(19) DANMARK

(10) **DK/EP 4088612 T3**

Patent- og Varemærkestyrelsen

(12) Oversættelse af europæisk patentskrift

(51) Int.Cl.: ***A 43 C 11/16 (2006.01)*** ***B 65 H 75/34 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2025-03-03**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2024-12-25**

(86) Europæisk ansøgning nr.: **22183962.4**

(86) Europæisk indleveringsdag: **2016-11-21**

(87) Den europæiske ansøgnings publiceringsdag: **2022-11-16**

(30) Prioritet: **2015-12-25 CN 201510995848**

(62) Stamansøgningsnr: **16877535.1**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

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(54) Benævnelse: **FASTGØRELSESANORDNING**

(56) Fremdragne publikationer:
WO-A1-2015/035885
CN-U- 204 895 922
DE-U1- 202011 101 828

DESCRIPTION

Description

Technical Field

[0001] The present disclosure relates to a fastening device, and more particularly, the present disclosure relates to a fastening device for tightening and releasing a lace.

Description of Related Art

[0002] In daily life, cords, such as a lace or a thread, are usually used to tighten articles. The most common tightening method is to use the cord to reciprocately 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 due to an external force. Not only does the knot need to be tied again, but also lots of inconveniences come owning to the insecurity of the articles.

[0003] In order to solve such problems, some practitioners developed a simple fastening mechanism including a case, an engaging unit and a spring. The case includes holes to allow the lace to pass through. Through the reaction force between the spring and the engaging unit, the lace can be clamped between the engaging 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 engaging 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 loosened due to vibrations or external forces. In addition, the fastening mechanism has no space to receive the lace, and exposure of the lace may bring danger.

[0004] Therefore, some practitioners developed another kind of buckle which can be rotated to tighten 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 so complex; as a result, the manufacturing cost is increased, and the buckle has assembly and repair difficulty.

[0005] Base on the above-mentioned problems, how to simplify the structure of the fastening device, reduce the manufacturing cost and maintain the securing capability becomes a pursuit target for practitioners. Document DE202011101828U1 discloses a shoe buckle including a base, a knob, a linking plate, a limiting member and a spool. The knob, the linking plate and

the spool are operationally coupled to the base. The knob includes an inner track, and the linking plate includes a protrusion guided by the inner track such that the linking plate is lifted or lowered to couple to or separate from the teeth of the spool. This document discloses a fastening device according to the preamble of claim 1.

Disclosure of Invention

[0006] The present invention provides a fastening device, according to the appended claim 1, includes a base, a spool, a knob, an engaging unit, a spiral track, a guiding portion coupled to the spiral track, and at least one retaining portion. The spool is disposed at the base, and a lace is wound around the spool. The knob is disposed at the base. The engaging unit is disposed at the base. The engaging unit has a first position and a second position relative to the knob. The engaging unit prohibits the spool from rotating toward a releasing direction when the engaging unit is at the first position. The engaging unit allows the spool to be rotated toward the releasing direction when the knob is rotated toward the releasing direction and the guiding portion moves relative to the spiral track to allow the engaging unit to switch to the second position. The at least one retaining portion is coupled to the knob or the base to allow the engaging unit to be remained at the first position or the second position

[0007] According to the aforementioned fastening device, the engaging unit can further include a pawl arm, and the base can include a plurality of inner teeth. When the engaging unit is at the first position, the pawl arm is engaged with the inner teeth in the releasing direction to prohibit the spool from rotating, and the pawl arm is disengaged with the inner teeth in a tightening direction opposite to the releasing direction.

[0008] According to the aforementioned fastening device, an anti-deformed capability along the radial direction of the at least one retaining portion is smaller than an anti-deformed capability along the radial direction of the pawl arm.

[0009] According to the aforementioned fastening device, a number of the at least one retaining portion can be two. The knob can further include two engaging portions, and the two engaging portions abut the two retaining portions, respectively, when the engaging unit is at the first position.

BRIEF DESCRIPTION OF THE DRAWINGS

[0010]

Fig. 1 shows a three-dimensional schematic view of a fastening device according to one embodiment of the present disclosure;

Fig. 2A shows one exploded view of the fastening device of Fig. 1;

Fig. 2B shows another exploded view of the fastening device of Fig. 1;

Fig. 3A shows one cross-sectional view of the fastening device of Fig. 1 taken along Line 3-3;

Fig. 3B shows another cross-sectional view of the fastening device of Fig. 1 taken along Line 3-3;

Fig. 4A shows one cross-sectional view of the fastening device of Fig. 1 taken along Line 4-4;

Fig. 4B shows another cross-sectional view of the fastening device of Fig. 1 taken along Line 4-4;

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

Fig. 6A shows one exploded view of the fastening device of Fig. 5;

Fig. 6B shows another exploded view of the fastening device of Fig. 5;

Fig. 7A shows one cross-sectional view of the fastening device of Fig. 5 taken along line 7-7;

Fig. 7B shows another cross-sectional view of the fastening device of Fig. 5 taken along Line 7-7;

Fig. 8A shows one cross-sectional view of the fastening device of Fig. 5 taken along Line 8-8;

Fig. 8B shows another cross-sectional view of the fastening device of Fig. 5 taken along Line 8-8;

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

Fig. 10A shows one exploded view of the fastening device of Fig. 9;

Fig. 10B shows another exploded view of the fastening device of Fig. 9;

Fig. 11A shows one cross-sectional view of the fastening device of Fig. 9 taken along line 11-11;

Fig. 11B shows another cross-sectional view of the fastening device of Fig. 9 taken along Line 11-11;

Fig. 12A shows one cross-sectional view of the fastening device of Fig. 9 taken along Line 12-12; and

Fig. 12B shows another cross-sectional view of the fastening device of Fig. 9 taken along Line 12-12.

DETAILED DESCRIPTION

[0011] The embodiments 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. In other words, 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 labels.

[0012] Please refer to Fig. 1, Fig. 2A and Fig. 2B, wherein Fig. 1 shows a three-dimensional schematic view of a fastening device 100 according to one embodiment of the present disclosure, Fig. 2A shows one exploded view of the fastening device 100 of Fig. 1, and Fig. 2B shows another exploded view of the fastening device 100 of Fig. 1. The fastening device 100 includes a base 200, a spool 300, a knob 500 and an engaging unit 400, the spool 300 is disposed at the base 200 and a lace (not shown) is wound therearound, the knob 500 is disposed at the base 200 and includes a spiral track 530 (shown in Fig. 2B), the engaging unit 400 is coupled to the spool 300 and includes a guiding portion 430 coupled to the spiral track 530; the guiding portion 430 is limitedly moved along the spiral track 530 by rotating the knob 500, such that the engaging unit 400 has a first position and a second position relative to the knob 500, the engaging unit 400 prohibits the spool 300 from rotating toward a releasing direction A1 when the engaging unit 400 is at the first position, and the engaging unit 400 allows the spool 300 to be rotated toward the releasing direction A1 when the engaging unit 400 is at the second position.

[0013] Therefore, the guiding portion 430 of the engaging unit 400 is coupled to the spiral track 530, and is moved along the spiral track 530 such that the position of the engaging unit 400 can be changed, so the lace can be tightened or released. The structure and operation of the embodiment will be described in detail in the following paragraphs.

[0014] The base 200 has a case structure, and includes a receiving space 210, a plurality of inner teeth 230, two lace holes 220 and an opening 240 (shown in Fig. 2B). The inner teeth 230 face toward the receiving space 210, the two lace holes 220 and the opening 240 are communicated with the receiving space 210, and two ends of the lace pass through the two lace holes 220, respectively, to be connected to the spool 300.

[0015] The spool 300 is disc-shaped, and includes an annular track 320 and a plurality of mounted teeth 310, the spool 300 is disposed inside the receiving space 210, the lace is wound around the annular track 320, and the mounted teeth 310 are configure to be coupled to the engaging unit 400.

[0016] The engaging unit 400 is ring-shaped and has a radial direction (not shown), and the engaging unit 400 includes a first retaining portion 410, a second retaining portion 420, three

guiding portions 430, four stopping portions 441, 442, 443, 444, a communicating hole 450, a plurality of engaged teeth 460 and three pawl arms 470. Each of the guiding portions 430 has an inclined block structure and is coupled to the spiral track 530, and the pawl arms 470 are configured for engaging with the inner teeth 230. The engaged teeth 460 are disposed at a wall of the communicating hole 450, which is near the base 200, and the four stopping portions 441, 442, 443, 444 are protruded from the wall of the communicating hole 450, which is near the knob 500, toward a center of the engaging unit 400 along the radial direction, and the positions of the stopping portions 441, 443 are relative to each other, the positions of the stopping portions 442, 444 are relative to each other.

[0017] Each of the first retaining portion 410 and the second retaining portion 420 can be deformed and can restore in the radial direction, precisely, the first retaining portion 410 has a first free end 411, and the second retaining portion 420 has a second free end 421, when each of the first free end 411 and the second free end 421 bears a force exerted thereon is larger than the force they can bear, they would be deformed in the radial direction, and when the external force is removed, the first free end 411 and the second free end 421 restore.

[0018] The knob 500 includes a cylinder 510, two engaging portions 521, 522 (shown in Fig. 4B) and the spiral track 530. The cylinder 510 is protruded toward the base 200, the two engaging portions 521, 522 are disposed at the cylinder 510 and the positions thereof are symmetrical to each other, the cylinder 510 and the engaging portions 521, 522 are protruded into the communicating hole 450 when assembling, when the engaging unit 400 is at the first position, the engaging portion 521 is pushed against the first retaining portion 410, and the engaging portion 522 is pushed against the second retaining portion 420. The spiral track 530 is disposed at an inner wall (not labeled) of the knob 500 and coupled to the guiding portion 430.

[0019] The main part (not labeled) of the fastening device 100 includes the base 200, the spool 300, the knob 500 and the engaging unit 400, and in addition to the main part, the fastening device 100 further includes a fastening member (not labeled) disposed at the main part such that the base 200, the spool 300, the knob 500 and the engaging unit 400 are assembled. In the embodiment, the fastening member includes a connecting post 600 and a screw (not shown), the connecting post 600 passes through the opening 240, the spool 300 and the communicating hole 450 to engage with the cylinder 510, and then the screw is fastened into the connecting post 600 to complete the assembly of the fastening device 100. In other embodiments, a protruding post (not shown) can protrude from the base 200 of the main part toward the knob 500, and the protruding post passes through the spool 300, the knob 500 and the engaging unit 400, and the fastening member has a screw structure, which can connect the elements by locking into the protruding post from the knob 500.

[0020] Please refer to Fig. 3A and Fig. 3B, and also refer to Fig. 2A and Fig. 2B, wherein Fig. 3A shows one cross-sectional view of the fastening device 100 of Fig. 1 taken along Line 3-3, and Fig. 3B shows another cross-sectional view of the fastening device 100 of Fig. 1 taken along Line 3-3.

