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(54) **FASTENING DEVICE AND LACE ASSEMBLING METHOD**

(57) The present invention provides a fastening device, comprising a case, a spool, and a knob. The case comprises a case body and a base, the case body comprises an accommodating space and two threading holes, and the two threading holes are communicated with the accommodating space; the base is detachably connected to the case body and comprises a continuous annular wall. The spool is accommodated in the accommodating space, and a lace is wound on the spool after passing through the two threading holes; the knob is provided on the case. After the base is connected to the case body, and the knob is rotated relative to the case to drive the spool to tighten the lace. In this way, the structure in which the continuous annular wall surround the bottom edge of the case body allows for more stable assembly of the base and the case body, thereby improving structural reliability.

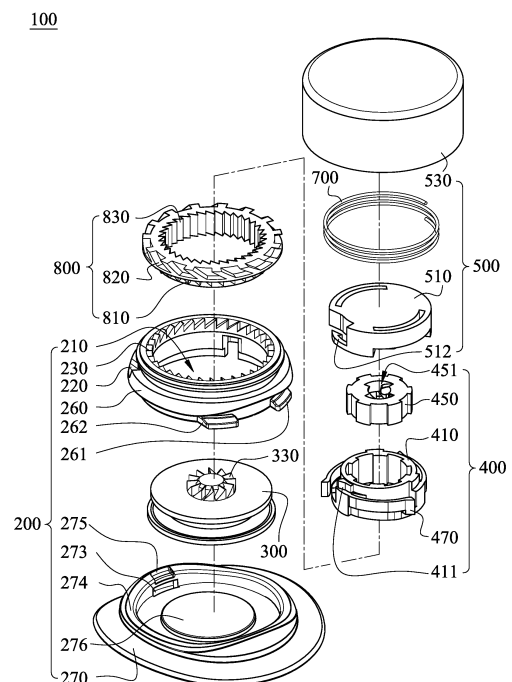


Fig. 2

Description

Technical Field

[0001] The present disclosure relates to a fastening device and a lace assembling method. More particularly, the present disclosure relates to a fastening device and a lace assembling method for securing an article through releasing or tensioning a lace.

Description of Related Art

[0002] In daily life, a lace or a thread is usually used to tighten articles, the most common tightening method is to use the cord to reciprocally pass through holes on the article, such as eyelets of a shoe, and then tie a knot to secure the article. But in this kind of tightening method, the knot is loosened easily because of an external force. Not only does the knot need to be tied again, but also lots of inconveniences come owing to the insecurity of the articles.

[0003] In order to solve such problems, some practitioners developed a simple fastening mechanism including a case, a driving unit and a spring. The case includes holes configured for the lace to pass therethrough. Through the reaction force between the spring and the driving unit, the lace can be clamped between the driving unit and the case so as to be fastened. The length of the lace can be changed by pressing the spring to change the position of the driving unit. However, in such fastening mechanism, the restoring force of the spring is served as the securing force; thus, the lace is easily to be released owing to vibrations or an external force. In addition, the fastening mechanism has no space to receive the lace, and the exposure of the lace may bring danger.

[0004] Therefore, some practitioners developed another kind of buckle which can be rotated to tension the lace, and the lace can be received inside the buckle. Through the interference between components inside the buckle, the length of the lace as well as the tightness can be adjusted. However, the structure of the buckles is complex, the manufacturing cost is therefore increased, and the buckle has assembly and repair difficulty. In addition, when the lace is broken and needs to be replaced, it is difficult to remove and assemble the lace, which is a problem has to be solved.

Disclosure of Invention

[0005] A fastening device is provided according to one embodiment of the present disclosure, which includes a case, a spool and a knob. The case includes a housing and a base, the housing includes a receiving space and two side holes, the aforementioned two side holes are communicated with the receiving space; the base is detachably connected to the housing and includes a continuous wall. The spool is received in the receiving space and a lace passes through the aforementioned two side

holes to be wound around the spool; the knob is disposed on the case. When the base is connected to the housing, the continuous wall surrounds a lower edge of the housing, and rotating the knob relative to the case causes the spool to fasten the lace.

[0006] Therefore, through the configuration that the continuous wall surrounds the lower edge of the housing, the base can be firmly combined with the housing, and the structural reliability thereof can be increased.

10 [0007] According to examples of the aforementioned fastening device, the continuous wall can have a uniform height.

[0008] According to examples of the aforementioned fastening device, the continuous wall can have a non-uniform height.

15 [0009] According to examples of the aforementioned fastening device, the continuous wall can include two first sections and two second sections connected alternately to each other, and each of the first sections is higher than each of the second sections.

20 [0010] According to examples of the aforementioned fastening device, the housing can further include at least one tab, the base can further include at least one hole, and the aforementioned at least one tab correspondingly engages with the aforementioned at least one hole.

25 [0011] According to examples of the aforementioned fastening device, a number of the aforementioned at least one tab can be three, two of the tabs are extended radially from a first side of the housing, and the other one of the tabs is extended radially from a second side of the housing.

30 [0012] According to examples of the aforementioned fastening device, the base can include a guiding groove and a bottom wall, the bottom wall is connected to the continuous wall, a number of the aforementioned at least one hole can be three, the three holes are recessed radially on the continuous wall near the bottom wall, the guiding groove is located on the continuous wall, and aligned with one of the three holes that corresponds to the other one of the aforementioned tabs.

35 [0013] According to examples of the aforementioned fastening device, the housing can further include a flange extending outwardly and radially, and the flange rests on the continuous wall.

40 [0014] According to examples of the aforementioned fastening device, the housing can further include an extending portion, the extending portion extends downwardly and axially from the flange, the base further includes an aligning groove, and the aligning groove is located on the continuous wall and aligned with the extending portion.

45 [0015] A lace assembling method is provided according to another embodiment of the present disclosure, which is configured for connecting a lace to a fastening device, the lace assembling method includes a fastening device providing step and a lace coupling step. In the fastening device providing step, a fastening device is provided, the fastening device includes a case, a spool and

a knob, the case includes a housing and a base, the housing includes a receiving space and two side holes communicated with the receiving space, the base is detachably connected to the housing and includes a continuous wall, when the base is connected to the housing, the continuous wall surrounds a lower edge of the housing, the spool is received in the receiving space and the aforementioned two side holes are configured for the lace to pass therethrough to be wound around the spool. In the lace coupling step, a first end of the lace and a second end of the lace are exposed from the housing after passing through the housing and the spool, and then the first end and the second end are knotted, so as to allow the lace to be coupled to the spool.

[0016] According to examples of the aforementioned lace assembling method, after the lace is coupled to the spool, the base is connected to the housing.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

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 view of the fastening device according to the 1st embodiment of Fig. 1;

Fig. 3 shows another exploded view of the fastening device according to the 1st embodiment of Fig. 1;

Fig. 4 shows a partial cross-sectional view of the fastening device according to the 1st embodiment of Fig. 1 coupled to a lace;

Fig. 5 shows a cross-sectional view of the fastening device according to the 1st embodiment of Fig. 1 coupled to the lace;

Fig. 6 shows a three-dimensional schematic view of a base of a fastening device according to a 2nd embodiment of the present disclosure;

Fig. 7 shows a side view of the base according to the 2nd embodiment of Fig. 6;

Fig. 8 shows a cross-sectional view of the base according to the 2nd embodiment of Fig. 6 taken along line 8-8;

Fig. 9 shows a three-dimensional schematic view of a base of a fastening device according to a 3rd embodiment of the present disclosure;

Fig. 10 shows a side view of the base according to the 3rd embodiment of Fig. 9;

Fig. 11 shows a cross-sectional view of the base according to the 3rd embodiment of Fig. 9 taken along line 11-11;

Fig. 12 shows a three-dimensional schematic view of a base of a fastening device according to a 4th embodiment of the present disclosure;

Fig. 13 shows a side view of the base according to the 4th embodiment of Fig. 12;

Fig. 14 shows a cross-sectional view of the base according to the 4th embodiment of Fig. 12 taken along line 14-14;

Fig. 15 shows a three-dimensional schematic view of a base of a fastening device according to a 5th embodiment of the present disclosure;

Fig. 16 shows a side view of the base according to the 5th embodiment of Fig. 15;

Fig. 17 shows a cross-sectional view of the base according to the 5th embodiment of Fig. 15 taken along line 17-17;

Fig. 18 shows a three-dimensional schematic view of a base of a fastening device according to a 6th embodiment of the present disclosure;

Fig. 19 shows a side view of the base according to the 6th embodiment of Fig. 18;

Fig. 20 shows a cross-sectional view of the base according to the 6th embodiment of Fig. 18 taken along line 20-20;

Fig. 21 shows one exploded view of a case of a fastening device according to a 7th embodiment of the present disclosure;

Fig. 22 shows another exploded view of the case according to the 7th embodiment of Fig. 21;

Fig. 23 shows a cross-sectional view of the assembly of the case according to the 7th embodiment of Fig. 21; and

Fig. 24 shows a flow chart of a lace assembling method according to an 8th embodiment of the present disclosure.

