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(54) **VEHICLE LENS APPARATUS**

(57) A vehicle lens apparatus includes a top lens (5) connected to a main lens (4). The main lens projects onto a horizontal surface a first light pattern (71) with a width in a rear-to-front direction to include a first main light region (711), and two first lateral light regions (712) respectively formed at left and right sides of the first main light region (711). The top lens (5) projects a second light pat-

tern (72) convexed in a rear-to-front direction, and includes a second main light region (721) superimposed on the first main light region (711), and two second lateral light regions (722) respectively and rearwardly extending from left and right sides of the second main light region (721) to protrude rearwardly from the first lateral light regions (712).

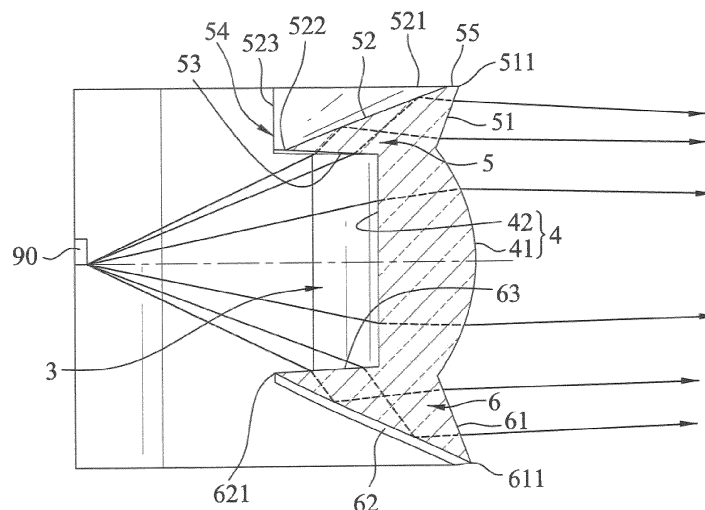


FIG.5

Description

[0001] The disclosure relates to a lens apparatus, and more particularly to a vehicle lens apparatus.

[0002] Figures 1 and 2 illustrate an existing vehicle lens apparatus 11 that includes a plurality of lens 12 integrally connected to and juxtaposed with each other in a right-left direction. Each lens 12 is convexed in a rear-to-front direction and has a light entry face 121 and a light exit face 122. The lenses 12 cooperate with each other to project light and generate a light distribution pattern on a road 13 as shown in Figure 2. The light from the lenses 12 can illuminate a main region 131 of the road 13 in front of the lenses 12 and left and right regions 14 at two sides of the main region 131. However, the lenses 12 are unable to project light to left and right rear areas 15 behind the left and right regions 14. Therefore, dark areas 15 are easily formed behind the left and right regions 14 and are likely to cause danger.

[0003] Therefore, an object of the disclosure is to provide a vehicle lens apparatus that can alleviate at least one of the drawbacks of the prior art.

[0004] According to the disclosure, a vehicle lens apparatus, suitable for projecting light rays of a light source on a horizontal surface, includes at least one lens unit that has a main lens and a top lens connected to a top end of the main lens.

[0005] The main lens includes a main light exit face and a main light entry face formed rearwardly of the main light exit face. The main lens is configured to project in a rear-to-front direction from the light source onto the horizontal surface a first light pattern having a length extending in a left-right direction and a width extending in the rear-to-front direction. The first light pattern includes a first main light region, and two first lateral light regions respectively formed at left and right sides of the first main light region.

[0006] The top lens is configured to project onto the horizontal surface a second light pattern that is convexed in the rear-to-front direction. The second light pattern includes a second main light region superimposed on the first main light region, and two second lateral light regions extending respectively and rearwardly from left and right sides of the second main light region. The second lateral light regions protrude rearwardly and respectively from the first lateral light regions.

[0007] Other features and advantages of the disclosure will become apparent in the following detailed description of the embodiment with reference to the accompanying drawings, of which:

Figure 1 is a perspective view of an existing vehicle lens apparatus;

Figure 2 illustrates a stimulated light pattern of the existing vehicle lens;

Figure 3 is a top perspective view illustrating a vehicle lens apparatus according to an embodiment of the disclosure;

Figure 4 is a bottom perspective view of the embodiment;

Figure 5 is a sectioned side view of the embodiment;

Figure 6 is a top view of the embodiment;

Figure 7 is a rear view of the embodiment;

Figure 8 is a bottom view of the embodiment;

Figure 9 is a simulated light distribution graph formed on a vertical surface by a main lens of the vehicle lens apparatus of the embodiment;

Figure 10 is a simulated light distribution graph formed on a horizontal surface by the main lens;

Figure 11 is a simulated light distribution graph formed on a vertical surface by a top lens of the vehicle lens apparatus of the embodiment;

Figure 12 is a simulated light distribution graph formed on a horizontal surface by the top lens;

Figure 13 is a simulated light distribution graph formed on a vertical surface by a bottom lens of the vehicle lens of the embodiment;

Figure 14 is a simulated light distribution graph formed on a horizontal surface by the bottom lens;

Figure 15 is a simulated light distribution graph formed on a vertical surface by the vehicle lens apparatus of the embodiment; and

Figure 16 is a simulated light distribution graph formed on a horizontal surface by the vehicle lens apparatus of the embodiment.

[0008] Figures 3 to 5 illustrate a vehicle lens apparatus according to an embodiment of the disclosure. The vehicle lens apparatus of the disclosure is suitable for projecting light rays of a light source 90 on a horizontal surface 91 (see Figure 10), and includes a plurality of lens units 3 juxtaposed with each other in a left-right direction and integrally connected to each other.

[0009] In this embodiment, each lens unit 3 is made of a transparent acrylic material. Each lens unit 3 includes a main lens 4, a top lens 5 integrally connected to a top end of the main lens 4, and a bottom lens 6 integrally connected to a bottom end of the main lens 4.

[0010] The main lens 4 includes a main light exit face 41 and a main light entry face 42 formed rearwardly of and spaced apart from the main light exit face 41. The main light exit face 41 in either horizontal or vertical cross section is convexed in a rear-to-front direction. The main light entry face 42 in horizontal cross section is convexed in the rear-to-front direction, and in vertical cross section is straight in a top-bottom direction.

[0011] Referring to Figures 6 and 7 in combination with Figures 3 to 5, the top lens 5 has a top lens front face 51, a top lens rear face 52, a top lens bottom face 53, two end faces 54, and a connection face 55.

[0012] The top lens front face 51 is connected to an upper end of the main light exit face 41 for exiting light. The top lens front face 51 includes a top lens upper edge 511 distal from the main light exit face 41. A cross section of the top lens front face 51, which is formed along a horizontal cutting plane, has the shape of a parabolic

curve that is convexed forwardly. Therefore, the top lens upper edge 511 is also the form of a parabolic curve convexed forwardly.

[0013] The top lens rear face 52 is a total internal reflection surface formed rearwardly of the top lens front face 51 for reflecting light to the top lens front face 51. The top lens rear face 52 includes an upper curve edge 521, a lower curve edge 522, and two rear edges 523. The upper curve edge 521 has two spaced apart rear ends 521a and is convexed forwardly from the rear ends 521a. The lower curve edge 522 has two spaced apart rear ends 522a lower than the rear ends 521a of the upper curve edge 521 and convexed forwardly from the two spaced apart rear ends 521a of the lower curve edge 521. A front side 522b of the lower curve edge 522 is situated behind and below a front side 521b of the upper curve edge 521. The top lens rear face 52 extends divergently and upwardly from the lower curve edge 522 to the upper curve edge 521. The rear edges 523 extend upwardly, divergently and respectively from the two spaced apart rear ends 522a of the lower curve edge 522 and are connected respectively to the rear ends 521a of the upper curve edge 521. As shown in Figure 3, the top lens rear face 52 resembles a halved section of truncated conical surface that is concaved downwardly toward the top lens bottom face 53 (details thereof are described hereinafter).

[0014] As shown in Figures 4 and 5, the top lens bottom face 53 is a semicircular refraction surface for entry of light and has a bottom face rear edge 531. The top lens bottom face 53 is connected to an upper end of the main light entry face 42 and extends rearwardly below the top lens rear face 52 from the upper end of the main light entry face 42 to the bottom face rear edge 531. The bottom face rear edge 531 has a notch 532. The lower curve edge 522 of the top lens rear face 52 is formed at the notch 532 as a boundary of the notch 532. The two spaced apart rear ends 522a of the lower curve edge 522 meet the bottom face rear edge 531. As shown in Figure 5, the light rays of a light source 90 are refracted by the top lens bottom face 53 to the top lens rear face 52, reflected by the top lens rear face 52 to the top lens front face 51, and then projected outwardly through the top lens front face 51.

