



- (51) **International Patent Classification:**
B60Q 3/62 (2017.01) *B60J 1/00* (2006.01)
B60Q 3/208 (2017.01) *B60J 3/04* (2006.01)

(21) **International Application Number:**
PCT/CN2024/142066

(22) **International Filing Date:**
25 December 2024 (25.12.2024)

(25) **Filing Language:** English

(26) **Publication Language:** English

(30) **Priority Data:**
202311833710.8 28 December 2023 (28.12.2023) CN

(71) **Applicant: SAINT-GOBAIN SEKURIT FRANCE**
[FR/FR]; Rue du Maréchal Joffre, 60150 Thourotte (FR).

(72) **Inventor; and**
(71) **Applicant (for BZ only): WAN, Tianjia** [CN/CN]; 55 Wen Jing Road, Minhang District, Shanghai 200245 (CN).

(72) **Inventors: SHI, Ce**; 55 Wen Jing Road, Minhang District, Shanghai 200245 (CN). **WANG, Lu**; 55 Wen Jing Road, Minhang District, Shanghai 200245 (CN). **YU, Jianshui**; 55 Wen Jing Road, Minhang District, Shanghai 200245 (CN).

(74) **Agent: NTD UNIVATION INTELLECTUAL PROPERTY AGENCY LTD.**; 10th Floor, Tower C, Beijing Global Trade Center, 36 North Third Ring Road East, Dongcheng District, Beijing 100013 (CN).

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

(84) **Designated States** (*unless otherwise indicated, for every kind of regional protection available*): ARIPO (BW, CV, GH, GM, KE, LR, LS, MW, MZ, NA, RW, SC, SD, SL, ST, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, ME, MK, MT, NL, NO, PL, PT, RO, RS, SE,

(54) Title: GLASS ASSEMBLY AND WINDOW ASSEMBLY

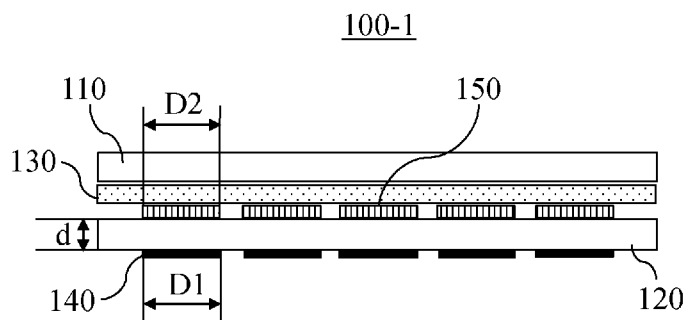


FIG.2B

(S7) Abstract: A glass assembly and a window assembly are disclosed. The glass assembly (100) comprises a glass body (110) having a first surface (111) and a second surface (112) arranged oppositely; a light-exiting region (140) forming a pattern and formed on the first surface (111) and/or the second surface (112) of the glass body (110) and/or formed within the glass body (110), and the light-exiting region (140) being configured such that light is led out of the second surface (112) from the light-exiting region (140); a light-shielding region (150) arranged on the first surface (111) and forming a pattern following the pattern formed by the light-exiting region to shield the light from the light-exiting region toward the light-shielding region. The glass assembly can realize the lighting effect and/or the luminous pattern effect on a surface of one side of the glass assembly, and reduce or avoid the adverse influence of the light from the light-exiting region on a surface of the other side of the glass assembly. Meanwhile, it will not affect the light transmittance of other regions of the glass assembly except the light-shielding region, thereby enhancing the driving experience.

SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN,
GQ, GW, KM, ML, MR, NE, SN, TD, TG).

Published:

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

GLASS ASSEMBLY AND WINDOW ASSEMBLY

FIELD

The present disclosure generally relates to the technical field of glass manufacturing, in particular to a glass assembly and a window assembly using the same.

BACKGROUND

With the rapid development of automobile industry, as a good medium to transmit information to the inside and/or the outside of a vehicle, lighting glass with decorative pattern has been widely valued by vehicle manufacturers and favored by consumers. The pattern of the lighting glass is usually based on enamel or ink to form a pattern area on the glass surface, and incident light emitted by a light source is projected to the pattern area, so as to realize a lighting effect of pattern luminescence.

Although presenting pattern through lighting glass can meet most of the requirements of the consumers, in some applications, the vehicle manufacturers and the consumers expect the pattern to be visible only on one surface of the lighting glass and not visible on the other surface. For example, while the luminous pattern is observed inside the vehicle, some relevant laws and regulations require that the light or the luminous pattern emitted by the vehicle to the outside will not or will not easily affect the vehicles and pedestrians outside the vehicle during the running of the vehicle. An existing solution, for example, uses a reflective layer on the entire surface of the lighting glass for reflecting the light back to the inside of the vehicle. However, in order not to affect the driver's or passenger's visual field to the outside of the vehicle, there is also a certain requirement for the overall light transmittance of the glass, and the reflective layer will change the transmission of the light and may affect the driver's or passenger's observation. Moreover, when it is necessary to form the luminous pattern, the reflective layer may lead to a very obvious reflection effect and affect the sensory experience of the occupants inside the vehicle. Therefore, the above-mentioned existing solution is difficult to achieve satisfactory results, and there is still a requirement for further adjustment or improvement in pattern presentation occasions, vehicle driving safety and privacy, etc.

SUMMARY

The purpose of the present disclosure is to provide a glass assembly, which can realize that the illumination light and/or the luminous pattern are visible on a surface of one side of the glass assembly but invisible on a surface of the other side of the glass assembly, meanwhile, the light transmittance level of the whole glass assembly will not be affected.

To this end, according to one aspect of the present disclosure, a glass assembly is provided. The glass assembly comprises a glass body having a first surface and a second surface arranged oppositely; a light-exiting region forming a pattern and formed on the first surface and/or the second surface of the glass body and/or formed within the glass body, and the light-exiting region being configured such that light is led out of the second surface from the light-exiting region; a light-shielding region arranged on the first surface and forming a pattern following the pattern formed by the light-exiting region to shield the light from the light-exiting region toward the light-shielding region.

According to the above technical concept, the embodiment of the present disclosure may further include any one or more of the following alternative forms.

In some alternative forms, the light-shielding region is configured to comprise any one of light absorption layer, switchable film and reflective layer.

In some alternative forms, the pattern formed by the light-exiting region and the pattern formed by the light-shielding region respectively comprise at least two patterns, and further optionally, the pattern formed by the light-exiting region and the pattern formed by the light-shielding region respectively comprise at least two discontinuous patterns.

In some alternative forms, the ratio of the area of the light-exiting region to the surface area of the glass body and the ratio of the area of the light-shielding region to the surface area of the glass body are less than or equal to 70%, less than or equal to 50%, less than or equal to 30%, or less than or equal to 10%, respectively.

According to another aspect of the present disclosure, a glass assembly is provided. The glass assembly comprises a first glass body, and a second glass body attached to the first glass body through an intermediate layer; a light-exiting region forming a pattern and formed on a surface of the first glass body away from the second glass body and/or formed within the first glass body, and/or formed on a surface of the second glass body away from the first glass body

and/or formed within the second glass body, and/or formed between the first glass body and the second glass body, and configured such that light is led out of the second glass body from the light-exiting region; a light-shielding region arranged on the surface of the first glass body away from the second glass body or arranged between the light-exiting region and the first
5 glass body, and forming a pattern following the pattern formed by the light-exiting region to shield the light from the light-exiting region toward the light-shielding region.

In some alternative forms, the light-exiting region formed between the first glass body and the second glass body comprises the light-exiting region is formed on a surface of the first glass body facing the second glass body, or formed on a surface of the second glass body
10 facing the first glass body, or formed on a surface of the intermediate layer or formed within the intermediate layer.

In some alternative forms, the light-shielding region is arranged between the intermediate layer and the first glass body or the second glass body, or is arranged within the intermediate layer; or the intermediate layer comprises a first intermediate layer attached to the first glass
15 body and a second intermediate layer attached to the second glass body, and the light-shielding region is arranged between the first intermediate layer and the second intermediate layer, or is arranged within the first intermediate layer or within the second intermediate layer.

In some alternative forms, the light-shielding region is configured to comprise any one of light absorption layer, switchable film and reflective layer.

20 In some alternative forms, the pattern formed by the light-exiting region and the pattern formed by the light-shielding region respectively comprise at least two patterns, and further optionally, the pattern formed by the light-exiting region and the pattern formed by the light-shielding region respectively comprise at least two discontinuous patterns.

In some alternative forms, the ratio of the area of the light-exiting region to the surface
25 area of the first glass body or the second glass body and the ratio of the area of the light-shielding region to the surface area of the first glass body or the second glass body are less than or equal to 70%, less than or equal to 50%, less than or equal to 30%, or less than or equal to 10%, respectively.

In some alternative forms, the light-exiting region is configured to comprise a light
30 extraction layer, the light extraction layer is formed within the first glass body and/or within

the second glass body by laser engraving, and/or the light extraction layer is formed on the surface of the first glass body and/or on the surface of the second glass body by laser engraving or printing or in a form of film layer, and/or the light extraction layer is sandwiched between the first glass body and the second glass body in a form of film layer.

5 In some alternative forms, the light-exiting region is configured to comprise a light extraction layer, the light extraction layer is embedded in the intermediate layer in a form of material mixing or printing or film layer, and/or the light extraction layer is formed on a surface of the intermediate layer by printing.

10 In some alternative forms, the light extraction region is configured to comprise a light extraction layer, and the intermediate layer comprises a first intermediate layer attached to the first glass body and a second intermediate layer attached to the second glass body, and the light extraction layer is sandwiched between the first intermediate layer and the second intermediate layer in a form of film layer, and/or the light extraction layer is embedded in the first intermediate layer and/or in the second intermediate layer in a form of material mixing
15 or printing or film layer, and/or the light extraction layer is formed on a surface of the first intermediate layer and/or on a surface of the second intermediate layer by printing.

20 In some alternative forms, the light-exiting region is configured to comprise an active light-emitting layer, the active light-emitting layer is sandwiched between the first glass body and the second glass body, and/or the active light-emitting layer is arranged on the surface of the first glass body away from the second glass body and/or on the surface of the second glass body away from the first glass body, and/or the active light-emitting layer is embedded in the intermediate layer in a form of material mixing or film layer.

25 In some alternative forms, the light-exiting region is configured to comprise an active light-emitting layer, and the intermediate layer comprises a first intermediate layer attached to the first glass body and a second intermediate layer attached to the second glass body, and the active light-emitting layer is sandwiched between the first intermediate layer and the second intermediate layer, and/or the active light-emitting layer is embedded in the first intermediate layer and/or in the second intermediate layer in a form of material mixing or film layer.

30 In some alternative forms, at least one functional layer is arranged between the light-

exiting region and the light-shielding region.

In some alternative forms, the glass assembly is configured to satisfy:

$$D1+d \times \tan \theta \leq D2 \leq D1 + 3d \times \tan \theta,$$

wherein D1 is the size of the pattern formed by the light-exiting region along the surface direction of the glass assembly, D2 is the corresponding size of the light-shielding region following the pattern formed by the light-exiting region along the surface direction of the glass assembly, d is the distance between the light-exiting region and the light-shielding region along the cross-sectional direction of the glass assembly, and θ is the critical angle for total reflection of the light within the glass assembly.

