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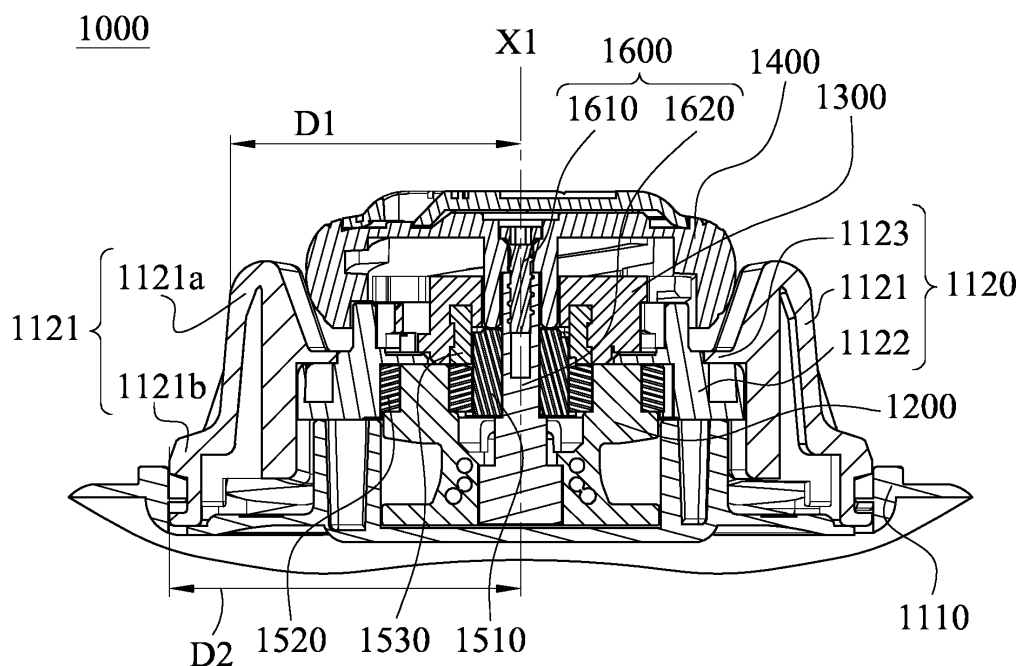
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(54) FASTENING DEVICE

(57) A fastening device includes a case, a spool disposed within the case and having an axis, an engaging unit disposed above the spool along the axis, and a knob covering the upper case body. The case includes an

upper case body including at least one protecting wing extending upward, and a base detachably coupled to the upper case body. At least a portion of the at least one protecting wing is higher than a lower edge of the knob.

**Fig. 4**

Description

BACKGROUND

Technical Field

[0001] The present disclosure relates to a fastening device. More particularly, the present disclosure relates to a fastening device which is used to be installed on an article and can fasten a lace.

Description of Related Art

[0002] A conventional fastening device includes a knob and a spool. The spool is coupled to a lace, and the lace may pass through an article. With operating the knob, the lace may be quickly tensioned or released, thereby facilitating for tension the article. The conventional fastening device may release the lace by pulling up the knob or rotating the knob reversely, and as the knob is not pulled up or rotated reversely, the spool may be secured. If the fastening device is used in a situation that may be easily hit, the knob may move by hitting, which leads to releasing of the lace, and a danger may happen.

[0003] Based on the aforementioned problems, how to improve the structure of the fastening device to increase the safety becomes a target that those in the field peruse.

SUMMARY

[0004] According to one aspect of the present disclosure, a fastening device is provided. The fastening device includes a case, a spool disposed within the case and having an axis, an engaging unit disposed above the spool along the axis, and a knob covering the upper case body. The case includes an upper case body including at least one protecting wing extending upward, and a base detachably coupled to the upper case body. At least a portion of the at least one protecting wing is higher than a lower edge of the knob.

[0005] According to one embodiment, the upper case body may further include an inner annular member, and an outer annular member surrounding the inner annular member. The at least one protecting wing is connected to one side of the outer annular member.

[0006] According to one embodiment, the outer annular member may include at least one mounting flange, the at least one mounting flange is disposed at the base, and the at least one protecting wing extends upward from the at least one mounting flange.

[0007] According to one embodiment, the inner annular member may include at least one engaging projection for engaging with the outer annular member.

[0008] According to one embodiment, the outer annular member may include two combining portions detachably connected to each other, a number of the at least one protecting wing is two, and each of the protecting wings is connected to each of the combining portions.

[0009] According to one embodiment, the outer annular member may include at least one tab, the at least one tab extends inward from a bottom of at least one of the combining portions, and the at least one tab is coupled to the inner annular member or the base.

[0010] According to one embodiment, the upper case body may include an inner annular member, the inner annular member include an annular main body and an annular flange connected to the annular main body for connecting the at least one protecting wings, and the annular flange is rested on a housing portion of the base.

[0011] According to one embodiment, the upper case body may include an upper opening, and the at least one protecting wing is higher than the upper opening.

[0012] According to one embodiment, the at least one protecting wing may include a top portion and a bottom portion, the top portion of the at least one protecting wing has an upper radial outer-most edge, the bottom portion of the at least one protecting wing has a lower radial outer-most edge, and a distance between the upper radial outer-most edge of the at least one protecting wing and the axis is equal to or smaller than a distance between the lower radial outer-most edge of the at least one protecting wing and the axis.

BRIEF DESCRIPTION OF THE DRAWINGS

[0013] 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 fastening device according to a 1st embodiment of the present disclosure.

Fig. 2 shows one exploded schematic view of the fastening device of the 1st embodiment in Fig. 1.

Fig. 3 shows another exploded schematic view of the fastening device of the 1st embodiment in Fig. 1.

Fig. 4 shows one cross-sectional schematic view of the fastening device of the 1st embodiment in Fig. 1.

Fig. 5 shows another cross-sectional schematic view of the fastening device of the 1st embodiment in Fig. 1.

Fig. 6 shows one three-dimensional schematic view of an outer annular member and protecting wings of a fastening device according to a 2nd embodiment of the present disclosure.

Fig. 7 shows another three-dimensional schematic view of the outer annular member and the protecting wings of the fastening device of the 2nd embodiment of Fig. 6.

Fig. 8 shows a three-dimensional schematic view of a fastening device according to a 3rd embodiment of the present disclosure.

Fig. 9 shows one exploded schematic view of the fastening device of the 3rd embodiment in Fig. 8.

Fig. 10 shows another exploded schematic view of

the fastening device of the 3rd embodiment in Fig. 8. Fig. 11 shows one cross-sectional schematic view of the fastening device of the 3rd embodiment in Fig. 8. Fig. 12 shows another cross-sectional schematic view of the fastening device of the 3rd embodiment in Fig. 8.

DETAILED DESCRIPTION

[0014] It will be understood that when an element is referred to as being "disposed on", "connected to" or "coupled to" another element, it can be directly disposed on, connected or coupled to the other one element, or it can be indirectly disposed on, connected or coupled to the other one element, that is, intervening elements may be present. In contrast, when an element is referred to as being "directly disposed on", "directly connected to" or "directly coupled to" another element, there are no intervening elements present.

[0015] 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.

[0016] Fig. 1 shows a three-dimensional schematic view of a fastening device 1000 according to a 1st embodiment of the present disclosure. Fig. 2 shows one exploded schematic view of the fastening device 1000 of the 1st embodiment in Fig. 1. Fig. 3 shows another exploded schematic view of the fastening device 1000 of the 1st embodiment in Fig. 1. The fastening device 1000 includes a case 1100, a spool 1200, an engaging unit 1300 and a knob 1400.

[0017] The case 1100 includes an upper case body 1120 including at least one protecting wing 1121 extending upward, and a base 1110 detachably coupled to the upper case body 1120. The spool 1200 is disposed within the case 1100 and has an axis X1 (labeled in Fig. 4). The engaging unit 1300 is disposed above the spool 1200 along the axis X1, and the knob 1400 covers the upper case body 1120. At least a portion of the at least one protecting wing 1121 is higher than a lower edge of the knob 1400.

