself or parts thereof can be presented on the display device. Thus, in particular the environmental region behind the trailer can be presented to the driver. In this manner, the driver can in particular be assisted in reversing the vehicle/trailer combination.

Furthermore, it is advantageous if further image data is received from at least one camera of the motor vehicle by the control device and the display device is additionally controlled by means of the control device depending on the further received image data. As already explained, the control device can serve for processing the image data of further cameras of the motor vehicle and controlling the display device depending thereon. The control device can for example be a part of a so-called Camera Monitoring Systems (CMS), which for example includes four cameras and by which the environmental region of the motor vehicle can be captured. This means that both the image data provided by the camera of the trailer and the image data provided by at least one camera of the motor vehicle are presented on the display device. For example, the image data of a front camera as well as of the lateral cameras of the motor vehicle can be displayed. Instead of the image data of the rear camera of the motor vehicle, the image data of the camera of the trailer can be displayed. Thus, a display can be presented to the driver of the motor vehicle, which presents the environmental region of the entire vehicle/trailer combination, thus of the motor vehicle and of the trailer. Thus, the driver can be reliably assisted in maneuvering the vehicle/trailer combination.

A camera system according to the invention for capturing an environmental region of a vehicle/trailer combination, which includes a motor vehicle and a trailer, which are electrically connected by a connecting cable for voltage supply of the rear lights of the trailer, includes a camera, which can be disposed on the trailer and by means of which image data describing the environmental region can be provided. Moreover, the camera system includes a first communication unit for transmitting the image data to the motor vehicle. Therein, it is provided that the first communication unit is adapted to transmit the image data to the motor vehicle via at least one line of the connection cable as a modulation signal. Thus, the camera system has a first component, which can be

disposed on the trailer of the vehicle/trailer combination. This first component of the camera system includes the camera, which can for example be disposed on an outer surface of the trailer. The camera can have a corresponding trailer fixing unit for fixing the camera to the trailer. For example, the camera can be disposed at a rear or a rear side of the trailer. In particular, the environmental region behind the trailer and/or laterally besides the trailer can be captured by the camera. In addition, the first component of the camera system includes the first communication unit, which can be formed in the manner of a splitter. By this first communication unit, the image data provided by the camera can be modulated onto the at least one line. In particular, the image data can be modulated onto two lines of the connecting cable. This first communication unit can additionally be disposed on or in the trailer.

Preferably, the camera system has a second communication unit, which is adapted to demodulate the modulation signal transmitted to the motor vehicle and to transmit the image data to a control device of the motor vehicle. Moreover, the camera system has a second component, which can be disposed on or in the motor vehicle. This second component of the camera system includes the second communication unit. The second communication unit can also be formed in the manner of a splitter. The second communication unit can be connected to the at least one line or the two lines of the connecting cable on the one hand. Thereby, the image data transmitted and modulated on the two lines can be correspondingly demodulated. On the other hand, the second communication unit can be connected to the control device of the motor vehicle. Thus, the received image data can be transmitted from the second communication unit to the control device.

Basically, it can also be provided that control signals are transmitted from the control device of the motor vehicle to the camera. This can also be effected via the at least one line of the connecting cable. Here too, it can be provided that the control signals are modulated onto the at least one connecting line. Thus, a bidirectional data exchange between the control device and the camera can be allowed.

A vehicle/trailer combination according to the invention includes a motor vehicle and a trailer coupled to the motor vehicle, wherein the motor vehicle and the trailer are electrically connected by a connecting cable for voltage supply of the rear lights of the trailer. In addition, the vehicle/trailer combination includes a camera system according to the invention. Therein, it is in particular provided that the first communication unit of the

camera system is disposed on or in the trailer and the second communication unit of the camera system is disposed on or in the motor vehicle.