[0015] The two end faces 54 are spaced apart from each other in the left-right direction. Each end face 54 is an upright surface connected between one of the rear edges 523 of the top lens rear face 52 and the bottom face rear edge 531 of the top lens bottom face 53. The upper curve edge 521 is semicircular, and the rear ends 521a of the upper curve edge 521 are respectively connected to upper ends of the rear edges 523 or the end faces 54. The lower curve edge 522 is semicircular, and lower ends of the end faces 54 are respectively connected to the rear ends 522a of the lower curve edge 522.

[0016] As shown in Figure 3, the connection face 55 are connected between the top lens upper edge 511 of the top lens front face 51 and the front side 521b of the

top lens rear face 52.

[0017] Referring to Figures 4, 7 and 8, the bottom lens 6 is connected to a bottom end of the main lens 4, and includes a bottom lens front face 61, a bottom lens rear face 62, and a bottom lens top face 63.

[0018] The bottom lens front face 61 is connected to a lower end of the main light exit face 41 for exiting light. The bottom lens front face 61 has a cross section formed along a horizontal cutting plane and resembles a parabolic curve that is convexed forwardly. Further, the bottom lens front face 61 includes a bottom lens front edge 611 distal from the lower end of the main light exit face 41 of the main lens 4. The bottom lens front edge 611 is the form of a parabolic curve convexed forwardly.

[0019] The bottom lens rear face 62 is a total internal reflection surface formed rearwardly of the bottom lens front face 61 for reflecting light to the bottom lens front face 61. The bottom lens rear face 62 has a cross section that is formed along a horizontal cutting plane and that resembles a concave curve concaved upwardly. The bottom lens rear face 62 has a bottom lens rear edge 621. The bottom lens rear face 62 extends rearwardly and upwardly from the bottom lens front edge 611 to the bottom lens rear edge 621. The bottom lens rear edge 621 is the form of a parabolically concave curve concaved upwardly.

[0020] The bottom lens top face 63 is a refraction surface for entry of light and is connected to a lower end of the main light entry face 41 and extends rearwardly above the bottom lens rear face 62. The bottom lens rear face 62 is concaved upwardly toward the bottom lens top face 63. The bottom lens rear edge 621 of the bottom lens rear face 62 is connected to a rear end of the bottom lens top face 63. The light from the light source 90 is refracted by the bottom lens top face 63 to the bottom lens rear face 62, reflected by the bottom lens rear face 62 to the bottom lens front face 61, and projected through the bottom lens front face 61.

[0021] Figures 9, 11, 13, and 15 illustrate simulated light patterns projected by the vehicle lens apparatus of the disclosure on a vertical plane placed 10 meters therefrom. Figures 10, 12, 14, and 16 illustrate stimulated light patterns projected on the horizontal surface 91 in front of the vehicle lens apparatus and on a road 92.

[0022] Referring to Figures 5, 9 and 10, the main lens 4 projects in the rear-to-front direction from the light source 90 onto the horizontal surface 91 a first light pattern 71 with a length extending in the left-right direction and a width extending in the rear-to-front direction. As shown in Figure 10, the first light pattern 71 in a rectangular form includes a first main light region 711 centrally covering the road 92, and two first lateral light regions 712 respectively formed at left and right sides of said first main light region 711.

[0023] Figures 11 and 12 illustrate light patterns generated by the top lens 5. A phantom area defined by phantom lines in Figure 12 schematically represents a region covered by the first light pattern 71.

[0024] As shown in Figure 12, the top lens 5 projects onto the horizontal surface 91 a second light pattern 72 that is convexed in the rear-to-front direction. The second light pattern 72 includes a second main light region 721 superimposed on the first main light region 711, and two second lateral light regions 722 extending respectively and rearwardly from left and right sides of the second main light region 721. A width of the second main light region 721 in the rear-to-front direction is smaller than that of the first main light region 711, and does not protrude from the first main light region 711. The second lateral light regions 722 protrude rearwardly and respectively from the first lateral light regions 712, and also protrude respectively and sidewardly from left and right sides of the road 92.

[0025] Figures 13 and 14 illustrate light patterns generated by the bottom lens 6. A phantom area defined by phantom lines in Figure 14 schematically represents a region covered by the first light pattern 71 and the second light pattern 72.

[0026] As shown in Figure 14, the bottom lens 6 projects from the light source 90 (see Figure 5) a third light pattern 73 with a length extending in the left-right direction and a width extending in the rear-to-front direction. The third light pattern 73 includes a third light region 731 protruding rearwardly from the first light pattern 71. The third light region 731 is situated between the second lateral light regions 722.

[0027] Figures 15 and 16 illustrate light patterns generated by the lens units 3. As shown in Figure 16, an overall light pattern 8 produced by the lens units 3 is composed of the first, second and third light patterns 71, 72, 73 of each lens unit 3. The second light pattern 72 produced by the top lens 5 of each lens unit 3 can eliminate the dark area or dead spot appearing in the light pattern of the prior art, so that the vehicle lens apparatus of the disclosure can enhance driving safety. By virtue of the third light pattern 73, the vehicle lens apparatus can provide more comprehensive light distribution.

Claims

1. A vehicle lens apparatus suitable for projecting light rays of a light source (90) on a horizontal surface (91), **characterized by:**

at least one lens unit (3) including a main lens (4), and a top lens (5) connected to a top end of said main lens (4);
said main lens (4) including a main light exit face (41) and a main light entry face (42) formed rearwardly of said main light exit face, said main lens (4) being configured to project in a rear-to-front direction from the light source (90) onto the horizontal surface (91) a first light pattern (71) with a length extending in a left-right direction and a width extending in the rear-to-front direction,

said first light pattern (71) including a first main light region (711), and two first lateral light regions (712) respectively formed at left and right sides of said first main light region (711); and
said top lens (5) being configured to project onto the horizontal surface a second light pattern (72) that is convexed in the rear-to-front direction, said second light pattern (72) including a second main light region (721) superimposed on said first main light region (711), and two second lateral light regions (722) extending respectively and rearwardly from left and right sides of said second main light region (721), said second lateral light regions (722) protruding rearwardly and respectively from said first lateral light regions (712).

2. The vehicle lens apparatus as claimed in Claim 1, **characterized in that** said top lens (5) includes a top lens front face (51) connected to an upper end of said main light exit face (41) and configured for exiting light, and a top lens rear face (52) disposed rearwardly of said top lens front face (51) for reflecting light toward said top lens front face (51), a cross section of said top lens front face (51), which is formed along a horizontal cutting plane, having the shape of a convex curve that is convexed forwardly.
3. The vehicle lens apparatus as claimed in Claim 1, **characterized in that** said top lens (5) includes a top lens front face (51) connected to an upper end of said main light exit face (41) and a top lens rear face (52) disposed rearwardly of said top lens front face (51), said top lens front face (51) including a top lens upper edge (511) distal from said main light exit face (41), said top lens upper edge (511) being the form of a convex curve convexed forwardly.
4. The vehicle lens apparatus as claimed in Claims 2 or 3, **characterized in that** said top lens (5) further includes a top lens bottom face (53) configured for entry of light and having a bottom face rear edge (531), said top lens bottom face (53) being connected to an upper end of said main light entry face (42) and extending rearwardly below said top lens rear face (52) from said upper end of said main light entry face (42) to said bottom face rear edge (531), said top lens rear face (52) having a concave surface that is concaved downwardly toward said top lens bottom face (53).
5. The vehicle lens apparatus as claimed in Claim 4, **characterized in that** said top lens rear face (52) resembles a section of a truncated conical surface that is concaved downwardly toward said top lens bottom face (53).
6. The vehicle lens apparatus as claimed in Claim 4,

characterized in that said top lens rear face (52) includes

an upper curve edge (521) having two spaced apart rear ends (521a) and being convexed forwardly from said rear ends (521a),
 a lower curve edge (522) having two spaced apart rear ends (522a) lower than said rear ends (521a) of said upper curve edge (521) and convexed forwardly from said two spaced apart rear ends (522a) of said lower curve edge (522), a front side (522b) of said lower curve edge (522) being situated behind and below a front side (521b) of said upper curve edge (521), and
 two rear edges (523) extending upwardly, divergingly and respectively from said two spaced apart rear ends (522a) of said lower curve edge (522) and connected respectively to said rear ends (521a) of said upper curve edge (521); and

characterized in that said top lens rear face (52) extends divergingly from said lower curve edge (522) to said upper curve edge (521).