[0018] Therefore, with that at least a portion of the protecting wing 1121 is higher than the lower edge of the knob 1400, loosening of a lace causing by an external force hitting the knob 1400 may be prevented, and a safety thereof is increased.

[0019] As shown in Figs. 2 and 3, the base 1110 is a one-piece element and includes a housing portion 1111, a base flange 1112, four coupling holes 1113 and two mounting areas 1114. The housing portion 1111 is disposed in a middle segment of the base flange 1112 and is connected to the upper case body 1120, thereby forming a spool space for receiving the spool 1200. The base flange 1112 is substantially ellipse-shaped, and the two mounting areas 1114 are located at two sides of the base

flange 1112 along a major axis thereof. Each of the mounting areas 1114 may include a radial combining groove. The four coupling holes 1113 are disposed at the housing portion 1111 at intervals and are used to couple to the upper case body 1120.

[0020] The upper case body 1120 may include an inner annular member 1122 and an outer annular member 1123 surrounding the inner annular member 1122. In the embodiment, a number of the at least one protecting wing 1121 is two, and the two protecting wings 1121 are respectively connected to two sides of the outer annular member 1123. In addition, the upper case body 1120 may further include an upper opening, and each of the protecting wings 1121 may be higher than the upper opening.

[0021] Precisely, the inner annular member 1122 is annular-shaped, and the upper opening is located at a top end of the inner annular member 1122. The upper case body 1120 may further include a plurality of engaging teeth 1124, a partition 1125, four legs 1126 and a plurality of inner teeth 1127. The partition 1125 extends inward from an inner wall of the inner annular member 1122 to separate an upper chamber, and the partition 1125 may include a central hole. The engaging teeth 1124 are located the top end of the inner annular member 1122 and face toward the upper chamber. The four legs 1126 are located at a lower end of the inner annular member 1122 and extend downward therefrom. The four legs 1126 are respectively inserted into the four coupling holes 1113, thereby assembling the inner annular member 1122 and the base 1110. The inner teeth 1127 are located at the inner wall of the inner annular member 1122 and below the partition 1125 to correspond to the spool space. The inner annular member 1122 may further include two engaging projections 1122a extending outward for engaging with the outer annular member 1123. In other embodiments, a number of the engaging projection is at least one, but the present disclosure is not limited thereto.

[0022] The outer annular member 1123 may include two mounting flanges 1123b, each of the two mounting flanges 1123b is disposed at the base 1110, and each of the two protecting wings 1121 extends upward from each of the two mounting flanges 1123b. Moreover, the outer annular member 1123 further includes an annular portion 1123a surrounding the inner annular member 1122, and the two protecting wings 1121 respectively extend upward and downward from two sides of the annular portion 1123a to form a shield-shaped structure. Each of the mounting flanges 1123b is connected to a bottom of each of the protecting wings 1121 and the annular portion 1123a, and therefore each of the protecting wings 1121 may be deemed as extending upward from each of the mounting flanges 1123b. The outer annular member 1123 may further include two hooks each extending downward from a portion of each of the protecting wings 1121 or extending downward from a portion of each of the mounting flanges 1123b, and each of the hooks may be

engaged with the radial combining groove of each of the mounting areas 1114, thereby assembling the outer annular member 1123 and the base 1110. Hence, the base 1110 provides a supporting force for the protecting wings 1121, which may facilitate for the protecting wings 1121 to bear a radial force.

[0023] Moreover, each of the two protecting wings 1121 has a top portion 1121a (labeled in Fig. 4) and a bottom portion 1121b (labeled in Fig. 4), each of the top portions 1121a has an upper radial outer-most edge (not labeled), each of the bottom portions 1121b has a lower radial outer-most edge (not labeled), and a distance D1 (labeled in Fig. 4) between each of the upper radial outer-most edges and the axis X1 is equal to or smaller than a distance D2 (labeled in Fig. 4) between each of the lower radial outer-most edges and the axis X1. With the configuration that the bottom portion 1121b is wider than or equal to the top portion 1121a, the structure strength is increased, and the protecting stability is improved. It is noted that, although two protecting wings 1121 are illustrated in the 1st embodiment, in other embodiments, only one protecting wing is included, and the present disclosure is not limited thereto.

[0024] The spool 1200 is received in the spool space formed by the inner annular member 1122 and the base 1110 and includes a top ring portion 1210, a lower ring portion 1220 and four pivotal shafts (not labeled). A winding tract is formed between the top ring portion 1210 and the lower ring portion 1220, thereby allowing the lace to wind around the winding track. The pivotal shafts may be disposed at an upper surface of the top ring portion 1210.

[0025] The fastening device 1000 may further include a transmitting set 1500 including a sun gear 1510, four planet gears 1520 and a transmitting gear 1530. The transmitting set 1500 is also received in the spool space. The four planet gears 1520 are respectively pivotally disposed at the four pivotal shafts and are engaged with the inner teeth 1127. The sun gear 1510 is located between the planet gears 1520 and is engaged with the planet gears 1520. One end of the transmitting gear 1530 is engaged with the sun gear 1510, and another end of the transmitting gear 1530 is engaged with the engaging unit 1300.

[0026] The engaging unit 1300 may include an engaging disc (not labeled), three pawl arms 1310, three flexible arms 1320 and three guiding portions 1330. The engaging disc includes teeth coupling to the transmitting gear 1530. Each of the pawl arms 1310 is disposed at the engaging disc and extends in a circumference direction. Each of the guiding portions 1330 extends outward from the engaging disc along a radial direction, and each of the guiding portions 1330 is located at a proximal end of each of the pawl arms 1310. Each of the flexible arms 1320 extends along the circumference direction from one side of each of the guiding portions 1330, each of the flexible arms 1320 extends further outward in the radial direction than each of the pawl arms

1310, and a length of each of the flexible arms 1320 along the circumference direction is shorter than a length of each of the pawl arms 1310 along the circumference direction. Each of the pawl arms 1310 corresponds to the engaging teeth 1124. Each of the pawl arms 1310 is disengaged from the engaging teeth 1124 in a tensioning direction A1, but is engaged with the engaging teeth 1124 in a releasing direction A2.

[0027] The knob 1400 may include a covering body 1410, a top body 1420, three guiding tracks 1430 and three pushing portions 1440. The covering body 1410 covers the inner annular member 1122 and includes an inner side wall. The three guiding tracks 1430 are located at the inner side wall of the covering body 1410 at intervals, the three pushing portions 1440 are also located at the inner side wall of the covering body 1410 at intervals, and each of the pushing portions 1440 is close to a top point of each of the guiding tracks 1430. Each of the guiding portions 1330 may protrude into each of the guiding tracks 1430 to be guided thereby. Each of the pushing portions 1440 may protrude into a gap between each of the guiding portions 1330 and each of the flexible arms 1320, and includes a tooth corresponding to a tooth of each of the flexible arms 1320. The top body 1420 covers the covering body 1410.

[0028] Fig. 4 shows one cross-sectional schematic view of the fastening device 1000 of the 1st embodiment in Fig. 1. Fig. 5 shows another cross-sectional schematic view of the fastening device 1000 of the 1st embodiment in Fig. 1. The fastening device 1000 may further include a connecting unit 1600 penetrating the spool 1200 and connected to the knob 1400, and the connecting unit 1600 does not contact the base 1110 directly. Precisely, the connecting unit 1600 may include a central post 1620 and a screw member 1610. The central post 1620 passes through the spool 1200 upward, and the screw member 1610 passes through the covering body 1410 downward to screw into the central post 1620, thereby connecting the knob 1400 and the spool 1200. Moreover, before the upper case body 1120 and the base 1110 are assembled, the transmitting set 1500 and the spool 1200 may be put into the upper case body 1120, and then the central post 1620 passes through the spool 1200, the transmitting set 1500 and the central hole of the partition 1125 in order. The central post 1620 may include a restricting portion for preventing the spool 1200 from falling. The engaging unit 1300 may be put into the upper chamber, then the covering body 1410 covers the upper case body 1120, and the screw member 1610 is fastened into the central post 1620. Therefore, the elements except for the base 1110 may be connected integrally first, and then the base 1110 is assembled.