A motor vehicle also belongs to the invention, which includes the first component of the camera system. The motor vehicle can for example be a passenger car. The motor vehicle can also be a truck. The motor vehicle can also be a towing vehicle. Therein, it can be provided that the two lines of the connecting cable, via which the image data is transmitted, are formed as a twisted pair of lines in the motor vehicle.

Further, a trailer with a second component of the camera system belongs to the invention. The trailer can be formed as a trailer for a motor vehicle or as a trailer for a truck. Here too, it can be provided that the two lines of the electrical connecting cable, via which the image data is transmitted, are formed as a twisted pair of lines. Further, it can be provided that at least one line of the connecting cable is used to supply the camera of the trailer with electrical energy. Thus, it is not required that the camera has an own energy storage, for example in the form of a battery.

The preferred embodiments presented with respect to the method according to the invention and the advantages thereof correspondingly apply to the camera system according to the invention, to the vehicle/trailer combination according to the invention, to the motor vehicle according to the invention as well as to the trailer according to the invention.

Further features of the invention are apparent from the claims, the figure and the description of figure. The features and feature combinations mentioned above in the description as well as the features and feature combinations mentioned below in the description of figure and/or shown in the figure 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 figure 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.

Now, the invention is explained in more detail based on a preferred embodiment as well as with reference to the attached drawing. Therein, the only figure shows a vehicle/trailer

combination according to an embodiment of the present invention, which has a camera system.

The figure shows a vehicle/trailer combination 1 according to an embodiment of the present invention in a plan view. The vehicle/trailer combination 1 includes a motor vehicle 2 as well as a trailer 3. Presently, the motor vehicle 2 is formed as a passenger car. The trailer 3 has a drawbar 4, which is connected to a trailer coupling 5 of the motor vehicle 2. Thus, the motor vehicle 2 and the trailer 3 are coupled. Moreover, the motor vehicle 2 and the trailer 3 are electrically connected by means of a supply cable 6. The supply cable 6 serves for voltage supply of the rear lights 7 of the trailer 3.

The supply cable 6 can for example be 7-pole or 13-pole formed. Further, the connecting cable 6 can have a connector in the area of the trailer coupling 5. For the sake of clarity, presently, a first line 8 and a second line 9 are illustrated of the connecting cable 6. Therein, the first line 8 and the second line 9 serve for electrical supply of the illuminants or the individual lights of one of the rear lights 7 of the trailer 3. Presently, the first line 8 is connected to a turn indicator 10 and the second line 9 is connected to a tail light 11 of one of the rear lights 7.

On the part of the motor vehicle, the connecting cable 6 or the first line 8 and the second line 9 are connected to a light controller 12. With the aid of the light controller 12, the voltage supply of the individual lights of the rear lights 7 and presently of the turn indicator 10 and the tail light 11 can be controlled. In other words, the turn indicator 10 and the tail light 11 can be activated and deactivated with the aid of the light controller 12.

Moreover, the vehicle/trailer combination 1 includes a camera system 13. This camera system 13 includes a first component 14 disposed on the trailer 3. This first component 14 of the camera system 13 includes a camera 15. The camera 15 is disposed on a rear side 16 of the trailer 3. With the aid of the camera 15, image data or video data can be provided, which shows an environmental region 17 of the trailer 3 or of the vehicle/trailer combination 1. Moreover, the camera system 13 or the first component 14 of the camera system 13 includes a first communication unit 18. This first communication unit 18 can be formed in the manner of a splitter and serve for modulating the image data captured by the camera 15 onto the first line 8 and the second line 9. Thereby, the image data can be transmitted to the motor vehicle 2 as a modulation signal. Basically, it can be provided that the first line 8 and the second line 9 are formed as a twisted pair of lines to avoid interferences in the data transmission of the image data.

