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(54) LAMP MODULE

(57) A lamp module (10) including a reflector (200) having an incident surface (210) and an output surface (220) and a light adjusting element (100) configured within the reflector (200) is provided. A light source (300) is configured in the incident surface (210). The light adjusting element (100) includes a first adjusting structure (110), a second adjusting structure (120) and a third adjusting structure (130). The second adjusting structure (120) is connected to the first adjusting structure (110) configured outside thereof. The third adjusting structure (130) is connected to the second adjusting structure (120) configured outside thereof. The first adjusting structure (110), the second adjusting structure (120) and the third adjusting structure (130) are applied for adjusting and controlling light emitted to the output surface (220). The distance between the third adjusting structure (130) and the incident surface (210) is less than the distance between the second adjusting structure (120) and the incident surface (210). The distance between the second adjusting structure (120) and the incident surface (210) is less than the distance between the first adjusting structure (110) and the incident surface (210) .

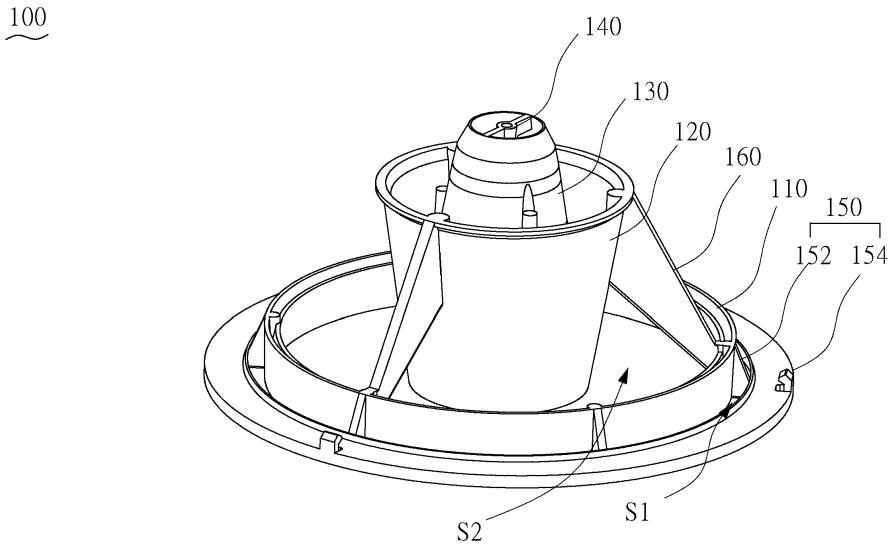

FIG.2

EP 3 495 724 A1

Description

BACKGROUND OF THE INVENTION

1. Field of the Invention

[0001] The present invention relates to a lamp module, particularly to a lamp module providing an improved visual effect.

2. Description of the Related Art

[0002] The current lighting technology generally uses direct lighting technology, which is relatively simple and straightforward but may lead to the problems that the light source is too dazzling and the lighting is uneven. Particularly, for some special occasions such as performances or exhibitions, the obvious light source produces less glare and less uniform light and cannot provide better or softer comfort.

Summary of the Invention

[0003] It is a major objective of the present invention to provide a lamp module to provide a better or softer light projection effect.

[0004] To achieve the above objective, the present invention provides a lamp module connected to a light source, which includes a reflector and a light adjusting element. The light source emits at least one light beam. The reflector has an incident surface and an output surface. The light source is configured in the incident surface, and the light adjusting element is configured within the reflector. Specifically, the light adjusting element includes a first adjusting structure, a second adjusting structure and a third adjusting structure. The second adjusting structure is connected to the first adjusting structure, and the third adjusting structure is connected to the second adjusting structure. The first adjusting structure, the second adjusting structure, and the third adjusting structure are used to adjust and control the light emitted to the output surface. Also, the first adjusting structure is disposed outside of the second adjusting structure, and the second adjusting structure is disposed outside of the third adjusting structure. The distance between the third adjusting structure and the incident surface is less than the distance between the second adjusting structure and the incident surface, and the distance between the second adjusting structure and the incident surface is less than the distance between the first adjusting structure and the incident surface.

[0005] In the present invention, the first adjusting structure is provided with a first cut-off groove, the opening of which is facing the incident surface.

[0006] In the present invention, the first cut-off groove is a V-shaped groove.

[0007] In the present invention, the first cut-off groove has a first cut-off wall and a second cut-off wall. The first cut-off wall is directly or indirectly connected to the reflector, and the second cut-off wall is connected to the second adjusting structure.

[0008] In the present invention, the distance between the first cut-off wall and the incident surface is less than the distance between the second cut-off wall and the incident surface.

[0009] In the present invention, the third adjusting structure is disposed inside of the second adjusting structure and extends from the inside of the second adjusting structure toward the incident surface to protrude outside the second adjusting structure.

[0010] In the present invention, a second cut-off groove is formed between the second adjusting structure and the third adjusting structure. The distance between the wall of the third adjusting structure and the incident surface is less than the distance between the second adjusting structure and the incident surface.

