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- Liu, Ruiyan
Tokyo (JP)
- Li, Shengqing
Tokyo (JP)
- Ye, Nan
Tokyo (JP)
- Tang, Jun
Tokyo (JP)

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(74) Representative: **Schmitt-Nilson Schraud Waibel
Wohlfrom
Patentanwälte Partnerschaft mbB
Pelkovenstraße 143
80992 München (DE)**

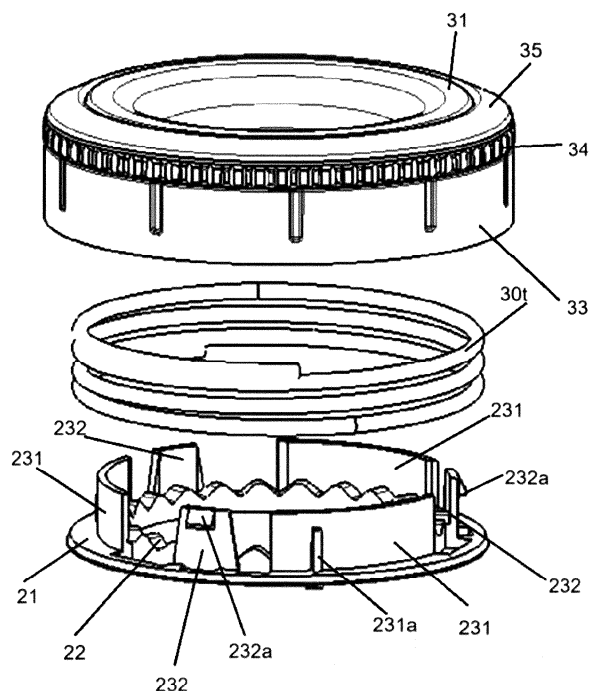
(71) Applicant: **Alps Alpine Co., Ltd.**
Ota-ku,
Tokyo 145-8501 (JP)

(72) Inventors:
• **Liu, Zhenming**
Tokyo (JP)

(54) **OPERATING DEVICE**

(57) An operating device capable of conducting a rotation operation and press operation is disclosed. The operating device includes a base; a rotation member installed on the base in a freely rotatable manner; a press member installed on the rotation member in a manner capable of freely sliding relative to the rotation member in an up-down direction; and a first elastic member disposed between the press member and the base in the up-down direction. In response to the press operation of the operating device being conducted, the press member is supported by the rotation member and slides relative to the rotation member in the up-down direction under the action of the first elastic member, and in response to the rotation operation of the operating device being performed, the rotation member rotates relative to the base in a state where the press member is supported by the first elastic member.

FIG.3



Description

[0001] The present disclosure is based on and claims the benefit of priority of Chinese Patent Application No. 202510405399.X filed on April 1, 2025.

[0002] The present disclosure relates to an operating device, and specifically, an operating device able to carry out a rotation operation and press operation.

[0003] At present, there exists an operating device that is capable of conducting a rotation operation and press operation. When carrying out the press operation of the operating device, it is possible to select a prompted function, and when performing the rotation operation of the operating device, the function selected when carrying out the press operation of the operating device can be switched.

[0004] In the above operating device, it is necessary to dispose both a rotation operation mechanism and press operation mechanism and also necessary to dispose a support member providing a guide rail for the press operation, so the operating device has many parts and a complex structure. As a result, there are problems such as assembly process time consumption, high cost, and so on.

[0005] Furthermore, because the rotation operation mechanism and press operation mechanism need to be disposed in the above operating device at the same time, the operating device usually has a larger radial width. If the operating device having such a larger radial width is provided in a scenario where the space is limited, for example, the display panel of a vehicle mounted apparatus, then the display region on the display panel may be excessively occupied. Additionally, in a case where the above operating device has a larger radial width, there also exists a problem that the operating device may obstruct a visual recognition region of a user, so that the range of the visual recognition region of the user may be limited.

[0006] In order to address one or more of the above technical problems, the object of the present disclosure is to provide an operating device able to carry out a rotation operation and press operation, that is simple in structure, small in size, thin in thickness, and light in weight.

[0007] An operating device in accordance with an embodiment of the present disclosure is provided, that is capable of conducting a rotation operation and press operation and characterized by having a base; a rotation member installed on the base in a freely rotatable manner; a press member installed on the rotation member in a manner capable of freely sliding relative to the rotation member in an up-down direction; and a first elastic member disposed between the press member and the base in the up-down direction, wherein, in a case where the press operation of the operating device is carried out, the press member is supported by the rotation member and slides relative to the rotation member in the up-down direction under the action of the first elastic member, and in a case where the rotation operation of the operating

device is carried out, the rotation member rotates relative to the base in a state where the press member is supported by the first elastic member.

[0008] Furthermore, the operating device in accordance with an embodiment of the present disclosure is characterized in that a wall portion and wavy portion located on the radially inner side of the wall portion are formed on the rotation member.

[0009] Moreover, the operating device in accordance with an embodiment of the present disclosure is characterized in that at least one protrusion is formed on the lower surface of the rotation member.

[0010] In addition, the operating device in accordance with an embodiment of the present disclosure is characterized in that the radial width of the wavy portion is greater than the radial width of the wall portion, and the height of the wavy portion is lower than the height of the wall portion.

[0011] Furthermore, the operating device in accordance with an embodiment of the present disclosure is characterized in that the wall portion includes first wall portions spaced apart from each other and second wall portions each of which is located between the adjacent first wall portions, at least one engagement protrusion is formed on the radially outer wall surface of each first wall portion, and at least one installation protrusion is formed on the radially outer wall surface of each second wall portion.

[0012] Additionally, the operating device in accordance with an embodiment of the present disclosure is characterized by further having a second elastic member, wherein, the second elastic member is installed on the base in a manner able to contact the rotation member in the up-down direction, and in a case where the press operation of the operating device is carried out, the second elastic member is embedded in and abuts against the at least one valley portion of the wavy portion, so that the rotation member is fixed relative to the base.

[0013] Moreover, the operating device in accordance with an embodiment of the present disclosure is characterized in that the press member includes a first inner side wall, first outer side wall, second outer side wall located on the radially outer side of the first outer side wall, flange portion, and top wall, the first outer side wall includes a first longitudinal wall portion, top wall portion located above the first longitudinal wall portion, and second longitudinal wall portion formed by extending on the radially outer side of the top wall portion, at least one engagement cut is formed on the first longitudinal wall portion for engaging with the at least one engagement protrusion, and at least one installation cut is also formed on the first longitudinal wall portion for engaging with the at least one installation protrusion.

[0014] Furthermore, the operating device in accordance with an embodiment of the present disclosure is characterized in that the first elastic member is a helical spring, and the first elastic member is disposed in a space surrounded by the first longitudinal wall portion, top wall

portion, and second longitudinal wall portion of the first outer side wall as well as the rotation member.

[0015] In addition, the operating device in accordance with an embodiment of the present disclosure is characterized in that the base is formed into a circular ring shape and includes a support portion and abutment portion installed on the support portion, the support portion includes an inner side wall, bottom wall, and outer side wall, at least one engagement portion and at least one cut portion are disposed on the inner side wall of the support portion, at least one notch is disposed on the outer side wall of the support portion, the abutment portion includes a side wall and eave portion above the side wall, extending radially outward from the side wall, at least one engaged portion engaging with the at least one engagement portion is disposed on the side wall, at least one lib portion engaging with the at least one cut portion is disposed on the radially inner wall surface of the side wall, the eave portion includes at least one first notch portion and at least one second notch portion, and the abutment portion is fixedly installed, by way of the at least one engaged portion and at least one lib portion, on the inner side wall of the support portion from the radial outer side of the inner side wall in such a manner that the eave portion is located on the upper side of the inner side wall.

[0016] Moreover, the operating device in accordance with an embodiment of the present disclosure is characterized in that the second elastic member is a leaf spring and includes at least one installation portion and at least one recess portion, the second elastic member is installed, by means of the at least one installation portion, to the at least one first notch portion on the lower side of the eave portion of the abutment portion, and the abutment portion, on which the second elastic member is installed, is disposed between the inner side wall of the support portion and the wall portion of the rotation member in such a manner that the at least one recess portion of the second elastic member contacts the wavy portion of the rotation member from the upper side of the wavy portion.

[0017] On the basis of the operating device in accordance with embodiments of the present disclosure, it is possible to achieve an operating device capable of performing a rotation operation and press operation, that is simple in structure, small in size, light in weight, and thin in thickness.

BRIEF DESCRIPTION OF THE DRAWINGS

[0018]

FIG. 1 is a stereogram showing an example of an operating device in accordance with an embodiment of the present disclosure;

FIG. 2 is a front sectional view presenting an example of the operating device in accordance with an embodiment of the present disclosure;

FIG. 3 is an exploded stereogram illustrating a partial

structure of an example of the operating device in accordance with an embodiment of the present disclosure viewed from an oblique top;

FIG. 4 is an exploded stereogram showing the partial structure of an example of the operating device in accordance with an embodiment of the present disclosure illustrated in FIG. 3 viewed from an oblique bottom;

FIG. 5 is a schematic diagram presenting a partial structure of an example of the operating device in accordance with an embodiment of the present disclosure;

FIG. 6 is a schematic diagram illustrating an example of a press operation mechanism of the operating device in accordance with an embodiment of the present disclosure;

FIG. 7 is a schematic diagram presenting an example of a press operation mechanism and rotation operation mechanism of the operating device in accordance with an embodiment of the present disclosure;

FIG. 8 is an exploded stereogram illustrating an example of the operating device in accordance with an embodiment of the present disclosure viewed from an oblique top;

FIG. 9 is a schematic diagram showing an example of a rotation operation mechanism of the operating device in accordance with an embodiment of the present disclosure;

FIG. 10 is an exploded stereogram presenting an example of the rotation operation mechanism of the operating device in accordance with an embodiment of the present disclosure illustrated in FIG. 9;

FIG. 11 is a stereogram showing an example of the rotation operation mechanism of the operating device in accordance with an embodiment of the present disclosure presented in FIG. 10;

FIG. 12 is a sectional view illustrating an example of the rotation operation mechanism of the operating device in accordance with an embodiment of the present disclosure;

FIG. 13 is a schematic diagram presenting the visible range of a function prompt region of an example of the operating device in accordance with an embodiment of the present disclosure; and

FIG. 14 is a schematic diagram showing the visible range of a function prompt region of an operating device in accordance with a comparative example.

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[0019] In what follows, an operating device 1 in accordance with embodiments of the present disclosure is concretely described by referring to the accompanying drawings.

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[0020] Furthermore, in the present specification and accompanying drawings, only components related to the technical idea of the present disclosure are described and illustrated, while other components are omitted.

[0021] Additionally, components having the same or

similar function in the present specification and accompanying drawings are labeled with the same reference numeral, and the repetition of the explanations to them are appropriately omitted.

[0022] Moreover, in the present specification and accompanying drawings, the up-down direction along the paper surface shown in FIG. 2 is defined as the up-down direction of the operating device 1 and is the height direction of the operating device 1. The use of "upper" and "lower" involved in terms such as "upper side", "upper surface", "lower surface", and the like in the present specification follow the definition of the up-down direction. Here, the up-down direction or height direction of the operating device 1 is also called a longitudinal direction, and the direction perpendicular to the longitudinal direction is called a radial direction.