[0021] As shown in Fig. 3A, the guiding portion 430 (shown in Fig. 2B) can be limitedly moved along the spiral track 530, in other words, the guiding portion 430 can be moved along the spiral track 530 when the knob 500 is rotated relative to the engaging unit 400, such that the engaging unit 400 can be lifted or lowered relative to the knob 500. As shown in Fig. 3A, the engaging unit 400 is at the first position, and the pawl arms 470 (shown in Fig. 2B) are relative to the inner teeth 230 (shown in Fig. 2A), and the engaged teeth 460 (shown in Fig. 2A) are engaged to the mounted teeth 310 (shown in Fig. 2A). The pawl arms 470 (shown in Fig. 2A) will be disengaged with the inner teeth 230 in the tightening direction A2 (shown in Fig. 2A) while engaged with the inner teeth 230 in the releasing direction A1 (shown in Fig. 2A) owning to the structure thereof, such that the engaging unit 400 can be driven to link up with the spool 300 by rotating the knob 500 toward the tightening direction A2, such that the lace is retracted, and when the knob 500 is stopped, the pawl arms 470 are engaged with the inner teeth 230 to prohibit the spool 300 from rotating toward the releasing direction A1, such that securing purpose is achieved.

[0022] As shown in Fig. 3B, when the guiding portion 430 is moved to switch the engaging unit 400 to the second position by rotating the knob 500, the pawl arms 470 are disengaged with the inner teeth 230, because the pawl arms 470 are disengaged with inner teeth 230, the rotation of the spool 300 toward the releasing direction A1 is not restricted, and the lace can be pulled so as to be released. In the embodiment, the engaging unit 400 is not coupled to the spool 300 when the engaging unit 400 is at the second position and the engaged teeth 460 are disengaged with the mounted teeth 310, however, in other embodiments, the engaged teeth 460 can be still engaged with the mounted teeth 310 while the pawl arms 470 are disengaged with the inner teeth 230, and further the inner teeth 230 can be, but not limited to, disposed at the spool 300.

[0023] Please refer to Fig. 4A and Fig. 4B, wherein Fig. 4A shows one cross-sectional view of the fastening device 100 of Fig. 1 taken along Line 4-4, Fig. 4B shows another cross-sectional view of the fastening device 100 of Fig. 1 taken along Line 4-4.

[0024] As shown in Fig. 4A, the engaging unit 400 is at the first position, the engaging portion 521 is abutted against the first retaining portion 410 and the stopping portion 441, and the engaging portion 522 is abutted against the second retaining portion 420 and the stopping portion 443. As a result, the knob 500 (shown in Fig. 2A) is engaged with the engaging unit 400, such that when the engaging unit 400 is rotated in the tightening direction A2, the engaging portion 521 presses the stopping portions 441, the engaging portion 522 presses the stopping portions 443, to rotate the engaging unit 400. In another hand, when the knob 500 is stopped, due to the structure arrangements of the first retaining portion 410 and the second retaining portion 420, the engaging portion 521 and the engaging portion 522 can be abutted for positioning the relative position of the knob 500 and the engaging unit 400, such that it is favorable for preventing the position of the knob 500 and the engaging unit 400 from being moved by the external force (which is a vibrating force in the environment during using, but not the force applied by the user) to lead the lace to be released.

[0025] When the knob 500 is rotated toward the releasing direction A1, owing to the engagement between the pawl arms 470 and the inner teeth 230, rotation of the engaging unit 400 is restricted, such that the engaging portion 521 presses the first free end 411 of the first retaining portion 410 when forced, the engaging portion 522 presses the second free end 421 of the second retaining portion 420 when forced, as a result, the first free end 411 and the second free end 421 are moved in the radial direction because the first free end 411 and the second free end 421 cannot bear the force, as shown in Fig. 4B, the knob 500 can be rotated relative to the engaging unit 400 to allow the engaging portion 521 to be abutted by the stopping portion 444 and the engaging portion 522 to be abutted by the stopping portion 442, and when the force acted on the first free end 411 and the second free end 421 is disappeared, the first free end 411 and the second free end 421 will restore. Hence, when the knob 500 is rotated relative to the engaging unit 400, the guiding portion 430 can be moved along the spiral track 530, and the engaging unit 400 can change from the first position to the second position.

[0026] In addition, if the knob 500 is rotated in the tightening direction A2, the engaging portion 521 will force on the first free end 411 and the engaging portion 522 will force on the second free end 421, because the engaging unit 400 is lowered to a position between the first position and the second position, the pawl arms 470 are engaged with the inner teeth 230, and before being disengaged with the inner teeth 230 in the fastening direction A2, the pawl arms 470 must be deformed in the radial direction.

[0027] It is noted that an anti-deformed capability along the radial direction of each of the first retaining portion 410 and the second retaining portion 420 is smaller than an anti-deformed capability along the radial direction of the pawl arm 470; hence, the first free end 411 and the second free end 421 will be deformed first because they cannot bear the force, and the engaging portions 521, 522 can return to the position shown in Fig. 4A, such that the engaging unit 400 can be changed from the second position to the first position.

[0028] In other embodiment, the structure of the first retaining portion 410 and the second retaining portion 420 can be changed, and in addition to engage with the knob, the retaining portion can engaged with the base, only when the retaining portion has capability to remain the relative position between the knob and the engaging unit to prevent the engaging unit from being lifted or lowered by an external force. The number of the retaining portion and the number of the engaging portion are not limited.

[0029] Please refer to Fig. 5, Fig. 6A and Fig. 6B, wherein Fig. 5 shows a three-dimensional schematic view of a fastening device 110 according to another embodiment of the present disclosure, Fig. 6A shows one exploded view of the fastening device 110 of Fig. 5, and Fig. 6B shows another exploded view of the fastening device 110 of Fig. 5. The fastening device 110 includes a base 200a, a spool 300a, an engaging unit 400a and a knob 500a. The structure and the operation of the fastening device 110 will be described in detail in the following paragraphs.

[0030] In the embodiment, the base 200a includes an upper base portion 250a and a lower base portion 260a, the upper base portion 250a includes a through hole 270a and a plurality of inner teeth 230a, the inner teeth 230a are disposed at a wall of the through hole 270a, which is near the knob 500a, the lower base portion 260a includes a receiving space 210a (shown in Fig. 6B), two lace holes 220a and an opening 240a, the two lace holes 220a are communicated with the receiving space 210a and allow two ends of a lace (not shown) to pass therethrough to connect to the spool 300a, and when the upper base portion 250a is assembled with the lower base portion 260a, the opening 240a is communicated with the through hole 270a.

[0031] The spool 300a has a structure similar to the structure of the embodiment shown in Fig. 2A, and includes an annular track 320a and a plurality of mounted teeth 310a, the mounted teeth 310a are engaged with the engaging unit 400a, and the spool 300a is disposed inside the receiving space 210a.

[0032] The engaging unit 400a includes a lifted member 490a and an engaging member 480a, the lifted member 490a includes a guiding portion 430a and a plurality of engaged teeth 460a, the engaged teeth 460a are disposed at one end of the guiding portion 430a, the engaging member 480a is ring-shaped and has a radial direction (not shown), the engaging member 480a includes a first retaining portion 410a (shown in Fig. 6B), a second retaining portion 420a, four pawl arms 470a and a communicating hole 450a, the first retaining portion 410a includes a first protrusion 411a (shown in Fig. 6B), and the second retaining portion 420a includes a second protrusion 421a. The lifted member 490a is engaged with the communicating hole 450a, and is coupled to the knob 500a via the guiding portion 430a.

[0033] The knob 500a includes a cylinder 510a, two engaging portions 521a, 522a (shown Fig. 8A), two abutting portions 541a, 542a (shown Fig. 8A) and a spiral track 530a. The two engaging portions 521a, 522a and the two abutting portions 541a, 542a are spaced in an inner wall (not labeled) of the knob 500a, the cylinder 510a is protruded toward the base 200a, and the spiral track 530a is disposed at the cylinder 510a. The cylinder 510a is coupled to the guiding portion 430a when assembling, and the lifted member 490a can be lifted or lowered relative to the knob 500a when the guiding portion 430a is moved along the spiral track 530a.

[0034] When assembling, the spool 300a is disposed inside the receiving space 210a, the upper base portion 250a is covered on the lower base portion 260a, then the engaging unit 400a is disposed in the through hole 270a to allow the engaged teeth 460a and the pawl arms 470a to be engaged with the mounted teeth 310a and the inner teeth 230a, respectively, the cylinder 510a of the knob 500a can be correspondingly screwed into the guiding portion 430a, such that the guiding portion 430a is coupled to the spiral track 530a, finally, the elements are assembled by a fastening member including a connecting post 600a and a screw (not shown), the connecting post 600a is passed through the opening 240a and the engaging unit 400a to engage with the cylinder 510a, and the screw is fastened therein to complete the assembly.

[0035] Please refer to Fig. 7A and Fig. 7B, and also refer to Fig. 6A and Fig. 6B, wherein Fig.

7A shows one cross-sectional view of the fastening device 110 of Fig. 5 taken along line 7-7, and Fig. 7B shows another cross-sectional view of the fastening device 110 of Fig. 5 taken along Line 7-7.

[0036] As shown in Fig. 7A, the guiding portion 430a (shown in Fig. 6B) can be limitedly moved along the spiral track 530a (shown in Fig. 6B), in other words, when the knob 500a is rotated relative to the engaging unit 400a, the guiding portion 430a will be moved along the spiral track 530a, such that the engaging unit 400a is lifted or lowered to be at a first position or a second position.

[0037] As shown in Fig. 7A, the engaging unit 400a is at the first position, and the engaged teeth 460a (shown in Fig. 6A) is engaged with the mounted teeth 310a (shown in Fig. 6A). The pawl arms 470a (shown in Fig. 6B) are engaged with the inner teeth 230a (shown in Fig. 6B), the pawl arms 470a will be disengaged with the inner teeth 230a in the tightening direction A2 (shown in Fig. 6B) while engaged with the inner teeth 230a in the releasing direction A1 (shown in Fig. 6B) owning to the structure thereof, such that the engaging unit 400a can be driven to link up with the spool 300a by rotating the knob 500a toward the tightening direction A2, such that the lace is retracted, and when the knob 500a is stopped, the pawl arms 470a are engaged with the inner teeth 230a to prohibit the lifted member 490a from rotating toward the releasing direction A1, such that securing purpose is achieved.

[0038] As shown in Fig. 7B, when the guiding portion 430a is moved to change the engaging unit 400a to the second position by rotating the knob 500a, the engaged teeth 460a are disengaged with the mounted teeth 310a, therefore, the spool 300a will not be limited and can be rotated in the any direction inside the receiving space 210; and the lace can be pulled so as to be released.

[0039] Please refer to Fig. 8A and Fig. 8B, wherein Fig. 8A shows one cross-sectional view of the fastening device 110 of Fig. 5 taken along Line 8-8, and Fig. 8B shows another cross-sectional view of the reel device 110 of Fig. 5 taken along Line 8-8.

