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(54) **PERISTALTIC PUMP DEVICE**

(57) A peristaltic pump device is provided with a tube allowing the passage of a fluid, a tube holder holding the tube, and a base to which the tube holder is fitted. A rotor is attached rotatably onto the base, and rollers are pivotally supported on the rotor and configured to rotate while pressing and crushing the tube. A substantially U-shaped tube holding groove is formed on a bonded surface of the tube holder on the base side. A depth of the tube holding groove is formed to be shorter than an outer diameter of the tube. When the tube is inserted into the tube holding groove, the tube is held inside the tube holding groove by a frictional resistance caused by a restoring elastic force of the tube.

Fig . 11

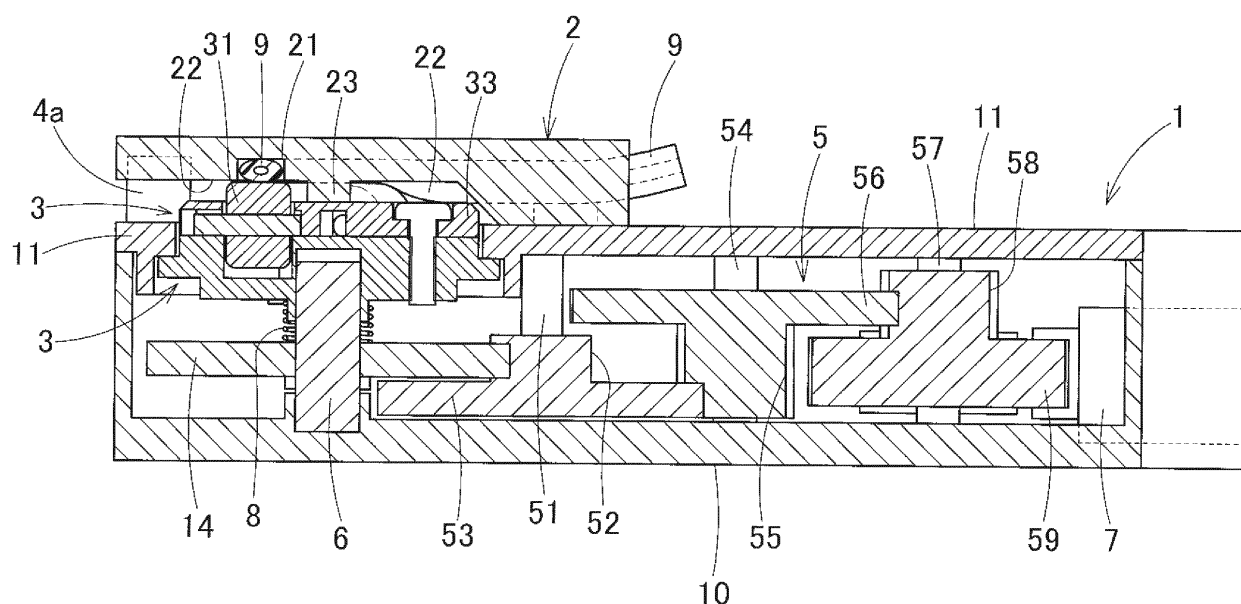
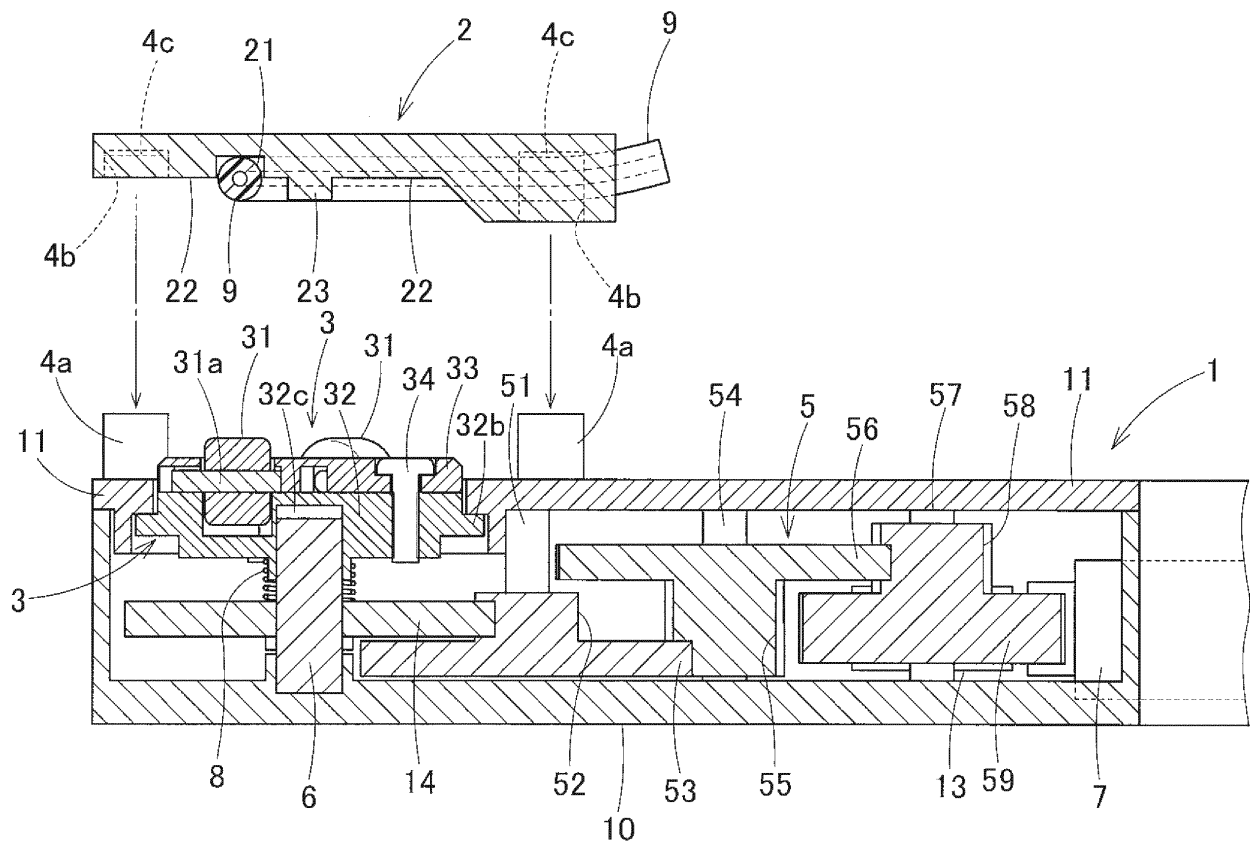


Fig . 12



Description

1. FIELD OF THE INVENTION

[0001] The present invention relates to a peristaltic pump device that supplies a micro-fluid such as various reagents through a tube, and specifically, to a peristaltic pump device which a tube can be easily attached to and removed from, and which can be downsized.

2. DESCRIPTION OF RELATED ART

[0002] Conventionally, a peristaltic pump (peristalsis pump) is known through JP No. 2007-523284A, etc., which includes a plurality of rollers pivotally supported rotatably on a circular rotor, and sends a fluid inside a tube while pressing an outer circumferential surface of each roller of the rotor against the tube and rotating the rotor.

[0003] However, the type of conventional peristaltic pump is configured so that a circular rotor that is rotary-driven by a motor pivotally supports a plurality of rollers rotatably on an outer circumferential portion of the rotor, spindles of the respective rollers are located in directions at right angles to a rotary shaft of the rotor, and when the rotor rotates, the outer circumferential surfaces of the respective rollers are pressed against the tube (flexible conduit tube), and while the rollers of the rotor are pressed in order against the tube and rotationally moved, the peristaltic pump sends a fluid.

[0004] Therefore, a reactive force of a load to press the tube by each roller is applied perpendicularly to the rotary shaft of the motor, so that a rotational load of the motor increases, and in particular, in a small-sized peristaltic pump device to be used to perform cell culturing, reagent screening, and chemical analysis, etc., by flowing a micro-fluid such as various reagents through a microfluidic flow path, the motor increases in size, and this poses a problem in which it is difficult to downsize the pump as a whole.