7. The vehicle lens apparatus as claimed in Claim 6, **characterized in that** said bottom face rear edge (531) has a notch (532), said lower curve edge (522) being formed at said notch (532) as a boundary of said notch (532), said two spaced apart rear ends (522a) of said lower curve edge (522) meeting said bottom face rear edge (531).
8. The vehicle lens apparatus as claimed in Claims 6 or 7, **characterized in that** said top lens (5) further includes two end faces (54) each of which is connected between one of said rear edges (523) and said bottom face rear edge (531).
9. The vehicle lens apparatus as claimed in any one of Claim 1 to 8, **characterized in that** said at least one lens unit (3) further includes a bottom lens (6) connected to a bottom end of said main lens (4), said bottom lens (6) being configured to project from the light source (90) a third light pattern (73) with a length extending in the left-right direction and a width extending in the rear-to-front direction, said third light pattern (73) including a third light region (731) protruding rearwardly from said first light pattern (71).
10. The vehicle lens apparatus as claimed in Claim 9, **characterized in that** said bottom lens (6) includes a bottom lens front face (61) connected to a lower end of said main light exit face (41) for exiting light, and a bottom lens rear face (62) formed rearwardly of said bottom lens front face (61) for reflecting light

to said bottom lens front face (61), said bottom lens front face (61) having a cross section formed along a horizontal cutting plane and resembling a convex curve that is convexed forwardly.

11. The vehicle lens apparatus as claimed in Claim 10, **characterized in that** said bottom lens rear face (62) has a cross section that is formed along a horizontal cutting plane and that resembles a concave curve concaved upwardly.

12. The vehicle lens apparatus as claimed in any one of Claims 1 to 11, **characterized in that**:

said at least one lens unit (3) further includes a bottom lens (6) connected to a bottom end of said main lens (4);
 said bottom lens (6) includes a bottom lens front face (61) connected to a lower end of said main light exit face (41) for exiting light, and a bottom lens rear face (62) formed rearwardly of said bottom lens front face (61) for reflecting light toward said bottom lens front face (61);
 said bottom lens front face (61) includes a bottom lens front edge (611) distal from said lower end of said main light exit face (41) of said main lens (4), said bottom lens front edge (611) being the form of a convex curve convexed forwardly; and
 said bottom lens rear face (62) has a bottom lens rear edge (621), said bottom lens rear face (62) extending rearwardly and upwardly from said bottom lens front edge (611) to said bottom lens rear edge (621), said bottom lens rear edge (621) being the form of a concave curve concaved upwardly.

13. The vehicle lens apparatus as claimed in any one of Claims 1 to 12, **characterized in that** said at least one lens unit (3) includes a plurality of lens units (3) juxtaposed to each other in the left-right direction and integrally connected to each other, each of said lens units (3) further including a bottom lens (6), said main lens (4) integrally interconnecting said top lens (5) and said bottom lens (6).

Amended claims in accordance with Rule 137(2) EPC.

1. A vehicle lens apparatus suitable for projecting light rays of a light source (90) on a horizontal surface (91), comprising:

at least one lens unit (3) including a main lens (4), and a top lens (5) connected to a top end of said main lens (4);
 said main lens (4) including a main light exit face

(41) and a main light entry face (42) formed rearwardly of said main light exit face (41), said main lens (4) being configured to project in a rear-to-front direction from the light source (90) onto the horizontal surface (91) a first light pattern (71) with a length extending in a left-right direction and a width extending in the rear-to-front direction, said first light pattern (71) including a first main light region (711), and two first lateral light regions (712) respectively formed at left and right sides of said first main light region (711); and

said top lens (5) being configured to project onto the horizontal surface (91) a second light pattern (72) that is convexed in the rear-to-front direction, said second light pattern (72) including a second main light region (721) superimposed on said first main light region (711), and two second lateral light regions (722) extending respectively and rearwardly from left and right sides of said second main light region (721), said second lateral light regions (722) protruding rearwardly and respectively from said first lateral light regions (712),

characterized in that

said top lens (5) includes a top lens front face (51) connected to an upper end of said main light exit face (41) and configured for exiting light, and a top lens rear face (52) disposed rearwardly of said top lens front face (51) for reflecting light toward said top lens front face (51), a cross section of said top lens front face (51), which is formed along a horizontal cutting plane, having the shape of a convex curve that is convexed forwardly;

said top lens front face (51) includes a top lens upper edge (511) distal from said main light exit face (41), said top lens upper edge (511) being the form of a convex curve convexed forwardly; said top lens (5) further includes a top lens bottom face (53) configured for entry of light;

said at least one lens unit (3) further includes a bottom lens (6) connected to a bottom end of said main lens (4), said bottom lens (6) being configured to project from the light source (90) a third light pattern (73) with a length extending in the left-right direction and a width extending in the rear-to-front direction, said third light pattern (73) including a third light region (731) protruding rearwardly from said first light pattern (71);

said bottom lens (6) includes a bottom lens front face (61) connected to a lower end of said main light exit face (41) for exiting light, and a bottom lens rear face (62) formed rearwardly of said bottom lens front face (61) for reflecting light to said bottom lens front face (61), said bottom lens front face (61) having a cross section formed

along a horizontal cutting plane and resembling a convex curve that is convexed forwardly; said bottom lens front face (61) includes a bottom lens front edge (611) distal from said lower end of said main light exit face (41) of said main lens (4), said bottom lens front edge (611) being the form of a convex curve convexed forwardly; said bottom lens rear face (62) has a bottom lens rear edge (621), said bottom lens rear face (62) extending rearwardly and upwardly from said bottom lens front edge (611) to said bottom lens rear edge (621), said bottom lens rear edge (621) being the form of a concave curve concaved upwardly; and

said bottom lens (6) further includes a bottom lens top face (63) connected to a lower end of said main light entry face (41) and extending rearwardly above the bottom lens rear face 62 for entry of light.

2. The vehicle lens apparatus as claimed in Claim 1, **characterized in that** said top lens bottom face (53) has a bottom face rear edge (531), said top lens bottom face (53) being connected to an upper end of said main light entry face (42) and extending rearwardly below said top lens rear face (52) from said upper end of said main light entry face (42) to said bottom face rear edge (531), said top lens rear face (52) having a concave surface that is concaved downwardly toward said top lens bottom face (53).

3. The vehicle lens apparatus as claimed in Claim 2, **characterized in that** said top lens rear face (52) resembles a section of a truncated conical surface that is concaved downwardly toward said top lens bottom face (53).

4. The vehicle lens apparatus as claimed in Claim 2, **characterized in that** said top lens rear face (52) includes

an upper curve edge (521) having two spaced apart rear ends (521a) and being convexed forwardly from said rear ends (521a),

a lower curve edge (522) having two spaced apart rear ends (522a) lower than said rear ends (521a) of said upper curve edge (521) and convexed forwardly from said two spaced apart rear ends (522a) of said lower curve edge (522), a front side (522b) of said lower curve edge (522) being situated behind and below a front side (521b) of said upper curve edge (521), and two rear edges (523) extending upwardly, divergently and respectively from said two spaced apart rear ends (522a) of said lower curve edge (522) and connected respectively to said rear ends (521a) of said upper curve edge (521); and

characterized in that said top lens rear face

(52) extends divergingly from said lower curve edge (522) to said upper curve edge (521).

5. The vehicle lens apparatus as claimed in Claim 4, **characterized in that** said bottom face rear edge (531) has a notch (532), said lower curve edge (522) being formed at said notch (532) as a boundary of said notch (532), said two spaced apart rear ends (522a) of said lower curve edge (522) meeting said bottom face rear edge (531).

6. The vehicle lens apparatus as claimed in Claims 4 or 5, **characterized in that** said top lens (5) further includes two end faces (54) each of which is connected between one of said rear edges (523) and said bottom face rear edge (531).

7. The vehicle lens apparatus as claimed in Claims 1 to 6, **characterized in that** said bottom lens rear face (62) has a cross section that is formed along a horizontal cutting plane and that resembles a concave curve concaved upwardly.

8. The vehicle lens apparatus as claimed in any one of Claims 1 to 7, **characterized in that** said at least one lens unit (3) includes a plurality of lens units (3) juxtaposed to each other in the left-right direction and integrally connected to each other, each of said lens units (3) further including a bottom lens (6), said main lens (4) integrally interconnecting said top lens (5) and said bottom lens (6).