In some alternative forms, the glass assembly is configured to satisfy:

$$D1 \leq D2 \leq D1 + 6\text{mm},$$

wherein D1 is the size of the pattern formed by the light-exiting region along the surface direction of the glass assembly, and D2 is the corresponding size of the light-shielding region following the pattern formed by the light-exiting region along the surface direction of the glass assembly.

In some alternative forms, the light transmittance T1 of the light-shielding region with respect to visible light is less than or equal to 70%, less than or equal to 50%, less than or equal to 30%, or less than or equal to 10%.

In some alternative forms, the glass assembly comprises a non-shielded region which is not shielded by the light-shielding region, and the light transmittance T2 of the non-shielded region with respect to visible light is greater than or equal to 50%, or greater than or equal to 70%.

In some alternative forms, the glass assembly comprises a tinted layer composed of the first glass body and/or any one or more layers between the first glass body and the light-exiting region.

In some alternative forms, the glass assembly comprises a tinted layer composed of the first glass body and/or the intermediate layer; or the intermediate layer comprises a first intermediate layer attached to the first glass body and a second intermediate layer attached to the second glass body, and the first glass body and/or the first intermediate layer and/or the second intermediate layer form the tinted layer.

In some alternative forms, the first glass body and/or the intermediate layer are directly attached with a tinted film or coated with a tinted coating, or the first glass body and/or the first intermediate layer and/or the second intermediate layer are directly attached with a tinted film or coated with a tinted coating to form the tinted layer.

5 In some alternative forms, the light transmittance T3 of the tinted layer with respect to visible light is less than or equal to 70%, less than or equal to 50%, less than or equal to 30%, or less than or equal to 10%.

In some alternative forms, the difference between the light transmittance T3 of the tinted layer with respect to visible light and the light transmittance T1 of the light-shielding region with respect to visible light is greater than or equal to 20%, greater than or equal to 30%,
10 greater than or equal to 40%, or greater than or equal to 50%.

In some alternative forms, the product of the light transmittance T3 of the tinted layer with respect to visible light and the light transmittance T1 of the light-shielding region with respect to visible light is less than or equal to 70%, less than or equal to 50%, less than or
15 equal to 30%, or less than or equal to 10%.

According to another aspect of the present disclosure, a window assembly is provided. The window assembly comprises the above glass assembly, wherein the window assembly comprises door, window, curtain wall, vehicle window glass, airplane glass or ship glass.

In some alternative forms, the window assembly is a vehicle window glass comprising
20 front windshield, rear windshield, skylight glass, vehicle door glass or corner window glass.

According to the glass assembly disclosed by the present disclosure, the light-shielding region is provided and forms the pattern following the pattern formed by the light-exiting region to shield the light from the light-exiting region toward the light-shielding region, so that the lighting effect and/or the luminous pattern effect can be realized on a surface of one
25 side of the glass assembly, and the adverse influence of the light from the light-exiting region on a surface of the other side of the glass assembly can be reduced or avoided. Meanwhile, the light transmittance of other regions of the glass assembly except the light-shielding region will not be affected, and the driving experience can be enhanced. According to different application occasions, the glass assembly disclosed by the present disclosure can also meet
30 functional requirements such as privacy, etc. through the design and combination of different

layer structures, and can be applied to various occasions to meet the diversified requirements of users.

BRIEF DESCRIPTION OF THE DRAWINGS

5 Other features and advantages of the present disclosure will be better understood by the following alternative embodiments described in detail in conjunction with the accompanying drawings, in the drawings:

Fig. 1A is a schematic cross-sectional view of a lighting mode of an existing glass assembly;

10 Fig. 1B is a schematic cross-sectional view of another lighting mode of an existing glass assembly;

Fig. 2A is a schematic cross-sectional view of a glass assembly according to an embodiment of the present disclosure, illustrating a single-layer glass body and a light-exiting region formed on a second surface of the glass body;

15 Fig. 2B is a schematic cross-sectional view of a glass assembly according to another embodiment of the present disclosure, illustrating a light-exiting region arranged on a surface of a second glass body away from a first glass body, and Figs. 2C to 2E respectively illustrate variations of the embodiment shown in Fig. 2B;

20 Fig. 3A is a schematic cross-sectional view of a glass assembly according to another embodiment of the present disclosure, illustrating a light-exiting region arranged between a first glass body and a second glass body, and Figs. 3B to 3C respectively illustrate variations of the embodiment shown in Fig. 3A;

25 Fig. 4A is a schematic cross-sectional view of a glass assembly according to another embodiment of the present disclosure, illustrating a light-exiting region arranged between a first glass body and a second glass body, and Figs. 4B to 4E illustrate variations of the embodiment shown in Fig. 4A;

Fig. 5 is a schematic cross-sectional view of a glass assembly according to another embodiment of the present disclosure, illustrating a light extraction layer formed within a second glass body;

30 Fig. 6A is a schematic cross-sectional view of a glass assembly according to another

embodiment of the present disclosure, illustrating a light extraction layer or an active light-emitting layer formed within an intermediate layer, and Fig. 6B illustrates a variation of the embodiment shown in Fig. 6A.

5 DETAILED DESCRIPTION OF EMBODIMENTS

The implementation and use of the embodiments are discussed in detail below. However, it should be understood that the specific embodiments discussed merely exemplify the specific ways of implementing and using the present disclosure, and do not limit the scope of the disclosure. When describing the structural positions of various components, such as the
10 directions of upper, lower, top, bottom, etc., the description is not absolute, but relative. When the various components are arranged as shown in the figures, these directional expressions are appropriate, but when the positions of the various components in the figures would be changed, these directional expressions would also be changed accordingly.

In this context, the expression "comprising" or similar expressions "having" and so on
15 which are synonymous are open, and do not exclude additional unlisted elements, steps or ingredients.

In this context, the terms "first", "second" and so on are not used to limit the sequence and the number of components unless otherwise stated.

In this context, the meaning of "a plurality of" refers to two or more than two, unless
20 otherwise specified.

In this context, unless otherwise specified, the terms such as "attach" should be understood broadly. For example, it can be fixed connection, detachable connection or integrated; it can be directly connected or indirectly connected through an intermediate medium, and it can be the internal communication of two components or the interaction
25 between two components. For those skilled in the art, the specific meanings of the above terms in this context can be understood according to specific situations.

In this context, "surface" of the glass body is bounded by the plane where the length and width of the glass body are located, and "edge" is bounded by the plane where the length or width and thickness or height of the glass body are located. "Section" of the glass assembly is
30 taken along the thickness or height direction of the glass assembly. "Pattern" includes any one

or combination of character, figure, symbol, number, beacon, trademark and the like formed by dots, lines, etc.

Hereinafter, a glass assembly applied to a vehicle window glass will be described, but it does not exclude that the glass assembly can be applied to other environments such as door, window, curtain wall, airplane glass or ship glass. When the glass assembly is described as the vehicle window glass of a vehicle, "outside" and "inside" refer to the directions relative to vehicle body, "outside" refers to the direction away from the vehicle body and "inside" refers to the direction facing the vehicle body. It should be understood that the vehicle window glass according to the embodiment of the present disclosure includes, but is not limited to, front windshield, rear windshield, skylight glass, vehicle door glass (including front vehicle door glass and rear vehicle door glass) or corner window glass, which can provide different lighting effects based on different requirements.

In the various described embodiments, unless otherwise specified, the thickness of the glass is the thickness commonly used in the art, and the thickness of each laminated structure on the glass is suitable for the conventional range and is not limited as shown in the figures. In addition, although it is shown as plane glass in the figures, the glass assembly of the present disclosure may also be curved glass. In various embodiments, it is described as an independent glass body or glass plate, however, in some cases not described, the surface of the glass can also use special coating to improve other properties such as thermal insulation and/or comfort.

As mentioned above, for the manufacturers and most vehicle users or passengers, it is expected that the vehicle window glass can be used to achieve the lighting effect and/or the decorative effect of the display pattern, and simultaneously meet the requirements of safe driving and some relevant laws and regulations, or the privacy requirements of some occasions. It should be understood that "safe driving" not only includes that the light will not be led out to the outside of the vehicle through the glass assembly and affect other vehicles and pedestrians, but also includes that the light will not be led to the inside of the vehicle through the glass assembly and affect the driver. "Privacy" is usually for people inside the vehicle, that is, the glass assembly can make people outside the vehicle unable to see the situation inside the vehicle (including the lighting effect and/or the decorative effect of the display pattern on the vehicle window glass) clearly, thus realizing the privacy protection function.

In some existing solutions, as shown in Fig. 1A, a glass assembly 10 includes a first glass body 11 and a second glass body 12, and an intermediate layer 13 attaches the first glass body 11 and the second glass body 12 to each other. In another glass assembly 10-1 shown in Fig. 1B, the intermediate layer includes a first intermediate layer 13a attached to the first glass body 11 and a second intermediate layer 13b attached to the second glass body 12. A pattern 14 formed by enamel or ink, for example, is formed on for example a surface of the second glass body 12 away from the first glass body 11. Incident light emitted by a light source enters the glass assembly 10 or 10-1 and will scatter or diffuse after contacting the pattern 14, and in turn be led out of the second glass body 12 to realize the lighting effect or the decorative effect with the pattern. In these two ways, a reflective layer 15 is arranged on the entire surface of the glass assembly, between the intermediate layer 13 and the second glass body 12 as shown in Fig. 1A, or between the first intermediate layer 13a and the second intermediate layer 13b as shown in Fig. 1B. In the case where the glass assembly is used for a vehicle window glass, and the first glass body 11 faces the outside of the vehicle and the second glass body 12 faces the inside of the vehicle, the reflective layer 15 reflects the incident light entering the glass assembly back to the inside of the vehicle. The inventors realized that, especially for the vehicle door glass, such as the front vehicle door glass, the reflective layer covering the entire surface of the glass assembly may adversely affect the driver's viewing field. In addition, when it is necessary to realize lighting and/or form a luminous pattern, the reflective layer may lead to a very obvious reflection effect, which may affect the sensory experience of the occupants inside the vehicle.

To this end, according to the concept of the present disclosure, a glass assembly is proposed. The glass assembly comprises a glass body having a first surface and a second surface arranged oppositely; a light-exiting region forming a pattern and formed on the first surface and/or the second surface of the glass body and/or formed within the glass body, and the light-exiting region is configured such that light is led out of the second surface from the light-exiting region; a light-shielding region arranged on the first surface and forming a pattern following the pattern formed by the light-exiting region to shield the light from the light-exiting region toward the light-shielding region. When the glass assembly is configured as laminated glass, the glass assembly includes a first glass body and a second glass body

attached to the first glass body through an intermediate layer. The light-exiting region forms a pattern and is formed on a surface of the first glass body away from the second glass body and/or formed within the first glass body, and/or formed on a surface of the second glass body away from the first glass body and/or formed within the second glass body, and/or formed
5 between the first glass body and the second glass body, and the light-exiting region is configured so that the light is led out of the second glass body from the light-exiting region. The light-shielding region is arranged on the surface of the first glass body away from the second glass body or arranged between the light-exiting region and the first glass body, and forms a pattern following the pattern formed by the light-exiting region to shield the light from
10 the light-exiting region toward the light-shielding region.

Depending on different requirements, the light-exiting region formed between the first glass body and the second glass body comprises the light-exiting region is formed on a surface of the first glass body facing the second glass body, or formed on a surface of the second glass body facing the first glass body, or formed on a surface of the intermediate layer or formed
15 within the intermediate layer.