[0040] As shown in Fig. 8A, when the knob 500a is rotated in the fastening direction A2, the engaging portion 521a is abutted against the first retaining potion 410a, the abutted portion 541a is abutted against a first end 413a of the first protrusion 411a, the engaging portion 522a is abutted against the second retaining potion 420a, the abutted portion 542a is abutted against a first end 423a of the second protrusion 421a, such that the knob 500a is engaged with the engaging unit 400a, precisely, engaged with the lifted member 490a, such that rotation of the knob 500a can cause driven of the engaging unit 400a to move the spool 300a toward the tightening direction A2 for retracting lace.

[0041] Oppositely, when the knob 500a is stopped, the first retaining portion 410a and the second retaining portion 420a can be abutted against the engaging portions 521a, 522a, the abutted portion 541a and the abutted portion 542a, respectively, owing to the structure thereof, such that the relative position between the knob 500a and the engaging unit 400a is remained.

Such structure can prevent the knob 500a from driving the engaging unit 400a to lead the engaging unit 400a to switch to the second position when an external force exerted on the fastening device 110, such that the lace will not be loosen.

[0042] When the knob 500a is rotated in the releasing direction A1, due to the engagement of the pawl arms 470a and the inner teeth 230a, rotation of the engaging unit 400a is limited, the abutted portion 541a will press the first protrusion 411a of the first retaining portion 410a, the abutted portion 542a will press the second protrusion 421a of the second retaining portion 420a, the first retaining portion 410a and the second retaining portion 420a are moved in the radial direction because they cannot bear the force, as shown in Fig. 8B, the first protrusion 411a and the second protrusion 421a is not abutted, the knob 500a is allowed to be rotated relative to the engaging unit 400a in the releasing direction A1, such that the lifted member 490a is lifted along the spiral track 530a, the engaged teeth 460a are disengaged with the mounted teeth 310a, finally the engaging unit 400a will not be affected by the engaging unit 400a, and the engaging unit 400a can be at the second position.

[0043] In addition, if the knob 500a is rotated in the tightening direction A2, the abutting portion 541a will force on a second end 412a of the first protrusion 411a, the abutting portion 541a will force on a second end 422a of the second protrusion 421a, because an anti-deformed capability along the radial direction of each of the first retaining portion 410a and the second retaining portion 420a is smaller than an anti-deformed capability along the radial direction of the pawl arm 470a, the first retaining portion 410a is deformed inwardly to allow the abutted portion 541a to pass the first protrusion 411a to abut against the first end 413a of the first protrusion 411a, and the second retaining portion 420a is deformed inwardly to allow the abutted portion 542a to pass the second protrusion 421a to abut against the first end 423a of the second protrusion 421a, meanwhile, the first retaining portion 410a and the second retaining portion 420a can restore and return to the condition shown in Fig. 8A.

[0044] Please refer to Fig. 9, Fig. 10A and Fig. 10B, wherein Fig. 9 shows a three-dimensional schematic view of a fastening device 120 according to yet another embodiment of the present disclosure, Fig. 10A shows one exploded view of the fastening device 120 of Fig. 9, and Fig. 10B shows another exploded view of the fastening device 120 of Fig. 9. The fastening device 120 includes a main part 700c and a fastening member (not labeled), the main part 700c is composed of a base 200b, a spool 300b, a knob 500b and an engaging unit 400b, the fastening member is disposed at the main part 700c to allow the base 200b, the spool 300b, the knob 500b and the engaging unit 400b to be assembled, and the structure and the operation of the fastening device 120 is similar to the structure and the operation of the embodiment of Figs. 1 to 2B.

[0045] The base 200b includes a plurality of inner teeth 230b, the spool 300b is disposed at the base 200b and includes a plurality of mounted teeth 310b, the engaging unit 400b is ring-shaped and has a radial direction (not shown), and the engaging unit 400b includes a first retaining portion 410b, a second retaining portion 420b, a third retaining portion 430b, a guiding portion 432b, three stopping portions 441b, 442b, 443b, a communicating hole 450b, a

plurality of engaged teeth 460b and three pawl arms 470b. The guiding portion 432b is coupled to the knob 500b, the pawl arms 470b are engaged with the inner teeth 230b, the engaged teeth 460b are disposed at the wall of the communicating hole 450b, which is near the base 200b, the three stopping portions 441b, 442b, 443b, are formed at an outer wall of the engaging unit 400b, which is near the knob 500b.

[0046] The first retaining portion 410b, the second retaining portion 420b and the third retaining portion 430b can be deformed in the radial direction and have restoring capability, the first retaining portion 410b has a first free end 411b, the second retaining portion 420b has a second free end 421b, the third retaining portion 430b has a third free end 431b, when each of the first free end 411b, the second free end 421b and the third free end 431b bears a force exerted thereon larger than the force which the first free end 411b, the second free end 421b and the third free end 431b can bear, they deformed in the radial direction, and when the force disappears, the first free end 411b, the second free end 421b and the third free end 431b can restore.

[0047] The knob 500b includes a cylinder 510b, three engaging portions 521b, 522b, 523b (shown in Fig. 11A), and a spiral track 530b, the spiral track 530b is disposed at the cylinder 510b, when the engaging unit 400b is at the first position, the engaging portion 521b is abutted against the first retaining portion 410b, the engaging portion 522b is abutted against the second retaining portion 420b, and the engaging portion 523b is abutted against the third retaining portion 430b.

[0048] The fastening member of the embodiment includes a connecting post 600b and a screw (not shown). The fastening method is the same with the embodiment shown in Fig. 2A, and will not be describe again.

[0049] Please refer to Fig. 11A and Fig. 11B, and also refer to Fig. 10A and Fig. 10B, Fig. 11A shows one cross-sectional view of the fastening device 120 of Fig. 9 taken along line 11-11, and Fig. 11B shows another cross-sectional view of the fastening device 120 of Fig. 9 taken along Line 11-11.

[0050] Because the guiding portion 432b (shown in Fig. 10B) can be moved along the spiral track 530b, the engaging unit 400b can be lifted or lowered relative to the knob 500b by moving the guiding portion 432b along the spiral track 530b. As shown in Fig. 11A, the engaging unit 400b is at the first position, the pawl arms 470b (shown in Fig. 10A) will be selectively engaged with the inner teeth 230b (shown in Fig. 10A), and rotation of the spool 300b in the releasing direction A1 (shown in Fig. 10A) is restricted.

[0051] As shown in Fig. 11B, the engaging unit 400b can be at the second position by moving the guiding portion 432b via the rotation of the knob 500b, the pawl arms 470b are disengaged with the inner teeth 230b, because the pawl arms 470 are disengaged with the inner teeth 230b, the rotation of the spool 300b in the releasing direction A1 is not restricted, as a result, the lace can be pulled and released.

[0052] Please refer to Fig. 12A and Fig. 12B, wherein Fig. 12A shows one cross-sectional view of the fastening device 120 of Fig. 9 taken along Line 12-12, and Fig. 12B shows another cross-sectional view of the fastening device 120 of Fig. 9 taken along Line 12-12.

[0053] As shown in Fig. 12A, the engaging unit 400b is at the first position, the engaging portion 521b is abutted against the first retaining portion 410b and the stopping portion 441b, the engaging portion 522b is abutted against the second retaining portion 420b and the stopping portion 442b, the engaging portion 523b is abutted against the third retaining portion 430b and the stopping portion 443b, hence, the knob 500b is engaged with the engaging unit 400b, when the engaging unit 400b is rotated in the tightening direction A2, the engaging portion 521b forces on the stopping portion 441b, the engaging portion 522b forces on the stopping portion 442b, the engaging portion 523b forces on the stopping portion 443b, such that the engaging unit 400b can be rotated. On the other hand, when the knob 500b is stopped, the first retaining portion 410b, the second retaining portion 420b and the third retaining portion 430b can be abutted against the engaging portions 521b, 522b, 523b, respectively, to remain the relative position between the knob 500b and the engaging unit 400b owing to the structure thereof.

[0054] When the knob 500b is rotated in the releasing direction A1, because the pawl arms 470b are engaged with the inner teeth 230b, rotation of the engaging unit 400b is restricted, the engaging portion 521b will press the first free end 411b of the first retaining portion 410b, the engaging portion 522b will press the second free end 421b of the second retaining portion 420b, the engaging portion 523b will press the third free end 431b of the third retaining portion 430b, the first free end 411b, the second free end 421b and the third free end 431b are moved in the radial direction because they cannot bear the force, and as shown in Fig. 12B, the knob 500b can be rotated relative to the engaging unit 400b.

[0055] In addition, if the knob 500b is rotated in the tightening direction A2, the engaging portion 521b will force on the first free end 411b, the engaging portion 522b will force on the second free end 421b, the engaging portion 523b will force on the third free end 431b, and the first free end 411b, the second free end 421b, and the third free end 431b will be moved in the radial direction first, and then restore and return to the condition shown in Fig. 12A.

[0056] To sum up, the present disclosure has the following advantages.

1. 1. Through the configuration and engagement of the guiding portion and the spiral track, the engaging unit can change position via the rotation of the knob, such that fastening or releasing condition thereof can be changed.
2. 2. Through configuration of the first retaining portion, a relative position between the engaging unit and the knob, i.e., the first position and the second position, can be remained, and the release of the lace owing to an external force in the environment can be prevented.
3. 3. Because an anti-deformed capability along the radial direction of each of the first retaining portion and the second retaining portion is smaller than an anti-deformed

capability along the radial direction of the pawl arm, the first retaining portion and the second retaining portion can be bended to allow the engaging unit to change from the first position to the second position along the spiral track while a relative position between the engaging unit and the knob can be remained.

4. 4. Because the main part of the fastening device is composed of the base, the spool, the knob and the engaging unit, the structure thereof is simplified, and the cost as well as the manufacturing difficulty can be reduced.

REFERENCES CITED IN THE DESCRIPTION

Cited references

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Patent documents cited in the description

- DE202011101828U1 [0005]

PATENTKRAV

1. Fastgørelsesanordning (100, 110, 120), der omfatter:

en basis (200, 200a, 200b);

en spole (300, 300a, 300b) placeret ved basen (200, 200a, 200b) og en snor viklet omkring spolen (300, 300a, 300b);

en knop (500, 500a, 500b) placeret ved basen (200, 200a, 200b); og

en indgrebsenhed (400, 400a, 400b) placeret ved basen (200, 200a, 200b);

hvor fastgørelsesanordningen (100, 110, 120) endvidere omfatter:

knoppen (500, 500a, 500b) omfattende en spiralbane (530, 530a, 530b);

indgrebsenheden (400, 400a, 400b) omfattende en føringsdel (430, 430a, 432b) koblet til spiralbanen (530, 530a, 530b); og

hvor indgrebsenheden (400, 400a, 400b) har første position og en anden position i forhold til knoppen (500, 500a, 500b), indgrebsenheden (400, 400a, 400b) forhindrer spolen (300, 300a, 300b) i at rotere mod en frigørelsesretning (A1), når indgrebsenheden (400, 400a, 400b) er i den første position, indgrebsenheden (400, 400a, 400b) gør det muligt for spolen (300, 300a, 300b) at rotere mod frigørelsesretningen (A1), når knoppen (500, 500a, 500b) roteres mod frigørelsesretningen (A1), og føringsdelen (430, 430a, 432b) bevæges i forhold til spiralbanen (530, 530a, 530b) for at gøre det muligt for indgrebsenheden (400, 400a, 400b) at omkoble til den anden position,

kendetegnet ved, at fastgørelsesanordningen (100, 110, 120) omfatter:

mindst én holdedel (410, 410a, 410b, 420, 420a, 420b, 430b);

og den mindst ene holdedel (410, 410a, 410b, 420, 420a, 420b, 430b) kobles til knoppen (500, 500a, 500b) eller basen (200, 200a, 200b) for at gøre det muligt for indgrebsenheden (400, 400a, 400b) at blive fastholdt i den første position eller den anden position.