[0011] In the present invention, the inner wall of the third adjusting structure is formed with a light reflective coating.

[0012] In the present invention, the second adjusting structure has a first opening and a second opening, and the third adjusting structure has a third opening and a fourth opening. The diameter of the first opening is larger than that of the second opening, the diameter of the third opening is less than that of the fourth opening, and the distance between the third opening and the incident surface is less than the distance between the first opening and the incident surface.

[0013] In the present invention, the second adjusting structure is an inverted cone structure, and the third adjusting structure is a cone structure.

[0014] In the present invention, the distance between the first opening and the incident surface is less than the distance between the second opening and the incident surface, and the distance between the third opening and the incident surface is less than the distance between the fourth opening and the incident surface.

[0015] In the present invention, the second adjusting structure has a base that extends from the second opening toward the first opening, and the third adjusting structure is located at the base.

[0016] In the present invention, the second adjusting structure further includes a cut-off surface surrounding the first opening.

[0017] In the present invention, the light adjusting element further includes a fourth adjusting structure connected to the third adjusting structure for adjusting light, and the third adjusting structure is disposed outside of the fourth adjusting structure.

[0018] In the present invention, the fourth adjusting structure is configured inside of the third adjusting structure and has a third cut-off groove.

[0019] In the present invention, the distance between the third adjusting structure and the incident surface is equal to the distance between the fourth adjusting structure and the incident surface.

[0020] In the present invention, the distance between the third adjusting structure and the output surface is less than the distance between the fourth adjusting structure and the output surface.

[0021] In the present invention, the outer wall of the fourth adjusting structure is formed with a light reflective coating.

[0022] In the present invention, the light adjusting element further includes a first connecting structure having a connecting element and a ring-shaped element. The first connecting structure is connected to the first adjusting structure configured outside thereof, the first connecting structure is connected to the reflector through the connecting element and the ring-shaped element, and the first adjusting structure and the ring-shaped element have a first gap therebetween.

[0023] In the present invention, the light adjusting element further includes a second connecting element, the second connecting element is connected to the second adjusting structure configured outside thereof and connected to the first adjusting structure, and the first adjusting structure and the second adjusting structure have a second gap therebetween.

[0024] Based on the abovementioned structures, the lamp module in the present invention provides a light adjusting element in the reflector to effectively adjust and control the light emitted to the output surface so as to provide an improved or softer light projection effect.

BRIEF DESCRIPTION OF THE DRAWINGS

[0025]

FIG. 1 is a cross-sectional view of a lamp module according to an embodiment of the present invention;

FIG. 2 is a schematic diagram showing a light adjusting element of the lamp module in FIG. 1;

FIG. 3 is a cross-sectional view of the light adjusting element in FIG. 2; and

FIG. 4 is an enlarged schematic diagram of a first adjusting structure in FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0026] Hereafter, the technical content of the present invention will be better understood with reference to preferred embodiments.

[0027] FIG. 1 is a cross-sectional view of a lamp module according to an embodiment of the present invention. FIG. 2 is a schematic diagram showing a light adjusting element of the lamp module in FIG. 1. FIG. 3 is a cross-sectional view of the light adjusting element in FIG. 2. FIG. 4 is an enlarged schematic diagram of a first adjusting structure in FIG. 1. Please refer to FIGS. 1, 2, 3, and 4. In the present embodiment, a lamp module 10 is connected to a light source 300. The light source 300, for example, is an LED (Light Emitting Diode), suitable for emitting at least one light beam. The lamp module 10 in the embodiment includes a light adjusting element 100, a reflector 200, and a light source 300. Also, the reflector 200, for example, is a reflector. The reflector 200 in the embodiment includes an incident surface 210 and an output surface 220. The light source 300 is configured in the incident surface 210.

[0028] It is worth noting that the light adjusting element 100 in the embodiment is disposed in the reflector 200 for effectively adjusting and controlling the light reflected to the output surface. Also, the light generated by the lamp module 10 according to the matched reflector 20 can be projected at an effective angle to form effective light. For example, the reflector 20 is a reflector of 10° and its effective angle is 10°, but it is not limited thereto. In this way, as the light intensity within the effective angle of 10° is more than 300cd, the light beyond 10° will be weakened and form a halo. The light that forms this halo can be softer because of the design of the light adjusting element 100. In other words, the lamp module 10 in the embodiment utilizes the design of the light-adjusting element 100 to generate a better or softer light projection effect after the light outside the effective angle of 10° is reflected by the light-adjusting element 100. As long as the user is standing at an angle of 75° and looking back at the lamp module 10, the user will not directly see the light source 300, such that the high-intensity light emitted by the light source 300 will not directly entering the user's eyes and cause discomfort. Particularly, for some special occasions such as performances and exhibitions, the light adjusting element 100 is designed such that the lamp module 10 in the embodiment can provide a more uniform illumination surface to further improve the visual appearance.