[0029] A user may rotate the knob 1400 in the tensioning direction A1 to tension the lace. As shown in Fig. 4, the engaging unit 1300 is located at a first position. The user may rotate the knob 1400 in the tensioning direction A1, and each of the pushing portions 1440 pushes one side of each of the guiding portions 1330. Because the each of

the pawl arms 1310 may be disengaged from the engaging teeth 1124 in the tensioning direction A1, the knob 1400 drives the engaging unit 1300 and the transmitting set 1500 to rotate the spool 1200 for tensioning the lace. As the user stops rotating the knob 1400, each of the pawl arms 1310 is engaged with the engaging teeth 1124, thereby preventing the spool 1200 from rotating the releasing direction A2. Hence, the lace is secured, and releasing of the lace is prevented.

[0030] On the contrary, as shown in Fig. 5, as the user rotates the knob 1400 in the releasing direction A2, each of the pushing portions 1440 pushes each of the flexible arms 1320, and as a force extends beyond a threshold of each of the flexible arms 1320, each of the pushing portions 1440 is displaced. Consequently, the knob 1400 is allowed to be rotated relative to the engaging unit 1300. Meanwhile, each of the guiding portions 1330 is guided by each of the guiding tracks 1430, and the engaging unit 1300 is lifted to a second position. The transmitting gear 1530 is disengaged from the sun gear 1510, and the spool 1200 is not affected by the engaging unit 1300, thereby releasing the lace.

[0031] Fig. 6 shows one three-dimensional schematic view of an outer annular member 2123 and protecting wings 2121 of a fastening device according to a 2nd embodiment of the present disclosure. Fig. 7 shows another three-dimensional schematic view of the outer annular member 2123 and the protecting wings 2121 of the fastening device of the 2nd embodiment of Fig. 6. The fastening device of the 2nd embodiment is similar to the fastening device 1000 of the first embodiment, but the structure of the outer annular member 2123 is slightly different. Hence, only the outer annular member 2123 and the protecting wings 2121 connected thereto are illustrated.

[0032] To be more specific, the outer annular member 2123 may include two combining portions 2123c detachably connected to each other, and each of the protecting wings 2121 is connected to each of the combining portions 2123c. The outer annular member 2123 may further include at least one tab 2129, the at least one tab 2129 extends inward from a bottom of at least one of the combining portions 2123c, and the at least one tab 2129 is coupled to an inner annular member (not shown in the 2nd embodiment) or the base (not shown in the 2nd embodiment).

[0033] Each of the combining portions 2123c is circular-shaped, and the outer annular member 2123 includes two assembling portions 2123d each connected to one end of each of the combining portions 2123c. Each of the protecting wings 2121 is connected to the other end of each of the combining portions 2123c and includes a groove. A number of the at least one tab 2129 is two, and each of the tabs 2129 is located at a middle segment of each of the combining portions 2123c. During assembling, the two combining portions 2123c may surround the inner annular member with the tabs 2129 coupling to the inner annular member, the assembling portions

2123d respectively insert into the grooves, and the two combining portions 2123c may be assembled by screws and nuts.

[0034] Fig. 8 shows a three-dimensional schematic view of a fastening device 3000 according to a 3rd embodiment of the present disclosure. Fig. 9 shows one exploded schematic view of the fastening device 3000 of the 3rd embodiment in Fig. 8. Fig. 10 shows another exploded schematic view of the fastening device 3000 of the 3rd embodiment in Fig. 8. The fastening device 3000 includes a case (not labeled in the 3rd embodiment), a spool 3200, an engaging unit 3300, a knob 3400 and a connecting unit 3600 (labeled in Fig. 11).

[0035] The case includes a base 3110 and an upper case body 3120. The upper case body 3120 includes two protecting wings 3121 and an inner annular member 3122. The inner annular member 3122 includes an annular main body and an annular flange 3122a connected to the annular main body for connecting the two protecting wings 3121, and the annular flange 3122a is rested on the housing portion of the base 3110. Moreover, a gap is formed between the inner surface of the annular flange 3122a and an outer surface of the annular main body, and a portion of the knob 3400 inserts the gap as covering the inner annular member 3122. In addition, a distance D1 (labeled in Fig. 11) between an upper radial outer-most edges of each of the protecting wings 3121 and an axis X1 is equal to a distance D2 (labeled in Fig. 11) between a lower radial outer-most edges of each of the protecting wings 3121 and the axis X1.

[0036] The upper case body 3120 may further include four clamping portions 3128. The clamping portions 3128 are located at a partition (not labeled in the 3rd embodiment) and surround the central hole. The engaging unit 3300 is restricted by the clamping portions 3128 as being disposed in the upper chamber.

[0037] The engaging unit 3300 may include an engaging disc, three pawl arms 3310 and a plurality of driving teeth 3340 located at a top end of the engaging disc. The knob 3400 may include an inner covering body 3410, an outer covering body 3420, a plurality of knob teeth 3450, and a driving boss 3460. The inner covering body 3410 covers the inner annular member 3122 with a portion inserting into the gap between the annular flange 3122a and an annular main body. The outer covering body 3420 covers the inner covering body 3410. The knob teeth 3450 are located at an inner top surface of the inner covering body 3410. The driving boss 3460 extends downward from the inner top surface for inserting a driving hole 3210 of the spool 3200. Therefore, rotation of the knob 3400 in the tensioning direction A1 may link with the engaging unit 3300 and the spool 3200.

[0038] The connecting unit 3600 may include a positioning post 3610, a screw member 3620 and a nut 3630. The positioning post 3610 inserts the spool 3200 upward to couple to a flexible coupling portion 3240 (labeled in Fig. 11) of the spool 3200. The nut 3630 is located inside the driving boss 3460 of the knob 3400, and the screw

member 3620 passes upward through the positioning post 3610 to fasten with the nut 3630, thereby connecting the knob 3400 and the spool 3200.

[0039] Fig. 11 shows one cross-sectional schematic view of the fastening device 3000 of the 3rd embodiment in Fig. 8. Fig. 12 shows another cross-sectional schematic view of the fastening device 3000 of the 3rd embodiment in Fig. 8. As shown in Fig. 11, the knob 3400 is located at a lower position, the knob 3400 can be rotated by a user in a tensioning direction A1 to allow the pawl arms 3310 to disengage from the engaging teeth, and the driving boss 3460 of the knob 3400 drives the driving hole 3210 of the spool 3200 to rotate the spool 3200 for tensioning the lace. As the user stops rotating the knob 3400, the pawl arms 3310 are engaged with the engaging teeth, and the lace is secured.

[0040] On the contrary, as shown in Fig. 12, as the knob 3400 is pulled upward to a higher position by the user, a positioning protrusion 3611 of the positioning post 3610 moves from a lower side of the flexible coupling portion 3240 to an upper side of the flexible coupling portion 3240, and the knob teeth 3450 are disengaged from the driving teeth 3340. Therefore, the engaging teeth cannot prohibit the spool 3200 from rotating, and the lace is released.

Claims

1. A fastening device (1000, 3000), **characterized in** comprising:

a case (1100), comprising:

an upper case body (1120, 3120) comprising at least one protecting wing (1121, 2121, 3121) extending upward; and
a base (1110, 3110) detachably coupled to the upper case body (1120, 3120);

a spool (1200, 3200) disposed within the case (1100) and having an axis (X1);
an engaging unit (1300, 3300) disposed above the spool (1200, 3200) along the axis (X1); and
a knob (1400, 3400) covering the upper case body (1120, 3120);
wherein at least a portion of the at least one protecting wing (1121, 2121, 3121) is higher than a lower edge of the knob (1400, 3400).

2. The fastening device (1000, 3000) of claim 1, wherein the upper case body (1120, 3120) further comprises:

an inner annular member (1122, 3122); and
an outer annular member (1123, 2123) surrounding the inner annular member (1122, 3122);

wherein the at least one protecting wing (1121, 2121, 3121) is connected to one side of the outer annular member (1123, 2123).