DETAILED DESCRIPTION

[0018] The embodiment will be described with the drawings. For clarity, some practical details will be described below. However, it should be noted that the present disclosure should not be limited by the practical

details. That is, in some embodiments, the practical details are unnecessary. In addition, for simplifying the drawings, some conventional structures and elements will be simply illustrated, and repeated elements may be represented by the same reference numerals.

[0019] 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, and therefore a first element/ component discussed below could be termed a second element/ component. Moreover, a combination of these elements/ components/ mechanisms/ modules of the present closure is not a known, common, or conventional combination in the art, and it cannot be predicted whether a relation of the combination thereof can be easily done by a person having skill in the art by these elements/ components/ mechanisms/ modules.

[0020] Please refer to Fig. 1, Fig. 2 and Fig. 3, Fig. 1 shows a three-dimensional schematic view of a fastening device 100 according to a 1st embodiment of the present disclosure, Fig. 2 shows one exploded view of the fastening device 100 according to the 1st embodiment of Fig. 1, and Fig. 3 shows another exploded view of the fastening device 100 according to the 1st embodiment of Fig. 1. The fastening device 100 can include a case 200, a spool 300 and a knob 500. The case 200 includes a housing 260 and a base 270, the housing 260 includes a receiving space 210 and two side holes 220, and the aforementioned two side holes 220 are communicated with the receiving space 210. The base 270 is detachably connected to the housing 260 and includes a continuous wall 274. The spool 300 is received in the receiving space 210 and a lace T1 (shown in Fig. 4) passes through the aforementioned two side holes 220 to be wound around the spool 300; the knob 500 is disposed on the case 200. When the base 270 is connected to the housing 260, the continuous wall 274 surrounds a lower edge 264 of the housing 260, and rotating the knob 500 relative to the case 200 causes the spool 300 to fasten the lace T1.

[0021] Therefore, through the configuration that the continuous wall 274 surrounds the lower edge 264 of the housing 260, the base 270 can be firmly combined with the housing 260, and the structural reliability thereof can be increased. The details of the fastening device 100 will be described in the following paragraphs.

[0022] As shown in Figs. 2 to 3, the housing 260 can further include a plurality of inner teeth 230 and a lower opening 240. The inner teeth 230 face to the receiving space 210, the lower opening 240 is communicated with the receiving space 210, and by assembling the base 270, the lower opening 240 can be closed to prohibit the spool 300 from falling out over the receiving space 210 from the lower opening 240. In detail, the continuous wall 274 is formed integrally, axial gaps are not recessed on the formed continuous wall 274 apparently, the continuous wall 274 can have a uniform or non-uniform height, but even the continuous wall 274 has the non-uniform height (a height of each region on the continuous wall

274 is different), the height of the continuous wall 274 changes smoothly instead of declining extremely as having the axial gaps. Therefore, through the configuration of smooth changing of the height of the continuous wall 274, the capability of the base 270 enduring the stress becomes stronger, the cladding capability becomes larger, the base 270 can be assembled with the housing 260 stably, and the problem of breaking out or cracking caused by excessive stress at the corner of the axial gap of the conventional base during disassembling can be avoided, so the reliability of the fastening device 100 can be improved.

[0023] The housing 260 can further include at least one tab 261, 262, 263, the base 270 can further include at least one hole 271, 272, 273, and the aforementioned at least one tab 261, 262, 263 correspondingly engages with the aforementioned at least one hole 271, 272, 273. In the 1st embodiment, a number of the aforementioned at least one tab 261, 262, 263 is three, the two tabs 261, 262 extends radially from a first side of the housing 260, and the other tab 263 is extended radially from a second side of the housing 260. The base 270 can include a guiding groove 275 and a bottom wall 276, the bottom wall 276 is connected to the continuous wall 274, a number of the aforementioned at least one hole 271, 272, 273 can be three, the three holes 271, 272, 273 are recessed radially on the continuous wall 274 near the bottom wall 276, the guiding groove 275 is located on the continuous wall 274 and aligned with the one hole 273 that corresponds to the other aforementioned tab 263. In other words, through the configuration of the tabs 261, 262, 263 respectively engaging with the holes 271, 272, 273, the base 270 can assemble with the housing 260, and during assembling, the tabs 261, 262 can be inserted into the holes 271, 272 first, and then the tab 263 is guided by the guiding groove 275 to be inserted into the hole 273. In other embodiments, a number of each of the tabs and the holes can be changed according to the requirements, the guiding groove is not necessary to be disposed, and the present disclosure is not limited thereto.

[0024] Please refer to Figs. 4 and 5, with references of Figs. 2 to 3, Fig. 4 shows a partial cross-sectional view of the fastening device 100 according to the 1st embodiment of Fig. 1 coupled to a lace T1, Fig. 5 shows a cross-sectional view of the fastening device 100 according to the 1st embodiment of Fig. 1 coupled to the lace T1, and in Fig. 4, the base 270 is omitted. The spool 300 can be disc-shaped and includes an axial cylinder (not labeled), a first opening 321, a second opening (not shown) and a bottom opening 315, and the first opening 321 and the second opening are communicated with the bottom opening 315. A first end and a second end of the lace T1 can respectively pass through the first opening 321 and the second opening to be coupled with the spool 300, and the lace T1 is wound around the axial cylinder. In detail, the first end of the lace T1 can be exposed from the lower opening 240 after passing through the first opening 321 and the bottom opening 315, the second

end of the lace T1 can be exposed from the lower opening 240 after passing through the second opening and the bottom opening 315, so as to allow a user to tie, such that the lace T1 can be limited in the first opening 321 and the second opening, and then the base 270 can be assembled to the housing 260.

[0025] The knob 500 can include a rotary cover 530 and an inner plate 510, and the inner plate 510 is coupled to the rotary cover 530. The fastening device 100 can further include a locking unit 400, a ratchet ring 800 and a spring 700, the locking unit 400 is coupled to the knob 500 and the spool 300, the ratchet ring 800 is disposed in the housing 260, and the spring 700 is disposed on the ratchet ring 800 and surrounds the inner plate 510, so that when the knob 500 is rotated to drive the locking unit 400, the spool 300 linked therewith is rotated to retract the lace T1.

[0026] Furthermore, the ratchet ring 800 includes a plurality of lower sloped teeth 810, a plurality of upper sloped grooves 820 and a plurality of ratchet teeth 830, both of the lower sloped teeth 810 and the upper sloped grooves 820 are located at an outer surface of the ratchet ring 800, the lower sloped teeth 810 are located below the upper sloped grooves 820 to correspond to the inner teeth 230, and the ratchet teeth 830 are located at an inner surface of the ratchet ring 800.

[0027] The locking unit 400 is located in the ratchet ring 800 and includes an engaging disc 410, an inner gear 450, a plurality of coupling teeth 460 and three pawl arms 470. The inner gear 450 is located in the engaging disc 410, the inner gear 450 can move axially and relatively to the engaging disc 410 and include a spiral hole 451. The coupling teeth 460 are located in the inner gear 450 and detachably engaged with the engaging teeth 330, and the three pawl arms 470 are disposed at the engaging disc 410 and correspond to the ratchet teeth 830.

[0028] The knob 500 can further include a guiding block 520 located at an inner wall of the rotary cover 530 and corresponding to the upper sloped grooves 820, the inner plate 510 can further include a spiral cylinder 511 and a coupling arm 512, the spiral cylinder 511 corresponds to the spiral hole 451, and the coupling arm 512 is selectively coupled to a buckling tab 411 of the engaging disc 410.

[0029] Through the configuration, when the rotary cover 530 is rotated in a tightening direction, the pawl arms 470 are disengaged with the ratchet teeth 830 repeatedly to allow the spool 300 to fasten the lace T1. On the contrary, when the rotary cover 530 is not pressed and is rotated in a loosening direction, the inner gear 450 driven by the spiral cylinder 511 is lifted relatively to the engaging disc 410, the inner gear 450 is disengaged with the engaging teeth 330 at this moment, and the spool 300 is not limited and can freely rotate to release the lace T1. When the rotary cover 530 is pressed and rotated in the loosening direction simultaneously, the upper sloped groove 820 is guided by the guiding block 520, such that

the ratchet ring 800 is lifted and the lower sloped teeth 810 disengage from the inner teeth 230 repeatedly, and then the lace T1 is release incrementally.

