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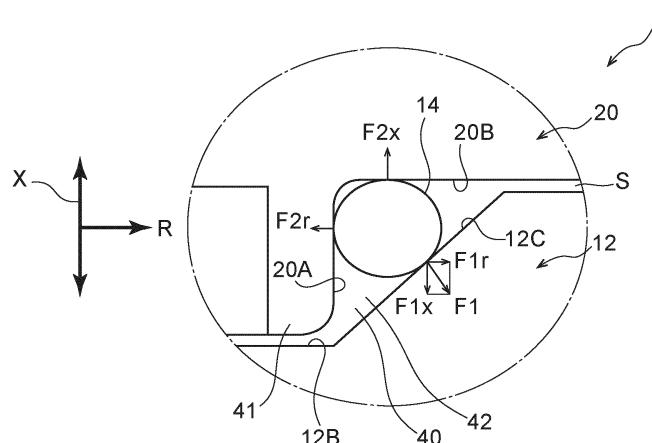
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(54) DRAIN PUMP

(57) A drain pump includes a rotary impeller, a lower cover (cover), a housing that together with the lower cover configures a pump chamber to house the rotary impeller, and that is joined in an axial direction X of the rotary impeller to the lower cover by a snap fitting, a ring-shaped O-ring (seal component), and a seating section that is disposed further out than the pump chamber in a

radial direction R of the rotary impeller, that is configured from the lower cover and the housing, and that seats the O-ring. The seating section includes an inner conical surface, an outer peripheral face, and a lower face (pressing section) that press the O-ring in the axial direction X and the radial direction R.

FIG.3

Description

Technical Field

[0001] The present disclosure relates to a drain pump.

Background Art

[0002] In drain pumps, a structure is disclosed in which a rotary impeller, for sucking up water by being rotated by a motor and externally discharging the water, is housed in a pump chamber, and the pump chamber is configured by a cover and housing being joined together by a snap fitting (see Japanese Patent Application Laid-Open (JP-A) Nos. 2010-275972 and 2013-167234). Waterproofing between the cover and the housing is secured by a seal component (O-ring).

SUMMARY OF INVENTION

Technical Problem

[0003] The snap fitting described above is a structure in which the cover and the housing are engaged in an axial direction of the rotary impeller (pump body). With a structure in which a seal component abutted the cover and the housing only in the radial direction of the housing, then due to there being no reaction force of the seal component acting in the axial direction, relative movement between the cover and the housing in the axial direction is unable to be suppressed by the seal component. In addition thereto, if a gap in the axial direction is present at portions of the snap fitting, then sometimes contact noise is generated from these portions of the snap fitting when vibration has developed due to motor rotation.

[0004] An object of the present disclosure is to suppress the generation of contact noise from portions of the snap fitting in a drain pump.

Solution to Problem

[0005] A drain pump according to a first aspect includes a rotary impeller, a cover, a housing that together with the cover configures a pump chamber to house the rotary impeller, and that is joined in an axial direction of the rotary impeller to the cover by a snap fitting, a ring-shaped seal component, and a seating section that is disposed further out than the pump chamber in a radial direction of the rotary impeller, that is configured from the cover and the housing, and that seats the ring-shaped seal component. The seating section includes a pressing section that presses the seal component in the axial direction and the radial direction.

[0006] In this drain pump, the seal component seals between the cover and the housing, and is seated in the seating section. The seating section includes the pressing section that presses the seal component in the axial

direction and the radial direction of the rotary impeller. Namely, the seal component is sandwiched pressed by the pressing section in the axial direction and the radial direction of the rotary impeller. Relative movement between the cover and the housing is thereby suppressed in the axial direction and the radial direction of the rotary impeller. This means that even if vibration develops due to rotation of a motor, contact noise is suppressed from being generated from these portions of the snap fitting.

[0007] A second aspect is the drain pump according to the first aspect, wherein the pressing section is provided at plural locations in a circumferential direction around a rotation direction of the rotary impeller.

[0008] A third aspect is the drain pump according to the first aspect, wherein the pressing section is provided over all circumferential direction regions around a rotation direction of the rotary impeller.

[0009] In this drain pump, the seal component that seals between the cover and the housing is seated in the seating section. This seating section includes the pressing section that presses the seal component in the axial direction and the radial direction of the rotary impeller at all circumferential direction regions around the rotation direction of the rotary impeller. Namely, the seal component is sandwiched pressed in the axial direction and the radial direction of the rotary impeller by the pressing section at all circumferential direction regions in the seating section. Relative movement between the cover and the housing is thereby suppressed in the axial direction and the radial direction of the rotary impeller. This means that even if vibration develops due to rotation of a motor, contact noise is suppressed from being generated from these portions of the snap fitting.

[0010] A fourth aspect is the drain pump according to any one of the first aspect to the third aspect, wherein at least one of a portion of the cover configuring the pressing section or a portion of the housing configuring the pressing section includes a conical surface.

[0011] In this drain pump, the seal component can be pressed by the conical surface in the axial direction and the radial direction of the rotary impeller.

[0012] A fifth aspect is the drain pump according to the fourth aspect, wherein the portion of the cover configuring the pressing section includes an outer peripheral face along the axial direction, and a lower face intersecting with the axial direction, the portion of the housing configuring the pressing section includes an inner conical surface that faces the outer peripheral face and the lower face, and the seal component is abutted against the outer peripheral face, the lower face, and the inner conical surface.

[0013] In this drain pump, the seal component is abutted against the outer peripheral face and the lower face of the cover, and the inner conical surface of the housing, and relative movement between the cover and the housing is thereby suppressed in the axial direction and the radial direction of the motor. This means that even if vibration develops due to motor rotation, contact

noise is suppressed from being generated from these portions of the snap fitting.

[0014] A sixth aspect is the drain pump according to the fourth aspect, wherein the portion of the housing configuring the pressing section includes an inner peripheral face along the axial direction and an upper face intersecting with the axial direction, the portion of the cover configuring the pressing section includes an outer conical surface that faces the inner peripheral face and the upper face, and the seal component is abutted against the inner peripheral face, the upper face, and the outer conical surface.

[0015] In this drain pump, the seal component is abutted against the inner peripheral face and the upper face of the housing and the outer conical surface of the cover, and relative movement between the cover and the housing is thereby suppressed in the axial direction and the radial direction of the motor. This means that even if vibration develops due to motor rotation, contact noise is suppressed from being generated from these portions of the snap fitting.

[0016] A seventh aspect is the drain pump according to any one of the first aspect to the third aspect, wherein the portion of the cover configuring the pressing section includes an outer peripheral face along the axial direction, and a lower face intersecting with the axial direction, the portion of the housing configuring the pressing section includes an inner peripheral face along the axial direction and an upper face intersecting with the axial direction, and the seal component is formed with a cross shaped cross-section and is abutted against the outer peripheral face, the lower face, the inner peripheral face, and the upper face.

[0017] In this drain pump, the seal component is formed with a cross shaped cross-section and is abutted against the outer peripheral face and the lower face of the cover and the inner peripheral face and the upper face of the housing, and relative movement between the cover and the housing is thereby suppressed in the axial direction and the radial direction of the motor. This means that even if vibration develops due to motor rotation, contact noise is suppressed from being generated from these portions of the snap fitting.

[0018] An eighth aspect is the drain pump according to any one of the first aspect to the third aspect, wherein the portion of the cover configuring the pressing section includes an outer peripheral face along the axial direction, and a lower face intersecting with the axial direction, the portion of the housing configuring the pressing section includes an inner peripheral face having an axial direction dimension smaller than the outer peripheral face along the axial direction, and an upper face intersecting with the axial direction, the seal component is abutted against the outer peripheral face, the lower face, the inner peripheral face, and the upper face, and a space to accommodate deformation of the seal component due to thermal expansion is provided between the cover and the housing.