[0029] Specifically, the light adjusting element 100 in the embodiment includes a first adjusting structure 110, a second adjusting structure 120, and a third adjusting structure 130. Specifically, the second adjusting structure 120 is connected to the first adjusting structure 110, and the third adjusting structure is connected to the second adjusting structure 120. In this embodiment, the first adjusting structure 110, the second adjusting structure 120 and the third adjusting structure 130 are used to control and adjust the light reflected to the output surface 220. Furthermore, in the present embodiment, the first adjusting structure 110 is disposed outside of the second adjusting structure 120, and the second adjusting structure 120 is disposed outside of the third adjusting structure 130. Preferably, the light adjusting element 100 in the embodiment can further include a fourth adjusting structure 140 for adjusting the light. The fourth adjusting structure 140 is connected to the third adjusting structure 130 on the inside of the third adjusting structure 130. In other words, the third adjusting structure 130 is disposed outside of the fourth adjusting structure 140.

[0030] Particularly, the central structure of the light adjusting element 100 in the embodiment has a relatively

high structural height, which corresponds to the incident surface 210. In contrast, the outside of the light adjusting element 100 has a relatively low structural height. Thus, in the present embodiment, the distance L3 between the third adjusting structure 130 and the incident surface 210 is equal to the distance L4 between the fourth adjusting structure 140 and the incident surface 210, the distance L3 between the third adjusting structure 130 and the incident surface 210 is less than the distance L2 between the second adjusting structure 120 and the incident surface 210, and the distance L2 between the second adjusting structure 120 and the incident surface 210 is less than the distance L1 between the first adjusting structure 110 and the incident surface 210. Furthermore, after the light source 300 emits the light, the fourth adjusting structure 140, the third adjusting structure 130, the second adjusting structure 120 and the first adjusting structure 110 adjust and control the light reflected to the output surface at different configuration positions or height positions respectively to provide better or softer light projection effects.

[0031] It is worth noting that, in the aforementioned embodiment, although the distance L3 between the third adjusting structure 130 and the incident surface 210 is equal to the distance L4 between the fourth adjusting structure 140 and the incident surface 210, in other preferred embodiments, the distance L3 between the third adjusting structure 130 and the incident surface 210 may be greater or less than the distance L4 between the fourth adjusting structure 140 and the incident surface 210, but the present invention is not limited thereto.

[0032] Furthermore, the light adjusting element 100 in the embodiment can also include a first connecting structure 150 and a second connecting element 160. The first connecting structure 150 is connected to the first adjusting structure 110 configured outside thereof, and connected to the reflector 200. Furthermore, the light adjusting element 100 is effectively fixed to the reflector 200. Preferably, the first connecting structure 150 has a connecting element 152 and a ring-shaped element 154. The connecting element 152 may be, for example, a rib. The first connecting structure 150 is connected to the first adjusting structure 110 configured outside thereof, and the first connecting structure 110 can be connected to the reflector 200 through the connecting element 152 and the ring-shaped element 154 in sequence. In a preferred embodiment, the first connecting structure 150 is a ring-shaped structure comprising a hook. The hook may be disposed on the ring-shaped element 154 such that the first connecting structure 150 can be connected with the inside of the reflector 200. Furthermore, a first gap S1 exists between the ring-shaped element 154 and the first connecting structure 110 for light penetration. Specifically, although the light adjusting element 100 in the embodiment is fixed to the reflector 200 through the first connecting structure 150, in other preferred embodiments, the light adjusting element 100 may be directly or indirectly connected with the reflector 200 by using the first adjusting structure 110, the second adjusting structure 120 or the third adjusting structure 130, but the present invention is not limited thereto.

[0033] In addition, the second connecting element 160 in the embodiment is connected to the second adjusting structure 120 configured outside thereof and connected to the first adjusting structure 110. Specifically, the second connecting element 160 may be, for example, a rib connected between the first adjusting structure 110 and the second adjusting structure 120. The first adjusting structure 110 and the second adjusting structure 120 have a second gap S2 therebetween for light penetration, wherein the width of the second gap S2 is larger than that of the first gap S1.

[0034] Next, the present invention will be described in detail herein with respect to the design of the first adjusting structure 110, the second adjusting structure 120, the third adjusting structure 130, and the fourth adjusting structure 140.

[0035] In this embodiment, the first adjusting structure 110 is provided with a first cut-off groove G1. The first cut-off groove G1 is a V-shaped groove, and its opening faces toward the incident surface 210. Furthermore, the first cut-off groove G1 has a first cut-off wall 112 and a second cut-off wall 114. The first cut-off wall 112 is indirectly connected to the reflector 200 through the first connecting structure 150, and the second cut-off wall 114 is connected to the second adjusting structure 120 through the second connecting element 160. The first cut-off wall 112 may be directly connected to the reflector 200, and the second cut-off wall 114 may be directly connected to the second adjusting structure 120, but the present invention is not limited thereto.