2. Fastgørelsesanordning (100, 110, 120) ifølge krav 1, **kendetegnet ved**, at indgrebsenheden (400, 400a, 400b) endvidere omfatter en palarm (470, 470a, 470b), basen (200, 200a, 200b) omfatter en flerhed af indvendige tænder (230, 230a, 230b), når indgrebsenheden (400, 400a, 400b) er i den første position, palarmen (470, 470a, 470b) går i indgreb med de indvendige tænder (230, 230a, 230b) i frigørelsesretningen (A1) for at forhindre spolen (300, 300a, 300b) i at rotere, og palarmen (470, 470a, 470b) frigøres fra de indvendige tænder (230, 230a, 230b) i en stramningsretning (A2) modsat frigørelsesretningen (A1).

3. Fastgørelsesanordning (100, 110, 120) ifølge krav 2, **kendetegnet ved**, at en evne til modvirkning af deformation langs den mindst ene holdedels (410, 410a, 410b, 420, 420a, 420b, 430b) radiale retning er mindre end en evne til modvirkning af deformation langs palarmens (470, 470a, 470b) radiale retning.

4. Fastgørelsesanordning (100, 110, 120) ifølge krav 3, **kendetegnet ved**, at et antal af den mindst ene holdedel (410, 410a, 410b, 420, 420a, 420b, 430b) er to, knoppen (500, 500a, 500b) endvidere omfatter to indgrebsdele (521, 522, 521a, 522a, 521b, 522b), og de to indgrebsdele (521, 522, 521a, 522a, 521b, 522b) ligger an mod de henholdsvis to holdedele (410, 410a, 410b, 420, 420a, 420b, 430b), når indgrebsenheden (400, 400a, 400b) er i den første position.

5. Fastgørelsesanordning (100, 110, 120) ifølge krav 4, **kendetegnet ved**, at indgrebsenheden (400, 400a, 400b) endvidere omfatter en flerhed af tænder i indgreb (460, 460a, 460b), spolen (300, 300a, 300b) omfatter en flerhed af monterede tænder (310, 310a, 310b), og de monterede tænder (310, 310a, 310b) går i indgreb med tænderne i indgreb (460, 460a, 460b) i den første position.

6. Fastgørelsesanordning (100, 110, 120) ifølge krav 5, **kendetegnet ved**, at indgrebsenheden (400, 400a, 400b) endvidere omfatter:

et løftet element (490a), der omfatter føringsdelen (430, 430a, 432b) og tænderne i indgreb (460, 460a, 460b); og

et indgrebselement (480a), koblet til det løftede element (490a), og indgrebselementet (480a) omfatter den mindst ene holdedel (410, 410a, 410b, 420, 420a, 420b, 430b) og en flerhed af palarme (470, 470a, 470b);

hvor, når indgrebsenheden (400, 400a, 400b) er i den første position, flerheden af palarme (470, 470a, 470b) går i indgreb med de indvendige tænder (230, 230a, 230b) i frigørelsesretningen (A1) for at forhindre spolen (300, 300a, 300b) i at rotere, flerheden af palarme (470, 470a, 470b) frigøres fra de indvendige tænder (230, 230a, 230b) i stramningsretningen (A2), og den mindst ene holdedel (410, 410a, 410b, 420, 420a, 420b, 430b) kobles til knoppen (500, 500a, 500b) for at gøre det muligt for indgrebsenheden (400, 400a, 400b) at blive fastholdt i den første position.

7. Fastgørelsesanordning (100, 110, 120) ifølge krav 6, **kendetegnet ved**, at, når indgrebsenheden (400, 400a, 400b) er i den anden position, tænderne i indgreb (460, 460a, 460b)

frigøres fra de monterede tænder (310, 310a, 310b).