It should be understood that, "following" means that the pattern formed by the light-shielding region is approximately the same as or slightly larger in proportion than the pattern formed by the light-exiting region. By providing the light-shielding region corresponding to the pattern formed by the light-exiting region, the glass assembly of the present disclosure can
20 realize the lighting effect and/or the luminous pattern effect on a surface of one side, and can simultaneously reduce or avoid the adverse influence of the light from the light-exiting region on a surface of the other side of the glass assembly. For example, the light transmittance T1 of the light-shielding region with respect to visible light (wavelength range from 390 nm to 780 nm) can be, for example, less than or equal to 70%, less than or equal to 50%, less than
25 or equal to 30%, or less than or equal to 10%. At the same time, it will not affect the light transmittance of other regions of the glass assembly except the light-shielding region. For occasions requiring high light transmittance, such as the front vehicle door glass, in a non-shielded region where no light-exiting region and corresponding light-shielding region are provided, the light transmittance T2 with respect to visible light can be maintained at, for
30 example, greater than or equal to 50%, or greater than or equal to 70%, thus ensuring the

driver's good observation of the outside of the vehicle. In addition, the glass assembly of the present disclosure can reduce or avoid the light providing the lighting effect and/or the decorative effect of the display pattern from being led out of the first surface of the glass body or being led out of the first glass body. If the first glass body is arranged to face the outside of the vehicle, the privacy of the illumination light and/or the luminous pattern can be effectively provided and the influence of the light on other vehicles and pedestrians can be reduced or avoided, thereby providing the privacy effect and safety effect. If the first glass body is arranged to face the inside of the vehicle, the influence of the illumination light and/or the light of the luminous pattern on the driver and passenger inside the vehicle can be reduced or avoided.

In particular, in connection with an embodiment shown in Fig. 2A, a glass assembly 100 of the present disclosure includes a glass body 110 having a first surface 111 and a second surface 112 arranged oppositely. According to different requirements, the glass body 110 can be toughened glass with a thickness of, for example, about 3 mm to 10 mm. In the embodiment shown in Fig. 2A, a light-exiting region 140 includes dots or lines 141 and 142 to form a pattern, which are formed on the second surface 112 of the glass body 110, for example, by laser engraving or printing or in a form of film layer, and the light-exiting region 140 is configured such that the light is led out of the second surface 112 from the light-exiting region 140. In some alternative or additional embodiments, the light-exiting region may be formed on the first surface 111 of the glass body 110 by laser engraving or printing or in a form of film layer and/or may be formed within the glass body 110 by laser engraving. A light-shielding region 150 is, for example, arranged on the first surface 111, and also forms a pattern following the pattern formed by the light-exiting region 140 to shield the light from the light-exiting region 140 toward the light-shielding region 150. In some embodiments, the pattern formed by the light-exiting region includes at least two patterns, further optionally, the pattern includes at least two discontinuous patterns. Correspondingly, the pattern formed by the light-shielding region also includes at least two patterns, further optionally, the pattern includes at least two discontinuous patterns and is configured to correspond to the at least two patterns (further optionally, the at least two discontinuous patterns) of the light-exiting region one by one. In addition, the light-shielding region is configured to shield the light from the light-

exiting region toward the light-shielding region from being led out of the first surface. In some embodiments, the light-exiting region and the light-shielding region can be arranged on the same surface of the glass body, for example, both can be arranged on the first surface 111 of the glass body 110, and the light-shielding region shields the light from the light-exiting region toward the light-shielding region. Alternatively, the light-shielding region 150 may be configured to include any one of light absorption layer, switchable film and reflective layer. It should be understood that, the light absorption layer refers to a coating or film layer including a material whose structure and/or chemical composition can absorb the light, which is usually composed of a variety of elements, compounds or polymers, and hardly transmits and reflects the light when the light shines on the material, such as carbon black material. The light absorption layer may be attached to the first surface 111 of the glass body 110 by coating or bonding, for example. The switchable film refers to a film layer that can be switched as required to achieve a transparent state or an opaque state, such as a dimming film of any one of polymer dispersed liquid crystal (PDLC), polymer network liquid crystal (PNLC), guest-host liquid crystal (GHLC) and electrochromic (EC), and has a certain haze and/or low light transmittance when switched to the opaque state. The switchable film may be attached to the first surface 111 of the glass body 110 by bonding, for example. The reflective layer refers to a coating or film layer that can change the transmittance of light in a certain wavelength range by reflection. It can be attached to the first surface 111 of the glass body 110 by coating, plating or bonding, for example, and may include one or more layers of metal, alloy or metal compound. Alternatively, the material of the reflective layer may include, but is not limited to, silver, aluminum, rhodium and molybdenum.

It should be understood that the number, size, distribution and positional relationship of the patterns formed by the light-exiting region 140 are only examples. Depending on different requirements, a plurality of patterns with different numbers and sizes, as well as uniform or non-uniform arrangement are all feasible, so that different display patterns or lighting effects can be generated through different designs.

In an embodiment of a laminated glass shown in Fig. 2B, a glass assembly 100-1 includes a first glass body 110 and a second glass body 120, and an intermediate layer 130 attaches the first glass body 110 and the second glass body 120 to each other. In this embodiment, the first

glass body 110, for example, faces the outside of the vehicle, which may be called outer glass, and the second glass body 120, for example, faces the inside of the vehicle, which may be called inner glass. The intermediate layer 130 is an adhesive layer suitable for the laminated glass, such as polyvinyl butyral (PVB) or ethylene-vinyl acetate copolymer (EVA). According to different requirements, the first glass body 110 can be any one of ordinary glass, ultra-transparent glass and tinted glass. The intermediate layer 130 can be transparent or tinted material, including but not limited to PVB or EVA mentioned above, or any one of polyphenyl ester (POB) and optically transparent adhesive (OCA), and the thickness can be selected from about 0.38 mm to 1.14 mm. The second glass body 120 may be ordinary glass or ultra-transparent glass, preferably ultra-transparent glass. The thickness of the first glass body 110 and the second glass body 120 may be about 1.1 mm to 6 mm (such as toughened glass, heat strengthened glass or annealed glass), or about 0.7 mm to 1.6 mm (such as chemically strengthened glass).

According to different requirements, the light-exiting region can be formed on a surface of the first glass body away from the second glass body and/or formed within the first glass body, and/or formed on a surface of the second glass body away from the first glass body and/or formed within the second glass body, and/or formed between the first glass body and the second glass body. Here, "between" covers various arrangements in which the light-exiting region is directly adjacent to or not directly adjacent to the first glass body or the second glass body. For example, the light-exiting region is formed on a surface of the first glass body facing the second glass body, or formed on a surface of the second glass body facing the first glass body, or formed on a surface of the intermediate layer or formed within the intermediate layer. According to different requirements, the light-exiting region can be configured to include a light extraction layer and/or an active light-emitting layer. It should be understood that, "light extraction layer" is a layer structure with light extraction structure such as micro-structure or micro-texture, and the size of the light extraction structure is in micron or even nanometer level. "Active light-emitting layer" refers to a layer structure that can emit light by itself when electricity is applied, without the need for a light source. For example, any one of OLED (organic light-emitting diode), Mirco LED, Mini LED and EL (Electroluminescence) can be used. When the light extraction layer is used, the light at the light-exiting region comes from

the light emitted by a light source, which is a passive light-emitting mode. When the active light-emitting layer is used, the light at the light-exiting region comes from the light emitted by the active light-emitting layer itself, which is an active light-emitting mode.

In the embodiment shown in Fig. 2B, the light-exiting region 140 is, for example, a light
5 extraction layer formed on the surface of the second glass body 120 away from the first glass body 110 by laser engraving or printing or in a form of film layer, or an active light-emitting layer arranged on the surface of the second glass body 120 away from the first glass body 110, such as a surface facing the interior of the vehicle. As for printing, the light extraction layer can be printed on the surface of the second glass body 120 with the material such as enamel
10 or ink by screen printing or inkjet printing. As for film layer, the light extraction layer can be adhered to the surface of the second glass body 120 by using a light extraction film. The incident light emitted by a light source (such as LED light-emitting strip or point-shaped LEDs with light guide) arranged at the edge of the glass assembly (such as the edge of the second glass body 120) or embedded in the glass assembly (such as embedded in the second glass
15 body 120) enters the glass assembly 100-1 and will scatter or diffuse after contacting the light extraction layer, and in turn be led out of the second glass body 120 to achieve the lighting effect or the decorative effect with luminous pattern. For the active light-emitting layer, the light emitted by the active light-emitting layer is directly led out of the active light-emitting layer.

20 Alternatively, the light-shielding region 150 may be configured to include any one of light absorption layer, switchable film and reflective layer. According to different requirements, the light-shielding region can be arranged on the surface of the first glass body away from the second glass body, or arranged between the intermediate layer and the first glass body or the second glass body, or arranged within the intermediate layer, and can be
25 optionally implemented by, for example, coating light absorbing material.

In the embodiment shown in Fig. 2B, the light-shielding region 150 is exemplarily arranged between the intermediate layer 130 and the second glass body 120, that is, the light-shielding region 150 is arranged on the surface of the second glass body 120 facing the first glass body 110 or on the surface of the intermediate layer 130 facing the second glass body
30 120. Alternatively, the light-shielding region 150 may be arranged between the intermediate

layer 130 and the first glass body 110, that is, the light-shielding region 150 is arranged on the surface of the first glass body 110 facing the second glass body 120 or on the surface of the intermediate layer 130 facing the first glass body 110. Or, the light-shielding region 150 is alternatively arranged within the intermediate layer 130. For example, when a switchable film is used, it can be arranged on the surface of the second glass body 120 facing the first glass body 110 by bonding or laminating by means of the intermediate layer 130; and when a reflective layer is used, it can be arranged on the surface of the second glass body 120 facing the first glass body 110 by coating, plating or bonding and so on; or the switchable film or the reflective layer can be sandwiched between two initial intermediate layers and laminated to form an intermediate layer with a light-shielding region, so as to shield the light from the light-exiting region 140 toward the light-shielding region 150 and prevent the light from the light-exiting region 140 from being led out of the first glass body 110. In this way, for people inside the vehicle, the lighting effect or the decorative effect of luminous pattern can be observed from the side of the second glass body 120, but the lighting effect or the luminous pattern cannot be observed or easily observed from the side of the first glass body 110 facing the outside of the vehicle, which can play the role of privacy protection of the illumination light and/or the luminous pattern, meanwhile, it can meet the requirements of some relevant laws and regulations because the illumination light or the luminous pattern will not or will not easily affect the vehicles and pedestrians outside the vehicle. It should be understood that when the first glass body 110 is arranged to face the interior of the vehicle, the lighting effect or the luminous pattern generated by the illustrated arrangement is for people outside the vehicle, and the driver and passenger inside the vehicle will not be affected by the illumination light or the luminous pattern, thus enhancing the driving and riding experience. The following exemplary embodiments will be described with the example that the first glass body is arranged to face the outside of the vehicle, however, various applications in which the first glass body is arranged to face the inside of the vehicle are not excluded.

As mentioned above, "following" means that the pattern formed by the light-shielding region is approximately the same as or slightly larger in proportion than the pattern formed by the light-exiting region. Accordingly, the glass assembly can be configured to satisfy:

$$D1+d \times \tan \theta \leq D2 \leq D1 + 3d \times \tan \theta.$$

Referring to Fig. 2A, D1 is the size of the pattern formed by the light-exiting region 140 along the surface direction of the glass assembly 100; D2 is the corresponding size of the light-shielding region 150 following the pattern formed by the light-exiting region along the surface direction of the glass assembly 100; d is the distance between the light-exiting region 140 and the light-shielding region 150 along the cross-sectional direction of the glass assembly 100, which is about the thickness of the glass body 110 in the illustrated embodiment; and θ is the critical angle for total reflection of the light within the glass assembly. Here, the dimensions of D1 and D2 are measured by the dimensions of dots, lines, etc. forming the pattern, such as line width diameter (line diameter) and/or line length of the form of line forming the pattern.