[0036] Additionally, in the present embodiment, the distance between the first cut-off wall 112 and the incident surface 210 is less than the distance between the second cut-off wall 114 and the incident surface 210. In other words, the height of the first cut-off wall 112 is greater than the height of the second cut-off wall 114. Therefore, a portion of the light emitted by the light source 300 is limited by the first cut-off wall 112 to avoid forming a halo after a portion of the light reflected by the reflector 200 is emitted at an effective angle. Also, the portion of the light emitted by the light source 300 is limited by the V-shaped groove between the first cut-off wall 112 and the second cut-off wall 114. Furthermore, a portion of the light emitted by the light source 300 is reflected repeatedly in the V-shaped groove, and it cannot easily be re-emitted to the output surface 220 due to structural blockage. Additionally, the outside of the second cut-off wall 114 will project the incident light at an effective angle to form effective light. That is, with the first adjusting structure 110 provided in the embodiment, the first cut-off wall 112 and the first cut-off groove G1 can be used to shield a portion of the light projected beyond the effective angle. Furthermore, the incident light projected at the effective angle by the outer edge of the second cut-off wall 114 can form effective light.

[0037] Furthermore, the second adjusting structure 120 in the embodiment is an inverted cone structure, and the third adjusting structure 130 is a cone structure. The third adjusting structure 130 is disposed at the inner edge of the second adjusting structure 120, extends from the inner edge of the second adjusting structure 120 toward the incident surface 210, and protrudes outside of the second adjusting structure 120. Specifically, the second adjusting structure 120 has a first opening O1 and a second opening 02. The distance between the first opening O1 and the incident surface 210 is less than the distance between the second opening 02 and the incident surface 210, and the diameter R1 of the first opening O1 is larger than the diameter R2 of the second opening 02. Correspondingly, the third adjusting structure 130 has a third opening 03 and a fourth opening 04. The distance between the third opening 03 and the incident surface 210 is less than the distance between the fourth opening 04 and the incident surface 210, and the diameter R3 of the third opening 03 is less than the diameter R4 of the fourth opening 04.

[0038] As described above, in the present embodiment, the second adjusting structure 120 has a base 122 that extends from the second opening 02 toward the first opening O1, and the third adjusting structure 130 is located at the base 122 and protrudes outside the second adjusting structure 120. In this way, the distance between the third opening 03 and the incident surface 210 is less than the distance between the first opening O1 and the incident surface 210. In other words, the distance between the third adjusting structure 130 and the incident surface 210 is less than the distance between the second adjusting structure 120 and the incident surface 210.

[0039] Particularly, in the present embodiment, a second cut-off groove G2 is designed to be disposed between the second adjusting structure 120 and the third adjusting structure 130. Since the distance between the third adjusting structure 130 and the incident surface 210 is less than the distance between the second adjusting structure 120 and the incident surface 210, in the design of the second cut-off groove G2, the distance between the wall of the third adjusting structure 130 and the incident surface 210 is less than the distance between the second adjusting structure 120 and the incident surface 210. In addition, the second adjusting structure 120 allows the surface surrounding the first opening O1 to be used as a cut-off surface 124 to effectively shield light that is partially projected at an effective angle.

[0040] So that the light projected to the effective angle will be more uniform, the embodiment can comprise a light reflective coating on the inner edge of the wall of the third adjusting structure 130. Similarly, the embodiment may also comprise a light reflective coating on the outer edge of the wall of the fourth adjusting structure 140. In this way, the light incident between the third adjusting structure 130 and the fourth adjusting structure 140 can be projected with a suitable light intensity. Additionally, the fourth adjusting structure 140 in the embodiment has a third cut-off groove G3 that is mainly capable of directly shielding a portion of the light directed to the output surface 220 to prevent visual discomfort and to soften the light projected from the output surface 220. The third cut-off groove G3 may also be, for example, a V-groove structure with the opening facing the incident surface 210.

[0041] In a preferred embodiment, the distance L3 between the third adjusting structure 130 and the output surface 220 is less than the distance L4 between the fourth adjusting structure 140 and the output surface 220. In other words, a portion of the light incident on the third adjusting structure 130 is not easily affected by the fourth adjusting structure 140. That is, a portion of the light incident on the third adjusting structure 130 can still be effectively reflected and projected from the output surface 220.

[0042] As described above, the lamp module of the present invention comprises a light adjusting element set in the reflector to shade or adjust the light by using the first adjusting structure, the second adjusting structure, the third adjusting structure and the fourth adjusting structure of the light adjusting element. In this way, the light emitted from the light source can have a better or softer light projection after passing through the light adjusting element without any uncomfortable visual experience.

[0043] It should be noted that the embodiments of the present invention described above are only illustrative. Those skilled in the art should understand that the structures and arrangement of the parts can be modified without departing from the scope of the invention as defined solely by the appended claims.

Claims

1. A lamp module (10), connected to a light source (300) emitting at least one light beam, the lamp module (10) comprising:

a reflector (200), having an incident surface (210) and an output surface (220), and the light source (300) configured in the incident surface (210); and
a light adjusting element (100), configured within the reflector, (200) comprising:

a first adjusting structure (110);
a second adjusting structure (120) connected to the first adjusting structure (110); and
a third adjusting structure (130) connected to the second adjusting structure (120);

wherein the first adjusting structure (110), the second adjusting structure (120) and the third adjusting structure (130) are used to adjust the light reflected to the output surface (220), the first adjusting structure (110) being disposed

outside of the second adjusting structure (120) and the second adjusting structure (120) being disposed outside of the third adjusting structure (130);
wherein the distance between the third adjusting structure (130) and the incident surface (210) is less than the distance between the second adjusting structure (120) and the incident surface (210), and the distance between the second adjusting structure (120) and the incident surface (210) is less than the distance between the first adjusting structure (110) and the incident surface (210).

