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(54) **ELECTRONIC PANEL FOR ROAD SIGNALING, APPLICATION PROCESS AND ITS USES**

(57) A road signalling electronic panel (1), its application process and respective uses, for installation on a support surface in a predetermined signalling direction, comprising: signalling face comprising a plurality of light emitters arranged in a matrix along lines and columns of said emitters; a panel fixing structure to the support surface by the panel part opposite to that of the signalling face; wherein said fixing structure is configured to secure the panel such that the signalling face and support surface are arranged at a predetermined angle, herein re-

ferred to as installation angle (α , A); wherein said light emitters are coupled to the panel forming a predetermined angle between the light projection direction of the emitters and said signalling face, referred to herein as projection angle (β); wherein, in a section perpendicular to said support surface and parallel to the signalling direction, said installation (α , A) and projection (β) angles are interior alternating angles relative to the transverse formed by the signalling face; wherein the projection angle is greater than the installation angle.

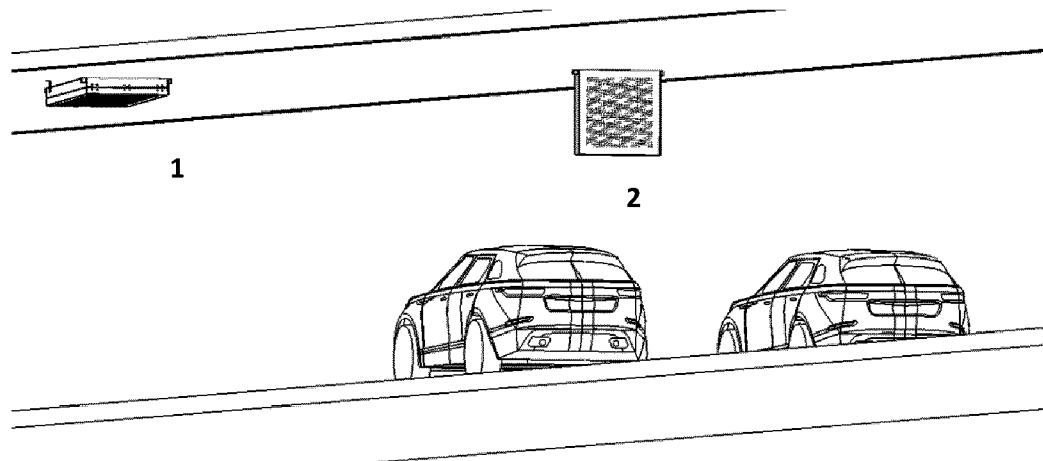


Figure 2

Description

Technical Field

[0001] The present disclosure relates to a dynamic or variable signalling panel, in LED technology, for application in road environments, road and traffic signalling, comprising a signalling face which may be installed at predetermined angles of visibility with respect to traffic roads and to vehicles traveling on the roads.

Background

[0002] The traditional solution of variable road signalling consists of LED technology electronic displays, which are installed in space/means above the traffic lane, tunnel ceiling or on gantry, or at the side of the road, on posts or side supports, but always in visibility angles perpendicular to the road, of front surface with respect to the vehicles traveling on the road.

[0003] The size of these displays, and hence the scope of their function, depends on the existence of minimum physical conditions for their applicability.

[0004] Patent document EP1596352 refers to an electronic panel for in-line variable road signalling which rotates about a drive shaft driven by a motor. According to the document, the device comprises a panel opening/closing mechanism and not a display or signalling solution itself. However, the signalling panel solution can be seen as similar or resembling to the one we are proposing given the installation method. But this solution does not allow angle adjustments as performed by our solution and is only applicable to tunnel ceilings. As such, this solution has a different construction and different application than the present disclosure.

[0005] SWARCO's EP0930600 document describes a panel comprising an optical element that comprises at least one LED, at least one converging lens and one divergent lens. The LED and the lenses are arranged in a common structure coaxial to the geometric axis of the element and at an angle of inclination to the geometric axis. As such, this solution concerns the optical elements, lenses, and not the panels themselves, and thus it is not related to what we are proposing.

[0006] Some of the industry competitors but only with traditional format solutions/products:

- AESYS (www.aesys.com)
- ORTANA (www.ortana.com)
- LACROIX (www.lacroix-city.com)
- SOLARI (www.solari.it)

[0007] These facts are described in order to illustrate the technical problem solved by the embodiments of the present document.

