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(54) Title: CONCEALED MOUNTING FOR AUTONOMOUS VEHICLE SENSOR

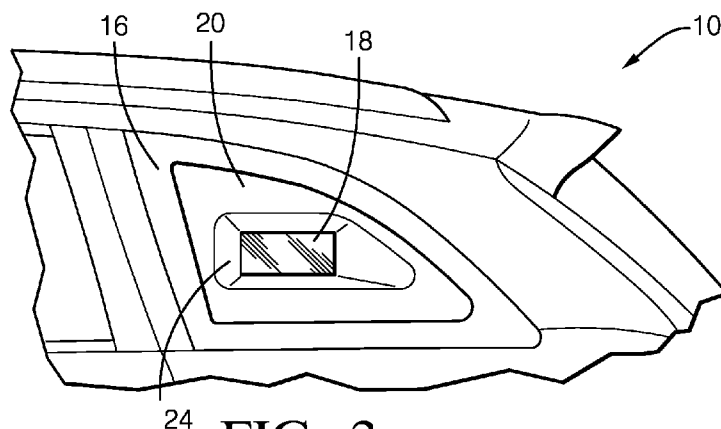


FIG. 2

(57) Abstract: A lidar unit is mounted to an autonomous vehicle within an existing rear side window opening. An opaque inner panel blocks light, while the exterior window covers and protects the lidar unit, maintaining the original appearance and aerodynamic form of the vehicle exterior, in conjunction with the opaque inner panel.

CONCEALED MOUNTING FOR AUTONOMOUS VEHICLE SENSOR.

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims the benefit of U.S. Provisional Patent Application No. 62/112,783, filed February 6, 2015, the entire disclosure of which is hereby incorporated herein by reference.

TECHNICAL FIELD OF INVENTION

[0002] This disclosure relates generally to mountings for autonomous vehicle sensors, and specifically to a mounting in which a sensor is environmentally protected, aerodynamic, and visually unobtrusive.

BACKGROUND OF INVENTION

[0003] Typically, in autonomous vehicles, the large number of necessary sensors needed around the perimeter of the vehicle are mounted on exterior brackets located wherever the optimal sensor location may be, without considering aerodynamics, environmental protection, or visual unobtrusiveness. It would be desirable to accommodate all three of these concerns if it could be done so while maintaining a near optimal location of the sensor or sensors.

SUMMARY OF THE INVENTION

[0004] In a preferred embodiment described herein, a sensor located on the side of a vehicle is mounted behind and within a vehicle body exterior panel that visually blends in with the exterior of the vehicle, but which has at least a portion that is sufficiently transparent to the sensing medium of the sensor (laser light, radar, etc) to allow it to operate. Specifically, a rear side window is replaced with a panel that has a central, transparent subportion, behind which the sensor is mounted, and an opaque border matching that typically found in a window. The sensor is contained between the front panel and a rear cover that protects and covers it from the vehicle interior, and which also helps mask the sensor from the outside and helps to maintain its unobtrusive visual impact.

[0005] Further features and advantages will appear more clearly on a reading of the following detailed description of the preferred embodiment, which is given by way of non-limiting example only and with reference to the accompanying drawings.

BRIEF DESCRIPTION OF DRAWINGS

[0006] The present invention will now be described, by way of example with reference to the accompanying drawings, in which:

[0007] Fig. 1 is a rear side perspective view of a vehicle;

[0008] Fig. 2 is an enlarged view of a rear side window opening on the same vehicle, with a sensor installed but uncovered;

[0009] Fig. 3 is a view similar to Fig. 2, showing the sensor covered;

[0010] Figure 4 is a view of the cover panel alone, showing the sensor location in a dotted line.

DETAILED DESCRIPTION

[0011] Fig. 1 illustrates a typical cross over style vehicle 10, although that is a non limiting example and other body styles are possible. A rear side window 12 is present, behind the rear passenger window 14, but is typically more to provide some illumination to the rear cargo space than a view out for a passenger. Window 12 is often tinted to match or blend well with the basic color of the vehicle, and serves an aesthetic purpose as much as a utilitarian one, as an uninterrupted metal panel in that location would give the vehicle more of a commercial appearance, undesirable in a personal vehicle. Window 12 is weather tight, of course, and its inner surface perimeter is often provided with an inch or two wide band of paint or “frit” to mask the metal body frame to which it is installed, typically by an adhesive bead. The outer surface of window 12, as well as all of the other windows and body panels may be said to define a vehicle outer surface in general, which it is desirable to maintain as uninterrupted as possible by any sensor mounting arrangements, for both aerodynamic and aesthetic reasons.