2. The lamp module (10) as claimed in claim 1, wherein the first adjusting structure (110) is provided with a first cut-off groove (G1), the opening of which faces the incident surface (210).

3. The lamp module (10) as claimed in claim 2, wherein the first cut-off groove (G1) is a V-shaped groove.

4. The lamp module (10) as claimed in claim 2, wherein the first cut-off groove (G1) has a first cut-off wall (112) and a second cut-off wall (114), the first cut-off wall (112) is directly or indirectly connected to the reflector (200), and the second cut-off wall (114) is connected to the second adjusting structure (120).

5. The lamp module (10) as claimed in claim 4, wherein the distance between the first cut-off wall (112) and the incident surface (210) is less than the distance between the second cut-off wall (114) and the incident surface (210).

6. The lamp module (10) according to any of the preceding claims, wherein the third adjusting structure (130) is disposed at the inner edge of the second adjusting structure (120) and extends from the inner edge of the second adjusting structure (120) toward the incident surface (210) to protrude outside the second adjusting structure (120).

7. The lamp module (10) according to any of the preceding claims, wherein a second cut-off groove (G2) is formed between the second adjusting structure (120) and the third adjusting structure (130), and the distance between the wall of the third adjusting structure (130) and the incident surface (210) is less than the distance between the second adjusting structure (120) and the incident surface (210).

8. The lamp module (10) according to any of the preceding claims, wherein the second adjusting structure(120) has a first opening (O1) and a second opening (02), the third adjusting structure (130) has a third opening (03) and a fourth opening (04), the diameter of the first opening (O1) is larger than that of the second opening (02), the diameter of the third opening (03) is less than that of the fourth opening (04), and the distance between the third opening (03) and the incident surface (210) is less than the distance between the first opening (O1) and the incident surface (210).

9. The lamp module (10) as claimed in claim 8, wherein the second adjusting structure (120) is an inverted cone structure, and the third adjusting structure (130) is a cone structure.

10. The lamp module (10) as claimed in claim 8 or 9, wherein the distance between the first opening (O1) and the incident surface (210) is less than the distance between the second opening (02) and the incident surface (210), and the distance between the third opening (03) and the incident surface (210) is less than the distance between the fourth opening (04) and the incident surface (210).

11. The lamp module (10) according to any of the preceding claims, wherein the second adjusting structure (120) has a base (122) that extends from the second opening (02) toward the first opening (O1), and the third adjusting structure (130) is located at the base (122).

12. The lamp module (10) according to any of the preceding claims, wherein the second adjusting structure (120) further includes a cut-off surface (124) surrounding the first opening (O1).

13. The lamp module (10) according to any of the preceding claims, wherein the light adjusting element (100) further includes a fourth adjusting structure (140) connected to the third adjusting structure (130) for adjusting light, and the third adjusting structure (130) is disposed outside of the fourth adjusting structure (140), wherein the fourth adjusting structure (140) is configured inside of the third adjusting structure (130) and includes a third cut-off groove (G3).

14. The lamp module (10) according to any of the preceding claims, wherein the light adjusting element (100) further includes a first connecting structure (150) having a connecting element (152) and a ring-shaped element (154), and the first connecting structure (150) is connected to the first adjusting structure (110) configured outside thereof; the first connecting structure (150) is connected to the reflector (200) through the connecting element (152) and the ring-shaped element (154), and the first adjusting structure (110) and the ring-shaped element have a first gap (S1) therebetween.

15. The lamp module (10) as claimed in claim 14, where-

in the light adjusting element (100) further includes a second connecting element (160) that is connected to the second adjusting structure (120) configured outside thereof and connected to the first adjusting structure (110), and the first adjusting structure (110) and the second adjusting structure (120) have a second gap (S2) therebetween, where the width of the second gap (S2) is greater than that of the first gap (S1).

