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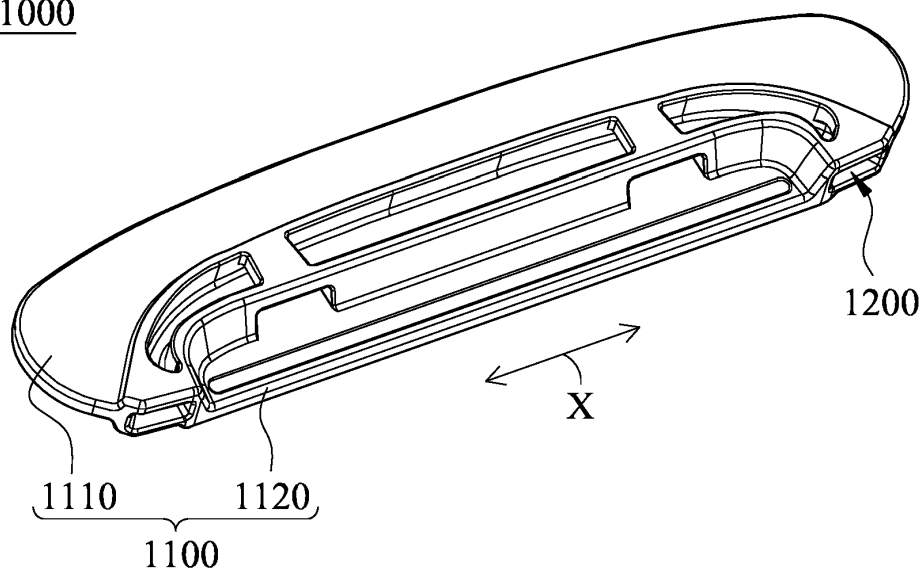
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(54) LACE COUPLING STRUCTURE AND LACE COUPLING STRUCTURE ASSEMBLING METHOD

(57) A lace coupling structure which is applied for being assembled to an article includes a mounting bracket. The mounting bracket includes a main body and a supporting portion. The supporting portion extends out-

ward and integrally from an outer surface of the main body. The supporting portion and the main body are made by a first thermoplastic material. The supporting portion is covered by the article.

1000**Fig. 1**

Description

BACKGROUND

Technical Field

[0001] The present disclosure relates to a coupling structure, a coupling structure assembling method and a coupling structure assembling fixture. More particularly, the present disclosure relates to a lace coupling structure for a lace to be wound therearound or pass therethrough, a lace coupling structure assembling method and a lace coupling structure assembling fixture.

Description of Related Art

[0002] Generally, wearable articles such as shoes may include a lace and holes, and with that the lace passes through the holes to be knotted, the wearable article can be fastened on a worn article. However, the conventional knotted lace is easily to be loosened, and it is not convenience for wearing or taking off the wearable article.

[0003] Hence, some practitioners developed lace coupling structures such as reel devices or lace guiding members. The reel device and the lace guiding member may be disposed at the wearable article. A lace may pass through the lace guiding member to couple to the reel member, and the lace may be released or tensioned via operating the reel device, thereby favorable for wearing or taking off the wearable article.

[0004] However, the conventional lace coupling structures are mounted at the wearable article via sewing, the manufacture time is long, and stitching lines thereon may affect the appearance. Therefore, some practitioners developed a welding method for coupling the lace coupling structure to the wearable article. However, the lace may pull the lace coupling structure as tensioned, and if the combination strength between the wearable article and the lace coupling structure is not enough, the wearable article may be damaged and the lace coupling structure may separate therefrom.

[0005] Based on the above, how to improve the structure configuration of the lace coupling device to increase the combination strength between the wearable article and the lace coupling structure becomes a target that those in the filed pursue.

SUMMARY

[0006] According to one aspect of the present disclosure, a lace coupling structure which is applied for being assembled to an article is provided. The lace coupling structure includes a mounting bracket. The mounting bracket includes a main body and a supporting portion. The supporting portion extends outward and integrally from an outer surface of the main body. The supporting portion and the main body are made by a first thermoplastic material. The supporting portion is covered by the

article.

[0007] According to one embodiment, the article may include an upper layer and a lower layer. The upper layer may include a hole for the main body to expose therefrom. The supporting portion is between the upper layer and the lower layer, and the upper layer and the lower layer are welded to combine the mounting bracket and the article.

[0008] According to one embodiment, the supporting portion may include a plurality of penetrating holes arranged with intervals, and the upper layer and the lower layer in the penetrating holes are welded.

[0009] According to one embodiment, the article may further include at least one central layer, and the at least one central layer is located between the upper layer and the lower layer.

[0010] According to one embodiment, the mounting bracket may further include a positioning portion located at the main body or the supporting portion, and the positioning portion is configured for a lace coupling structure assembling fixture to be correspondingly aligned.

[0011] According to one embodiment, a distance between the supporting portion and the outer surface may be larger than or equal to 2 mm.

[0012] According to one embodiment, the lace coupling structure may further include a reel assembly disposed at the mounting bracket and including a housing and a spool. The housing is detachably connected to the mounting bracket to form an inner space with the mounting bracket. The spool is located within the inner space and configured for a lace to be wound therearound.

[0013] According to one embodiment, the lace coupling structure may further include a mounting flange. The mounting flange extends outward from the main body and is connected to the supporting portion. The mounting flange is made by a second thermoplastic material. A melting point of the second thermoplastic material is lower than a melting point of the first thermoplastic material, and the mounting flange is configured to be welded with the article.

[0014] According to one embodiment, the supporting portion may include a plurality of ribs arranged with intervals.

[0015] According to one embodiment, the supporting portion may include an upper part and a lower part, the upper part protrudes from an upper surface of the mounting flange, and the lower part protrudes from a lower surface of the mounting flange.

[0016] According to one embodiment, a distance between an outer periphery of the mounting flange and the outer surface may be larger than or equal to 2 mm.

[0017] According to one embodiment, each of the melting point of the first thermoplastic material and the melting point of the second thermoplastic material may be larger than or equal to 60 °C and smaller than or equal to 250 °C.

[0018] According to another aspect of the present disclosure, a lace coupling structure assembling method

includes a mounting bracket placing step and a mounting bracket welding step. In the mounting bracket placing step, an article includes an upper layer and a lower layer, a mounting bracket of at least one lace coupling structure is placed on the article, the mounting bracket of the at least one lace coupling structure includes a main body and a supporting portion, the main body and the supporting portion are made by a first thermoplastic material, and the supporting portion of the at least one lace coupling structure is located between the upper layer and the lower layer. In the mounting bracket welding step, a thermal energy is provided, and the upper layer and the lower layer are welding to combine the mounting bracket of the at least one lace coupling structure to the article.

[0019] According to one embodiment, the lace coupling structure assembling method may further include a lace coupling step. A number of the at least one lace coupling structure is equal to or more than two. The lace coupling structures are arranged at the article with intervals. Each of the lace coupling structures may include a passage on the mounting bracket. A lace is passed through the passage of a first one of the lace coupling structures, and then the lace is passed through the passage of a second one of the lace coupling structures.

[0020] According to one embodiment, the lace coupling structure assembling method may further include a lace coupling step. A number of the at least one lace coupling structure is one. The lace coupling structure may further include a reel assembly including a spool, and the reel assembly is connected to the mounting bracket after a lace is wound around the spool.

BRIEF DESCRIPTION OF THE DRAWINGS

[0021] The present disclosure can be more fully understood by reading the following detailed description of the embodiment, with reference made to the accompanying drawings as follows:

Fig. 1 shows a three-dimensional schematic view of a lace coupling structure according to a first embodiment of the present disclosure.

Fig. 2 shows a cross-section view of the lace coupling structure of the first embodiment of Fig. 1 assembling to an article.

Fig. 3 shows a three-dimensional schematic view of a lace coupling structure according to a second embodiment of the present disclosure.

Fig. 4 shows a cross-section view of the lace coupling structure of the second embodiment of Fig. 3 assembling with an article.

Fig. 5 shows a three-dimensional schematic view of a lace coupling structure according to a third embodiment of the present disclosure.

Fig. 6 shows an exploded view of the lace coupling structure of the third embodiment of Fig. 5.

Fig. 7 shows a three-dimensional schematic view of a mounting bracket of a lace coupling structure according to a fourth embodiment of the present disclosure.

Fig. 8 shows a three-dimensional schematic view of a mounting bracket of a lace coupling structure according to a fifth embodiment of the present disclosure.

Fig. 9 shows a three-dimensional schematic view of a mounting bracket of a lace coupling structure according to a sixth embodiment of the present disclosure.

Fig. 10 shows one three-dimensional schematic view of a mounting bracket of a lace coupling structure according to a seventh embodiment of the present disclosure.

Fig. 11 shows another three-dimensional schematic view of the mounting bracket of the seventh embodiment of Fig. 10.

Fig. 12 shows a cross-section view of the mounting bracket of the seventh embodiment of Fig. 10 assembling to an article taken along line 12-12.

Fig. 13 shows a cross-section view of the mounting bracket of the seventh embodiment of Fig. 10 assembling to the article taken along line 13-13.

Fig. 14 shows a three-dimensional schematic view of a mounting bracket of a lace coupling structure according to an eighth embodiment of the present disclosure.

Fig. 15 shows a cross-section view of the mounting bracket of the eighth embodiment of Fig. 14 taken along line 15-15.

Fig. 16 shows a three-dimensional schematic view of a mounting bracket of a lace coupling structure according to a ninth embodiment of the present disclosure.

Fig. 17 shows one three-dimensional schematic view of a mounting bracket of a lace coupling structure according to a tenth embodiment of the present disclosure.

Fig. 18 shows another three-dimensional schematic view of the mounting bracket of the tenth embodiment of the present disclosure.

ment of Fig. 17.

Fig. 19 shows a block flow chart of a lace coupling structure assembling method according to an eleventh embodiment of the present disclosure.

Fig. 20 shows a three-dimensional schematic view of a lace coupling structure according to a twelfth embodiment of the present disclosure.

Fig. 21 shows a three-dimensional schematic view of a lace coupling structure according to a thirteenth embodiment of the present disclosure.

Fig. 22 shows a three-dimensional schematic view of a lace coupling structure according to a fourteenth embodiment of the present disclosure.

Fig. 23 shows a side view of the lace coupling structure of the fourteenth embodiment of Fig. 22.

Fig. 24 shows a top view of a lace coupling structure according to a fifteenth embodiment of the present disclosure.

Fig. 25 shows one three-dimensional schematic view of a lace coupling structure assembling fixture according to a sixteenth embodiment of the present disclosure clamping a mounting bracket of a lace coupling structure and two central layers.

Fig. 26 shows another three-dimensional schematic view of the lace coupling structure assembling fixture of the sixteenth embodiment of Fig. 25 clamping the mounting bracket and the two central layers.

Fig. 27 shows a cross-section view of the lace coupling structure assembling fixture of the sixteenth embodiment of Fig. 25 clamping the mounting bracket taken along line 27-27.

Fig. 28 shows one three-dimensional schematic view of a lace coupling structure assembling fixture according to a seventeenth embodiment of the present disclosure clamping a mounting bracket of a lace coupling structure and two central layers.

Fig. 29 shows another three-dimensional schematic view of the lace coupling structure assembling fixture of the seventeenth embodiment of Fig. 28 clamping the mounting bracket and the two central layers.

Fig. 30 shows a cross-section view of the lace coupling structure assembling fixture of the seventeenth embodiment of Fig. 28 clamping the mounting bracket taken along line 30-30.

Fig. 31 shows one three-dimensional schematic

view of a lace coupling structure assembling fixture according to an eighteenth embodiment of the present disclosure clamping a mounting bracket of a lace coupling structure and two central layers.

Fig. 32 shows another three-dimensional schematic view of the lace coupling structure assembling fixture of the eighteenth embodiment of Fig. 31 clamping the mounting bracket and the two central layers.

Fig. 33 shows a cross-section view of the lace coupling structure assembling fixture of the eighteenth embodiment of Fig. 31 clamping the mounting bracket taken along line 33-33.

DETAILED DESCRIPTION

[0022] The embodiments of the present disclosure will be illustrated with drawings hereinafter. In order to clearly describe the content, many practical details will be mentioned with the description hereinafter. However, it will be understood by the reader that the practical details will not limit the present disclosure. In other words, in some embodiment of the present disclosure, the practical details are not necessary. Additionally, in order to simplify the drawings, some conventional structures and elements will be illustrated in the drawings in a simple way; the repeated elements may be labeled by the same or similar reference numerals.

[0023] In addition, the terms first, second, third, etc. are used herein to describe various elements or components, these elements or components should not be limited by these terms. Consequently, a first element or component discussed below could be termed a second element or component. Moreover, the combinations of the elements, the components, the mechanisms and the modules are not well-known, ordinary or conventional combinations, and whether the combinations can be easily completed by the one skilled in the art cannot be judged based on whether the elements, the components, the mechanisms or the module themselves are well-known, ordinary or conventional.

[0024] Fig. 1 shows a three-dimensional schematic view of a lace coupling structure 1000 according to a first embodiment of the present disclosure. Fig. 2 shows a cross-section view of the lace coupling structure 1000 of the first embodiment of Fig. 1 assembling to an article A1. The lace coupling structure 1000 is applied for being assembled to the article A1. The lace coupling structure 1000 includes a mounting bracket 1100. The mounting bracket 1100 includes a main body 1120 and a supporting portion 1110. The supporting portion 1110 extends outward from an outer surface 1121 of the main body 1120. The supporting portion 1110 and the main body 1120 are made by a first thermoplastic material. The supporting portion 1110 is covered by the article A1.

[0025] Therefore, with the configuration of the supporting portion 1110, the combination strength between the

mounting bracket 1100 and the article A1 is increased. Details of the lace coupling structure 1000 will be described hereinafter.

[0026] The lace coupling structure 1000 of the first embodiment may be used as a lace guiding member. The main body 1120 may be substantially half oval-shaped and includes the outer surface 1121 with curvature. The supporting portion 1110 extends outward and integrally from the outer surface 1121, and a length of the supporting portion 1110 along an X axis is longer than a length of the main body 1120 along the X axis.

[0027] The lace coupling structure 1000 may further include a passage 1200 disposed at the mounting bracket 1100 for a lace to pass therethrough, and the passage 1200 is especially located at the main body 1120. As shown in Figs. 1 and 2, the main body 1120 may further include a protrusion near the supporting portion 1110 and a board portion far away from the supporting portion 1110. The protrusion is higher than the board portion, the outer surface 1121 is the outer side surface of the protrusion, and the passage 1200 is disposed inside the protrusion.

[0028] The article A1 may include an upper layer A11 and a lower layer A12. The upper layer A11 includes a hole for the main body 1120 to expose therefrom. The supporting portion 1110 is between the upper layer A11 and the lower layer A12, and the upper layer A11 and the lower layer A12 are welded to combine the mounting bracket 1100 and the article A1. Precisely, the upper layer A11 and the lower layer A12 may be fabric or nylon. A size and a shape of the hole of the upper layer A11 correspond to a size and a shape of the main body 1120, respectively. Hence, as the mounting bracket 1100 is placed between the upper layer A11 and the lower layer A12, the main body 1120 may expose therefrom. In other embodiments, the upper layer may include two passage openings respectively correspond to two passage entrances of the passage, and the upper layer covers whole of the main body and the supporting portion. The lace may enter the passage via the passage entrances and the passage openings, and the main body is not limited to be fully exposed from the upper layer. The mounting bracket may be welded to one of the upper layer and the lower, and the other one of the upper layer and the lower is attached thereto, thereby the article covering the supporting portion.

[0029] A melting point of the first thermoplastic material may be larger than or equal to 60 °C and smaller than or equal to 250 °C. Hence, methods such as thermocompression welding, ultrasonic welding, or high-frequency welding are used to provide a thermal energy, and the upper layer A11, the lower layer A12 and the supporting portion 1110 are at least partially welded to combine each other. Therefore, the mounting bracket 1100 may be mounted at the article A1. It is noted that, although the mounting bracket 1100 in Fig. 2 aligns a side edge of the article A1, in other embodiments, the article may surround the main body if the supporting portion surrounds the main body. In addition, a distance between the sup-

porting portion 1110 and the outer surface 1121 is larger than or equal to 2 mm, and the distance indicates a distance between a farthest point of a contour of the outer surface 1121 and a nearest point of a contour of the supporting portion 1110.