[0030] Please refer to Figs. 6, 7 and 8, Fig. 6 shows a three-dimensional schematic view of a base 270a of a fastening device according to a 2nd embodiment of the present disclosure, Fig. 7 shows a side view of the base 270a according to the 2nd embodiment of Fig. 6, Fig. 8 shows a cross-sectional view of the base 270a according to the 2nd embodiment of Fig. 6 taken along line 8-8, in Figs. 6 to 8, only the base 270a is shown, the other elements of the fastening device are omitted, and the fastening device can further include a knob, a locking unit, a spool and a housing essentially. The knob can cover on the housing, the locking unit and the spool can disposed in the housing, the locking unit is coupled to the knob and includes a plurality of pawl arms interfering with inner teeth of the housing, the spool can be engaged with the locking unit, the locking unit can be disengaged with the spool through pulling or rotating the knob, such that the spool is allowed to freely rotate, and the aforementioned detail and the structure are not described herein again. The base 270a is configured for assembling the housing and has a non-uniform height, a continuous wall 271a can include two first sections 2711a and two second sections 2712a which are connected alternately to each other, and each of the first sections 2711a is higher than each of the second sections 2712a. It is worthy to be noted that, in the 2nd embodiment, there is no real boundary between the first sections 2711a and the second sections 2712a, it is only for convenience to distinguish the first sections 2711a and the second sections 2712a, and the present disclosure is not limited thereto.

[0031] A height H2 of each of the first sections 2711a is higher than a height H1 of each of the second sections 2712a, and each of the first sections 2711a is connected between the two second sections 2712a to form a continuous and integral wall without any gap. Moreover, each of the first sections 2711a and the second sections 2712a is an arc structure which protrudes in the middle and heights of the two ends of each of the first sections 2711a and the second sections 2712a can be slightly decreased. In other words, the height of the intersection between the second sections 2712a and the first sections 2711a is lower than the height H1, such that the continuous wall 271a forms a wave-shaped structure.

[0032] Please refer to Figs. 9, 10 and 11, Fig. 9 shows a three-dimensional schematic view of a base 270b of a fastening device according to a 3rd embodiment of the present disclosure, Fig. 10 shows a side view of the base 270b according to the 3rd embodiment of Fig. 9., and Fig. 11 shows a cross-sectional view of the base 270b according to the 3rd embodiment of Fig. 9 taken along line 11-11. A continuous wall 271b of the base 270b has a uniform height, that is, a height of each section of the continuous wall 271b is the same.

[0033] Please refer to Figs. 12, 13 and 14, Fig. 12 shows a three-dimensional schematic view of a base

270c of a fastening device according to a 4th embodiment of the present disclosure, Fig. 13 shows a side view of the base 270c according to the 4th embodiment of Fig. 12, and Fig. 14 shows a cross-sectional view of the base 270c according to the 4th embodiment of Fig. 12 taken along line 14-14. A continuous wall 271c of the base 270c has two sections 2711c. The two sections 2711c are connected to each other symmetrically, and each of the sections 2711c is an arc structure and the middle portion of each of the sections 2711c is higher than the two lateral portions of each of the sections 2711c, and the two sections 2711c are connected to each other via the two lateral portions thereof.

[0034] Please refer to Figs. 15, 16 and 17, Fig. 15 shows a three-dimensional schematic view of a base 270d of a fastening device according to a 5th embodiment of the present disclosure, Fig. 16 shows a side view of the base 270d according to the 5th embodiment of Fig. 15, and Fig. 17 shows a cross-sectional view of the base 270d according to the 5th embodiment of Fig. 15 taken along line 17-17. The base 270d is similar to the base 270a, a continuous wall 271d includes two first sections 2711d and two second sections 2712d, each of the first sections 2711d is an arc structure which protrudes in the middle, but a height of each part of the second sections 2712d are uniform.

[0035] Please refer to Figs. 18, 19 and 20, Fig. 18 shows a three-dimensional schematic view of a base 270e of a fastening device according to a 6th embodiment of the present disclosure, Fig. 19 shows a side view of the base 270e according to the 6th embodiment of Fig. 18, Fig. 20 shows a cross-sectional view of the base 270e according to the 6th embodiment of Fig. 18 taken along line 20-20. The base 270e is similar to the base 270c, a continuous wall 271e has two sections 2711e, but each of the sections 2711e is an arc structure and the middle portion of each of the sections 2711e is lower than the two lateral portions of each of the sections 2711e, and the two sections 2711e are connected to each other via the two lateral portions thereof.

[0036] Please refer to Figs. 21, 22 and 23, Fig. 21 shows one exploded view of a case 200f of a fastening device according to a 7th embodiment of the present disclosure, Fig. 22 shows another exploded view of the case 200f according to the 7th embodiment of Fig. 21, and Fig. 23 shows a cross-sectional view of the assembly of the case 200f according to the 7th embodiment of Fig. 21. The case 200f can include a base 270f and a housing 260f, the housing 260f is disposed on the base 270f, the housing 260f can include a flange 264f extending outwardly and radially, and the flange 264f rests on a continuous wall 271f. The housing 260f can further include an extending portion 265f, and the extending portion 265f extends downwardly and axially from the flange 264f. The base 270f can further include an aligning groove 272f, and the aligning groove 272f is located on the continuous wall 271f and aligned with the extending portion 265f.

[0037] Please refer to Fig. 24, with references of Figs. 1 to 6, Fig. 24 shows a flow chart of a lace assembling method 100g according to an 8th embodiment of the present disclosure. The lace assembling method 100g is configured for connecting a lace T1 to a fastening device 100, and the lace assembling method 100g includes a fastening device providing step S01 and a lace coupling step S02.

[0038] In the fastening device providing step S01, the fastening device 100 is provided, the fastening device 100 includes a case 200, a spool 300 and a knob 500, the case 200 includes a housing 260 and a base 270, the housing 260 includes a receiving space 210 and two side holes 220 communicated with the receiving space 210, the base 270 is detachably connected to the housing 260 and includes a continuous wall 274, when the base 270 is connected to the housing 260, the continuous wall 274 surrounds a lower edge 264 of the housing 260, the spool 300 is received in the receiving space 210, and the aforementioned two side holes 220 are configured for the lace T1 to pass therethrough to be wound around spool 300.

[0039] In the lace coupling step S02, a first end of the lace T1 and a second end of the lace T1 are exposed from the housing 260 and the spool 300 after passing through the housing 260, and then the first end and the second end are knotted, so as to allow the lace T1 to be coupled to the spool 300. Before assembling the base 270, a user can respectively align a first opening 321 and a second opening of the spool 300 with the two side holes 220, then allow the first end of the lace T1 to pass through one of the side holes 220 and the first opening 321 after passing through openings on a wearable object, and allow the second end of the lace T1 to pass through the other one of the side holes 220 and the second opening after passing through openings on the wearable object, at last limit the lace T1 in the spool 300 through knotting.

[0040] Lastly, after the lace T1 is coupled to the spool 300, the base 270 can be connected to the housing 260, and the assembling of the lace T1 is completed.

[0041] Although the present disclosure has been described as above, but the present disclosure is not limited thereto, any one skilled in the art, within the spirit and scope of the present disclosure, can take modifications and variations, and thus the protecting scope of the present disclosure is defined by the scope of the following claims.

REFERENCE NUMERAL

[0042]

100: fastening device
100g: lace assembling method
200, 200f: case
210: receiving space
220: side hole
230: inner tooth

240: lower opening
 260, 260f: housing
 261, 262, 263: tab
 264: lower edge
 264f: flange
 265f: extending portion
 270, 270a, 270b, 270c, 270d, 270e, 270f: base
 271, 272, 273: hole
 271a, 271b, 271c, 271d, 271e, 271f, 274: continuous wall
 2711a, 2711d: first section
 2711c, 2711e: section
 2712a, 2712d: second section
 272f: aligning groove
 275: guiding groove
 276: bottom wall
 300: spool
 315: bottom opening
 321: first opening
 330: engaging tooth
 400: locking unit
 410: engaging disc
 411: buckling tab
 450: inner gear
 451: spiral hole
 460: coupling tooth
 470: pawl arm
 500: knob
 510: inner plate
 511: spiral cylinder
 512: coupling arm
 520: guiding block
 530: rotary cover
 700: spring
 800: ratchet ring
 810: lower sloped tooth
 820: upper sloped groove
 830: ratchet tooth
 H1, H2: height
 S01: fastening device providing step
 S02: lace coupling step
 T1: lace

Claims

1. A fastening device, **characterized by**, comprising:

a case, comprising:

a housing, comprising a receiving space and two side holes, the two side holes being communicated with the receiving space; and
 a base, detachably connected to the housing and comprising a continuous wall;

a spool, received in the receiving space, and a

lace passing through the two side holes to be wound around the spool; and
 a knob, disposed on the case;
 wherein, after the base is connected to the housing, the continuous wall surrounds a lower edge of the housing, and rotating the knob relative to the case causes the spool to fasten the lace.

2. The fastening device of claim 1, wherein, the continuous wall has a uniform height.

3. The fastening device of claim 1, wherein, the continuous wall has a non-uniform height.

4. The fastening device of claim 3, wherein, the continuous wall comprises two first sections and two second sections connected alternately to each other, and each of the first sections is higher than each of the second sections.

5. The fastening device of claim 1, wherein, the housing further comprises at least one tab, the base further comprises at least one hole, and the at least one tab correspondingly engages with the at least one hole.

6. The fastening device of claim 5, wherein, a number of the at least one tab is three, two of the tabs are extended radially from a first side of the housing, and the other one of the tabs is extended radially from a second side of the housing.

