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Ruiz Ortega et al.

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(54) **BLIND SPOT INDICATOR ASSEMBLY FOR A MOTOR VEHICLE AND REAR-VIEW MIRROR COMPRISING SAID BLIND SPOT INDICATOR ASSEMBLY**

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B60Q 1/50	(2006.01)
B60Q 9/00	(2006.01)
B60R 1/12	(2006.01)

(52) **U.S. Cl.**

CPC ***B60Q 1/2665*** (2013.01); ***B60Q 1/50*** (2013.01); ***B60Q 9/008*** (2013.01); ***B60R 1/1207*** (2013.01)

(58) **Field of Classification Search**

CPC B60Q 1/2665; B60Q 1/50; B60Q 9/008; B60R 1/1207; F21S 43/14; F21S 43/26; F21S 43/40; F21V 5/00; F21V 5/04; F21V 7/00; F21V 13/00

See application file for complete search history.

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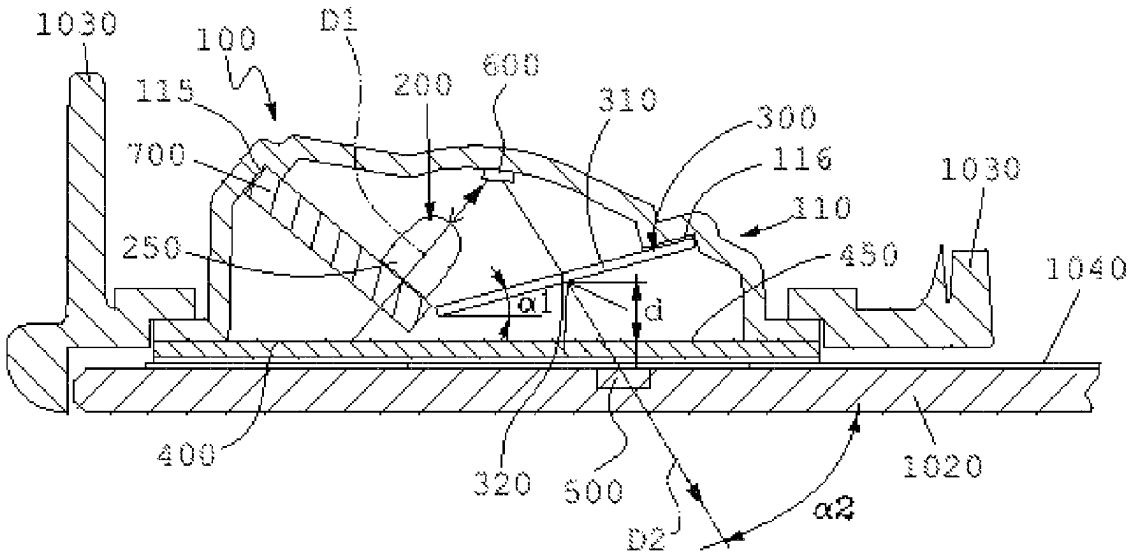
(57) **ABSTRACT**

A blind spot indicator assembly (**100**) for a motor vehicle is disclosed comprising a housing (**110**), at least one light source (**200**) to project light along a first direction (D**1**), a light control film (**300**) inclined at an angle (α**1**) to a lens assembly (**400**) to receive light from the light source (**200**). The lens assembly (**400**) has a light-receiving portion (**450**) to receive light from the light control film (**300**). A rear-view mirror is also disclosed comprising a blind spot indicator assembly (**100**).

14 Claims, 5 Drawing Sheets



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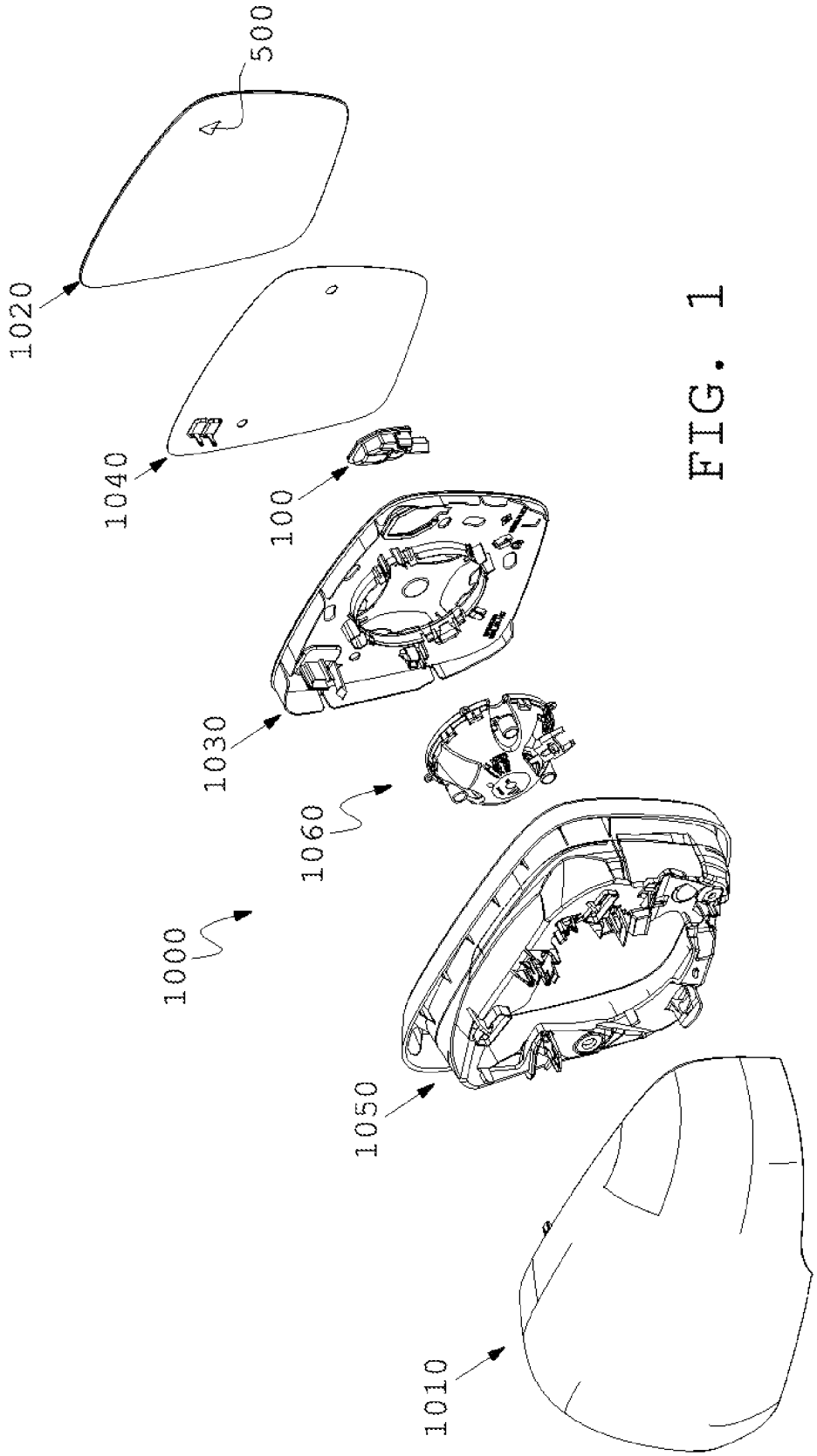