1. A vehicle lens apparatus, comprising:

a light source (90);
at least one lens unit (3) including a main lens (4), and a top lens (5) connected to a top end of said main lens (4);
said main lens (4) including a main light exit face (41) and a main light entry face (42) formed rearwardly of said main light exit face (41), said main lens (4) projecting in a rear-to-front direction from light rays of said light source (90) onto a horizontal surface (91) a first light pattern (71) with a length extending in a left-right direction and a width extending in the rear-to-front direction, said first light pattern (71) including a first main light region (711), and two first lateral light regions (712) respectively formed at left and right sides of said first main light region (711); and
said top lens (5) projecting onto the horizontal surface (91) a second light pattern (72) that is convexed in the rear-to-front direction, said second light pattern (72) including a second main light region (721) superimposed on said first main light region (711), and two second lateral light regions (722) extending respectively and

rearwardly from left and right sides of said second main light region (721), said second lateral light regions (722) protruding rearwardly and respectively from said first lateral light regions (712),

characterized in that

said top lens (5) includes a top lens front face (51) connected to an upper end of said main light exit face (41) and configured for exiting light, and a top lens rear face (52) disposed rearwardly of said top lens front face (51) for reflecting light toward said top lens front face (51), a cross section of said top lens front face (51), which is formed along a horizontal cutting plane, having the shape of a convex curve that is convexed forwardly;

said top lens front face (51) includes a top lens upper edge (511) distal from said main light exit face (41), said top lens upper edge (511) being the form of a convex curve convexed forwardly; said top lens (5) further includes a top lens bottom face (53) configured for entry of light;

said at least one lens unit (3) further includes a bottom lens (6) connected to a bottom end of said main lens (4), said bottom lens (6) projecting from said light source (90) a third light pattern (73) with a length extending in the left-right direction and a width extending in the rear-to-front direction, said third light pattern (73) including a third light region (731) protruding rearwardly from said first light pattern (71);

said bottom lens (6) includes a bottom lens front face (61) connected to a lower end of said main light exit face (41) for exiting light, and a bottom lens rear face (62) formed rearwardly of said bottom lens front face (61) for reflecting light to said bottom lens front face (61), said bottom lens front face (61) having a cross section formed along a horizontal cutting plane and resembling a convex curve that is convexed forwardly;

said bottom lens front face (61) includes a bottom lens front edge (611) distal from said lower end of said main light exit face (41) of said main lens (4), said bottom lens front edge (611) being the form of a convex curve convexed forwardly; said bottom lens rear face (62) has a bottom lens rear edge (621), said bottom lens rear face (62) extending rearwardly and upwardly from said bottom lens front edge (611) to said bottom lens rear edge (621), said bottom lens rear edge (621) being the form of a concave curve concaved upwardly; and

said bottom lens (6) further includes a bottom lens top face (63) connected to a lower end of said main light entry face (41) and extending rearwardly above the bottom lens rear face 62 for entry of light.

2. The vehicle lens apparatus as claimed in Claim 1, **characterized in that** said top lens bottom face (53) has a bottom face rear edge (531), said top lens bottom face (53) being connected to an upper end of said main light entry face (42) and extending rearwardly below said top lens rear face (52) from said upper end of said main light entry face (42) to said bottom face rear edge (531), said top lens rear face (52) having a concave surface that is concaved downwardly toward said top lens bottom face (53).

3. The vehicle lens apparatus as claimed in Claim 2, **characterized in that** said top lens rear face (52) resembles a section of a truncated conical surface that is concaved downwardly toward said top lens bottom face (53).

4. The vehicle lens apparatus as claimed in Claim 2, **characterized in that** said top lens rear face (52) includes

an upper curve edge (521) having two spaced apart rear ends (521a) and being convexed forwardly from said rear ends (521a),
a lower curve edge (522) having two spaced apart rear ends (522a) lower than said rear ends (521a) of said upper curve edge (521) and convexed forwardly from said two spaced apart rear ends (522a) of said lower curve edge (522), a front side (522b) of said lower curve edge (522) being situated behind and below a front side (521b) of said upper curve edge (521), and two rear edges (523) extending upwardly, divergingly and respectively from said two spaced apart rear ends (522a) of said lower curve edge (522) and connected respectively to said rear ends (521a) of said upper curve edge (521); and **characterized in that** said top lens rear face (52) extends divergingly from said lower curve edge (522) to said upper curve edge (521).

5. The vehicle lens apparatus as claimed in Claim 4, **characterized in that** said bottom face rear edge (531) has a notch (532), said lower curve edge (522) being formed at said notch (532) as a boundary of said notch (532), said two spaced apart rear ends (522a) of said lower curve edge (522) meeting said bottom face rear edge (531).

6. The vehicle lens apparatus as claimed in Claims 4 or 5, **characterized in that** said top lens (5) further includes two end faces (54) each of which is connected between one of said rear edges (523) and said bottom face rear edge (531).

7. The vehicle lens apparatus as claimed in Claims 1 to 6, **characterized in that** said bottom lens rear face (62) has a cross section that is formed along a

horizontal cutting plane and that resembles a concave curve concaved upwardly.

8. The vehicle lens apparatus as claimed in any one of Claims 1 to 7, **characterized in that** said at least one lens unit (3) includes a plurality of lens units (3) juxtaposed to each other in the left-right direction and integrally connected to each other, each of said lens units (3) further including a bottom lens (6), said main lens (4) integrally interconnecting said top lens (5) and said bottom lens (6).