When the dimension D1 of the pattern formed by the light-exiting region is determined, the dimension D2 of the light-shielding region corresponding to the pattern can be set accordingly. In addition, when the laminated structure of glass assembly is determined and the arrangement mode of the light source is determined, the critical angle θ can also be determined. In this way, depending on different laminated structures of glass assembly, the dimension D2 of the light-shielding region 150 along the surface direction of the glass assembly 100 can be approximately the same as or slightly larger than the dimension D1 of the pattern formed by the light-exiting region 140 along the surface direction of the glass assembly 100, which can effectively meet the light-shielding effect. In some embodiments, the glass assembly can be configured to satisfy $D1 \leq D2 \leq D1+6\text{mm}$.

Advantageously, the ratio of the area of the light-exiting region 140 to the surface area of the glass body 110 and the ratio of the area of the light-shielding region 150 to the surface area of the glass body 110 are less than or equal to 70%, less than or equal to 50%, less than or equal to 30%, or less than or equal to 10%, respectively.

In combination with the embodiment shown in Fig. 2B, d is the distance between the light-exiting region 140 and the light-shielding region 150 along the cross-sectional direction of the glass assembly 100-1, which is about the thickness of the second glass body 120 in the illustrated embodiment. In some embodiments, the light-shielding region 150 can be arranged between the intermediate layer 130 and the first glass body 110, and correspondingly, d is the distance between the light-exiting region 140 and the light-shielding region 150 along the cross-sectional direction of the glass assembly, that is, it is about the sum of the thicknesses

of the intermediate layer 130 and the second glass body 120, and the glass assembly can also obtain the similar effects mentioned above, which is not repeated here.

Advantageously, the ratio of the area of the light-exiting region 140 to the surface area of the first glass body 110 or the second glass body 120 and the ratio of the area of the light-shielding region 150 to the surface area of the first glass body 110 or the second glass body 120 are less than or equal to 70%, less than or equal to 50%, less than or equal to 30%, or less than or equal to 10%, respectively.

In some embodiments, the light-shielding region can be arranged on the surface of the first glass body 110 away from the second glass body 120. In an embodiment shown in Fig. 2C, the light-shielding region 150 is arranged on the surface of the first glass body 110 of a glass assembly 100-2 away from the second glass body 120. In this way, with respect to the above formula, d is the distance between the light-exiting region 140 and the light-shielding region 150 along the cross-sectional direction of the glass assembly 100-2, which is about the sum of the thicknesses of the first glass body 110, the intermediate layer 130 and the second glass body 120 in the illustrated embodiment.

In some embodiments, the glass assembly includes a tinted layer composed of the first glass body and/or any one or more layers between the first glass body and the light-exiting region. Further alternatively, the glass assembly may include a tinted layer composed of the first glass body and/or the intermediate layer. In other words, depending on different requirements, the tinted layer may be a single-layer structure (for example, the first glass body or the intermediate layer) or a double-layer structure (for example, the first glass body and the intermediate layer) or a multi-layer structure (for example, the first glass body and a plurality of intermediate layers). It should be understood that "tinted layer" refers to a colored layer structure, or a translucent or opaque layer structure, and the tinted layer has a lower light transmittance than that of a transparent layer structure. The light transmittance of the tinted layer is the product of the individual light transmittances of all contained layers. The so-called "tinted" refers to the inherent color in the tinted layer in a natural state (for example, not in electrically variable state) no matter whether it is naturally colored or added with color through a process. In some embodiments, the first glass body itself and/or the intermediate layer itself may or may not have a color, and the first glass body and/or the intermediate layer may be

directly attached (e.g., adhered, pressed, etc.) with a tinted film or coated with a tinted coating, such as a tinted film made of polyethylene terephthalate (PET), polypropylene (PP), polyethylene (PE), etc., to form the tinted layer. Advantageously, the light transmittance T3 of the tinted layer with respect to visible light is less than or equal to 70%, less than or equal to 50%, less than or equal to 30%, or less than or equal to 10%. By arranging the tinted layer, it can further protect the privacy of the illumination light and/or the luminous pattern for the glass assembly, and in the case that the first glass body is arranged to face the outside of the vehicle, it can further make the light or the luminous pattern not or not easily affect the vehicles and pedestrians outside the vehicle, and can meet the requirements of some relevant laws and regulations. Because the light-shielding region restricts the light from the light-exiting region toward the light-shielding region to be led out, the tinted layer can have a relatively large light transmittance (for example, greater than or equal to 50%, greater than or equal to 70%) without hindering the transmission of visible light. For example, alternatively, the difference between the light transmittance T3 of the tinted layer with respect to visible light and the light transmittance T1 of the light-shielding region with respect to visible light is greater than or equal to 20%, greater than or equal to 30%, greater than or equal to 40%, or greater than or equal to 50%. Or alternatively, for example, the product of the light transmittance T3 of the tinted layer with respect to visible light and the light transmittance T1 of the light-shielding region with respect to visible light is less than or equal to 70%, less than or equal to 50%, less than or equal to 30%, or less than or equal to 10%. Therefore, for example, the safety requirement of the driver inside the vehicle to observe the outside of the vehicle during driving can be not affected, which is beneficial to the application of the vehicle door glass in particular.

In a glass assembly 100-3 of another embodiment shown in Fig. 2D, the difference from the embodiment shown in Fig. 2B is that the first glass body 110 of the glass assembly 100-3 is configured as a tinted layer. As described above, in alternative embodiments, the intermediate layer 130 may also be configured as a tinted layer, or both the first glass body 110 and the intermediate layer 130 may be configured as tinted layers. When the light-exiting region 140 is configured as an active light-emitting layer, the second glass body 120 may also be configured as a tinted layer.

In a glass assembly 100-4 of another embodiment shown in Fig. 2E, the difference from the embodiment shown in Fig. 2B is that the intermediate layer includes a first intermediate layer 130a attached to the first glass body 110 and a second intermediate layer 130b attached to the second glass body 120, and the light-shielding region 150 is arranged between the first intermediate layer 130a and the second intermediate layer 130b. Depending on different arrangements, alternatively, as described in connection with Fig. 2B, the light-shielding region 150 may also be arranged within the first intermediate layer 130a or within the second intermediate layer 130b. In addition, in the embodiment shown in Fig. 2E, at least one functional layer may be arranged between the light-exiting region 140 and the light-shielding region 150, and one functional layer 160 is exemplarily shown in this embodiment. Depending on different requirements, the functional layer 160 may include, for example, but not limited to, light guide layer, adhesive layer, imaging layer, display layer, thermal insulation layer or touching layer. Alternatively, the light guide layer can be any one of glass, PVB, polycarbonate (PC) and PET. Accordingly, with respect to the above formula, d is the distance between the light-exiting region 140 and the light-shielding region 150 along the cross-sectional direction of the glass assembly 100-4, which is about the sum of the thicknesses of the functional layer 160, the second intermediate layer 130b and the second glass body 120 in the illustrated embodiment.

In the embodiment shown in Fig. 2E, the first intermediate layer 130a is also configured as a tinted layer. Alternatively, any one or more layers from the first glass body 110 to the second intermediate layer 130b can be configured as tinted layers, that is, any one or more layers of the first glass body 110, the first intermediate layer 130a, the functional layer 160 and the second intermediate layer 130b can be configured as tinted layers. When the light-exiting region 140 is configured as an active light-emitting layer, the second glass body 120 may also be configured as a tinted layer.

Fig. 3A illustrates a glass assembly 200 of another embodiment, which includes a first glass body 210 and a second glass body 220, an intermediate layer 230 attaches the first glass body 210 and the second glass body 220 to each other, and the first glass body 210 is configured as a tinted layer. Alternatively, the intermediate layer 230 may also be configured as a tinted layer. Different from the embodiment shown in Fig. 2B, a light-exiting region 240

is, for example, a light extraction layer formed on a surface of the second glass body 220 facing the first glass body 210 by laser engraving or printing or in a form of film layer; or the light-exiting region 240 is, for example, a light extraction layer formed on a surface of the intermediate layer 230 facing the second glass body 220 by printing; or the light-exiting region 240 is, for example, an active light-emitting layer sandwiched between the first glass body 210 and the second glass body 220, for example, sandwiched between the intermediate layer 230 and the second glass body 220. In this embodiment, a light-shielding region 250 may be arranged between the intermediate layer 230 and the first glass body 210. Accordingly, with respect to the above formula, d is the distance between the light-exiting region 240 and the light-shielding region 250 along the cross-sectional direction of the glass assembly 200, which is about the thickness of the intermediate layer 230 in the illustrated embodiment.

In a glass module 200-1 of another embodiment shown in Fig. 3B, the difference from the embodiment shown in Fig. 3A is that at least one functional layer is arranged between the light-exiting region 240 and the light-shielding region 250, and in this embodiment, one functional layer 260 is exemplarily shown. Accordingly, with respect to the above formula, d is the distance between the light-exiting region 240 and the light-shielding region 250 along the cross-sectional direction of the glass assembly 200-1, which is about the sum of the thicknesses of the functional layer 260 and the intermediate layer 230 in the illustrated embodiment. In this embodiment, the first glass body 210 is configured as a tinted layer. Alternatively, any one or more layers of the first glass body 210, the intermediate layer 230, and the functional layer 260 may be configured as tinted layers.

In a glass assembly 200-2 of another embodiment shown in Fig. 3C, the difference from the embodiment shown in Fig. 3B is that the intermediate layer includes a first intermediate layer 230a attached to the first glass body 210 and a second intermediate layer 230b attached to the second glass body 220, and the light-shielding region 250 is arranged between the first intermediate layer 230a and the second intermediate layer 230b. Accordingly, with respect to the above formula, d is the distance between the light-exiting region 240 and the light-shielding region 250 along the cross-sectional direction of the glass assembly 200-2, which is about the sum of the thicknesses of the functional layer 260 and the second intermediate layer 230b in the illustrated embodiment.

In the embodiment shown in Fig. 3C, the first glass body 210 is also configured as a tinted layer. Alternatively, any one or more layers from the first glass body 210 to the second intermediate layer 230b can be configured as tinted layers, that is, any one or more layers of the first glass body 210, the first intermediate layer 230a, the functional layer 260 and the second intermediate layer 230b can be configured as tinted layers.