FIG. 1

FIG. 1a

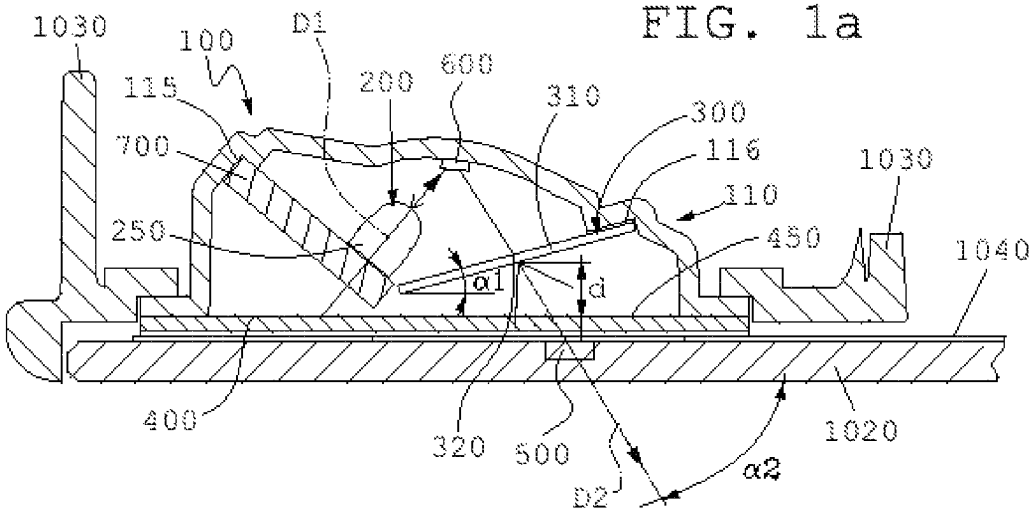
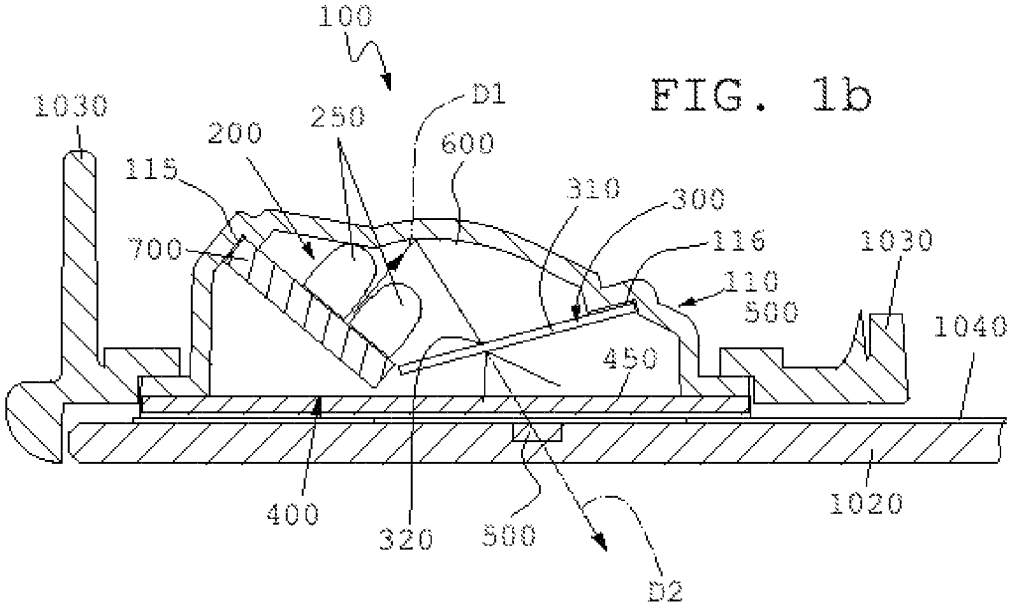