DRAWINGS

Drawing

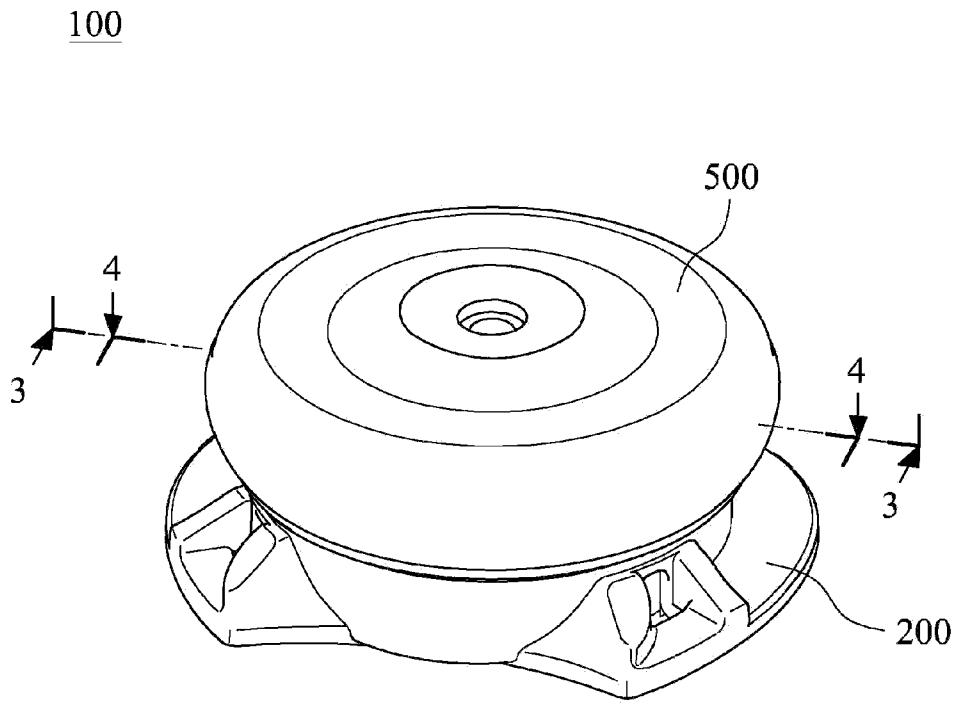


Fig. 1

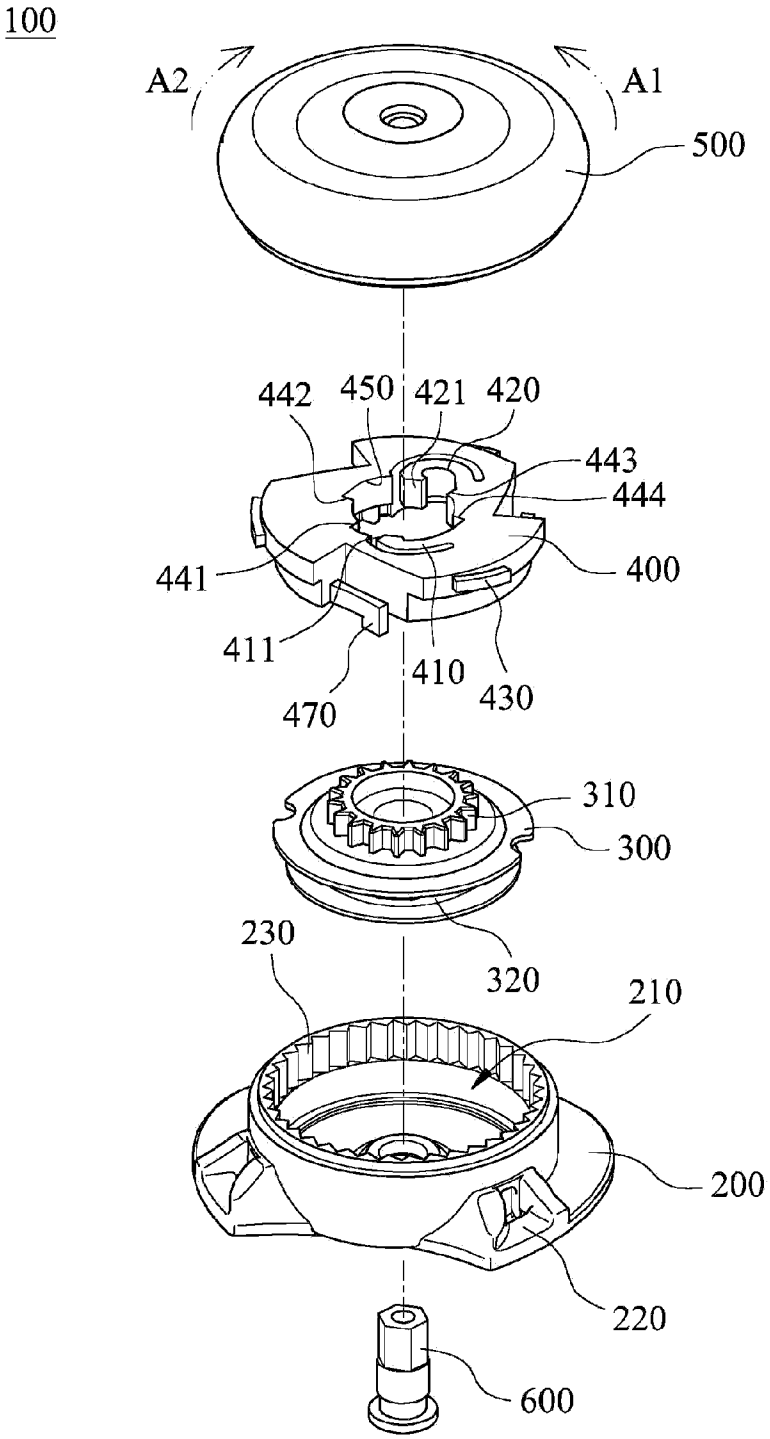

100
A2
A1
500
442
450
421
420
443
444
441
400
411
410
430
470
310
300
230
320
210
200
220
600

Fig. 2A

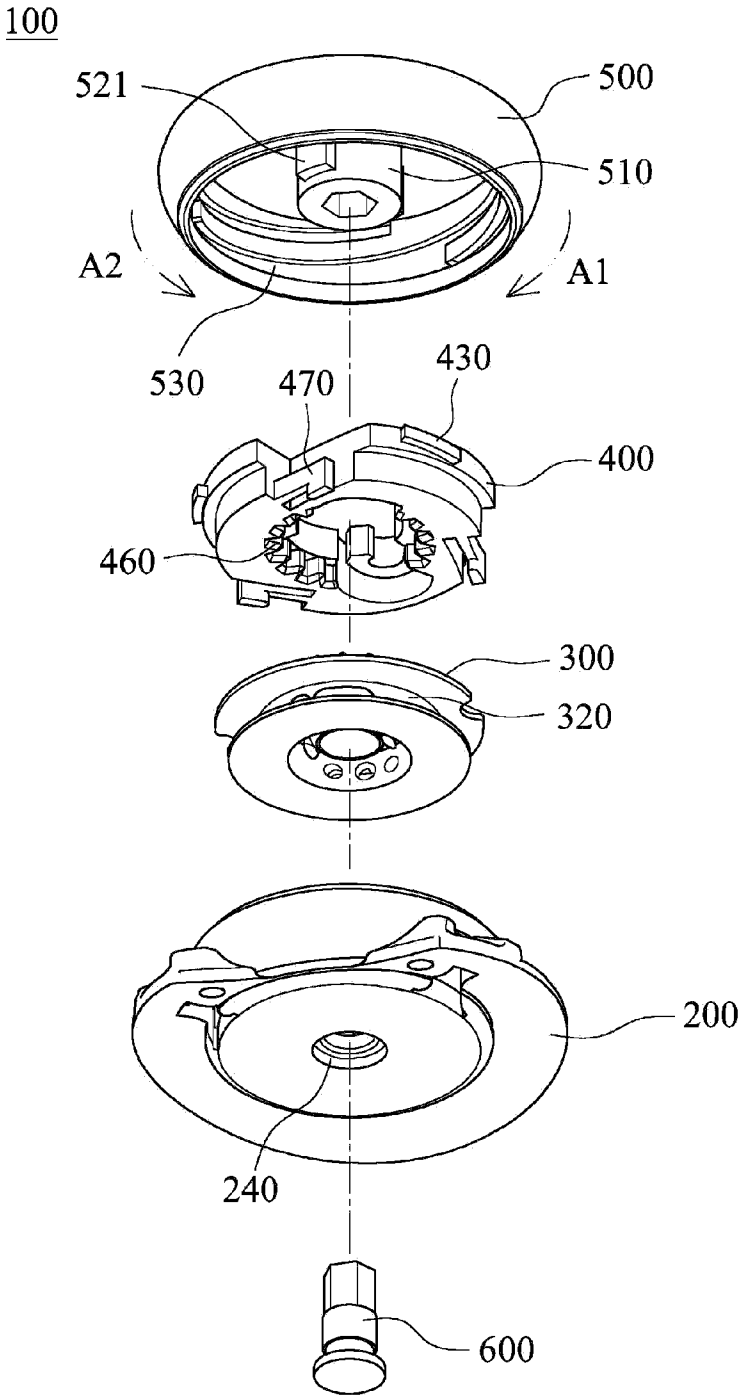


Fig. 2B

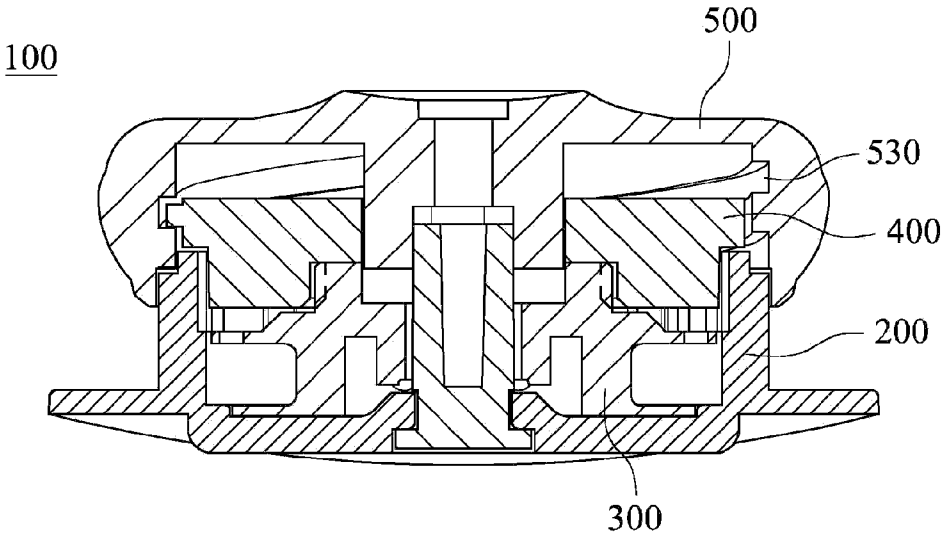


Fig. 3A

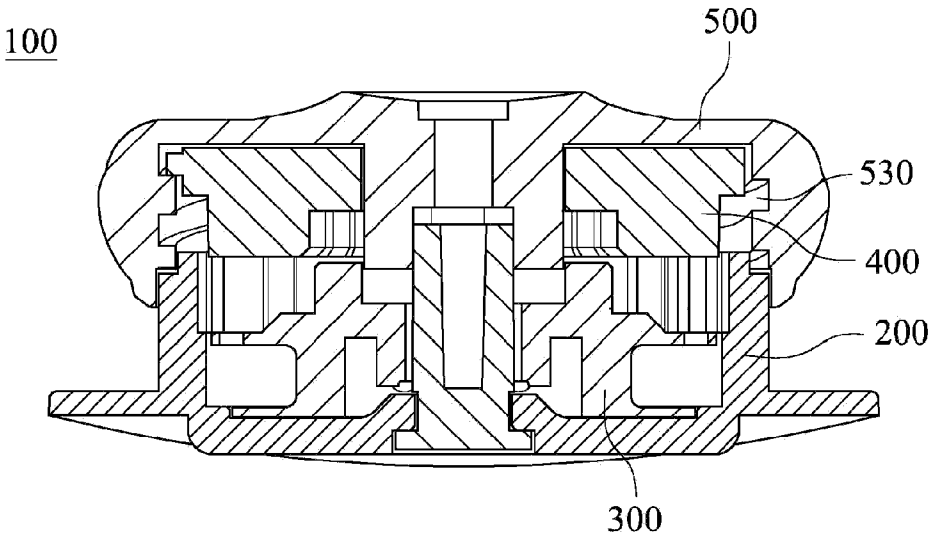


Fig. 3B

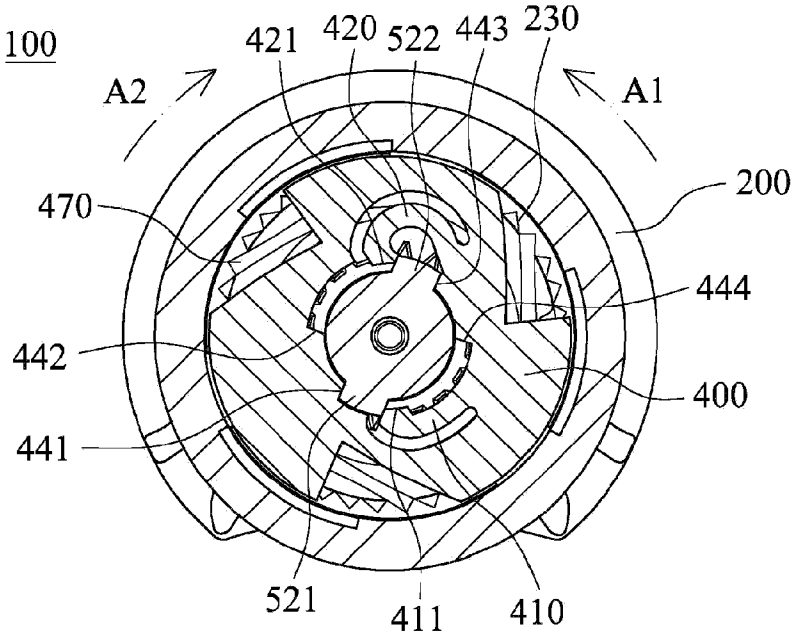

100
421
420
522
443
230
A2
A1
200
470
444
442
400
441
521
411
410

Fig. 4A