[0023] In addition, the accompanying drawings are schematic or conceptual, and the relationship between the thickness and width of each part, the ratio of the sizes between parts, etc. may not be the same as in reality. Even when presenting the same parts in the accompanying drawings, there is a case where the dimensions and ratios of the same parts are illustrated differently from each other.

[0024] Hereinafter, the structure of an example of the operating device 1 in accordance with an embodiment of the present disclosure is described with reference to FIGS. 1 and 2. Here, FIG. 1 is a stereogram showing an example of the operating device 1 in accordance with an embodiment of the present disclosure. FIG. 2 is a front sectional view presenting an example of the operating device 1 in accordance with an embodiment of the present disclosure.

[0025] As shown in FIGS. 1 and 2, the operating device 1 in accordance with an embodiment of the present disclosure is an operating device capable of conducting a rotation operation and press operation. The operating device 1 may be disposed on the display panel of a vehicle mounted apparatus, for example. A plurality of functions may be prompted on the display panel. When a user performs the press operation of the operating device 1, the user can select a function prompted on the display panel, and when the user conducts the rotation operation of the operating device 1, the user can switch the function selected when performing the press operation.

[0026] Here, the operating device 1 is illustrated and explained by taking a circumstance, where the operation device 1 is in the shape of a circular ring, as an example. The side closer to the center of the circular ring is defined as a radially inner side; the side farther from the center of the circular ring is defined as a radial outer side; and the direction along the circumference of the circular ring is defined as a circumferential direction.

[0027] As illustrated in FIGS. 1 and 2, the operating device 1 has a base 10, rotation member 20, press member 30, and first elastic member 30t.

[0028] Here, the base 10 is made of resin, for example, and is formed into a circular ring shape. The base 10

functions as an installation portion when the operating device 10 is mounted to a vehicle mounted apparatus, for example. Additionally, the base 10 also functions as a receipt portion that accommodates or receives the rotation member 20, press member 30, and first elastic member 30t.

[0029] Furthermore, the rotation member 20 is made of resin, for example, and is installed on the base 10 in a freely rotatable manner. The rotation member 20 functions as a component achieving the rotation operation of the operating device 1. In a case where the rotation operation of the operating device 1 is carried out, the rotation member 20 moves relative to the base 10 in a freely rotatable manner.

[0030] In addition, the press member 30 is made of resin, for example, and is installed on the rotation member 20 in a manner able to freely slide relative to the rotation member 20 in the up-down direction. Here, the press member 30 is formed into a roughly circular ring cover shape mating with the base 10. In the operating device 1, the outer peripheral edge of the press member 30 is located on the radial outer side of the outer peripheral edge of the base 10, and the inner peripheral edge of the press member 30 is located on the radially inner side of the inner peripheral edge of the base 10. In this way, the press member 30 and base 10 constitute an outer shell of the operating device 1 and simultaneously form a space for accommodating the various components of the operating device 1.

[0031] Moreover, the press member 30 functions as an operation portion of the operating device 1. For example, the user presses the press member 30 to cause the press member 30 to freely slide relative to the rotation member 20 in the up-down direction, thereby accomplishing the press operation of the operating device 1. Additionally, the user rotates the rotation member 20 to cause the rotation member 20 to move along the circumferential direction relative to the base 10 in a freely slidable manner, thereby fulfilling the rotation operation of the operating device 1.

[0032] Furthermore, the first elastic member 30t is, for example, a helical spring. The first elastic member 30t can be disposed between the press member 30 and base 10 in the up-down direction. Additionally, in the operating device 1, the first elastic member 30t can be disposed between the press member 30 and the base portion 21 of the rotation member 20 in a state where the elastic deformation of the first elastic member 30t may occur to a certain extent. That is, in a case where the operating device 1 is not operated, the first elastic member 30t supports the press member 30 with a predetermined elastic force, so that it is possible to ensure that rotation member 20 operates stably when the rotation operation of the operating device 1 is carried out.

[0033] Moreover, when pressing the press member 30 to perform the press operation of the operating device 1, the first elastic member 30t undergoes elastic deformation to provide the user with a tactile sensation of the

press operation. Additionally, after the press operation is released, the elastic restoring force of the first elastic member 30t causes the press member 30 to reset (i.e., return to its original position).

[0034] In other words, in a case where the press operation of the operating device 1 is carried out, the press member 30 is supported by the rotation member 20 and slides in the up-down direction relative to the rotation member 20 under the action of the first elastic member 30t. On the other hand, in a case where the rotation operation of the operating device 1 is carried out, the rotation member 20 rotates relative to the base 10 in a state where the press member 30 is supported by the first elastic member 30t.

[0035] As such, the operating device 1 in accordance with an embodiment of the present disclosure does not require additionally disposing a mechanism to support the press member 30 and rotation member 20. By making the rotation member 30 also serve as a support mechanism for the press member 20 and employing the first elastic member 30t to support the press member 30 with a predetermined elastic force, the number of components of the operating device 1 can be decreased; the assembly process time can be shortened; the cost can be reduced; and the press operation and rotation operations can be carried out smoothly.

[0036] From now on, an exemplary press operation mechanism of the operating device 1 in accordance with an embodiment of the present disclosure is explained by referring to FIGS. 3 to 7. Here, FIG. 3 is an exploded stereogram illustrating a partial structure of an example of the operating device 1 in accordance with an embodiment of the present disclosure viewed from an oblique top. FIG. 4 is an exploded stereogram showing the partial structure of an example of the operating device 1 in accordance with an embodiment of the present disclosure illustrated in FIG. 3 viewed from an oblique bottom. FIG. 5 is a schematic diagram presenting a partial structure of an example of the operating device 1 in accordance with an embodiment of the present disclosure. FIG. 6 is a schematic diagram illustrating an example of a press operation mechanism of the operating device 1 in accordance with an embodiment of the present disclosure. FIG. 7 is a schematic diagram presenting an example of a press operation mechanism and rotation operation mechanism of the operating device 1 in accordance with an embodiment of the present disclosure.

[0037] As an example, the press operation mechanism of the operating device 1 in accordance with an embodiment of the present disclosure mainly includes the press member 30, the first elastic member 30t, and the rotation member 20 serving as a support mechanism.

[0038] As shown in FIGS. 3 to 7, a wall portion 23 and wavy portion 22 located on the radially inner side of the wall portion 23 are formed on the rotation member 20.

[0039] Alternatively, it is also possible to integrally form, on the rotation member 20, the base portion 21 in a circular ring shape, wavy portion 22 disposed along

the circumferential direction on the radially inner edge of the base portion 21, and wall portion 23 disposed along the circumferential direction on at least a part of the radially outer side of the wavy portion 22. In addition, the base portion 21 on the rotation member 20 may be formed, for example, as a flange in a circular ring shape, but is not limited to this.

[0040] Furthermore, the wavy portion 22 is formed on the upper surface of the base portion 21 by extending vertically upward along the radially inner edge of the base portion 21. The wavy portion 22 is provided in the circumferential direction along the entire radially inner edge of the base portion 21. Here, the peak portions and valley portions of the wavy portion 22 are formed on the upper surface side of the wavy portion 22. Additionally, the peak portions and valley portions of the wavy portion 22 are uniformly disposed along the circumferential direction to guarantee that the tactile feel of the rotation operation is uniform and stable. However, this is not a limitation; the height of the peak portions and valley portions of the wavy portion 22 may be adjusted according to a relevant specification. For example, in a case where the tactile feel in some regions needs to be enhanced, it is also possible to increase the height of the peak portions and/or valley portions of the wavy portion 22. Moreover, the peak portions and/or valley portions of the wavy portion 22 may also have different heights.

[0041] In addition, the wall portion 23 is adjacent to the wavy portion 22 in the radial direction. The wall portion 23 is formed on the upper surface of the base portion 21 by extending vertically upward along the circumferential direction on the radially outer side of the wavy portion 22. The wall portion 23 is formed on at least a part of the upper surface of the base portion 21 along the circumferential direction, for example.

[0042] Moreover, the height of the wavy portion 22 is lower than the height of the wall portion 23. The width of the wavy portion 22 in the radial direction is greater than the width of the wall portion 23 in the radial direction.

[0043] As illustrated in FIGS. 3 and 5 to 7, the wall portion 23 is inclusive of first wall portions 231 spaced apart from each other and one or more second wall portions 232s each of which is located between the adjacent first wall portions 231.

[0044] Here, the first wall portions 231 and second wall portions 232 are separated from each other. When conducting the press operation, the gaps between the first wall portions 231 and second wall portions 232 are used to accommodate a part of the press member 30 described later to ensure that the press operation can be carried out.

[0045] Furthermore, the first wall portions 231 and second wall portions 232 are formed by extending upward from the base portion 21. For example, the height of the first wall portions 231 is the same as the height of the second wall portions 232.

[0046] Additionally, a case, where three first wall portions 231 and three second wall portions 232 are dis-

posed, respectively, is presented in the accompanying drawings. However, this is not a limitation. It is also possible to dispose two first wall portions 231 and two second wall portions 232, respectively, or four or more first wall portions 231 and four or more second wall portions 232, respectively.

[0047] Moreover, the arc length of the first wall portions 231 along the circumferential direction is greater than the arc length of the second wall portions 232 along the circumferential direction. The arc length of the first wall portions 231 along the circumferential direction is set to be relatively long to ensure that the first wall portions 231 are not easily deformed, so that the rotation member 20 can stably support the press member 30 and provide a slideway to ensure that both the rotation operation and press operation are performed smoothly and stably. On the other hand, the arc length of the second wall portions 232 along the circumferential direction is set to be relatively short to ensure that the second wall portions 232 are easily deformed, that helps one or more installation protrusions 232a described later to engage with the press member 30.

[0048] In a case where the installation of the relevant components and the stability and reliability of the rotation operation and press operation are guaranteed, it is also possible to appropriately adjust the arc lengths of the first wall portions 231 and second wall portions 232 along the circumferential direction and the numbers of them, respectively.

[0049] Furthermore, an engagement protrusion 231a is formed on the wall surface of the radially outer side of each of the first wall portions 231. For example, the engagement protrusion 231a is formed into a rib shape. The engagement protrusion 231a is formed by extending on the wall surface of the radially outer side of the corresponding first wall portion 231 along the up-down direction from the base portion 21, for example.

[0050] Preferably, the height of the engagement protrusion 231a is lower than the height of the corresponding first wall portion 231. Moreover, in the circumferential direction, the engagement protrusion 231a may be formed approximately at the center of the wall surface on the radially outer side of the corresponding first wall portion 231 or a position offset from the center of the wall surface on the radially outer side of the corresponding first wall portion 231 to ensure the installation of the relevant components and the stability and reliability of the rotation operation and press operation. In a case where the installation of the relevant components and the stability and reliability of the rotation operation and press operation are guaranteed, in the circumferential direction, the engagement protrusion 231a may also be formed at the end portion of the wall surface on the radially outer side of the corresponding first wall portion 231.