[0005] In this type of a peristaltic pump, normally, the portion of the tube cannot be easily removed from a pump casing including the rotor. This poses a problem in which, when supplying a chemical, etc., the tube cannot be easily brought into contact with and removably fitted to the roller portion of the rotor, and the used tube cannot be easily disposed of or cleaned.

SUMMARY OF THE INVENTION

[0006] An object of the present invention is to provide a peristaltic pump device which a tube serving as a flow path can be easily attached to and removed from, and which can be downsized. The object of the present invention can be achieved by a peristaltic pump device configured as described below.

[0007] That is, a peristaltic pump device according to the present invention includes a tube allowing the pas-

sage of a fluid, a tube holder holding the tube, a base to which the tube holder is fitted, a rotor attached rotatably onto the base, and at least one roller pivotally supported on the rotor and configured to rotate while pressing and crushing the tube, wherein a tube holding groove is formed on a bonded surface of the tube holder on the base side, a depth of the tube holding groove is formed to be shorter than an outer diameter of the tube, and the depth of the tube holding groove is formed so that, when the tube is inserted into the tube holding groove, the tube is held inside the tube holding groove by a frictional resistance caused by a restoring elastic force of the tube.

[0008] According to the peristaltic pump device of the present invention, a tube holding groove is formed on a bonded surface of the tube holder on the base side, and a depth of the tube holding groove is formed to be shorter than an outer diameter of the tube and set so that, when the tube is inserted into the tube holding groove, the tube is held inside the tube holding groove by a frictional resistance caused by a restoring elastic force of the tube, and therefore, by removing the tube holder from the base, the tube can be easily removed from the tube holding groove of the tube holder. The tube holder can be formed to be very thin, so that the peristaltic pump device can be sufficiently downsized.

[0009] Here, a configuration can be adopted in which, on the bonded surface of the tube holder on the base side, a concave portion is formed so as to allow a portion of the rotor to enter, and at substantially the center of the bonded surface, a positioning convex portion to be positioned by contact with the surface of the rotor is provided. With this configuration, excessive pressing and crushing of the tube due to variation in dimensions of the respective members, variation in elastic force of a spring member, variation in inner and outer diameters of the tube, or variation in elasticity of the tube among products can be prevented, and the pressing and crushing amount can be fixed. It is preferable that the rotor is held on the base movably in an axial direction, and a spring member configured to bias the rotor to the tube holder side is provided. The tube is preferably configured to be exposed so as to become removable when the tube holder is removed from the base.

[0010] Here, a projecting amount of the tube from the tube holding groove is preferably formed to be larger than an inner diameter of the tube. With this configuration, when the roller presses and crushes the tube, a proper pressing and crushing amount of the tube can be secured.

[0011] The peristaltic pump device of the present invention enables the tube serving as a flow path to be easily attached to and removed from the peristaltic pump device, and the device can be downsized.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012]

Fig. 1 is a perspective view of a peristaltic pump device according to the present invention.

Fig. 2 is a perspective view of the same peristaltic pump device, viewed from a changed angle direction.

Fig. 3 is a perspective view showing a state where a tube holder is removed.

Fig. 4 is a perspective view showing a state where the tube holder is removed, viewed from below.

Fig. 5 is an exploded perspective view of the peristaltic pump device.

Fig. 6 is an exploded perspective view of a rotor.

Fig. 7 is a bottom view of the tube holder.

Fig. 8 is a sectional view taken along the line VIII-VIII in Fig. 7.

Fig. 9 is a sectional view taken along the line IX-IX in Fig. 7.

Fig. 10 is a sectional view along a longitudinal direction of the peristaltic pump device.

Fig. 11 is a sectional view along a longitudinal direction of the peristaltic pump in use.

Fig. 12 is a sectional view of the same peristaltic pump device in a state where the tube holder is removed.

Fig. 13 is a partial sectional view showing an inner diameter of a tube and a projecting amount of the tube.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0013] Hereinafter, the present invention is described based on embodiments shown in the drawings. The present invention is not limited to the embodiments. All modifications within requirements of the claims or equivalents regarding the requirements shall be included in the scope of the claims.

[0014] A peristaltic pump device of the present invention includes a tube 9 that allows the passage of a fluid, a tube holder 2 that holds the tube 9, a base 1 to which the tube holder 2 is fitted, a rotor 3 attached rotatably onto the base 1, and rollers 31 that are pivotally supported on the rotor 3 and rotate while pressing and crushing the tube 9.

[0015] The tube holder 2 includes, as shown in Fig. 4, a plate-shaped main body 20, and on an inner side at one side of the plate-shaped main body 20, that is, at the rotor 3 side, a concave portion 22 is formed so as to allow the rollers 31 to enter, and at the other side, a contact portion 25 that comes into contact with the upper surface of a cover 11 of the base 1 is formed. The plate-shaped main body 20 of the tube holder 2 is formed to be thick at the contact portion 25 that comes into contact with the upper surface of the cover 11 of the base 1, and thin at the portion of the concave portion 22 that the rollers 31 of the rotor 3 enter.

[0016] As shown in Fig. 4 and Fig. 7, a substantially U-shaped tube holding groove 21 is formed continuously to these concave portion 22 and contact portion 25. The

substantially U-shaped tube holding groove 21 opens outward at a side surface of the contact portion 25, and is formed so that the tube 9 is bent into a U shape and led in and led out of the pump.

[0017] A depth $f1$ of the tube holding groove 21 in the concave portion 22 is formed to be, as shown in Fig. 9, shorter than an outer diameter $r1$ of the tube 9, and a width $w1$ of the tube holding groove 21 is formed to be, as shown in Fig. 7, longer than an outer diameter $r1$ of the tube 9. A depth $f2$ of the tube holding groove 21 in the contact portion 25 is formed to be, as shown in Fig. 9, substantially equal to the outer diameter $r1$ of the tube 9.

[0018] Accordingly, when the tube 9 is bent into a U shape and inserted into the tube holding groove 21, by a frictional resistance caused by a restoring elastic force of the tube 9, the tube 9 is reliably held inside the tube holding groove 21 in the contact portion 25. In addition, the tube 9 inside the tube holding groove 21 in the concave portion 22 can be excellently pressed and crushed by the rollers 31.

[0019] As shown in Fig. 13, a projecting amount $r3$ of the tube 9, that is, an amount of projection of the tube 9 from the tube holding groove 21 (outer diameter $r1$ - depth $f1$) is formed to be larger than an inner diameter $r2$ of the tube 9. Accordingly, when the rollers 31 press and crush the tube 9, a proper pressing and crushing amount of the tube 9 is secured.

[0020] The tube 9 is a very thin tube with, for example, an outer diameter of approximately 2 mm and an inner diameter of approximately 0.5 mm, and is formed of a flexible material with flexibility such as thermoplastic elastomer and silicone rubber, and generates an excellent restoring elastic force when being bent into a U shape to form an arc-shaped flow path and when being pressed and crushed by the rollers 31. The tube holding groove 21 is formed into the U shape as shown in Fig. 7, however, the tube holding groove may be arc-shaped as long as it is along a rotational trajectory of the rollers 31 and causes the tube bent and inserted into the groove to generate a restoring elastic force.

[0021] The tube holder 2 is removably located on the base 1, and between the upper surface of the base 1 and the tube holder 2, an attaching retainer 4 to retain the tube holder 2 is provided. The attaching retainer 4 includes magnet-made retaining shafts 4a attached to either one of the tube holder 2 and the base 1, and retaining holes 4b provided in the other one of the tube holder 2 and the base 1. In the present embodiment, the retaining shafts 4a are provided to project on the surface of the base 1, the retaining holes 4b are formed in a lower surface of the tube holder 2 so as to allow the retaining shafts 4 to be closely inserted, and as shown in Fig. 8 and Fig. 9, magnet pieces 4c are attached inside the retaining holes 4b.