Fig. 4A illustrates a glass assembly 300 of another embodiment, which includes a first glass body 310 and a second glass body 320, and the intermediate layer includes a first intermediate layer 330a attached to the first glass body 310 and a second intermediate layer 330b attached to the second glass body 320, and the first glass body 310 is configured as a tinted layer. Alternatively, the first intermediate layer 330a may be configured as a tinted layer, or both the first glass body 310 and the first intermediate layer 330a may be configured as tinted layers. In this embodiment, a light-exiting region 340a may be configured as a light extraction layer or an active light-emitting layer sandwiched between the first glass body and the second glass body in a form of film layer. Similarly, "between" here covers various arrangements in which the light extraction layer or the active light-emitting layer is directly adjacent to or not directly adjacent to the first glass body or the second glass body. A glass assembly 300-1 of another embodiment shown in Fig. 4B is similar to the glass assembly 300 shown in Fig. 4A. In both illustrated embodiments, the light-exiting region 340a is arranged between the first intermediate layer 330a and the second intermediate layer 330b, and may be configured as a light extraction layer. For example, light extraction structures can adopt micro-textures such as bumps (Fig. 4B) protruding toward the second glass body 320 and/or notches (Fig. 4A) recessed toward the first glass body 310 formed on a substrate such as PET and form the light extraction layer. In the two illustrated embodiments, the light-exiting region 340a may be directly adjacent to the light-shielding region 350, that is, the light-shielding region 350 is arranged between the first intermediate layer 330a and the second intermediate layer 330b, and no any other layer is arranged between the light-exiting region 340a and the light-shielding region 350. In some embodiments, the light-exiting region 340a can also be, for example, a light extraction layer formed on a surface of the second intermediate layer 330b facing the first glass body 310 by printing, such as in a glass assembly 300-2 of an embodiment shown in Fig. 4C and a glass assembly 300-3 of an embodiment shown in Fig. 4D. Similarly,

in the two illustrated embodiments, the light-exiting region 340a may be directly adjacent to the light-shielding region 350, that is, no any other layer is arranged between the light-exiting region 340a and the light-shielding region 350. Accordingly, with respect to the above formula, d is the distance between the light-exiting region 340a and the light-shielding region 350 along the cross-sectional direction of the glass assemblies 300, 300-1, 300-2 and 300-3, which may be substantially zero in the illustrated embodiments. In this way, the dimensions of the light-shielding region 350 and the light-exiting region 340a along the surface direction of the glass assembly 300 may be approximately the same.

In a glass assembly 300-4 of another embodiment shown in Fig. 4E, the difference from the embodiment shown in Fig. 4A is that at least one functional layer can be arranged between the light-exiting region 340b and the light-shielding region 350, and in this embodiment, one functional layer 360 is exemplarily shown. Furthermore, in addition to the first glass body 310 being configured as a tinted layer, the first intermediate layer 330a is also configured as a tinted layer. Alternatively, only the first intermediate layer 330a may be configured as a tinted layer, or only the first glass body 310 may be configured as a tinted layer. Further alternatively, the functional layer 360 can be configured as a tinted layer, which is not detailed here. In this embodiment, the light-exiting region 340b may be configured as an active light-emitting layer sandwiched between the first intermediate layer 330a and the second intermediate layer 330b. Accordingly, with respect to the above formula, d is the distance between the light-exiting region 340b and the light-shielding region 350 along the cross-sectional direction of the glass assembly 300-4, which is about the thickness of the functional layer 360 in the illustrated embodiment.

Fig. 5 shows a glass assembly 400 of another embodiment, which includes a first glass body 410 and a second glass body 420, an intermediate layer 430 attaches the first glass body 410 and the second glass body 420 to each other, a light-shielding region 450 is arranged between the intermediate layer 430 and the second glass body 420, and the first glass body 410 is configured as a tinted layer. Different from the embodiment shown in Fig. 2B, a light-exiting region 440 is configured as a light extraction layer formed within the second glass body 420 by laser engraving, for example. Similarly, in alternative embodiments, the intermediate layer 430 may be configured as a tinted layer, or both the first glass body 410

and the intermediate layer 430 may be configured as tinted layers. Accordingly, with respect to the above formula, d is the distance between the light-exiting region 440 and the light-shielding region 450 along the cross-sectional direction of the glass assembly 400. In the illustrated embodiment, because the light-exiting region 440 is located within the second glass body 420, the calculation of d is relatively complicated, and d can be roughly regarded as zero. In this way, the dimensions of the light-shielding region 450 and the light-exiting region 440 along the surface direction of the glass assembly 400 may be approximately the same.

Fig. 6A shows a glass assembly 500 of another embodiment, which includes a first glass body 510 and a second glass body 520, an intermediate layer 530 attaches the first glass body 510 and the second glass body 520 to each other, a light-shielding region 550 is arranged between the intermediate layer 530 and the first glass body 510, and the first glass body 510 is configured as a tinted layer. Different from the embodiment shown in Fig. 3A, a light-exiting region 540 is configured as a light extraction layer embedded in the intermediate layer 530 in a form of material mixing or printing or film layer, for example. For example, if the intermediate layer 530 is made of PVB, two initial intermediate layers can be provided, and materials such as enamel can be printed on one surface of the initial intermediate layer to form a pattern by screen printing or inkjet printing, etc., and then an intermediate layer with a light extraction layer inside can be formed by laminating the two initial intermediate layers. In some embodiments, scattering particles can be mixed into the intermediate layer when making it, and the particle size of the scattering particles is in the micron or even nanometer level, thus forming an intermediate layer with a light extraction layer. Scattering particles are, for example, glass microspheres, hollow glass microspheres, titanium dioxide particles, etc. In some embodiments, the light-exiting region 540 can be for example configured as an active light-emitting layer embedded in the intermediate layer 530 in a form of material mixing or film layer, for example, an intermediate layer with an active light-emitting layer can be prepared by mixing electroluminescent material into intermediate layer material. Accordingly, with respect to the above formula, d is the distance between the light-exiting region 540 and the light-shielding region 550 along the cross-sectional direction of the glass assembly 500. In the illustrated embodiment, because the light-exiting region 540 is located within the intermediate layer 530, and the thickness of the intermediate layer 530 is relatively thin, for

example, it can be selected from about 0.38 mm to 1.14 mm as described above, and the calculation of d is relatively complicated, d can be roughly regarded as zero. In this way, the dimensions of the light-shielding region 550 and the light-exiting region 540 along the surface direction of the glass assembly 500 may be approximately the same.

5 In a glass assembly 500-1 of another embodiment shown in Fig. 6B, the difference from the embodiment shown in Fig. 6A is that the intermediate layer includes a first intermediate layer 530a attached to the first glass body 510 and a second intermediate layer 530b attached to the second glass body 520, the light-shielding region 550 is arranged between the first intermediate layer 530a and the second intermediate layer 530b, and the light-exiting region
10 540 is configured as a light extraction layer embedded in the second intermediate layer 530b in a form of material mixing or printing or film layer, for example. Furthermore, in addition to the first glass body 510 being configured as a tinted layer, the first intermediate layer 530a is also configured as a tinted layer. Alternatively, only the first intermediate layer 530a may be configured as a tinted layer, or only the first glass body 510 may be configured as a tinted layer. In some embodiments, the light-exiting region 540 can be configured as an active light-emitting layer embedded in the second intermediate layer 530b in a form of material mixing or film layer, for example. Accordingly, with respect to the above formula, d is the distance between the light-exiting region 540 and the light-shielding region 550 along the cross-sectional direction of the glass assembly 500-1. Similarly, since the light-exiting region 540
15 is located within the second intermediate layer 530b, while the thickness of the second intermediate layer 530b is relatively thin, and the calculation of d is relatively complicated, d can be roughly regarded as zero in the illustrated embodiment. In this way, the dimensions of the light-shielding region 550 and the light-exiting region 540 along the surface direction of the glass assembly 500-1 may be approximately the same.

25 It can be seen from the above description that, no matter what arrangement mode, in the glass assembly of the present disclosure, by providing the light-exiting region and the light-shielding region, and the light-shielding region forms the pattern following the pattern formed by the light-exiting region to shield the light from the light-exiting region toward the light-shielding region, the light can be led out to a surface of one side of the glass assembly through
30 the light-exiting region, and the light-shielding region can restrict the light from the light-

exiting region from being led out to a surface of the other side of the glass assembly. While realizing the lighting effect and/or the display effect of the luminous pattern, the overall light transmittance of the rest regions of the glass assembly will not be affected, and the driving safety can be ensured when the glass assembly is applied to the vehicle door window, and the requirements of privacy and some relevant laws and regulations can be met, and the glass assembly has the beneficial effects of simple process, obvious performance improvement and the like.

It should be understood that in the described or not described possible embodiments, various improvements can be used independently of each other or in combination. For example, the light extraction layer and the active light-emitting layer in the above embodiments can be used at the same time to form the light-exiting region, for example, distributed in different regions along the surface direction of the glass assembly. For another example, the light extraction layer can be formed on the surface of the first glass body away from the second glass body by laser engraving or printing or in a form of film layer and/or formed within the first glass body by laser engraving, and/or the active light-emitting layer can be arranged on the surface of the first glass body away from the second glass body, and/or the light extraction layer can be formed on the surface of the first intermediate layer by printing and/or embedded in the first intermediate layer in a form of material mixing or printing or film layer, and/or the active light-emitting layer can be embedded in the first intermediate layer in a form of material mixing or film layer, as long as the light-shielding region can shield the light from the light-exiting region toward the light-shielding region. The glass assembly disclosed by the present disclosure can be applied to various occasions to meet the diversified requirements of users.

It should be understood here that the embodiments shown in the drawings only illustrate the optional architectures, shapes, sizes and arrangements of various optional components of the glass assembly according to the present disclosure; however, it is only illustrative rather than restrictive, and other shapes, sizes and arrangements can be adopted without departing from the spirit and scope of the present disclosure.

The technical content and technical features of the present disclosure have been disclosed above. However, it can be understood that those skilled in the art can make various changes

and improvements to the above disclosed concept under the creative idea of the present disclosure, all of which fall within the protection scope of the present disclosure. The description of the above embodiments is illustrative rather than restrictive, and the protection scope of the present disclosure is determined by the claims.

CLAIMS

1. A glass assembly comprising:

a glass body having a first surface and a second surface arranged oppositely;

a light-exiting region forming a pattern and formed on the first surface and/or the second surface of the glass body and/or formed within the glass body, and the light-exiting region being configured such that light is led out of the second surface from the light-exiting region;

a light-shielding region arranged on the first surface and forming a pattern following the pattern formed by the light-exiting region to shield the light from the light-exiting region toward the light-shielding region.

2. The glass assembly according to claim 1, wherein the light-shielding region is configured to comprise any one of light absorption layer, switchable film and reflective layer.

3. The glass assembly according to claim 1, wherein the pattern formed by the light-exiting region and the pattern formed by the light-shielding region respectively comprise at least two patterns, and further optionally, the pattern formed by the light-exiting region and the pattern formed by the light-shielding region respectively comprise at least two discontinuous patterns.

4. The glass assembly according to claim 1, wherein the ratio of the area of the light-exiting region to the surface area of the glass body and the ratio of the area of the light-shielding region to the surface area of the glass body are less than or equal to 70%, less than or equal to 50%, less than or equal to 30%, or less than or equal to 10%, respectively.

5. A glass assembly comprising a first glass body, and a second glass body attached to the first glass body through an intermediate layer;

a light-exiting region forming a pattern and formed on a surface of the first glass body away from the second glass body and/or formed within the first glass body, and/or formed on a surface of the second glass body away from the first glass body and/or formed within the second glass body, and/or formed between the first glass body and the second glass body, and configured such that light is led out of the second glass body from the light-exiting region;

a light-shielding region arranged on the surface of the first glass body away from the second glass body or arranged between the light-exiting region and the first glass body, and forming a pattern following the pattern formed by the light-exiting region to shield the light from the light-exiting region toward the light-shielding region.

5

6. The glass assembly according to claim 5, wherein the light-exiting region formed between the first glass body and the second glass body comprises the light-exiting region is formed on a surface of the first glass body facing the second glass body, or formed on a surface of the second glass body facing the first glass body, or formed on a surface of the intermediate layer or formed within the intermediate layer.