3. The fastening device (1000, 3000) of any of claims 1 to 2, wherein the outer annular member (1123, 2123) comprises at least one mounting flange (1123b), the at least one mounting flange (1123b) is disposed at the base (1110, 3110), and the at least one protecting wing (1121, 2121, 3121) extends upward from the at least one mounting flange (1123b).
4. The fastening device (1000, 3000) of any of claims 1 to 3, wherein the inner annular member (1122, 3122) comprises at least one engaging projection (1122a) for engaging with the outer annular member (1123, 2123).
5. The fastening device (1000, 3000) of any of claims 1 to 4, wherein the outer annular member (1123, 2123) comprises two combining portions (2123c) detachably connected to each other, a number of the at least one protecting wing (1121, 2121, 3121) is two, and each of the protecting wings (1121, 2121, 3121) is connected to each of the combining portions (2123c).
6. The fastening device (1000, 3000) of any of claims 1 to 5, wherein the outer annular member (1123, 2123) comprises at least one tab (2129), the at least one tab (2129) extends inward from a bottom of at least one of the combining portions (2123c), and the at least one tab (2129) is coupled to the inner annular member (1122, 3122) or the base (1110, 3110).
7. The fastening device (1000, 3000) of any of claims 1 to 6, wherein the upper case body (1120, 3120) comprises an inner annular member (1122, 3122), the inner annular member (1122, 3122) comprises an annular main body and an annular flange (3122a) connected to the annular main body for connecting the at least one protecting wings (1121, 2121, 3121), and the annular flange (3122a) is rested on a housing portion (1111) of the base (1110, 3110).
8. The fastening device (1000, 3000) of any of claims 1 to 7, wherein the upper case body (1120, 3120) comprises an upper opening, and the at least one protecting wing (1121, 2121, 3121) is higher than the upper opening.
9. The fastening device (1000, 3000) of any of claims 1 to 8, wherein the at least one protecting wing (1121, 2121, 3121) comprises a top portion (1121a) and a bottom portion (1121b), the top portion (1121a) of the at least one protecting wing (1121, 2121, 3121) has an upper radial outer-most edge, the bottom portion (1121b) of the at least one protecting wing (1121,

2121, 3121) has a lower radial outer-most edge, and a distance (D1) between the upper radial outer-most edge of the at least one protecting wing (1121, 2121, 3121) and the axis (X1) is equal to or smaller than a distance (D2) between the lower radial outer-most edge of the at least one protecting wing (1121, 2121, 3121) and the axis (X1).

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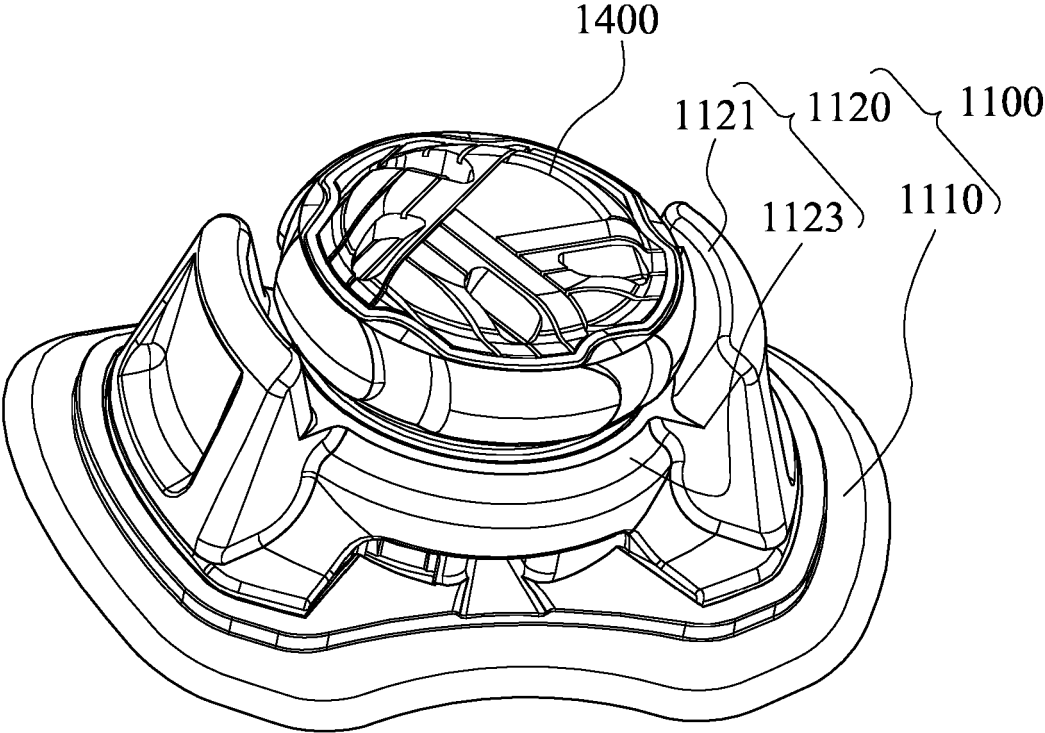