7. The fastening device of claim 6, wherein, the base comprises a guiding groove and a bottom wall, the bottom wall is connected to the continuous wall, a number of the at least one hole is three, the three holes are recessed radially on the continuous wall near the bottom wall, the guiding groove is located on the continuous wall, and aligned with one of the three holes that corresponds to the other one of the tabs.

8. The fastening device of claim 1, wherein, the housing further comprises a flange extending outwardly and radially, and the flange rests on the continuous wall.

9. The fastening device of claim 8, wherein, the housing further comprises an extending portion, the extending portion extends downwardly and axially from the flange, the base further comprises an aligning groove, and the aligning groove is located on the continuous wall and aligned with the extending portion.

10. A lace assembling method, which is configured for connecting a lace to a fastening device, **characterized by**, the lace assembling method comprising:

a fastening device providing step, wherein the

fastening device is provided, the fastening device comprises a case, a spool and a knob, the case comprises a housing and a base, the housing comprises a receiving space and two side holes communicated with the receiving space, the base is detachably connected to the housing and comprises a continuous wall, when the base is connected to the housing, the continuous wall surrounds a lower edge of the housing, the spool is received in the receiving space, and the two side holes are configured for the lace to pass therethrough to be wound around the spool; and a lace coupling step, wherein a first end of the lace and a second end of the lace are exposed from the housing after passing through the housing and the spool, and then the first end and the second end are knotted, so as to allow the lace to be coupled to the spool.

11. The lace assembling method of claim 10, wherein, after the lace is coupled to the spool, the base is connected to the housing.

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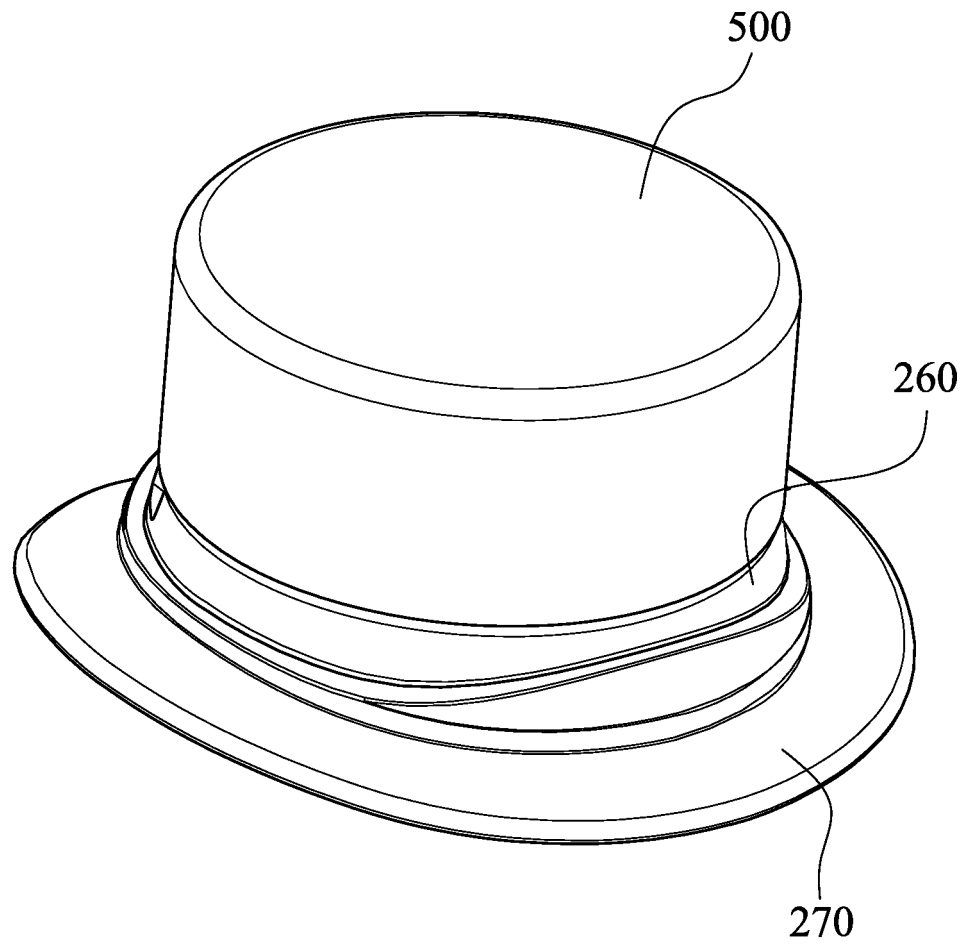


Fig. 1

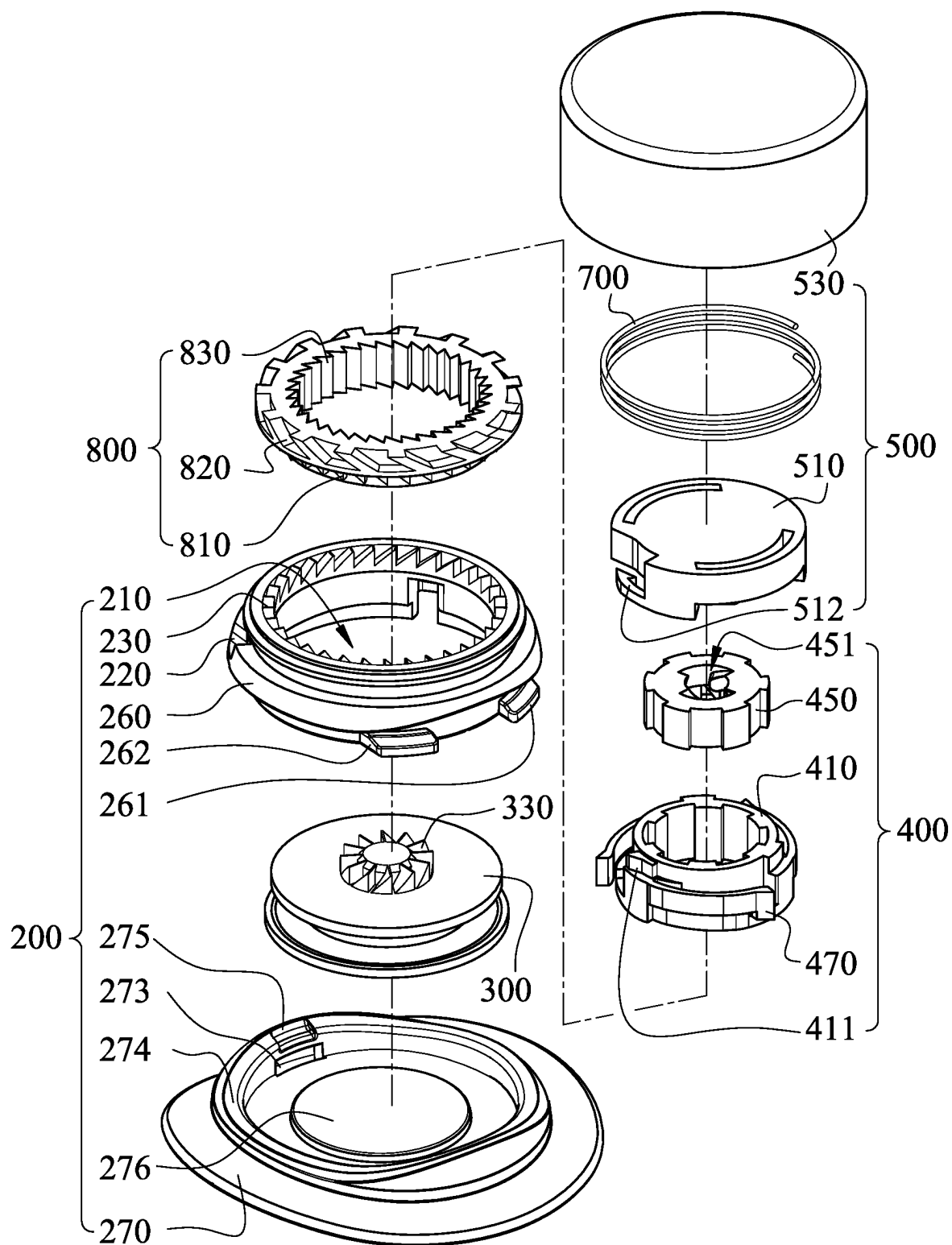
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Fig. 2