10

7. The glass assembly according to claim 5, wherein the light-shielding region is arranged between the intermediate layer and the first glass body or the second glass body, or is arranged within the intermediate layer; or the intermediate layer comprises a first intermediate layer attached to the first glass body and a second intermediate layer attached to the second glass body, and the light-shielding region is arranged between the first intermediate layer and the second intermediate layer, or is arranged within the first intermediate layer or within the second intermediate layer.

15

20

8. The glass assembly according to claim 5, wherein the light-shielding region is configured to comprise any one of light absorption layer, switchable film and reflective layer.

9. The glass assembly according to claim 5, wherein the pattern formed by the light-exiting region and the pattern formed by the light-shielding region respectively comprise at least two patterns, and further optionally, the pattern formed by the light-exiting region and the pattern formed by the light-shielding region respectively comprise at least two discontinuous patterns.

25

10. The glass assembly according to claim 5, wherein the ratio of the area of the light-exiting region to the surface area of the first glass body or the second glass body and the ratio of the area of the light-shielding region to the surface area of the first glass body or the second glass

30

body are less than or equal to 70%, less than or equal to 50%, less than or equal to 30%, or less than or equal to 10%, respectively.

11. The glass assembly according to claim 5, wherein the light-exiting region is configured to
5 comprise a light extraction layer, the light extraction layer is formed within the first glass body and/or within the second glass body by laser engraving, and/or the light extraction layer is formed on the surface of the first glass body and/or on the surface of the second glass body by laser engraving or printing or in a form of film layer, and/or the light extraction layer is sandwiched between the first glass body and the second glass body in a form of film layer.

12. The glass assembly according to claim 5, wherein the light-exiting region is configured to
10 comprise a light extraction layer, the light extraction layer is embedded in the intermediate layer in a form of material mixing or printing or film layer, and/or the light extraction layer is formed on a surface of the intermediate layer by printing.

13. The glass assembly according to claim 5, wherein the light-exiting region is configured to
15 comprise a light extraction layer, and the intermediate layer comprises a first intermediate layer attached to the first glass body and a second intermediate layer attached to the second glass body, and the light extraction layer is sandwiched between the first intermediate layer and the second intermediate layer in a form of film layer, and/or the light extraction layer is
20 embedded in the first intermediate layer and/or in the second intermediate layer in a form of material mixing or printing or film layer, and/or the light extraction layer is formed on a surface of the first intermediate layer and/or on a surface of the second intermediate layer by printing.

14. The glass assembly according to claim 5, wherein the light-exiting region is configured to
25 comprise an active light-emitting layer, the active light-emitting layer is sandwiched between the first glass body and the second glass body, and/or the active light-emitting layer is arranged on the surface of the first glass body away from the second glass body and/or on the surface
30 of the second glass body away from the first glass body, and/or the active light-emitting layer

is embedded in the intermediate layer in a form of material mixing or film layer.

15. The glass assembly according to claim 5, wherein the light-exiting region is configured to comprise an active light-emitting layer, and the intermediate layer comprises a first intermediate layer attached to the first glass body and a second intermediate layer attached to the second glass body, and the active light-emitting layer is sandwiched between the first intermediate layer and the second intermediate layer, and/or the active light-emitting layer is embedded in the first intermediate layer and/or in the second intermediate layer in a form of material mixing or film layer.

16. The glass assembly according to claim 5, wherein at least one functional layer is arranged between the light-exiting region and the light-shielding region.

17. The glass assembly according to any one of claims 1 to 4 or the glass assembly according to any one of claims 5 to 16, wherein the glass assembly is configured to satisfy:

$$D1 + d \times \tan \theta \leq D2 \leq D1 + 3d \times \tan \theta,$$

wherein D1 is the size of the pattern formed by the light-exiting region along the surface direction of the glass assembly, D2 is the corresponding size of the light-shielding region following the pattern formed by the light-exiting region along the surface direction of the glass assembly, d is the distance between the light-exiting region and the light-shielding region along the cross-sectional direction of the glass assembly, and θ is the critical angle for total reflection of the light within the glass assembly.

18. The glass assembly according to any one of claims 1 to 4 or the glass assembly according to any one of claims 5 to 16, wherein the glass assembly is configured to satisfy:

$$D1 \leq D2 \leq D1 + 6\text{mm},$$

wherein D1 is the size of the pattern formed by the light-exiting region along the surface direction of the glass assembly, and D2 is the corresponding size of the light-shielding region following the pattern formed by the light-exiting region along the surface direction of the glass assembly.

19. The glass assembly according to any one of claims 1 to 4 or the glass assembly according to any one of claims 5 to 16, wherein the light transmittance T1 of the light-shielding region with respect to visible light is less than or equal to 70%, less than or equal to 50%, less than or equal to 30%, or less than or equal to 10%.

20. The glass assembly according to claim 19, wherein the glass assembly comprises a non-shielded region which is not shielded by the light-shielding region, and the light transmittance T2 of the non-shielded region with respect to visible light is greater than or equal to 50%, or greater than or equal to 70%.

21. The glass assembly according to claim 19 or 20, wherein the glass assembly comprises a tinted layer composed of the first glass body and/or any one or more layers between the first glass body and the light-exiting region.

22. The glass assembly according to claim 21, wherein the glass assembly comprises a tinted layer composed of the first glass body and/or the intermediate layer; or the intermediate layer comprises a first intermediate layer attached to the first glass body and a second intermediate layer attached to the second glass body, and the first glass body and/or the first intermediate layer and/or the second intermediate layer form the tinted layer.

23. The glass assembly according to claim 22, wherein the first glass body and/or the intermediate layer are directly attached with a tinted film or coated with a tinted coating, or the first glass body and/or the first intermediate layer and/or the second intermediate layer are directly attached with a tinted film or coated with a tinted coating to form the tinted layer.

24. The glass assembly according to any one of claims 21 to 23, wherein the light transmittance T3 of the tinted layer with respect to visible light is less than or equal to 70%, less than or equal to 50%, less than or equal to 30%, or less than or equal to 10%.

25. The glass assembly according to any one of claims 21 to 24, wherein the difference between the light transmittance T3 of the tinted layer with respect to visible light and the light transmittance T1 of the light-shielding region with respect to visible light is greater than or equal to 20%, greater than or equal to 30%, greater than or equal to 40%, or greater than or equal to 50%.

26. The glass assembly according to any one of claims 21 to 24, wherein the product of the light transmittance T3 of the tinted layer with respect to visible light and the light transmittance T1 of the light-shielding region with respect to visible light is less than or equal to 70%, less than or equal to 50%, less than or equal to 30%, or less than or equal to 10%.

27. A window assembly comprising a glass assembly according to any one of claims 1 to 4 or a glass assembly according to any one of claims 5 to 26, wherein the window assembly comprises door, window, curtain wall, vehicle window glass, airplane glass or ship glass.

28. The window assembly according to claim 27, wherein the window assembly is a vehicle window glass comprising front windshield, rear windshield, skylight glass, vehicle door glass or corner window glass.