[0019] In this drain pump, the seal component is abutted against the outer peripheral face and the lower face of the cover and the inner peripheral face and the upper face of the housing, and relative movement between the cover and the housing is thereby suppressed in the axial direction and the radial direction of the motor. This means that even if vibration develops due to motor rotation, contact noise is suppressed from being generated from these portions of the snap fitting. Moreover, due to the space being provided between the cover and the housing, deformation of the seal component due to thermal expansion can be accommodated.

Advantageous Effects

[0020] The present disclosure enables contact noise to be suppressed from being generated by portions of a snap fitting in a drain pump.

BRIEF DESCRIPTION OF DRAWINGS

[0021]

Fig. 1 is a front view illustrating a drain pump according to a first exemplary embodiment.

Fig. 2 is an exploded front view illustrating a drain pump according to the first exemplary embodiment.

Fig. 3 is an enlarged cross-section illustrating an attached state of an O-ring according to the first exemplary embodiment.

Fig. 4 is an enlarged cross-section illustrating an attached state of an O-ring according to a second exemplary embodiment.

Fig. 5 is an enlarged cross-section illustrating an attached state of an O-ring according to a third exemplary embodiment.

Fig. 6 is an enlarged cross-section illustrating an attached state of an O-ring according to a fourth exemplary embodiment.

Fig. 7 is an enlarged cross-section illustrating an attached state of an O-ring according to a fifth exemplary embodiment.

Fig. 8 is an enlarged cross-section illustrating an attached state of an O-ring according to a sixth exemplary embodiment.

DESCRIPTION OF EMBODIMENTS

[0022] Description follows regarding embodiments to implement the present disclosure, based on the drawings. Configuration elements indicated using the same reference numerals across the drawings means that they are the same or similar configuration elements. Note that sometimes duplicate explanation and reference numerals are omitted in the exemplary embodiments described below. Moreover, the drawings employed in the following description are all merely schematic, and dimensional relationships of each element, proportions of each ele-

ment, and the like illustrated in the drawings do not necessarily match actual dimensions and proportions thereof. Moreover, dimensional relationships of each element, proportions of each element, and the like do not necessarily match each other across plural drawings.

[0023] In the drawings, a direction of arrow X indicates an axial direction of a motor 16, described later, and a direction of arrow R indicates a radial direction of the motor 16. In the present exemplary embodiment, the axial direction of the motor 16 is the same direction as an axial direction of a rotary impeller 51, described later, and as an up-down direction of a drain pump 1, and the radial direction of the motor 16 is the same direction as the radial direction of the rotary impeller 51. In the up-down directions, upward is the side of a cover 10, described later, and downward is the side of an intake port 18 of a housing 12, described later.

First Exemplary Embodiment

[0024] In Fig. 1 to Fig. 4, the drain pump 1 according to the present exemplary embodiment is a pump for sucking up drain water remaining in a drain pan and discharging the water outside. This drain pump 1 includes a motor unit 15, and a pump body 50. In the drain pump 1, the pump body 50 is driven by the motor unit 15, and sucks up and discharges the water. In the present exemplary embodiment, the drain pump 1 includes the cover 10. The cover 10 configures part of the motor unit 15, and configures part of the pump body 50. The cover 10 includes an upper cover 30 and a lower cover 20. The upper cover 30 configures part of the motor unit 15. The lower cover 20 configures part of the pump body 50.

[0025] The motor unit 15 includes the motor 16, and the upper cover 30 houses the motor 16.

[0026] The pump body 50 includes the rotary impeller 51, the lower cover 20, the housing 12, an O-ring 14 serving as an example of a seal component, and a seating section 40.

[0027] The lower cover 20 is an example of a cover provide to an opening at an upper end of the housing 12. The lower cover 20 is, for example, a member manufactured from a synthetic resin with a bottomed cylinder shape attached to an upper portion (upper opening) of the housing 12 with the O-ring 14 interposed therebetween. A bottom portion of the lower cover 20 configures an upper face of a pump chamber. Engaged portions 22B are provided to the lower cover 20, and snap fitting arms 22A provided to the housing 12 engage therewith. The lower cover 20 is attached to the housing 12 so as to be detachable therefrom by a snap fitting function using resilient force of the snap fitting arms 22A.

[0028] The motor 16 configured from a stator, a rotor, and the like is installed to an upper portion of the lower cover 20. A lead-wire pull-out section 24 for leading lead-wires out from the motor 16 is exposed at the outside. A drive shaft of the motor 16 is coupled to a rotation shaft of the rotary impeller 51 disposed inside a pump chamber

21. A hole is formed in a bottom portion of the lower cover 20 for placement of a transmission member for transmitting rotation of the motor 16 to the rotary impeller 51 therein.

[0029] The upper cover (also referred to as a motor cover) 30, which is made from a synthetic resin in a short cylinder shape with a lid covering an upper side of the motor 16, is attached to an upper portion (upper opening) of the lower cover 20. The upper cover 30 is attached to the lower cover 20 so as to be detachable therefrom by a snap fitting function using resilient force of snap fitting arms 26 provided to the upper cover 30. Plural attachment portions 28 are provided to the upper cover 30 for installing the drain pump 1 at attachment locations.

[0030] The housing 12 is a member configuring the pump chamber and is, for example, made from a synthetic resin and joined to the lower cover 20 in the axial direction X of the motor 16 by a snap fitting 22. The rotary impeller 51 is seated in the housing 12. The rotary impeller 51 is driven by the motor 16 and by rotating sucks up water and externally discharges the water. The housing 12 is formed with a pipe shaped intake port 18 provided to a lower portion of the pump chamber, and a pipe shaped discharge port 19 extending sideways from the pump chamber.

[0031] The snap fitting arms 22A are provided at plural locations in the circumferential direction of an upper edge portion of the housing 12. The snap fitting arms 22A each include resiliently displaceable claws so as to be able to engage with the engaged portions 22B of the lower cover 20 and to be capable of releasing the engagement therewith. The snap fitting 22 is configured by the snap fitting arms 22A and the engaged portions 22B of the lower cover 20.

[0032] In Fig. 3, the O-ring 14 is a member that is sandwiched respectively pressed by both the lower cover 20 and the housing 12 in the axial direction X and the radial direction R of the motor 16, and that seals between the lower cover 20 and the housing 12.

[0033] The housing 12 and the lower cover 20 configured as described above have an spigot structure. As the spigot structure, the lower cover 20 includes a circular cylinder portion 41 at, for example, the peripheral outside of a lower face 20B. An outer peripheral portion of the housing 12 is configured such that the circular cylinder portion 41 can be placed therein in a state in which the lower cover 20 has been attached to the housing 12 to configure the pump chamber 21. The housing 12 includes, for example, a recessed portion 42 serving as a structure enabling placement of the circular cylinder portion 41 therein.

[0034] The seating section 40 is configured by the housing 12 and the lower cover 20 at the outside of the pump chamber 21 in the radial direction of the rotary impeller 51, and is a site for seating the O-ring 14. The seating section 40 is, for example, provided to an spigot section that is a site provided with an spigot structure. The seating section 40 includes, for example, the circular

cylinder portion 41 and periphery thereof provided to one of the lower face 20B of the lower cover 20 or an upper face 12B of the housing 12, and the ring-shaped recessed portion 42 provided to the other thereof and seating part or all of the circular cylinder portion 41. In the present exemplary embodiment, as an example, the circular cylinder portion 41 is formed to the lower face 20B of the lower cover 20, and the recessed portion 42 is formed to the upper face 12B of the housing 12. In the present exemplary embodiment, the recessed portion 42 may be configured by an upper edge portion of the housing 12 and a space at the inside thereof. In a state in which the lower cover 20 is assembled to the housing 12, the circular cylinder portion 41 of the lower cover 20 is placed at the inside of the upper edge portion serving as the recessed portion 42 of the housing 12. The upper face 12B of the housing 12 is a face facing the lower cover 20 in the axial direction X of the motor 16.