1030
100
D1
115
200
600
310
300
116
1030
700
110
250
450
1040
α1
d
400
320
500
1020
D2
α2

FIG. 1b


100
1030
D1
250
200
600
115
310
300
700
116
1030
110
500
1040
450
400
320
500
1020
D2

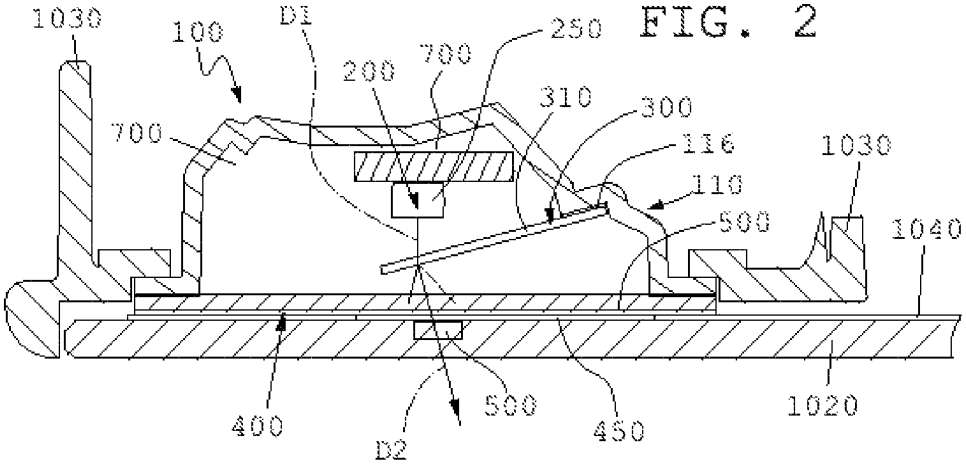

1030
100
D1
250
200
700
310
300
700
116
1030
110
500
1040
400
D2
500
450
1020

FIG. 2

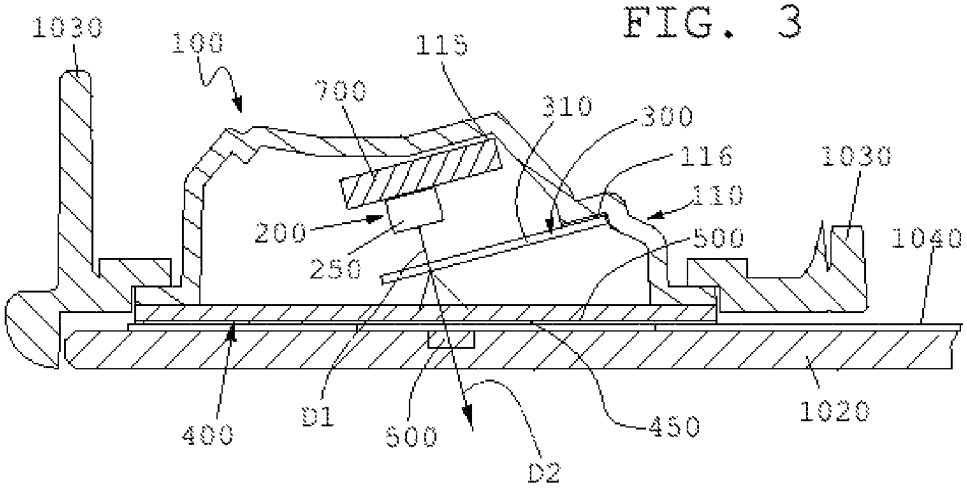

1030
100
115
700
310
300
116
1030
110
200
500
1040
250
400
D1
500
D2
450
1020

FIG. 3

FIG. 4

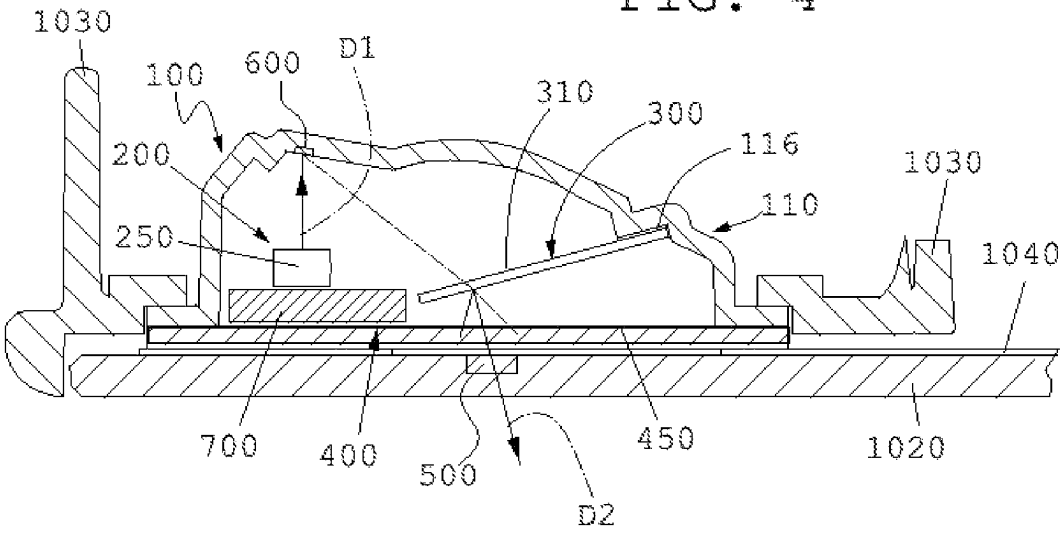

1030
100
600
D1
310
300
116
1030
200
110
250
1040
700
400
500
450
1020
D2

FIG. 5

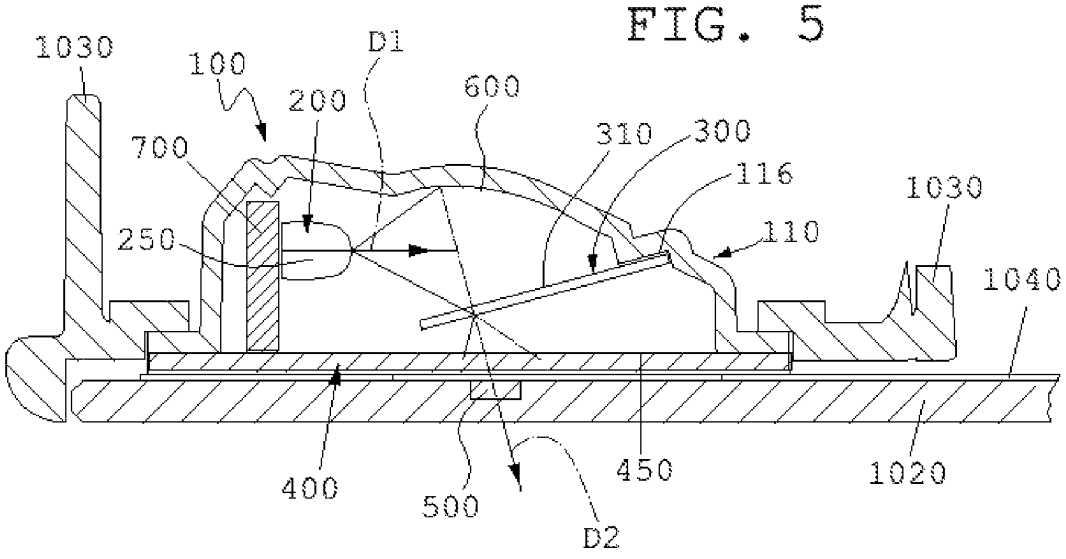

1030
100
D1
200
600
700
310
300
116
1030
110
250
1040