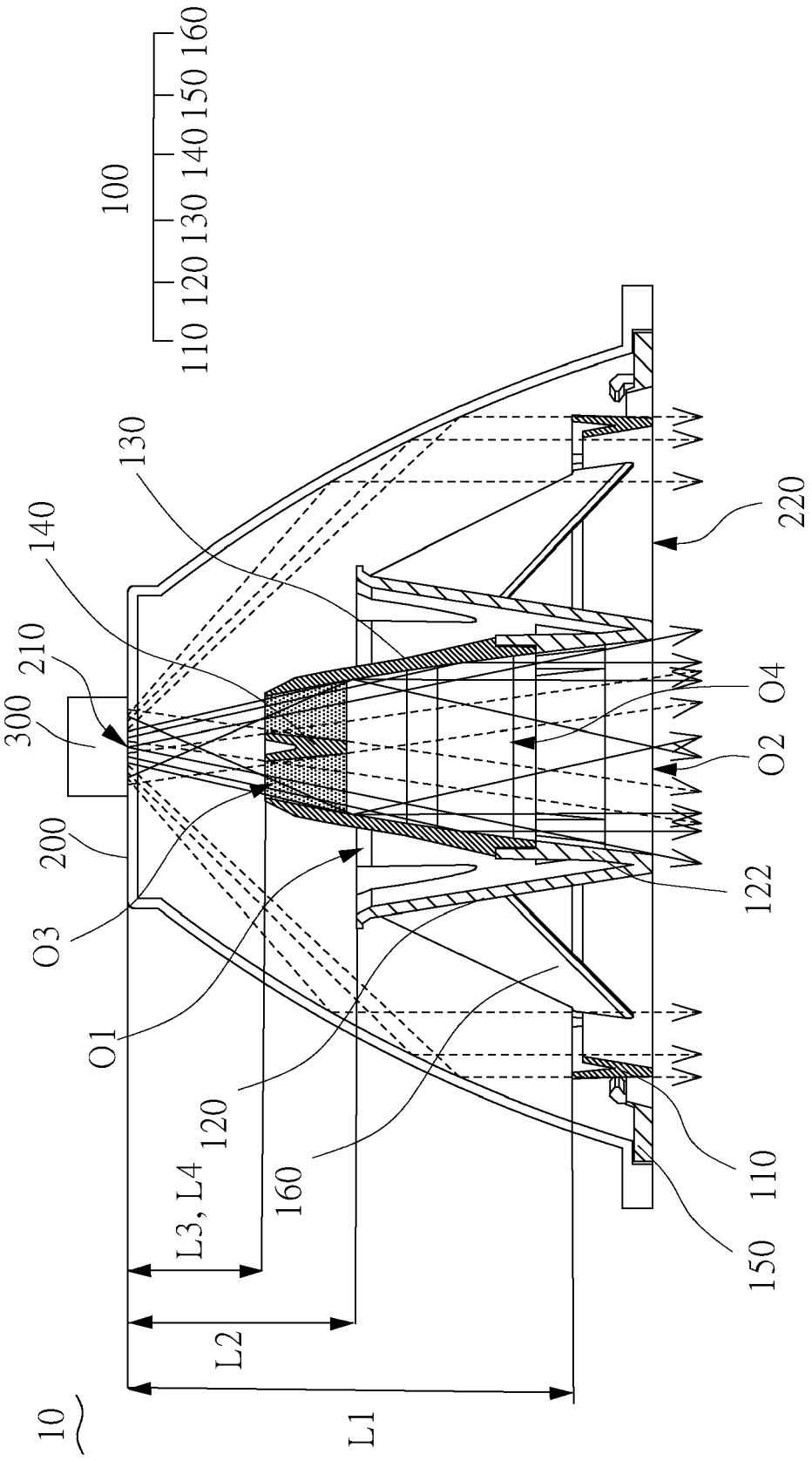
100
110 120 130 140 150 160
130
140
210
300
200
O3
O1
120
L3, L4
160
L2
L1
10
220
O4
O2
122
110
150