[0035] The seating section 40 includes, for example, pressing sections that press the O-ring 14 in both the axial direction X and the radial direction R at least at 3 locations in a circumferential direction along a rotation direction of the rotary impeller 51. The seating section 40 presses the O-ring 14 in the radial direction R between each two circumferential direction adjacent pressing sections from out of the pressing sections at the at least three locations. Namely, the seating section 40 presses the O-ring 14 in the radial direction R over all circumferential direction regions around the rotation direction of the rotary impeller 51. By the seating section 40 pressing the O-ring 14 in the radial direction R over all circumferential direction regions around the rotation direction of the rotary impeller 51 in this manner, waterproofing is performed by the O-ring 14 between the housing 12 and the lower cover 20. The seating section 40 presses the O-ring 14 in the axial direction X at least at three locations in the circumferential direction. Moreover, the seating section 40 may be configured as a pressing section over all circumferential direction regions around the rotation direction of the rotary impeller 51. In the present exemplary embodiment, the seating section 40 is configured as a pressing section over all circumferential direction regions around the rotation direction of the rotary impeller 51.

[0036] A portion of the lower cover 20 configuring the seating section 40 includes, as an example of a pressing section, an outer peripheral face 20A of the circular cylinder portion 41 and a lower face 20B intersecting with the axial direction X. The outer peripheral face 20A is, for example, a face along the axial direction X. The outer peripheral face 20A is, for example, parallel to the axial direction X. As an example, the outer peripheral face 20A and the lower face 20B are orthogonal. The lower face 20B of the lower cover 20 is a face facing the housing 12 along the axial direction X of the motor 16.

[0037] A portion configuring the seating section 40 of the housing 12 includes, as an example of a pressing section, an inner conical surface 12C facing the outer peripheral face 20A and the lower face 20B of the lower

cover 20. The inner conical surface 12C is an inner peripheral face of the recessed portion 42, and is contiguous for one cycle in the circumferential direction around the rotation direction of the rotary impeller 51. The inner conical surface 12C configures part of the recessed portion 42.

[0038] The O-ring 14 is abutted against the outer peripheral face 20A and the lower face 20B of the lower cover 20, and against the inner conical surface 12C of the housing 12. A reaction force F1 from the O-ring 14 acts on the inner conical surface 12C of the housing 12. The reaction force F1 can be analyzed as being a component force F1x in the axial direction X, and a component force F1r in the radial direction R. Namely, a reaction force from the O-ring 14 acts on the housing 12 in both the axial direction X and the radial direction R.

[0039] A reaction force F2r in the radial direction R from the O-ring 14 acts on the outer peripheral face 20A of the lower cover 20. A reaction force F2x in the axial direction X from the O-ring 14 acts on the lower face 20B of the lower cover 20. Namely, a reaction force from the O-ring 14 acts on the lower cover 20 in both the axial direction X and the radial direction R.

[0040] The O-ring 14 is thereby sandwiched respectively pressed by the lower cover 20 and the housing 12 in both the axial direction X and the radial direction R.

[0041] In the axial direction X, a gap S is formed between the lower cover 20 and the housing 12. Due to the gap S being formed to this portion, a gap in the axial direction X is reduced between the snap fitting arms 22A and the engaged portions 22B in the snap fitting 22 (see Fig. 1).

Operation

[0042] The present exemplary embodiment is configured as described above, and description follows regarding the operation thereof. In the drain pump 1 according to the present exemplary embodiment illustrated in Fig. 3, the O-ring 14 sealing between the lower cover 20 and the housing 12 is seated in the seating section 40. The seating section 40 is configured as a pressing section that presses the O-ring 14 in the axial direction X and the radial direction R of the rotary impeller 51 over all circumferential direction regions around the rotation direction of the rotary impeller 51. Namely, the O-ring 14 is sandwiched respectively pressed by the lower cover 20 and the housing 12 in the axial direction X and the radial direction R over all circumferential direction regions in the seating section 40. Specifically, the O-ring 14 is abutted against the outer peripheral face 20A and the lower face 20B of the lower cover 20 and the inner conical surface 12C of the housing 12. Moreover, a gap in the axial direction X between the snap fitting arms 22A and the engaged portions 22B of the snap fitting 22, namely play therebetween, is suppressed. Relative movement between the lower cover 20 and the housing 12 is accordingly suppressed in the axial direction X and the radial

diment, a seating section 40 is configured as a pressing section over all circumferential direction regions around the rotation direction of the rotary impeller 51, and presses the O-ring 14 in the axial direction X and the radial direction R over all circumferential direction regions.

[0058] In the drain pump 4 according to the present exemplary embodiment illustrated in Fig. 6, the lower cover 20 includes, as an example of a pressing section, an outer peripheral face 20A of a circular cylinder portion 41, and a lower face 20B intersecting with the axial direction X. The outer peripheral face 20A is, for example, along the axial direction X. The outer peripheral face 20A is, for example, parallel to the axial direction X. The outer peripheral face 20A and the lower face 20B are, for example, orthogonal. The housing 12 includes, as an example of a pressing section, an inner peripheral face 12A of a recessed portion 42 and an upper face 12B intersecting with the axial direction X. The inner peripheral face 12A is, for example, along the axial direction X. The inner peripheral face 12A is, for example parallel to the axial direction X. The inner peripheral face 12A and the upper face 12B are, for example, orthogonal.

[0059] The O-ring 14 is formed with a cross shape in cross-section and is abutted against the outer peripheral face 20A, the lower face 20B, the inner peripheral face 12A, and the upper face 12B. A reaction force $F1r$ in the radial direction R from the O-ring 14 acts on the inner peripheral face 12A of the housing 12. A reaction force $F1x$ in the axial direction X from the O-ring 14 acts on the upper face 12B of the housing 12. Namely, a reaction force from the O-ring 14 acts on the lower cover 20 in both the axial direction X and the radial direction R.

[0060] Moreover, a reaction force $F2r$ in the radial direction R from the O-ring 14 acts on the outer peripheral face 20A of the lower cover 20. A reaction force $F2x$ in the axial direction X from the O-ring 14 acts on the lower face 20B of the lower cover 20. Namely, a reaction force from the O-ring 14 acts on the lower cover 20 in both the axial direction X and the radial direction R. In this manner, the O-ring 14 is sandwiched respectively pressed by the lower cover 20 and the housing 12 in the axial direction X and the radial direction R.

[0061] In the present exemplary embodiment, the O-ring 14 formed with a cross shaped cross-section is abutted against the outer peripheral face 20A and the lower face 20B of the lower cover 20 and against the inner peripheral face 12A and the upper face 12B of the housing 12, and relative movement between the lower cover 20 and the housing 12 is accordingly suppressed in both the axial direction X and the radial direction R. This means that even if vibration develops due to rotation of the motor 16, contact noise is suppressed from being generated from these portions of the snap fitting 22.

Fifth Exemplary Embodiment

[0062] Fig. 7 illustrates a fifth exemplary embodiment

of a drain pump 2. In the present exemplary embodiment, the seating section 40 is configured as a pressing section over all circumferential direction regions around the rotation direction of the rotary impeller 51, and presses the O-ring 14 in the axial direction X and the radial direction R over all circumferential direction regions.