General description

[0008] The present disclosure relates to a dynamic and variable signalling panel in LED technology, for application in road environments, road and traffic signalling, which comprises a flat front surface which can be installed at visibility angles up to 180 degrees relative to the traffic roads and to the vehicles traveling therein.

[0009] The idea and concept behind the present disclosure is based on the principle of the optical illusion, anamorphosis, paintings or markings on flat surfaces, their perspective interpretation, the distance and function of the angle of visibility.

[0010] Based on that principle, by resorting to the technologies and materials used in the construction of variable signalling products, namely LED - Light Emitting Diode technology, applying a new design, organization and technological construction, the present disclosure is obtained, with the same performance and compatibility level, in accordance with the applicable European standard: EN 12966 of 2009.

[0011] The disclosure includes:

- Variable signalling panel in LED technology, with flat front surface that can be installed at visibility angles up to 180 degrees with respect to the traffic roads, at lateral, top and bottom positions relative to the vehicles traveling on the roads.
- Significant reduction of artificial or natural light reflections, towards the vehicles on the road, considering the installation angle, given that the entire front side is flat and angled up to 180 degrees.
- Requirements for physical space, allocation or reduction of usable space concerning structure gauge or roadsides, of traffic roads, to less than 200mm.
- Possibility of installation on any surface around the road: top, sides or bottom.
- Flat front side allowing easy maintenance and better adaptation to environmental conditions, whether weather or pollution.

[0012] In an embodiment of the present disclosure the road panel for installation on a support surface in a predetermined signalling direction may comprise:

- signalling face comprising a plurality of light emitters arranged in a matrix along lines and columns of said emitters;
- a panel fixing structure to the support surface by the panel part opposite to that of the signalling face;
- wherein said fixing structure is configured to secure the panel in such a way that the signalling face and support surface are arranged at a predetermined angle, herein referred to as installation angle (α , A);

wherein said light emitters are coupled to the panel forming a predetermined angle between the light projection direction of the emitters and said signalling face, referred to herein as projection angle (β); wherein, in a section perpendicular to said support surface and parallel to the signalling direction, said installation (α , A) and projection (β) angles are interior alternating angles relative to the transverse formed by the signalling face; wherein the projection angle is greater than the installation angle.

[0013] In an embodiment the signalling panel comprises the installation angle (α , A) which is adjustable.

[0014] In an embodiment, the signalling panel comprises the projection angle (β) which is adjustable.

[0015] Both angles can be adjusted, or constructed with different combinations in a way to provide the best intended visibility for the installation.

[0016] In an embodiment, the signalling panel comprises, on the signalling face, a plurality of openings, each one housing at least one respective light emitter, forming a pixel which is an element of an image to be signalled by the signalling face, wherein said openings are elongated in the direction of signalling.

[0017] Preferably, the electronic signalling panel is a display.

[0018] In an embodiment, the openings are oval or rectangular or stadium-shaped.

[0019] In an embodiment, the panel comprises an interior support for the light emitters with a sawtooth-shaped cross-section, wherein a surface of each sawtooth receives a line of light emitters arranged with the light projection direction.

[0020] In an embodiment, the installation angle is between 0° and 15° , in particular being between 0° and 7° .

[0021] In an embodiment, the installation angle is of 0° , 1° , 2° , 3° , 4° , 5° , 6° , or 7° .

[0022] In an embodiment, the projection angle is between 5° to 60° , in particular between 5° and 30° .

[0023] In an embodiment, the projection angle can be of 5° , 6° , 7° , 8° , 9° , 10° , 11° , 12° , 13° , 14° , 15° , 16° , 17° , 18° , 19° , 20° , 21° , 22° , 23° , 24° , 25° , 26° , 27° , 28° , 29° or 30° .

[0024] In an embodiment, the signalling face is flat.

[0025] In an embodiment, the support surface may be comprised: in a side wall, in a vertical pillar, in a tunnel ceiling, or under a bridge.

[0026] In an embodiment, the signs are warnings, information or images.

[0027] The disclosure also includes a method of applying an electronic signalling panel according to any one of the preceding claims, that comprises: applying said electronic signalling panel to said support surface, such that the signalling face and the support surface are arranged at said predetermined installation angle (α , A).