[0051] In addition, an installation protrusion 232a is formed on the wall surface of the radially outer side of each of the second wall portions 232. For example, the

installation protrusion 232a is formed into a wedge shape. The installation protrusion 232a is formed in such a manner that its radial thickness gradually increases downward from the upper end of the wall surface on the radially outer side of the corresponding second wall portion 232, for example. Furthermore, the lower surface of the installation protrusion 232a is, for example, orthogonal to the wall surface on the radially outer side of the corresponding second wall portion 232.

[0052] Preferably, the height of the installation protrusion 232a is less than the height of the corresponding second wall portion 232. More preferably, the height of the installation protrusion 232a is less than half the height of the corresponding second wall portion 232. Additionally, in the circumferential direction, the installation protrusion 232a is formed, for example, approximately at the center of the wall surface of the radially outer side of the corresponding second wall portion 232 to ensure the installation of the relevant components and the stability and reliability of the rotation operation and press operation.

[0053] Additionally, the accompanying drawings show a case where one engagement protrusion 231a is formed on each first wall portion 231 and one installation protrusion 232a is formed on each second wall portion 232, but this is not a limitation. The number of engagement protrusions 231a formed on each first wall portion 231 and the number of installation protrusions 232a formed on each second wall portion 232 may be adjusted according to the relevant specification. For example, one engagement protrusion 231a may be formed on each first wall portion 231, and two installation protrusions 232a may be formed on each second wall portion 232. This is as long as the numbers and positions of the engagement protrusions 231a and installation protrusions 232a match the numbers and positions of the corresponding components on the press member 30, respectively.

[0054] Moreover, as illustrated in FIG. 4, protrusions 21a are provided on the lower surface of the rotation member 20. The protrusions 21a are used to fix the rotation member 20 to the base 10 to ensure that the rotation member 20 cannot rotate when the press operation of the operating device 1 is carried out. Here, three protrusions 21a are disposed circumferentially on the lower surface of the rotation member 20; however, the present disclosure is not limited to this. The number and positions of the protrusions 21a may be adjusted appropriately according to the relevant specification.

[0055] As presented in FIGS. 3 to 7, the press member 30 includes a first inner side wall 31, first outer side wall 32, second outer side wall 33 located on the radially outer side of the first outer side wall 32, flange portion 34, and top wall 35. Here, the second outer side wall 33, flange portion 34, top wall 35, and first inner side wall 31 constitute a part of the outer shell of the operating device 1.

[0056] As shown in FIG. 7, the first inner side wall 31 of the press member 30 includes a radial wall portion 311, inclined wall portion 312, and longitudinal wall portion

313. The radial wall portion 311 is located upward than the rotation member 20, and the longitudinal wall portion 313 is located radially inward than the rotation member 20. Here, the radial wall portion 311 and inclined wall portion 312 as well as the inclined wall portion 312 and longitudinal wall portion 313 are smoothly connected, respectively. The radial wall portion 311 of the first inner side wall 31 is a portion that the user usually contacts when conducting the press operation of the operating device 1.

[0057] As shown in FIGS. 6 and 7, the first outer side wall 32 includes a first longitudinal wall portion 321, top wall portion 322 located above the first longitudinal wall portion 321, and second longitudinal wall portion 323 formed by extending on the radially outer side of the top wall portion 322. The first longitudinal wall portion 321, top wall portion 322, and second longitudinal wall portion 323 generate a space in which the first elastic member 30t is disposed. The dimensions of the first longitudinal wall portion 321, top wall portion 322, and second longitudinal wall portion 323 may be adjusted by way of the dimension of the first elastic member 30t, for example. Furthermore, the first outer side wall 32 is connected to the flange portion 34 via the second longitudinal wall portion 323. Additionally, for example, the radially inner side of the top wall portion 322 extends above the wall portion 23 of the rotation member 20.

[0058] In addition, as presented in FIG. 5, engagement cuts 321a are formed on the first longitudinal wall portion 321 for engaging with the engagement protrusions 231a, respectively, and installation cuts 321b are also formed on the first longitudinal wall portion 321 for engaging with the installation protrusions 232a, respectively. A slideway 23L is formed on the radially inner side of the first longitudinal wall portion 321 for accommodating and sliding the wall portion 23 of the rotation member 20.

[0059] As illustrated in FIGS. 6 and 7, through the engagement of the engagement protrusions 231a and engagement cuts 321a, the wall surface on the radially inner side of the first longitudinal wall portion 321 slides in contact with the rotation member 20 on its radially outer side. Furthermore, the height of the wall surface on the radially outer side of the wall portion 23 of the rotation member 20 (i.e., the height from the base portion 21 to the upper surface of the wall portion 23) is greater than or equal to the height of the first longitudinal wall portion 321 and less than the height of the first outer side wall 32.

[0060] Moreover, as shown in FIGS. 6 and 7, the top wall portion 322 of the first outer side wall 32 is located below the radial wall portion 311 of the first inner side wall 31 and above the rotation member 20. When performing the press operation of the operating device 1, the press member 30 slides downward relative to the rotation member 20 by the engagement of the engagement protrusions 231a and the engagement cuts 321a. The sliding stops when the lower surface of the top wall portion 322 comes into contact with the upper surface of the wall portion 23 of the rotation member 20.

[0061] The top wall 35 is disposed on the upper side of the top wall portion 322 and second longitudinal wall portion 323 of the first outer side wall 32 and the radially outer side of the radial wall portion 311 of the first inner side wall 31. The top wall 35 together with the radial wall portion 311 of the first inner side wall 31 are also a portion that the user usually contacts when conducting the press operation of the operating device 1.

[0062] The flange portion 34 is located between the top wall 35 and second outer side wall 33 in the up-down direction and on the radially outer side of the second longitudinal wall portion 323 of the first outer side wall 32. The radially outer peripheral wall surface of the flange portion 34 is, for example, formed into a concave-convex shape. The flange portion 34 is a portion that the user contacts when the rotation operation of the operating device 1 is carried out.

[0063] Furthermore, as presented in FIGS. 3, 4, 6, and 7, the first elastic member 30t is a helical spring. The first elastic member 30t is disposed in a space surrounded by the first longitudinal wall portion 321, top wall portion 322, and second longitudinal wall portion 323 of the first outer side wall 32 as well as the rotation member 20. Additionally, the first elastic member 30t is disposed between the press member 30 and rotation member 20. For example, the first elastic member 30t is formed such that in the up-down direction, one end of the first elastic member 30t can be supported on the lower surface of the top wall portion 322 of the press member 30, and another end of the first elastic member 30t can be supported on the upper surface of the base portion 21 of the rotation member 20. Moreover, it is preferable that the height of the first elastic member 30t is greater than the height of the first longitudinal wall portion 321 of the press member 30. As a result, in a case where the press operation of the operating device 1 is not carried out, the first elastic member 30t supports the press member 30 with a pre-determined elastic force, and in a case where the user conducts the press operation of the operating device 1, the elastic force generated when the first elastic member 30t elastically deforms can provide a tactile sensation to the user. In addition, in a case where the user releases the press operation of the operating device 1, the elastic restoring force of the first elastic member 30t causes the press member 30 to reset.

[0064] As such, in the press operation mechanism of the operating device 1 according to an embodiment of the present disclosure, the rotation member 20, press member 30, and first elastic member 30t are involved. The press member 30 is supported by the rotation member 20 and first elastic member 30t. When the user conducts a press operation on the press member 30 of the operating device 1, the press force causes the press member 30 to slide downward relative to the rotation member 20, and the elastic force of the first elastic member 30t provides the user with a tactile sensation. The sliding stops when the lower surface of the top wall portion 322 abuts against the upper surface of the wall portion 23 of the rotation

member 20. On the other hand, in a case where the user releases the press operation of the operating device 1, under the action of the elastic restoring force of the first elastic member 30t, the press member 30 slides upward relative to the rotation member 20 while supported by the rotation member 20 and first elastic member 30t, thereby causing the press member 30 to reset. Additionally, in the operating device 1 according to an embodiment of the present disclosure, the first elastic member 30t is a ring-shaped helical spring, so the press force can be uniform when the press operation is carried out.

[0065] From now on, an exemplary rotation operation mechanism of the operating device 1 in accordance with an embodiment of the present disclosure is explained with reference to FIGS. 8 to 12. Here, FIG. 8 is an exploded stereogram illustrating an example of the operating device 1 in accordance with an embodiment of the present disclosure viewed from an oblique top. FIG. 9 is a schematic diagram showing an example of a rotation operation mechanism of the operating device 1 in accordance with an embodiment of the present disclosure. FIG. 10 is an exploded stereogram presenting an example of the rotation operation mechanism of the operating device 1 in accordance with an embodiment of the present disclosure illustrated in FIG. 9. FIG. 11 is a stereogram showing an example of the rotation operation mechanism of the operating device 1 in accordance with an embodiment of the present disclosure presented in FIG. 10. FIG. 12 is a sectional view illustrating an example of the rotation operation mechanism of the operating device 1 in accordance with an embodiment of the present disclosure.

[0066] As an example, the rotation operation mechanism of the operating device 1 in accordance with an embodiment of the present disclosure includes the press member 30, first elastic member 30t, rotation member 20, second elastic member 20t, and base 10.

[0067] Here, the structures of the press member 30, first elastic member 30t, and rotation member 20 are the same as those described above, so their descriptions are not repeated. Only the structures of the second elastic member 20t and base 10 are described in detail.

[0068] As shown in FIG. 8, the second elastic member 20t is fixed to the base 10. The structure described above, that consists of the press member 30, first elastic member 30t, and rotation member 20, is installed on the base 10.

[0069] As presented in FIGS. 8 to 11, the base 10 is formed into a circular ring shape and includes a support portion 11 and abutment portion 12 installed on the support portion 11.

[0070] Here, the support portion 11 is formed with a cross-sectional shape approximately U-shaped, orthogonal to the circumferential direction. For example, the support portion 11 includes an inner side wall 111, bottom wall 112, and outer side wall 113. Furthermore, engagement portions 111a and cut portions 111b are disposed on the inner side wall 111 of the support portion 11. Here, the engagement portions 111a are provided on the wall sur-

face of the radially outer side of the inner side wall 111. The engagement portions 111a are used to engage with the abutment portion 12. Additionally, notches 113a are disposed on the outer side wall 113 of the support portion 11 for mating with the press member 30. The cut portions 111b are used to receive the abutment portion 12. For example, two cut portions 111b sandwiching one engagement portion 111a serve as one set. The accompanying drawings show a case where three sets, each of which consists of two cut portions 111b and one engagement portion 111a, are distributed on the inner side wall 111, but this is not a limitation. Two or more sets, or even four or more sets, may be distributed on the inner side wall 111, as long as they are configured according to the relevant specification.