[0022] As shown in Fig. 4, at four corners of an inside surface of the tube holder 2, the retaining holes 4b of the attaching retainer 4 are formed, and to the inner sides of

these retaining holes 4b, the magnet pieces 4c are attached. At fixed positions on the base 1, that is, at four positions corresponding to the retaining holes 4b, the magnet-made retaining shafts 4a are provided to project upward. When the four retaining shafts 4a are inserted into the respective retaining holes 4b, the retaining shafts 4a are closely fitted in the retaining holes 4b, and the magnet pieces 4c and the retaining shafts 4a made of magnets attract each other. Accordingly, the tube holder 2 in an accurately positioned state is removably fitted to the base 1 without backlash. One of the magnet-made retaining shafts 4a and the magnet pieces 4 may be magnetic bodies such as stainless steel.

[0023] Further, as shown in Fig. 4, on a surface of the tube holder 2 on the base 1 side, the concave portion 22 is formed so as to allow a portion of the rotor 3 to enter, and at substantially the center of the concave surface, a positioning convex portion 23 to be positioned by contact with the surface of the rotor 3 is provided. That is, at substantially the center of the concave portion 22 of the tube holder 2, a pin-shaped positioning convex portion 23 is provided to project downward.

[0024] This positioning convex portion 23 comes into contact with the upper surface of the rotor 3 when the tube holder 2 is attached to a position to cover the rotor 3 on the base 1, and accordingly, the attaching position of the tube holder 2 to the base 1 (a position with respect to the rotor 3) is accurately set.

[0025] The rotor 3 is fitted onto a rotary shaft 6 provided vertically in the base 1, movably in the axial direction (vertical direction in Fig. 10) and rotatably together with the rotary shaft 6. As shown in Fig. 10, a spring member (coil spring) 8 is fitted onto the rotary shaft 6, and the spring member 8 biases the rotor 3 to the tube holder 2 side. The pressing and crushing amount of the tube 9 is determined by the position of the tube 9 with respect to the roller 31 and a spring force of the spring member 8, and the spring force of the spring member 8 is set so that a proper pressing and crushing amount is generated.

[0026] The base 1 includes a case 10 formed into a substantially rectangular parallelepiped shape, and the upper surface of the case 10 is covered by a plate-shaped cover 11. As shown in Fig. 5, at an end portion of the cover 11, a circular opening 12 is formed, and the rotor 3 is fitted so that an upper portion of the rotor 3 pivotally supported inside the case 10 is exposed and slightly projects upward from the circular opening 12. The rotor 3 is pivotally supported on the rotary shaft 6 pivotally supported vertically inside the circular opening 12, biased upward by the spring member 8, and accordingly located inside the circular opening 12 in a state where the rotor is biased upward by an elastic force.

[0027] As shown in Fig. 5, to a terminal end portion of the inside of the case 10, a motor 7 is attached sideways so as to become parallel to a longitudinal direction of the case 10. Near a front end portion of the inside of the case 10, the rotary shaft 6 is supported in the vertical direction (longitudinal direction) in Fig. 10 rotatably via a bearing.

A spur gear 14 is pivotally fitted to the rotary shaft 6, and the rotary shaft 6 is coordinated with a gear mechanism 5 including pluralities of spur gears and pinions, via the spur gear 14. With an input side of the gear mechanism 5, an output shaft of the motor 7 is coordinated via a worm 13. Accordingly, when the motor 7 is activated, the rotary shaft 6 and the rotor 3 are rotary-driven at a low speed via the gear mechanism 5.

[0028] As shown in Fig. 10, the gear mechanism 5 is configured so that the spur gear 14 attached to the rotary shaft 6 is meshed with a pinion 52 of an adjacent rotary shaft 51, and a spur gear 53 coaxial with the pinion 52 is meshed with a pinion 55 of an adjacent rotary shaft 54. Further, a spur gear 56 coaxial with the pinion 55 is meshed with a pinion 58 of an adjacent rotary shaft 57, and a spur gear 59 coaxial with the pinion 58 is meshed with the worm 13 provided on an output shaft of the motor 7. The number of rotations of the output shaft of the motor 7 is reduced by this gear mechanism 5, and rotary-drives the rotary shaft 6 of the rotor 3 at a low speed. This gear mechanism 5 is configured to be thin so as to reduce a thickness of the base 1, and further, by housing the small-sized motor 7 sideways inside the case 10, the thickness of the base 1 is minimized.

[0029] The rotor 3 is configured to include a discoid substrate 32 in which openings 32a for three rollers 31 are formed, rollers 31 located inside the respective openings 32a, and a discoid cover 33 covered on the substrate 32 from above the rollers 31 and fixed. In the discoid substrate 32, three openings 32a are formed on the circumference at even intervals, that is, at intervals of approximately 120 degrees, and at a circumferential edge portion of the substrate 32, a flange 32b is formed.

[0030] The flange 32b is formed so that, as shown in Fig. 6, when the rotor 3 is inserted into the circular opening 12 from the inside of the circular opening 12 of the cover 11 of the base 1, the flange 32b becomes contactable with the inside of the cover 11, and an ascending limit of the rotor 3 that is biased upward by the spring member 8 is set by this flange 32b. As shown in Fig. 10, at the center of a bottom portion of the substrate 32 of the rotor 3, a shaft hole 32c is opened, and a tip end of the rotary shaft 6 is rotatably fitted in this shaft hole 32c.

[0031] As shown in Fig. 6 and Fig. 10, in the cover 33 as well, three openings 33a are formed at even intervals at positions corresponding to the respective openings 32a of the substrate 32. The rollers 32 provided with spindles 31a on their axes are respectively housed inside the openings 32a provided in the substrate 32, and the spindles 31a are positioned on the substrate 32 and covered by a cover 33 from above.

[0032] Accordingly, by the cover 33, the spindles 31a of the rollers 31 are held rotatably between the cover 33 and the substrate 32. In this state, fixing screws 34 are inserted into the holes 33b to fasten and fix the cover 33 and the substrate 32. Accordingly, the three rollers 31 are held on the substrate 32 radially at intervals of approximately 120 degrees so as to be rotatable via the

spindles 31a. The rotor 3 including such rollers 31 holds the respective rollers 31 rotatably and is pivotally supported in a state where, as shown in Fig. 10, upper portions of the respective rollers 31 are exposed from the openings 33a of the cover 33 and project.

[0033] When the rotor 3 is attached to the base 1, as shown in Fig. 5, onto the rotary shaft 6 of the base 1, the shaft hole 32c at the center of the substrate bottom portion of the rotor 3 is fitted, and from above these, the cover 11 is covered and attached onto the case 10. As shown in Fig. 5, the spring member 8 is fitted onto the rotary shaft 6 in advance. Accordingly, the rotor 3 is attached onto the base 1 in a state where upper portions of the respective rollers 31 project and the rotor is biased upward by the spring member 8.

[0034] Next, a usage form and operation of the peristaltic pump device configured as described above are described. This peristaltic pump device is used to supply, for example, a micro-fluid such as various reagents by flowing the micro-fluid through the flow path in the tube 9.

[0035] The tube 9 to be used is inserted into the tube holding groove 21 on the inside surface of the tube holder 2 as shown in Fig. 7 after the tube holder 2 is removed. At this time, the substantially linear tube 9 in a free state is bent into a U shape and fitted into the tube holding groove 21, and at this time, the tube 9 itself generates a restoring elastic force, and an outside surface of the tube 9 in the bent state comes into contact with the inner surface of the tube holding groove 21.

[0036] Accordingly, a frictional resistance is generated between the tube 9 and the tube holding groove 21, the tube 9 is held inside the tube holding groove 21, and is excellently held even in a state where the tube holder 2 is reversed. In particular, the tube 9 is held in an excellently pressed and crushed form by the tube holding groove 21 in the concave portion 22 of the tube holder 2, and excellent holding performance is secured inside the deep tube holding groove 21 in the contact portion 25.