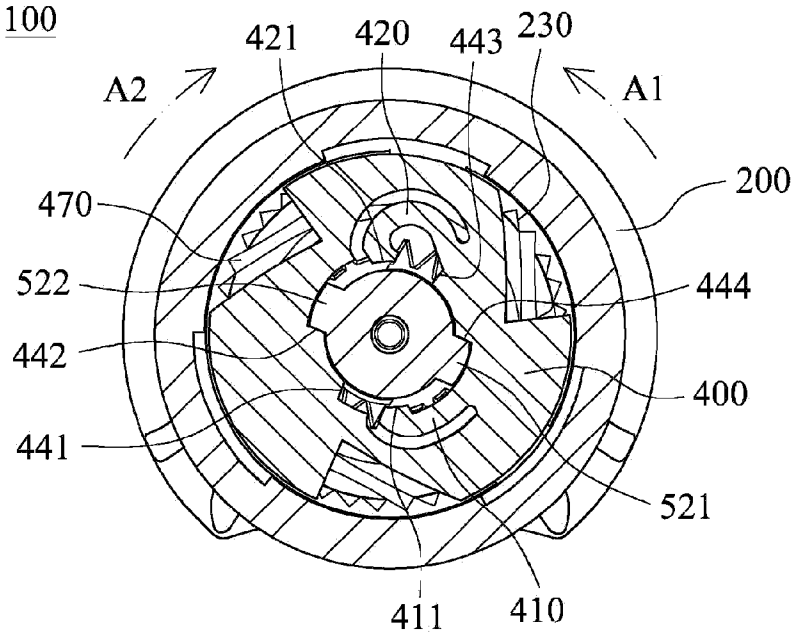

100
421
420
443
230
A2
A1
200
470
522
444
442
400
441
521
411
410

Fig. 4B

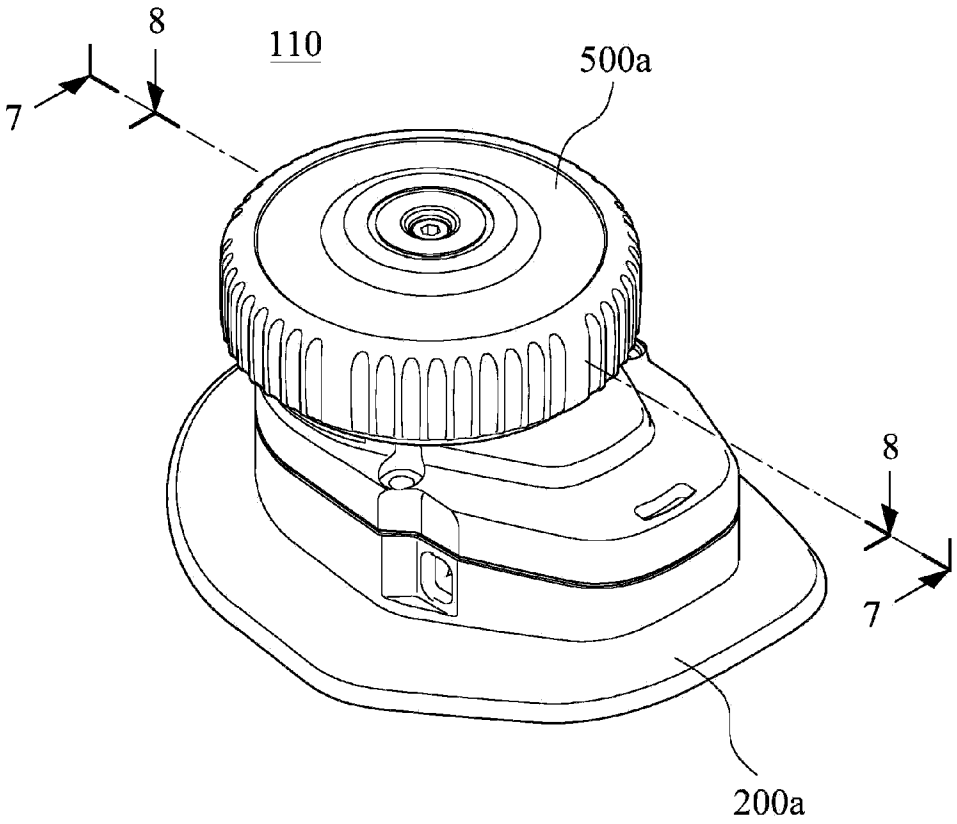


Fig. 5

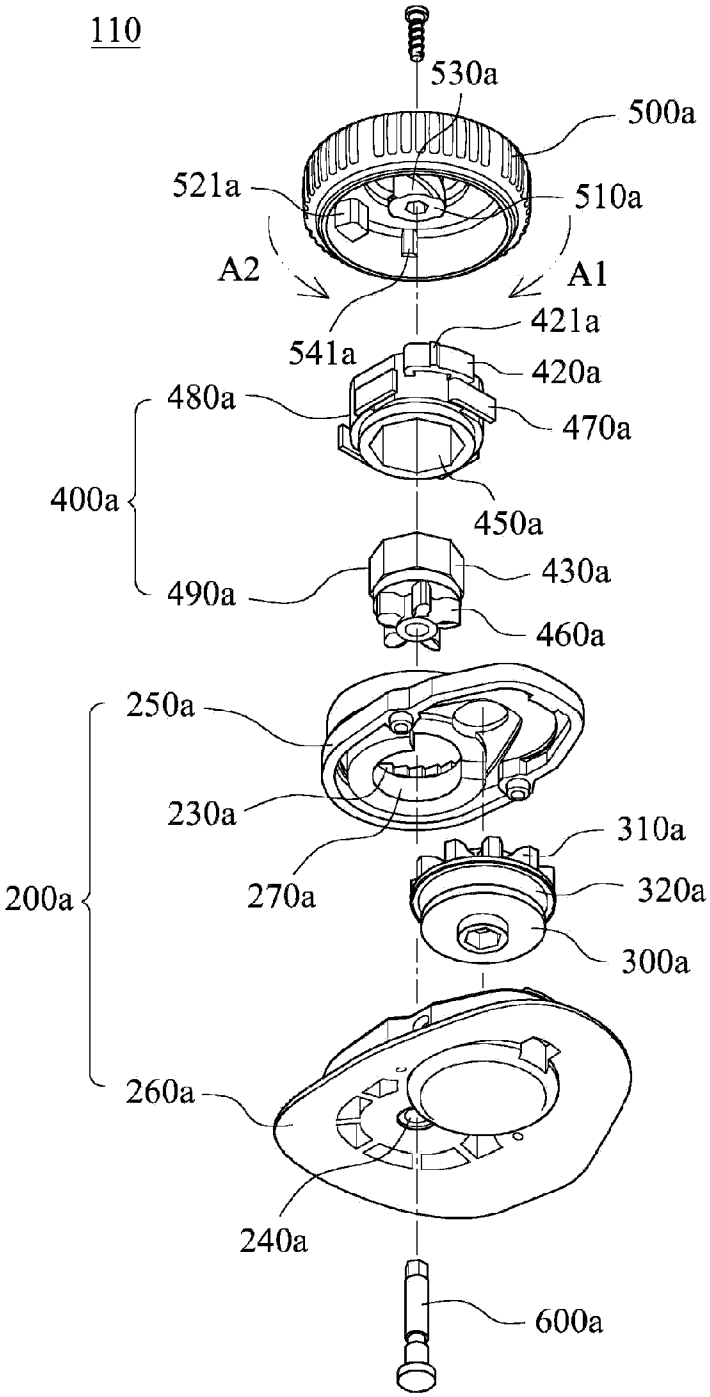

110
530a
500a
521a
510a
A2
A1
541a
421a
420a
480a
470a
400a
450a
430a
490a
460a
250a
230a
310a
270a
320a
200a
300a
260a
240a
600a

Fig. 6A

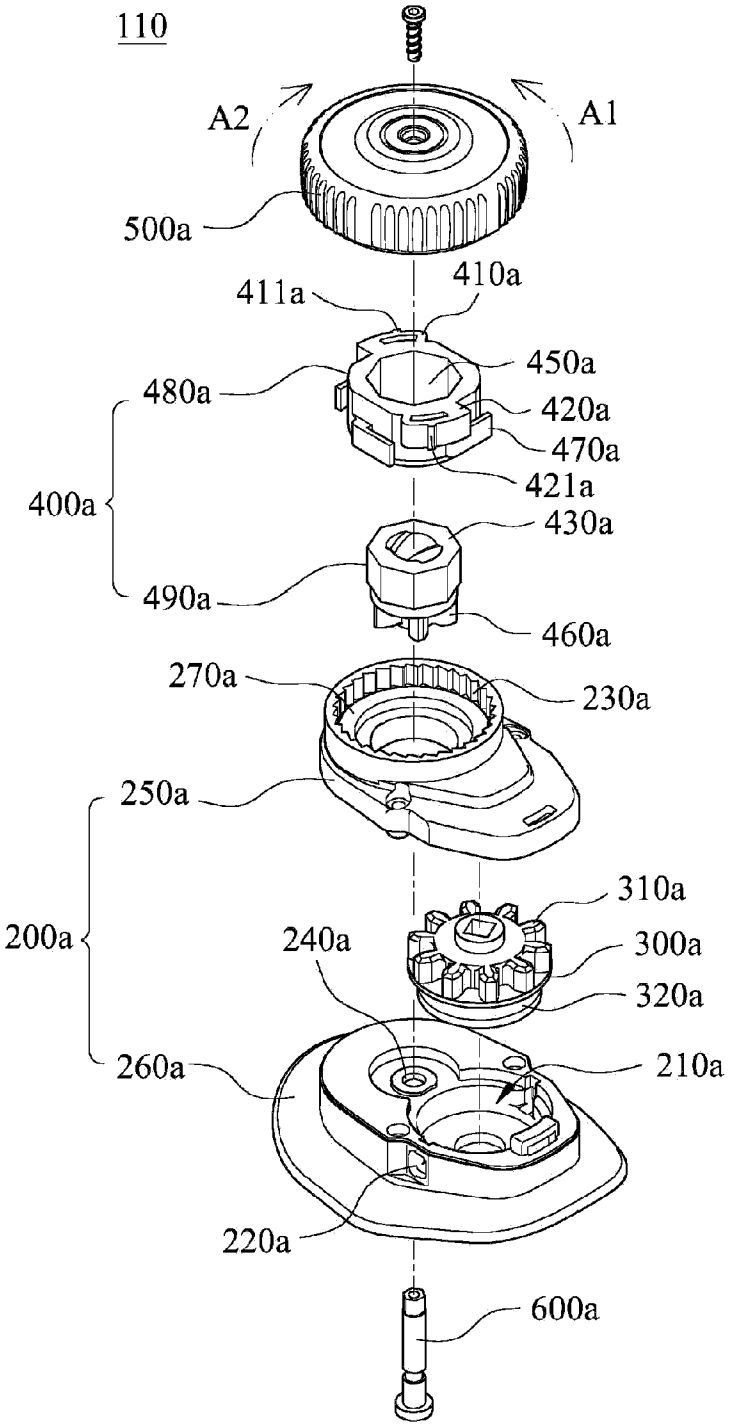

110
A2
A1
500a
411a
410a
450a
480a
420a
470a
421a
400a
430a
490a
460a
270a
230a
250a
310a
200a
240a
300a
320a
260a
210a
220a
600a