[0030] As shown in Fig. 2, the article A1 may further include at least one central layer A13, and the at least one central layer A13 is located between the upper layer A11 and the lower layer A12. Precisely, the central layer A13 may be placed above the lower layer A12, and then the mounting bracket 1100 and the upper layer A11 are placed thereon. Consequently, as the thermal energy is provided to combine the upper layer A11, the lower layer A12 and the supporting portion 1110, the central layer A13 may be located between the lower layer A12 and the mounting bracket 1100 to increase the combination strength. The central layer A13 may be glue or meltable plastic, but the present disclosure is not limited thereto. It is noted that, in other embodiments, a size of the central layer is identical to a size of the supporting portion, but the present disclosure is not limited thereto.

[0031] Fig. 3 shows a three-dimensional schematic view of a lace coupling structure 2000 according to a second embodiment of the present disclosure. Fig. 4 shows a cross-section view of the lace coupling structure 2000 of the second embodiment of Fig. 3 assembling with an article A1. The lace coupling structure 2000 of the second embodiment is similar to the lace coupling structure 1000 of the first embodiment, but the difference is that the supporting portion 2110 includes a plurality of penetrating holes 2111 arranged with intervals. In other words, the supporting portion 2110 may include a supporting sheet 2112, and the penetrating holes 2111 penetrate the supporting sheet 2112. Hence, after an upper layer A11, a lower layer A12 and the supporting portion 2110 are welded, the upper layer A11 and the lower layer A12 located in the penetrating holes 2111 will also be welded, and the combination strength of the article A1 and the lace coupling structure 2000 is increased, thereby favorable for avoiding the lace coupling structure 2000 from separating from the article A1 as an external force pulls the article A1 and the lace coupling structure 2000.

[0032] Moreover, a central layer A13 may be placed below the upper layer A11, and as a thermal energy is provided to combine the upper layer A11, the lower layer A12 and the supporting portion 2110, the central layer A13 may be located between the upper layer A11 and the supporting portion 2110. In other embodiments, a number of the central layers may be two, and the two central layers may be respectively placed below the upper layer and above the lower layer, but the present disclosure is not limited thereto. It is noted that, although the structures of the upper layer A11, the central layer A13, the supporting portion 2110 and the lower layer A12 are separately illustrated in Fig. 4, the structures may be welded into one, and it is not limited by the drawings.

[0033] Fig. 5 shows a three-dimensional schematic view of a lace coupling structure 3000 according to a

third embodiment of the present disclosure. Fig. 6 shows an exploded view of the lace coupling structure 3000 of the third embodiment of Fig. 5. The lace coupling structure 3000 is a reel device, and therefore the lace coupling structure 3000 may further include a reel assembly 3300. The reel assembly 3300 is disposed at a mounting bracket 3100 and includes a housing 3310 detachably connected to the mounting bracket 3100 to form an inner space with the mounting bracket 3100, and a spool 3320 located within the inner space and configured for a lace to be wound therearound.

[0034] To be more specific, the reel assembly 3300 may further include an engaging unit 3330, a knob 3340 and a connecting unit 3350. The engaging unit 3330 is disposed above the spool 3320, the knob 3340 covers the housing 3310, and the connecting unit 3350 connects the spool 3320 to the knob 3340. With the operation of the knob 3340, the lace may be wound around or released from spool 3320. In the present disclosure, the reel assembly 3300 is not an improving point, and the details thereof will not be described. Moreover, the components of the reel assembly 3300 may be replaced with other components having identical functions, and the present disclosure is not limited thereto.

[0035] The main body 3120 and the supporting portion 3110 may be disc-shaped, and the main body 3120 may further include engaging holes for corresponding to tabs of the housing 3310 so as to assemble with the housing 3310. Hence, as the mounting bracket 3100 is assembled to an article using the same method similar to the first embodiment, the main body 3120 may be exposed to couple to the housing 3310. Other details similar to the first embodiment will not be repeated.

[0036] Fig. 7 shows a three-dimensional schematic view of a mounting bracket 4100 of a lace coupling structure according to a fourth embodiment of the present disclosure. The mounting bracket 4100 is similar to the mounting bracket 3100 of the third embodiment and includes a main body 4120 and a supporting portion 4110, but the supporting portion 4110 may include a supporting sheet 4112 and a plurality of penetrating holes 4111 penetrating the supporting sheet 4112.

[0037] Fig. 8 shows a three-dimensional schematic view of a mounting bracket 5100 of a lace coupling structure according to a fifth embodiment of the present disclosure. The mounting bracket 5100 is similar to the mounting bracket 3100 of the third embodiment, but a shape of a supporting portion 5110 is different.

[0038] Fig. 9 shows a three-dimensional schematic view of a mounting bracket 6100 of a lace coupling structure according to a sixth embodiment of the present disclosure. The mounting bracket 6100 is similar to the mounting bracket 4100 of the fourth embodiment, but a shape of a supporting portion 6110 is different.

[0039] Fig. 10 shows one three-dimensional schematic view of a mounting bracket 7100 of a lace coupling structure according to a seventh embodiment of the present disclosure. Fig. 11 shows another three-dimensional

schematic view of the mounting bracket 7100 of the seventh embodiment of Fig. 10. The mounting bracket 7100 includes a main body 7120, a supporting portion 7110, and a mounting flange 7130. The supporting portion 7110 extends outward from an outer surface of the main body 7120. The supporting portion 7110 and the main body 7120 are made by a first thermoplastic material. The mounting flange 7130 extends outward from the main body 7120 and is connected to the supporting portion 7110. The mounting flange 7130 is made by a second thermoplastic material. A melting point of the second thermoplastic material is lower than a melting point of the first thermoplastic material, and the mounting flange 7130 is configured to be welded to combine to an article A1 (shown in Fig. 12). The melting point of the first thermoplastic material and the melting point of the second thermoplastic material may be larger than or equal to 60 °C and smaller than or equal to 250 °C.

[0040] Fig. 12 shows a cross-section view of the mounting bracket 7100 of the seventh embodiment of Fig. 10 assembling to the article A1 taken along line 12-12. Fig. 13 shows a cross-section view of the mounting bracket 7100 of the seventh embodiment of Fig. 10 assembling to the article A1 taken along line 13-13. Please refer to Figs. 12 to 13 with references of Figs. 10 to 11, the supporting portion 7110 of the mounting bracket 7100 includes four supporting frames 7113, four ribs 7114 and four penetrating holes 7111. Two of the supporting frames 7113 are located at one side of a main body 7120 relative to a Y axis and are spaced apart from each other along an axis of the main body 7120. The other two of the supporting frames 7113 are located at the other side of the main body 7120 relative to the Y axis and are spaced apart from each other along the axis of the main body 7120. Similarly, two of the ribs 7114 are located at one side of the main body 7120 relative to the X axis and are spaced apart from each other along the axis of the main body 7120. The other two of the ribs 7114 are located at the other side of the main body 7120 relative to the X axis and are spaced apart from each other along the axis of the main body 7120. The four penetrating holes 7111 are respectively located at the four supporting frames 7113.

[0041] In the seventh embodiment, the supporting frames 7113 and the ribs 7114 located at an upper side may be deemed as an upper part of the supporting portion 7110, and the supporting frames 7113 and the ribs 7114 located at a lower side may be deemed as a lower part of the supporting portion 7110. The upper part may protrude from an upper surface of the mounting flange 7130, and the lower part may protrude from a lower surface of the mounting flange 7130. The main body 7120 may include a ring groove extending inward from an outer surface thereof to correspond to a gap between the upper part and the lower part, and the ring groove is configured for connecting the mounting flange 7130, thereby increasing the combination strength between the main body 7120 and the mounting flange 7130.

In one embodiment, the mounting flange made by the second thermoplastic material is formed first, and then the main body and the supporting portion made by the first thermoplastic material are formed by insert molding, but the present disclosure is not limited thereto.

[0042] As shown in Fig. 12, as combining the article A1, an upper layer A11 and a lower layer A12 clamp the ribs 7114 and the mounting flange 7130, and as shown in Fig. 13, the upper layer A11 and the lower layer A12 clamp the supporting frames 7113 and the mounting flange 7130. Hence, as conducting the thermocompression welding or the ultrasonic welding, a temperature may be controlled, and only the second thermoplastic material having the lower melting point is melted so as to weld with the upper layer A11 and the lower layer A12. With the structure of the supporting portion 7110, the combination strength of the mounting bracket 7100 and the article A1 may be increased.

[0043] Furthermore, a distance, i.e., a first distance, between an outer periphery of the mounting flange 7130 and the outer surface of the main body 7120 along the X axis is larger than 2 mm, for example 5 mm. A distance, i.e., a second distance, between the farthest point of the supporting frames 7113 and the outer surface of the main body 7120, and a distance, i.e., a third distance, between the farthest point of the ribs 7114 and the outer surface of the main body 7120 are smaller than the first distance.

[0044] Fig. 14 shows a three-dimensional schematic view of a mounting bracket 8100 of a lace coupling structure according to an eighth embodiment of the present disclosure. Fig. 15 shows a cross-section view of the mounting bracket 8100 of the eighth embodiment of Fig. 14 taken along line 15-15. The mounting bracket 8100 is similar to the mounting bracket 7100 of the seventh embodiment, but a supporting portion 8110 of the mounting bracket 8100 does not include the supporting frames 7113 and the penetrating holes 7111 as shown in Fig. 10, but includes a plurality of ribs 8114 arranged with intervals. Similarly, two of the ribs 8114 are spaced apart from each other along an axis of a main body 8120 of the mounting bracket 8100 at the same position near the main body 8120, but the supporting portion 8110 further includes a plurality of connecting portions 8115 respectively connected between two of the ribs 8114 that are spaced apart from each other along the axis. Hence, the combination strength between a mounting flange 8130 and the main body 8120 is increased. In other embodiments, no connecting portion is contained between two ribs.

[0045] Fig. 16 shows a three-dimensional schematic view of a mounting bracket 9100 of a lace coupling structure according to a ninth embodiment of the present disclosure. A supporting portion 9110 of the mounting bracket 9100 may include a supporting sheet 9112 and a plurality of penetrating holes 9111 penetrating the supporting sheet 9112. The penetrating holes 9111 may penetrate the supporting sheet 9112 along an outer surface of a main body 9120, thereby dividing the supporting

sheet 9112 into a plurality of ribs and an annular ring.

[0046] Fig. 17 shows one three-dimensional schematic view of a mounting bracket 10100 of a lace coupling structure according to a tenth embodiment of the present disclosure. Fig. 18 shows another three-dimensional schematic view of the mounting bracket 10100 of the tenth embodiment of Fig. 17. The mounting bracket 10100 is similar to the mounting bracket 8100 of the eighth embodiment, but only one rib 10114 is located at the same position near a main body 10120 of the mounting bracket 10100, the connecting portion 8115 of the eighth embodiment is not included, and a mounting flange 10130 is located above ribs 10114.

[0047] Fig. 19 shows a block flow chart of a lace coupling structure assembling method S1000 according to an eleventh embodiment of the present disclosure. The lace coupling structure assembling method S1000 includes a mounting bracket placing step S1100 and a mounting bracket welding step S1200.

[0048] Please refer to Figs. 1 and 2, in the mounting bracket placing step S1100, the article A1 includes the upper layer A11 and the lower layer A12. The mounting bracket 1100 of the at least one lace coupling structure 1000 is placed on the article A1. The mounting bracket 1100 of the at least one lace coupling structure 1000 includes the main body 1120 and the supporting portion 1110, the main body 1120 and the supporting portion 1110 are made by the first thermoplastic material, and the supporting portion 1110 of the at least one lace coupling structure 1000 is located between the upper layer A11 and the lower layer A12.

[0049] In the mounting bracket welding step S1200, the thermal energy is provided, and the upper layer A11 and the lower layer A12 are welding to combine the mounting bracket 1100 and the article A1.

[0050] The lace coupling structure assembling method S1000 may further include a lace coupling step S1300. A number of the at least one lace coupling structure 1000 is equal to or more than two. The lace coupling structures 1000 are arranged at the article A1 with intervals. Each of the lace coupling structures 1000 includes the passage 1200 on the mounting bracket 1100. The lace is passed through the passage 1200 of a first one of the lace coupling structures 1000, and then the lace is passed through the passage 1200 of a second one of the lace coupling structures 1000.

[0051] Please refer to Figs. 5 and 6, in another embodiment, in the lace coupling step, a number of the at least one lace coupling structure 3000 is one. The lace coupling structure 3000 may further include the reel assembly 3300 including the spool 3320, and the reel assembly 3300 is connected to the mounting bracket 3100 after the lace is wound around the spool 3320.

[0052] For example, as the article A1 is a shoe, a plurality of lace coupling structures 1000 of the first embodiment may be installed at a first side and a second side of the shoe by the aforementioned method to be served as the lace guiding members. The lace coupling

structure 3000 of the third embodiment may be installed at the tongue of the shoe by the aforementioned method to be served as the reel device. Hence, the lace can pass through the lace coupling structures 1000 which are served as the lace guiding members first, and then may couple to the lace coupling structure 3000 which is served as the reel device, thereby fastening the shoe by tensioning the lace.

[0053] Fig. 20 shows a three-dimensional schematic view of a lace coupling structure 12000 according to a twelfth embodiment of the present disclosure. The lace coupling structure 12000 may be served as a lace guiding member and is similar to the lace coupling structure 2000 of the second embodiment. The difference is that a supporting portion 12110 surrounds a main body 12120. It is noted that, there is not real boundary between the supporting portion 12110 and the board portion of the main body 12120, and the division of the supporting portion 12110 and the board portion of the main body 12120 is only for convenience illustration. Moreover, as conducting welding, only the supporting portion 12110 is welded. In other words, the portion which is not welded is called the board portion. It is further noted that, in other embodiments, if the main body is totally enclosed by the article, there is no requirement to distinguish the board portion and the supporting portion.

[0054] Fig. 21 shows a three-dimensional schematic view of a lace coupling structure 13000 according to a thirteenth embodiment of the present disclosure. The lace coupling structure 13000 is similar to the lace coupling structure 12000, but a supporting portion 13110 of the lace coupling structure 13000 does not include through holes.

[0055] Fig. 22 shows a three-dimensional schematic view of a lace coupling structure 14000 according to a fourteenth embodiment of the present disclosure. Fig. 23 shows a side view of the lace coupling structure 14000 of the fourteenth embodiment of Fig. 22. The lace coupling structure 14000 may be served as a lace guiding member. The lace coupling structure 14000 may include a guiding groove 14400 located at a mounting bracket 14100, and the guiding groove 14400 is for contacting and guiding a lace. Precisely, the mounting bracket 14100 includes a supporting portion 14110 and a main body 14120, a curved board extends horizontally from the main body 14120, and the guiding groove 14400 is formed between the curved board and a board portion of the main body 14120. The mounting bracket 14100 may further include a positioning portion 14130 located at the supporting portion 14110, and the positioning portion 14130 is for a lace coupling structure assembling fixture to be correspondingly aligned. In the fourteenth embodiment, the positioning portion 14130 may have a through hole structure, and two positioning portions 14130 are included. The two positioning portions 14130 may be symmetrically disposed at the supporting portion 14110, but the present disclosure is not limited thereto.

[0056] Fig. 24 shows a top view of a lace coupling

structure 15000 according to a fifteenth embodiment of the present disclosure. The lace coupling structure 15000 may be served as a lace guiding member and is similar to the lace coupling structure 14000 of the fourteenth embodiment, but a supporting portion 15110 may include a plurality of penetrating holes 15111 arranged with intervals. Precisely, a number of the penetrating holes 15111 may be six, three of the penetrating holes 15111 are near a guiding groove 15400, and the other three of the penetrating holes 15111 are far away from the guiding groove 15400. Two positioning portions 15130 are respectively near two openings of the guiding groove 15400.