[0037] As described above, only by removing the tube holder 2 and inserting the tube 9 into the tube holding groove 21, the tube 9 can be easily set at a proper position, and reliably held at a fixed position. When the tube 9 is replaced for each use, the tube can be very easily replaced, and the tube can be easily disposed of after use.

[0038] Next, the tube holder 2 in which the tube 9 is set is attached to a position covering the rotor 3 of the base 1. At this time, as shown in Fig. 12, only by fitting the retaining holes 4b of the tube holder 2 to the retaining shafts 4a provided to project on the base 1, the tube holder 2 can be easily attached. That is, when the retaining holes 4b of the tube holder 2 are fitted to the retaining shafts 4a, the retaining shafts 4a closely enter the insides of the retaining holes 4b and are attracted to the magnetic pieces 4c, and the tube holder 2 can be accordingly easily attached to a fixed position on the base 1 without backlash.

[0039] When the tube holder 2 is attached to a fixed

position on the base 1, as shown in Fig. 11, the rollers 31 are made to press and crush the tube 9 by a biasing force of the spring member 8. In this state, as shown in Fig. 11, the positioning convex portion 23 of the tube holder 2 comes into contact with the center of the upper surface of the rotor 3. Therefore, even when the dimensions of the respective members vary, the inner and outer diameters and the elastic force of the tube 9 vary, and the spring force of the spring member 8 varies among products, the tube 9 can be pressed and crushed by a constant pressing and crushing amount.

[0040] In this state, when the motor 7 is activated, the rotor 3 rotates and the rollers 31 freely rotate while pressing and crushing the tube 9. At this time, a load of pressing the tube 9 by the rollers 31 is applied parallel to the rotary shaft 6. Therefore, a rate at which a rotational load of the rotor 3 increases due to the pressing load of the rollers 31 is very small. Therefore, even with the motor 7 that is very small in size and has a low output, the rotor 3 can be rotary-driven and a liquid inside the tube 9 can be sent, so that the device is used for supply of a chemical, etc.

[0041] Then, after use, as shown in Fig. 12, the tube holder 2 is removed from the upper surface of the base 1, and the tube 9 is removed from the tube holding groove 21 of the tube holder 2. At this time, since fixtures such as fixing screws or hooks are not used for attachment and removal of the tube holder 2, a user can easily attach or remove the tube holder 2 only by grasping the tube holder 2 by his/her fingers.

[0042] As described above, in the peristaltic pump device configured as described above, a tube holding groove 21 is formed on a bonded surface of the tube holder 2 on the base 1 side, and the depth f1 (Fig. 9) of the tube holding groove 21 is formed to be shorter than the outer diameter r1 (Fig. 7) of the tube 9, and when the tube 9 is inserted into the tube holding groove 21, by a frictional resistance caused by a restoring elastic force of the tube 9, the tube 9 is held inside the tube holding groove 21, so that by removing the tube holder 2 from the base 1, the tube 9 can be easily removed from the tube holding groove 21 of the tube holder 2. In addition, the tube holder 2 can be formed to be very thin, so that the peristaltic pump device can be sufficiently downsized.

[0043] It is explicitly stated that all features disclosed in the description and/or the claims are intended to be disclosed separately and independently from each other for the purpose of original disclosure as well as for the purpose of restricting the claimed invention independent of the composition of the features in the embodiments and/or the claims. It is explicitly stated that all value ranges or indications of groups of entities disclose every possible intermediate value or intermediate entity for the purpose of original disclosure as well as for the purpose of restricting the claimed invention, in particular as limits of value ranges.

Claims

1. A peristaltic pump device comprising:
 - a tube allowing the passage of a fluid; 5
 - a tube holder holding the tube;
 - a base to which the tube holder is fitted;
 - a rotor attached rotatably onto the base; and
 - at least one roller pivotally supported on the rotor 10
 - and configured to rotate while pressing and crushing the tube, wherein
 - a tube holding groove is formed on a bonded surface of the tube holder on the base side,
 - a depth of the tube holding groove is formed to 15
 - be shorter than an outer diameter of the tube, and
 - the depth of the tube holding groove is formed so that, when the tube is inserted into the tube holding groove, the tube is held inside the tube holding groove by a frictional resistance caused 20
 - by a restoring elastic force of the tube.
2. The peristaltic pump device according to Claim 1, wherein
 - on the bonded surface of the tube holder on the base 25
 - side, a concave portion is formed so as to allow a portion of the rotor to enter, and at substantially the center of the bonded surface, a positioning convex portion to be positioned by contact with the surface 30
 - of the rotor is provided.
3. The peristaltic pump device according to Claim 1, wherein
 - the peristaltic pump device is configured so that the 35
 - tube is exposed so as to become removable when the tube holder is removed from the base.
4. The peristaltic pump device according to Claim 1, wherein
 - the rotor is held on the base movably in an axial 40
 - direction, and a spring member configured to bias the rotor to the tube holder side is provided.
5. The peristaltic pump device according to Claim 1, wherein 45
 - a projecting amount of the tube from the tube holding groove is formed to be larger than an inner diameter of the tube.