100

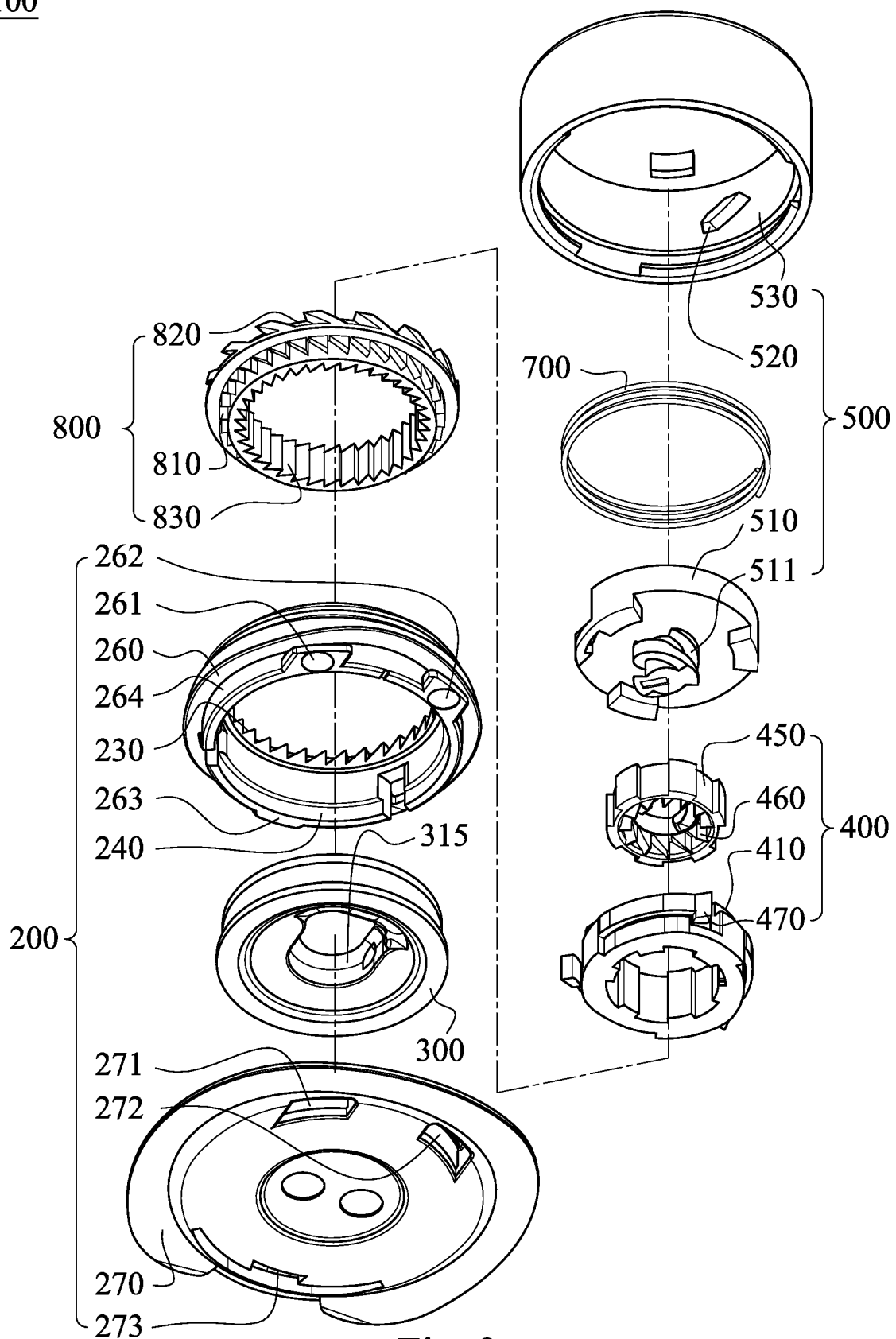


Fig. 3

100

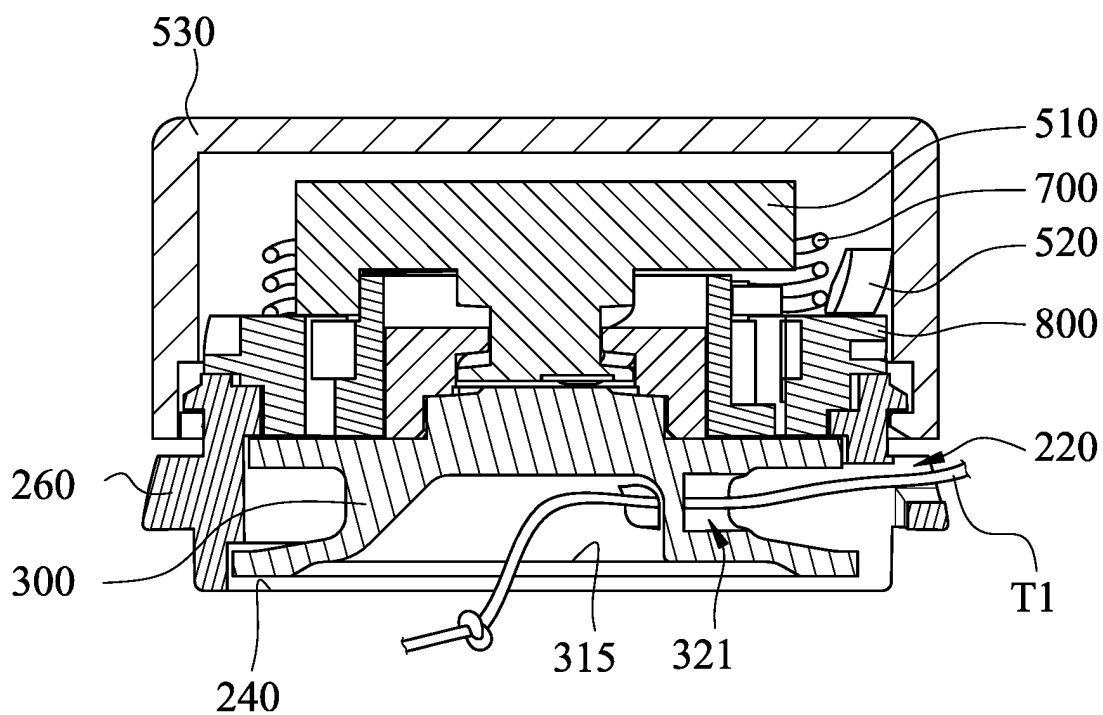


Fig. 4

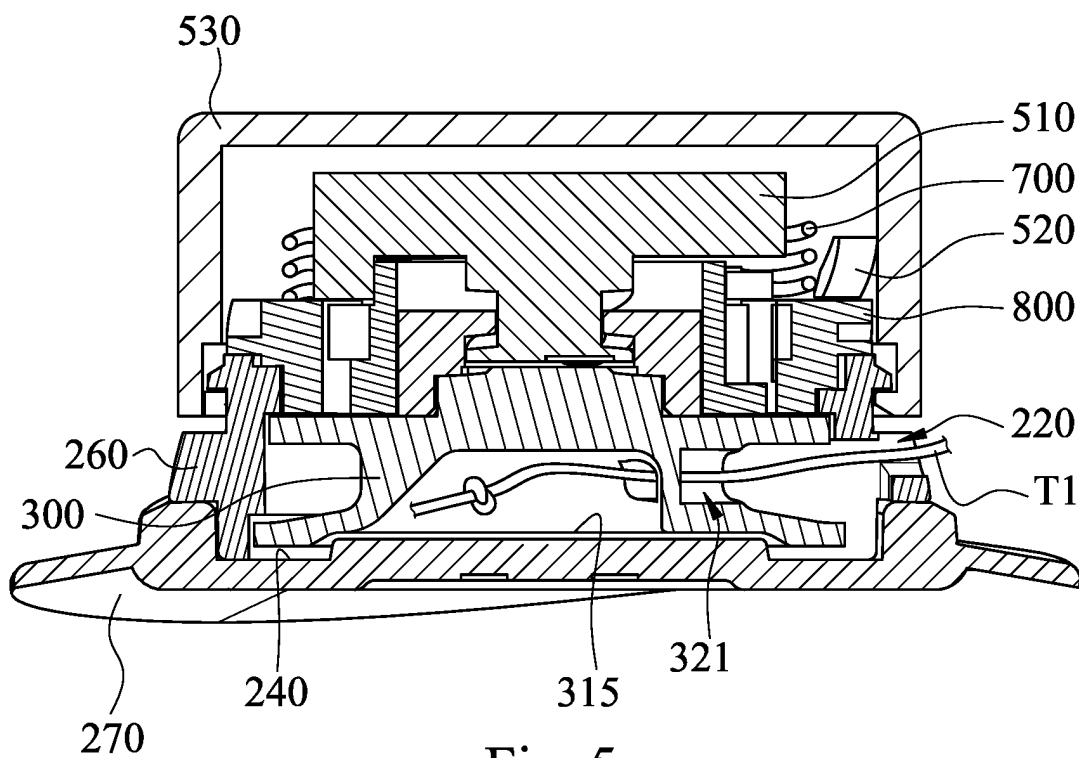


Fig. 5

270a

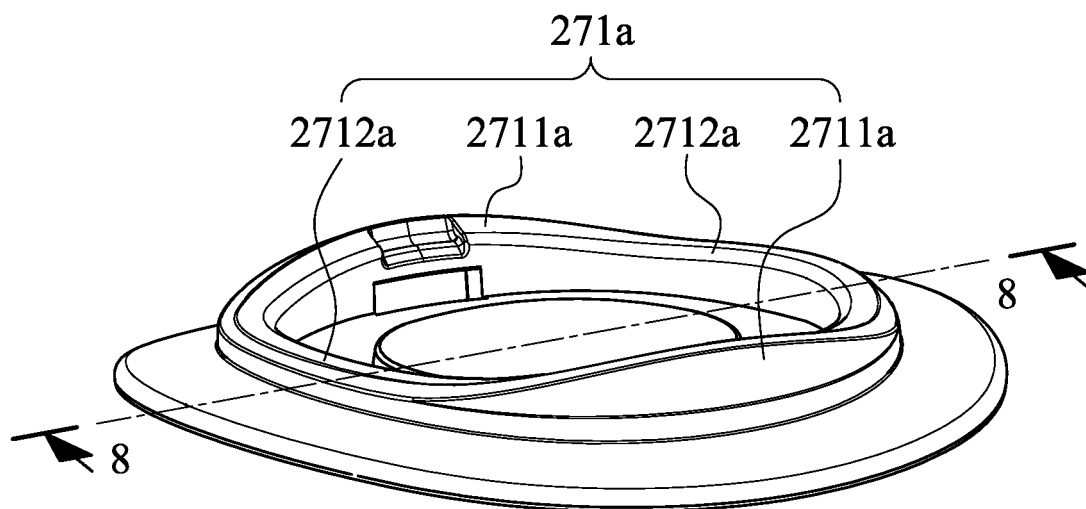


Fig. 6

270a

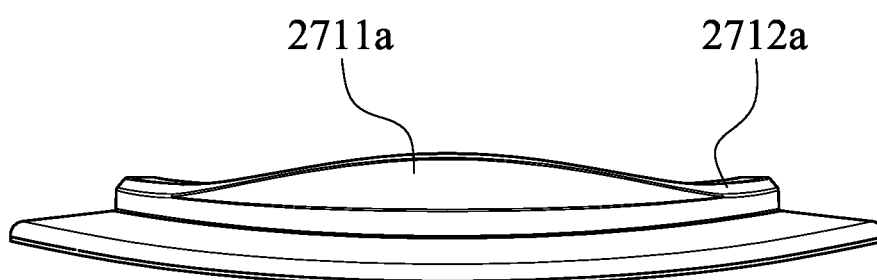


Fig. 7

270a

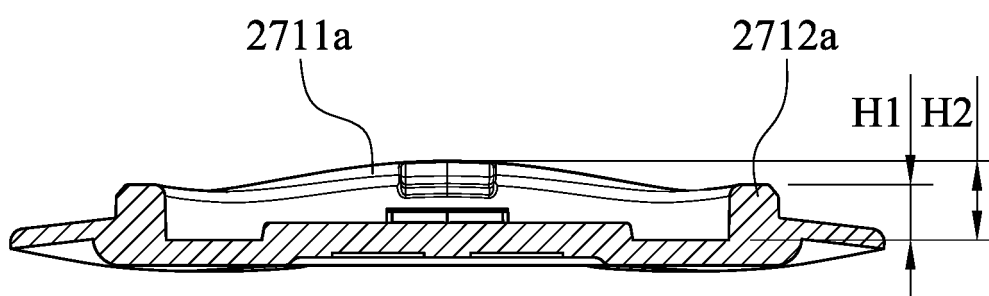


Fig. 8

270b

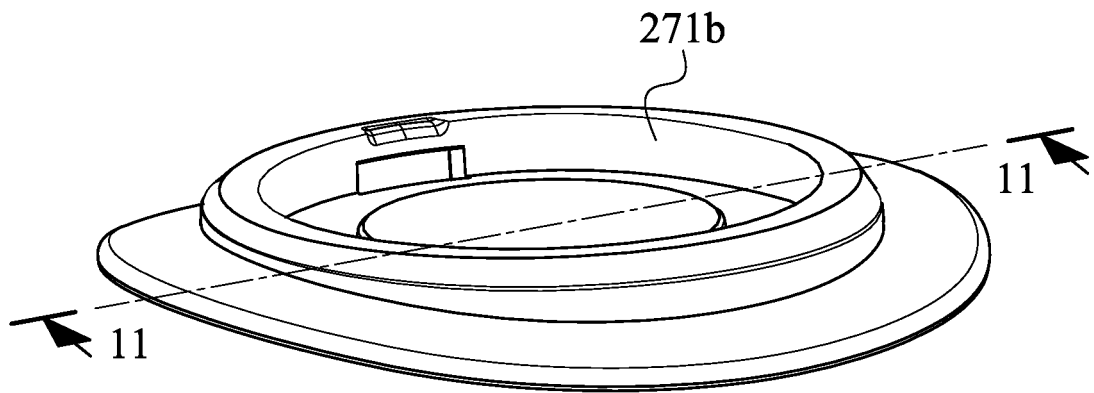


Fig. 9

270b

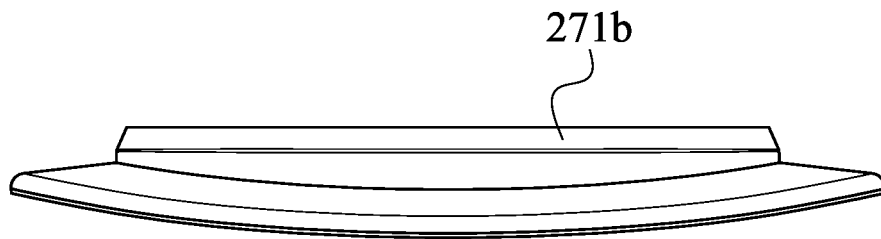


Fig. 10

270b

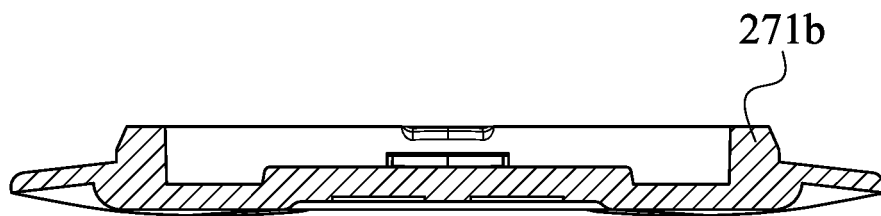


Fig. 11

270c

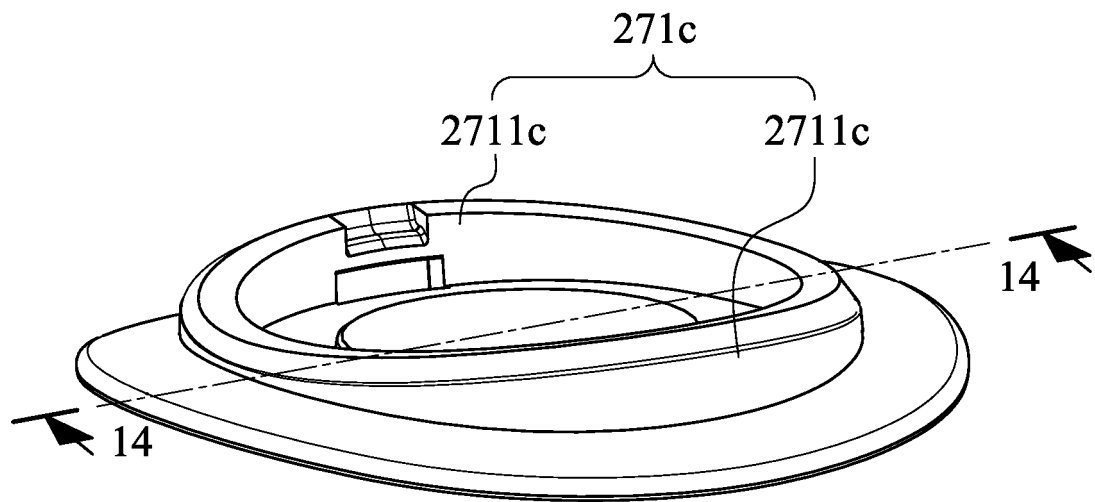


Fig. 12

270c

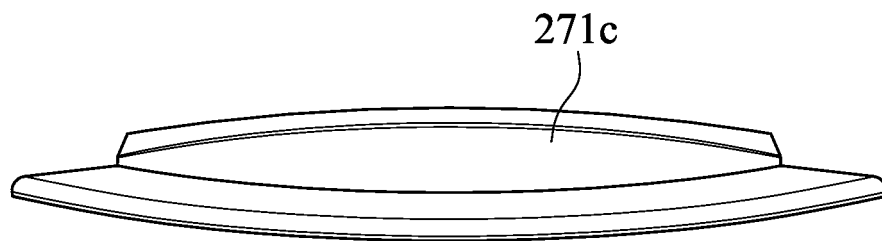


Fig. 13

270c

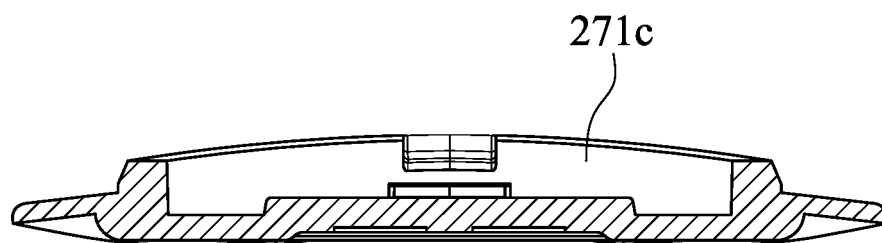


Fig. 14

270d

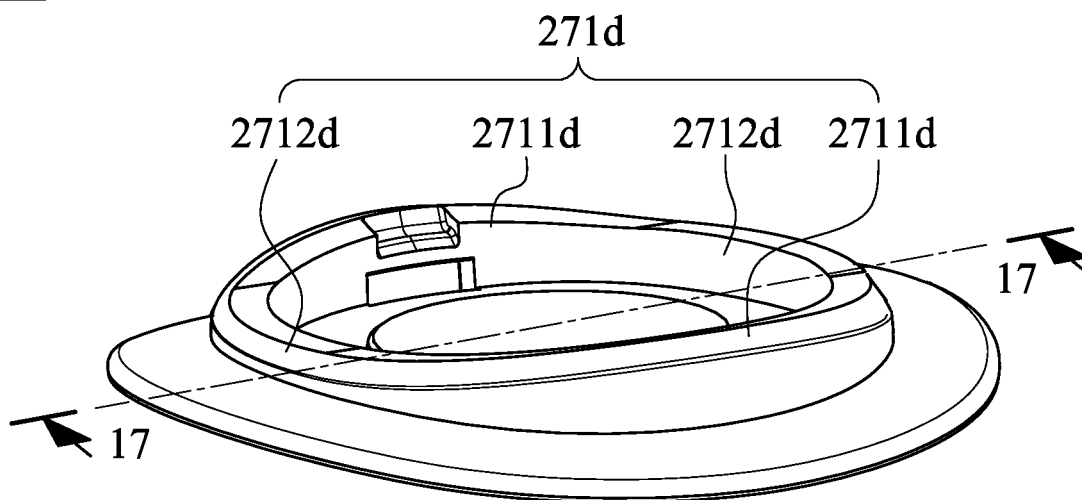


Fig. 15

270d