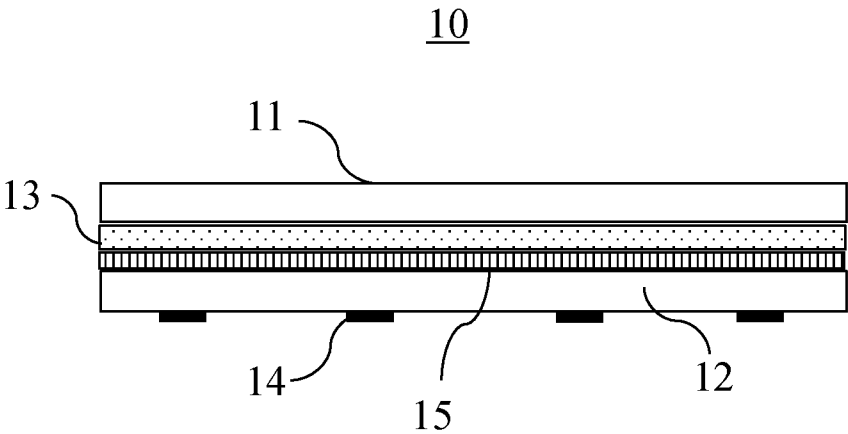


FIG.1A

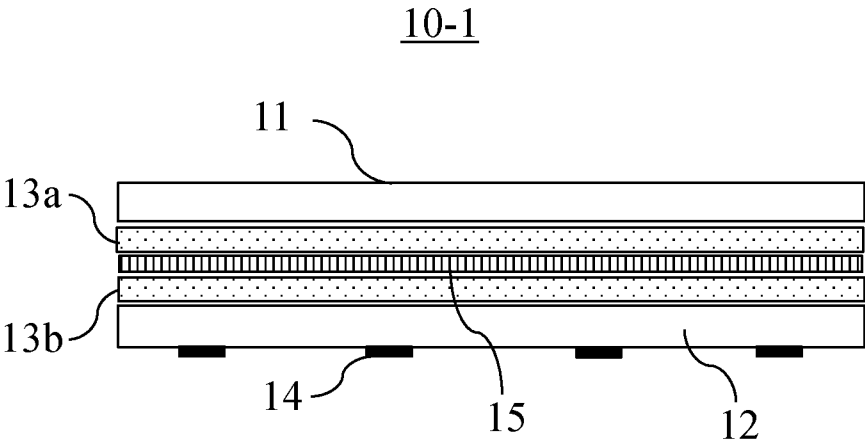


FIG.1B

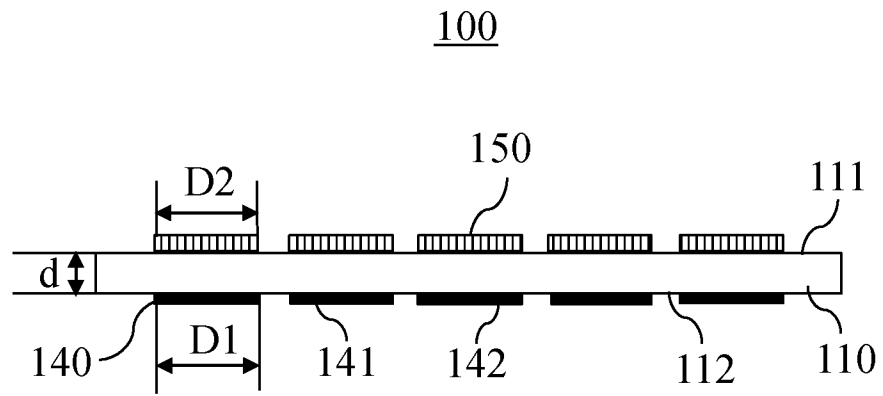


FIG.2A

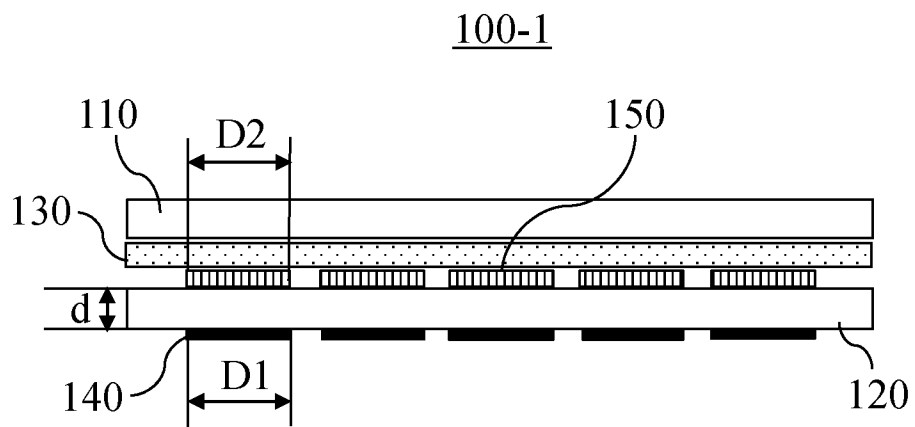


FIG.2B

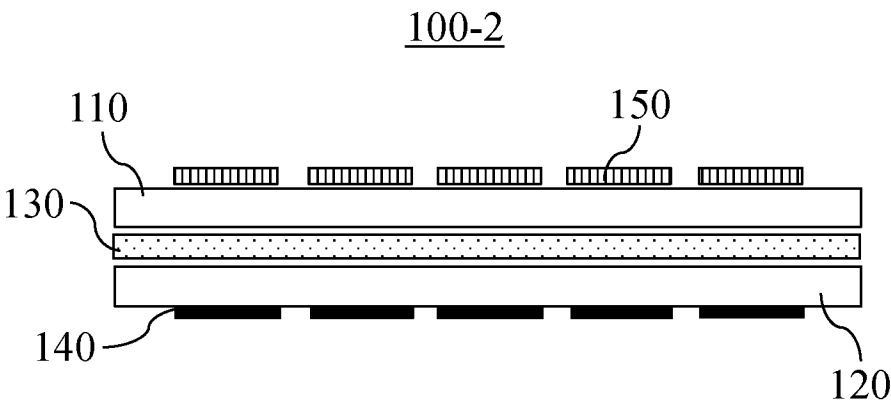


FIG.2C

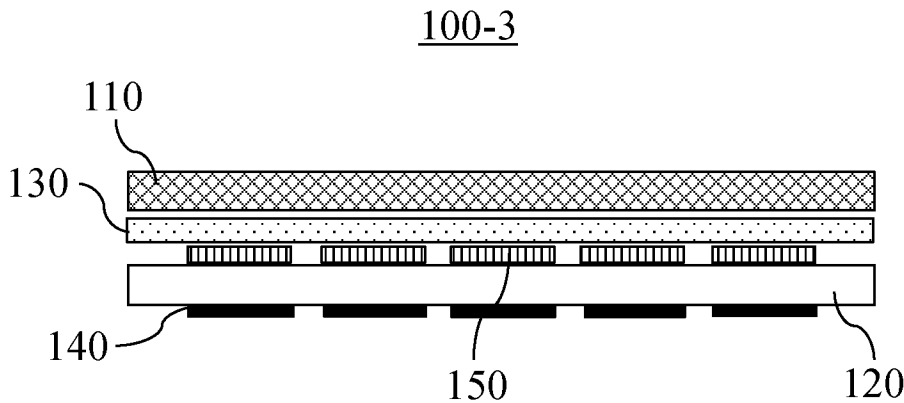


FIG.2D

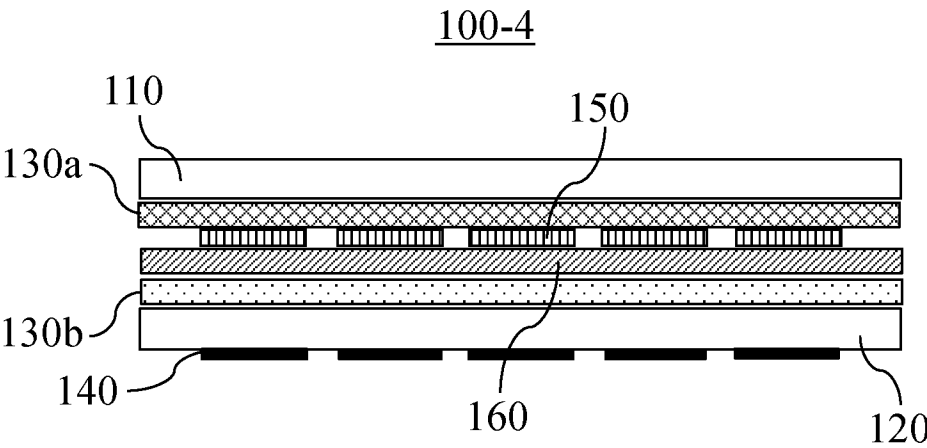


FIG.2E

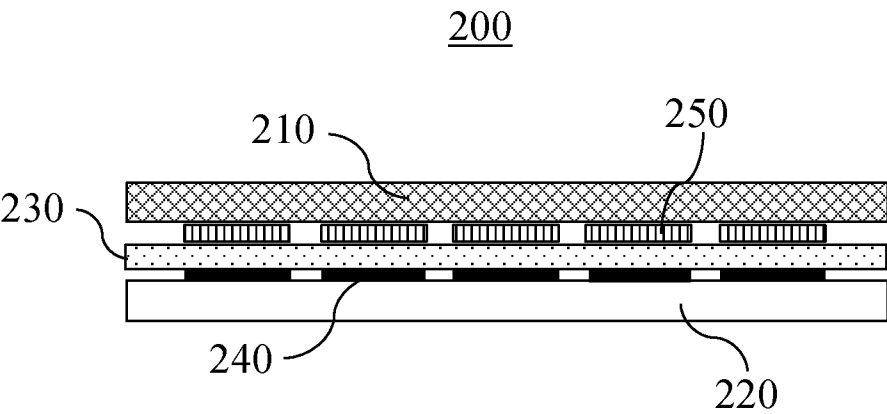


FIG.3A

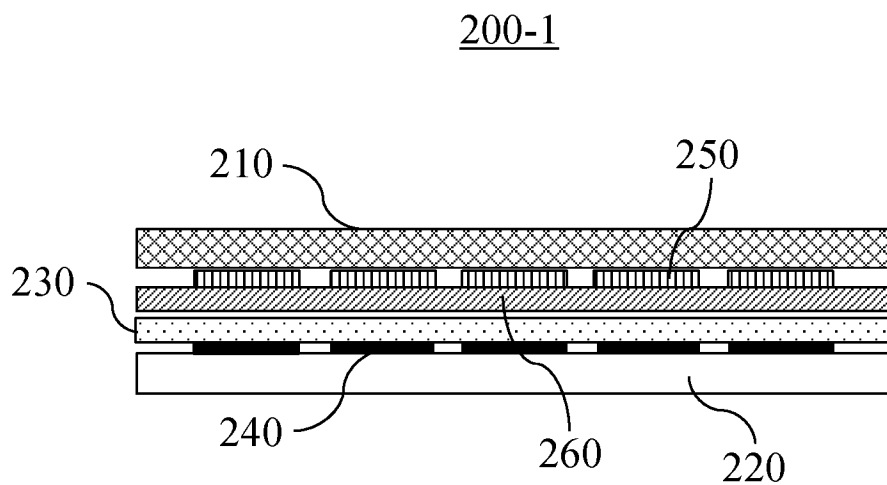


FIG.3B

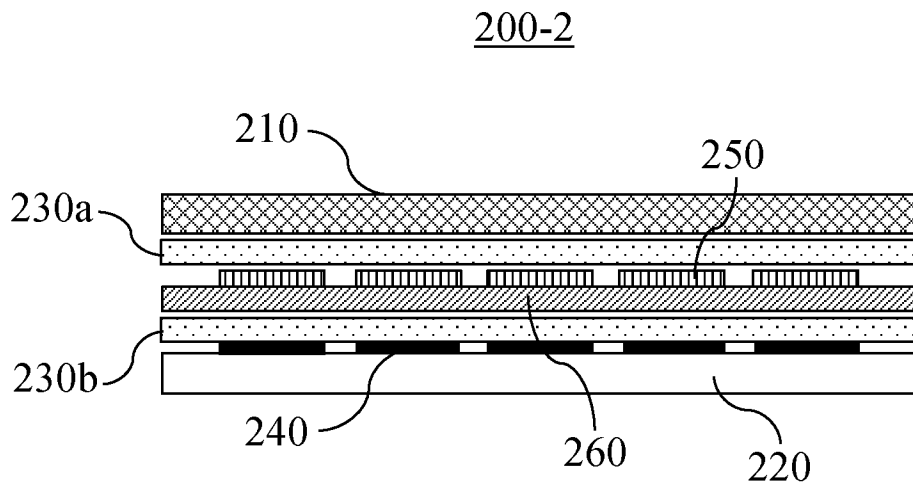


FIG.3C

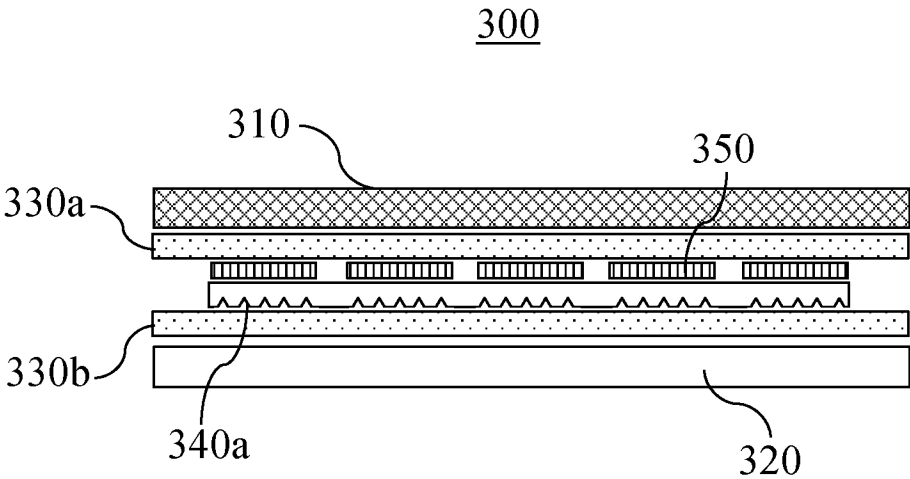


FIG.4A

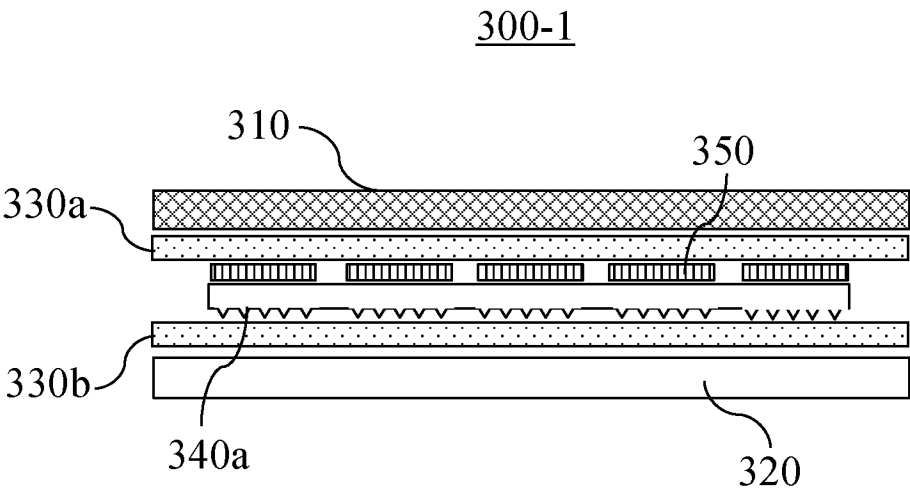


FIG.4B

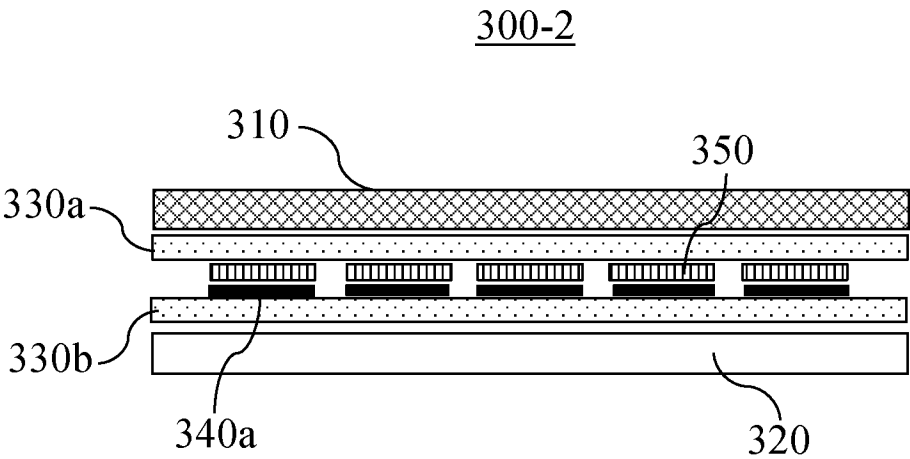


FIG.4C

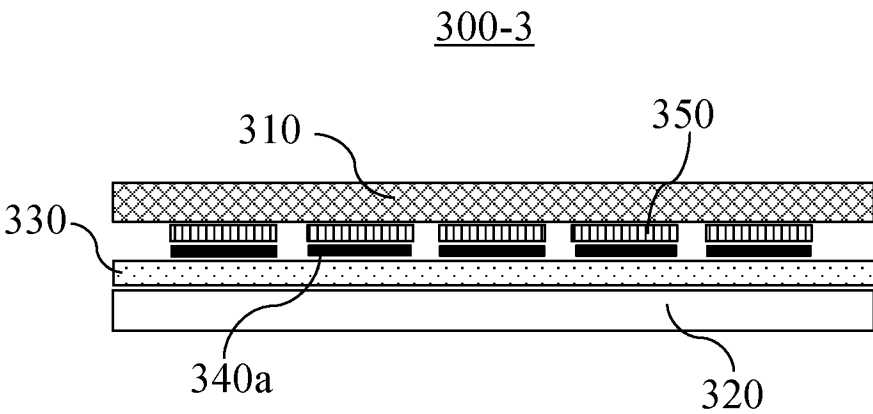


FIG.4D

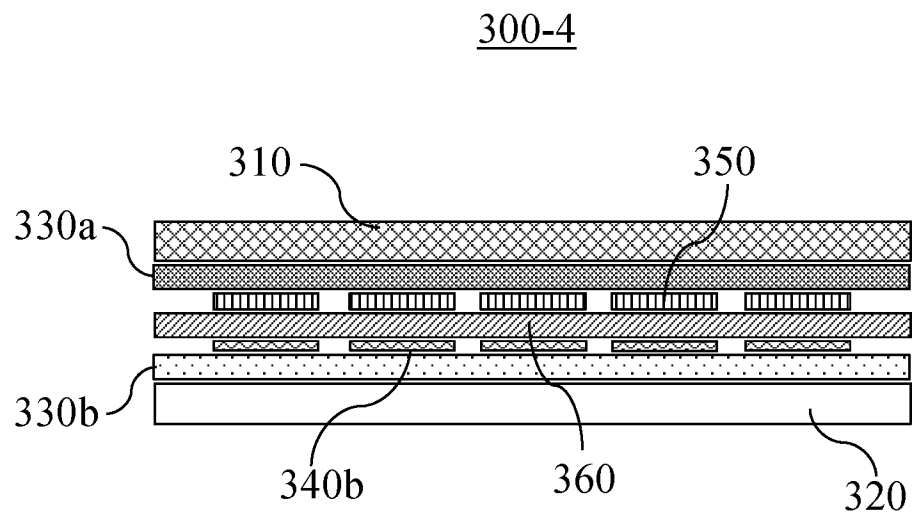


FIG.4E

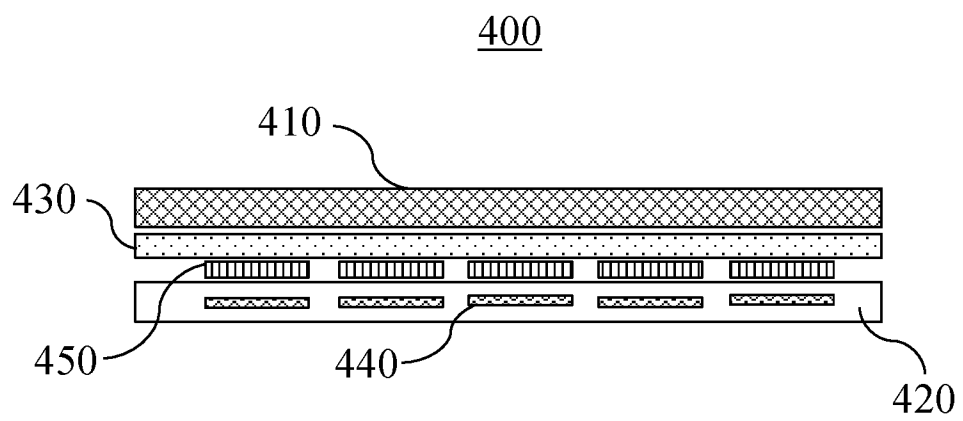


FIG.5

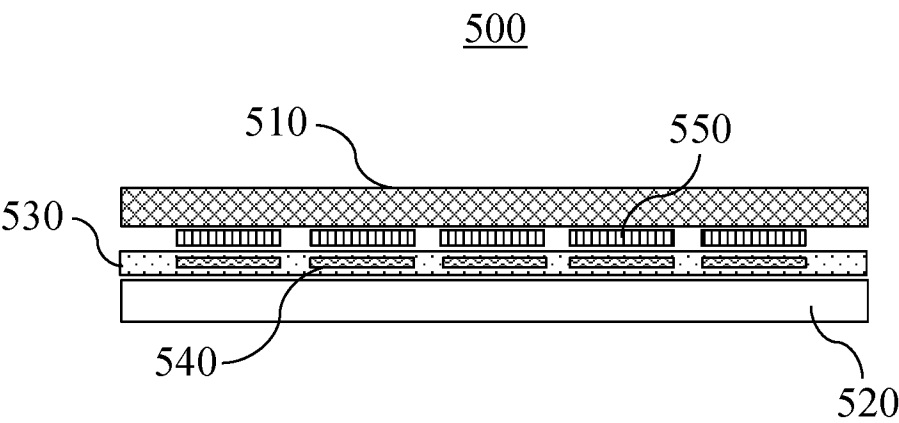


FIG.6A

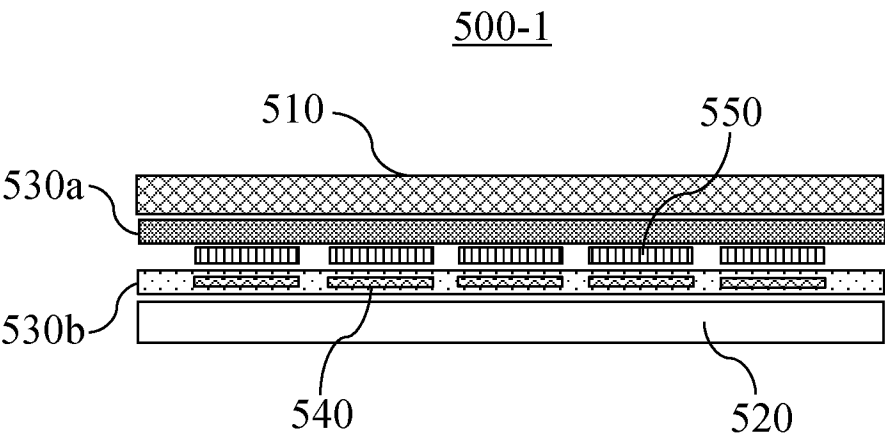


FIG.6B

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2024/142066

A. CLASSIFICATION OF SUBJECT MATTER B60Q3/62(2017.01)i; B60Q3/208(2017.01)i; B60J1/00(2006.01)i; B60J3/04(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) IPC:B60Q,B60J, B32B 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) CNTXT, ENTXT, VEN,CJFD,ENTXTC: 玻璃, 窗, 发光, 照明, 提取, 遮蔽, 遮挡, 吸收, glass,light, exiting, emitting, extract+,shielding, absorpt+		
C. DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 3925774 A1 (INALFA ROOF SYS GROUP BV) 22 December 2021 (2021-12-22) paragraphs 36-52 of the discription, fig.1-6	1,3-7,9-10,16-18,27-28
Y	EP 3925774 A1 (INALFA ROOF SYS GROUP BV) 22 December 2021 (2021-12-22) paragraphs 36-52 of the discription, fig.1-6	2,8,11-15,19-26
Y	CN 116766891 A (FUYAO GLASS IND GROUP CO LTD) 19 September 2023 (2023-09-19) paragraphs 54-72 of the discription, fig.1-15	2,8,19-26
Y	CN 115923457 A (SAINT-GOBAIN GLASS FRANCE SA,etc.) 07 April 2023 (2023-04-07) paragraphs 42-63 of the discription, fig.1-8	11-15
A	CN 103260918 A (CIE DE SAINT-GOBAIN,etc.) 21 August 2013 (2013-08-21) the whole document	1-28