Fig. 6B

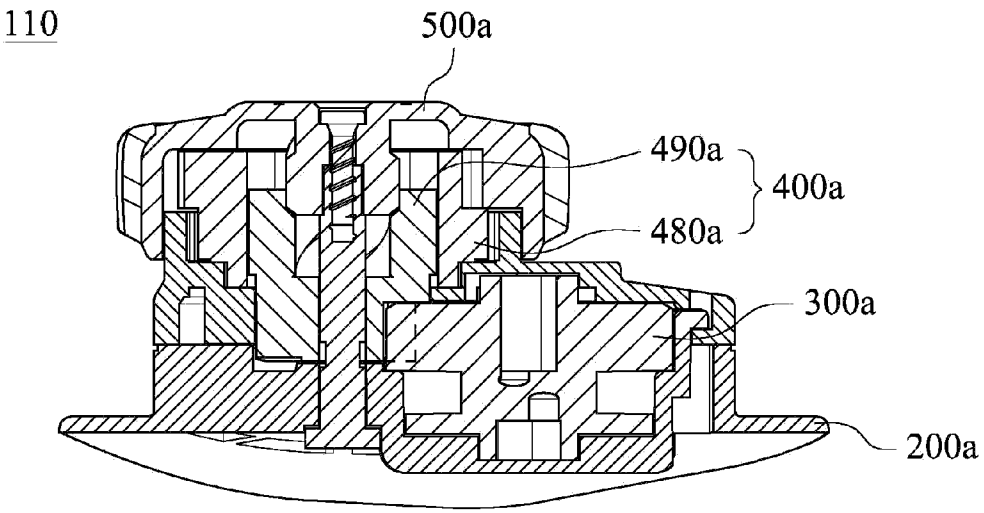

110
500a
490a
400a
480a
300a
200a

Fig. 7A

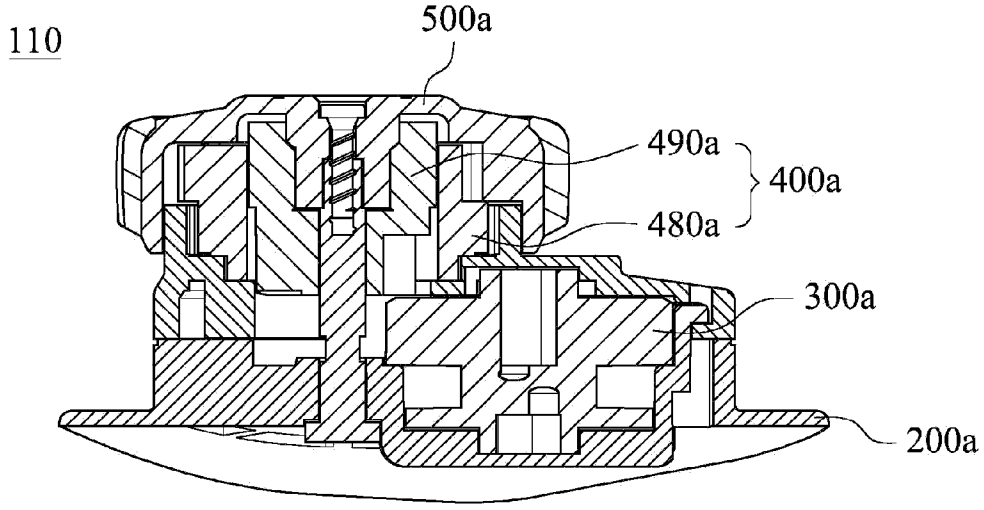

110
500a
490a
400a
480a
300a
200a

Fig. 7B

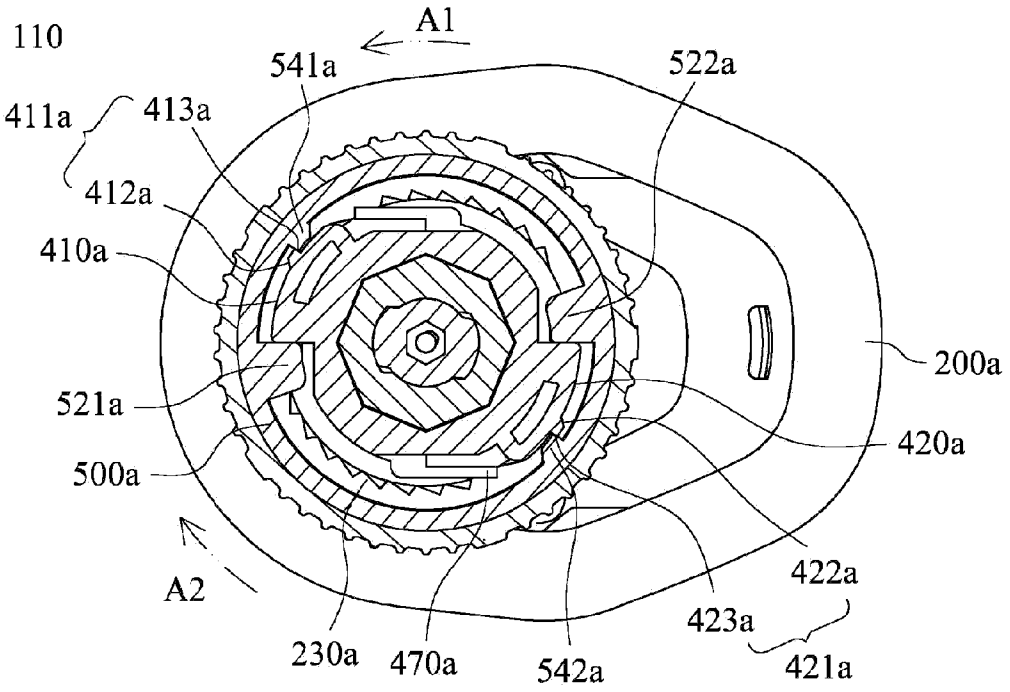

110
A1
541a
522a
411a
413a
412a
410a
200a
521a
420a
500a
A2
422a
423a
421a
230a
470a
542a

Fig. 8A

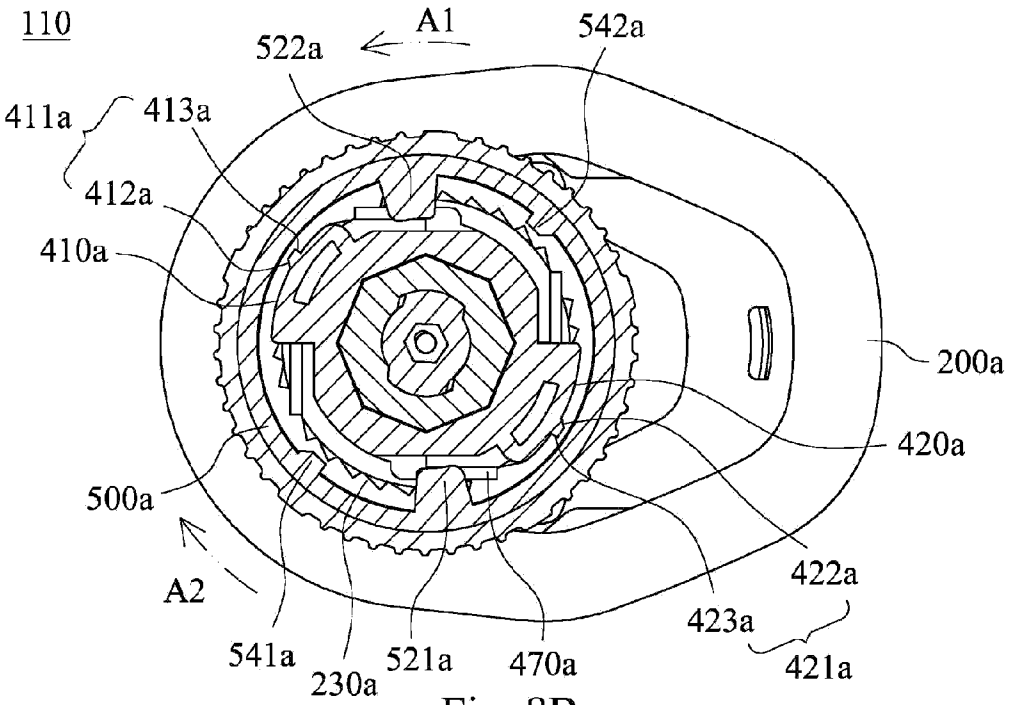

110
A1
522a
542a
411a
413a
412a
410a
200a
420a
500a
A2
422a
423a
421a
541a
230a
521a
470a

Fig. 8B

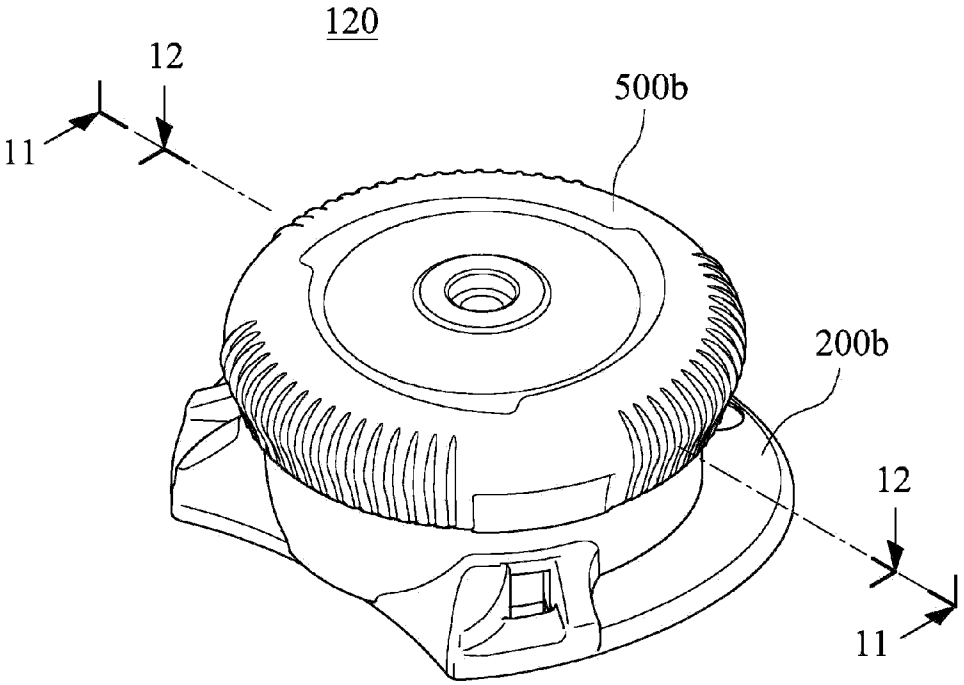