[0028] It is also disclosed the use of an electronic signalling panel according to any one of described embod-

iments for signalling in a tunnel, in a road speed bump, or in a road floor.

Brief description of the figures

[0029] For an easier understanding of the present disclosure, figures are herein attached, which represent preferred embodiments which, however, are not intended to limit the scope of the present disclosure.

Figure 1: Front view of an embodiment of the panels with the application of the present disclosure (1) compared to the application of traditional solutions (2).

Figure 2: Perspective of an embodiment of the panels with the application of the present disclosure (1) compared to the application of traditional solutions (2).

Figure 3: Side view of an embodiment of the panels with the application of the present disclosure (1) compared to the application of traditional solutions (2).

Figure 4: Side view of an embodiment of the panels of the present disclosure compared to the panel size of traditional solutions for the same area of visibility where:

- (A) represents a traditional panel at 90° - 318 mm;
- (B) represents a traditional panel at 83° - 316 mm;
- (C) represents an embodiment of the present disclosure at 7° - 800mm;
- (D) represents an embodiment of the present disclosure at 0° - 1527 mm.

Figure 5: An embodiment of the panels applied in the form of a floor panel embedded in a speed bump (a) and a modular floor panel embedded in a speed bump with a top view (b) and a distance view by the driver (c).

Figure 6: An embodiment of the panels with the sawtoothed inner frame and respective lighting system.

Figure 7: An embodiment of the panels with side, top and driver views.

Figure 8: An embodiment of the present disclosure regarding the relationship between the rotation of the displays and the respective visibility distance.

Detailed Description

[0030] The present disclosure comprises a new and innovative constructive principle/design for dynamic/var-

iable signalling panels for application in road environments, road and traffic signalling.

[0031] This new constructive principle/design offers the possibility to install signalling panels with reduced physical space and at non-traditional angles relative to the road infrastructure while maintaining and ensuring the performance, functionality and technology characteristics of variable signalling, but allowing its application, introduction and installation under physical conditions where the traditional format is not possible. Examples of these conditions are as follows:

- Installation of variable signalling on tunnel ceilings having low structure gauge;
- Variable signalling installation on tunnel walls, or on the sides of narrow roadside roads (e.g. bridges, toll lanes, old, urban or rural roads, access to car parking or others);
- Installation of variable signalling on the floor of roads, integrated in the floor or in artificial speed bumps.

[0032] The final solution provides a product with a simple construction, with a front side having flat surface, that can be installed at visibility angles of up to 180 degrees relative to the traffic roads and to the vehicles traveling therein. Figures 5, 6 and 9 below illustrate this application on the road floor.

[0033] To allow for the practical implementation of the principle described, the LED display electronic solution is reorganized in an even more modular way than the traditional one, by means of a system that allows the creation of visibility lines adjustable in angle of light projection - and adjustable in intervals with each other so as to create the optical illusion and the correct interpretation/reading of the signalling. In practice, the solution can be implemented with predefined visibility points (LEDs) for predefined signalling, or LED lines that are configurable/programmable through smart controllers.

Table I - Relationship between display rotation and respective visibility distance.

Panel Rotation (A)	Visibility Distance (B)
0°	12.724 m
1°	13.623 m
2°	14.666 m
3°	15.888 m
4°	17.340 m
5°	19.087 m
6°	21.231 m
7°	23.919 m

[0034] In figure 8 it is possible to see the relationship between the rotation of the display (A) and the visibility

distance (B) of the driver on the traffic road (see also Table I).

[0035] In figure 4 it is possible to observe how the inclination of the panel allows having a physically shorter display, but which visually corresponds to a display of larger dimensions that had been mounted flat relative to the support surface.

[0036] The term "comprises" or "comprising" when used herein is intended to indicate the presence of the mentioned characteristics, elements, integers, steps and components, but does not preclude the presence or addition of one or more other characteristics, elements, integers, steps and components, or groups thereof.

[0037] The described embodiments are combinable with each other. The present invention is, of course, in no way restricted to the embodiments described herein and a person with ordinary skills in the art may foresee many possibilities of modification thereof and substitution of technical characteristics for other equivalents, depending on the requirements of each situation, as defined in the appended claims. The following claims define further embodiments of the present description.