Moreover, the camera system 13 includes a second component 19, which is disposed in the motor vehicle 2. The second component 19 of the camera system 13 includes a second communication unit 20, which serves to demodulate the image data transmitted and modulated via the connecting cable 6 or the lines 8, 9. Further, the second communication unit 20, which can also be formed in the manner of a splitter, is connected to a control device 21 of the motor vehicle 2. The control device 21 can for example be a part of a so-called Camera Monitoring System, which receives the image data from multiple cameras of the motor vehicle 2 and presents a corresponding display by means of a display device depending thereon. In addition, the display device can be correspondingly controlled by the control device 21 and thus the image data received from the camera 15 of the trailer 3 can be presented on the display device. Thereby, the driver of the vehicle/trailer combination 1 can be assisted in maneuvering.

Claims

1. Method for capturing an environmental region (17) of a vehicle/trailer combination (1) including a motor vehicle (2) and a trailer (3), which are electrically connected by a connecting cable (6) for voltage supply of rear lights (7) of the trailer (3), in which image data describing the environmental region (17) is provided by means of a camera (15) disposed on the trailer (3) and is transmitted to the motor vehicle (2), characterized in that
the image data is transmitted to the motor vehicle (2) via at least one line (8, 9) of connecting cable (6) as a modulation signal and the supply cable (6) includes a first conductor (8) and a second conductor (9), which are associated with one of the rear lights (7) of the trailer (3), and the modulation signal is transmitted to the motor vehicle (2) via the first line (8) and the second line (9).
2. Method according to claim 1,
characterized in that
the modulation signal has a higher frequency compared to a supply voltage transmitted via the at least one line (8, 9).
3. Method according to claim 1 or 2,
characterized in that
for transmitting the modulation signal, the first line (8) and the second line (9) of the connecting cable (6) are provided as a twisted pair of lines at least in certain areas.
4. Method according to any one of the preceding claims,
characterized in that
the modulation signal transmitted to the motor vehicle (2) is demodulated and the image data is transmitted to a control device (21) of the motor vehicle (2).
5. Method according to claim 3,
characterized in that
a display device of the motor vehicle (2) is controlled for presenting a display by means of the control device (21) depending on the image data.

6. Method according to claim 5,
characterized in that
further image data is received from at least one camera of the motor vehicle (2) by the control device (21) and the display device is additionally controlled by means of the control device (21) depending on the further received image data.
7. Camera system (13) for capturing an environmental region (17) of a vehicle/trailer combination (1), which includes a motor vehicle (2) and a trailer (3), which are electrically connected by a connecting cable (6) for voltage supply of rear lights (7) of the trailer (3), wherein the camera system (13) includes a camera (15), which can be disposed on the trailer (3) and by means of which image data describing the environmental region (17) can be provided, and a first communication unit (18) for transmitting the image data to the motor vehicle (2),
characterized in that
the first communication unit (18) is adapted to transmit the image data to the motor vehicle (2) via at least one line (8, 9) of the connecting cable (6) as a modulation signal.
8. Camera system (13) according to claim 7,
characterized in that
the camera system (13) has a second communication unit (20), which is adapted to demodulate the modulation signal transmitted to the motor vehicle (2) and to transmit the image data to a control device (21) of the motor vehicle (2).
9. Vehicle/trailer combination (1) with a motor vehicle (2), with a trailer (3) coupled to the motor vehicle (2), wherein the motor vehicle (2) and the trailer (3) are electrically connected by a connecting cable (6) for voltage supply of rear lights (7) of the trailer (3), and with a camera system (13) according to claim 8.
10. Vehicle/trailer combination (1) according to claim 9,
characterized in that
the first communication unit (18) of the camera system (13) is disposed on or in the trailer (3) and the second communication unit (20) of the camera system (13) is disposed on or in the motor vehicle (2).