Fig. 1

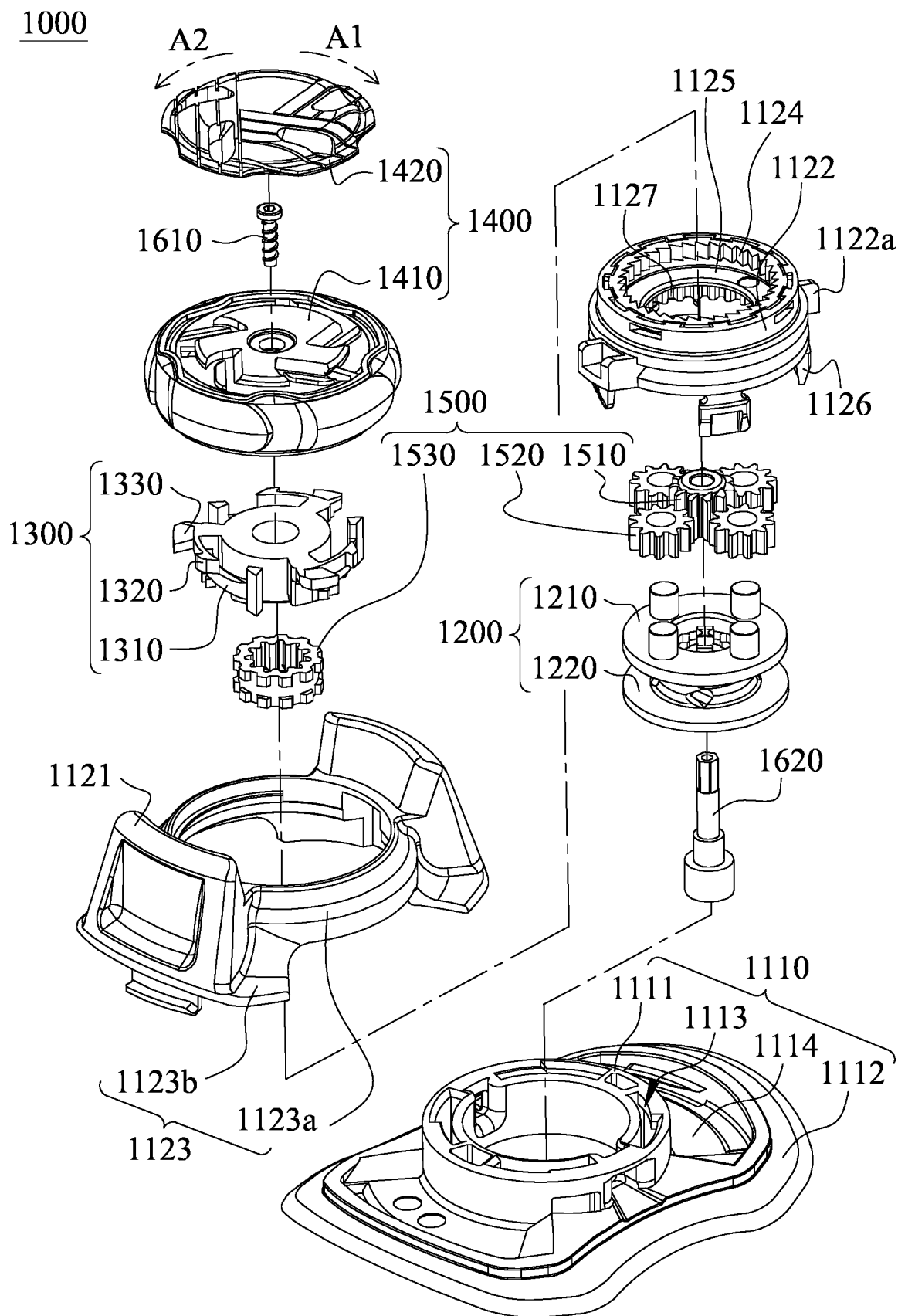


Fig. 2

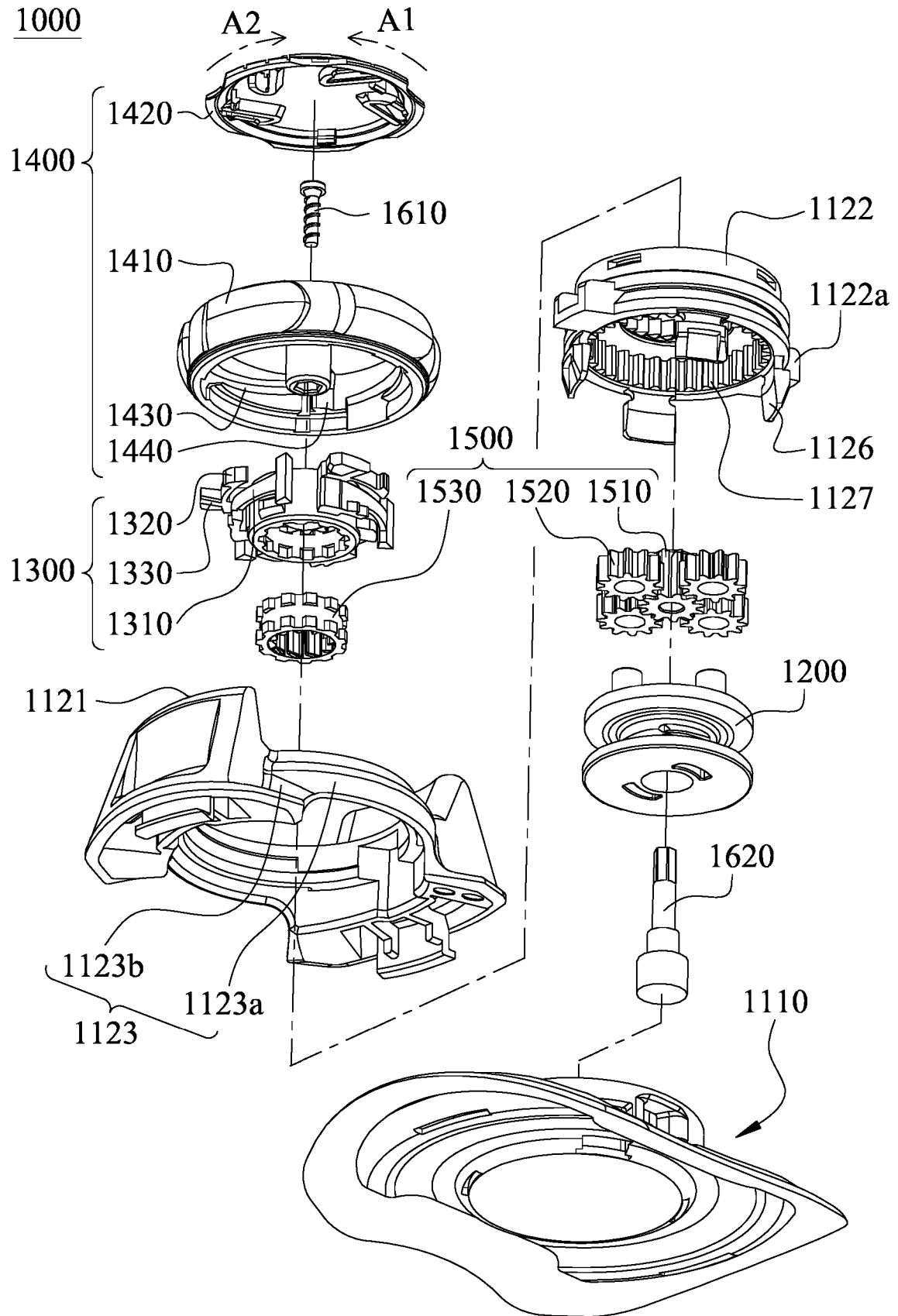


Fig. 3

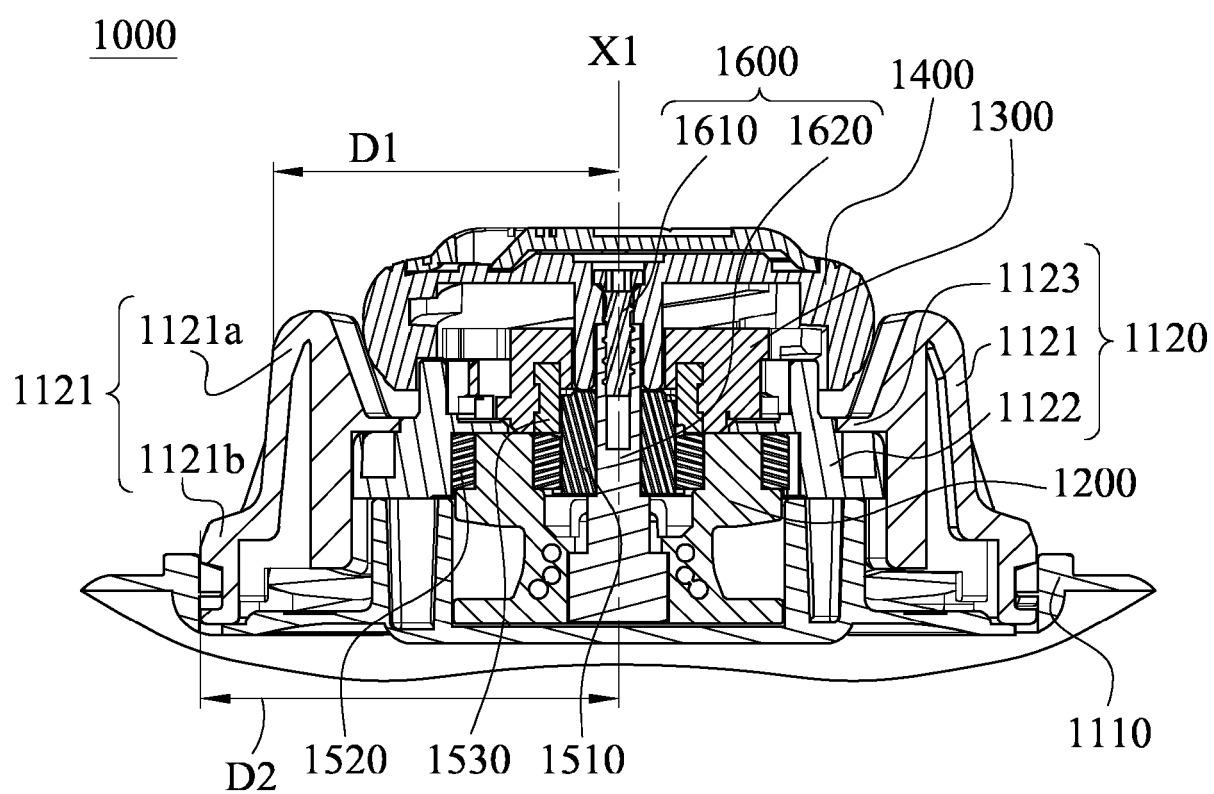