[0063] In the drain pump 5 according to the present exemplary embodiment illustrated in Fig. 7, the lower cover 20 includes, as an example of a pressing section, an outer peripheral face 20A of a circular cylinder portion 41, and a lower face 20B intersecting with the axial direction X. The outer peripheral face 20A is, for example, a face along the axial direction X. The outer peripheral face 20A is, for example, parallel to the axial direction X. The outer peripheral face 20A and the lower face 20B are, for example, orthogonal. The housing 12 includes, as an example of a pressing section, an inner peripheral face 12A having an axial direction X dimension smaller than the outer peripheral face 20A along the axial direction X, and an upper face 12B intersecting with the axial direction X. In the present exemplary embodiment, the upper face 12B is formed as conical surface gradually lower toward the inside in the radial direction R. Note that the upper face 12B is not limited to being a conical surface. As another example, it may be a face orthogonal to the axial direction X.

[0064] The O-ring 14 is respectively abutted against the outer peripheral face 20A and the lower face 20B of the lower cover 20 and against the inner peripheral face 12A and the upper face 12B of the housing 12.

[0065] A reaction force $F1r$ in the radial direction R from the O-ring 14 acts on the inner peripheral face 12A of the housing 12. A reaction force $F1x$ in the axial direction X from the O-ring 14 acts on the upper face 12B of the housing 12. Namely, a reaction force from the O-ring 14 acts on the lower cover 20 in both the axial direction X and the radial direction R. Note that when the upper face 12B is a conical surface, not only the reaction force $F1x$ in the axial direction X, but a reaction force in the radial direction R also acts on the upper face 12B (not illustrated in the drawings).

[0066] Moreover, a reaction force $F2r$ in the radial direction R from the O-ring 14 acts on the outer peripheral face 20A of the lower cover 20. A reaction force $F2x$ in the axial direction X from the O-ring 14 acts on the lower face 20B of the lower cover 20. Namely, a reaction force from the O-ring 14 acts on the lower cover 20 in both the axial direction X and the radial direction R. In this manner, the O-ring 14 is sandwiched respectively pressed by the lower cover 20 and the housing 12 in the axial direction X and the radial direction R.

[0067] A space 32 accommodating deformation of the O-ring 14 is provided between the lower cover 20 and the housing 12.

[0068] In the present exemplary embodiment, the O-ring 14 is abutted against the outer peripheral face 20A and the lower face 20B of the lower cover 20 and against the inner peripheral face 12A and the upper face 12B of

the housing 12, and relative movement between the lower cover 20 and the housing 12 is accordingly suppressed in both the axial direction X and the radial direction R. This means that even if vibration develops due to rotation of the motor 16, contact noise is suppressed from being generated from these portions of the snap fitting 22. Moreover, deformation of the O-ring 14 due to expansion can be accommodated by the space 32 provided between the lower cover 20 and the housing 12. Expansion of the O-ring 14 includes thermal expansion and fluid-induced swelling. Sometimes thermal expansion or fluid-induced swelling occurs depending on the material of the O-ring 14.

[0069] Other portions are similar to the first exemplary embodiment and so explanation thereof will be omitted.

Sixth Exemplary Embodiment

[0070] Fig. 8 illustrates a sixth exemplary embodiment of a drain pump 2. In the first exemplary embodiment to the fifth exemplary embodiment described above, the housing 12 and the lower cover 20 have an spigot structure, with the circular cylinder portion 41 formed to the lower cover 20 and the recessed portion 42 for placement of the circular cylinder portion 41 formed to the housing 12. However, such an spigot structure is not limited to a structure in which the circular cylinder portion 41 is formed to the lower cover 20 and the recessed portion 42 is formed to the housing 12. As another example, an spigot structure may be adopted in which a circular cylinder portion 41 is formed to the housing 12, and a profile (recessed portion 42) for placement of the circular cylinder portion 41 is formed to the lower cover 20. Such an example will be described in the present exemplary embodiment.

[0071] In the drain pump 6 according to the present exemplary embodiment illustrated in Fig. 8, a circular cylinder portion 41 is formed to an upper face 12B of a housing 12, and a recessed portion 42 is formed to a lower face 20B of a lower cover 20. In the present exemplary embodiment, a seating section 40 is configured as a pressing section over all circumferential direction regions around the rotation direction of the rotary impeller 51, and presses the O-ring 14 in the axial direction X and the radial direction R over all circumferential direction regions.

[0072] The portion where the seating section 40 of the housing 12 is configured includes, as an example of a pressing section, an outer peripheral face 12D of the circular cylinder portion 41, and the upper face 12B intersecting with the axial direction X. The outer peripheral face 12D is, for example, along the axial direction X. The outer peripheral face 12D is, for example, parallel to the axial direction X. The outer peripheral face 12D and the upper face 12B are, for example, orthogonal. Moreover, the portion of the lower cover 20 configuring the seating section 40 includes, as an example of a pressing section, an inner conical surface 20D facing the outer

peripheral face 12D and the upper face 12B of the housing 12. The inner conical surface 20D is an inner peripheral face of a recessed portion 42.

[0073] The O-ring 14 is abutted against the outer peripheral face 12D and the upper face 12B of the housing 12, and the inner conical surface 20D of the lower cover 20. A reaction force F2 from the O-ring 14 acts on the inner conical surface 20D of the lower cover 20. The reaction force F2 can be analyzed as being a component force F2x in the axial direction X, and a component force F2r in the radial direction R. Namely, a reaction force from the O-ring 14 acts on the lower cover 20 in both the axial direction X and the radial direction R.

[0074] Moreover, a reaction force F1r in the radial direction R from the O-ring 14 acts on the outer peripheral face 12D of the housing 12. A reaction force F1x in the axial direction X from the O-ring 14 acts on the upper face 12B of the housing 12. Namely, a reaction force from the O-ring 14 acts on the housing 12 in both the axial direction X and the radial direction R.

[0075] The O-ring 14 is accordingly sandwiched respectively pressed by the housing 12 and the lower cover 20 in the axial direction X and the radial direction R.

[0076] In the present exemplary embodiment, similarly to in the first exemplary embodiment, relative movement between the lower cover 20 and the housing 12 is suppressed in both the axial direction X and the radial direction R. This means that even if vibration develops due to rotation of the motor 16, contact noise is suppressed from being generated from these portions of the snap fitting 22.

[0077] Other portions are similar to the first exemplary embodiment and so explanation thereof will be omitted.

Other Exemplary Embodiments

[0078] Although examples of exemplary embodiments of the present disclosure have been described above, the exemplary embodiment of the present disclosure are not limited thereto, and obviously various other modifications may be implemented thereto within a scope not departing from the spirit of the present disclosure.

[0079] In the examples described above, the seating section 40 is configured as a pressing section that presses the O-ring 14 in the axial direction and the radial direction of the rotary impeller 51 over all circumferential direction regions. Namely, the seating section 40 includes the pressing section that presses the O-ring 14 in the axial direction and the radial direction of the rotary impeller 51 over all circumferential direction regions thereof. However, the seating section 40 is not limited to a configuration including the pressing section over all circumferential direction regions around the rotation direction of the rotary impeller 51. As another example, the seating section 40 may be configured including pressing sections that press the O-ring 14 in the axial direction and the radial direction of the rotary impeller 51 at two or more locations (plural locations) in the circumferential direction around the rotation direction of the rotary impeller 51, as

illustrated in Fig. 3, Fig. 4, Fig. 5, Fig. 6, and Fig. 7. The pressing sections provided at plural locations are preferably placed separated from each other in the circumferential direction so as to enable the lower cover 20 to be placed stably with respect to the housing 12. The pressing sections provided at the plural locations are, for example, placed separated from each other equally spaced (equal angle spacings) in the circumferential direction. A configuration may be adopted in which the O-ring 14 is sandwiched in the radial direction R between two circumferential direction adjacent pressing sections by the seating section 40 pressing the O-ring 14 in the radial direction R of the rotary impeller 51.