Fig. 9

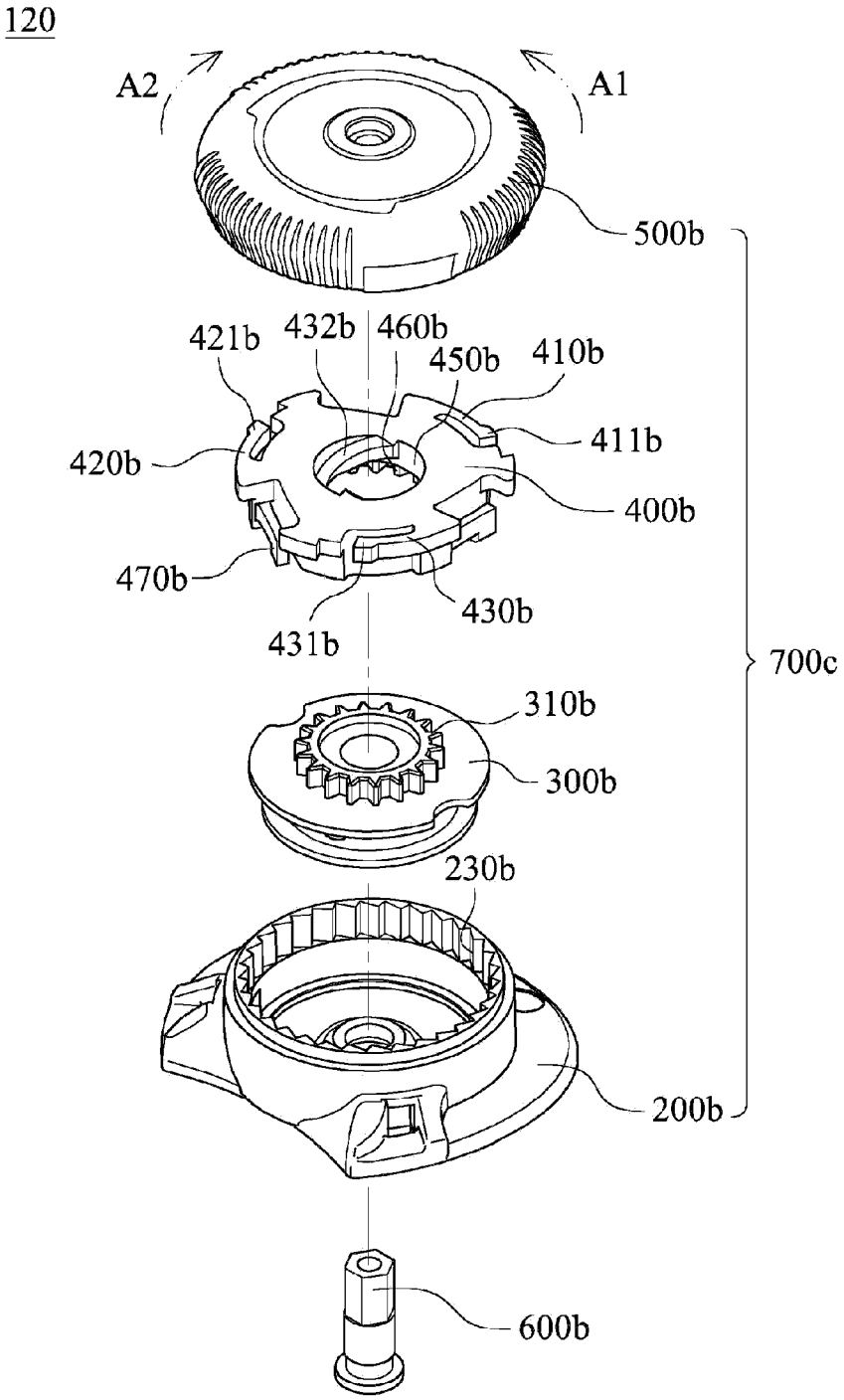

120
A2
A1
500b
421b
432b
460b
450b
410b
411b
420b
400b
470b
430b
431b
700c
310b
300b
230b
200b
600b

Fig. 10A

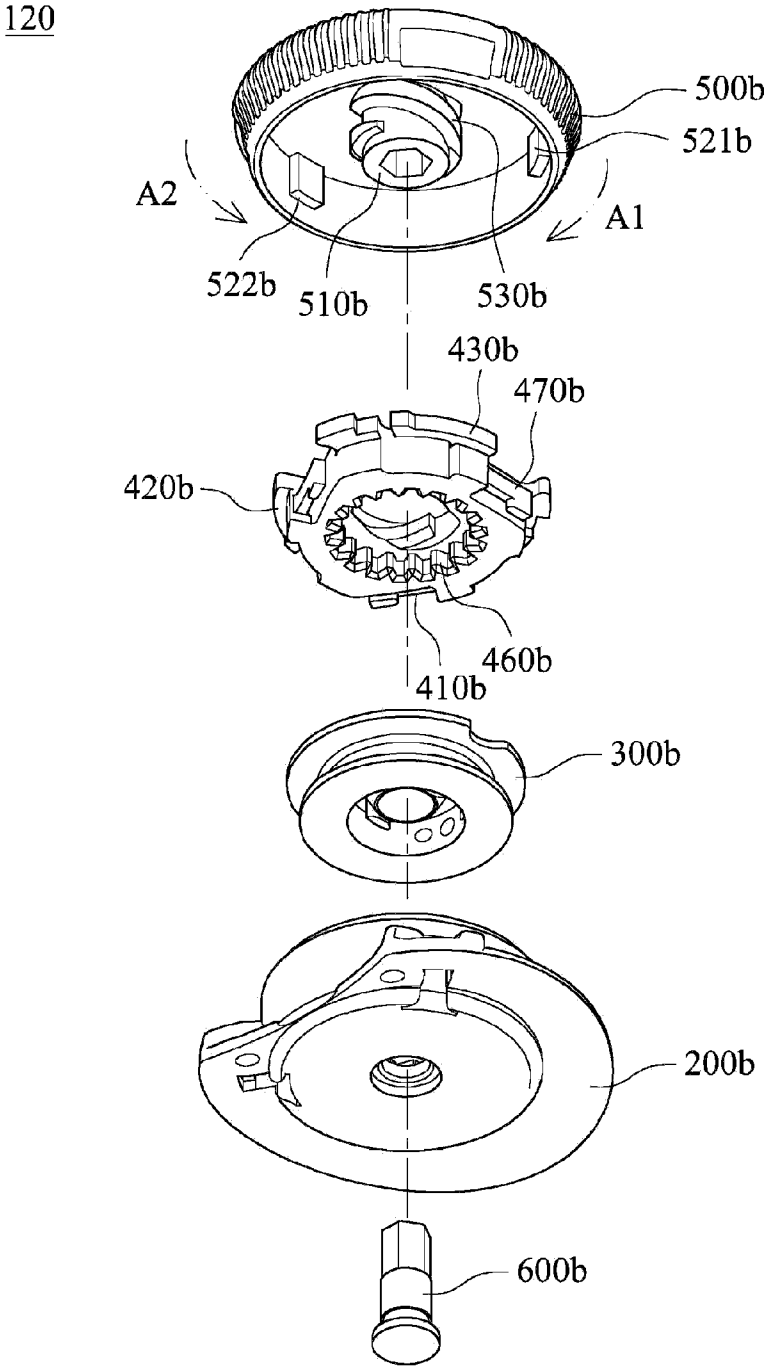

120
500b
521b
A2
A1
522b
510b
530b
430b
470b
420b
460b
410b
300b
200b
600b

Fig. 10B

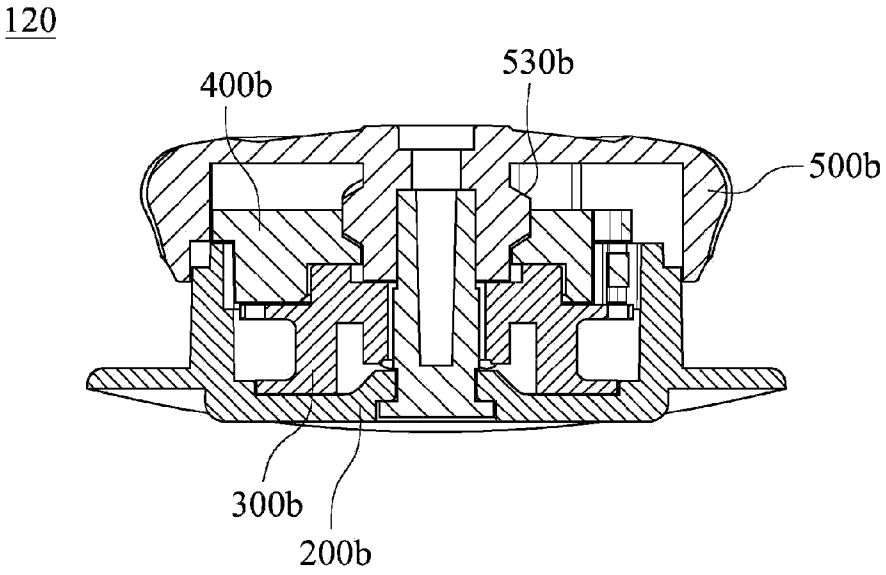


Fig. 11A

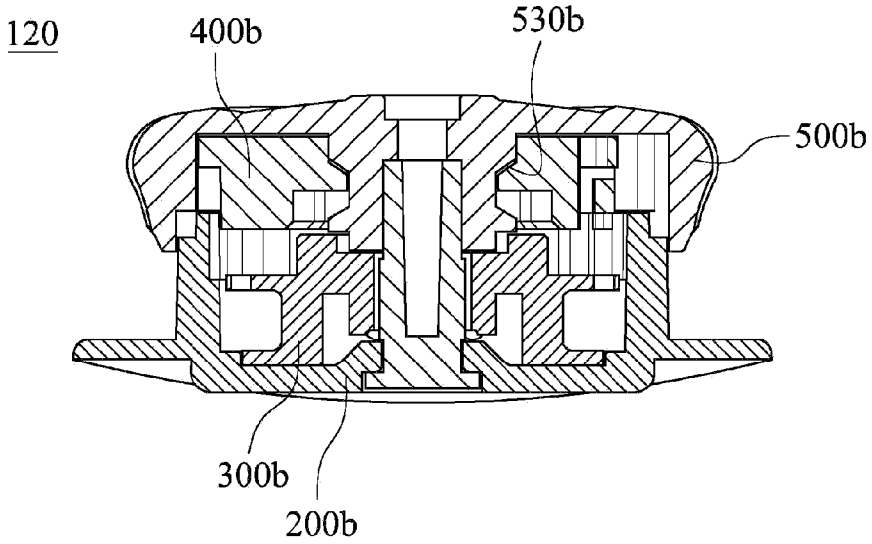


Fig. 11B

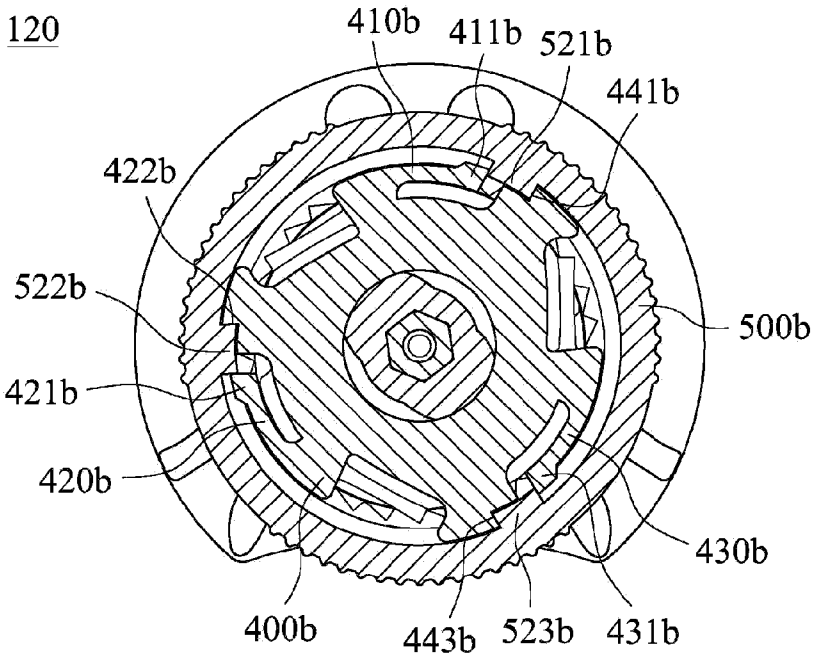


Fig. 12A

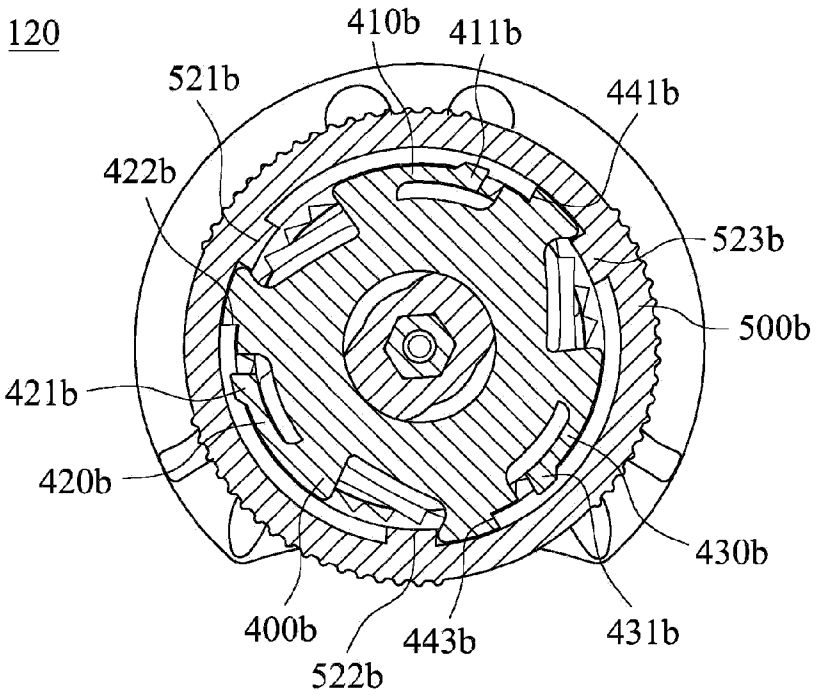


Fig. 12B