[0057] Fig. 25 shows one three-dimensional schematic view of a lace coupling structure assembling fixture 16000 according to a sixteenth embodiment of the present disclosure clamping a mounting bracket B100 of a lace coupling structure and two central layers C110, C120. Fig. 26 shows another three-dimensional schematic view of the lace coupling structure assembling fixture 16000 of the sixteenth embodiment of Fig. 25 clamping the mounting bracket B100 and the two central layers C110, C120. Fig. 27 shows a cross-section view of the lace coupling structure assembling fixture 16000 of the sixteenth embodiment of Fig. 25 clamping the mounting bracket B100 taken along line 27-27. It is noted that the central layers C110, C120 are omitted in Fig. 27 owing to the thickness. The lace coupling structure assembling fixture 16000 is applied for assembling the mounting bracket B100 to an article. The lace coupling structure assembling fixture 16000 includes a first mold 16500 and a second mold 16600. In Figs. 25 to 27, the mounting bracket B100 is similar to the mounting bracket 3100 of the third embodiment, but two positioning portions B131 are located at a supporting portion B110. The supporting portion B110 may include a plurality of depressions B111 surround the supporting portion B110, and the two positioning portions B131 are nearer a main body B120 than the depressions B111.

[0058] The first mold 16500 includes a first pressing seat 16510, and the first pressing seat 16510 is for the mounting bracket B100 to be placed thereon. The second mold 16600 corresponds to the first mold 16500 and includes a second pressing seat 16610. The article includes an upper layer and a lower layer. As the mounting bracket B100 is placed between the first pressing seat 16510 and the second pressing seat 16610, the upper layer is located between the supporting portion B110 and the first pressing seat 16510, the lower layer is located between the second pressing seat 16610 and the supporting portion B110, and the first pressing seat 16510 and the second pressing seat 16610 generate a thermal energy to weld the upper layer, the lower layer and the supporting portion B110.

[0059] To be more specific, the first mold 16500 may further include four positioning posts 16540, an annular groove 16520 and a positioning member 16530. The first pressing seat 16510 is substantially a rectangular block.

The annular groove 16520 is disposed at one side of the first pressing seat 16510 facing toward the second pressing seat 16610. The positioning member 16530 is disposed at the side of the first pressing seat 16510 facing toward the second pressing seat 16610. The four positioning posts 16540 are respectively located at four corners of the first pressing seat 16510 and face toward the second pressing seat 16610. As the mounting bracket B100 is placed between the first pressing seat 16510 and the second pressing seat 16610, the main body B120 exposes from a hole of the upper layer to protrude into the annular groove 16520, and the positioning member 16530 correspond to the positioning portion B131. The first pressing seat 16510 includes a first boss located at the side of the first pressing seat 16510 facing toward the second pressing seat 16610. The first boss includes a first pressing surface 16511 and the first pressing surface 16511 faces toward the supporting portion B110. The first pressing surface 16511 is divided into a central area and a pressing area by the annular groove 16520, the central area corresponds to a recess of the main body B120, and the pressing area corresponds to the supporting portion B110. The positioning member 16530 may be disposed at the pressing area so as to correspond to the positioning portion B131 of the supporting portion B110. The first mold 16500 may further include a plurality of bumps 16550 disposed annularly at the first pressing surface 16511. More particular, the bumps 16550 are aligned at the pressing area of the first pressing surface 16511, and the positioning member 16530 may be radially located between the annular groove 16520 and the bumps 16550.

[0060] The second mold 16600 may further include four through holes 16620, and the four through holes 16620 penetrate the second pressing seat 16610 and are configured for the four positioning posts 16540 to pass therethrough. The second pressing seat 16610 may include a second boss, and the second boss has a second pressing surface 16611. A shape of the second pressing surface 16611 corresponds to a shape of an assembling bottom surface of the mounting bracket B100. Since the assembling bottom surface slightly protrudes outward, the second pressing surface 16611 slightly protrude inward to match the assembling bottom surface.

[0061] The central layer C110 is ring-shaped and can be placed between the first pressing seat 16510 and the mounting bracket B100. The central layer C120 is also ring-shaped and can be placed between the mounting bracket B100 and the second pressing seat 16610. Shapes of the central layers C110, C120 correspond to a shape of the supporting portion B110 of the mounting bracket B100. In the welding, the upper layer, the central layer C110, the mounting bracket B100, the central layer C120 and the lower layer are sequentially placed on the first pressing seat 16510, the positioning members 16530 protrude into the positioning portions B131 of the mounting bracket B100, and then the bumps 16550 protrude into the depressions B111. After which,

the second pressing seat 16610 of the second mold 16600 is placed to allow the positioning posts 16540 to pass through the through holes 16620, thereby favorable for positioning. Finally, the upper layer, the central layer C110, the mounting bracket B100, the central layer C120 and the lower layer are welded, and a plurality of indentations corresponding to the depressions B111 are obviously shown in the upper layer of the article.

[0062] Fig. 28 shows one three-dimensional schematic view of a lace coupling structure assembling fixture 17000 according to a seventeenth embodiment of the present disclosure clamping a mounting bracket B200 of a lace coupling structure and two central layers C210, C220. Fig. 29 shows another three-dimensional schematic view of the lace coupling structure assembling fixture 17000 of the seventeenth embodiment of Fig. 28 clamping the mounting bracket B200 and the two central layers C210, C220. Fig. 30 shows a cross-section view of the lace coupling structure assembling fixture 17000 of the seventeenth embodiment of Fig. 28 clamping the mounting bracket B200 taken along line 30-30. It is noted that the central layers C210, C220 are omitted in Fig. 30 owing to the thickness. The lace coupling structure assembling fixture 17000 is similar to the lace coupling structure assembling fixture 16000 of the sixteenth embodiment, but the first mold 17500 does not include the bumps 16550 as the first mold 16500, and positioning members 17530 are located at the central area, that is, being radially inward relative to an annular groove 17520. Positioning portions B221 may be located at a main body B220 to correspond to the positioning members 17530.

[0063] As shown in Figs. 28 to Fig. 30, with that the first pressing seat 17510 and the second pressing seat clamping and thermally pressing the upper layer, the lower layer, the central layers C210, C220 and the mounting bracket B200, the upper layer, the lower layer, the central layers C210, C220 and the mounting bracket B200 are welded. Since a supporting portion B210 of the mounting bracket B200 does not include depressions or through holes, no indentation is obviously shown on the upper layer of the article. It is noted that, the mounting bracket B200 may be welded by the lace coupling structure assembling fixture 16000 of the sixteenth embodiment, and higher temperature or longer heating time may be used to form depressions on the supporting portion B210, and indentations are obviously shown on the upper layer of the article, but the present disclosure is not limited thereto.

[0064] Fig. 31 shows one three-dimensional schematic view of a lace coupling structure assembling fixture 18000 according to an eighteenth embodiment of the present disclosure clamping a mounting bracket B300 of a lace coupling structure and two central layers C310, C320. Fig. 32 shows another three-dimensional schematic view of the lace coupling structure assembling fixture 18000 of the eighteenth embodiment of Fig. 31 clamping the mounting bracket B300 and the two central layers C310, C320. Fig. 33 shows a cross-section view of

the lace coupling structure assembling fixture 18000 of the eighteenth embodiment of Fig. 31 clamping the mounting bracket B300 taken along line 33-33. It is noted that the central layers C310, C320 are omitted in Fig. 33 owing to the thickness. The lace coupling structure assembling fixture 18000 is similar to the lace coupling structure assembling fixture 16000 of the sixteenth embodiment and includes a first mold 18500 and a second mold 18600, and the first mold 18500 includes the bumps 18550 and a first pressing seat 18510, but positions of positioning portions B321 are different. The positioning portions B321 of the mounting bracket B300 are disposed at a main body B320. A supporting portion B310 includes throughout penetrating holes B311, and an upper layer and a lower layer in the penetrating holes B311 may be welded. The details will not be repeated.

Claims

1. A lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000), which is applied for being assembled to an article (A1), **characterized in** the lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) comprising:

a mounting bracket (1100, 3100, 4100, 5100, 6100, 7100, 8100, 9100, 10100, 14100, B100, B200, B300), comprising:

a main body (1120, 3120, 4120, 7120, 8120, 9120, 10120, 12120, 14120, B120, B220, B320); and

a supporting portion (1110, 2110, 3110, 4110, 5110, 6110, 7110, 8110, 9110, 12110, 13110, 14110, 15110, B110, B210, B310) extending outward and integrally from an outer surface (1121) of the main body (1120, 3120, 4120, 7120, 8120, 9120, 10120, 12120, 14120, B120, B220, B320), the supporting portion (1110, 2110, 3110, 4110, 5110, 6110, 7110, 8110, 9110, 12110, 13110, 14110, 15110, B110, B210, B310) and the main body (1120, 3120, 4120, 7120, 8120, 9120, 10120, 12120, 14120, B120, B220, B320) being made by a first thermoplastic material;

wherein the supporting portion (1110, 2110, 3110, 4110, 5110, 6110, 7110, 8110, 9110, 12110, 13110, 14110, 15110, B110, B210, B310) is covered by the article (A1).

2. The lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) of claim 1, wherein the article (A1) comprises an upper layer (A11) and a lower layer (A12), the upper layer (A11) comprises a hole for the main body (1120, 3120, 4120, 7120,

8120, 9120, 10120, 12120, 14120, B120, B220, B320) to expose therefrom, the supporting portion (1110, 2110, 3110, 4110, 5110, 6110, 7110, 8110, 9110, 12110, 13110, 14110, 15110, B110, B210, B310) is between the upper layer (A11) and the lower layer (A12), and the upper layer (A11) and the lower layer (A12) are welded to combine the mounting bracket (1100, 3100, 4100, 5100, 6100, 7100, 8100, 9100, 10100, 14100, B100, B200, B300) and the article (A1).

3. The lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) of any of claims 1 to 2, wherein the supporting portion (1110, 2110, 3110, 4110, 5110, 6110, 7110, 8110, 9110, 12110, 13110, 14110, 15110, B110, B210, B310) comprises a plurality of penetrating holes (2111, 4111, 7111, 9111, 15111, B311) arranged with intervals, and the upper layer (A11) and the lower layer (A12) in the penetrating holes (2111, 4111, 7111, 9111, 15111, B311) are welded.

4. The lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) of any of claims 1 to 3, wherein the article (A1) further comprises at least one central layer (A13, C110, C120, C210, C220, C310, C320), and the at least one central layer (A13, C110, C120, C210, C220, C310, C320) is located between the upper layer (A11) and the lower layer (A12).

5. The lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) of any of claims 1 to 4, wherein the mounting bracket (1100, 3100, 4100, 5100, 6100, 7100, 8100, 9100, 10100, 14100, B100, B200, B300) further comprises a positioning portion (14130, 15130, B131, B221, B321) located at the main body (1120, 3120, 4120, 7120, 8120, 9120, 10120, 12120, 14120, B120, B220, B320) or the supporting portion (1110, 2110, 3110, 4110, 5110, 6110, 7110, 8110, 9110, 12110, 13110, 14110, 15110, B110, B210, B310), and the positioning portion (14130, 15130, B131, B221, B321) is configured for a lace coupling structure assembling fixture (16000, 17000, 18000) to be correspondingly aligned.

6. The lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) of any of claims 1 to 5, where a distance between the supporting portion (1110, 2110, 3110, 4110, 5110, 6110, 7110, 8110, 9110, 12110, 13110, 14110, 15110, B110, B210, B310) and the outer surface (1121) is larger than or equal to 2 mm.

7. The lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) of any of claims 1 to 6, further comprising:

a reel assembly (3300) disposed at the mounting bracket (1100, 3100, 4100, 5100, 6100, 7100, 8100, 9100, 10100, 14100, B100, B200, B300) and comprising:

a housing (3310) detachably connected to the mounting bracket (1100, 3100, 4100, 5100, 6100, 7100, 8100, 9100, 10100, 14100, B100, B200, B300) to form an inner space with the mounting bracket (1100, 3100, 4100, 5100, 6100, 7100, 8100, 9100, 10100, 14100, B100, B200, B300); and
a spool (3320) located within the inner space and configured for a lace to be wound there-around.

8. The lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) of any of claims 1 to 7, further comprising:

a mounting flange (7130, 8130, 10130) extending outward from the main body (1120, 3120, 4120, 7120, 8120, 9120, 10120, 12120, 14120, B120, B220, B320) and connected to the supporting portion (1110, 2110, 3110, 4110, 5110, 6110, 7110, 8110, 9110, 12110, 13110, 14110, 15110, B110, B210, B310), the mounting flange (7130, 8130, 10130) being made by a second thermoplastic material, wherein a melting point of the second thermoplastic material is lower than a melting point of the first thermoplastic material, and the mounting flange (7130, 8130, 10130) is configured to be welded with the article (A1).

9. The lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) of any of claims 1 to 8, wherein the supporting portion (1110, 2110, 3110, 4110, 5110, 6110, 7110, 8110, 9110, 12110, 13110, 14110, 15110, B110, B210, B310) comprises a plurality of ribs (7114, 8114, 10114) arranged with intervals.

10. The lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) of any of claims 1 to 9, wherein the supporting portion (1110, 2110, 3110, 4110, 5110, 6110, 7110, 8110, 9110, 12110, 13110, 14110, 15110, B110, B210, B310) comprises an upper part and a lower part, the upper part protrudes from an upper surface of the mounting flange (7130, 8130, 10130), and the lower part protrudes from a lower surface of the mounting flange (7130, 8130, 10130).

11. The lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) of any of claims 1 to 10, wherein a distance between an outer periphery of the mounting flange (7130, 8130, 10130) and the outer surface (1121) is larger than or equal to 2 mm.

12. The lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) of any of claims 1 to 11, wherein each of the melting point of the first thermoplastic material and the melting point of the second thermoplastic material is larger than or equal to 60 °C and smaller than or equal to 250 °C.

13. A lace coupling structure assembling method (S1000), **characterized in** comprising:

a mounting bracket placing step (S1100), wherein an article (A1) comprises an upper layer (A11) and a lower layer (A12), a mounting bracket (1100, 3100, 4100, 5100, 6100, 7100, 8100, 9100, 10100, 14100, B100, B200, B300) of at least one lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) is placed on the article (A1), the mounting bracket (1100, 3100, 4100, 5100, 6100, 7100, 8100, 9100, 10100, 14100, B100, B200, B300) of the at least one lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) comprises a main body (1120, 3120, 4120, 7120, 8120, 9120, 10120, 12120, 14120, B120, B220, B320) and a supporting portion (1110, 2110, 3110, 4110, 5110, 6110, 7110, 8110, 9110, 12110, 13110, 14110, 15110, B110, B210, B310), the main body (1120, 3120, 4120, 7120, 8120, 9120, 10120, 12120, 14120, B120, B220, B320) and the supporting portion (1110, 2110, 3110, 4110, 5110, 6110, 7110, 8110, 9110, 12110, 13110, 14110, 15110, B110, B210, B310) are made by a first thermoplastic material, and the supporting portion (1110, 2110, 3110, 4110, 5110, 6110, 7110, 8110, 9110, 12110, 13110, 14110, 15110, B110, B210, B310) of the at least one lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) is located between the upper layer (A11) and the lower layer (A12); and

a mounting bracket welding step (S1200), wherein a thermal energy is provided, and the upper layer (A11) and the lower layer (A12) are welding to combine the mounting bracket (1100, 3100, 4100, 5100, 6100, 7100, 8100, 9100, 10100, 14100, B100, B200, B300) of the at least one lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) to the article (A1).

14. The lace coupling structure assembling method (S1000) of claim 13, further comprising:

a lace coupling step (S1300), wherein a number of the at least one lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) is equal to or more than two, the lace coupling structures (1000, 2000, 3000, 12000, 13000, 14000, 15000) are arranged at the article (A1) with intervals, each of the lace coupling structures (1000, 2000, 3000, 12000,

13000, 14000, 15000) comprises a passage (1200) on the mounting bracket (1100, 3100, 4100, 5100, 6100, 7100, 8100, 9100, 10100, 14100, B100, B200, B300), a lace is passed through the passage (1200) of a first one of the lace coupling structures (1000, 2000, 3000, 12000, 13000, 14000, 15000), and then the lace is passed through the passage (1200) of a second one of the lace coupling structures (1000, 2000, 3000, 12000, 13000, 14000, 15000).