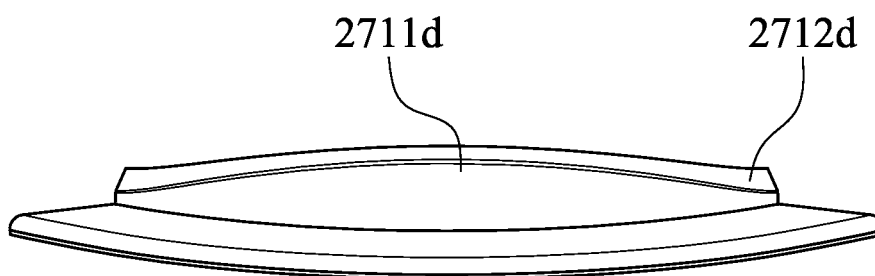


Fig. 16

270d

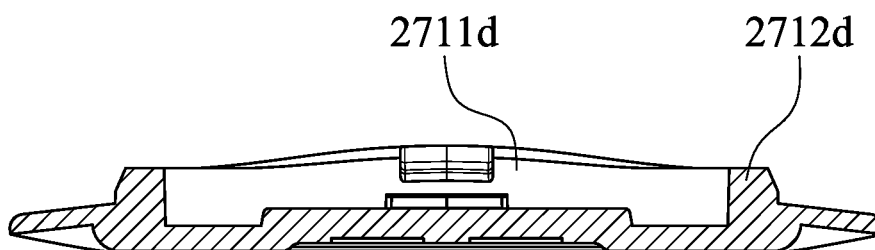


Fig. 17

270e

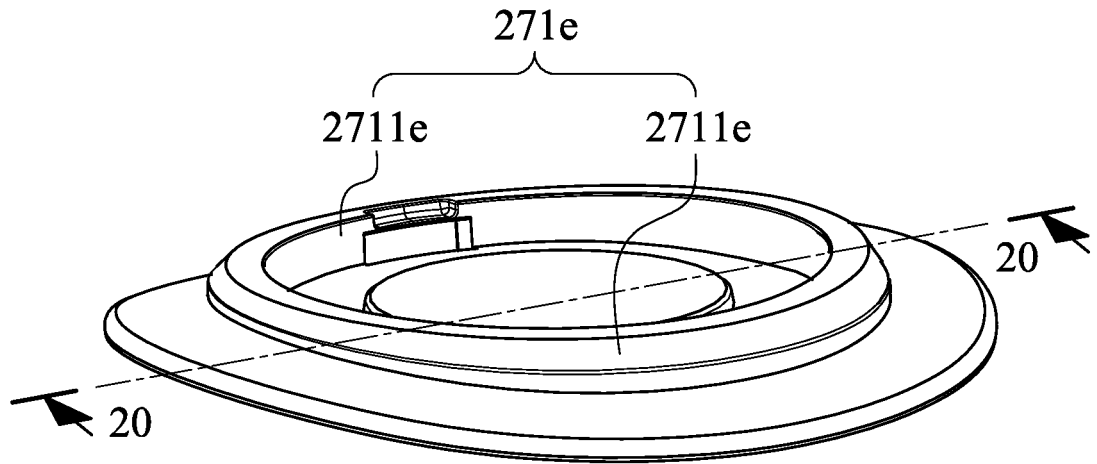


Fig. 18

270e

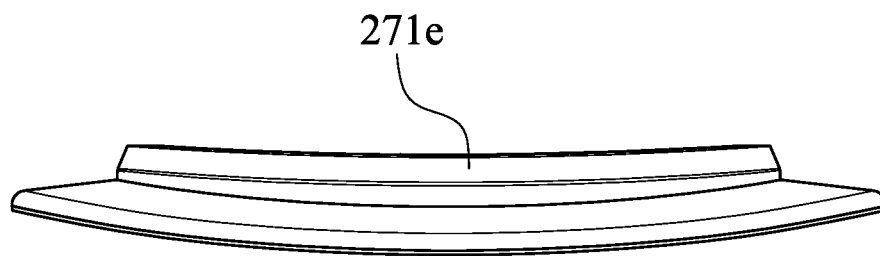


Fig. 19

270e

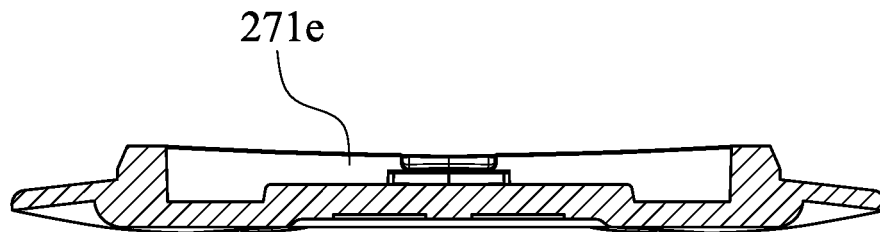


Fig. 20

200f

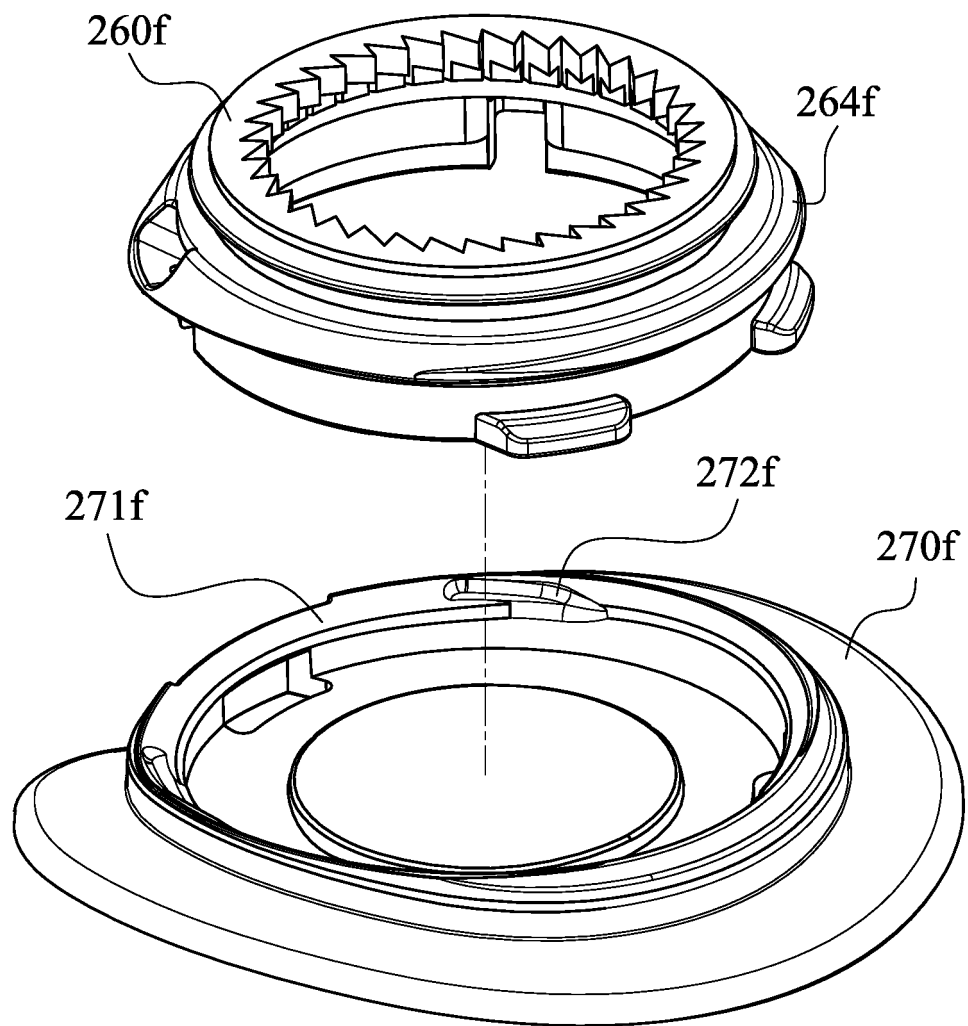


Fig. 21

200f

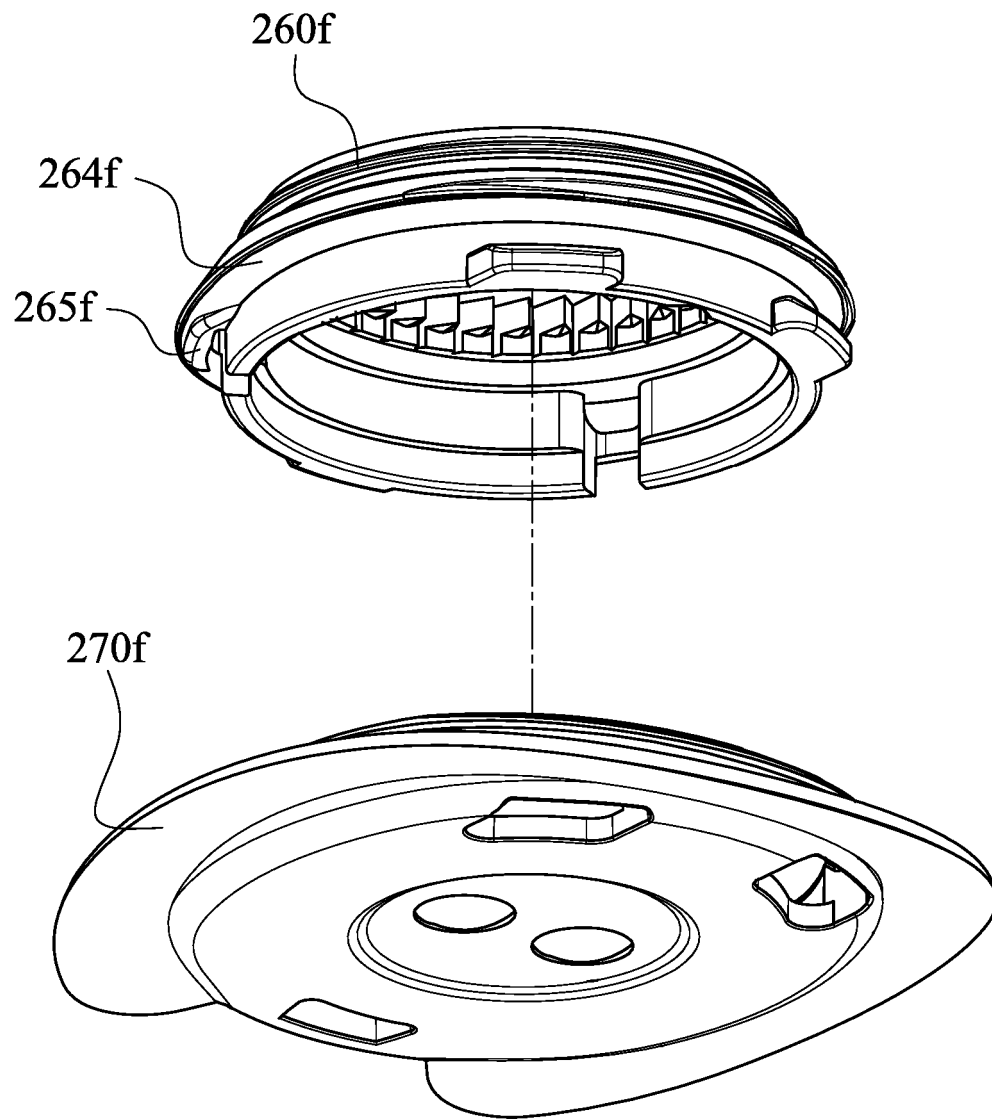


Fig. 22

200f

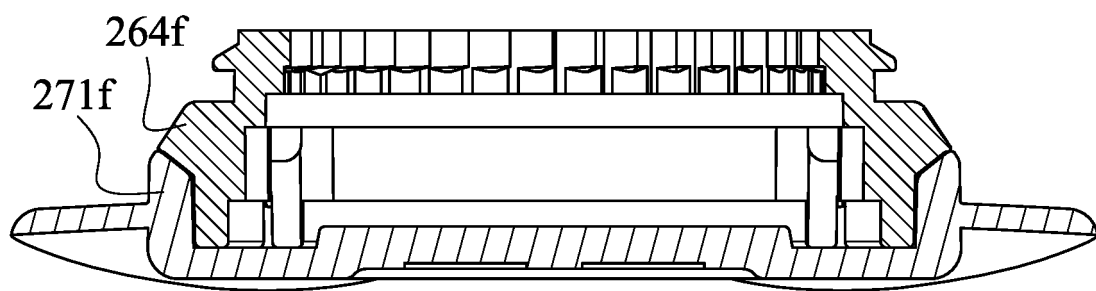


Fig. 23

100g

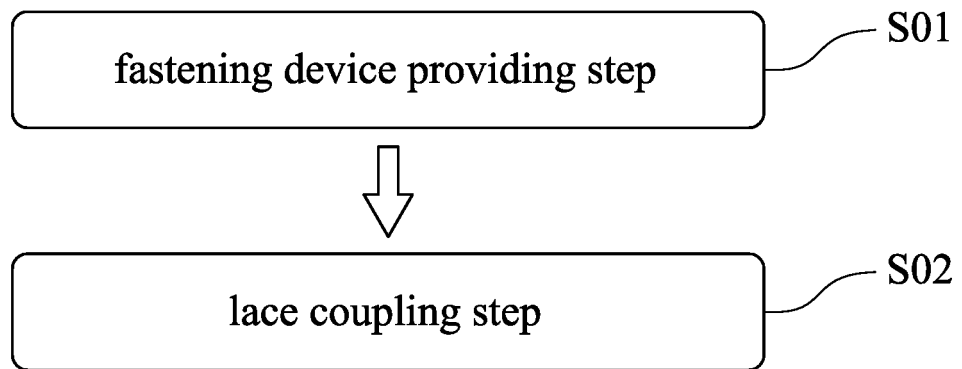


Fig. 24

INTERNATIONAL SEARCH REPORT

International application No.

PCT/CN2021/107298

A. CLASSIFICATION OF SUBJECT MATTER

A43C 11/16(2006.01)i

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

A43C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