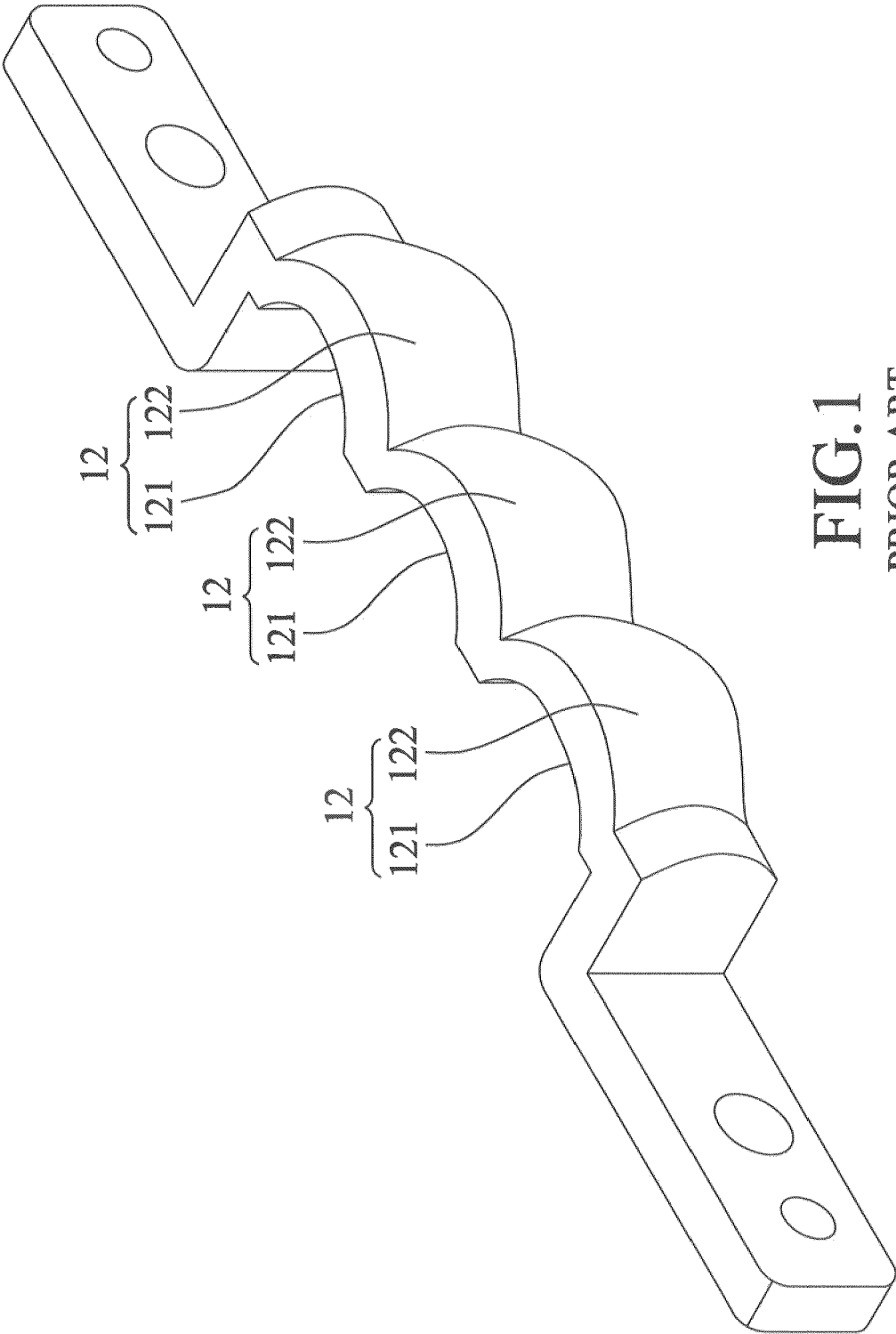


FIG. 1
PRIOR ART

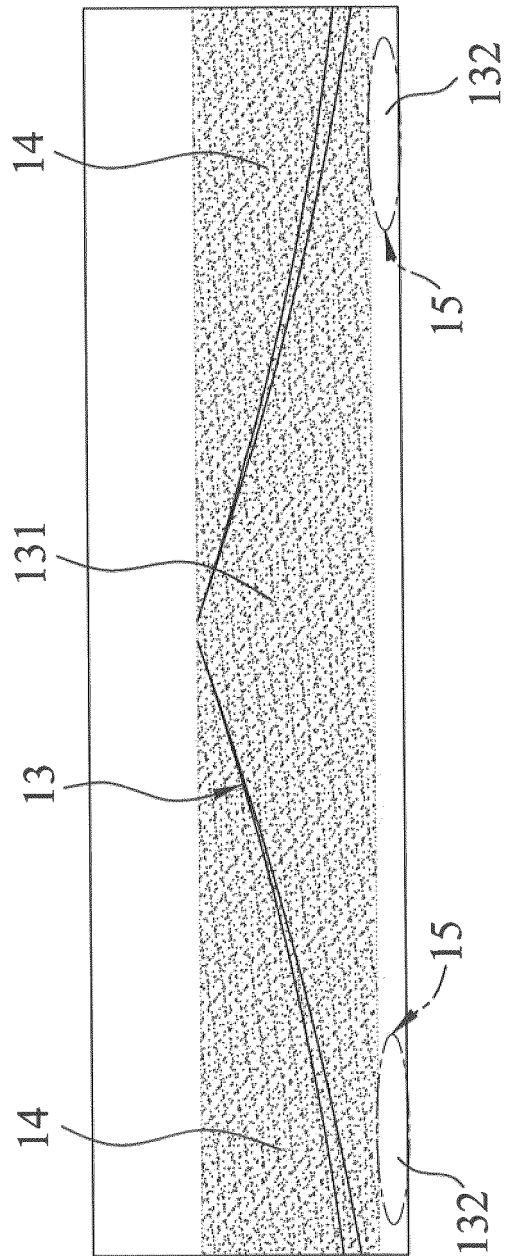


FIG.2
PRIOR ART

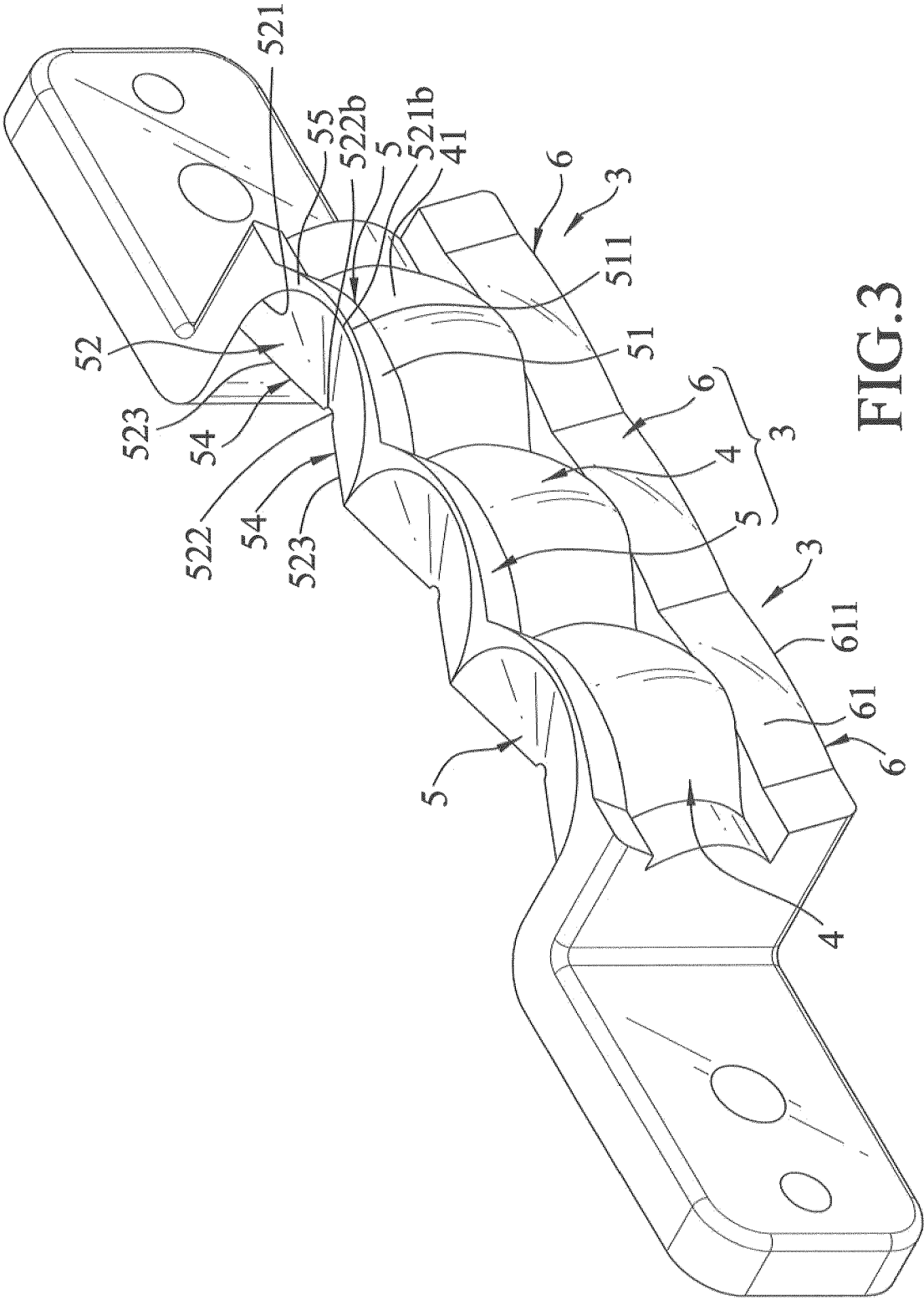


FIG.3

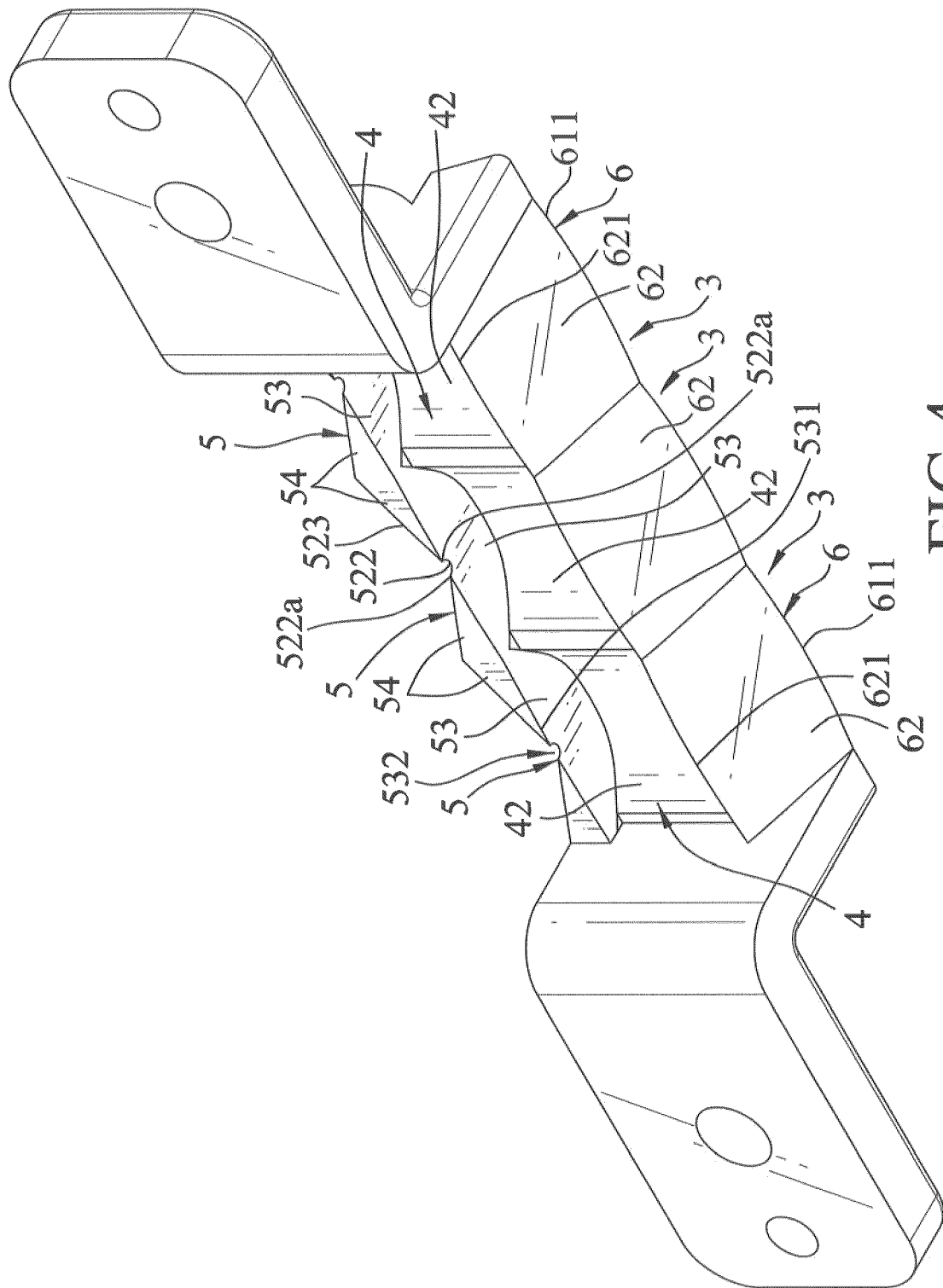


FIG. 4

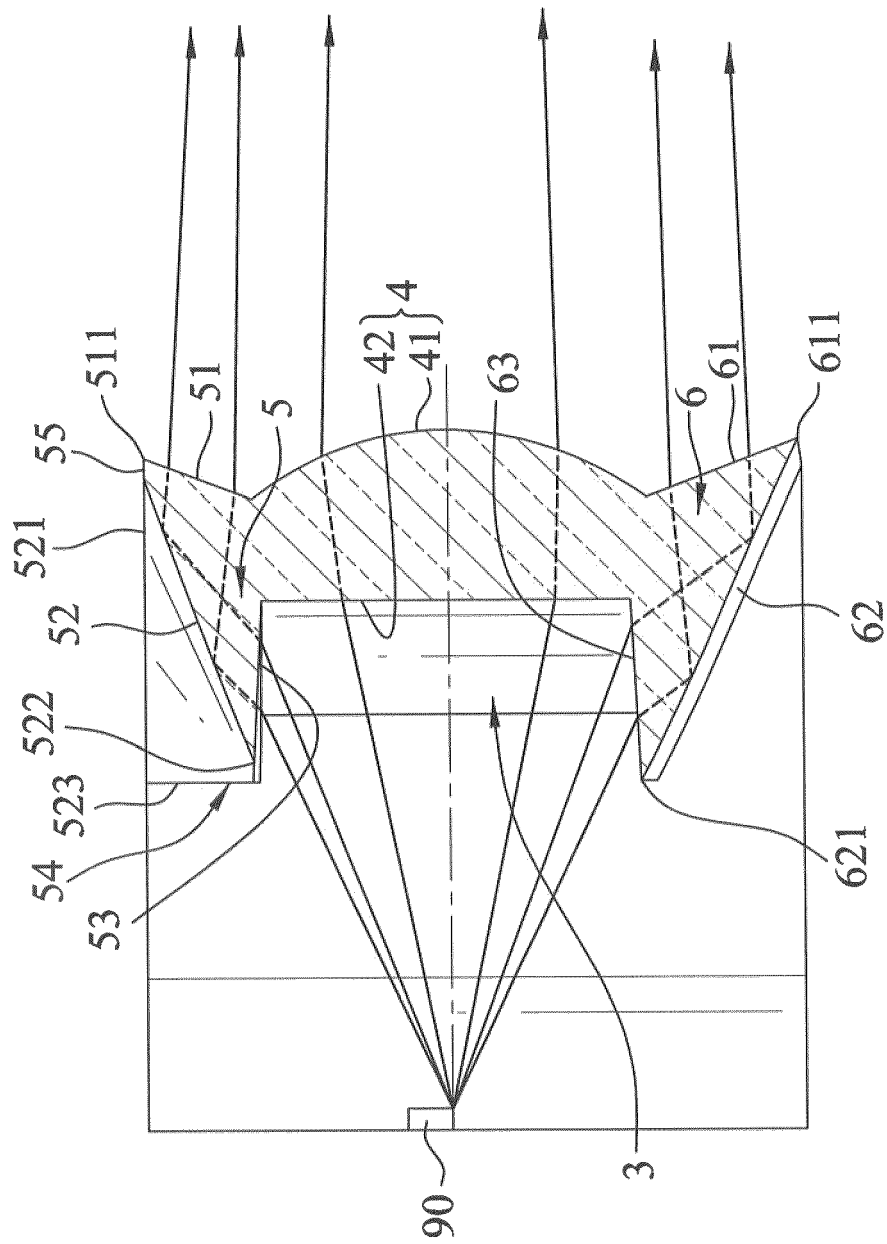