FIG.1

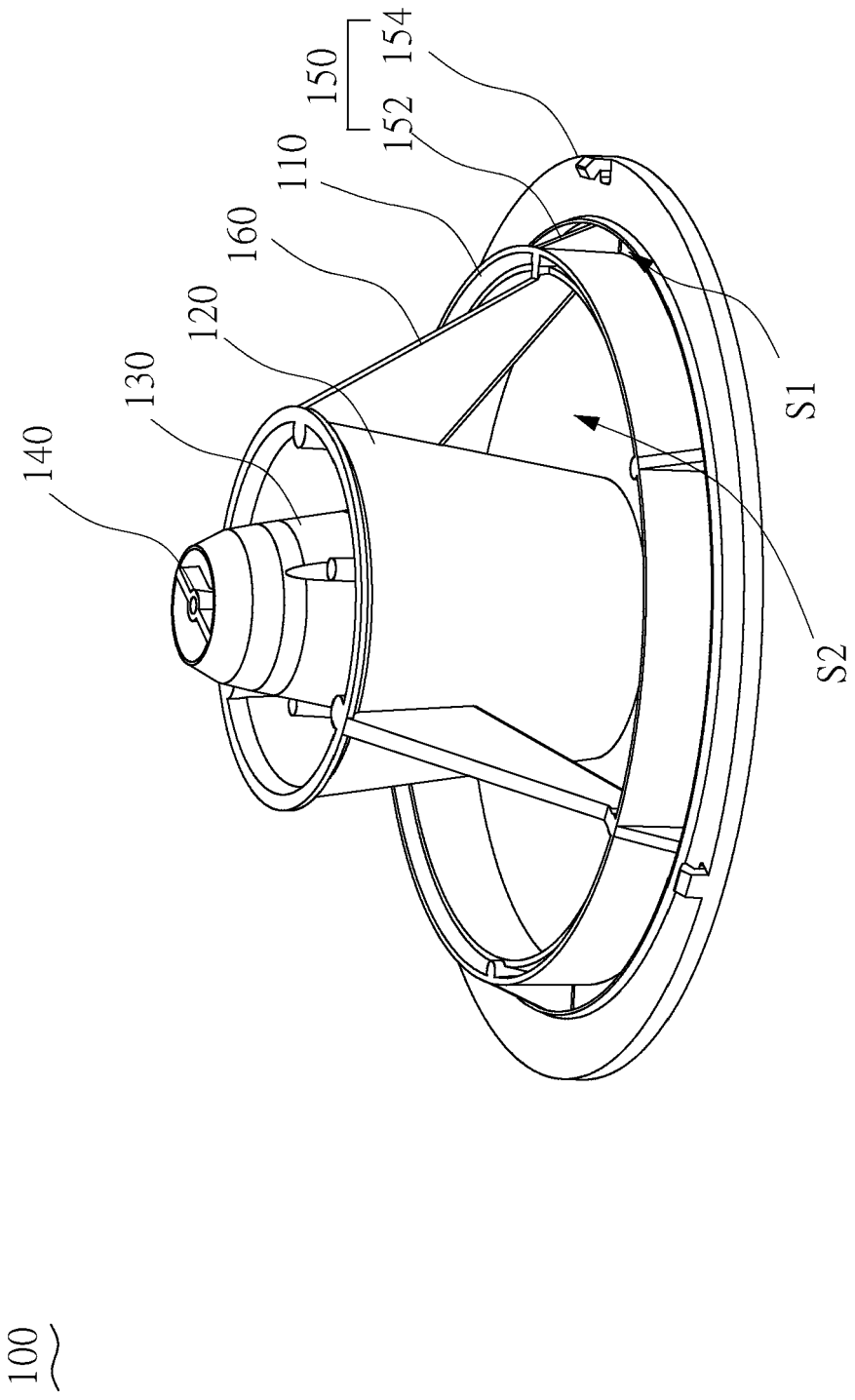

FIG.2

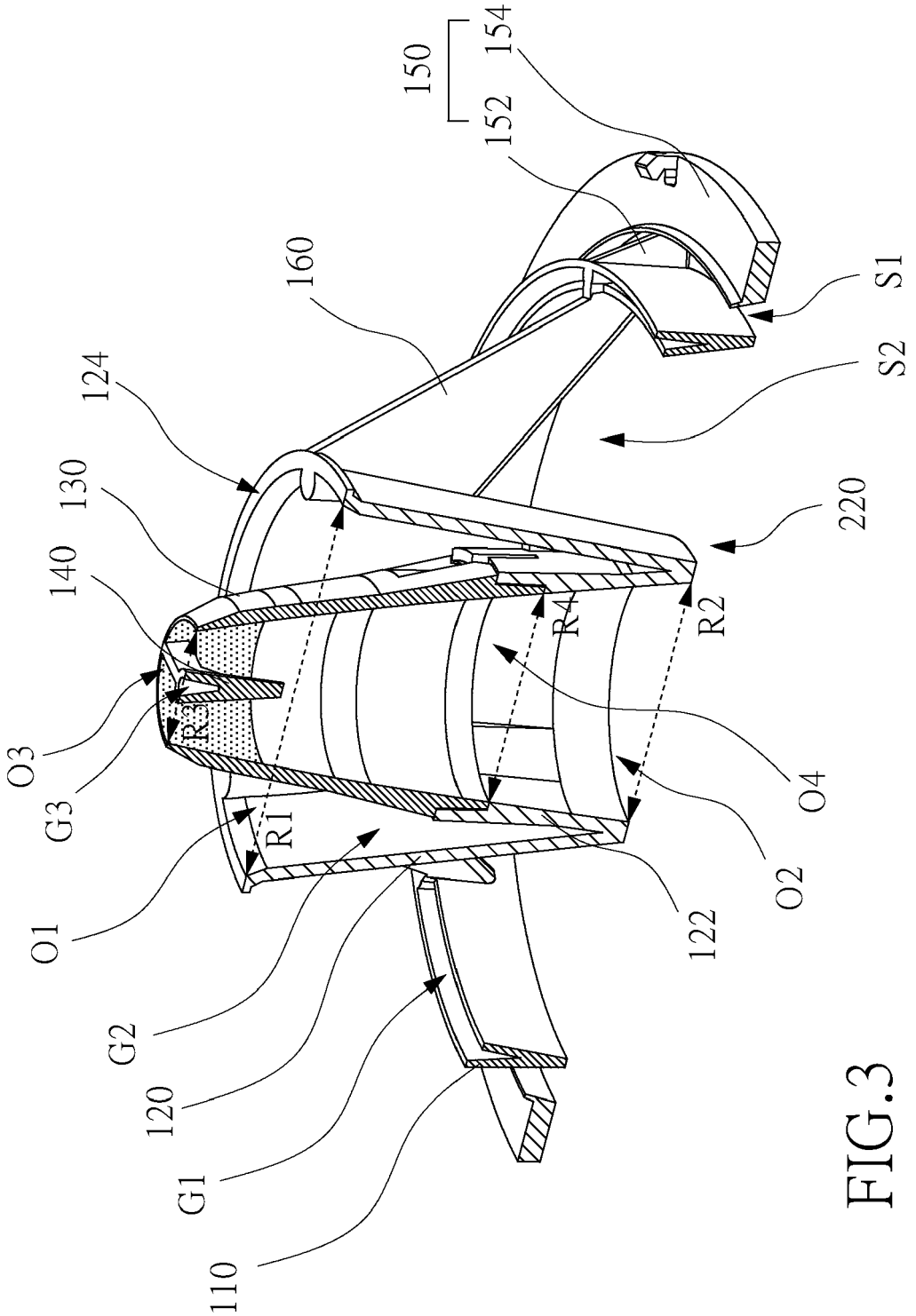
150
152
154
160
124
130
140
O3
G3
R3
R1
O1
G2
120
G1
110
S1
S2
220
R4
R2
O4
O2
122