[0071] Furthermore, each engagement portion 111a is, for example, formed into a wedge shape. Each engagement portion 111a is formed in such a manner that its radial thickness gradually increases downwards from the upper end of the wall surface on the radially outer side of the inner side wall 11, for example. Additionally, the lower surface of each engagement portion 111a is, for example, orthogonal to the wall surface on the radially outer side of the inner side wall 111. Preferably, the height of each engagement portion 111a is less than the height of the inner side wall 111. More preferably, the height of each engagement portion 111a is less than half the height of the inner side wall 111. Moreover, in the circumferential direction, for example, the engaging portions 111a are distributed approximately equally on the wall surface of the radially outer side of the inner side wall 111 to ensure the stability and reliability of the abutment portion 12 during installation.

[0072] Additionally, as shown in FIG. 10, the abutment portion 12 includes a side wall 121 and eave portion 122 extending radially outward from the side wall 121, above the side wall 121. Engaged portions 121a are disposed on the side wall 121 for engaging with the engagement portions 111a, respectively. Here, each of the engaged portions 121a is, for example, a through hole. The shape, positions, and number of these through holes should match the shape, positions, and number of the engagement portions 111a, respectively. Furthermore, rib portions 121b, that engage with the cut portions 111b, respectively, are provided on the wall surface of the radially inner side of the side wall 121. For example, two rib portions 121b sandwiching one engaged portion 121a serve as one set. The accompanying drawings show a case where three sets, each of which consists of two rib portions 121b and one engaged portion 121a, are distributed on the side wall 121, but this is not a limitation. Two or more sets, or even four or more sets, may be distributed on the side wall 121, as long as they are configured according to the relevant specification.

[0073] The abutment portion 12 is installed to the support portion 11 by means of the engaged portions 121a that respectively engage with the engagement portions 111a and the rib portions 121b that respectively engage

with the cut portions 111b. For example, as presented in FIG. 11, the abutment portion 12 is fixedly installed to the inner side wall 111 of the support portion 11 from the radially outer side of the inner side wall 111 in a manner where the eave portion 122 is located on the upper side of the inner side wall 111.

[0074] In addition, as shown in FIG. 10, at least one first notch portion 122a and second notch portion 122b are disposed on the eave portion 122 of the abutment portion 12.

[0075] As illustrated in FIGS. 9 and 10, the first notch portion 122a and second notch portion 122b are, for example, formed to be recessed from the upper surface of the eave portion 122 along the up-down direction. Furthermore, two first notch portions 122a are formed on the eave portion 122, sandwiching one second notch 122b. The ends of the two first notch portions 122a away from the second notch 122b in the circumferential direction are, for example, not continuous with the eave portion 122, so that the second elastic member 20t is installed to the first notch portions 122a. Furthermore, the two ends of the second notch 122b in the circumferential direction are continuous with the eave portion 122. Additionally, a group consisting of a set of two rib portions 121b and one engaged portion 121a is provided on the side wall 121 located below the second notch portion 122b.

[0076] Additionally, for example, a component for installing the second elastic member 20t is provided on the first notch portion(s) 122a. The second elastic member 20t may be installed to the first notch portion(s) 122a by way of adhesive bonding, riveting, or screw fixing.

[0077] Furthermore, in the operating device 1, the second notch portion(s) 122b of the abutment portion 12 is positioned at a height slightly above the peak portions of the wavy portion 22 of the rotation member 20. Thus, the second notch portion(s) 122b of the abutment portion 12 can restrict the upward movement of the rotation member 20 due to the elastic force of the second elastic member 20t when conducting the rotation operation. Moreover, the second notch portion(s) 122b of the abutment portion 12 can also restrict the upward movement of the rotation member 20 along with the press member 30 due to the elastic restoring force of the first elastic member 30t when performing the press operation.

[0078] In addition, as shown in FIGS. 8 to 11, the second elastic member 20t is a leaf spring. The second elastic member 20t is fixedly installed on the abutment portion 12 of the base 10.

[0079] As presented in FIG. 10, the second elastic member 20t is approximately arc-shaped in a whole, and an installation portion(s) 20ta and recess portion(s) 20tb are provided on the second elastic member 20t. The number of the installation portions 20ta of the second elastic member 20t is the same as the number of the first notch portions 122a. The installation portions 20ta are formed, for example, at the ends of the second elastic member 20t, respectively. The recess portion 20tb is

formed, for example, approximately at the middle of the second elastic member 20t. Moreover, the recess portion 20tb of the second elastic member 20t is formed such that the recess portion 20tb can be accommodated in the valley portion V of the rotation member 20 (see FIG. 10).

[0080] For example, as shown in FIGS. 8 and 11, the second elastic member 20t is installed on the abutment portion 12 in a manner where the second elastic member 20t is located directly below the eave portion 122 on the radially outer side of the side wall 121. Furthermore, in the operating device 1, along the up-down direction, the second elastic member 20t is located above the wavy portion 22 and below the eave portion 122. Additionally, in the operating device 1, along the radial direction, the second elastic member 20t is located on the radially outer side of the side wall 121 of the base 10 and the radially inner side of the wall portion 23 of the rotation member 20.

[0081] Moreover, as illustrated in FIG. 11, in the operating device 1, the rotation member 20 is disposed on the base 10 such that the base portion 21 faces the bottom wall 112 of the base 10, and the wall portion 23 is located between the outer side wall 113 of the base 10 and the abutment portion 12 in the radial direction. Additionally, the abutment portion 12, on which the second elastic member 20t is mounted, is disposed between the inner side wall 111 of the support portion 11 and the wall portion 23 of the rotation member 20 such that the recess portion 20tb of the second elastic member 20t contacts the wavy portion 22 of the rotation member 20 from the upper side of the wavy portion 22. Furthermore, the height of the rotation member 20 is greater than the height of the abutment portion 12.

[0082] In addition, as shown in FIG. 12, the width of the wavy portion 22 of the rotation member 20 in the radial direction is greater than the width of the wall portion 23 of the rotation member 20 in the radial direction. As a result, the wavy portion 22, that extends throughout the circumference of the rotation member 20, can function as a reinforcing portion of the wall portion 23 of the rotation member 20, so as to ensure that the rotation member 20 operates stably and reliably as a support component of the press member 30.

[0083] As such, in the operating device 1 according to an embodiment of the present disclosure, when the user performs a rotation operation by means of the flange portion 34 of the press member 30, the rotation member 20 rotates relative to the base 10 in the circumferential direction, and the recess portion 20tb of the second elastic member 20t, that is fixedly mounted to the base 10, relatively moves on the wavy portion 22 of the rotation member 20 as the rotation member 20 rotates. For example, the position of the valley portion V of the wavy portion 22, that engages with the recess portion 20tb of the second elastic member 20t, changes as the rotation member 20 rotates. This provides a tactile feel for the rotation operation.

[0084] Furthermore, in the operating device 1 accord-

ing to an embodiment of the present disclosure, the wavy portion 22 of the rotation member 20 and the recess portion 20tb of the second elastic member 20t are arranged in the up-down direction. As a result, the radial dimension of the operating device 1 can be reduced, that helps to achieve a thinner and lighter operating device.

[0085] As described above, in the operating device 1 according to an embodiment of the present disclosure, the press operation mechanism is inclusive of the rotation member 20, press member 30, and first elastic member 30t, and the rotation operation mechanism includes the press member 30, first elastic member 30t, rotation member 20, second elastic member 20t, and the base 10.

[0086] In the operating device 1 in accordance with an embodiment of the present disclosure, the wall portion 23 of the rotation member 20 includes the first wall portions 231 spaced apart from each other and one or more second wall portions 232 each of which is located between the adjacent first wall portions 231. The wall surface on the radially outer side of each first wall portion 231 has the engagement protrusion(s) 231a for engaging with the corresponding engagement cut(s) 321a of the press member 30, and the wall surface on the radially outer side of each second wall portion 232 has an installation protrusion(s) 232a for engaging with the installation cut(s) 321b of the press member 30. As such, when conducting the rotation operation of the operating device 1, the engagement protrusion(s) 231a and installation protrusion(s) 232a of the rotation member 20 engage with the engagement cut(s) 321a and installation cut(s) 321b disposed on the press member 30, respectively, thereby being capable of fixing the press member 30 and rotation member 20 together. In this way, by performing a rotation operation on the press member 30 serving as an operation portion of the operating device 1, the rotation member 20 fixed to the press member 30 is driven to rotate, thereby completing the rotation operation. On the other hand, when carrying out the press operation of the operating device 1, by means of the engagement of the engaging protrusion(s) 231a and engagement cut(s) 321a, the press member 30 is able to slide along the up-down direction relative to the rotation member 20. Thus, there is no need to provide a dedicated press guide rail related component for the press member 30; the rotation member 20 functions as a support component for the sliding of the press member 30. Moreover, when conducting the press operation of the operating device 1, the installation cut(s) 321b and installation protrusion(s) 232a engage or disengage with each other as the press member 30 slides in the up-down direction, without hindering the movement of the press member 30.

[0087] Additionally, in the operating device 1 according to an embodiment of the present disclosure, the wavy portion 22 is provided in the rotation member 20. The wavy portion 22, that extends throughout the circumference of the rotation member 20, can function as a reinforcing portion of the wall portion 23 of the rotation member 20, so as to ensure that the rotation member

20 operates stably and reliably as a support component of the pressing member 30.

[0088] In this way, there is no need to set up a separate component providing a press guide rail for the press member 30. The rotation member 20 acts as a rotation component to operate; at the same time, the rotation member 20 also functions as a support component required for the press operation and provides a slideway. That is, the rotation member 20 serves as a constituent component for both the press operation mechanism and rotation operation mechanism, thereby decreasing the number of the parts of the operating device 1, reducing the size of the operating device 1, and making the operating device 1 thinner and lighter.

[0089] Furthermore, in the operating device 1 according to an embodiment of the present disclosure, the first elastic member 30t is configured to support the press member 30 with a predetermined elastic force in a case where the operating device 1 is not operated, so that it is possible to guarantee that the rotation member 20 operates stably when the rotation operation of the operating device 1 is carried out. Additionally, when the press operation of the operating device 1 is carried out by pressing the press member 30, the first elastic member 30t undergoes elastic deformation to provide the user with a tactile feel. Moreover, after the press operation is released, the elastic restoring force of the first elastic member 30t causes the press member 30 to reset. In this way, in a case where the press operation of operating device 1 is carried out, the press member 30 is supported by the rotation member 20 and slides in the up-down direction relative to the rotation member 20 under the action of the first elastic member 30t. On the other hand, in a case where the rotation operation of the operating device 1 is carried out, the rotation member 20 can rotate smoothly and stably relative to the base 10 in a state where the press member 30 is supported by the first elastic member 30t. As a result, in the operating device 1 according to an embodiment of the present disclosure, the first elastic member 30t serves as a constituent component for both the press operation mechanism and rotation operation mechanism, thereby decreasing the number of the parts of the operating device 1, reducing the size of the operating device 1, and making the operating device 1 thinner and lighter. In this way, it is possible to shorten the assembly process time, reduce cost, and ensure that both the press operation and rotation operation are performed smoothly.

[0090] Moreover, in the operating device 1 according to an embodiment of the present disclosure, the slideway for the press operation is arranged in the up-down direction, and the wavy portion 22 of the rotation member 20 and the recess portion(s) 20tb of the second elastic member 20t are also arranged in the up-down direction. That is, both the press operation mechanism and rotation operation mechanism are constructed along the up-down direction, thus decreasing the radial width of the operating device 1 and reducing the area occupied by the

operating device 1 when it is mounted on the surface of another device.