10

- 15.** The lace coupling structure assembling method (S1000) of any of claims 13 to 14, further comprising: a lace coupling step (S1300), wherein a number of the at least one lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) is one, the lace coupling structure (1000, 2000, 3000, 12000, 13000, 14000, 15000) further comprises a reel assembly (3300) comprising a spool (3320), and the reel assembly (3300) is connected to the mounting bracket (1100, 3100, 4100, 5100, 6100, 7100, 8100, 9100, 10100, 14100, B100, B200, B300) after a lace is wound around the spool (3320).

25

30

35

40

45

50

55

1000

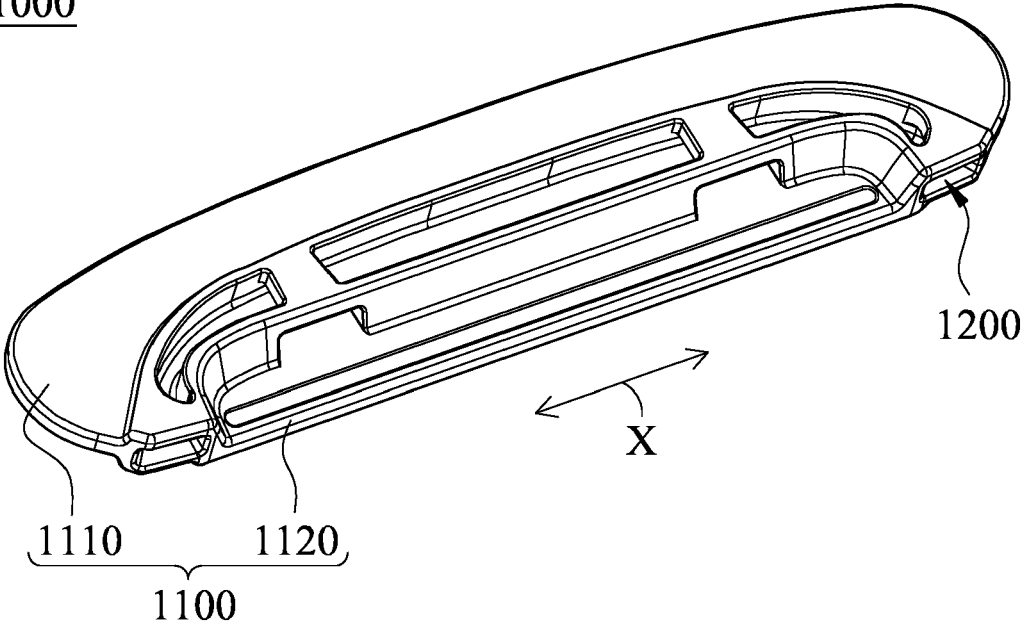


Fig. 1

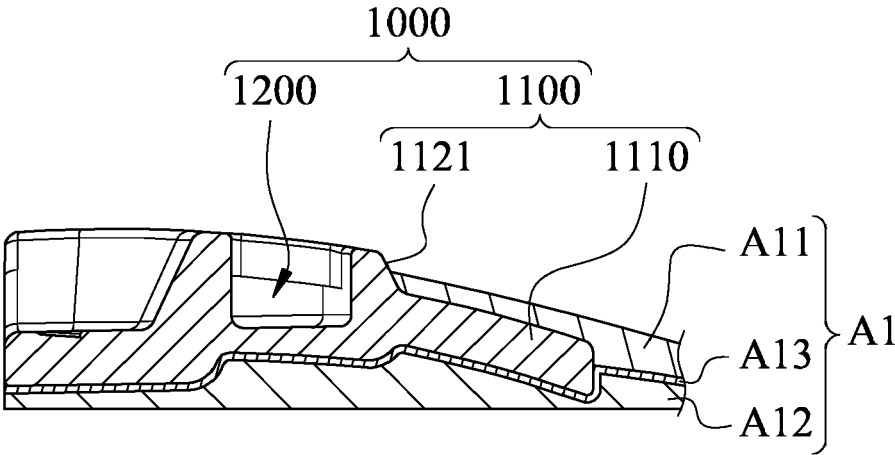


Fig. 2

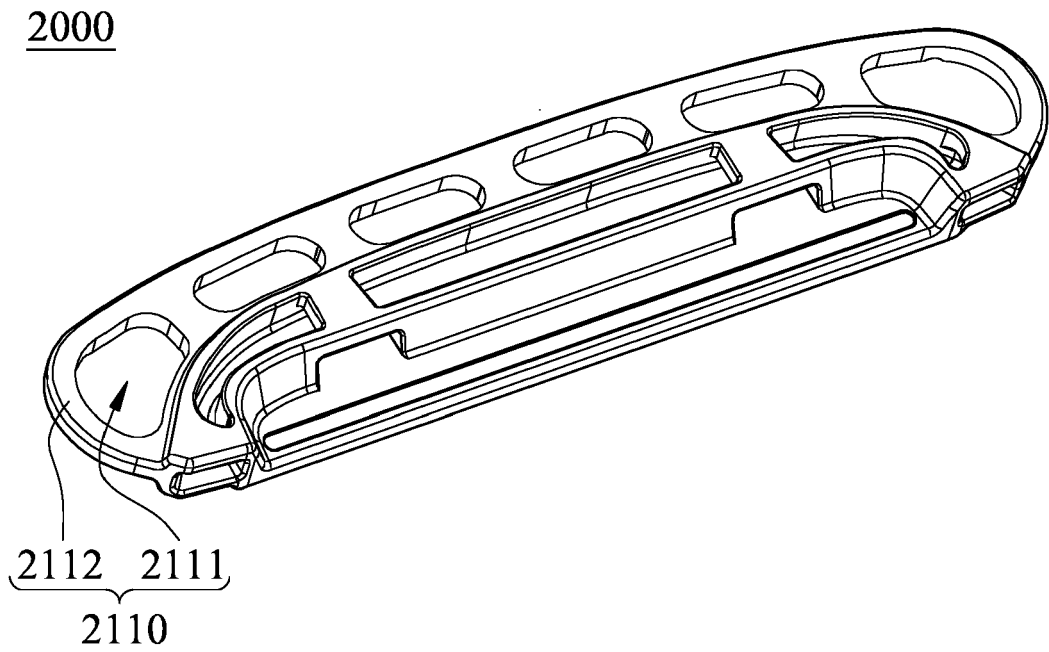


Fig. 3

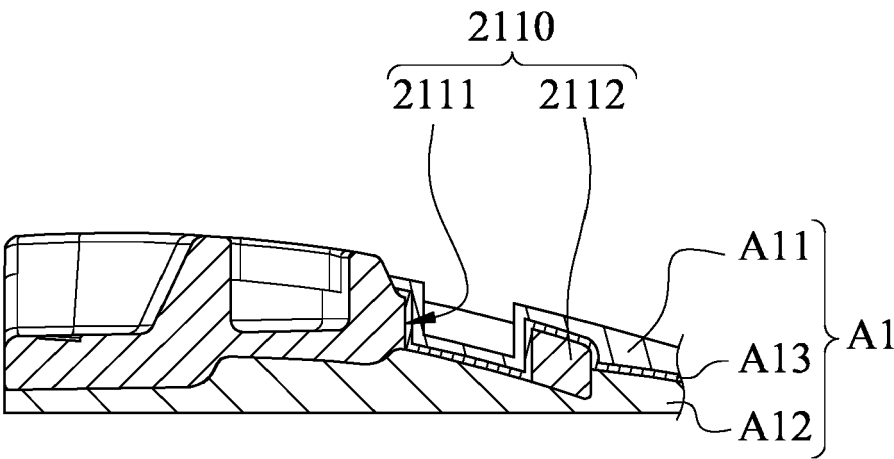


Fig. 4

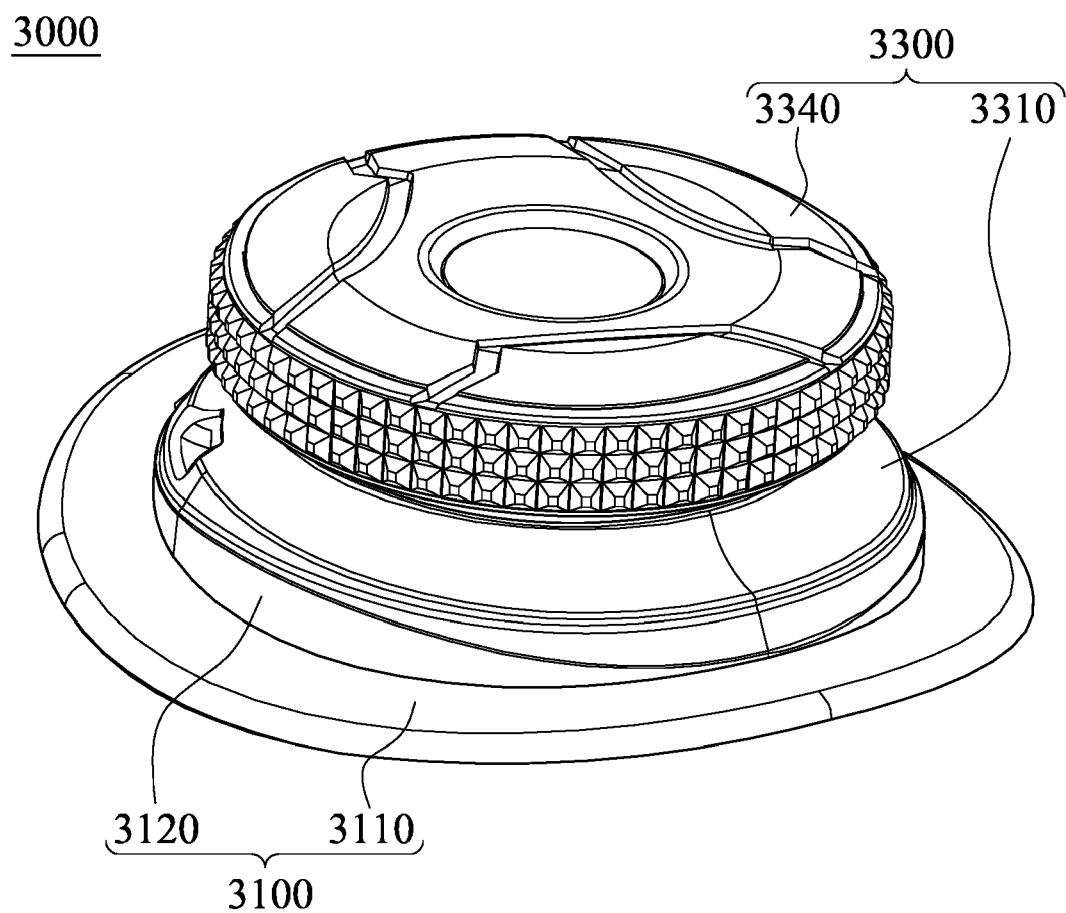


Fig. 5

3000

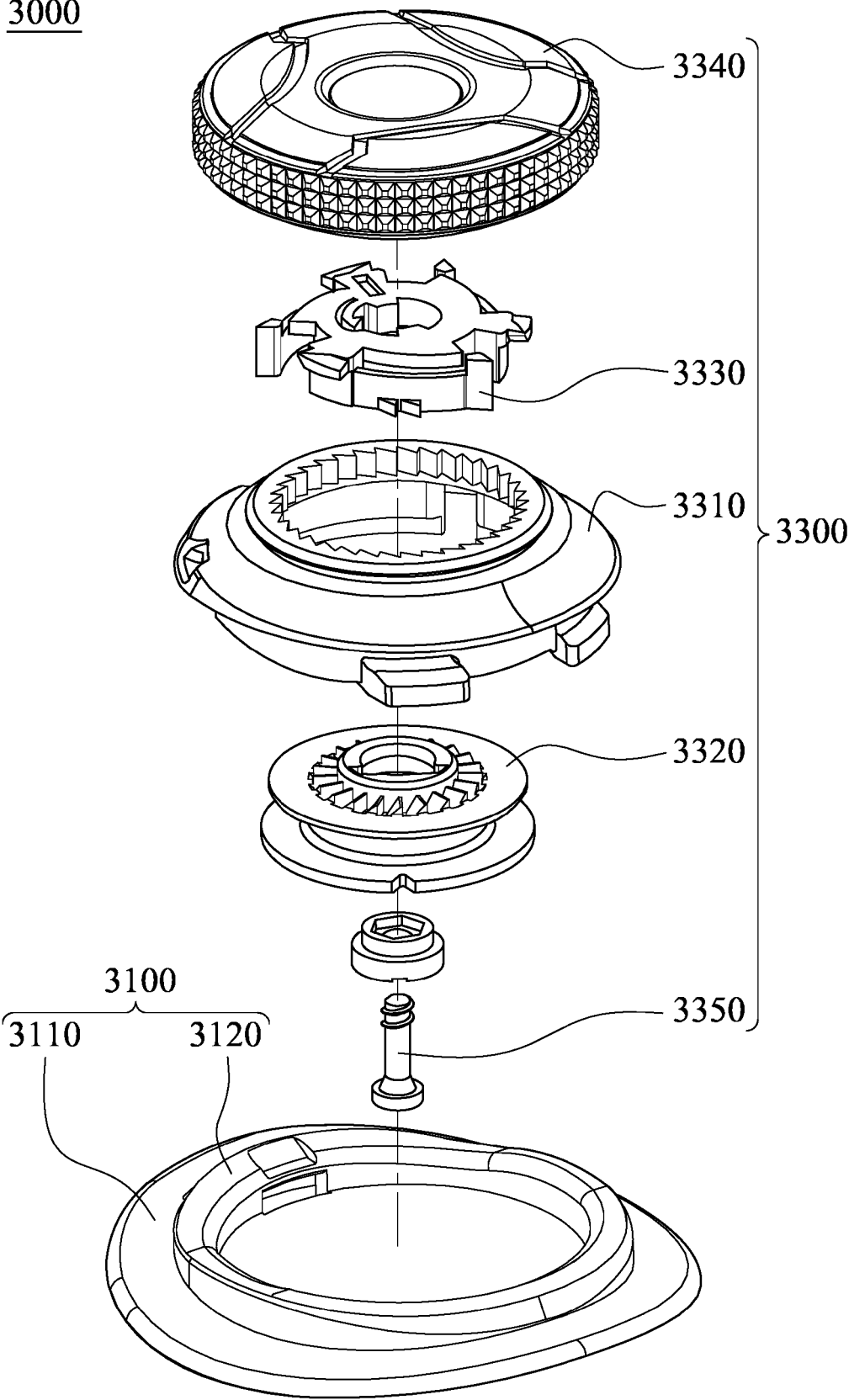


Fig. 6

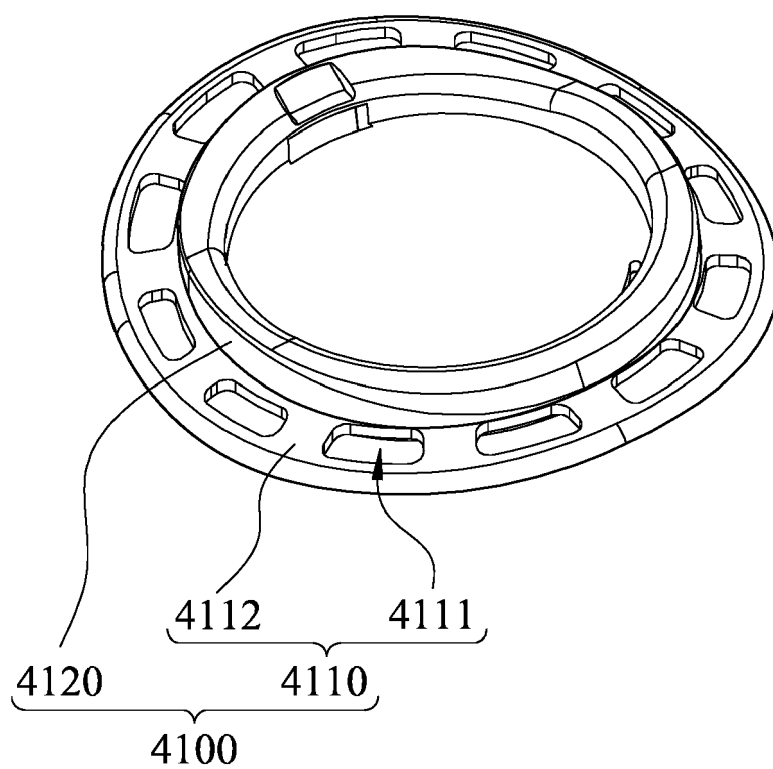