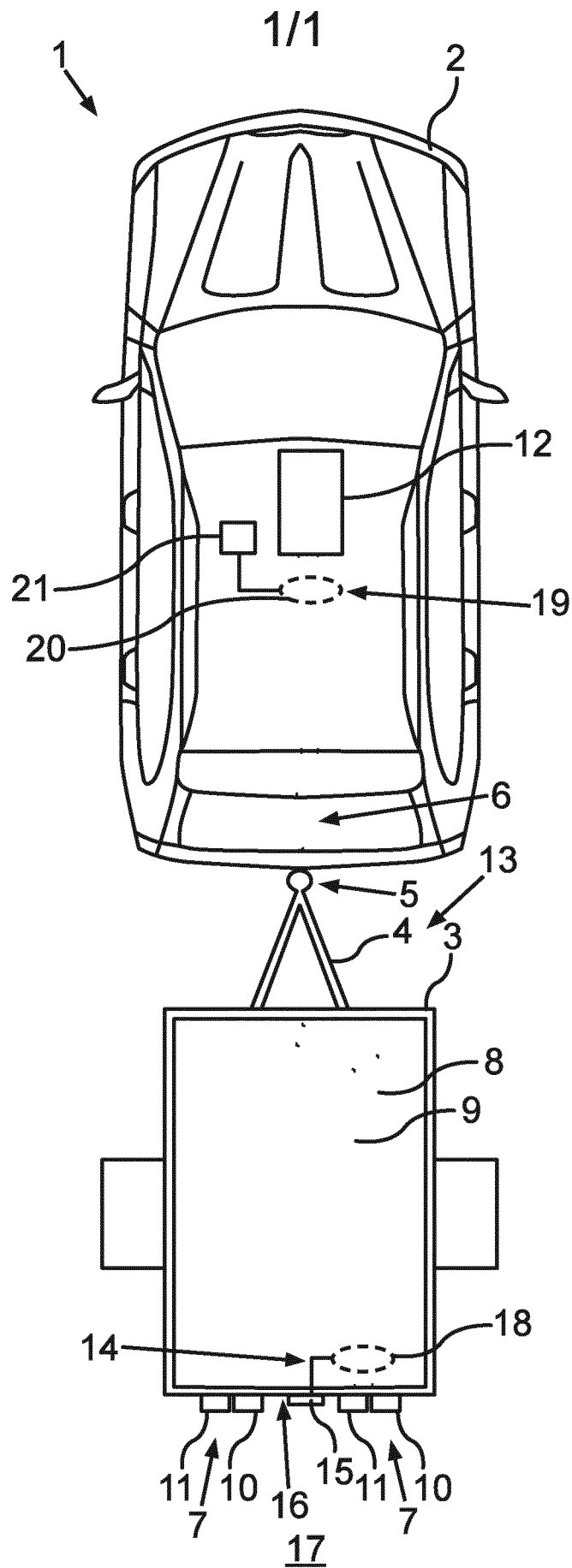


Fig.

INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2016/080872

A. CLASSIFICATION OF SUBJECT MATTER
 INV. B60R1/02 B60D1/62
 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)

B60R B60D H04N

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 2006/064208 A1 (LANG HEINRICH [DE] ET AL) 23 March 2006 (2006-03-23) paragraphs [0011], [0029] - [0036], [0040]; figures -----	1,2,4-10
X	US 2013/158740 A1 (KAHLER PETER [DE] ET AL) 20 June 2013 (2013-06-20) paragraphs [0010] - [0012], [0023], [0053] - [0056]; figure 2 -----	1,2,4-10
X	DE 10 2006 020511 A1 (EFKON MOBILITY GMBH [DE]) 8 November 2007 (2007-11-08) paragraphs [0030] - [0032], [0041] - [0044]; figure 5 -----	1,2,4-10
X	DE 10 2011 006812 A1 (BOSCH GMBH [DE]) 11 October 2012 (2012-10-11) paragraphs [0034], [0064], [0065]; figure 6 -----	1-5



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

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"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

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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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Name and mailing address of the ISA/

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Authorized officer

Krieger, Philippe

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2016/080872

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