☐ 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 “D” document cited by the applicant in the international application “E” earlier application or patent but published on or after the international filing date “L” document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified) “O” document referring to an oral disclosure, use, exhibition or other means “P” document published prior to the international filing date but later than the priority date claimed “T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention “X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone “Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art “&” document member of the same patent family		
Date of the actual completion of the international search 15 March 2025		Date of mailing of the international search report 31 March 2025
Name and mailing address of the ISA/CN CHINA NATIONAL INTELLECTUAL PROPERTY ADMINISTRATION 6, Xitucheng Rd., Jimen Bridge, Haidian District, Beijing 100088, China		Authorized officer SUN,YingChun Telephone No. (+86) 010-62085459

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2024/142066

Patent document cited in search report			Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
EP	3925774	A1	22 December 2021	None	
CN	116766891	A	19 September 2023	None	
CN	115923457	A	07 April 2023	None	
CN	103260918	A	21 August 2013	IN 64182014A	03 July 2015
				CA 2851501	A1 16 May 2013
				MX 2014005435	A 22 August 2014
				MX 336460	B 20 January 2016
				PL 2776261	T3 06 December 2021
				BR 112014009290	A8 20 June 2017
				BR 112014009290	A2 23 June 2020
				BR 112014009290	B1 08 December 2020
				HUE 056346	T2 28 February 2022
				KR 20140095478	A 01 August 2014
				KR 102003578	B1 24 July 2019
				ES 2886524	T3 20 December 2021
				JP 2015502880	A 29 January 2015
				JP 5993020	B2 14 September 2016
				EP 2776261	A1 17 September 2014
				EP 2776261	B1 25 August 2021
				AR 088666	A1 25 June 2014
				WO 2013068678	A1 16 May 2013
				EA 201490939	A1 29 August 2014
				EA 024975	B1 30 November 2016
				FR 2982196	A1 10 May 2013
				FR 2982196	B1 17 July 2015
				US 2014240997	A1 28 August 2014
				US 9109773	B2 18 August 2015