FIG. 5

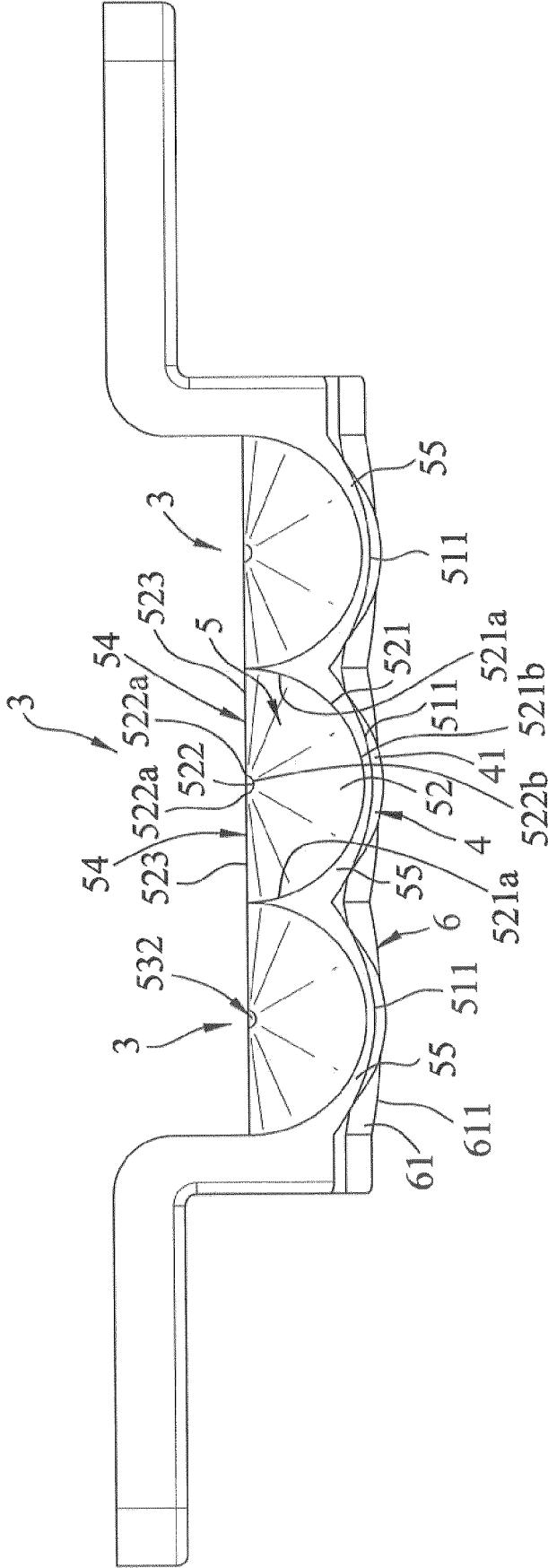


FIG. 6

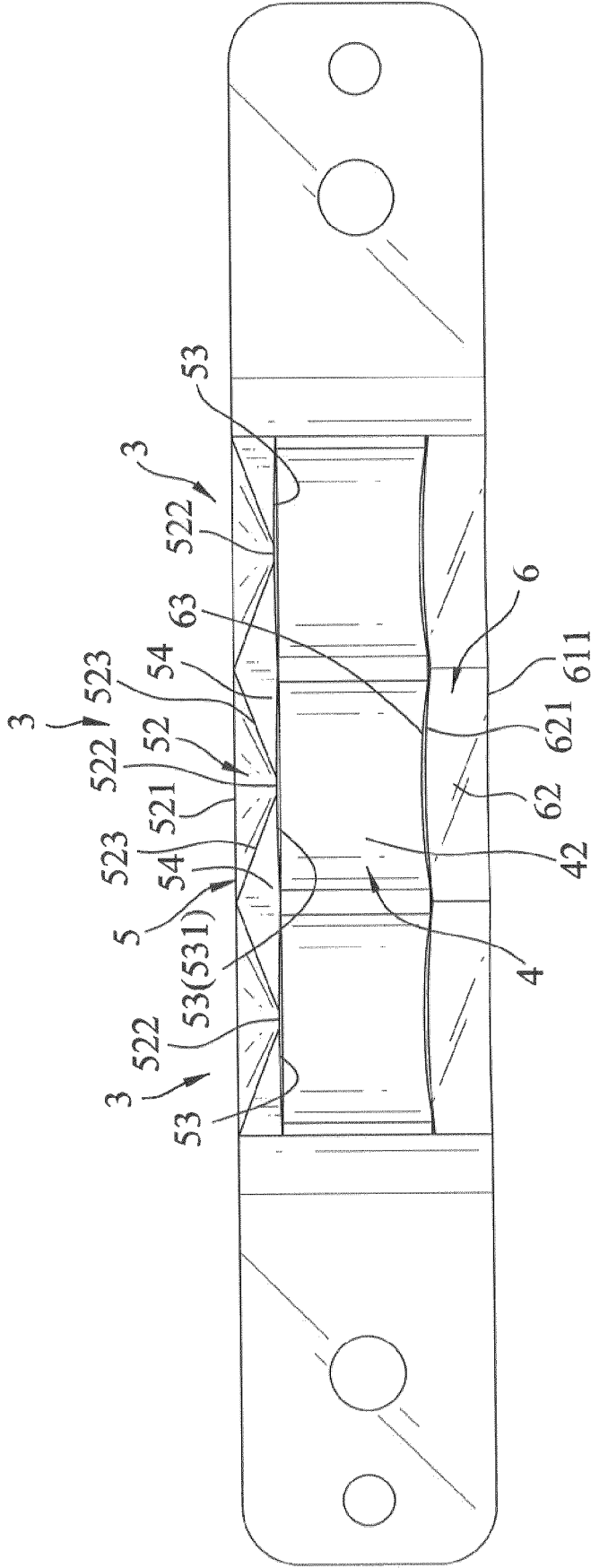


FIG. 7

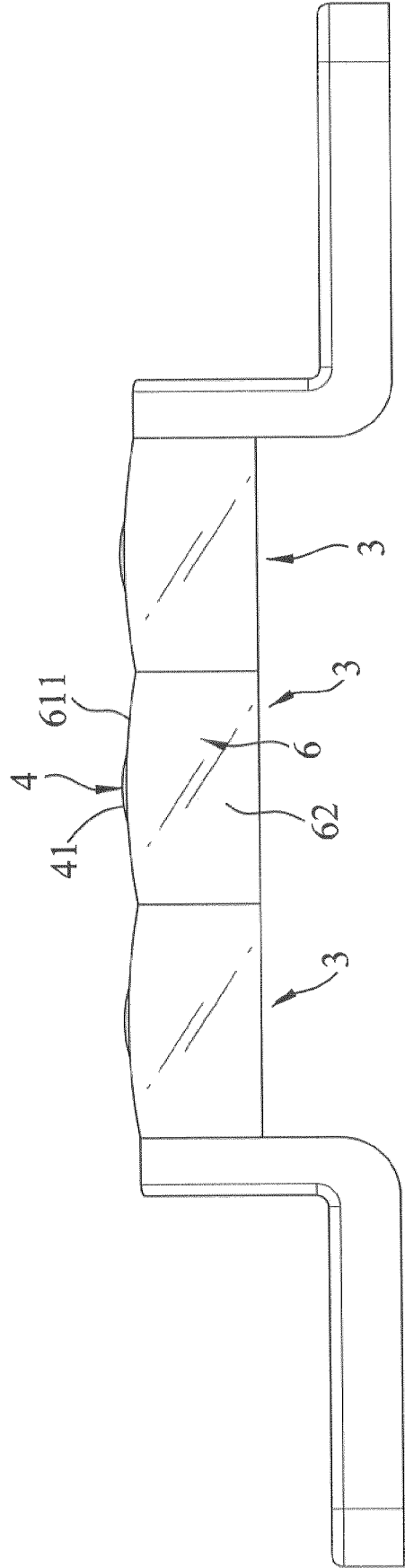


FIG.8

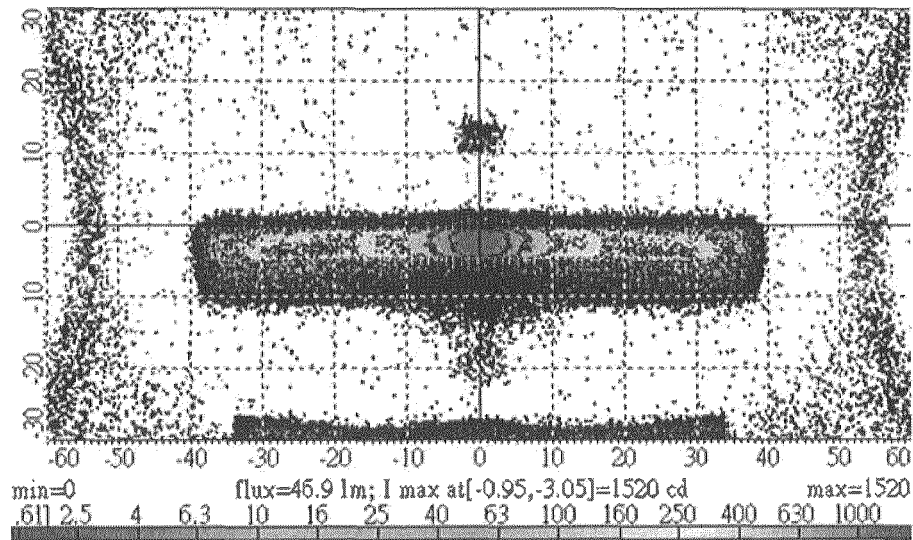


FIG. 9

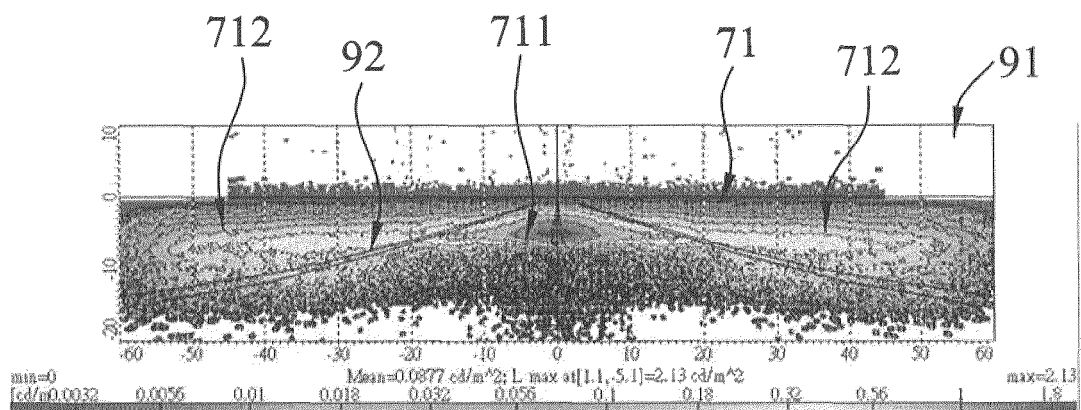