[0012] Referring next to Figure 2, a rear window opening 16 in the vehicle body comprises a perimeter flange of whatever vehicle body material is used in the particular vehicle, typically stamped metal. Conventionally, the window 12 would simply be mounted to it, as described above. But, here, it is used as a convenient location for a sensor, specifically a lidar sensor 18. While the invention is not limited to such a sensor, it is a typical one in the location indicated for autonomous vehicles. LIDAR is not an

acronym, as is commonly believed, but is shorthand for Light Detection and Ranging, an amalgam of Light and Radar. In effect, it is a ranging radar that uses laser light instead of radio waves. LIDAR uses ultraviolet, visible or near infrared light to image objects, and is capable of doing so with a very high level of resolution. Two types of pulse models are available, micropulse, and high energy, with the lower energy, “eye safe” systems being preferable for mobile sensing applications, as here. The particular LIDAR device 18 used here, though the invention is not limited to such, is an ibeo LUX 2010 Laserscanner. It is of the general type described above, and is defined by a rectangular prism, with a length L of approximately 150 mm, a width W of approximately 90 millimeters (at the front) and a depth D of approximately 90 mm. To work properly, it needs a solid mounting and must be able to emit and receive its light signal.

[0013] Still referring to Figure 2, a structurally solid and opaque inner panel 20, of rigid formed plastic or the like, and preferably black or dark, is fixed solidly in or to the window opening 16 so as to substantially fill it and prevent the transmission of light in or out of vehicle 10, but for a central opening 22 within which the lidar may be fixed. A concave depression 24 formed around opening 22 allows the lidar unit 18 to be mounted further back within the vehicle interior while still being unobstructed in terms of emitting and receiving its light signal.

[0014] Referring next to Figures 3 and 4, The mounting for lidar unit 18 is completed by an exterior panel, indicated generally at 26 which, at least in the embodiment disclosed, may be essentially identical to the rear side window 12 that it replaces. Fundamentally, exterior panel 26 serves the function of sealing the window opening 16 weather tight, while matching the pre existing exterior surface contour to maintain aerodynamics and

appearance. The central area 28 of panel 26 is transmissive to whatever signal the enclosed sensor emits and receives, in this case, light, and so is sufficiently transparent to light in the case of a lidar unit 18. Central area 28 could be tinted so as to help match the existing color scheme of the vehicle exterior, and still be sufficiently transparent. In the case of a radar unit or the like panel 26 could be completely opaque, and formed of any suitable material for the passing of the signal involved. In the case of a nearly transparent central area 28, an opaque or nearly opaque border 30 is formed around the inner surface perimeter, which serves to mask the window opening 16 to which the panel 26 is attached, typically by an adhesive bead. Especially in the case where the central 28 area is nearly transparent, the opaque inner panel 20 helps to maintain the visual unobtrusiveness of the mounting by preventing the passage of light into or out of the exterior of the vehicle interior. Even in the case where the sensor enclosed did not rely on visible light, a transparent central area 28 could help to maintain the original visible appearance of the vehicle 10 in conjunction with the opaque inner panel 20.

[0015] While this invention has been described in terms of the preferred embodiments thereof, it is not intended to be so limited, but rather only to the extent set forth in the claims that follow.

WE CLAIM:

1. A concealed mounting assembly for a sensor in an autonomously driven vehicle, comprising,
a sensor that emits and receives a sensing signal,
a vehicle body having a pre-defined outer surface,
an opening in said body outer surface,
an opaque panel mounted within said opening inboard of said vehicle body outer surface, said sensor being mounted within said opening so as be able to emit and receive without interference from said opaque panel while is blocked from passing through said opening to and from the exterior of the vehicle, and,
an exterior panel fixed to the vehicle so as to seal the opening from the exterior and having at least a portion transmissive to the signal of the sensor, so that said sensor may operate while being substantially visibly concealed.
2. The mounting in accordance with claim 1, wherein said sensor relies on visible light, and said exterior panel includes a substantially transparent central area.
3. The mounting in accordance with claim 2, in which said opening is defined by a perimeter flange and said exterior panel contains a substantially opaque border masking said window opening flange.

4. The mounting in accordance with claim 1, in which said opening comprises a rear side window opening, and said exterior panel comprises the original rear side window.