[0091] Additionally, in the operating device 1 according to an embodiment of the present disclosure, the second elastic member 20t fixed on the abutment portion 12 can be embedded in the valley portion(s) (e.g., the valley portion V described above) of the wavy portion 22 of the rotation member 20. As such, it is possible to restrict the rotation of the rotation member 20 when the user conducts the press operation of the operating device 1, thereby being able to make the press operation stable.

[0092] Furthermore, as shown in FIG. 13, in the operating device 1 according to an embodiment of the present disclosure, the heights of the components located on the radially inner side, such as the abutment portion 12 and so on, are lower than the height of the component(s) located on the radially outer side, such as the first outer side wall 32. As such, it is possible to set up the inclined wall portion 312 to connect the radial wall portion 311 and longitudinal wall portion 313. As a result, compared with the conventional operating device presented in FIG. 14, the volume of the component(s) that may block light is reduced, and the range of light entering the function prompt region of the operation device 1 is enlarged, so that the visible range of the function prompt region can be increased.

[0093] In addition, in the operating device 1 according to an embodiment of the present disclosure, the press member 30 is located on the radially outer side of the rotation member 20, thereby being capable of reducing the friction between the rotation member 20 providing a press guide rail and the press member and making the press force of the user conducting the press operation of the operating device 1 uniform.

[0094] While the present disclosure is described with reference to specific embodiments chosen for the purpose of illustration, it should be apparent that the present disclosure is not limited to these embodiments, but numerous modifications may be made thereto by a person skilled in the art without departing from the scope of the claims.

[0095] For example, in the above description, the case, where the operating device 1 has a circular ring shape, is taken as an instance for illustration; however, the present disclosure is not limited to this. The operating device 1 may also have another shape such as a circular shape, elliptical shape, square shape, or square ring shape.

[0096] Moreover, in the above description, the case, where the first elastic member 30t is located on the radially outer side of the rotation member 20, is used as an example for illustration, but this is not a limitation. Depending on the shape and specification of the operating device 1, the first elastic member 30t may also be located on the radially inner side of the rotation member 20.

[0097] Furthermore, in the above description, the case, where the second elastic member 20t is fixed to the abutment portion 12 of the base 10 as an independent

component, is taken as an instance for illustration, but the present disclosure is not limited to this. The second elastic member 20t may also be integrally formed with the abutment portion 12.

[0098] In addition, it should be noted that the mechanical structure of the operating device 1 has been described above, while, as for the electronic and electrical components involved in realizing the functions of the operating device 1, a person skilled in the art may make relevant designs on the basis of common knowledge in the field, and these are not related to the inventive concept. Therefore, their illustrations and detailed descriptions are omitted here.

Claims

1. An operating device capable of conducting a rotation operation and press operation, comprising:

a base;
a rotation member installed on the base in a freely rotatable manner;
a press member installed on the rotation member in a manner capable of freely sliding relative to the rotation member in an up-down direction; and
a first elastic member disposed between the press member and the base in the up-down direction,
wherein,
in response to the press operation of the operating device being carried out, the press member is supported by the rotation member and slides relative to the rotation member in the up-down direction under action of the first elastic member, and
in response to the rotation operation of the operating device being carried out, the rotation member rotates relative to the base in a state where the press member is supported by the first elastic member.

2. The operating device according to claim 1, wherein, a wall portion and wavy portion located on a radially inner side of the wall portion are formed on the rotation member.

3. The operating device according to claim 2, wherein, one or more protrusions are formed on a lower surface of the rotation member.

4. The operating device according to claim 2 or 3, wherein,

a radial width of the wavy portion is greater than a radial width of the wall portion, and
a height of the wavy portion is lower than a height

of the wall portion.

5. The operating device according to one of claims 2 to 4, wherein,

the wall portion includes first wall portions spaced apart from each other and second wall portions each of which is located between the adjacent first wall portions, one or more engagement protrusions are formed on a wall surface of a radially outer side of each first wall portion, and one or more installation protrusions are formed on a wall surface of a radially outer side of each second wall portion.

6. The operating device according to one of claims 2 to 5, further comprising:

a second elastic member installed on the base in a manner able to contact the rotation member in the up-down direction, wherein, in response to the press operation of the operating device being carried out, the second elastic member is embedded in and abuts against one or more valley portions of the wavy portion, so that the rotation member is fixed relative to the base.

7. The operating device according to claim 5 or 6, wherein,

the press member includes a first inner side wall, first outer side wall, second outer side wall located on a radially outer side of the first outer side wall, flange portion, and top wall, the first outer side wall includes a first longitudinal wall portion, top wall portion located above the first longitudinal wall portion, and second longitudinal wall portion formed by extending on a radially outer side of the top wall portion, one or more engagement cuts are formed on the first longitudinal wall portion for engaging with the one or more engagement protrusions; and one or more installation cuts are also formed on the first longitudinal wall portion for engaging with the one or more installation protrusions.

8. The operating device according to claim 7, wherein,

the first elastic member is a helical spring, and the first elastic member is disposed in a space surrounded by the first longitudinal wall portion, top wall portion, and second longitudinal wall portion of the first outer side wall as well as the rotation member.

9. The operating device according to one of claims 1 to 8, wherein,

the base is formed into a ring shape and includes a support portion and abutment portion installed on the support portion, the support portion includes an inner side wall, bottom wall, and outer side wall, at least one engagement portion and cut portion are disposed on an inner side wall of the support portion, at least one notch is disposed on an outer side wall of the support portion, the abutment portion includes a side wall and eave portion above the side wall, extending radially outward from the side wall, at least one engaged portion for engaging with the at least one engagement portion is disposed on the side wall, at least one lib portion for engaging with the at least one cut portion is disposed on a wall surface of a radially inner side of the side wall, the eave portion includes at least one first notch portion and second notch portion, and the abutment portion is fixedly installed, by way of the at least one engaged portion and lib portion, on the inner side wall of the support portion from a radial outer side of the inner side wall in such a manner that the eave portion is located on an upper side of the inner side wall.

10. The operating device according to claim 9, wherein,

the second elastic member is a leaf spring, the second elastic member includes at least one installation portion and recess portion, the second elastic member is installed, by means of the at least one installation portion, to the at least one first notch portion on a lower side of the eave portion of the abutment portion, and the abutment portion, on which the second elastic member is installed, is disposed between an inner side wall of the support portion and the wall portion of the rotation member in such a manner that the at least one recess portion of the second elastic member contacts the wavy portion of the rotation member from an upper side of the wavy portion.