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Fig . 1

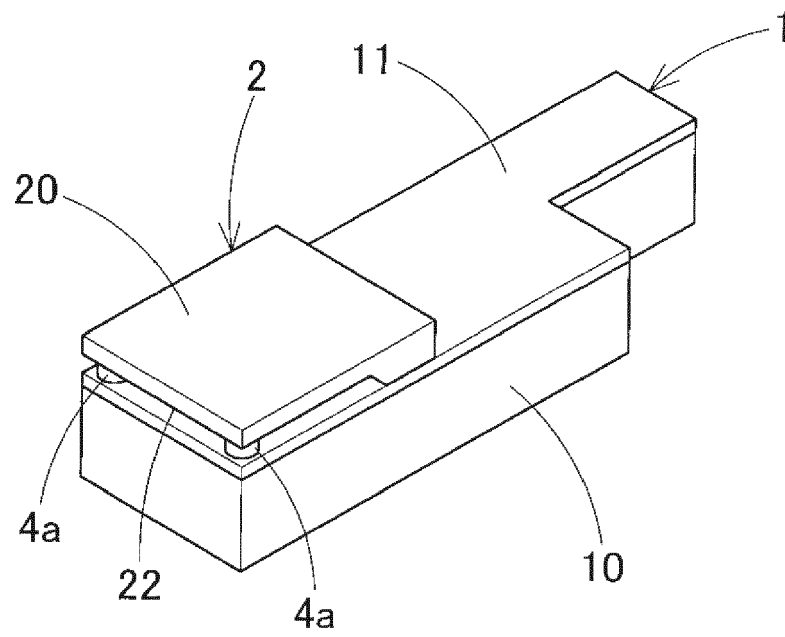


Fig . 2

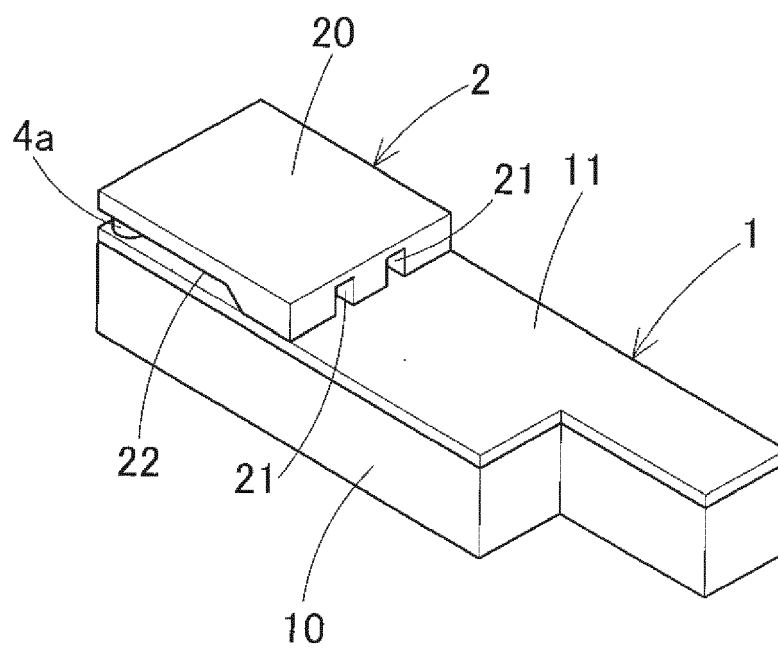


Fig . 3

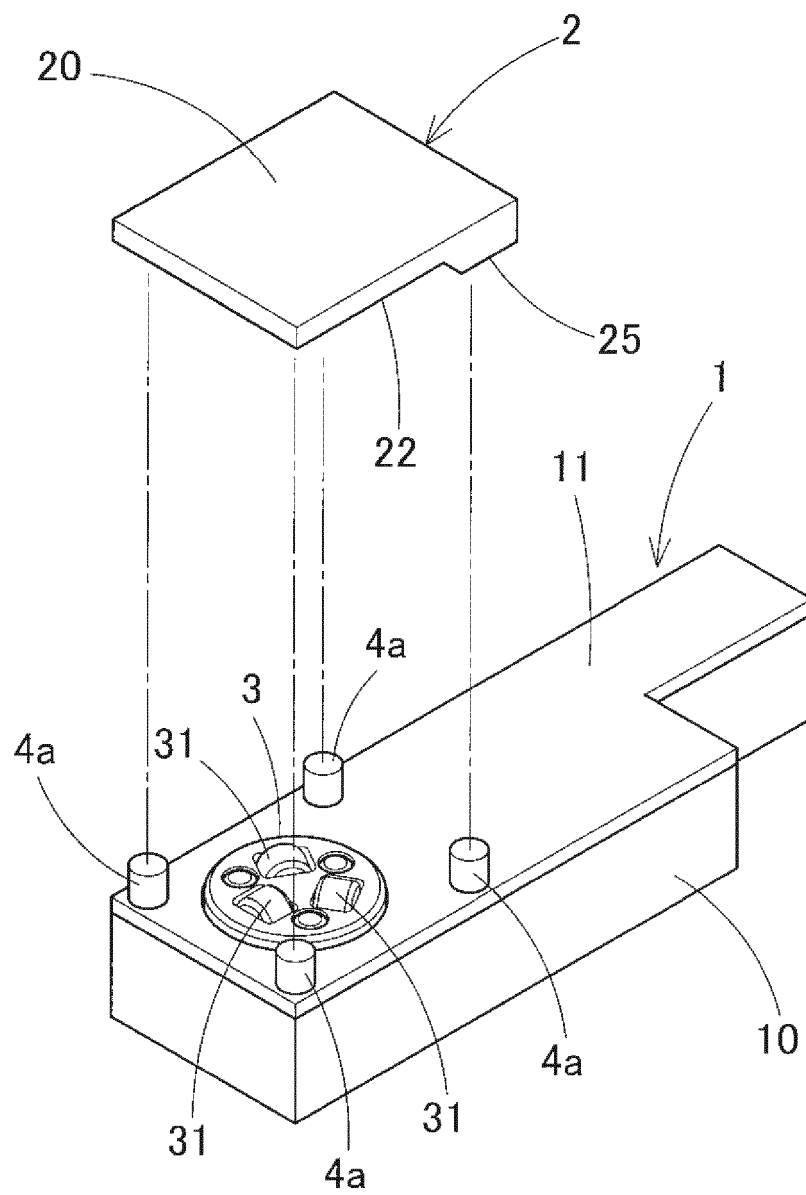