Fig. 7

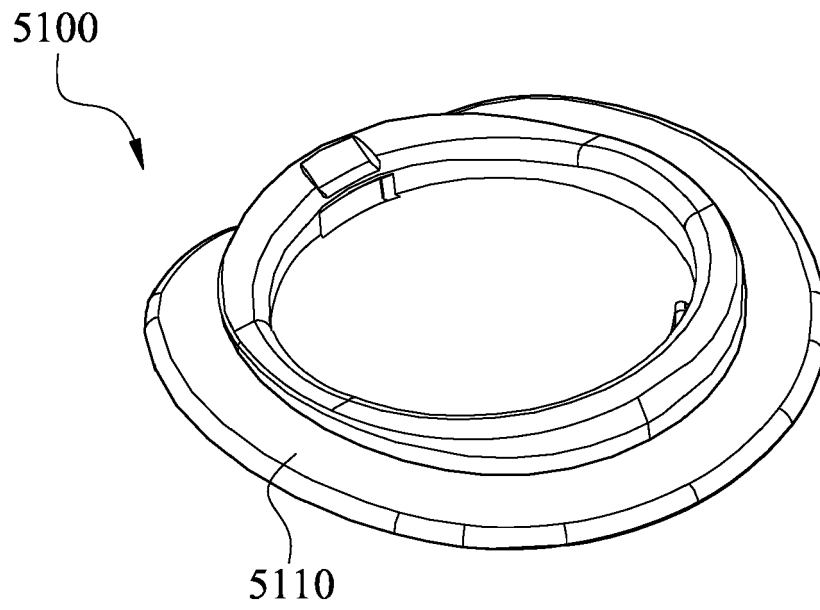


Fig. 8

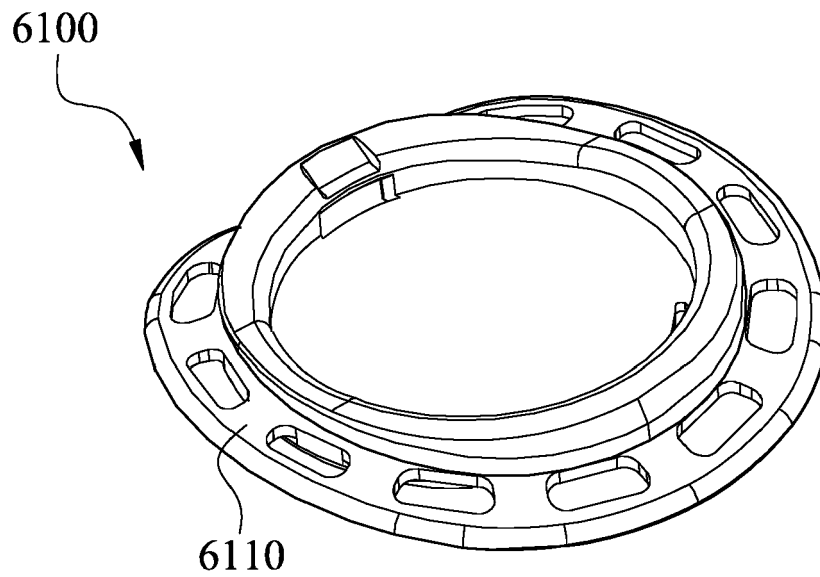


Fig. 9

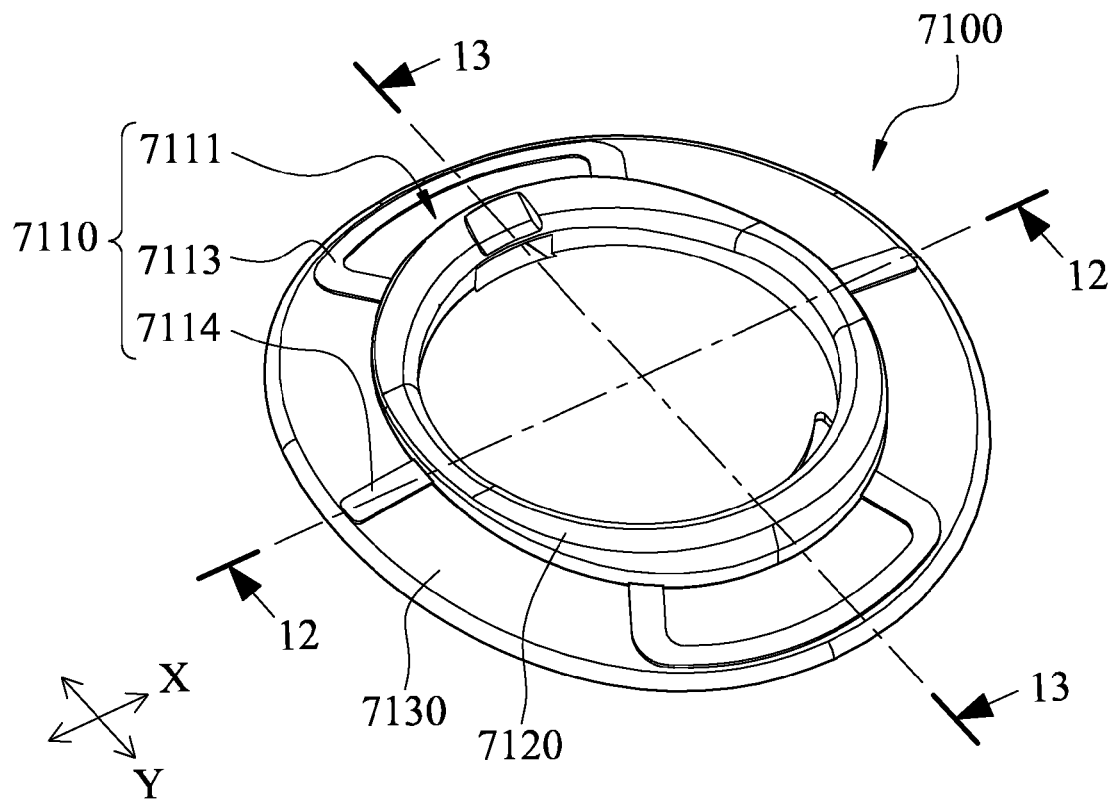


Fig. 10

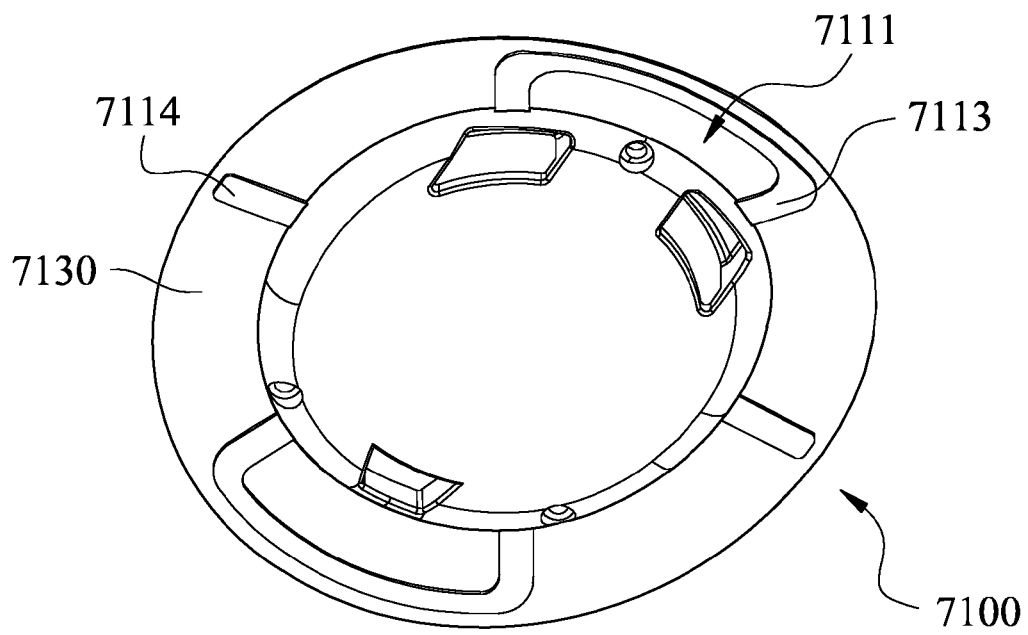


Fig. 11

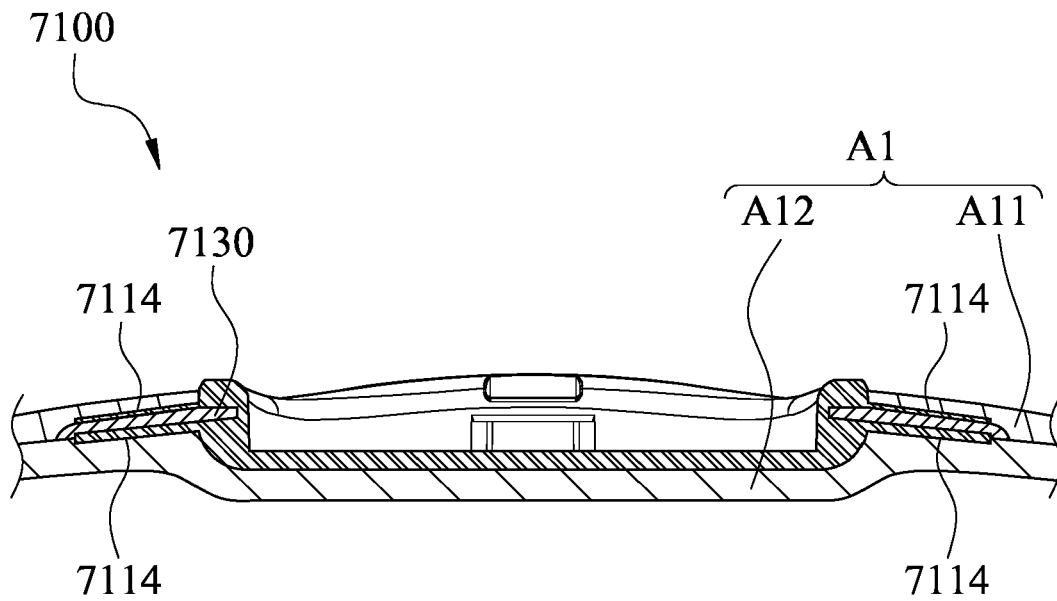


Fig. 12

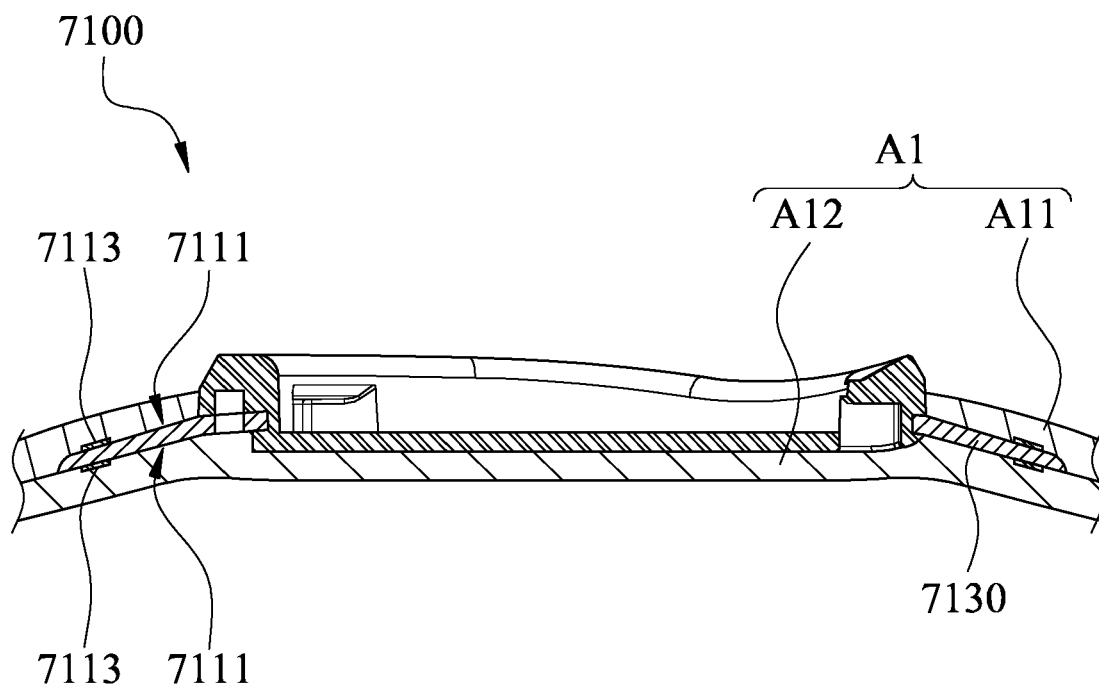


Fig. 13

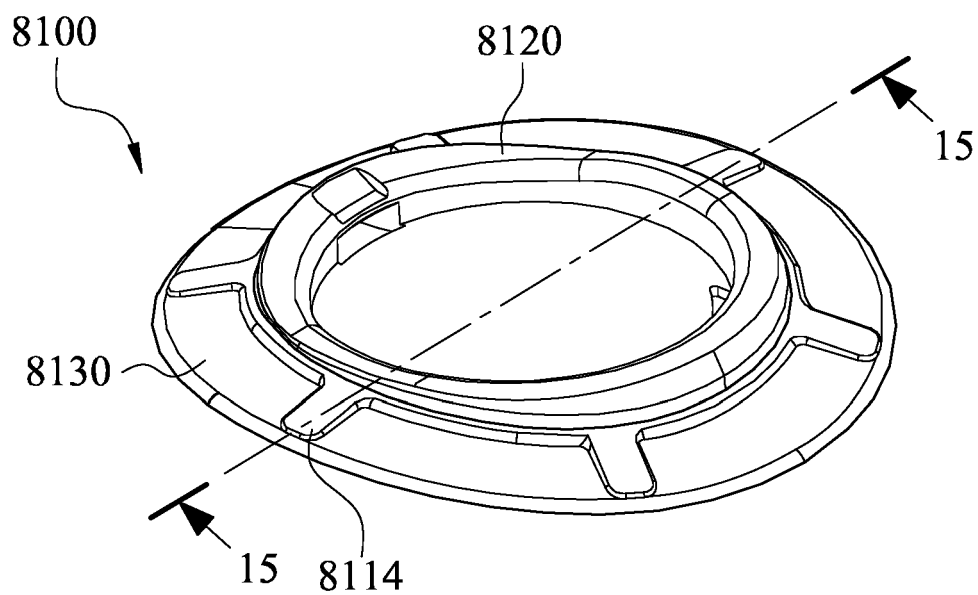


Fig. 14

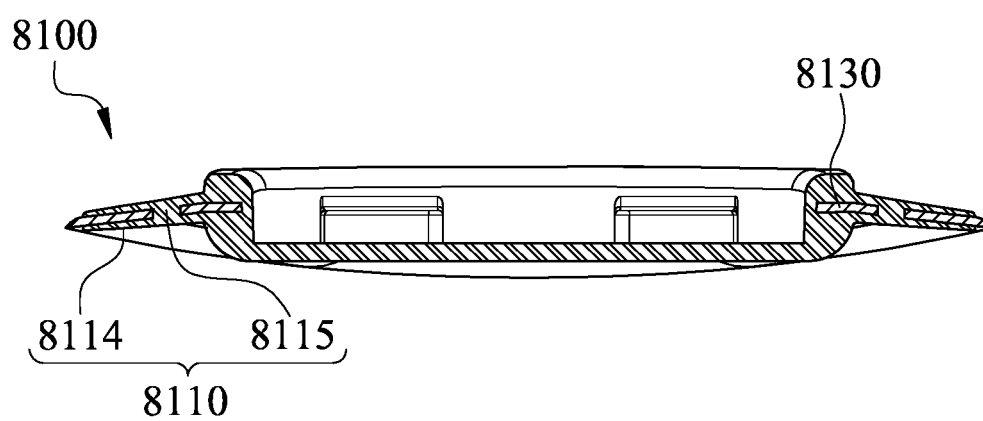


Fig. 15

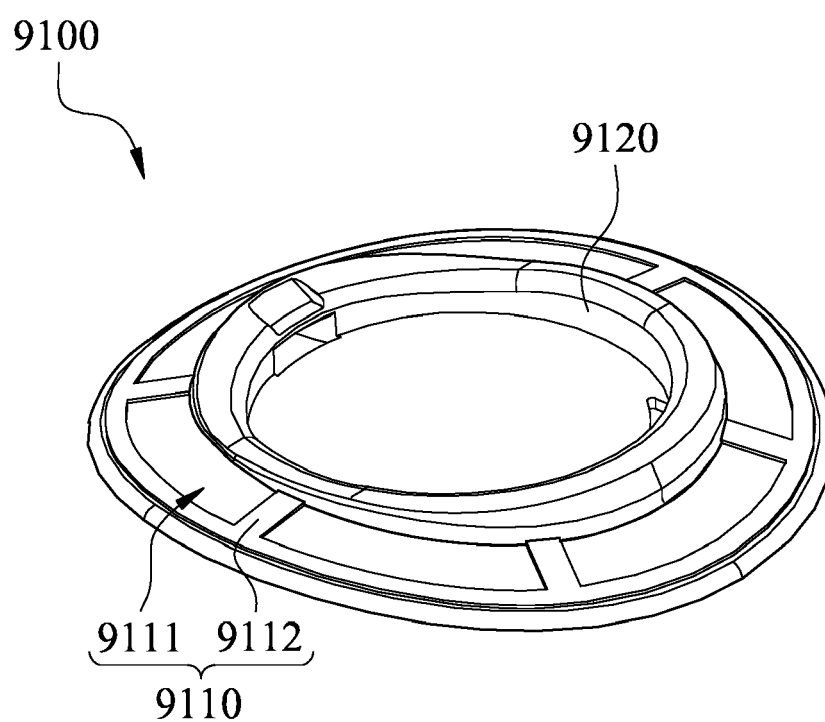


Fig. 16