Fig. 4

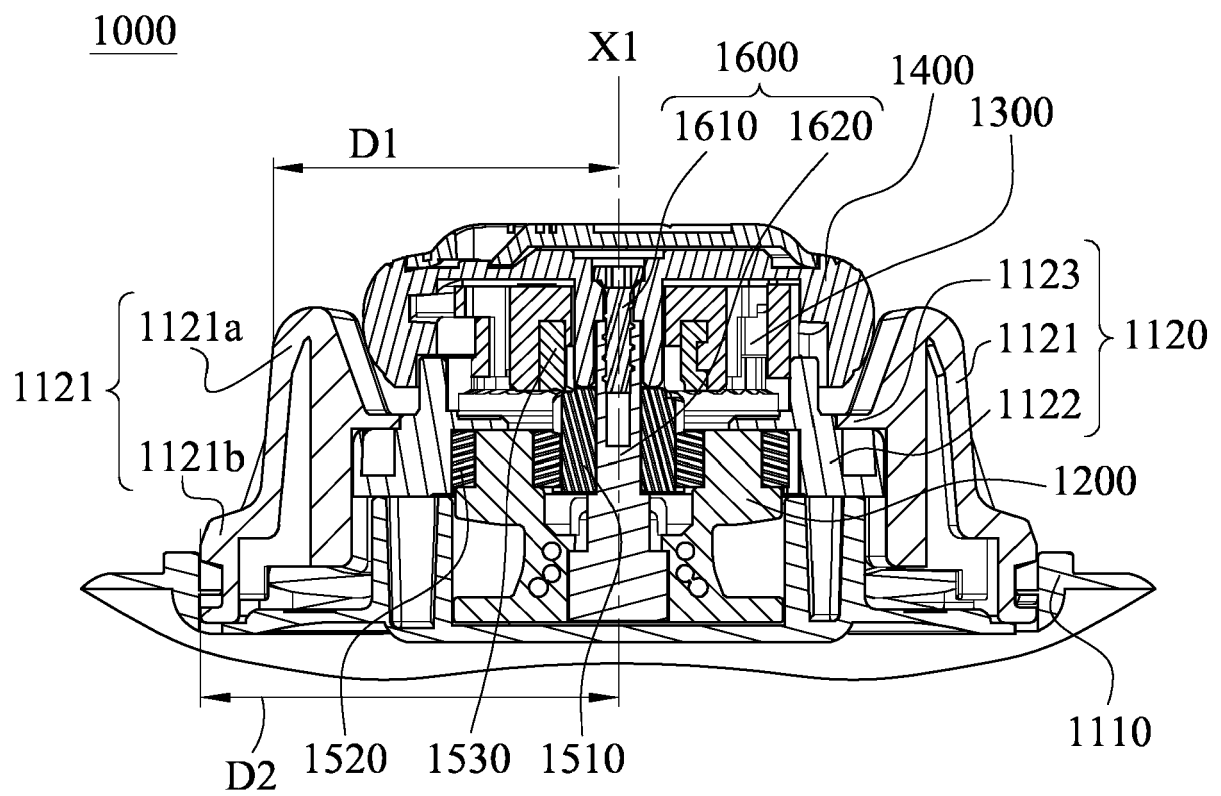


Fig. 5

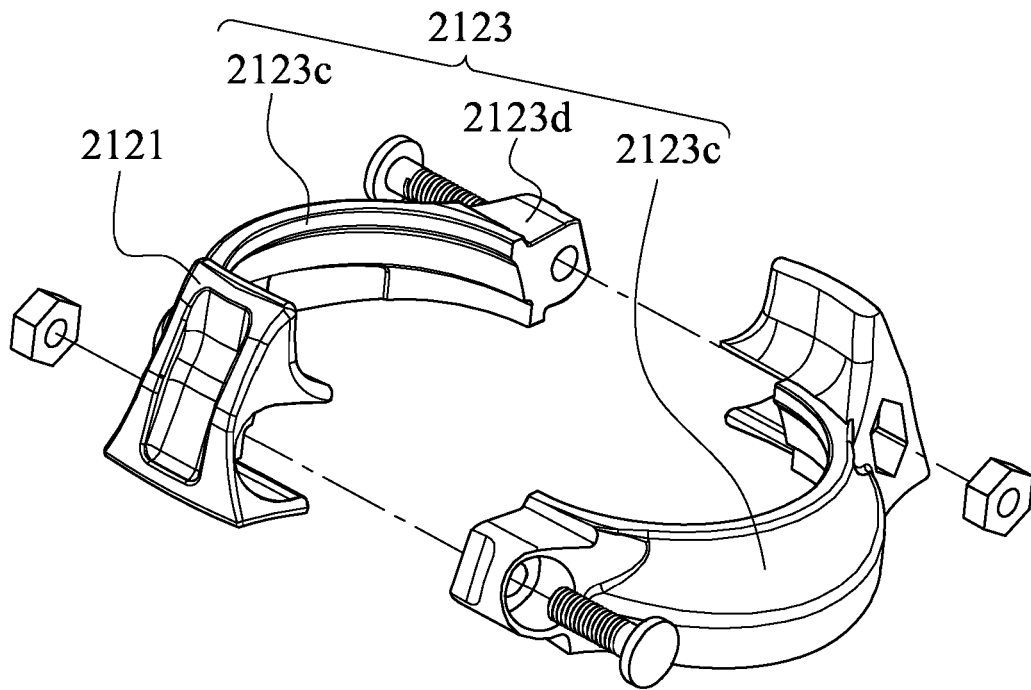


Fig. 6

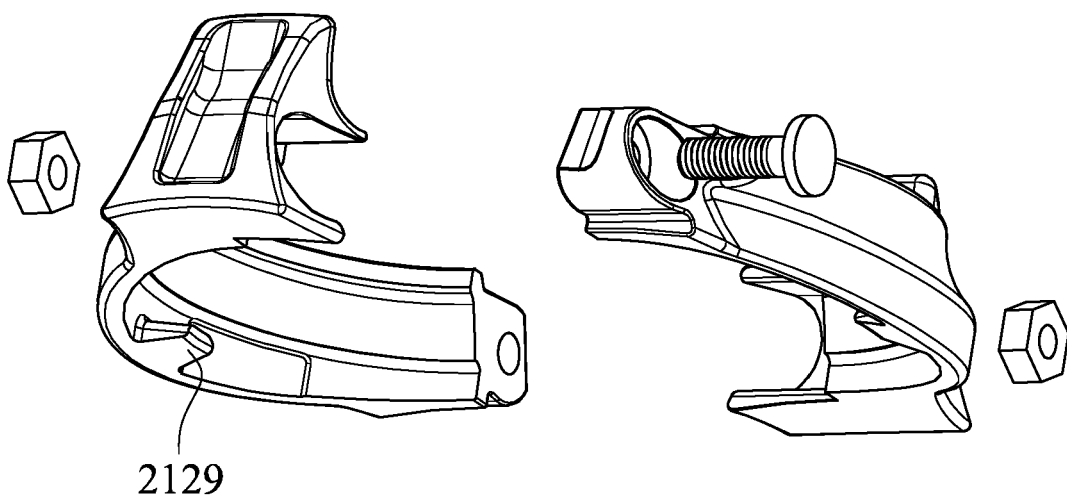


Fig. 7