FIG.3

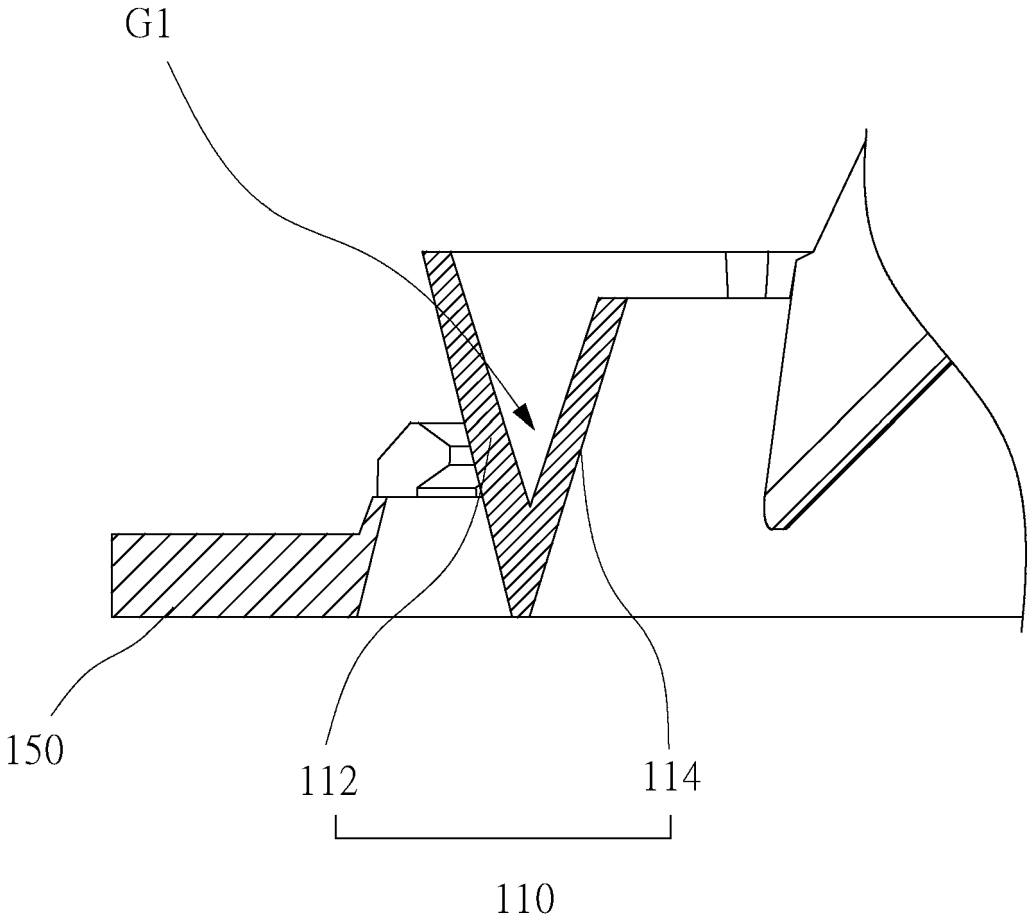

FIG.4

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EUROPEAN SEARCH REPORT

Application Number
EP 18 15 7158

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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Y	WO 2005/090857 A1 (KONINKL PHILIPS ELECTRONICS NV [NL]; HOLTEN PETRUS A J [NL]) 29 September 2005 (2005-09-29) * figure 3 * * page 5, line 10 - line 16 *	2-4	
X Y	US 2006/203493 A1 (BROWER RICHARD [US] ET AL) 14 September 2006 (2006-09-14) * paragraph [0080] * * figure 3 *	1,12 8,10	
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A	EP 2 796 778 A1 (HELLA KGAA HUECK & CO [DE]) 29 October 2014 (2014-10-29) * the whole document *	1-15	TECHNICAL FIELDS SEARCHED (IPC) F21V
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	17 May 2018	Amerongen, Wim

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 18 15 7158

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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