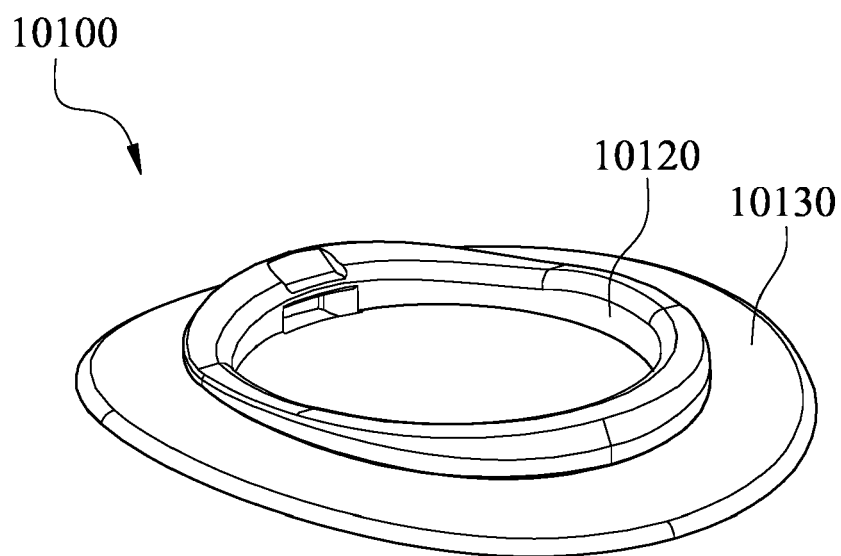


Fig. 17

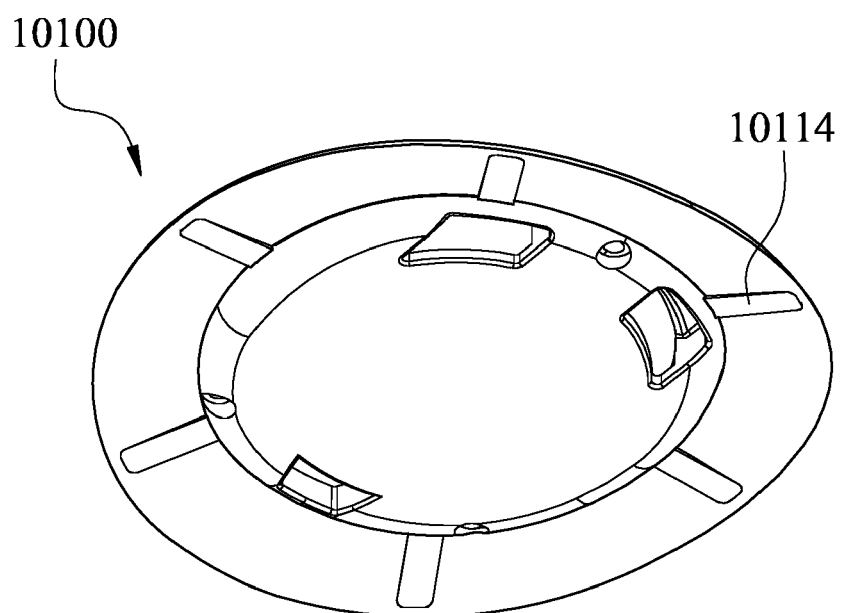


Fig. 18

S1000

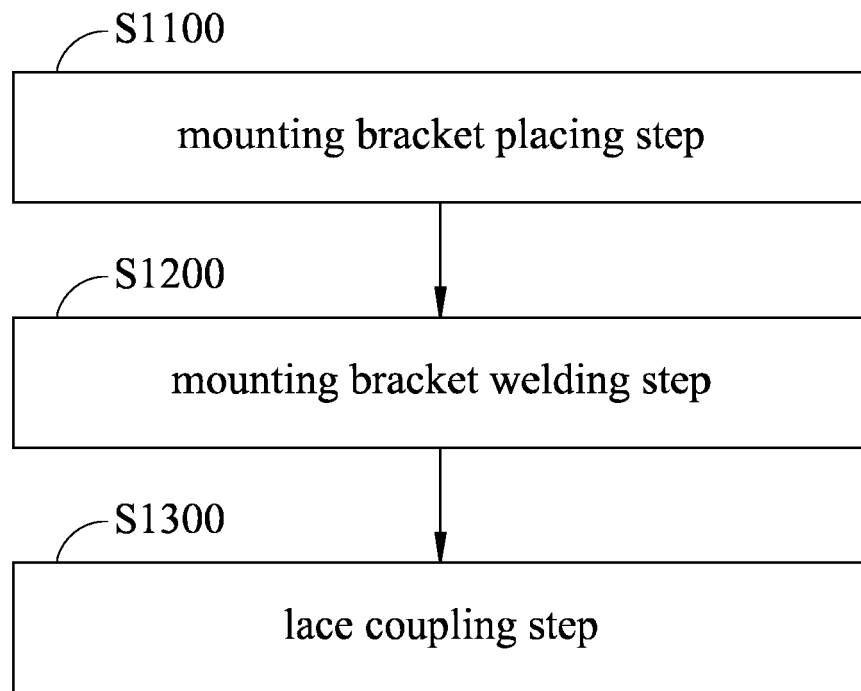


Fig. 19

12000

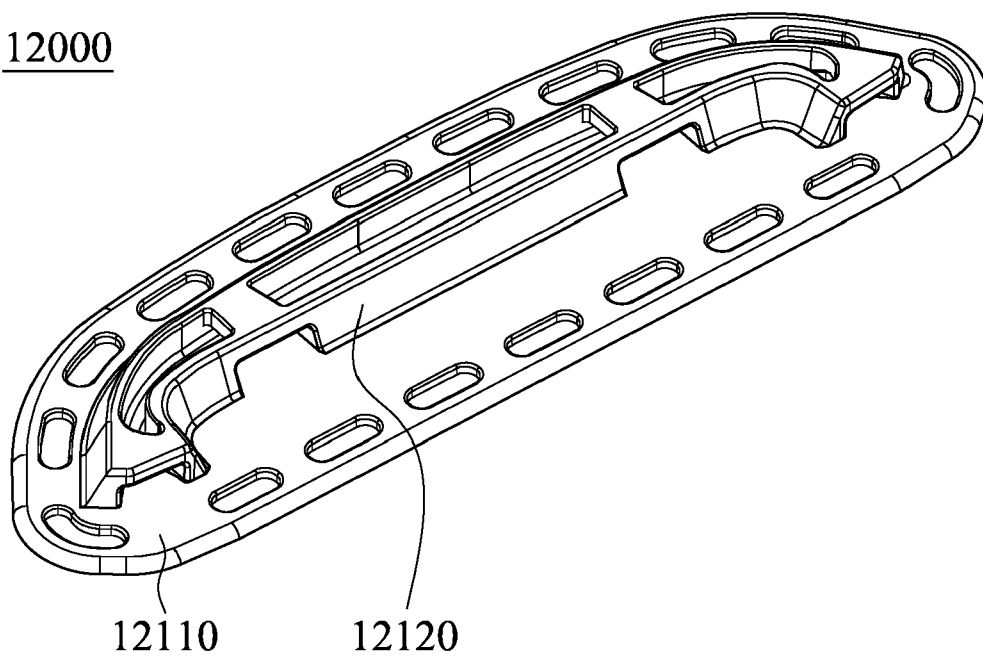


Fig. 20

13000

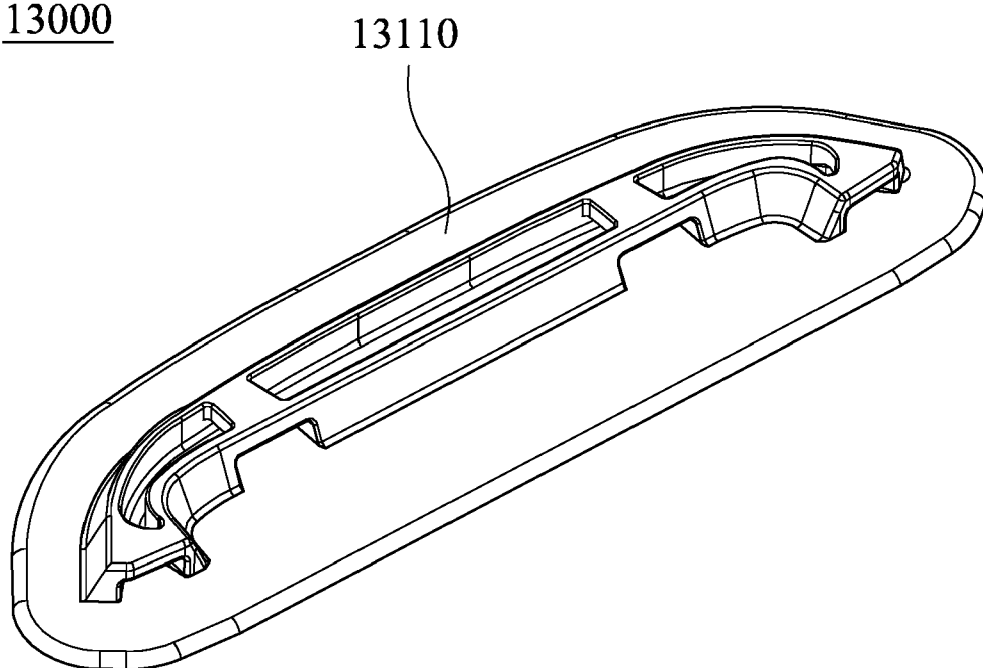


Fig. 21

14000

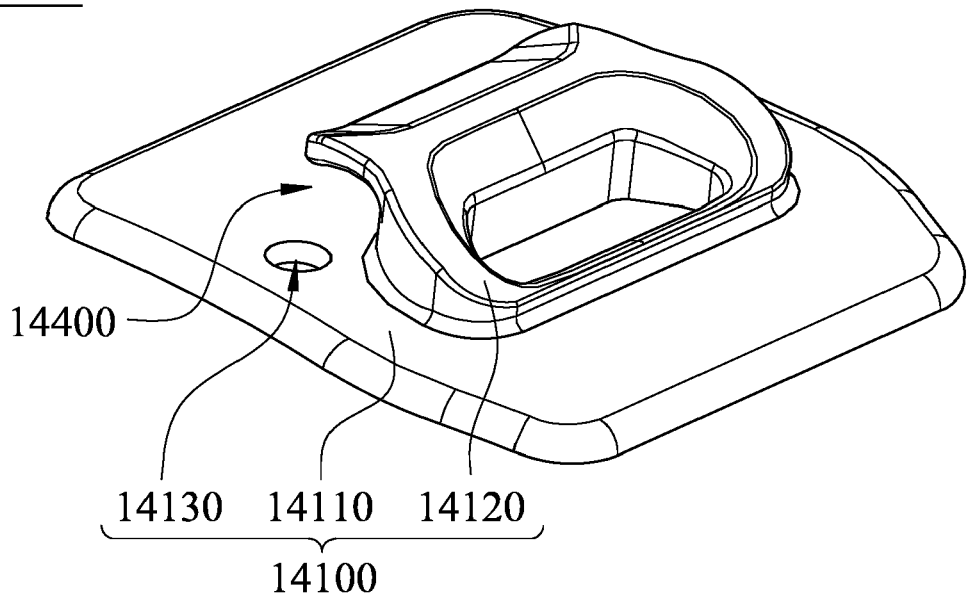


Fig. 22

14000

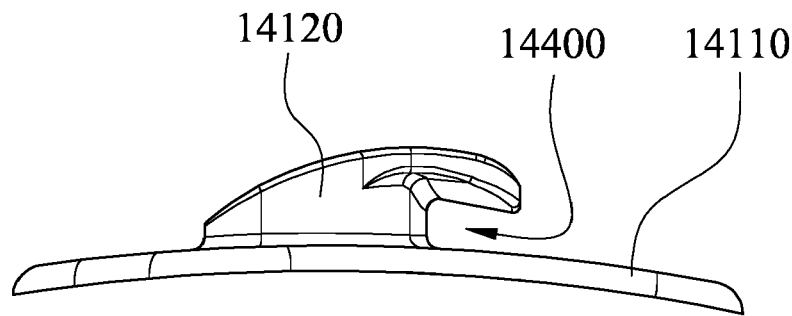


Fig. 23

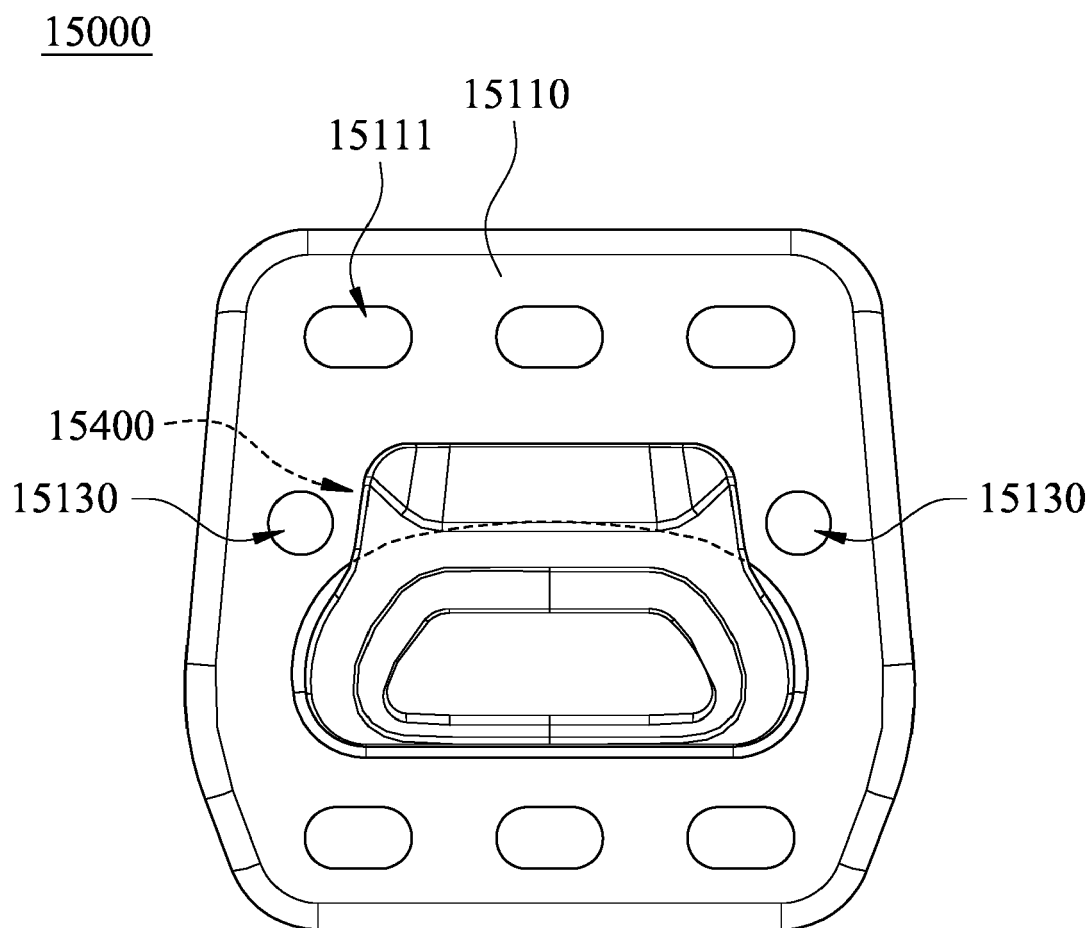


Fig. 24

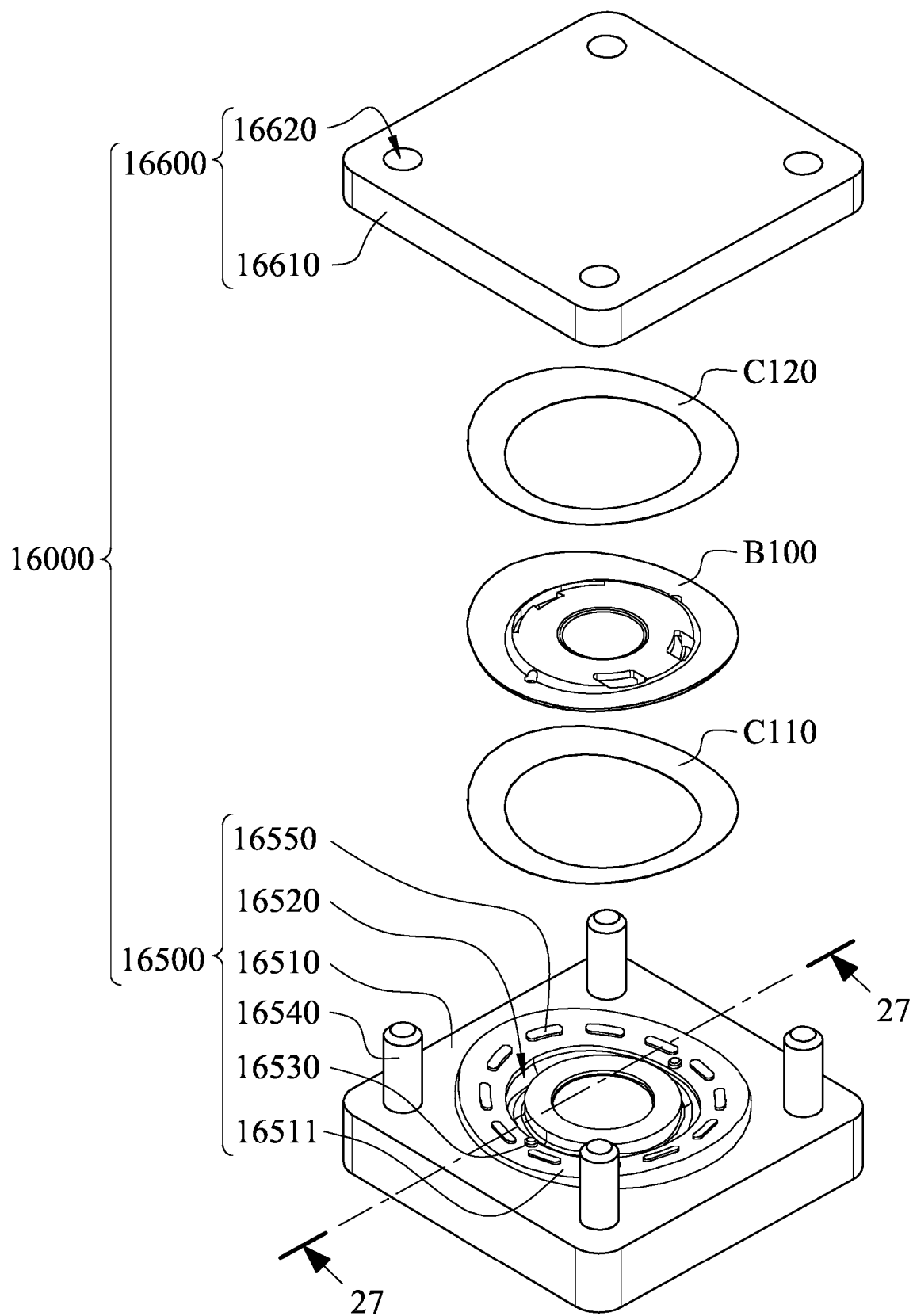