[0080] In such a configuration in which the seating section 40 is configured including pressing sections at plural locations in the circumferential direction around the rotation direction of the rotary impeller 51 too, the O-ring 14 is sandwiched in the radial direction R over all circumferential direction regions, and so waterproofing is performed by the O-ring 14 between the housing 12 and the lower cover 20.

[0081] In cases in which a configuration is adopted in which there are pressing sections provided at plural locations, respective positions of the plural pressing sections, and the respective sizes (circumferential direction lengths) of the plural pressing sections, are set to positions and sizes that enable the lower cover 20 to be stabilized with respect to the housing 12. The respective sizes (circumferential direction lengths) of the plural pressing sections are not limited to being the same as each other. The respective lengths thereof may also be different.

[0082] In cases in which there is a single pressing section, there is no limitation to the pressing section being formed in a ring shape around the entire seating section 40. The pressing section may, for example, be configured with a C-shape on plan view. In cases in which the number of pressing sections is one, the position and size (circumferential direction length) of the single pressing section is set to a placement and size capable of stabilizing the lower cover 20 with respect to the housing 12.

[0083] The entire content of the disclosure of Japanese Patent Application No. 2022-91050 filed on June 3, 2022 is incorporated by reference in the present specification.

[0084] All publications, patent applications and technical standards mentioned in the present specification are incorporated by reference in the present specification to the same extent as if each individual publication, patent application, or technical standard was specifically and individually indicated to be incorporated by reference.

Claims

1. A drain pump, comprising:

a rotary impeller;
a cover;

a housing that together with the cover configures a pump chamber to house the rotary impeller, and that is joined in an axial direction of the rotary impeller to the cover by a snap fitting;
a ring-shaped seal component; and
a seating section that is disposed further out than the pump chamber in a radial direction of the rotary impeller, that is configured from the cover and the housing, and that seats the ring-shaped seal component,
wherein the seating section includes a pressing section that presses the seal component in the axial direction and the radial direction.

2. The drain pump of claim 1, wherein the pressing section is provided at a plurality of locations in a circumferential direction around a rotation direction of the rotary impeller.

3. The drain pump of claim 1, wherein the pressing section is provided over all circumferential direction regions around a rotation direction of the rotary impeller.

4. The drain pump of any one of claim 1 to claim 3, wherein at least one of a portion of the cover configuring the pressing section or a portion of the housing configuring the pressing section includes a conical surface.

5. The drain pump of claim 4, wherein:

the portion of the cover configuring the pressing section includes an outer peripheral face along the axial direction, and a lower face intersecting with the axial direction;
the portion of the housing configuring the pressing section includes an inner conical surface that faces the outer peripheral face and the lower face; and
the seal component is abutted against the outer peripheral face, the lower face, and the inner conical surface.

6. The drain pump of claim 4, wherein:

the portion of the housing configuring the pressing section includes an inner peripheral face along the axial direction, and an upper face intersecting with the axial direction;
the portion of the cover configuring the pressing section includes an outer conical surface that faces the inner peripheral face and the upper face; and
the seal component is abutted against the inner peripheral face, the upper face, and the outer conical surface.

7. The drain pump of any one of claim 1 to claim 3, wherein:

the portion of the cover configuring the pressing section includes an outer peripheral face along the axial direction, and a lower face intersecting with the axial direction; 5
the portion of the housing configuring the pressing section includes an inner peripheral face along the axial direction and an upper face intersecting with the axial direction; and 10
the seal component is formed with a cross shaped cross-section and is abutted against the outer peripheral face, the lower face, the inner peripheral face, and the upper face. 15

8. The drain pump of any one of claim 1 to claim 3, wherein:

the portion of the cover configuring the pressing section includes an outer peripheral face along the axial direction, and a lower face intersecting with the axial direction; 20
the portion of the housing configuring the pressing section includes an inner peripheral face having an axial direction dimension smaller than the outer peripheral face along the axial direction, and an upper face intersecting with the axial direction; 25
the seal component is abutted against the outer peripheral face, the lower face, the inner peripheral face, and the upper face; and 30
a space to accommodate deformation of the seal component due to expansion is provided between the cover and the housing. 35

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FIG.1

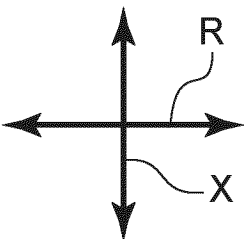
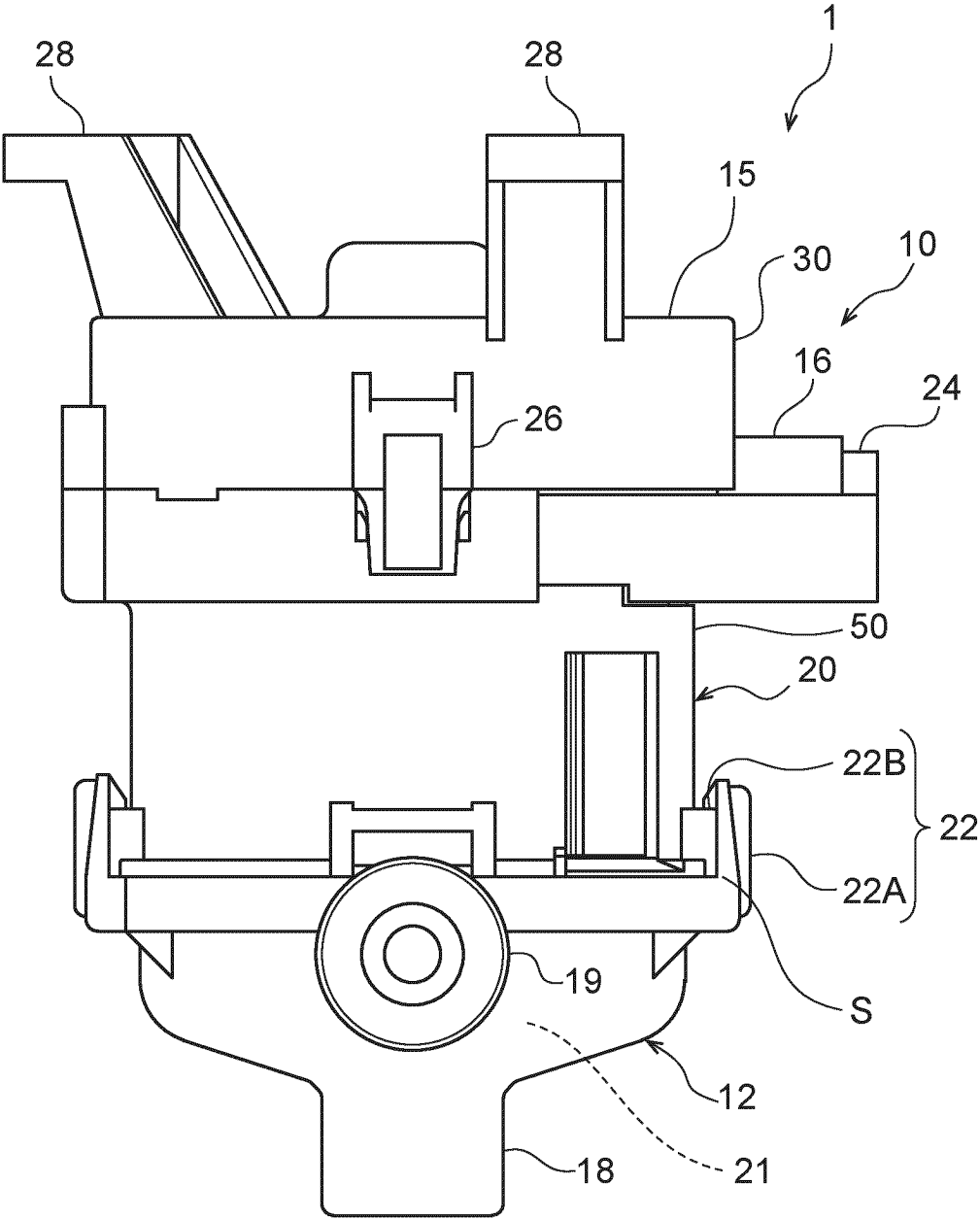