Claims

1. Electronic road signalling panel for installation on a support surface in a predetermined signalling direction, comprising:

signalling face comprising a plurality of light emitters arranged in a matrix along lines and columns of said emitters;

a panel fixing structure to the support surface by the panel part opposite to that of the signalling face;

wherein said fixing structure is configured to secure the panel such that the signalling face and support surface are arranged at a predetermined angle,

herein referred to as installation angle (α , A);

wherein said light emitters are coupled to the panel forming a predetermined angle between the light projection direction of the emitters and said signalling face, referred to herein as projection angle (β);

wherein, in a section perpendicular to said support surface and parallel to the signalling direction, said installation (α , A) and projection (β) angles are interior alternating angles relative to the transverse formed by the signalling face; wherein the projection angle is greater than the installation angle.

2. Electronic signalling panel according to the preceding claim wherein the signalling face comprises a plurality of openings, each housing at least one respective light emitter, forming a pixel which is an el-

ement of an image to be signalled by the signalling face; wherein said openings are elongated in the signalling direction, preferably said electronic signalling panel being a display.

3. Electronic signalling panel according to the preceding claim wherein the openings are oval or rectangular or stadium-shaped. 5
4. Electronic signalling panel according to any one of the preceding claims, wherein the installation angle (α , A) is adjustable. 10
5. Electronic signalling panel according to any one of the preceding claims, wherein the projection angle (β) is adjustable. 15
6. Electronic signalling panel according to any one of the preceding claims, wherein the panel comprises an interior support for the light emitters with a saw-tooth-shaped cross-section, wherein a surface of each saw-tooth receives a line of light emitters arranged with the light projection direction. 20
7. Electronic signalling panel according to any one of the preceding claims, wherein the installation angle is between 0° and 15°, in particular being between 0° and 7°. 25
8. Electronic signalling panel according to the preceding claim, wherein the installation angle is of 0°, 1°, 2°, 3°, 4°, 5°, 6°, or 7°. 30
9. Electronic signalling panel according to any one of the preceding claims, wherein the projection angle is between 5° and 60°, in particular being between 5° and 30°. 35
10. Electronic signalling panel according to the preceding claim, wherein the projection angle is of 5°, 6°, 7°, 8°, 9°, 10°, 11°, 12°, 13°, 14°, 15°, 16°, 17°, 18°, 19°, 20°, 21°, 22°, 23°, 24°, 25°, 26°, 27°, 28°, 29° or 30°. 40
11. Electronic signalling panel according to any one of the preceding claims, wherein the signalling face is flat. 45
12. Electronic signalling panel according to any one of the preceding claims, wherein the support surface is comprised: in a side wall, in a vertical pillar, in a tunnel ceiling, or under a bridge. 50
13. Electronic signalling panel according to any one of the preceding claims wherein the signs are warnings, information or images. 55
14. Method of applying an electronic signalling panel ac-

cording to any one of the preceding claims, that comprises:

applying said electronic signalling panel to said support surface, such that the signalling face and the support surface are arranged at said predetermined installation angle (α , A).

15. Use of an electronic signalling panel according to any one of claims 1 - 13 for signalling in tunnel, in road speed bump, or in road floor.