Fig. 25

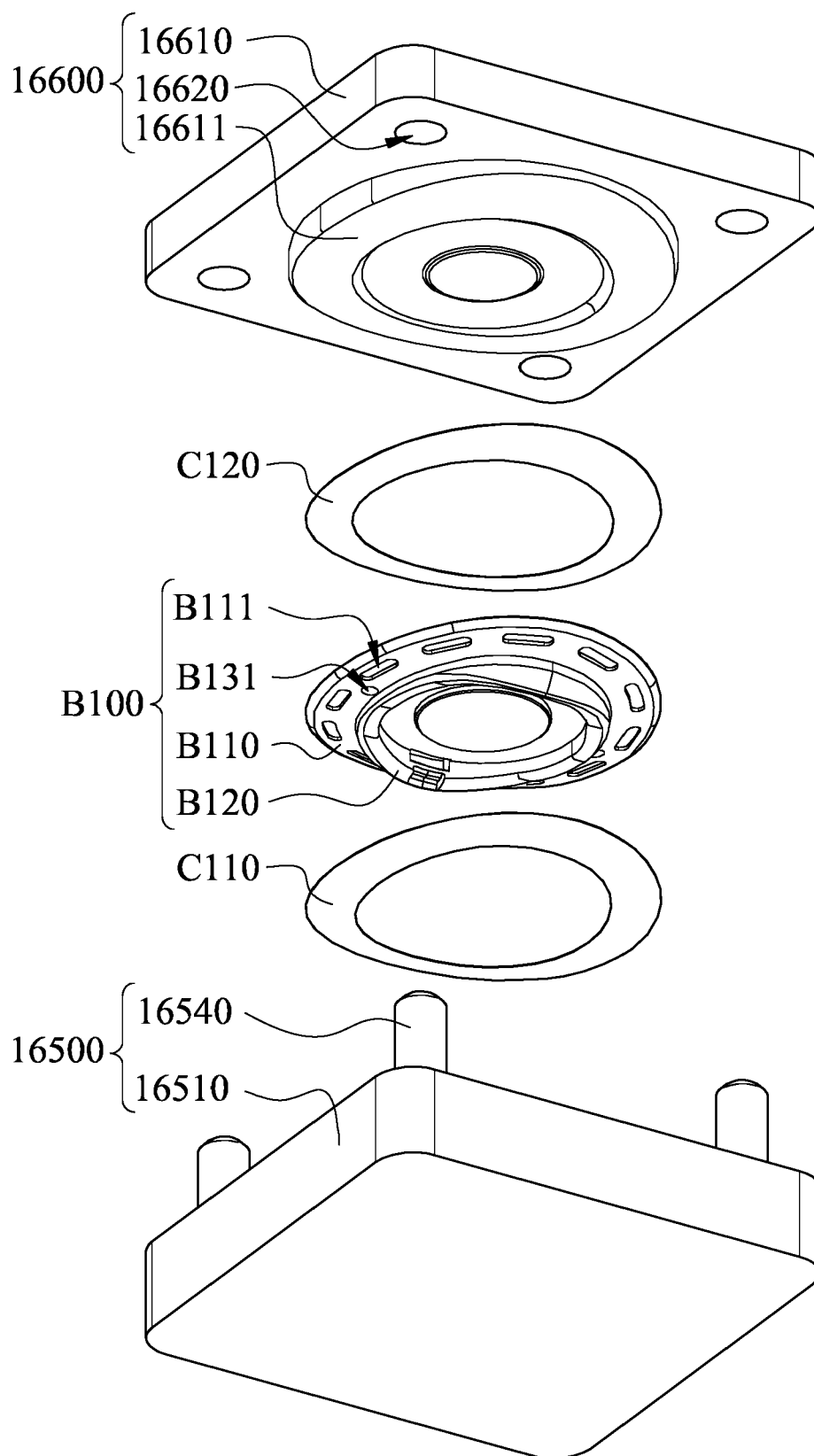


Fig. 26

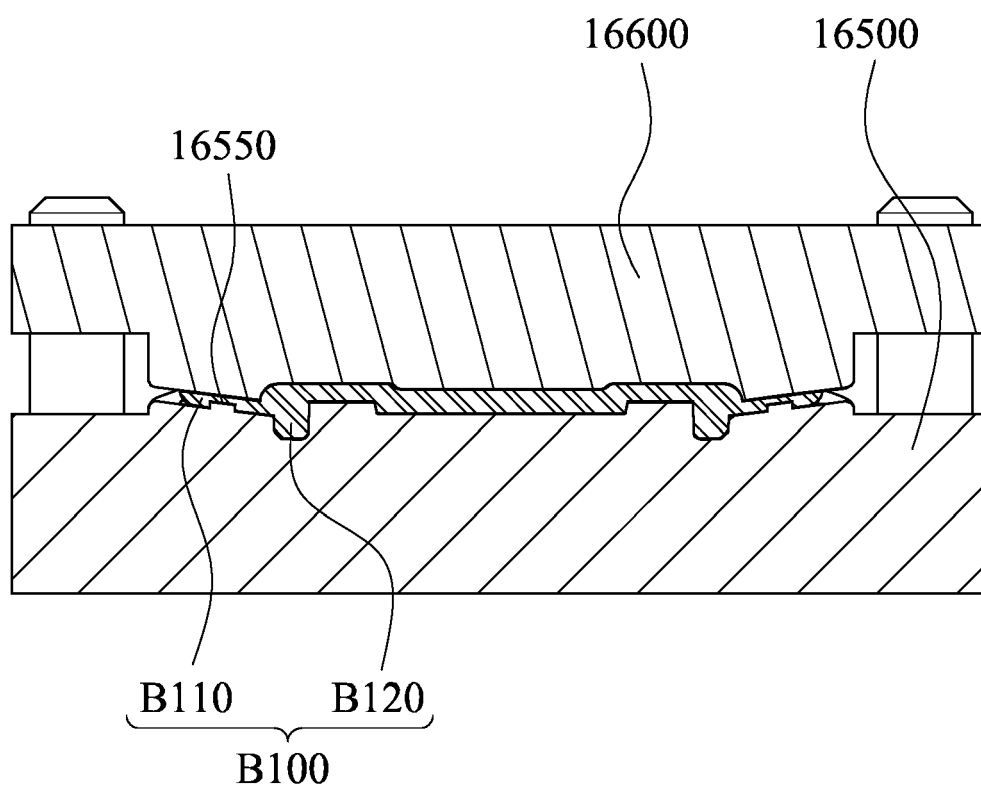


Fig. 27

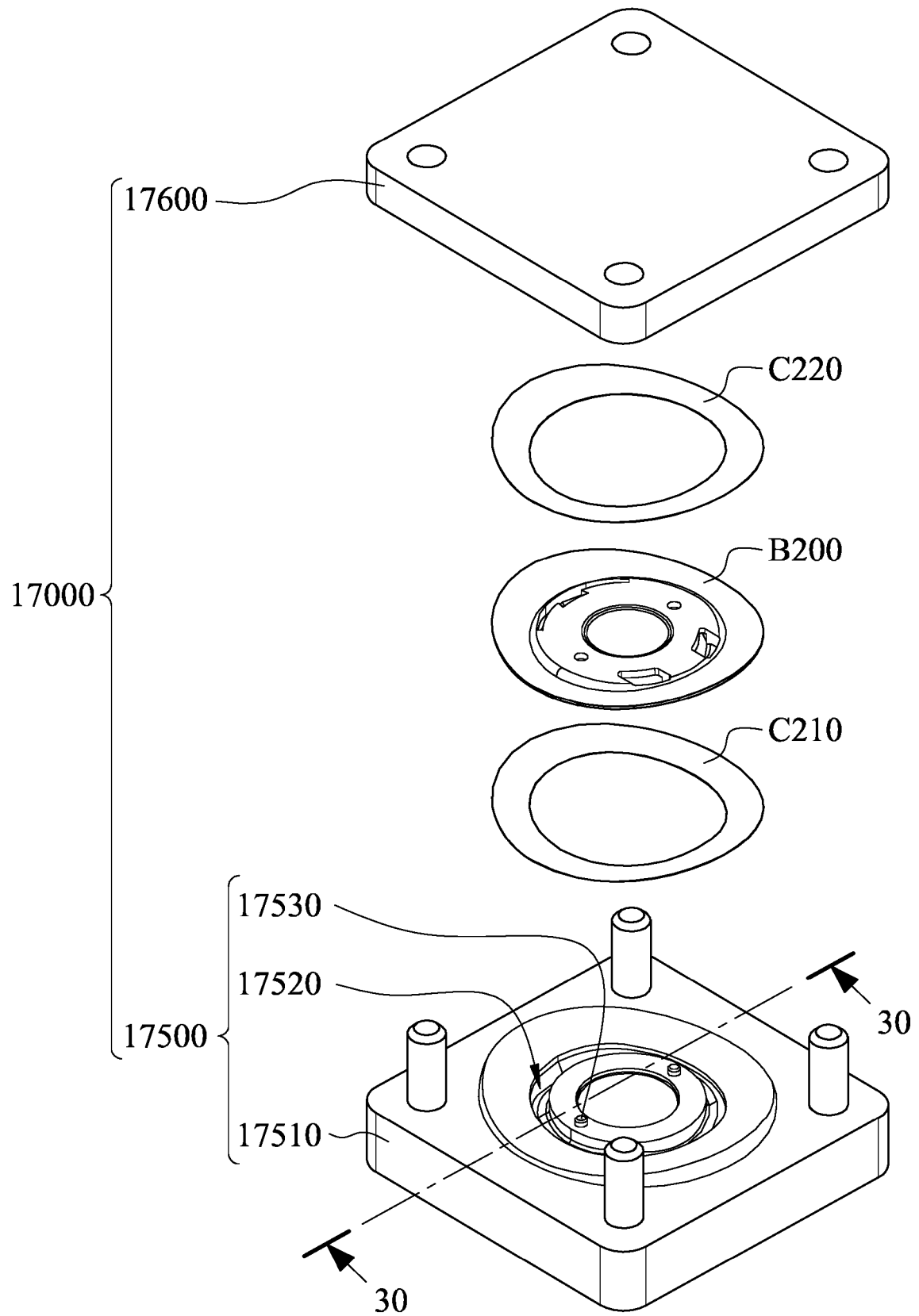


Fig. 28

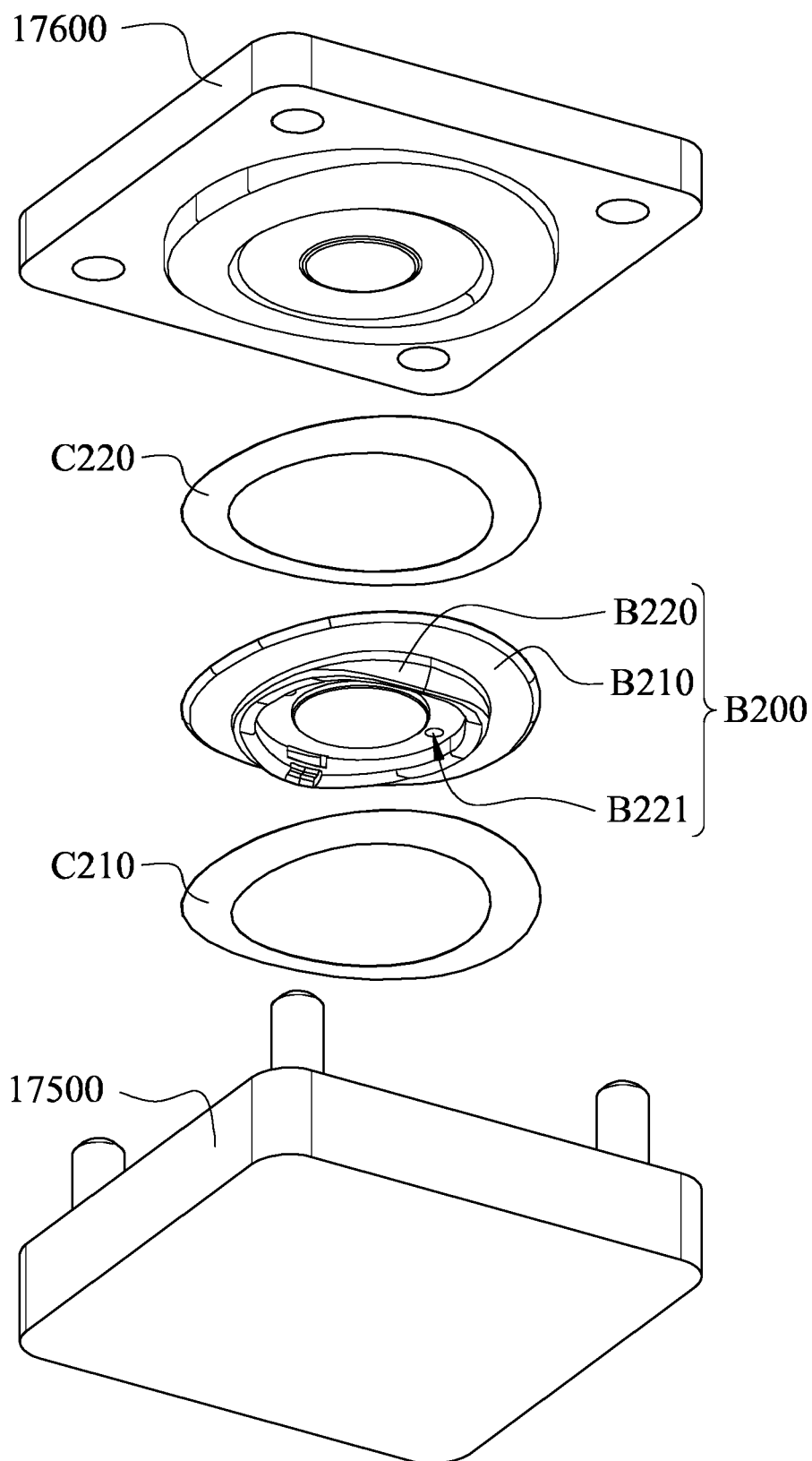


Fig. 29

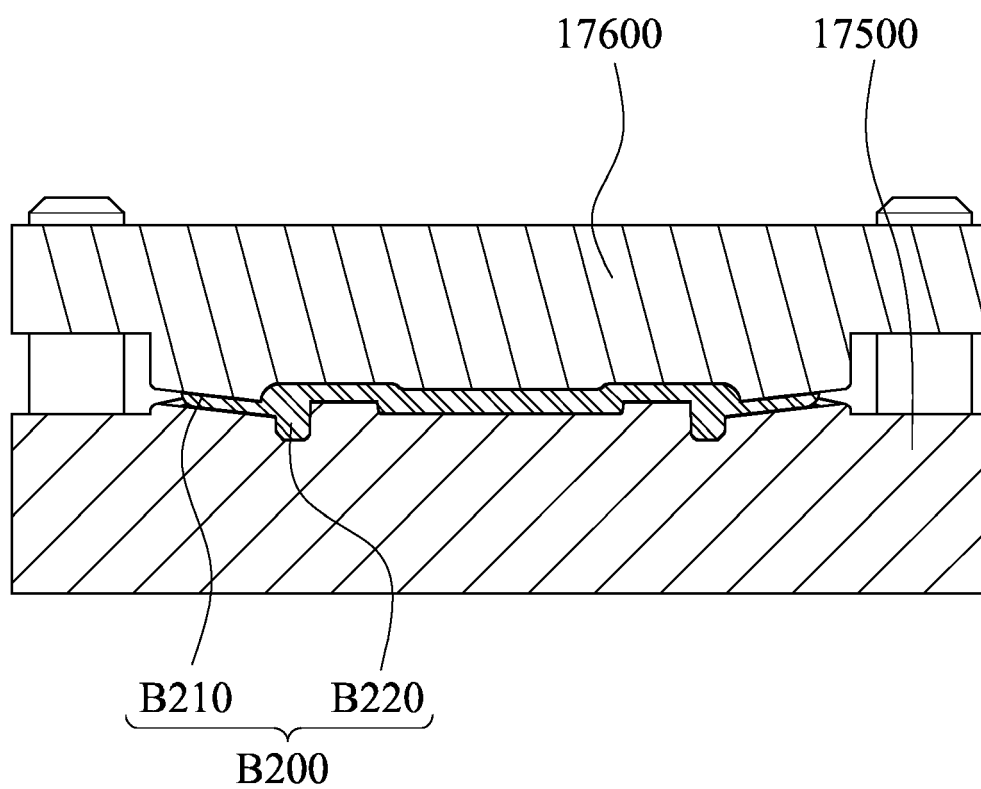


Fig. 30

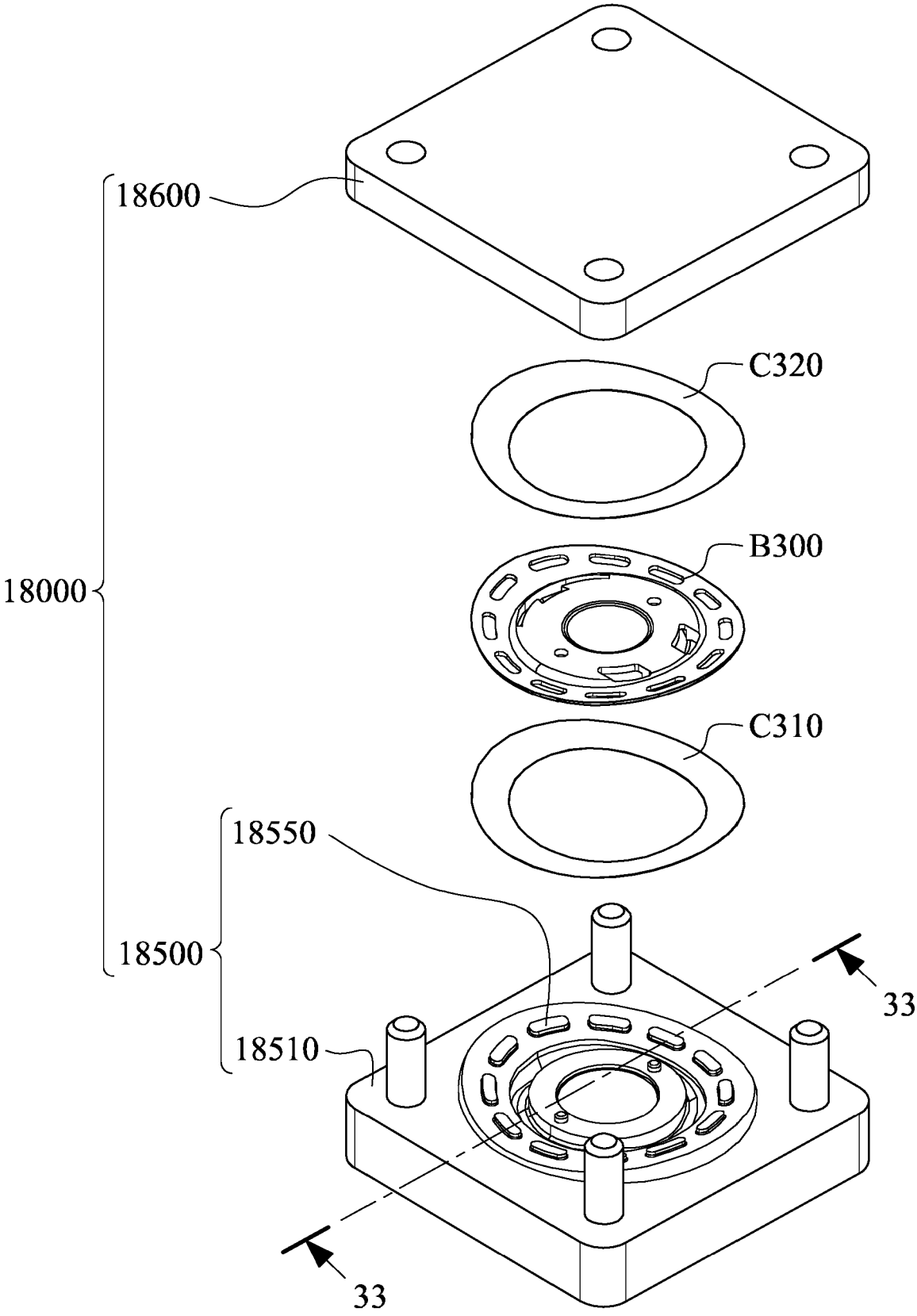


Fig. 31

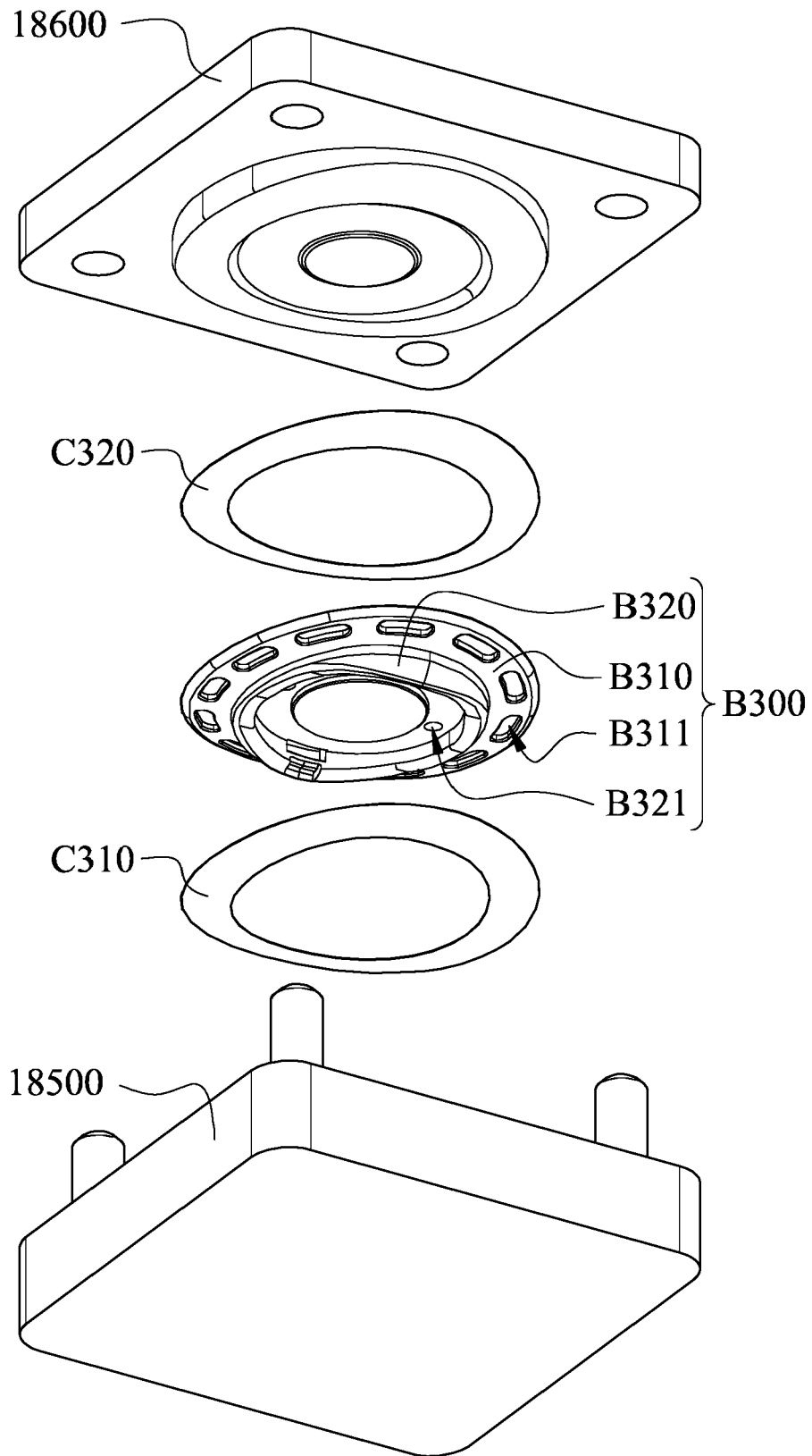


Fig. 32

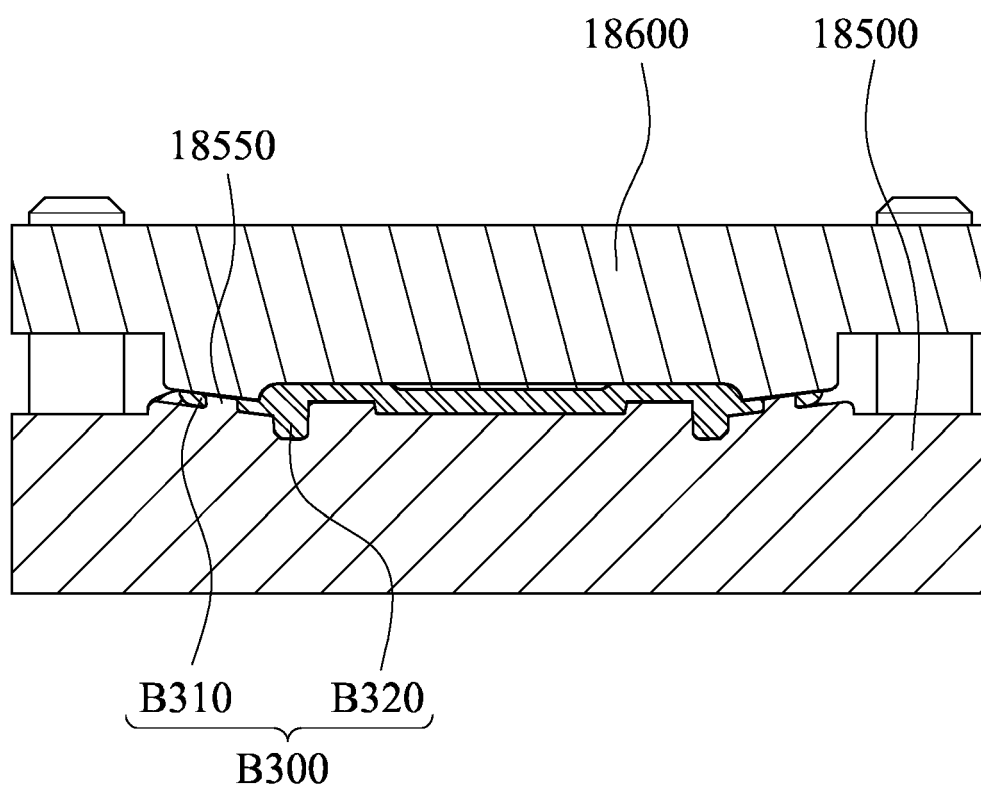


Fig. 33



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