Fig . 4

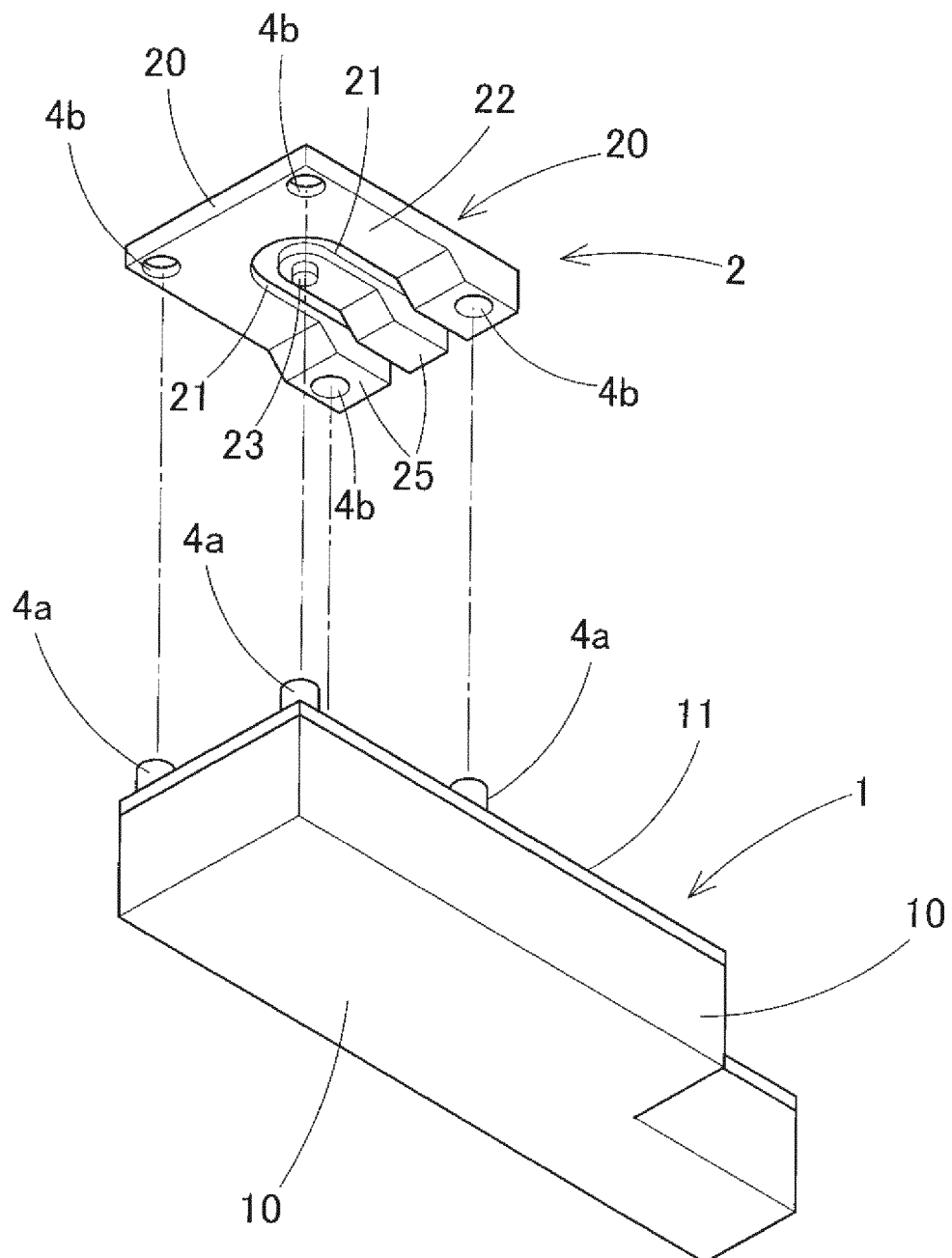


Fig . 5

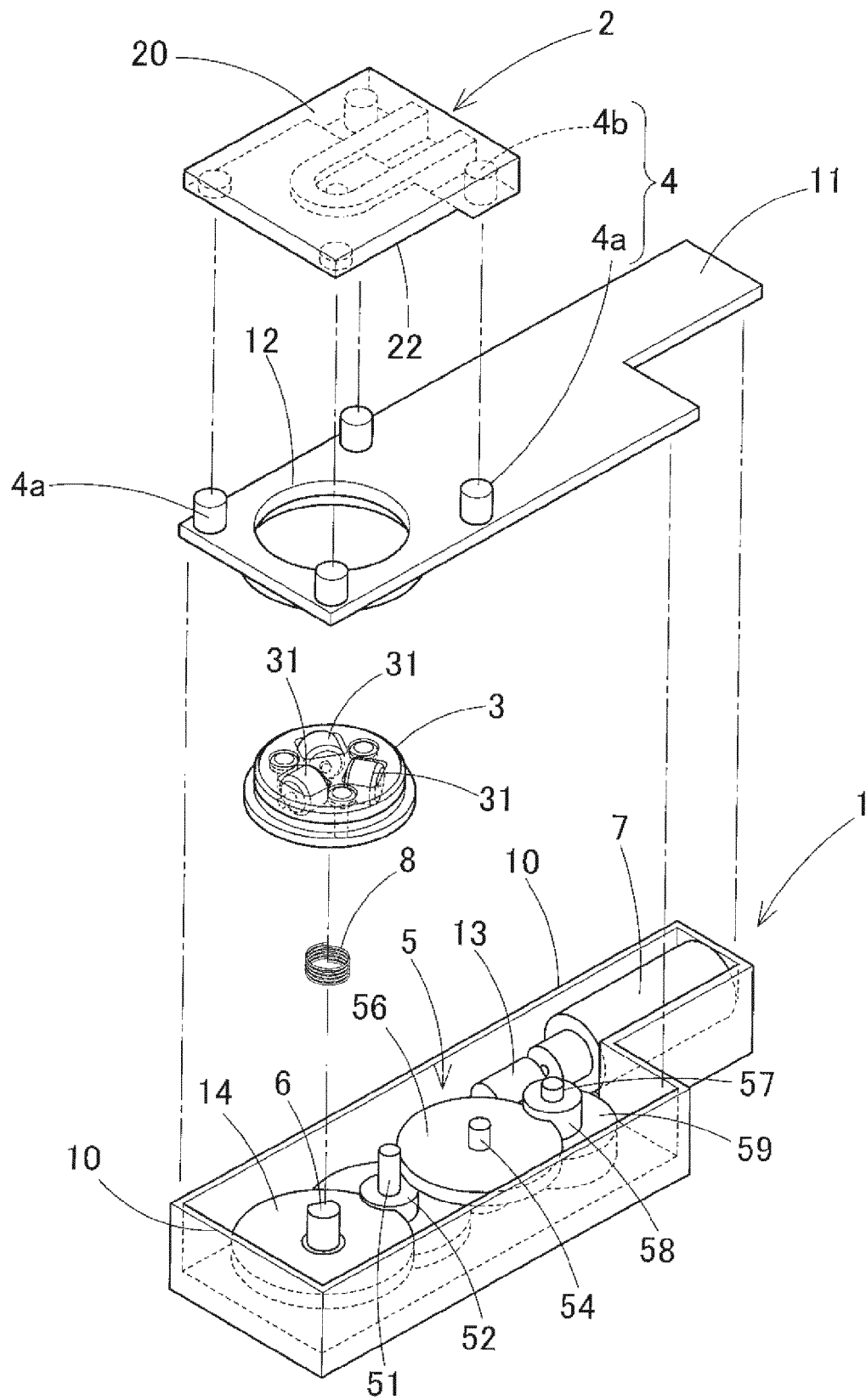


Fig . 6

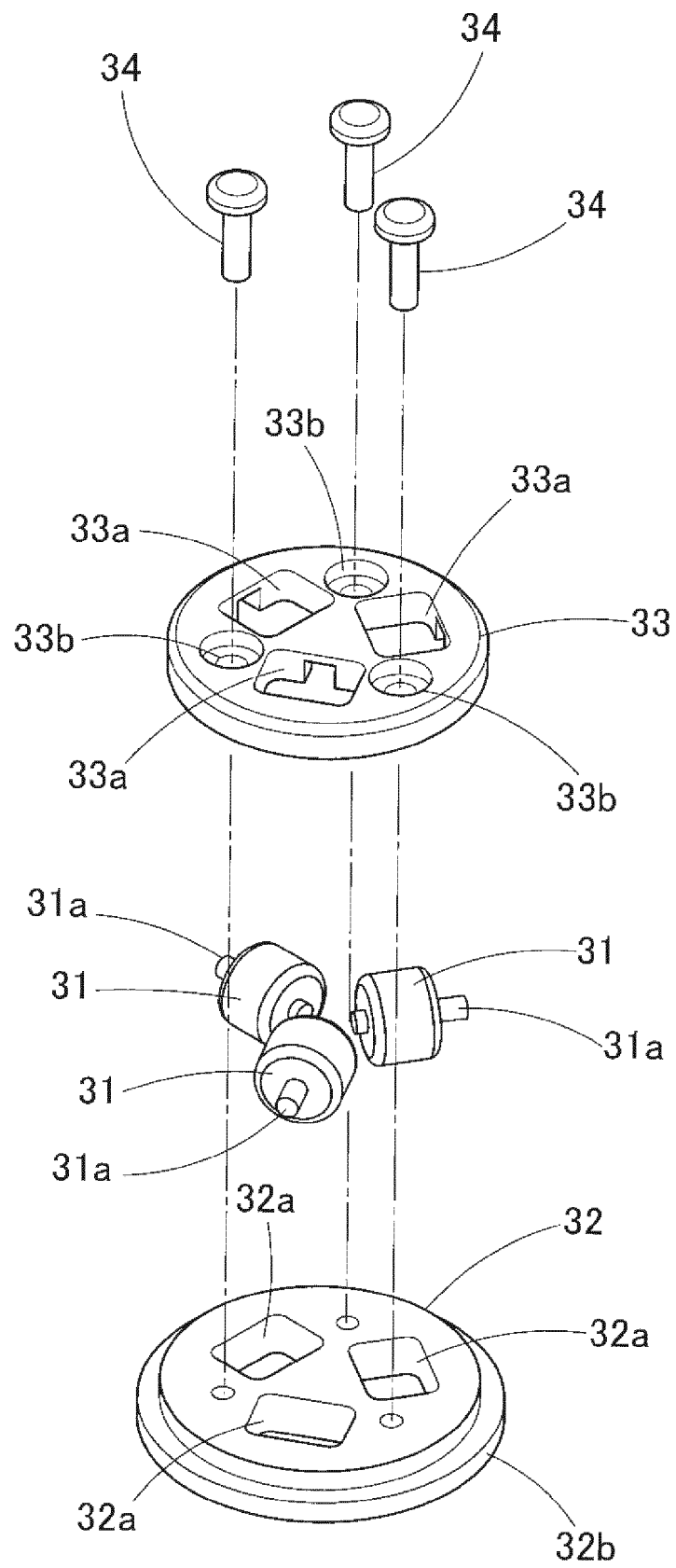


Fig. 7

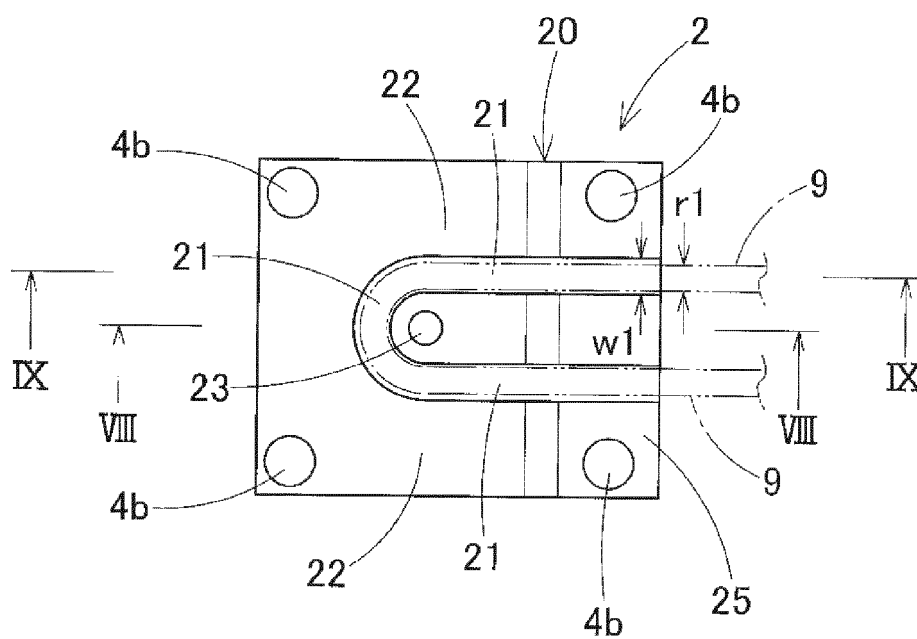