FIG. 10

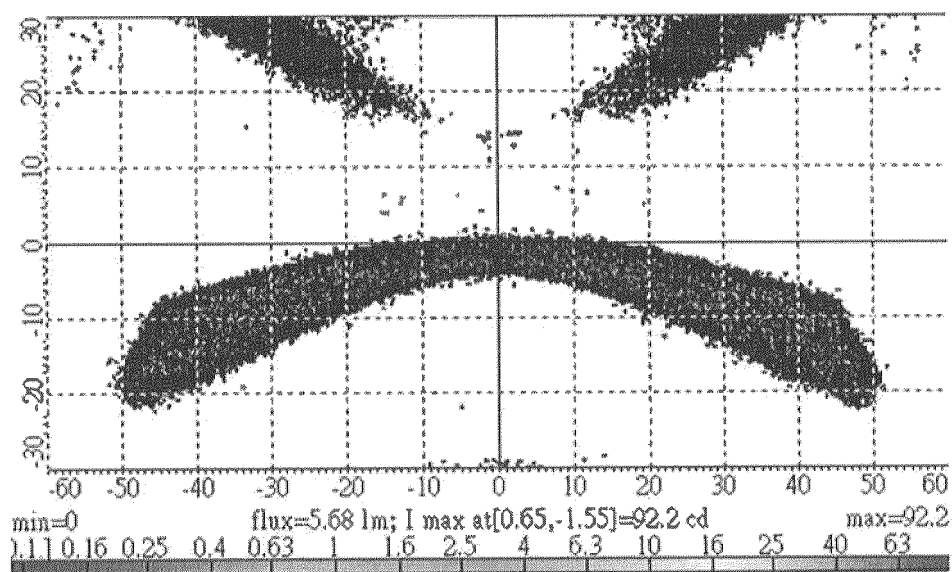


FIG.11

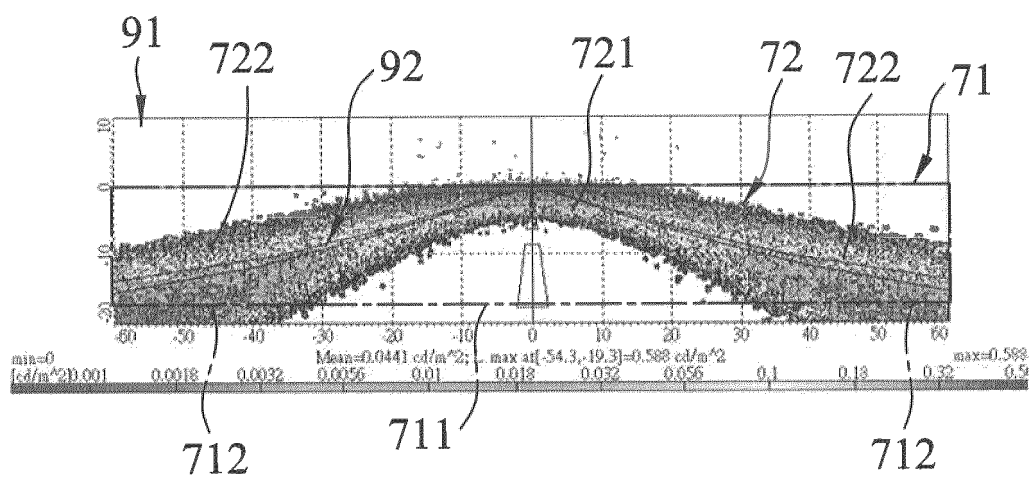


FIG.12

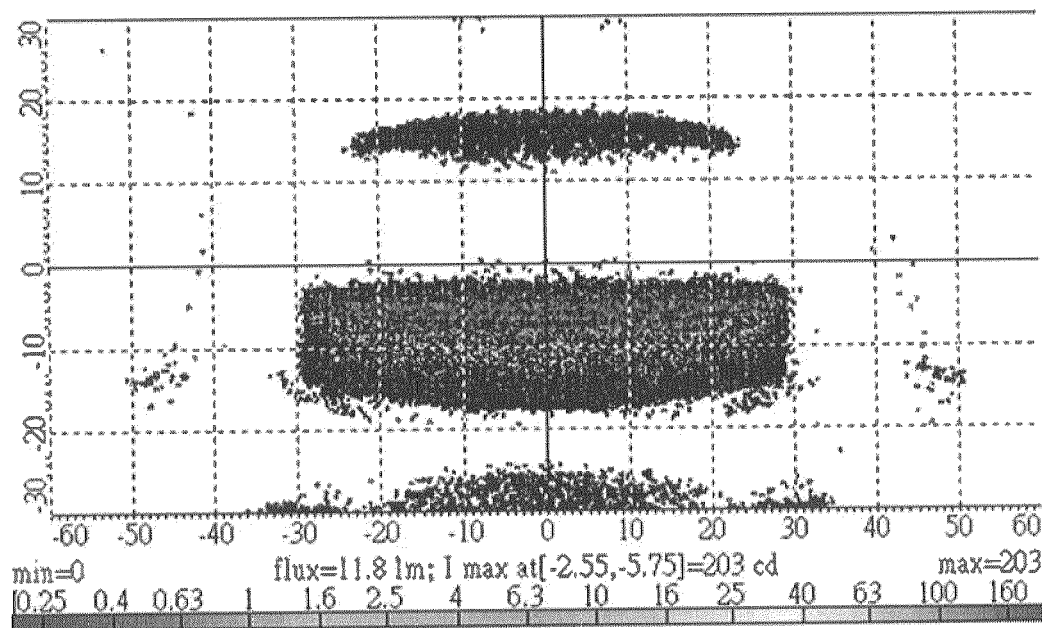


FIG. 13

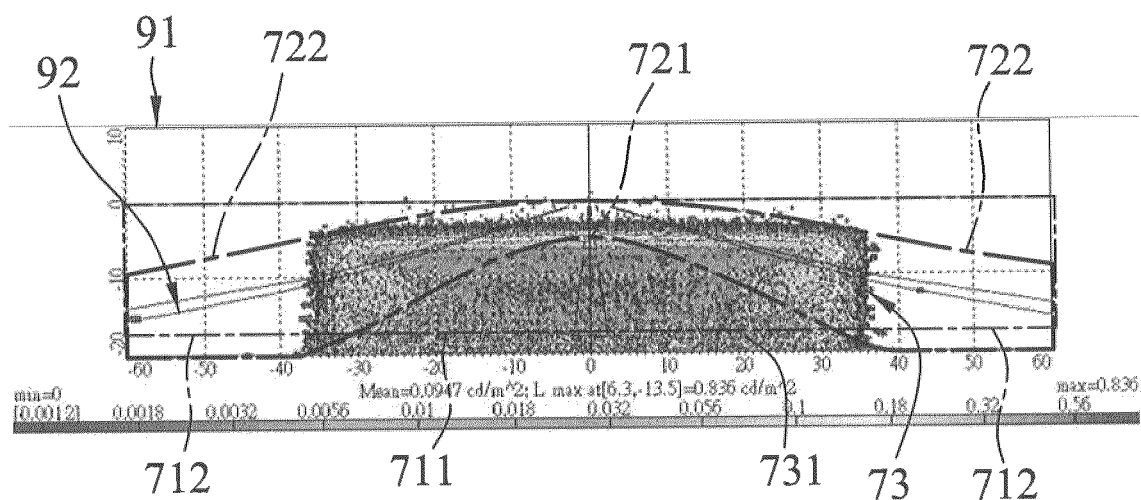


FIG. 14

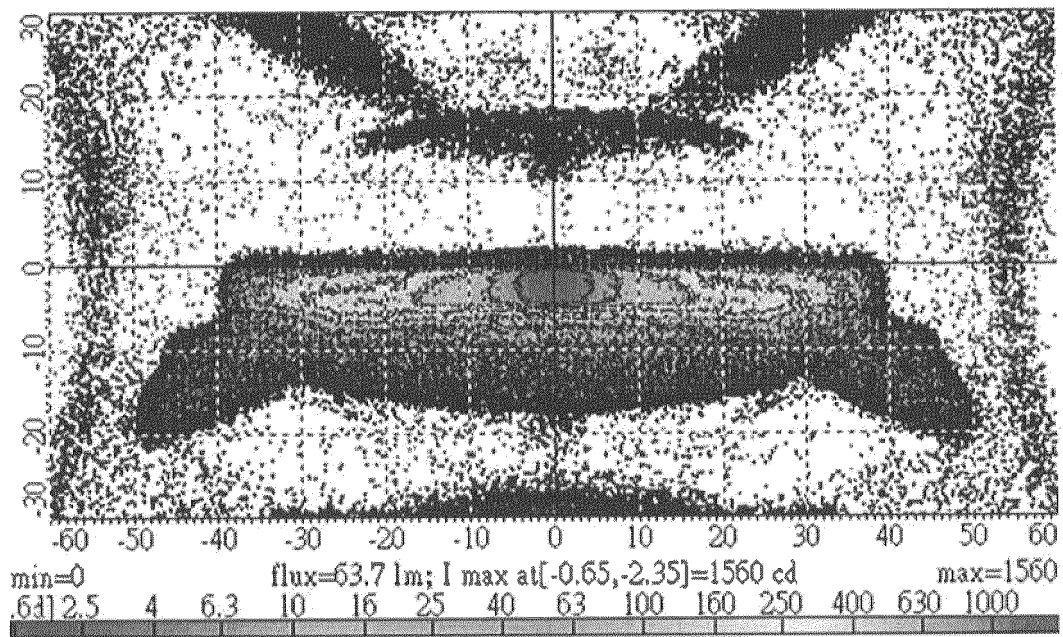