400
500
450
1020
D2

FIG. 6

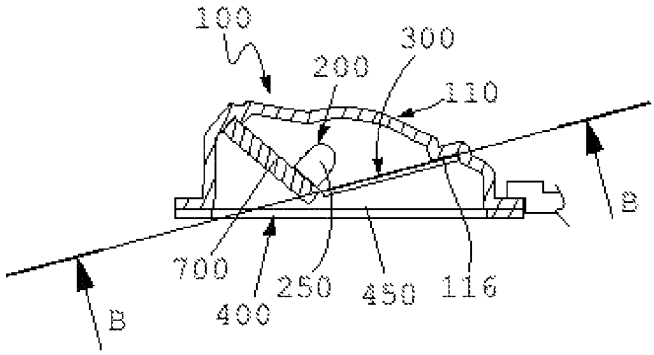


FIG. 7

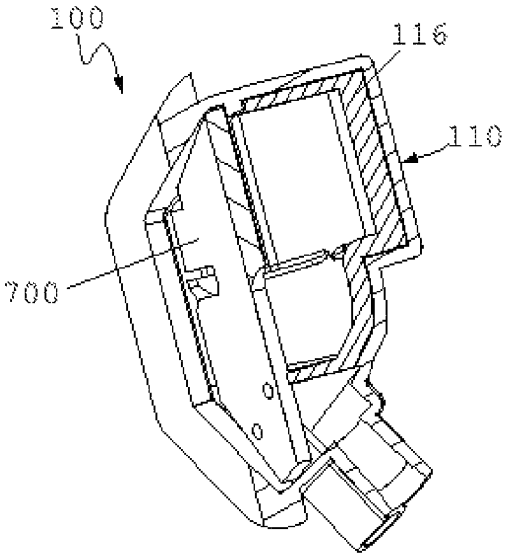
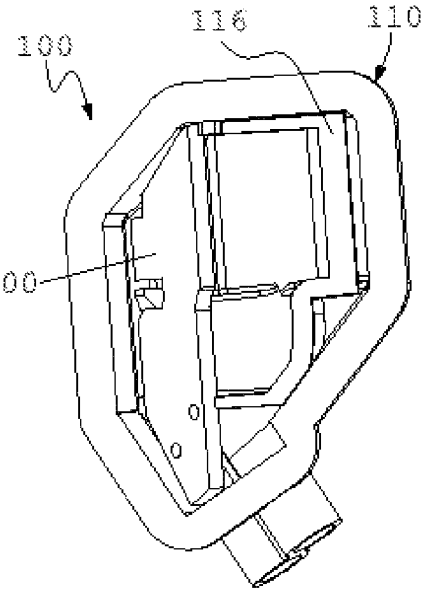


FIG. 8



BLIND SPOT INDICATOR ASSEMBLY FOR A MOTOR VEHICLE AND REAR-VIEW MIRROR COMPRISING SAID BLIND SPOT INDICATOR ASSEMBLY

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of European Application Serial No. 22383265.0 filed Dec. 22, 2022, the disclosure of which is incorporated herein by reference in its entirety.

BACKGROUND

The present disclosure relates to indicator assemblies intended to warn a motor vehicle driver that an object, such as another vehicle, is within a blind spot or blind area.