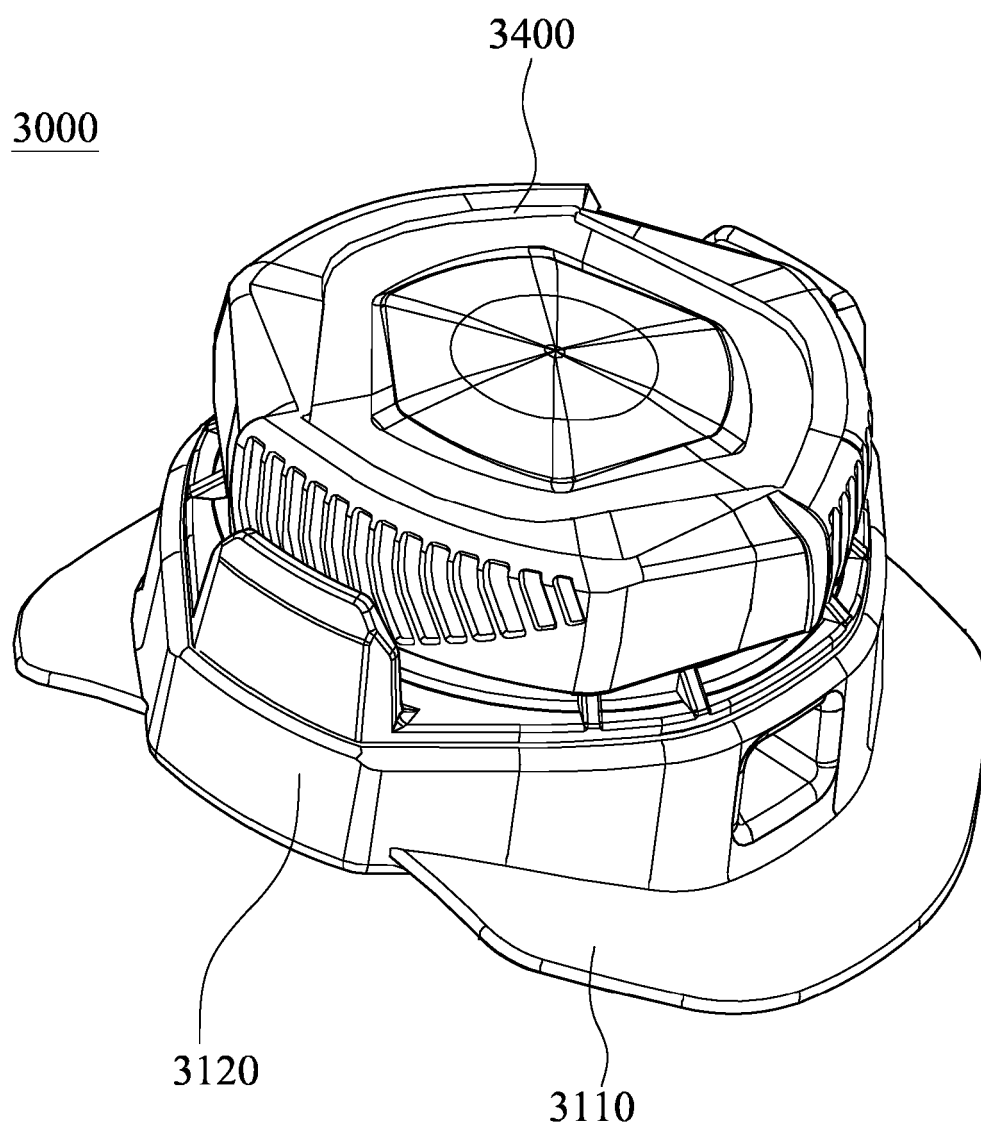


Fig. 8

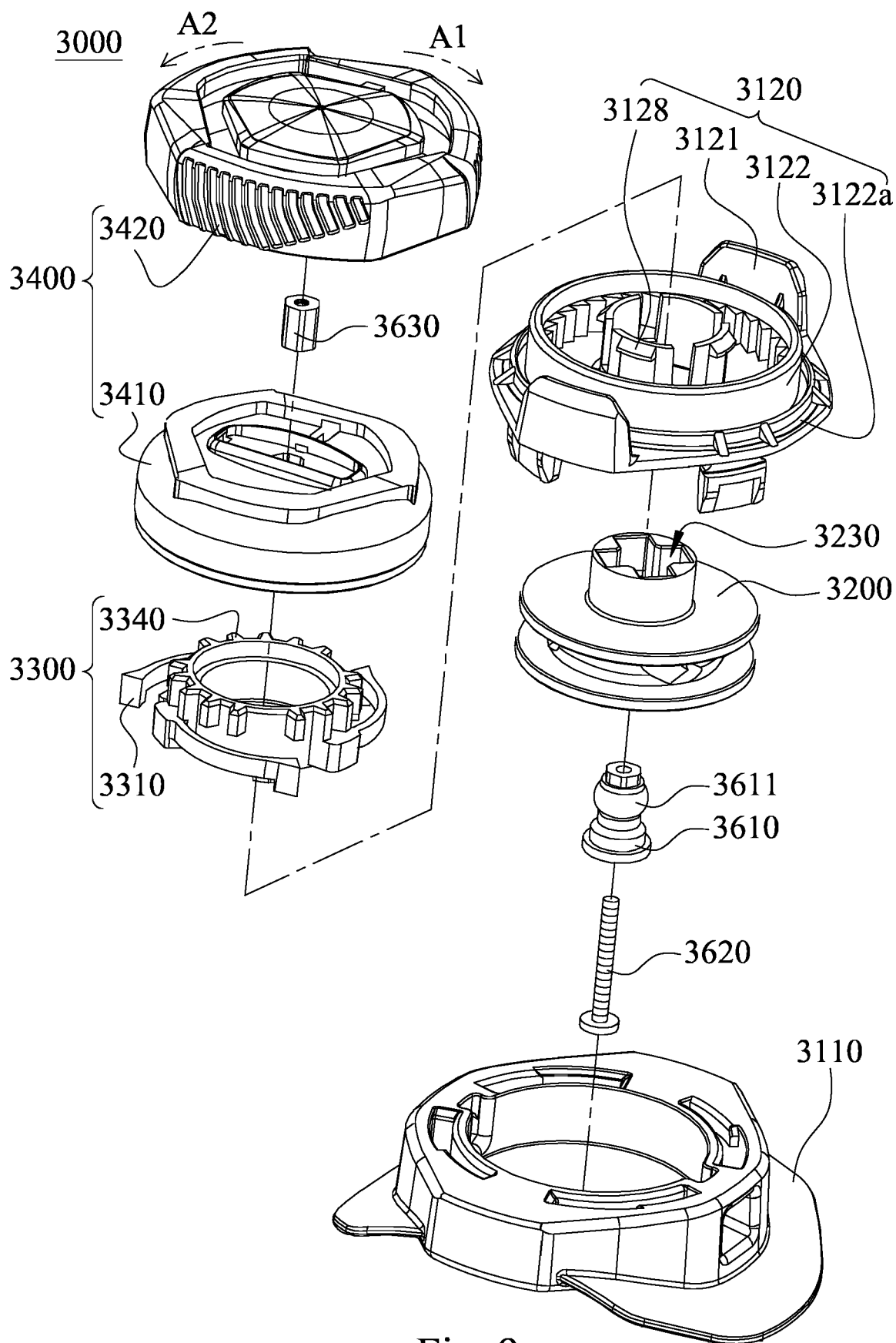


Fig. 9

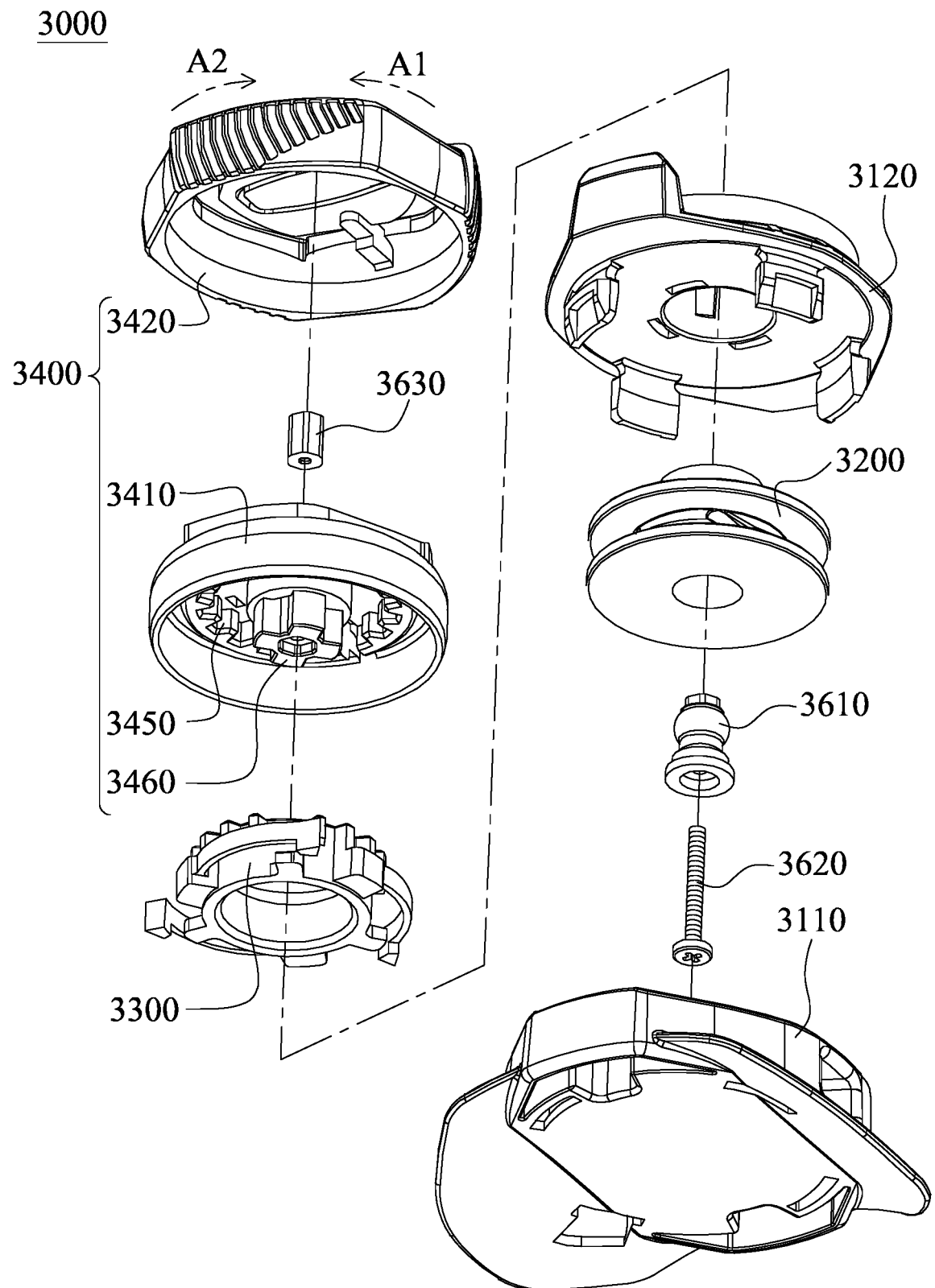


Fig. 10