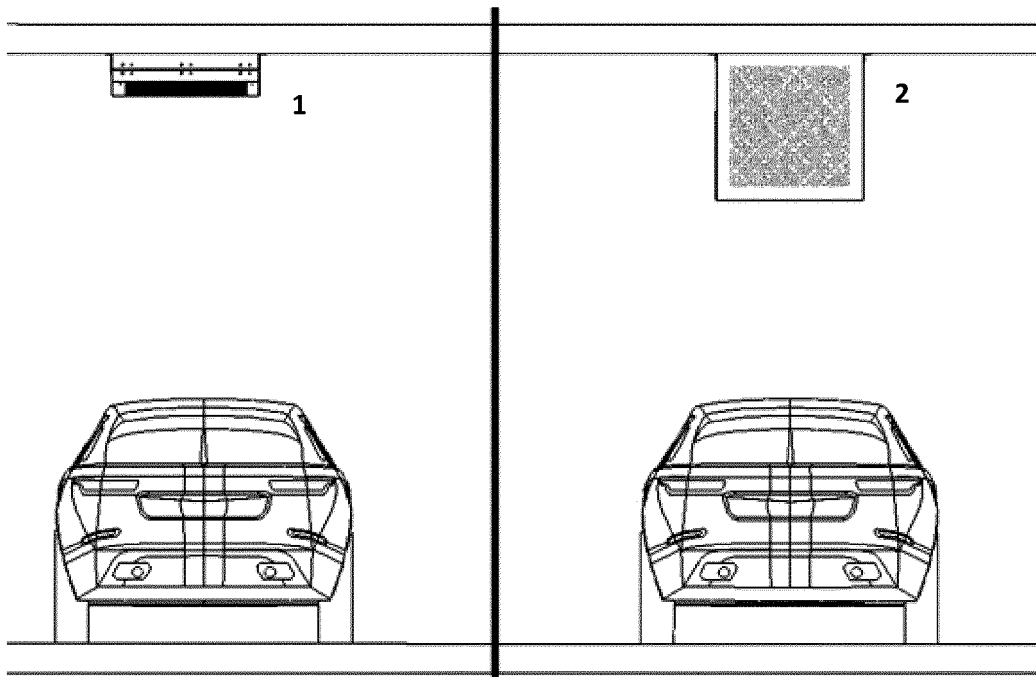


Figure 1

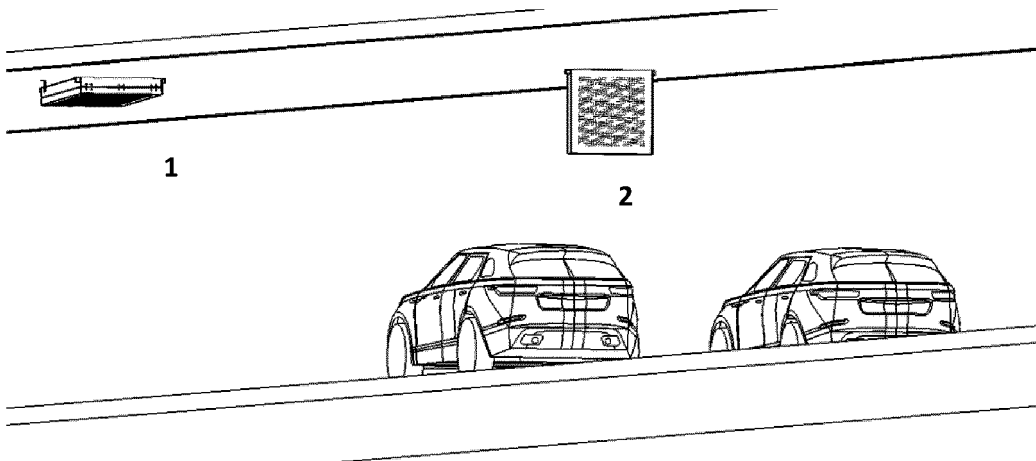


Figure 2

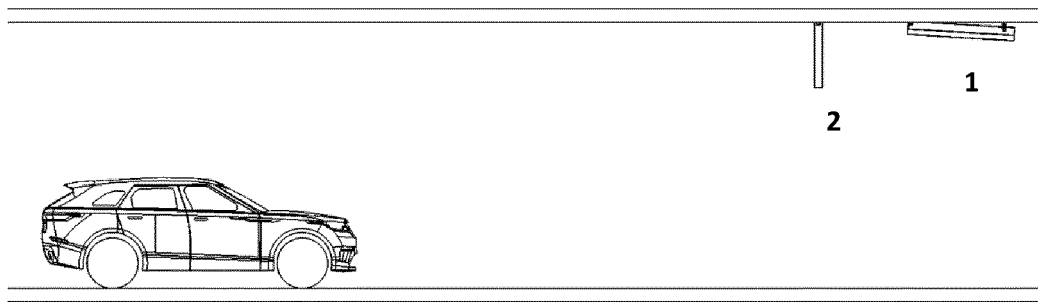


Figure 3

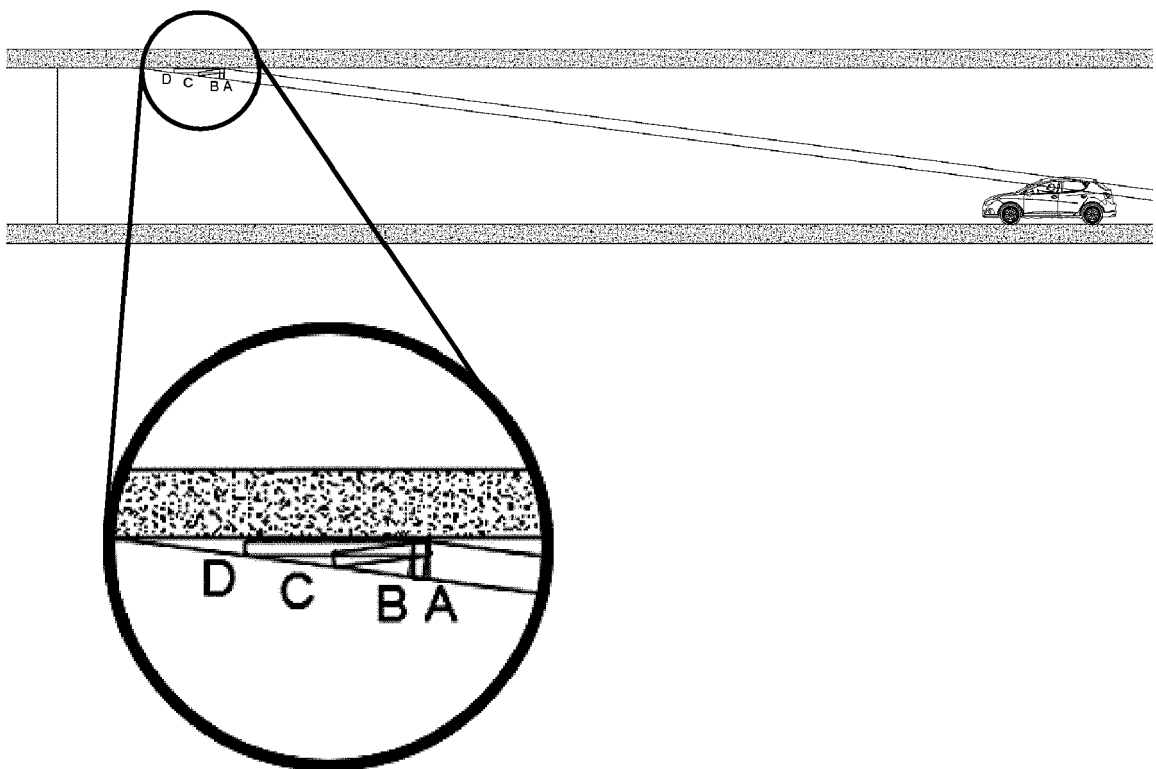


Figure 4

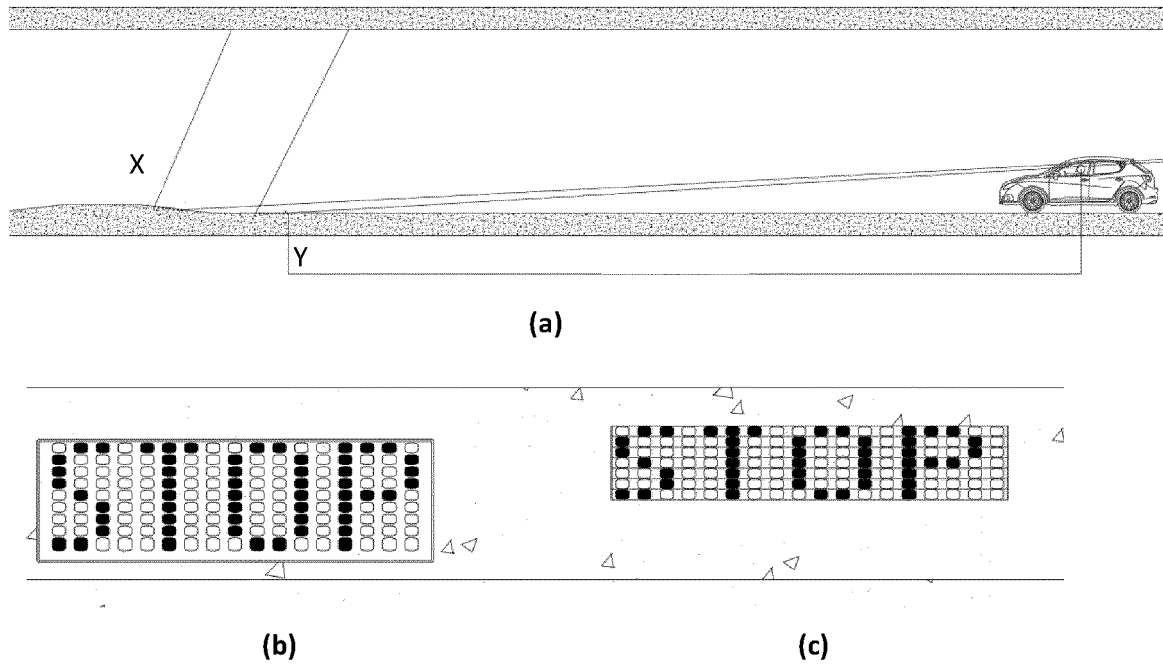


Figure 5