CNPAT, CNKI, WPI, EPODOC: 绳, 线, 丝, 卷, 盘, 绕, 缠, 壁, 凸起, 突起, 凸缘, 突缘, 环, 包围, 围绕, spool, wall, continuous, lace, coil, roll, wrap.

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
PX	US 2021127794 A1 (CHEN, Chin Chu) 06 May 2021 (2021-05-06) description, paragraphs 73-85, and figures 10-30	1-11
PX	US 2021127795 A1 (CHEN, Chin Chu) 06 May 2021 (2021-05-06) description, paragraphs 89-95, and figures 15-22	1-11
X	CN 108377640 A (SHINKYUNG INC.) 07 August 2018 (2018-08-07) description paragraphs 29-163, figures 1-4b	1-11
A	CN 111114877 A (CHEN, Jinzhu) 08 May 2020 (2020-05-08) entire document	1-11
A	CN 111115388 A (CHEN, Jinzhu) 08 May 2020 (2020-05-08) entire document	1-11
A	CN 111846339 A (CHEN, Jinzhu) 30 October 2020 (2020-10-30) entire document	1-11
A	DE 202011101828 U1 (CHEN, Chin Chu) 06 October 2011 (2011-10-06) entire document	1-11

☐ Further documents are listed in the continuation of Box C.
 ☒ See patent family annex.

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search

29 September 2021

Date of mailing of the international search report

19 October 2021

Name and mailing address of the ISA/CN

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Facsimile No. (86-10)62019451

Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.

PCT/CN2021/107298

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CN 111846339 A	30 October 2020	None	
DE 202011101828 U1	06 October 2011	None	

Form PCT/ISA/210 (patent family annex) (January 2015)