A blind spot or area is a lateral zone near the motor vehicle where the driver has no suitable vision when looking in the rear-view mirrors.

Blind spot indicators are known based on sensors and optical elements that identify when objects enter a blind spot or zone that are capable of alerting the driver that the blind spot is now being occupied by an object, such as for example a vehicle in the adjacent lane.

One example of a rear-view mirror assembly having a blind spot indicator for motor vehicles is disclosed in U.S. Pat. No. 9,663,027 filed in the name of the same applicant of the present application. The rear-view mirror assembly comprises a reflective element attached to a clamping plate, and a watertight illumination module attached to the reflective element. A printed circuit board is arranged in an inner cavity of the watertight illumination at an angle to the clamping plate. At least one light emitting diode is provided on the printed circuit board. A protective case for the watertight illumination module has a metalized and textured surface in its interior. A first side of the printed circuit board rests on the watertight illumination module and a second side opposite the first side does not rest on the watertight illumination module, with the printed circuit board. The light emitted by the light emitting diodes bounces on the metalized surface of the protective case emitting light indirectly passing through the surface of the reflecting element through its opening.

Although blind spot indicators enhance driving safety, it has been found that a problem exists that illumination is partially directed on directions different from the driver. Thus, there still remains a need for blind spot indicators in which the illumination on users different from the driver can be efficiently avoided with reduced costs.

SUMMARY

The present disclosure provides a blind spot indicator assembly for a motor vehicle for warning of the presence of another vehicle or object in the vicinity. The present blind spot indicator assembly has been found to address the above issues in prior art devices while, at the same time, provides further significant advantages.

The present blind spot indicator assembly may be, for example, a visual indicator to show the driver that another vehicle or object has been detected. The present disclosure further relates to a rear-view minor assembly for motor vehicles including such blind spot indicator assembly.

The blind spot indicator assembly for motor vehicles disclosed herein comprises a housing and at least one light source arranged to project light along a first predetermined direction. The light source may include at least one light emitting diode. The light source may be attached to a light source attaching portion within the housing.

The blind spot indicator assembly further includes a light control film with at least one surface arranged to receive light from the above mentioned at least one light source. Said light control film may be a film such as the diffusor polycarbonate film model Lexan® DFS 1329 available from The Konig Film Centre. Alternatively, the light control film may be one or more of a refractive film and a polarizing film.

The blind spot indicator assembly further includes a lens assembly. The lens assembly is adapted to allow light to come out from the blind spot indicator assembly. For this purpose, the lens assembly may comprise at least one lens layer such as for example a transparent lens layer or diffusor. The lens assembly has a light-receiving portion arranged to receive light from the light control film. The lens assembly may comprise at least a light diffuser layer.

The light control film is inclined at an angle, for example 10-70°, to the lens assembly and/or the light control film is positioned such that at least a point of the light control film is spaced apart from the lens assembly by a separation distance. Said separation distance from a point of the light control film to the lens assembly may be 2-6 mm. The light control film may be at least one of a refractive, a polarizing, or a diffusive light control film. The light control film is preferably arranged to project light, such as at least 60-70% of the light received, in a second predetermined direction. Said second predetermined direction extends at an angle to the lens assembly such as, for example, 30-170°.

At least one portion of the light control film is attached to the housing. Preferably, the light control film is attached to the housing through a light control film accommodation area. The light control film accommodation area may extend along a perimeter portion within the housing formed therein, preferably, opposite the light source attaching portion. The perimeter portion may include any portion of the housing interior such as an inner surface, area, or wall thereof.

In one example, the above mentioned first predetermined direction may extend perpendicular to at least one of the light control film and the lens assembly.

In other examples, a light-reflective portion may be formed in an inner surface of the housing. The light-reflective portion of the housing is arranged to receive light from the light source and to reflect it towards the above-mentioned light control film.

In said other examples, one portion of the light from the light source may reflect into the light-reflective portion formed in an inner surface of the housing and another portion of the light from the light source may directly impinge on the light control film.

The present blind spot indicator assembly may further include at least one electronics carrier such as a suitable printed circuit board. In use, the light source is connected to said electronics carrier.

A rear-view minor for a motor vehicle is also disclosed herein comprising a blind spot indicator assembly.

The blind spot indicator assembly comprises a housing, at least one light source arranged to project light along a first predetermined direction, a light control film having at least one surface arranged to receive light from the at least one light source, and a lens assembly having a light-receiving portion arranged to receive light from the light control film. The lens assembly is adapted to allow light to come out from the blind spot indicator assembly. For this purpose, the lens

assembly may comprise at least one lens layer such as for example a transparent lens layer or diffusor.

The light control film of the blind spot indicator assembly is inclined at an angle to the glass pane and/or at least a point of the light control film is spaced apart from the lens assembly by a separation distance.

The rear-view mirror further comprises a mirror head that includes a mirror housing, and a glass pane. A mirror plate is provided for attachment of the glass pane to the mirror head. An icon element, such as for example a triangle although many other symbols may be used, even a simple dot, is arranged in optical connection with the light-receiving portion of the lens assembly so as to be illuminated by light received from the blind spot indicator assembly. The icon element acts as a warning indicator such that when a vehicle is detected within the blind spot area, the icon element is illuminated in the rearview mirror. For this purpose, the icon element may be located in a position corresponding to the light-receiving portion of the lens assembly or as an icon of a translucid area of the glass pane, so as to be illuminated by light received from the light control film. When the rear-view mirror is already installed in the vehicle, the main light output direction from the blind spot indicator is directed towards the driver. The icon element may be included in the blind spot indicator assembly, or it may be a transparent area formed by removing at least one portion of the reflective coating material of the glass pane.