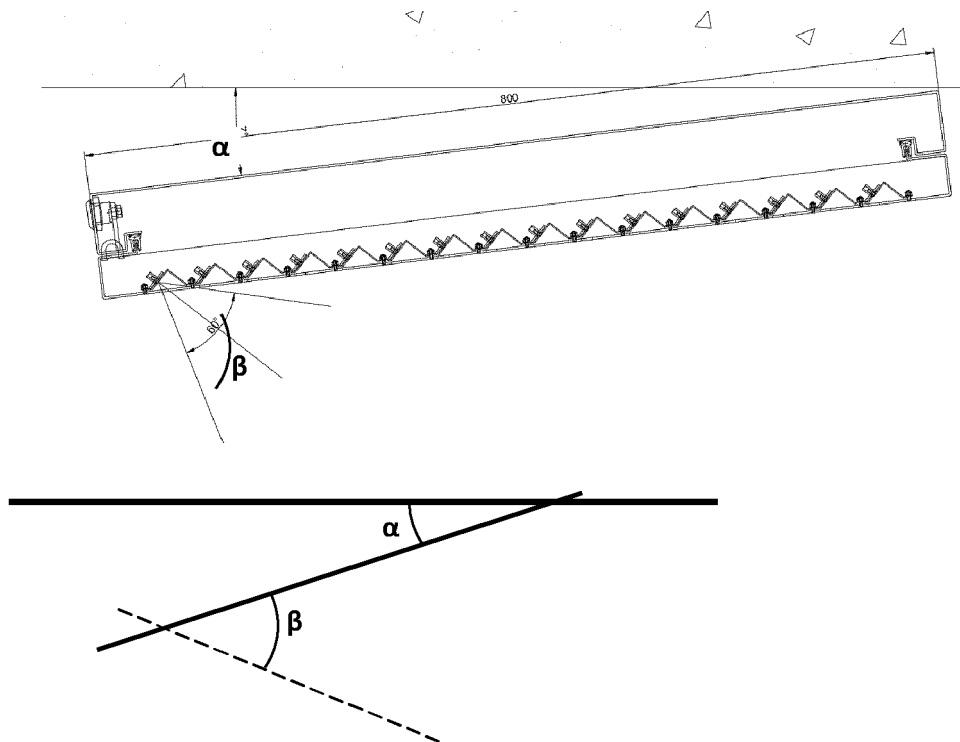
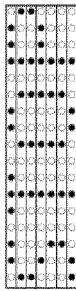


Figure 6

**Driver
View**



**Side
View**

**Top
View**

Figure 7

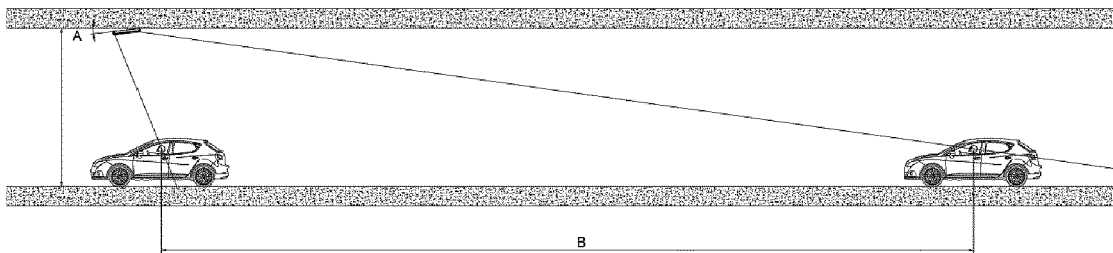


Figure 8



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 EP 19 21 5846

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Place of search Munich		Date of completion of the search 16 April 2020	Examiner Giannakou, Evangelia
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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