Fig. 8

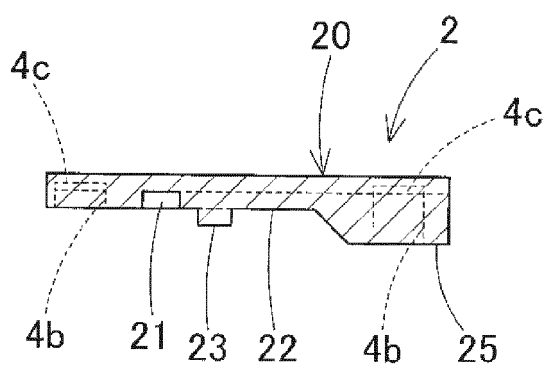


Fig. 9

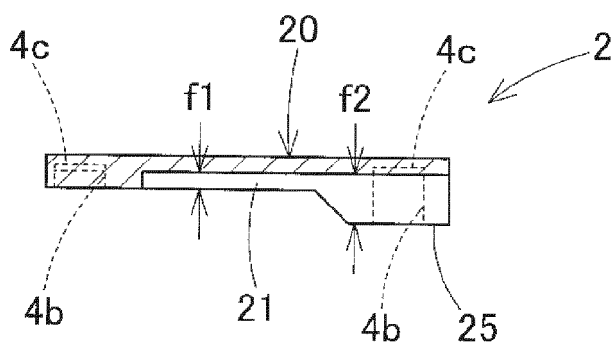


Fig. 10

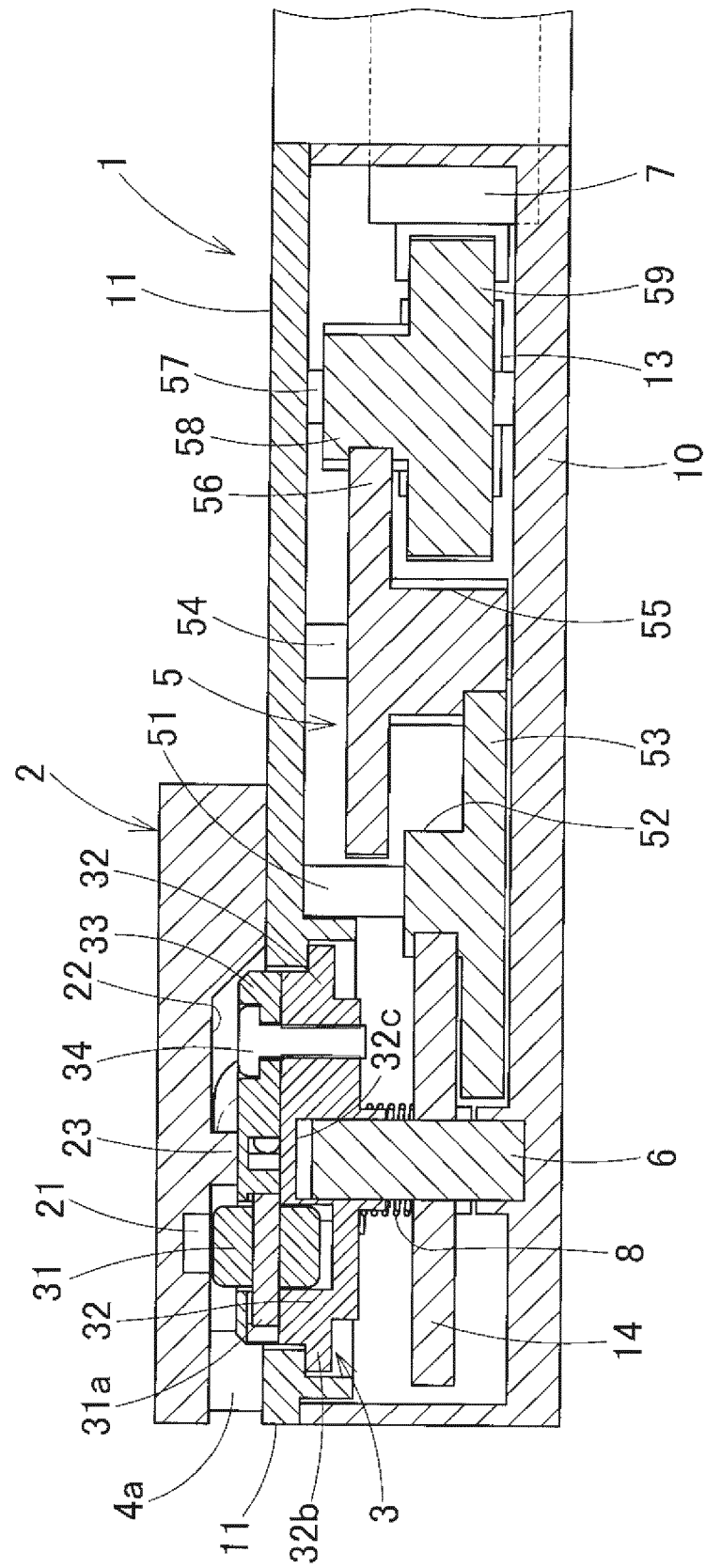
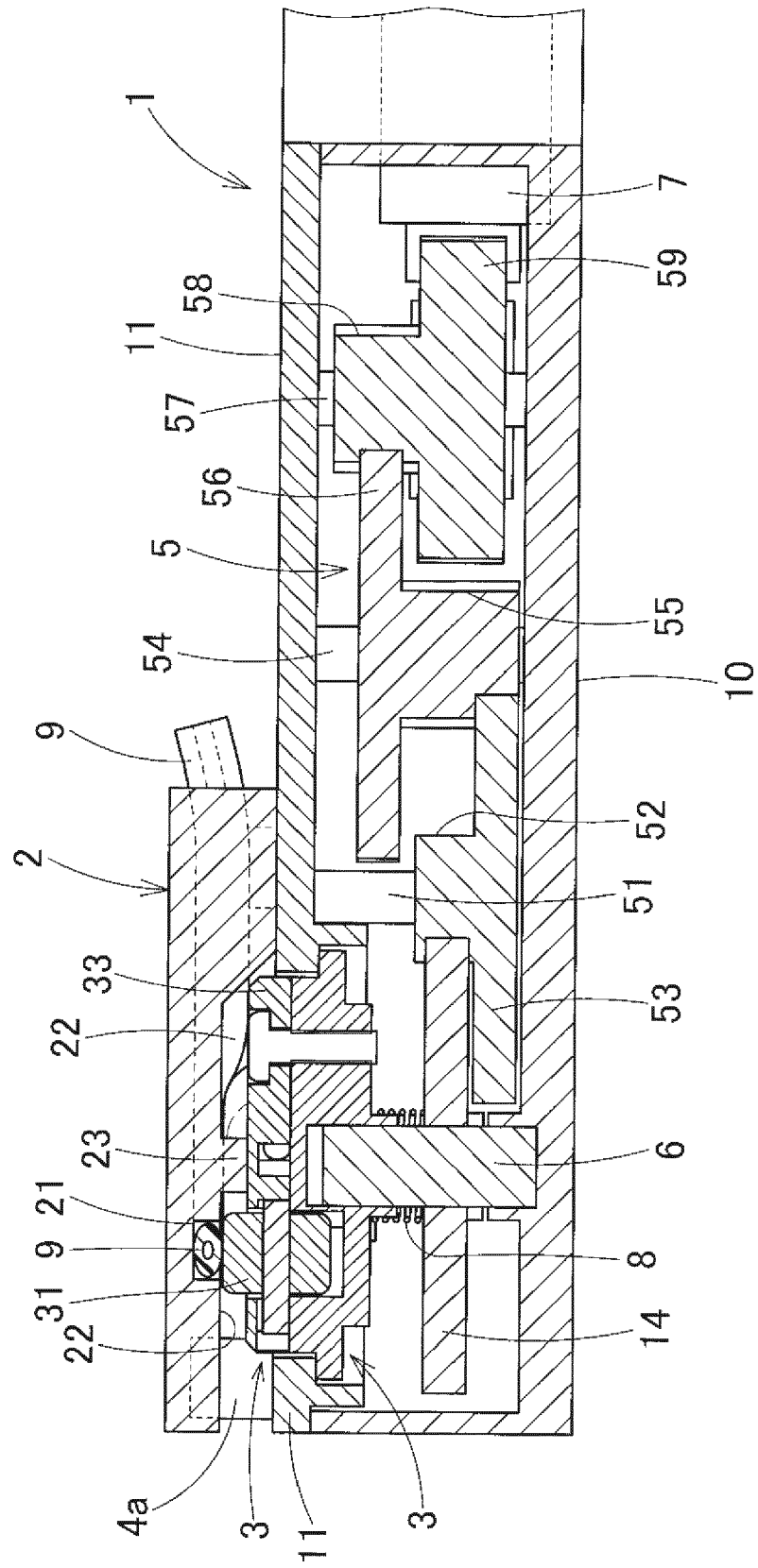