The lens assembly is arranged in the blind spot indicator assembly between the light control film and the icon element. When the lens assembly comprises a diffusing lens, the lens assembly also diffuses light received from the light control film to the icon element.

The rear-view mirror may further include a heater attached to the glass pane, and preferably, the mirror plate, and the blind spot indicator assembly through the housing and/or the lens assembly. The heater serves the purpose of providing resistive heat to the glass pane. Said heater may comprises a sheet material with electrical resistance for delivering thermal energy as an electric current flows there through. This results in that a defrosting effect is provided, as well as removal of obstacles and any water-based obstructions that may be attached to the glass pane.

The light output through the lens assembly from the blind spot indicator assembly faces an opening formed in the heater. The light transmissive portion of the glass pane, that is, the icon element, faces that opening of the heater and the light output from the blind spot indicator assembly. Therefore, the icon is in optical connection with the light output through the lens assembly of the blind spot indicator assembly.

The blind spot indicator assembly in the rear-view mirror may be attached to at least one of the glass pane, the heater and the minor plate.

The light control film may be arranged to project light along the second predetermined direction at an angle to the glass pane.

The glass pane may be attached to the back plate by a suitable adhesive and optionally through the heater itself.

The above-described blind spot indicator assembly for motor vehicles has been found to be advantageous and efficient as illumination on users different from the driver can be effectively avoided at a reduced cost.

BRIEF DESCRIPTION OF THE DRAWINGS

Non-limiting examples of the present disclosure will be described in the following, with reference to the appended drawings, in which:

FIG. **1** is a disassembled perspective view of one example of a mirror head of a rear-view mirror for a motor vehicle with the present blind spot indicator assembly, in accordance with a non-limiting example;

FIG. **1***a* is a sectional view of a first example of the present blind spot indicator assembly where a light source is arranged to emit light towards a light-reflective portion formed in an inner surface of the housing of the blind spot indicator assembly to be reflected towards a light control film, in accordance with a non-limiting example;

FIG. **1***b* is a sectional view of a second example of the present blind spot indicator assembly corresponding to the example shown in FIG. **1***a* but using a light source including two light emitting diodes arranged to emit light towards a light-reflective portion formed in an inner surface of the housing of the blind spot indicator assembly to be reflected towards a light control film, in accordance with a non-limiting example;

FIG. **2** is a sectional view of a third example of the present blind spot indicator assembly light where no light-reflective portion is provided within the housing such that a light source is arranged to emit light directly to a light control film along a direction perpendicular to the lens assembly, in accordance with a non-limiting example;

FIG. **3** is a sectional view of a fourth example of the present blind spot indicator assembly where again no light-reflective portion is provided within the housing such that and a light source is arranged to emit light directly to a light control film along a direction at an angle to the lens assembly, in accordance with a non-limiting example;

FIG. **4** is a sectional view of a fifth example of the present blind spot indicator assembly where a light source is arranged to emit light along a direction perpendicular to and away from the lens assembly towards a light-reflective portion formed in an inner surface of the housing, to be reflected towards a light control film, in accordance with a non-limiting example;

FIG. **5** is a sectional view of a sixth example of the present blind spot indicator assembly where a light source is arranged to emit light such that one portion of the emitted light is reflected towards a light-reflective portion in an inner surface of the housing and another portion of the light directly impinges on a light control film, in accordance with a non-limiting example;

FIG. **6** is a sectional view of the present blind spot indicator assembly, in accordance with a non-limiting example;

FIG. **7** is a sectional view of the blind spot indicator assembly taken along section plane B-B in FIG. **6**, in accordance with a non-limiting example; and

FIG. **8** is a front view of the blind spot indicator in FIGS. **6** and **7**, in accordance with a non-limiting example.

DETAILED DESCRIPTION

In the disassembled perspective view of FIG. **1** of the drawings, one non-limiting example of a mirror head **1000** of a rear-view minor for a motor vehicle is illustrated. The minor head **1000** of a rear-view mirror for a motor vehicle in FIG. **1** is provided with a blind spot indicator assembly **100** that will be described in detail below with reference to FIGS. **1***a*, **1***b*, and **2-8** of the drawings.

The minor head **1000** shown in FIG. **1** comprises a mirror housing **1010**, a glass pane **1020**, a mirror plate **1030** and a minor frame **1050**. The glass pane **1020** has therein an icon element **500**. The icon element **500** comprises any suitable symbol or text that may be illuminated to alert the driver

when a vehicle is within a blind spot area. The icon element **500** may be, for example, a triangle, although many other suitable symbols may be used as a warning indicator.

The icon element **500** is located at a position corresponding to a light-receiving portion **450** of said glass pane **1020**, so as to be illuminated by light received the blind spot indicator assembly **100** as it will be described in detail below.

The glass pane **1020** of the minor head **1000** is attached to the mirror housing through the minor plate **1030**. The glass pane **1020** can be moved to the mirror housing through a glass actuator **1060**.

A heater **1040** is attached to the glass pane **1020** and/or the minor plate **1030** of the mirror head **1000**. In the example shown, the glass pane **1020** is attached to the mirror plate **1030** and optionally through the above-mentioned heater **1040** by means of a suitable adhesive. The heater **1040** is intended for resistive heating of the above-mentioned glass pane **1020**. For this purpose, the heater **1040** comprises a sheet material with electrical resistance for delivering thermal energy as an electric current flows there through. This results in a defrosting effect, as well as removal of obstacles and any water-based obstructions that may be attached to the above-mentioned glass pane **1020**.