FIG.15

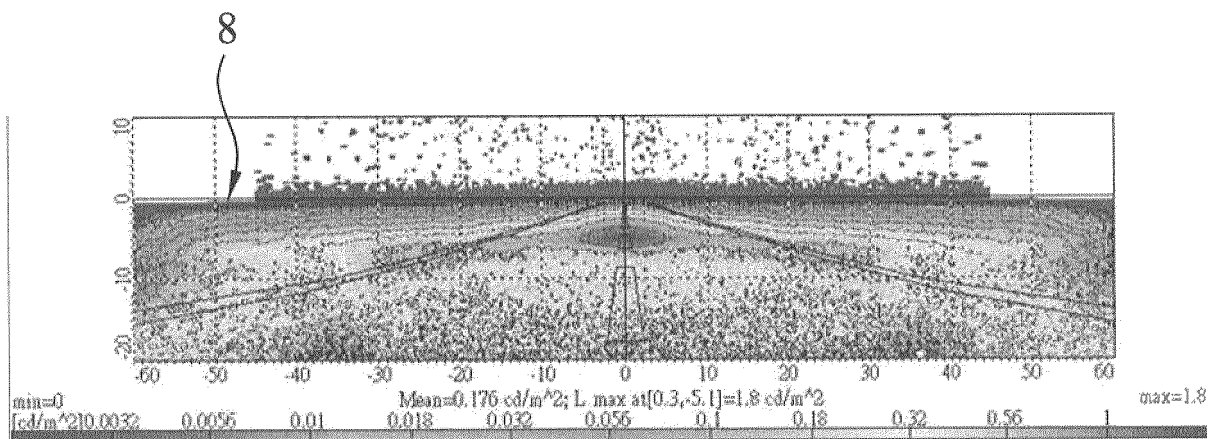


FIG.16



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Place of search Munich		Date of completion of the search 29 October 2021	Examiner Panatsas, Adam
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