Fig. 11



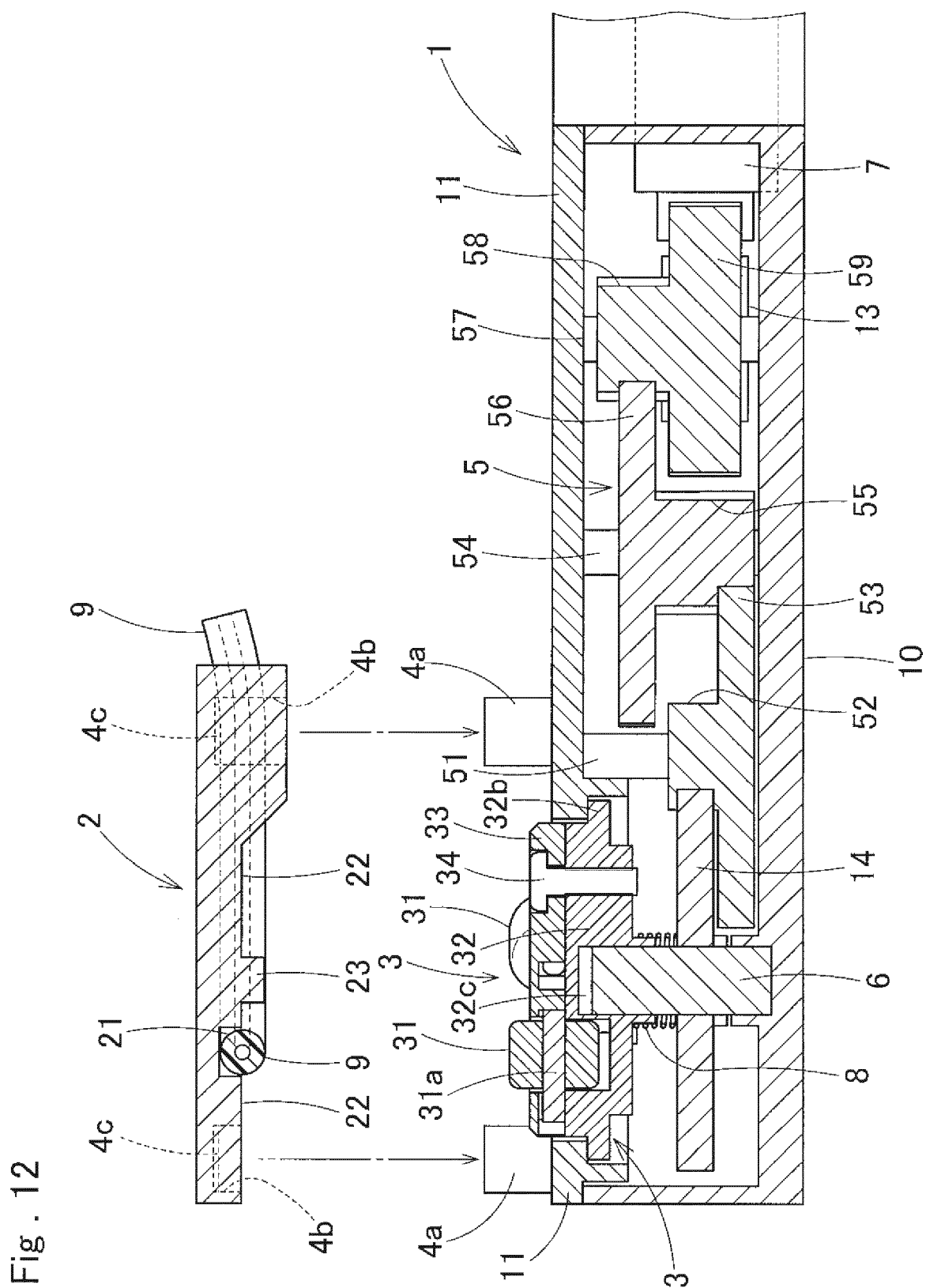
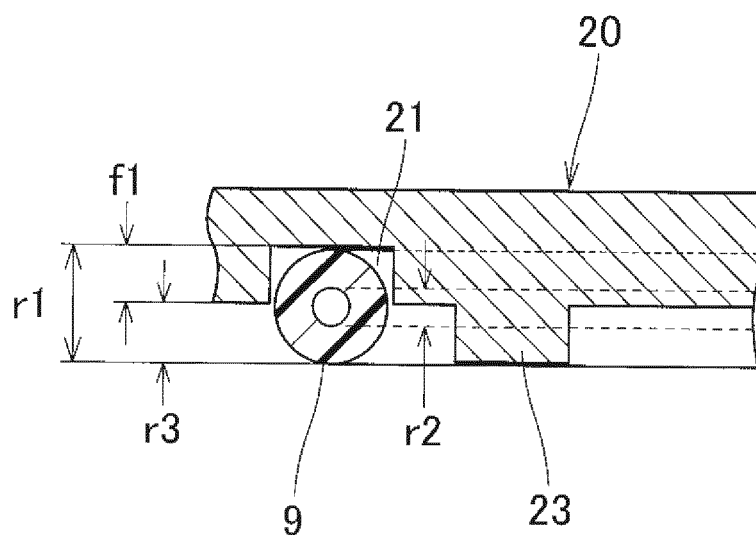


Fig . 13





EUROPEAN SEARCH REPORT

Application Number
EP 18 20 4974

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DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 7 074 021 B2 (BYRNE MEDICAL INC [US]) 11 July 2006 (2006-07-11)	1-3,5	INV. F04B43/12
Y	* figures 2-5 * * column 3, line 25 - column 7, line 30 *	4	
Y	EP 0 026 704 A1 (BOEUF LOLA LE [FR]) 8 April 1981 (1981-04-08)	4	
A	* figures 1-2 * * page 5, line 19 - page 9, line 14 *	1-3,5	
A	US 4 705 464 A (ARIMOND TIMOTHY V [US]) 10 November 1987 (1987-11-10) * figure 3 *	1-5	
A	US 4 178 138 A (ILES FRANK [GB]) 11 December 1979 (1979-12-11) * figure 1 * * column 1, line 66 - column 2, line 38 *	1-5	TECHNICAL FIELDS SEARCHED (IPC)
			F04B
The present search report has been drawn up for all claims			
Place of search Munich		Date of completion of the search 1 February 2019	Examiner Ricci, Saverio
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document 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			

EPO FORM 1503 03/82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

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5 This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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01-02-2019

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