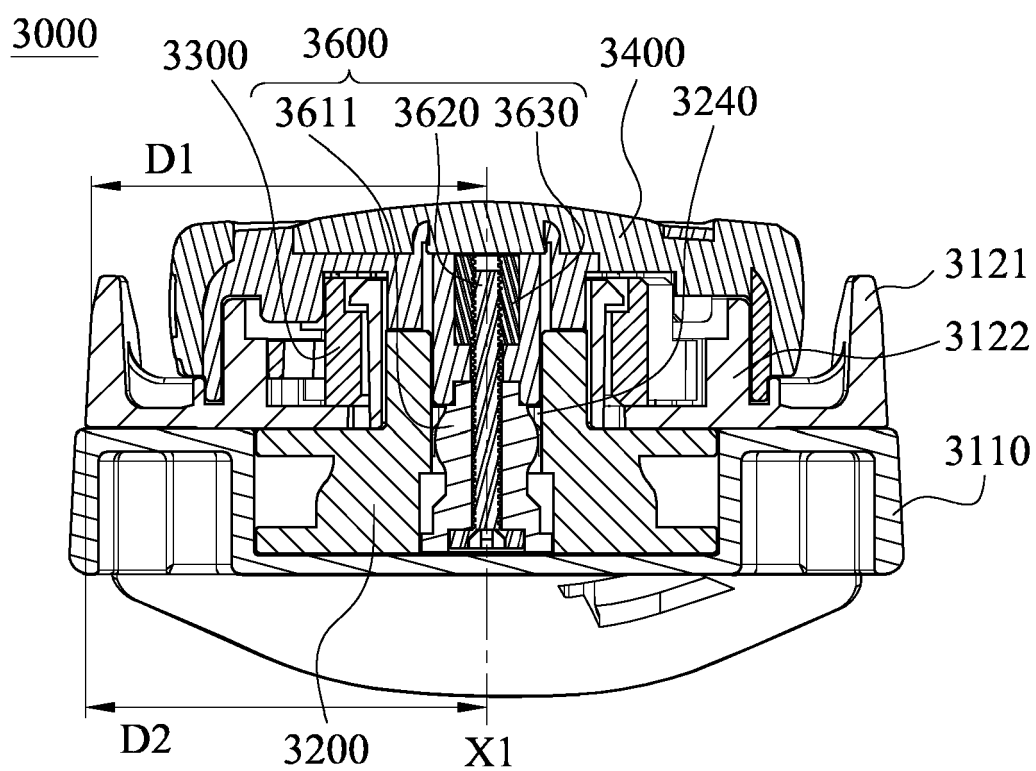


Fig. 11

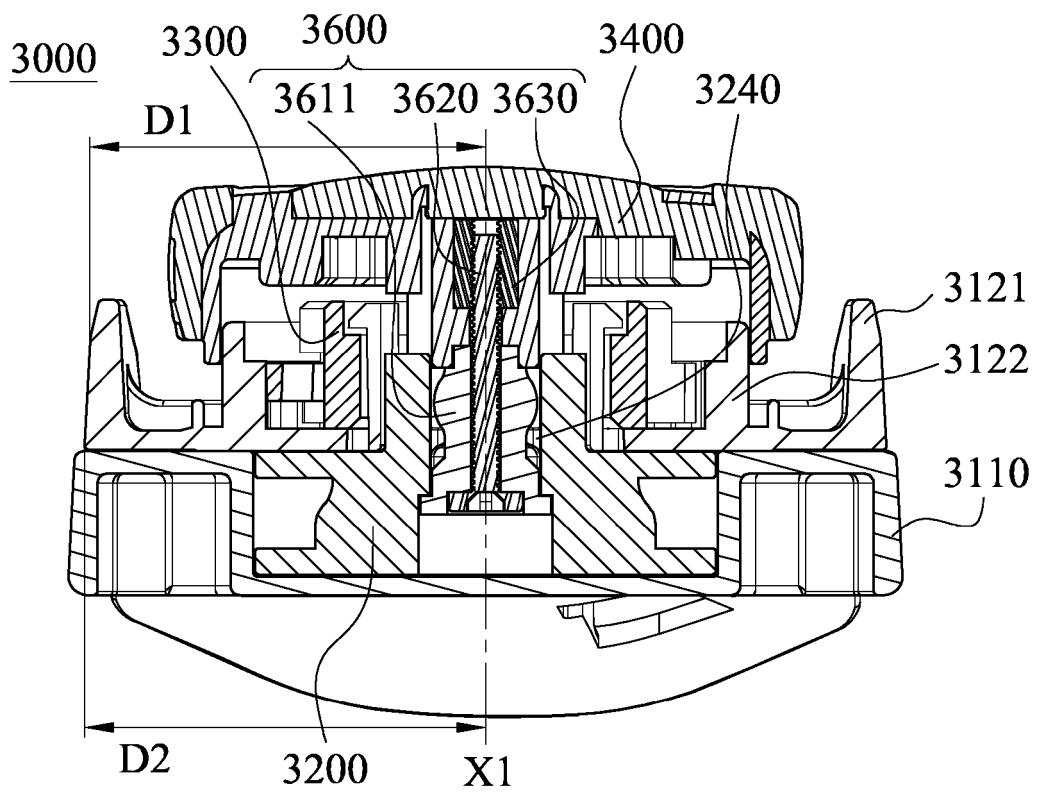


Fig. 12



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