FIG.2

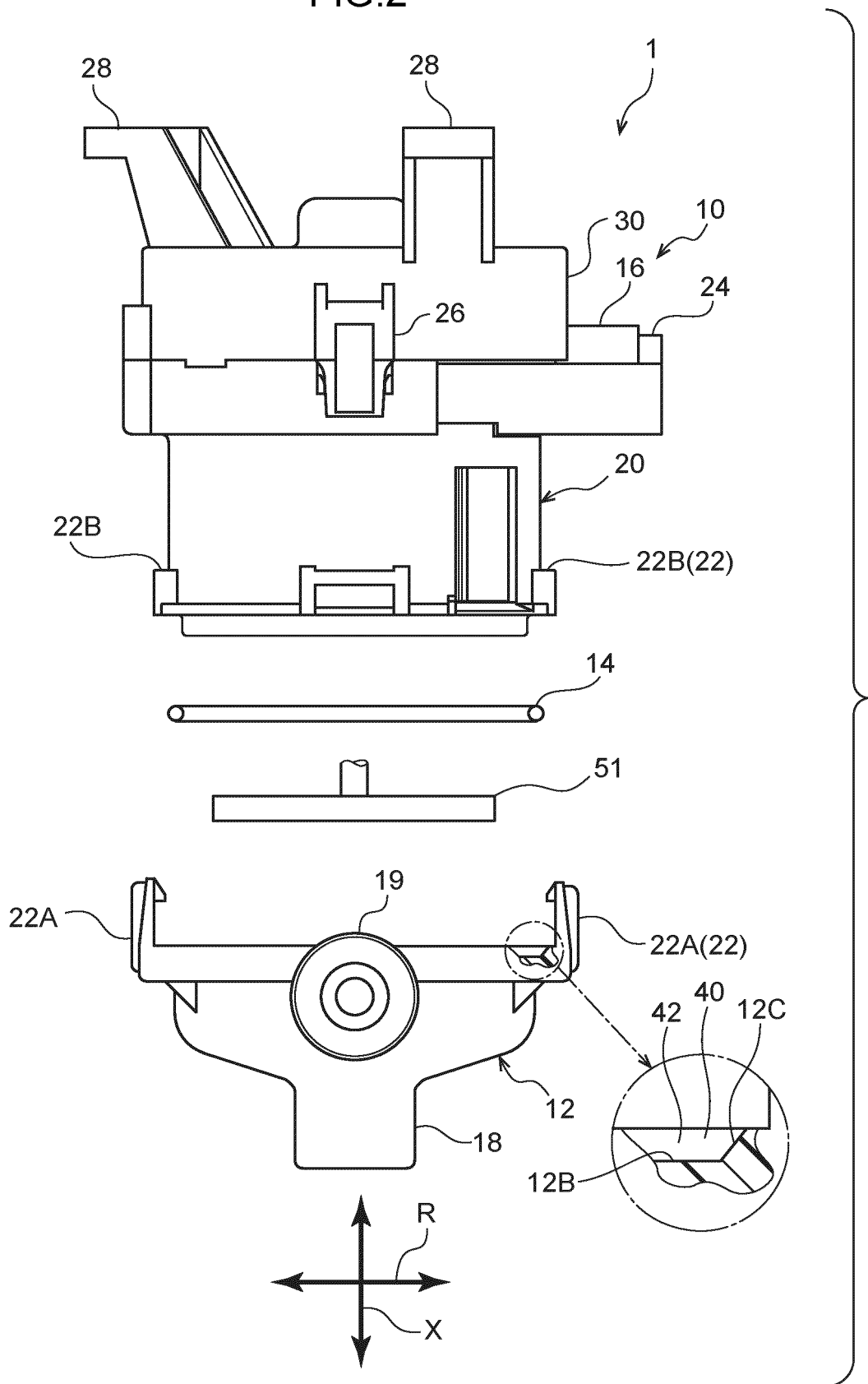


FIG.3

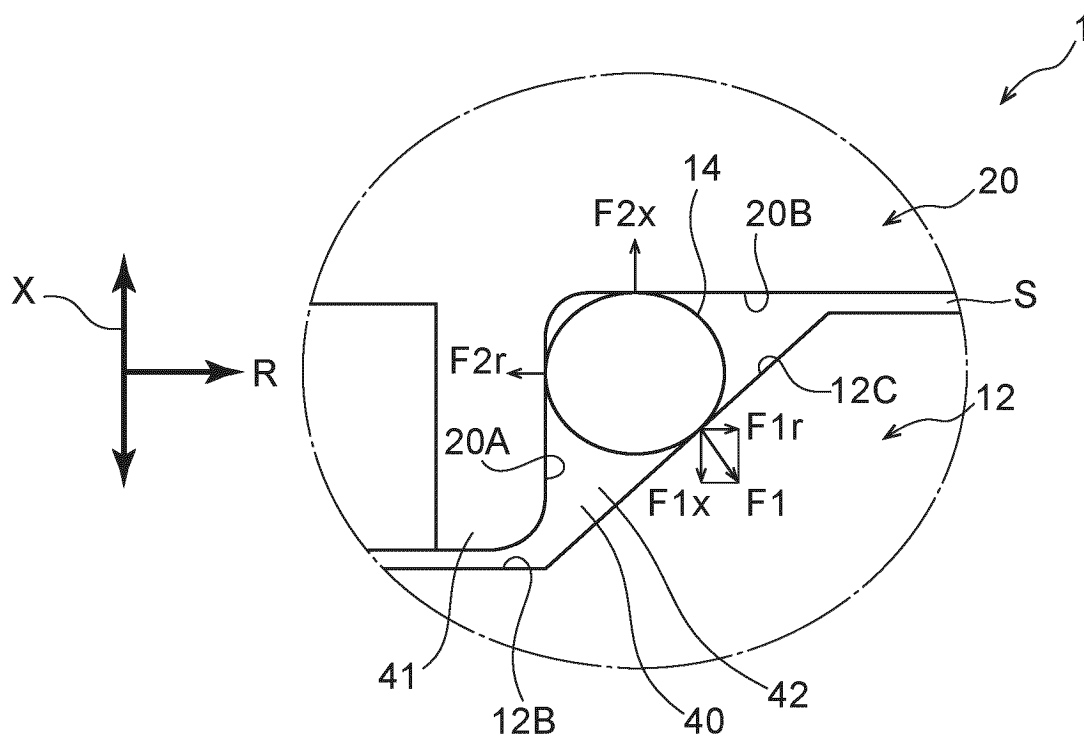


FIG.4

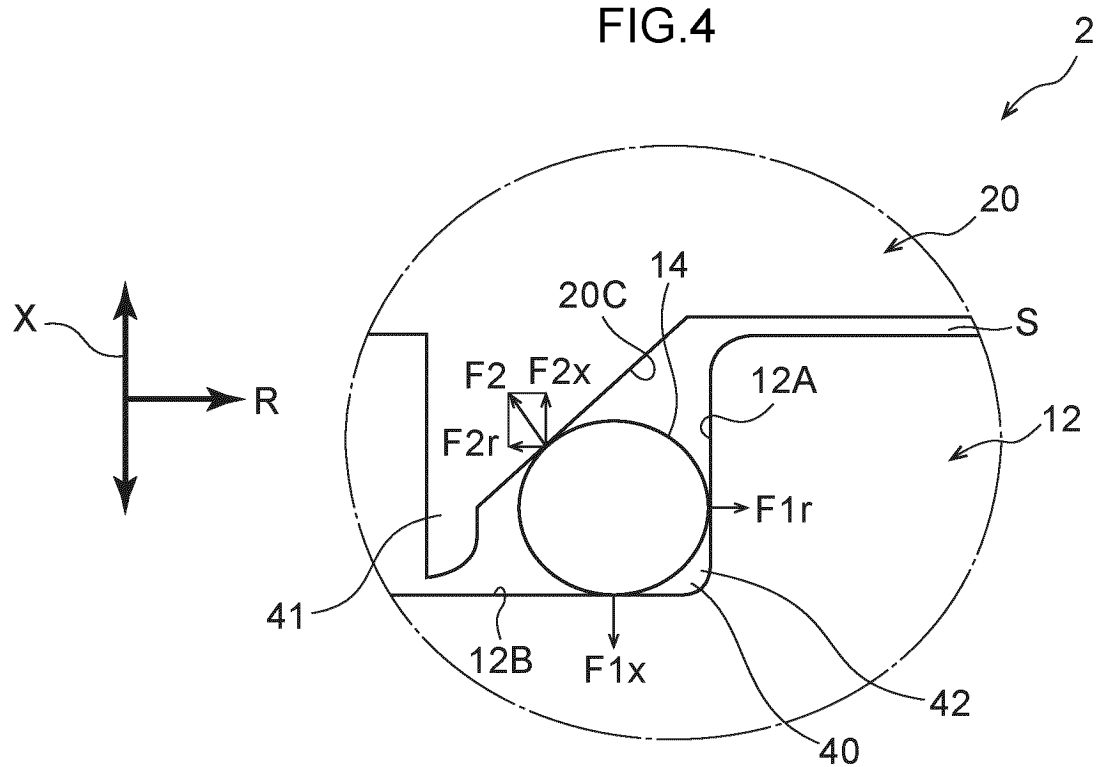


FIG.5

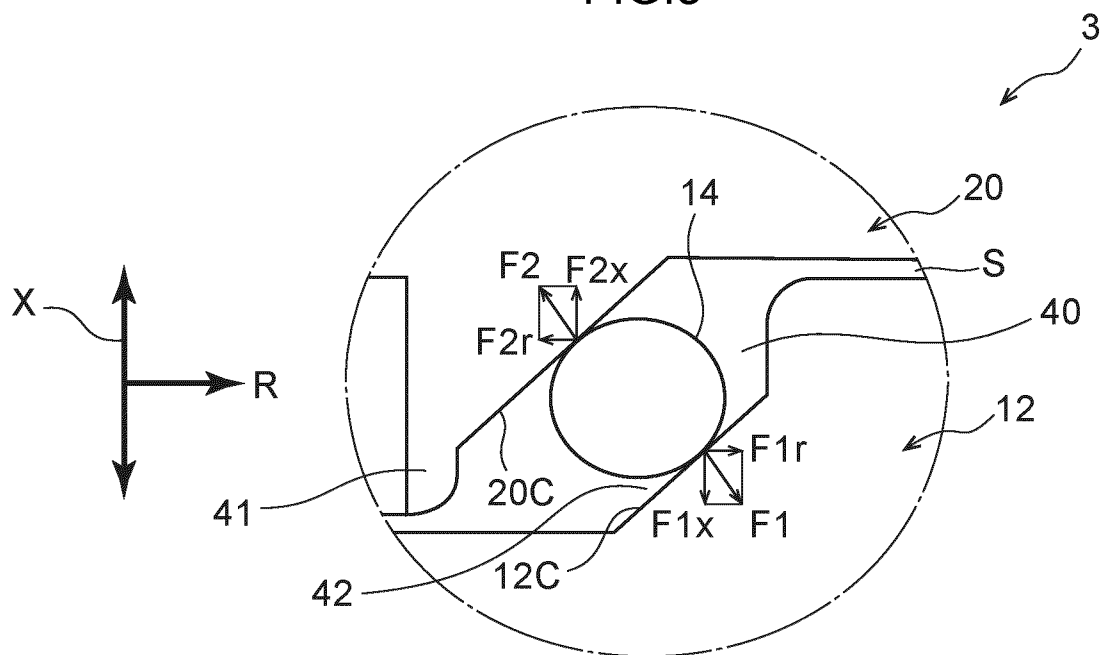


FIG.6

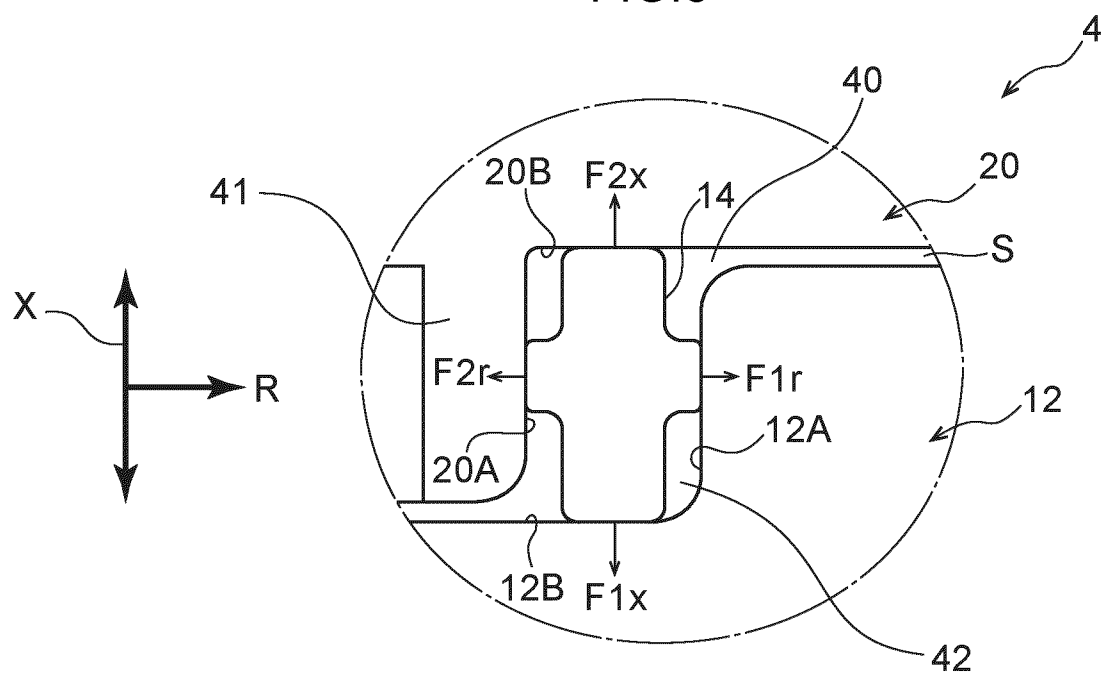


FIG.7

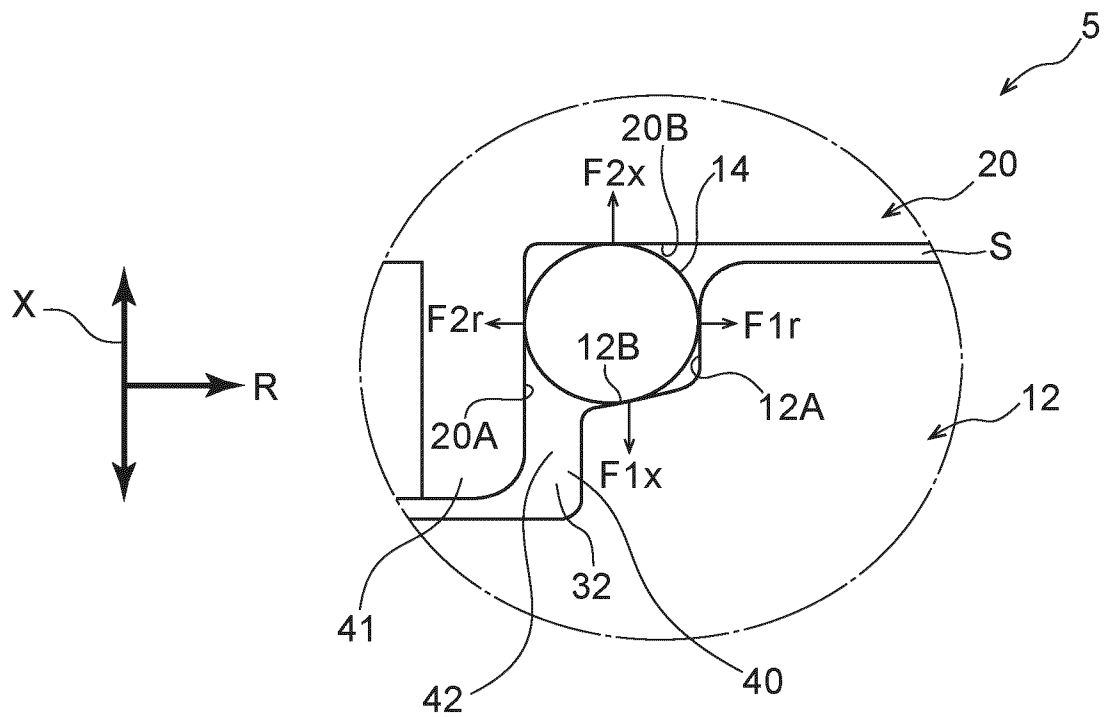
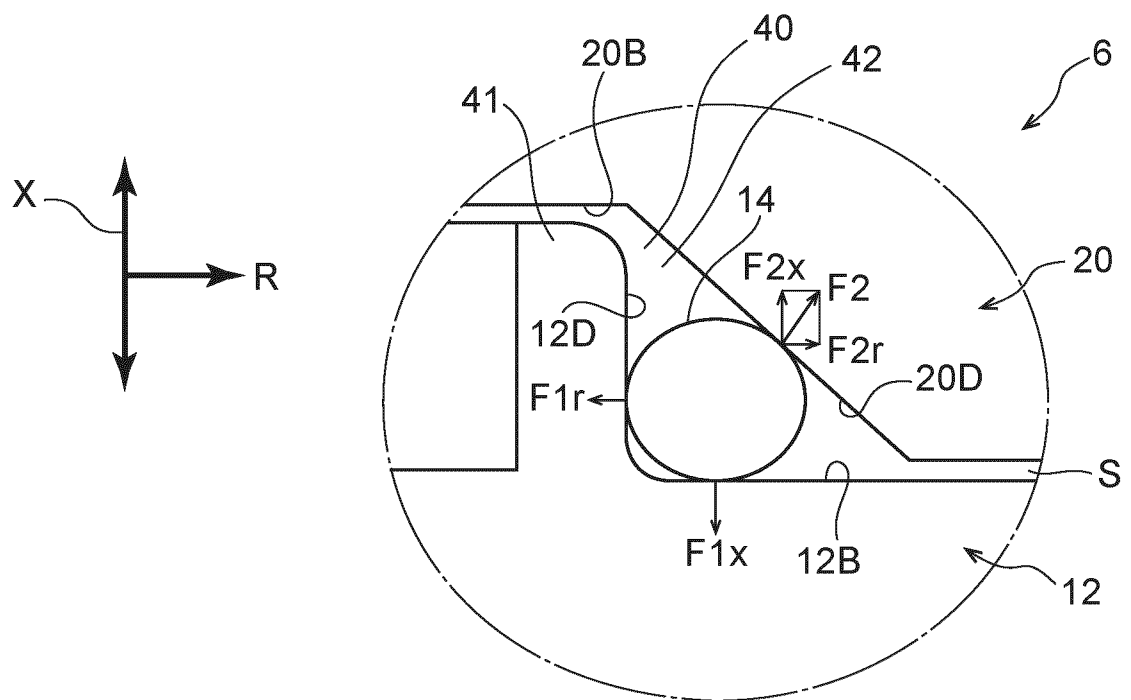


FIG.8



INTERNATIONAL SEARCH REPORT

International application No.

PCT/JP2023/018159

A. CLASSIFICATION OF SUBJECT MATTER

F04D 29/08(2006.01)i; **F04D 29/44**(2006.01)i; **F04D 29/60**(2006.01)i; **F04D 29/66**(2006.01)i
 FI: F04D29/08 B; F04D29/44 E; F04D29/60 E; F04D29/66 A

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

F04D29/08; F04D29/44; F04D29/60; F04D29/66

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

Published examined utility model applications of Japan 1922-1996
 Published unexamined utility model applications of Japan 1971-2023
 Registered utility model specifications of Japan 1996-2023
 Published registered utility model applications of Japan 1994-2023