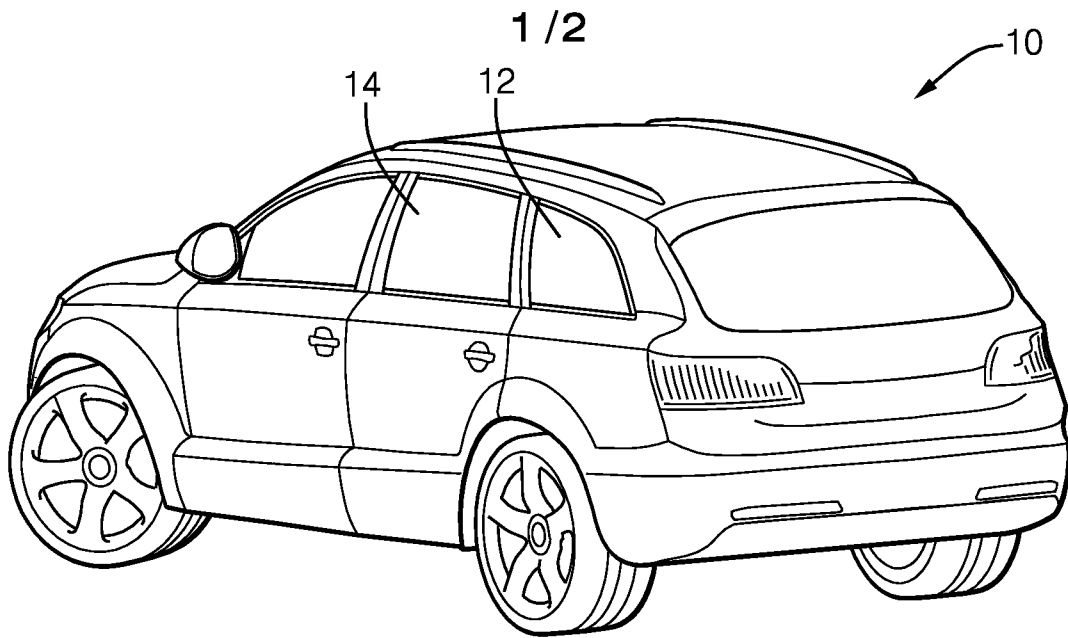


FIG. 1

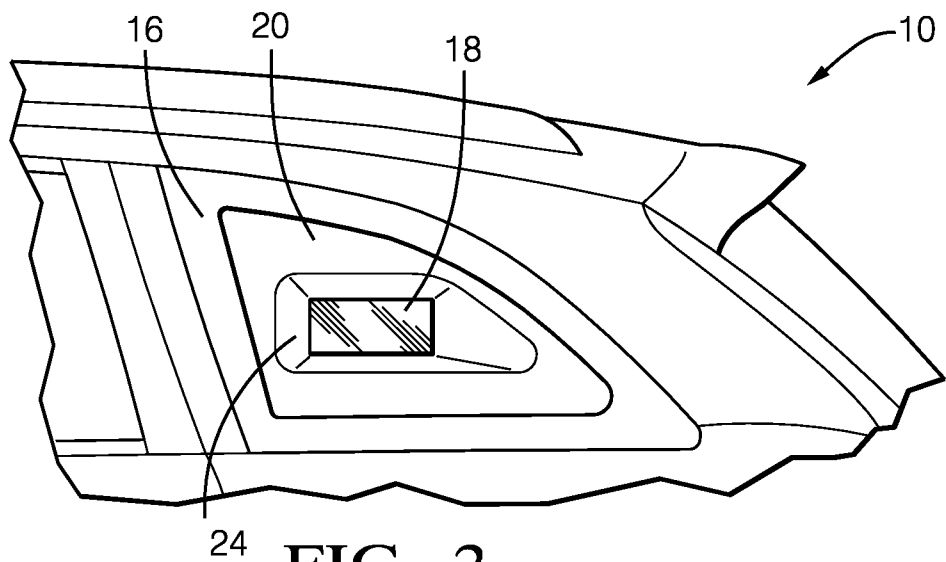


FIG. 2

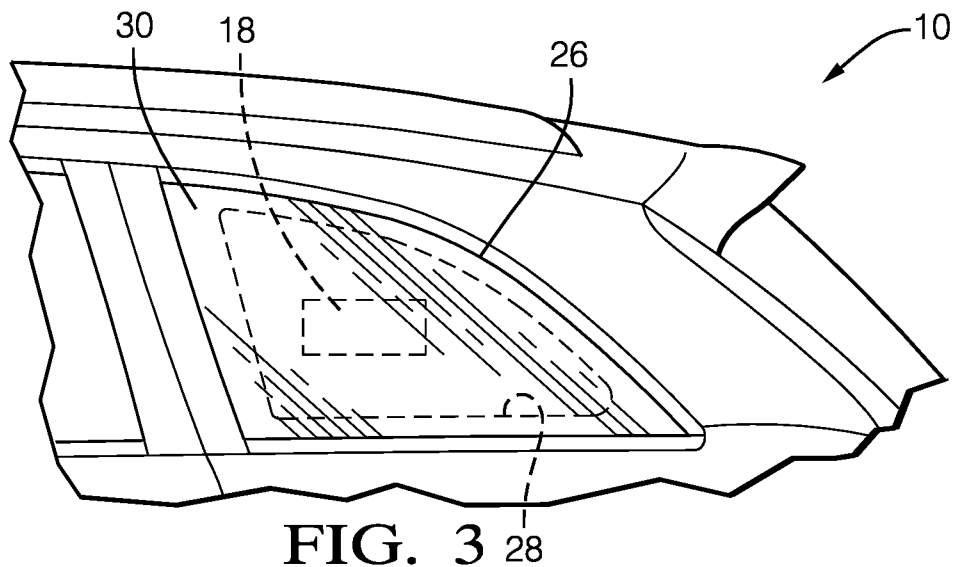


FIG. 3

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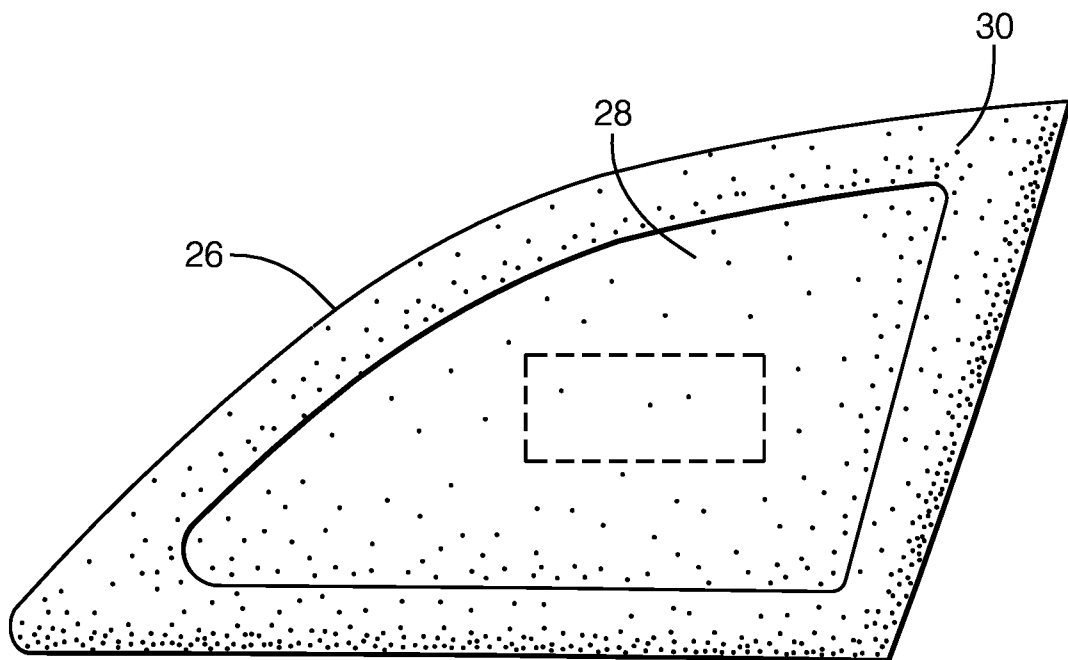


FIG. 4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US2016/016045**A. CLASSIFICATION OF SUBJECT MATTER****G01S 17/93(2006.01)i, G05D 1/02(2006.01)i**

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)

G01S 17/93; B60R 1/00; F21V 23/04; G09G 3/32; B60Q 1/00; G08G 1/00; G01C 3/08; G05D 1/02

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

Korean utility models and applications for utility models

Japanese utility models and applications for utility models

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

eKOMPASS(KIPO internal) & keywords: lidar, vehicle, window, transparent, conceal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
Y	US 2008-0225395 A1 (VEERASAMY) 18 September 2008 See paragraphs [0003]-[0004], [0101]-[0107] and figure 1B.	1-4
Y	US 2010-0238006 A1 (GRIDER et al.) 23 September 2010 See paragraphs [0044]-[0052], claim 1 and figures 1-5.	1-4
A	US 5629690 A (KNOLL) 13 May 1997 See abstract and figures 1-2.	1-4
A	US 2013-0265563 A1 (VOGT et al.) 10 October 2013 See figures 1-9.	1-4
A	US 7637631 B2 (MCDERMOTT et al.) 29 December 2009 See figures 1-5.	1-4



Further documents are listed in the continuation of Box C.



See patent family annex.

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"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

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INTERNATIONAL SEARCH REPORT

Information on patent family members

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