FIG. 1

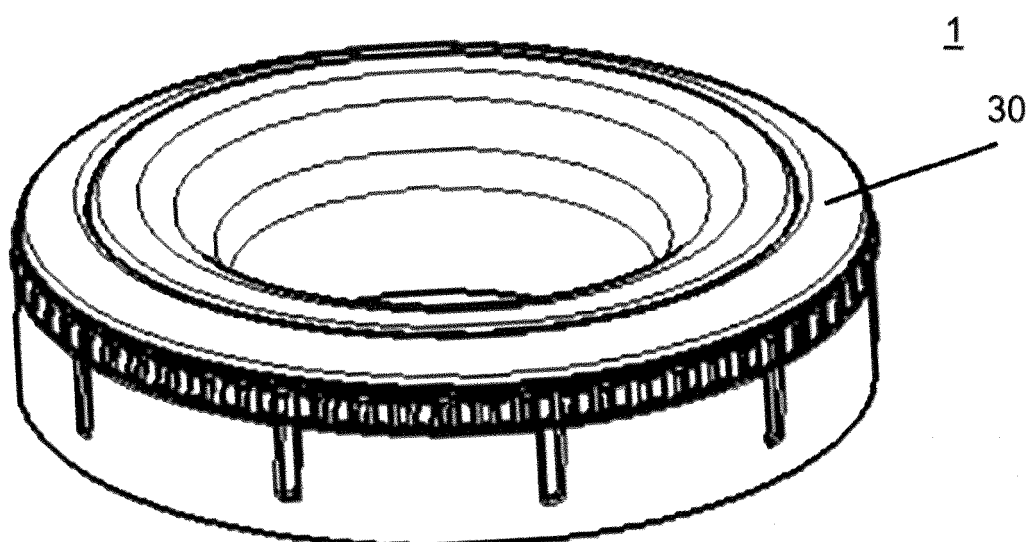


FIG.2

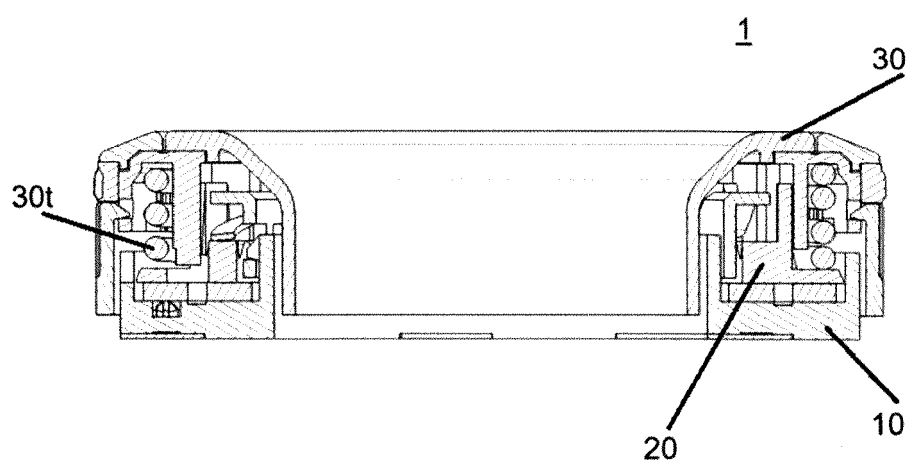


FIG.3

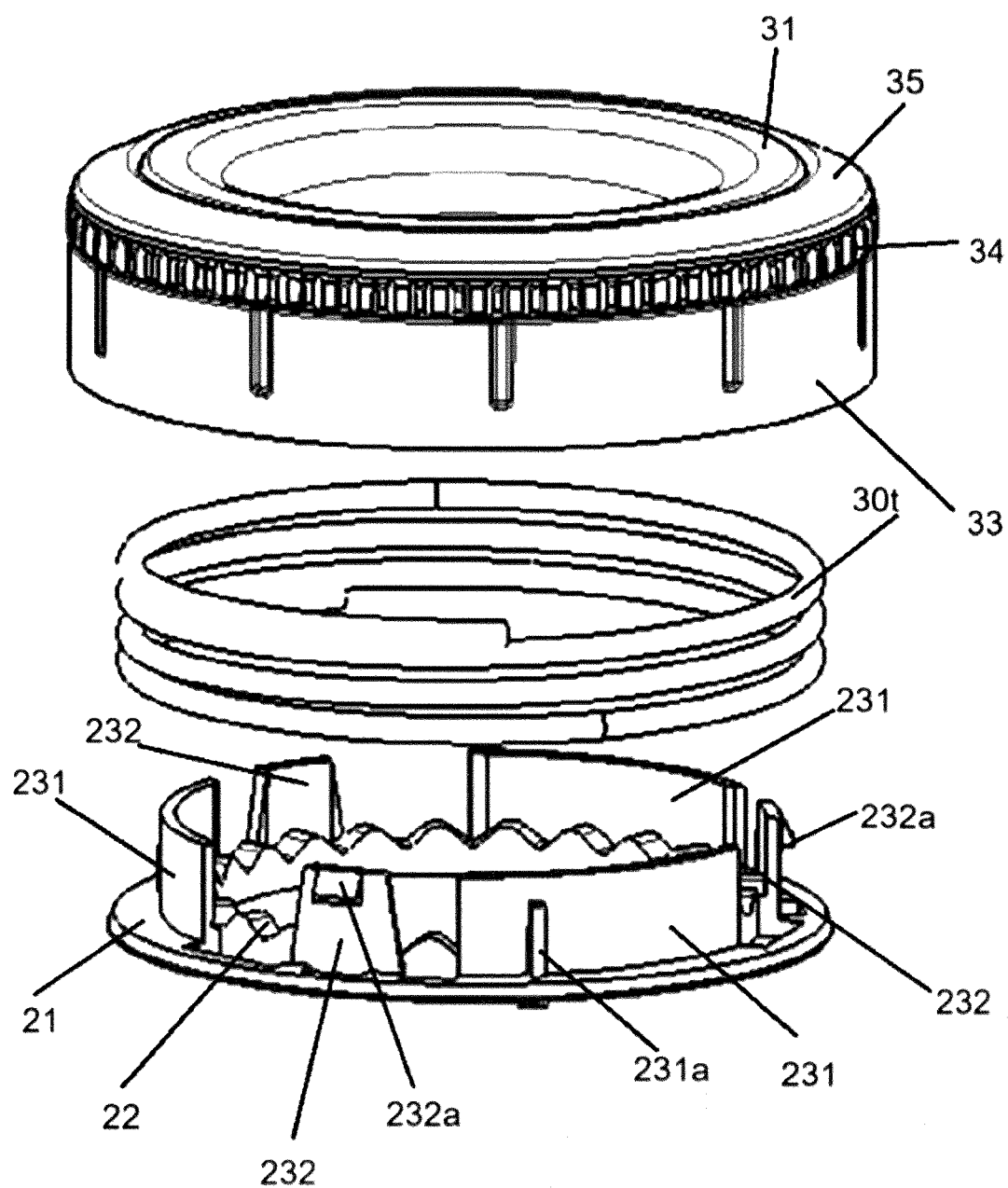


FIG.4

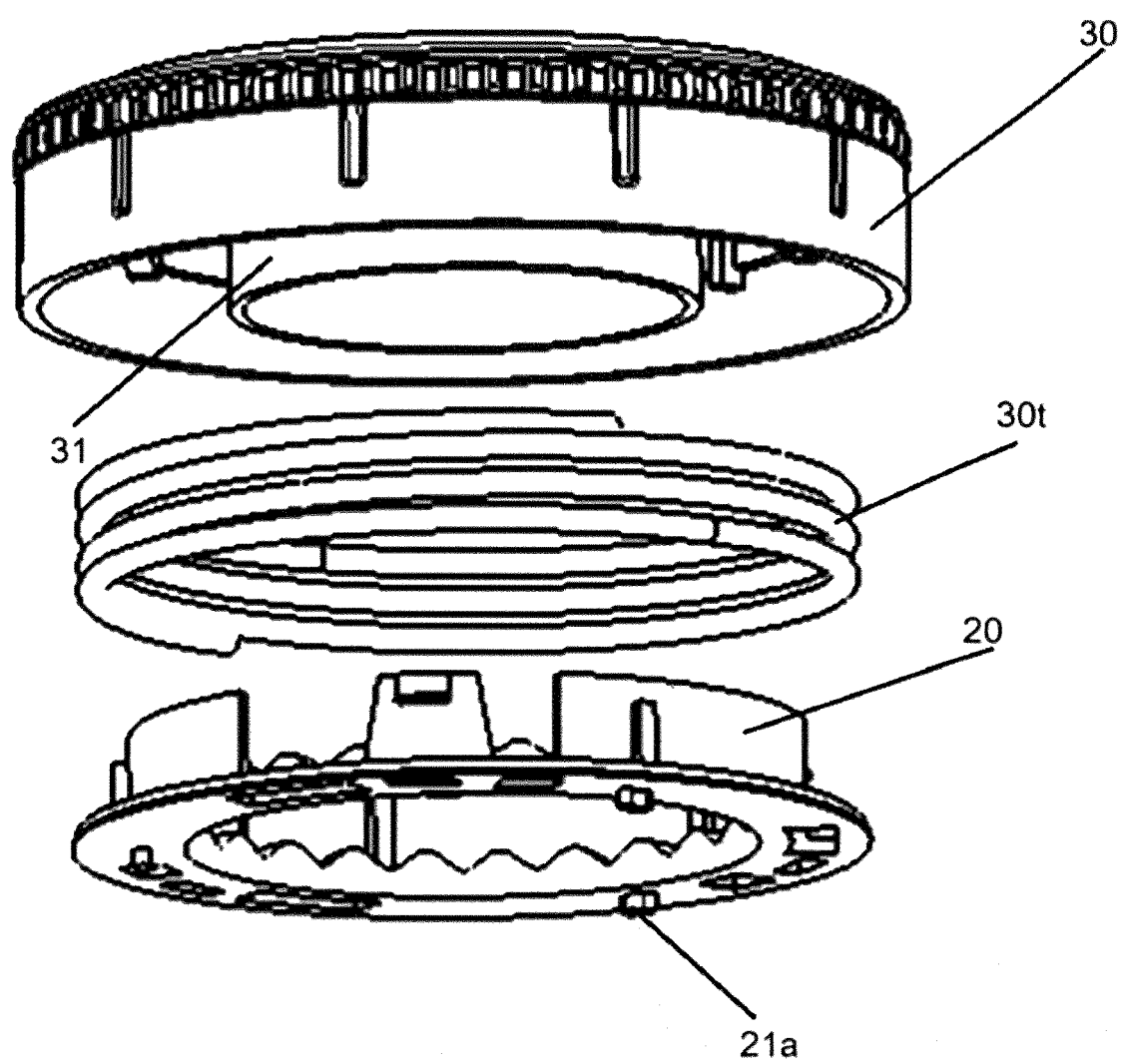


FIG.5

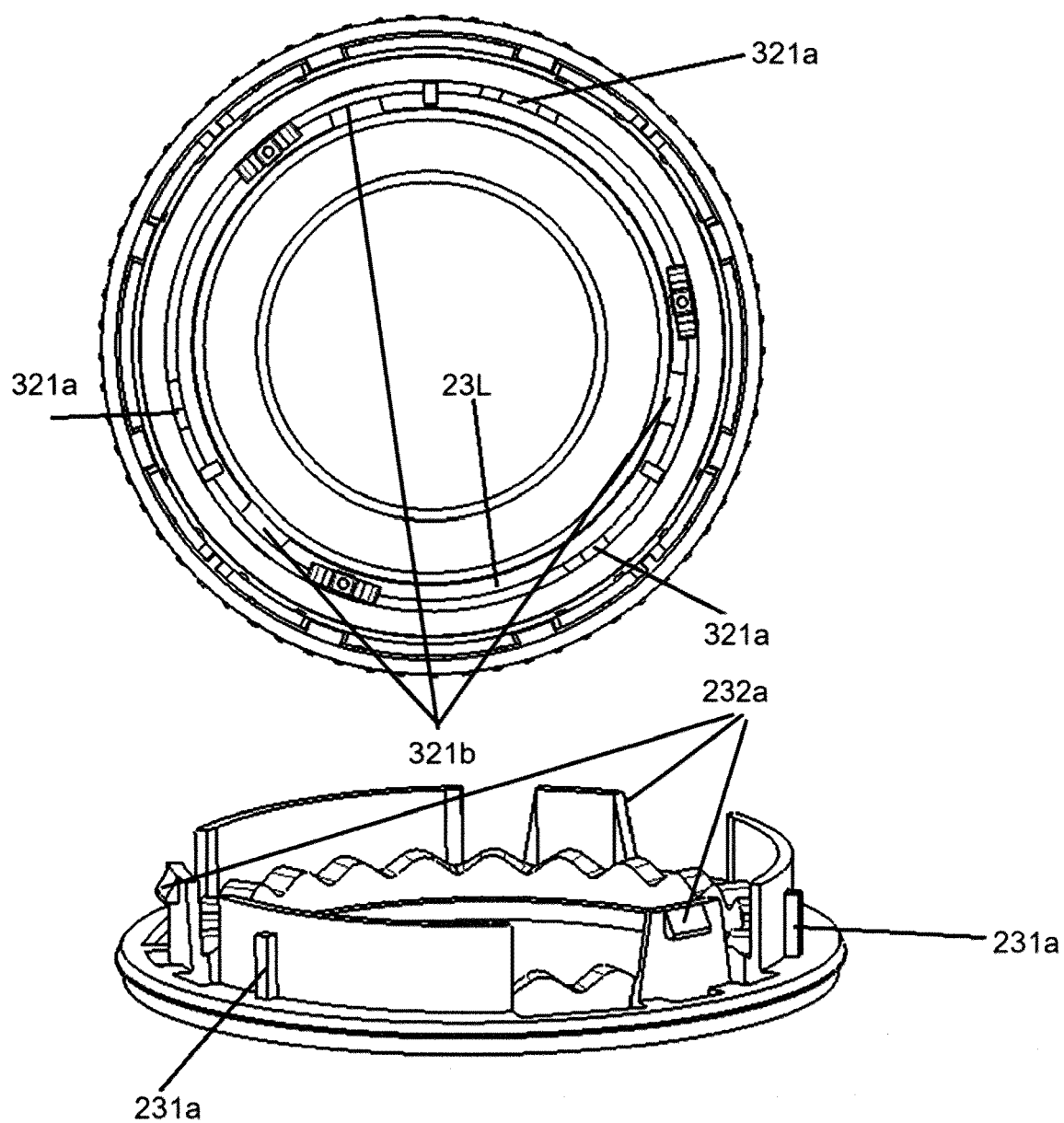


FIG.6

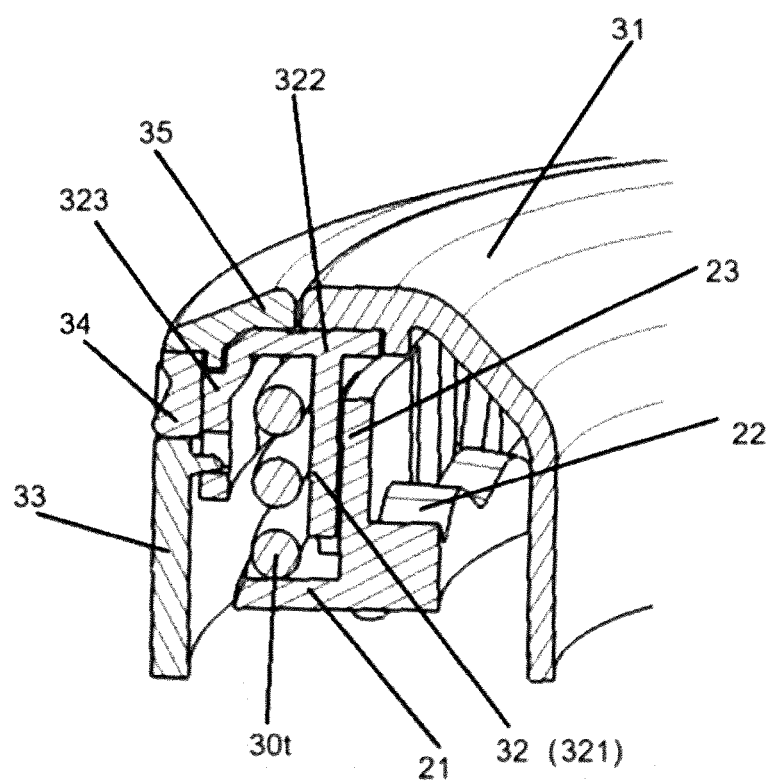


FIG.7

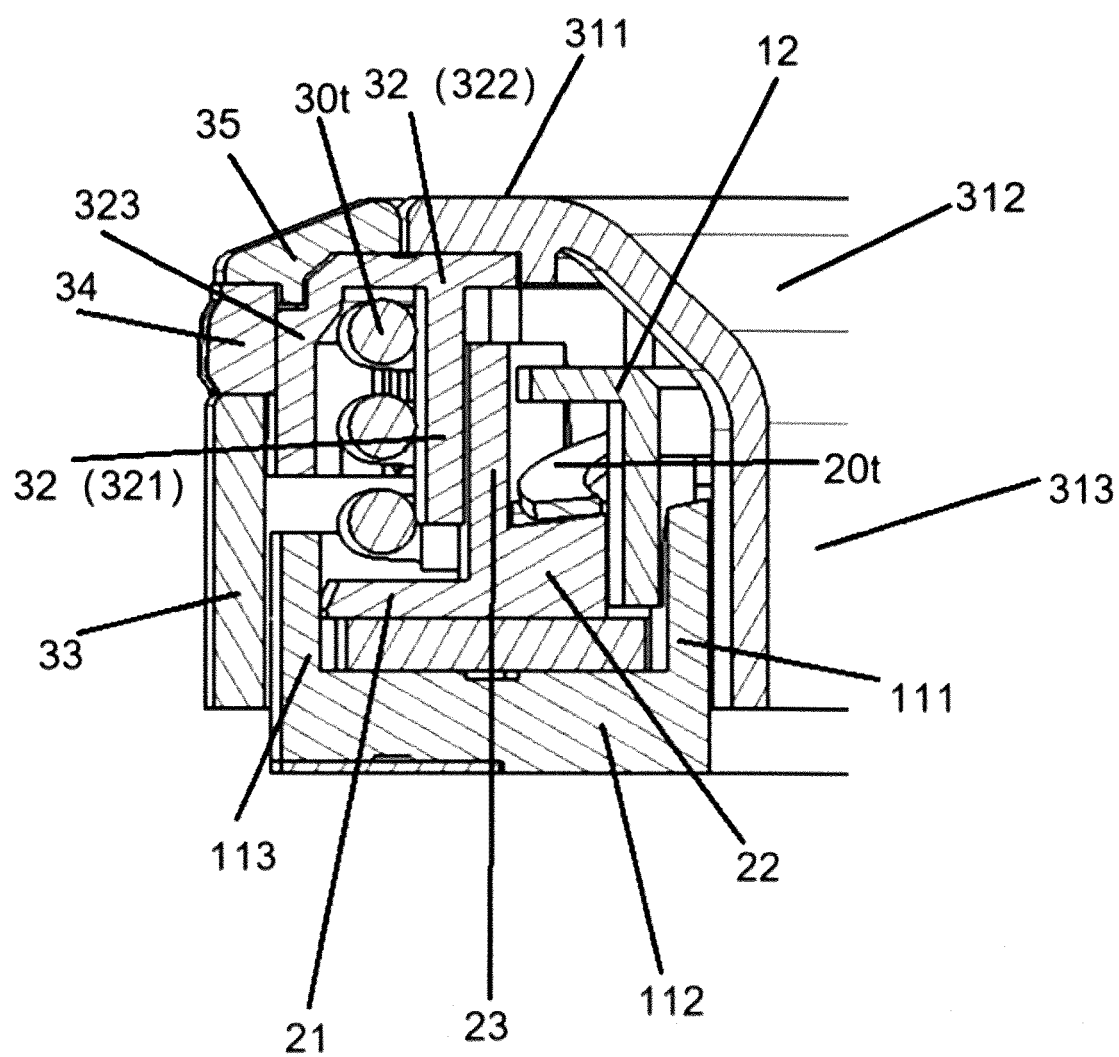


FIG.8

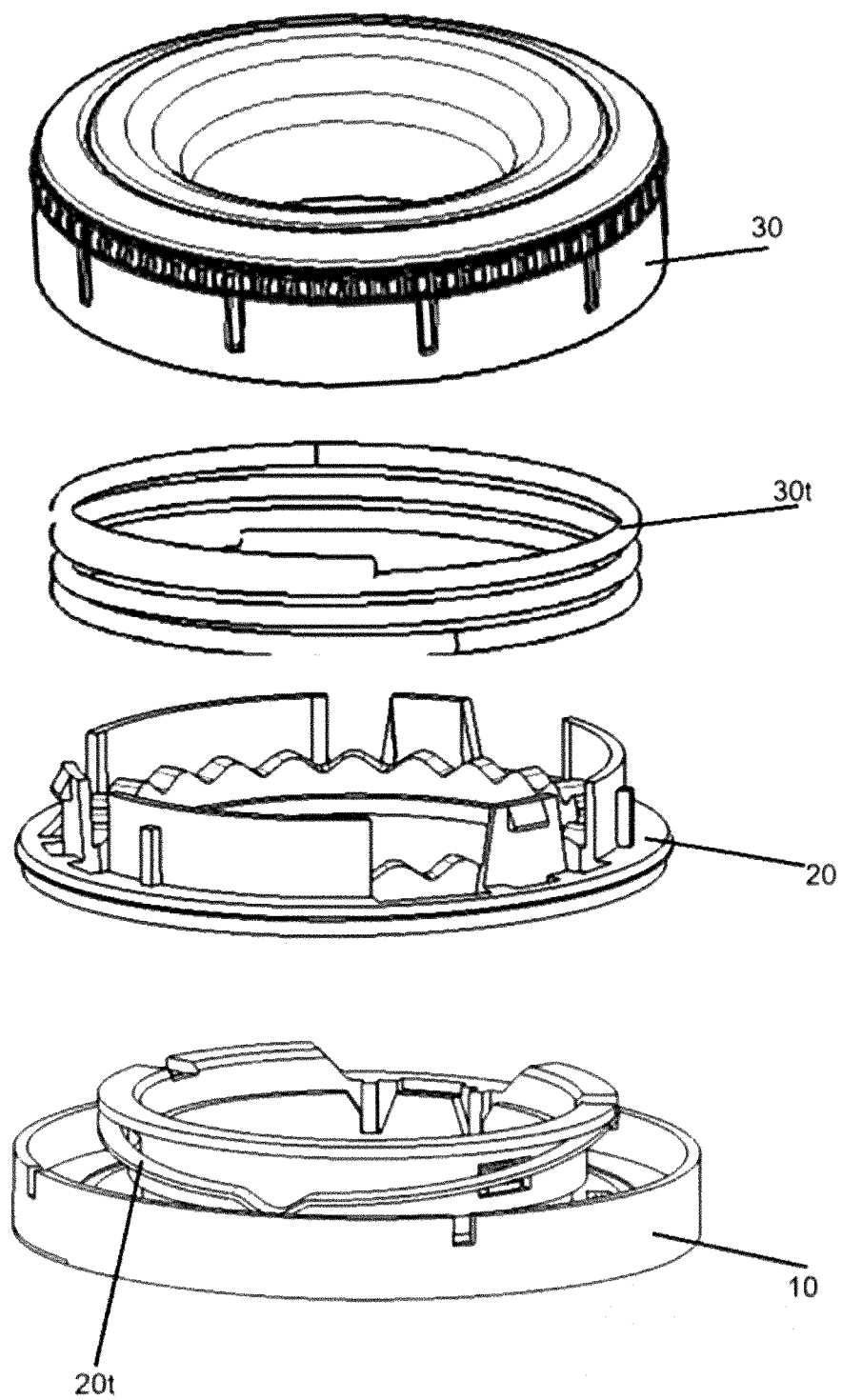