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

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	JP 2002-21778 A (SAGINOMIYA SEISAKUSHO INC.) 23 January 2002 (2002-01-23) paragraphs [0012]-[0016], fig. 1, 2	1-3
Y		4-8
Y	JP 8-75003 A (KOIDE KINZOKU KOGYO KK) 19 March 1996 (1996-03-19) fig. 2, 4, 5	4-8
Y	JP 2013-170603 A (YAMAHA MOTOR CO., LTD.) 02 September 2013 (2013-09-02) fig. 2-4	4-8
Y	WO 2010/128606 A1 (NOK CORP.) 11 November 2010 (2010-11-11) fig. 11	4-8

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

* Special categories of cited documents:

“A” document defining the general state of the art which is not considered to be of particular relevance

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“O” document referring to an oral disclosure, use, exhibition or other means

“P” document published prior to the international filing date but later than the priority date claimed

“T” later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

“X” document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

“Y” document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

“&” document member of the same patent family

Date of the actual completion of the international search

27 June 2023

Date of mailing of the international search report

11 July 2023

Name and mailing address of the ISA/JP

Japan Patent Office (ISA/JP)
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Authorized officer

Telephone No.

INTERNATIONAL SEARCH REPORT
Information on patent family members

International application No.
PCT/JP2023/018159

Patent document cited in search report	Publication date (day/month/year)	Patent family member(s)	Publication date (day/month/year)
JP 2002-21778 A	23 January 2002	(Family: none)	
JP 8-75003 A	19 March 1996	(Family: none)	
JP 2013-170603 A	02 September 2013	(Family: none)	
WO 2010/128606 A1	11 November 2010	US 2012/0043331 A1 fig. 11	
		KR 10-2012-0022724 A	
		CN 202971892 U	

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- JP 2010275972 A [0002]
- JP 2013167234 A [0002]
- JP 2022091050 A [0083]