As stated above, mirror head **1000** shown in FIG. **1** further comprises a blind spot indicator assembly **100** which is shown in detail in FIGS. **1***a*, **1***b*, and **2-8** of the drawings. The blind spot indicator assembly **100** is configured for warning of the presence of another vehicle or object that has been detected to be within a blind spot area.

In the present example, the blind spot indicator assembly **100** is attached directly to the glass pane **1020** of the minor head **1000** through the heater **1040** that comprises two opposite adhesive layers, the first one for being attached to the mirror pane **1020**, and the second one for being attached to the back plate **1030** and the blind spot indicator assembly **100**. In general, the blind spot indicator assembly **100** is attached to at least one of the glass pane **1020**, the heater **1040** and the mirror plate **1030** of the mirror head **1000**.

The blind spot indicator assembly **100** comprises a housing **110**. The heater **1040** of the minor head **1000** may be attached to said housing **110** of the blind spot indicator assembly **100** or even to a lens assembly **400** of the blind spot indicator assembly **100**. Light output from the blind spot indicator assembly **100** through the lens assembly **400** faces an opening formed in the heater **1040**. A light transmissive portion of the glass pane **1020** that is at least part of the above-mentioned icon element **500** faces that opening of the heater **1040** so that light output from the blind spot indicator assembly **100** illuminates the icon element **500** when an object or vehicle is within a blind spot area. Therefore, the icon **500** is optical connected to the blind spot indicator assembly **1000** lens assembly **400**.

A light source **200** is attached to a light source attaching portion **115** within the housing **110**. In the examples of FIGS. **1***a*, **2**, **3**, **4** and **5** of the drawings, the light source **200** includes a light emitting diode **250** that is connected to an electronics carrier **700** such as a PCB. Other configurations are possible such as the one illustrated in FIG. **1***b* where the light source **200** includes two light emitting diodes, LEDs, **250**, connected to the PCB **700**. In general, there should be as many LEDs **250** and PCBs **700** as required.

In any case, the light source **200** is arranged to project light along a first predetermined direction D**1** upon detection of an approaching object, such as for example another vehicle, within a blind spot or blind area. In the example of FIGS. **2** and **4**, the first predetermined direction D**1** along which the light source **200** emits light is perpendicular to the above-mentioned lens assembly **400** of the blind spot indicator assembly **100**. The light source **200** may be arranged in other different positions so that light is emitted along the first predetermined direction D**1** at other angles to the lens assembly **400** as shown in FIGS. **1***a*, **1***b*, **3**, and **5** of the drawings.

A light control film **300** is provided. The light control film **300** has at least one receiving surface **310** arranged to receive light from the light source **200**. In that example, the light control film **300** has diffusive characteristics, diffusing the light received by the light source **200** towards the lens assembly **400**. The light control film **300** may be one or more of a refractive light control film, a polarizing light control film, and a diffusive light control film.

As mentioned above, the blind spot indicator assembly **100** is also provided with the lens assembly **400**. Said lens assembly **400** has a light-receiving portion **450** that is arranged to receive light from the above-mentioned light control film **300**. The lens assembly **400** comprises at least a light diffuser layer. The lens assembly **400** is located between the light control film **300** and the icon element **500** to diffuse light received from the light control film **300** to the icon element **500** through its light diffuser layer.

Light from light source **200** may be emitted directly or indirectly onto the receiving surface **310** of the light control film **300**. The light source **200** may be arranged in different positions. For example, in the case illustrated in FIG. **3** of the drawings, the light source **200** is arranged so that light is emitted along the first predetermined direction D**1** substantially perpendicular to the light control film **300**. Other arrangements are possible for the positioning of the light source **200** relative to the light control film **300**.

As the light source **200** emits light along the above mentioned first predetermined direction D**1** directly or indirectly striking the light control film **300**, at least 60% and more preferably, at least 70% of the light is then projected along a second predetermined direction D**2**. The second predetermined direction D**2** corresponds to a main direction of output light from the blind spot indicator assembly **100**. The second predetermined direction D**2** extends at an angle $\alpha 2$ with respect to the lens assembly **400**, or the glass pane **1020**. The angle of inclination $\alpha 2$ of the second predetermined direction D**2** may be of 30°-170° although other values may be possible. The direction of the light exiting the blind spot indicator assembly **100** corresponds to the second predetermined direction D**2**, different from the first predetermined direction D**1** of the light emitted from the light source **200**.

In use, with the rear-view mirror **1000** already installed in the vehicle, the second predetermined direction D**2** is directed towards the driver such that light on users different from the driver is advantageously avoided in an efficient manner

In the example shown in FIG. **1***a* of the drawings, the light control film **300** is inclined with respect to the lens assembly **400**. Specifically in the example shown in the drawings, the light control film **300** is inclined at angle $\alpha 1$ of 10°-70° with respect to the lens assembly **400**.

Alternatively or additionally, the positioning of the light control film **300** may be defined through a separation distance d from at least one point, such as mid-point **320** in the light control film **300**, as illustrated in FIG. **1***a*, to the lens assembly **400**. Said separation distance d may be for example 2-6 mm. Positioning of the light control film **300** spaced from the lens assembly **400** allows suitable pretreating of the light before reaching the lens assembly **400**

resulting in final characteristics of light beams to be optimally improved at the output of the blind spot indicator assembly **100** towards the icon element **500** in the rear-view mirror **1000**.