FIG.9

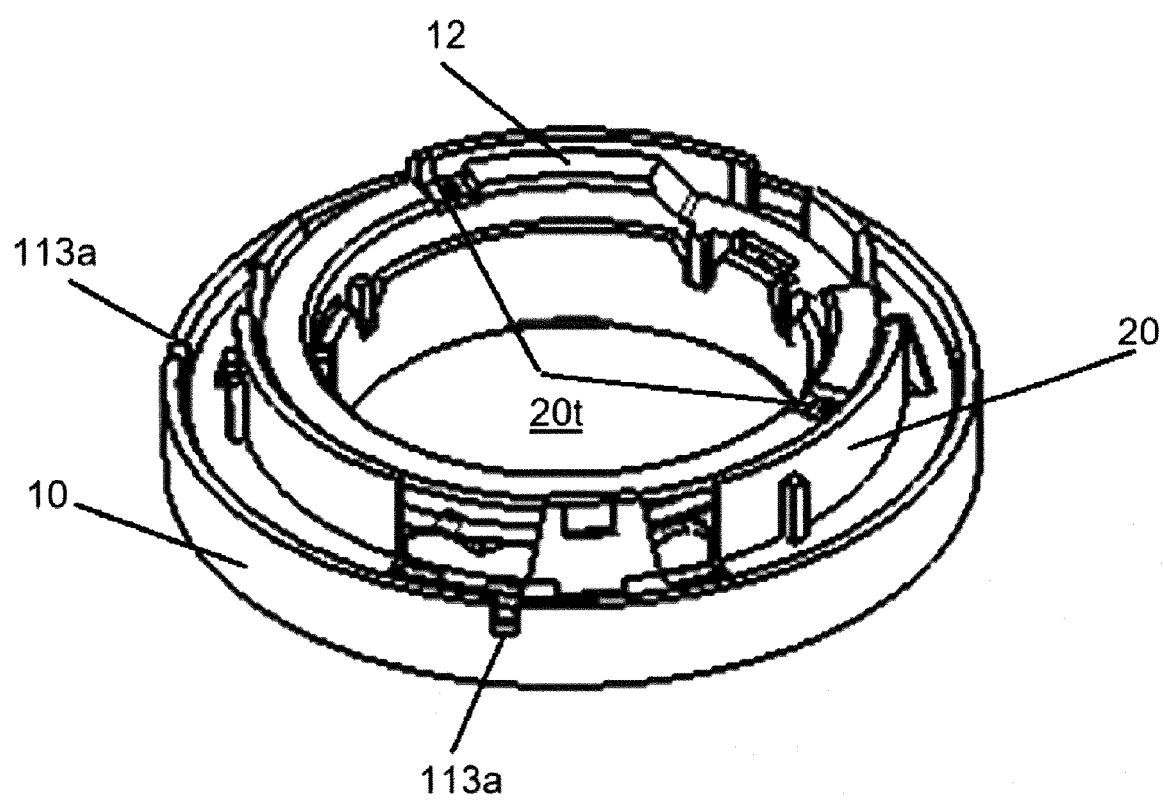


FIG.10

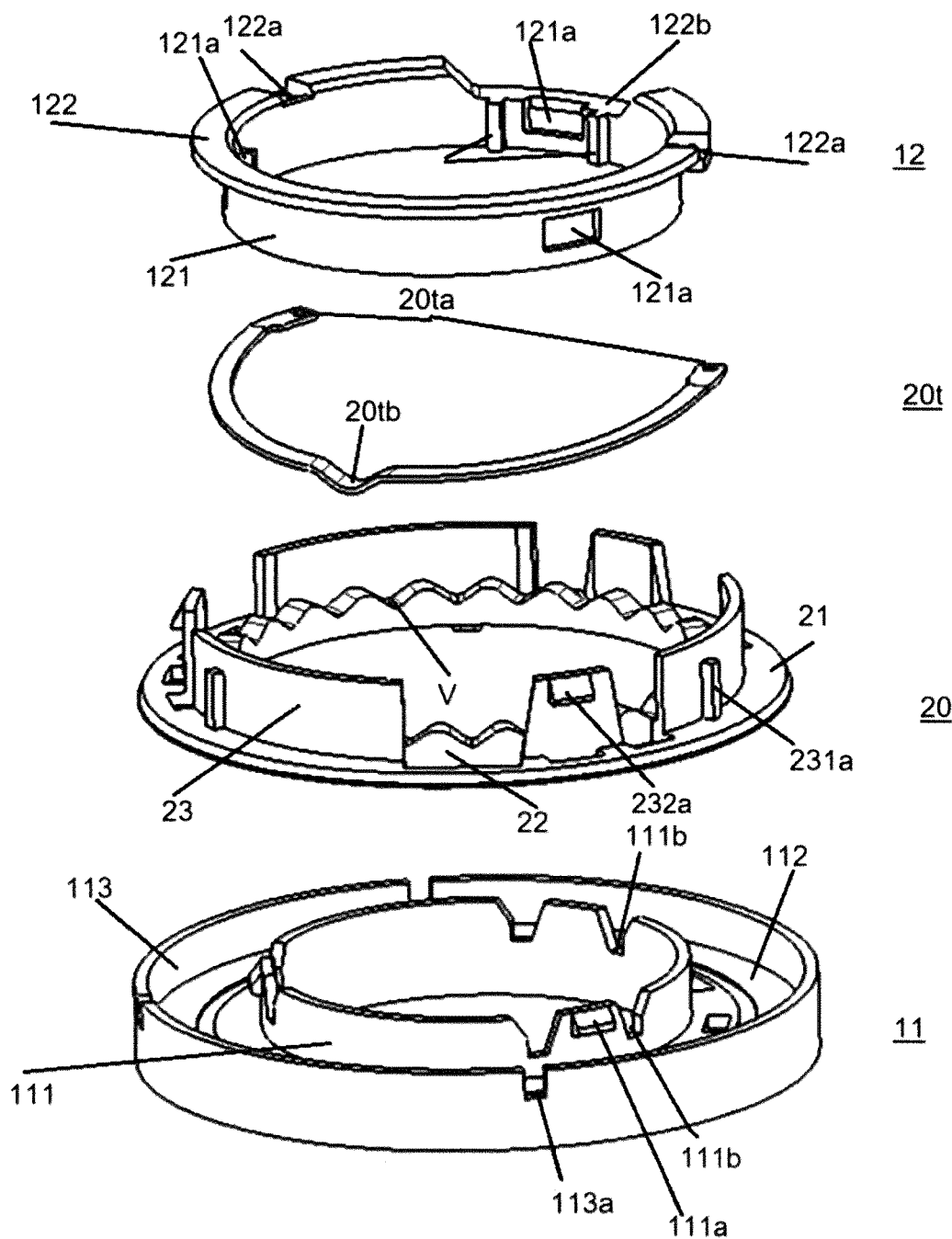


FIG.11

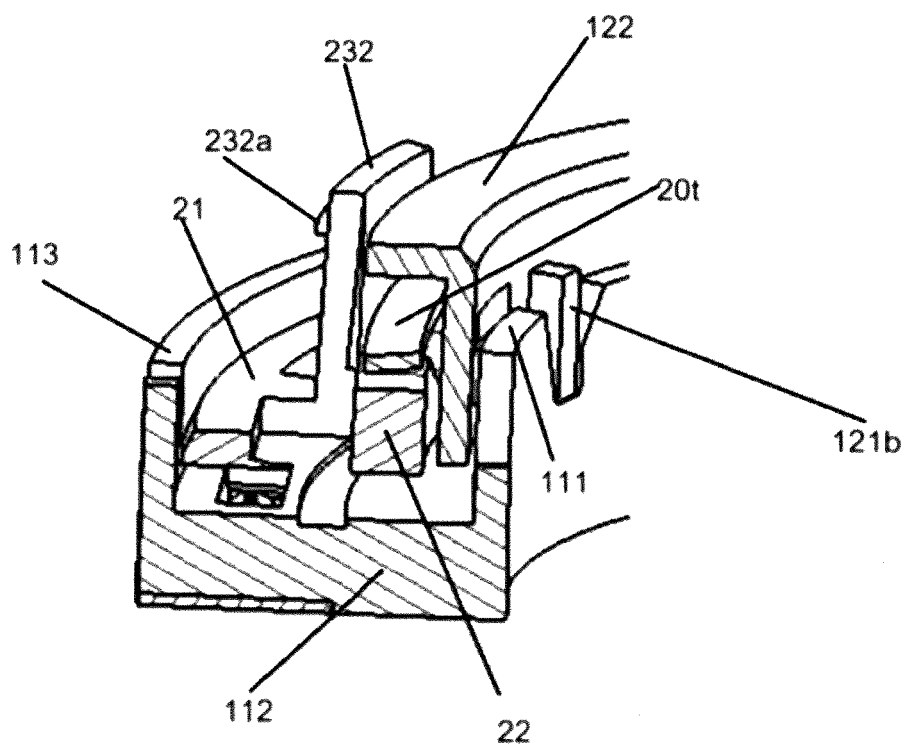


FIG.12

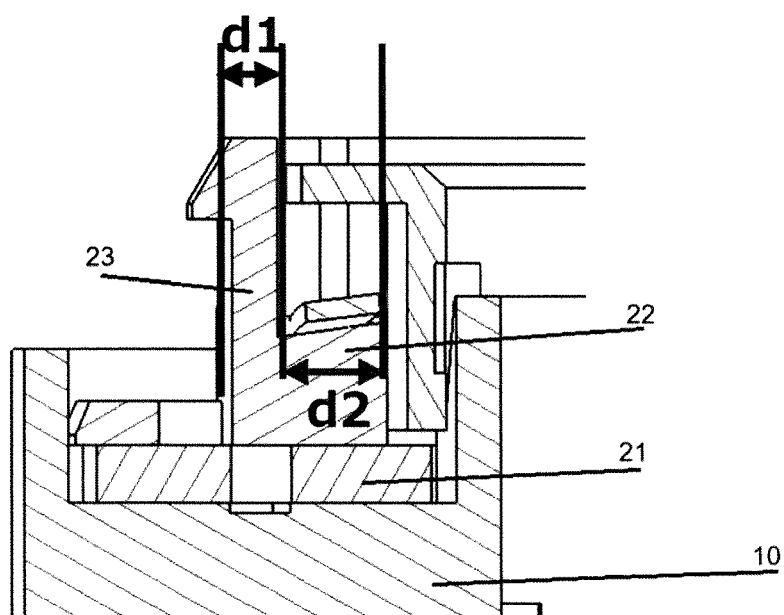


FIG.13

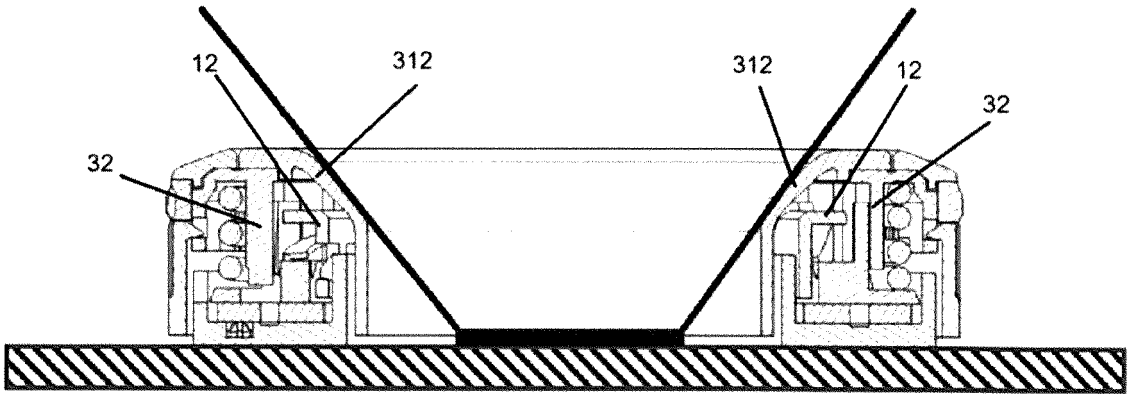
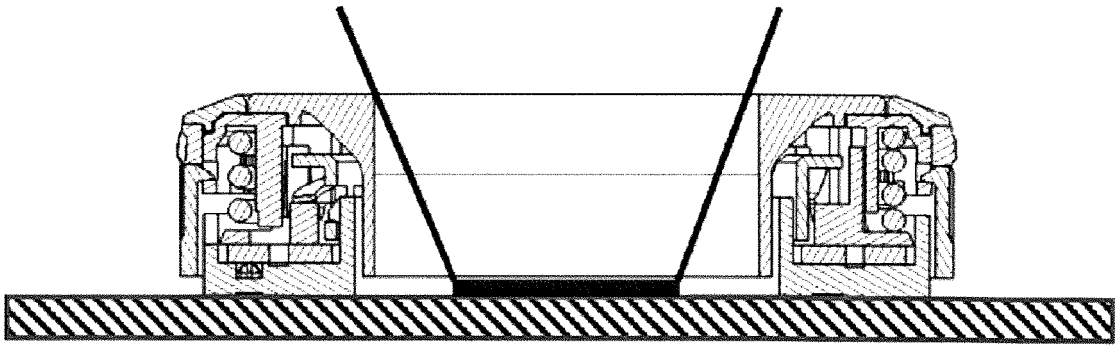


FIG.14





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Application Number

EP 26 16 8131

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Place of search		Date of completion of the search	Examiner
Munich		19 August 2026	Nieto, José Miguel
CATEGORY OF CITED DOCUMENTS			
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T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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