In the particular case illustrated in FIGS. **1***a*, **1***b*and **4**, light is emitted along the first predetermined direction D**1** towards a light-reflective portion **600** that is formed in an inner surface of the housing **110**. Said light-reflective portion **600** is arranged to receive light from the LED(s) **250** and to reflect towards the receiving surface **310** of the light control film **300**.

In the case shown in FIG. **5** of the drawings, the PCB **700** is arranged in a substantially vertical position such that one portion of the emitted light from the light source **200** is reflected towards the light-reflective portion **600** and another portion of the light from the light source **200** directly impinges on the receiving surface **310** of the light control film **300**.

At least one portion of the light control film **300** is attached to the housing **110** through a light control film accommodation area **116**. Said light control film accommodation area **116** extends along a perimeter portion within the housing **110**. Within the housing **110**, the light source attaching portion **115** is located facing the light control film accommodation area **116**, as shown in FIGS. **1***a*, **1***b*, **4**, and **5** of the drawings. However, other different arrangements are possible such as the ones illustrated in the examples shown in FIGS. **2** and **3**.

Although several examples have been disclosed herein, other alternatives, modifications, uses and/or equivalents thereof are possible. Furthermore, all possible combinations of the described examples are also covered. Thus, the scope of the present disclosure should not be limited by particular examples, but should be determined only by a fair reading of the claims that follow. If reference signs related to drawings are placed in parentheses in a claim, they are solely for attempting to increase the intelligibility of the claim, and shall not be construed as limiting the scope of the claim.

What is claimed is:

1. A blind spot indicator assembly (**100**) for a motor vehicle, the assembly (**100**) comprising:

a housing (**110**);

at least one light source (**200**) arranged to project light along a first predetermined direction (D**1**);

a light control film (**300**) having at least one surface (**310**) arranged to receive light from the at least one light source (**200**); and

a lens assembly (**400**) having a light-receiving portion (**450**) arranged to receive light from the light control film (**300**);

wherein the light control film (**300**) is inclined at an angle (α**1**) to the lens assembly (**400**) and/or at least a point of the light control film (**300**) is spaced apart from the lens assembly (**400**) by a separation distance (d);

wherein a light-reflective portion (**600**) is formed in an inner surface of the housing (**110**) arranged to receive light from the light source (**200**) and to reflect it towards the light control film (**300**).

2. The assembly (**100**) according to claim **1**, wherein the separation distance (d) from a point of the light control film (**300**) to the lens assembly (**400**) is 2-6 mm.

3. The assembly (**100**) according to claim **1**, wherein the light control film (**300**) is inclined at an angle (α**1**) of 10-70° to the lens assembly (**400**).

4. The assembly (**100**) according to claim **1**, wherein the light control film (**300**) is arranged to project light in a second predetermined direction (D**2**) at an angle (α**2**) to the lens assembly (**400**).

5. The assembly (**100**) according to claim **4**, wherein the angle (α**2**) of the second predetermined direction (D**2**) to the lens assembly (**400**) is 30-170°.

6. The assembly (**100**) according to claim **1**, wherein the light source (**200**) is attached to a light source attaching portion (**116**) within the housing (**110**).

7. The assembly (**100**) according to claim **1**, wherein at least one portion of the light control film (**300**) is attached to the housing (**110**).

8. The assembly (**100**) according to claim **7**, wherein the light control film (**300**) is attached to the housing (**110**) through a light control film accommodation area (**115**) extending along a perimeter portion within the housing (**110**) formed opposite the light source attaching portion (**116**).

9. The assembly according to claim **1**, wherein the first predetermined direction (D**1**) is perpendicular to at least one of the light control film (**300**) and the lens assembly (**400**).

10. The assembly according to claim **1**, wherein one portion of the light from the light source (**200**) reflects into the light-reflective portion (**600**) formed in an inner surface of the housing (**110**) and another portion of the light from the light source (**200**) directly impinges on the light control film (**300**).

11. A rear-view mirror for a motor vehicle comprising:

a blind spot indicator assembly (**100**) including:

a housing (**110**);

at least one light source (**200**) arranged to project light along a first predetermined direction (D**1**);

a light control film (**300**) having at least one surface (**310**) arranged to receive light from the at least one light source (**200**); and

a lens assembly (**400**) having a light-receiving portion (**450**) arranged to receive light from the light control film (**300**); and

a mirror head (**1000**) that includes a mirror housing (**1010**), a glass pane (**1020**), a mirror plate (**1030**) for attachment of the glass pane (**1020**) to the mirror head (**1000**), and an icon element (**500**) arranged in optical connection with the light-receiving portion (**450**) of the lens assembly (**400**) so as to be illuminated by light received from the blind spot indicator assembly (**100**)

wherein a light-reflective portion (**600**) is formed in an inner surface of the housing (**110**) arranged to receive light from the light source (**200**) and to reflect it towards the light control film (**300**).

12. The rear-view mirror according to claim **11**, wherein the lens assembly (**400**) is arranged between the light control film (**300**) and the icon element (**500**) to diffuse light received from the light control film (**300**) to the icon element (**500**).

13. The rear-view mirror according to claim **11**, wherein the light control film (**300**) is arranged to project light in the second predetermined direction (D**2**) at an angle (α**2**) to the glass pane (**1020**).

14. The rear-view mirror according to claim **11**, wherein it further includes a heater (**1040**) attached to at least one of the glass pane (**1020**), the mirror plate (**1030**), and the housing (**110**) of the blind spot indicator assembly (**100**).

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