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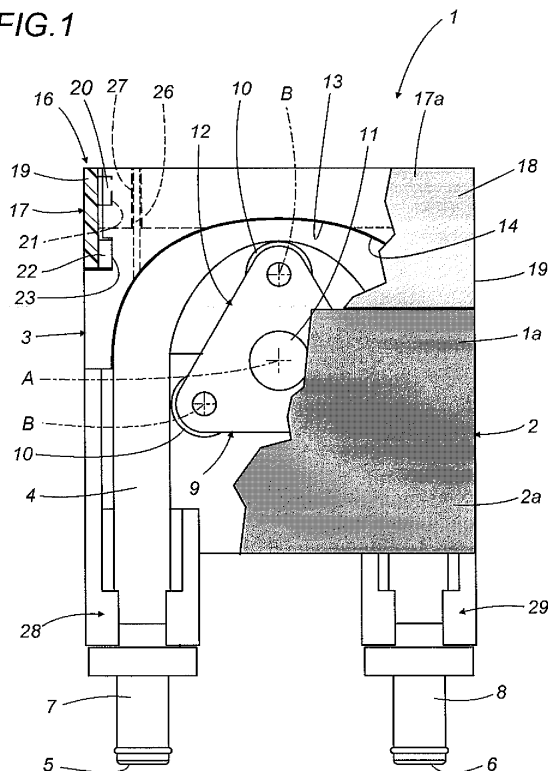
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(54) **Peristaltic pump**

(57) A peristaltic pump comprises a main body (2); a contact body (3) slidably connected to the main body (2) and having at least one "vaulted" inner wall (13) for at least partly forming a contact surface (14); a flexible tube (4) at least partly positioned inside the main body (2) for allowing the transit of a fluid from an intake section (5) to a delivery section (6); at least two rollers (10) positioned inside the main body (2) and able to move along a circular trajectory so as to press the tube (4) against the contact surface (14) and produce corresponding constrictions moving from the intake section (5) to the delivery section (6); the contact body (3) being able to move between a first position, in which the inner wall (13) is at its closest to the rollers (10), and a second position, in which the inner wall (13) is at its furthest from the rollers (10) and a tube (4) access compartment (15) is formed.

FIG. 1



Description

[0001] The present invention relates to a peristaltic pump. In particular, the present invention is applied in the food industry. More in particular, the present invention is applied in machines for producing and dispensing crushed-ice drinks, sorbets, ice creams, soft ice creams, cream, yoghurt and the like and in machines for producing and preserving mixtures for ice cream, creams, sauces, soups and mixtures in general and the like.

[0002] Peristaltic pumps of the known type comprise a containment body housing a flexible tube in which a fluid flows, the fluid being pumped from an intake section to a delivery section.

[0003] In detail, the containment body is made of two half-parts which are connected to each other.

[0004] Prior art pumps comprise a rotor which is rotatably connected to a first half-part of the containment body, the outside of the rotor supporting a plurality of idle rollers positioned with their axis of rotation perpendicular to a direction of tube extension.

[0005] The rollers are in contact with the tube and, in conjunction with a contact wall opposite the rotor relative to the tube, they create respective tube constrictions.

[0006] As the rotor drives the rotation of the rollers, the constrictions are moved from intake to delivery to convey a portion of the fluid contained in the tube between two constrictions which come one after the other.

[0007] The tube comprises an intake coupling and a delivery coupling and is made of flexible plastic material such as polymeric or silicone material.

[0008] The diameter of the tube, in conjunction with the speed of rotation of the rotor, determines the pump capacity.

[0009] The contact wall is made in a second half-part of the containment body.

[0010] In prior art peristaltic pumps the two half-parts of the containment body are rigidly connected. For example, in prior art peristaltic pumps the two half-parts are connected by screws.

[0011] Disadvantageously, when the tube must be substituted if there is a fault, the two half-parts must be moved away from each other in order to move the wall away from the rollers and free the tube so that it can be extracted from the containment body.

[0012] Said operation is very complex and laborious, since it requires pump containment body disassembly.

[0013] Moreover, if the pump capacity has to be changed, substituting the tube with another having a different diameter is not sufficient.

[0014] The width of the contact wall is substantially equal to the width of the tube at the constriction.

[0015] Consequently, it is not possible to insert a flexible tube which has a greater diameter, since said tube at the constrictions would exceed the width of the contact wall.

[0016] On the other hand, if a tube with smaller diameter were inserted, said tube could not be effectively

housed and might exit its position with significant consequences in terms of pump operation.

[0017] In this context, the technical purpose of the present invention is to propose a peristaltic valve which is free of the above-mentioned disadvantages.

[0018] In particular, the present invention has for an aim to propose a peristaltic valve which is easy to maintain.

[0019] Another aim of the present invention is to propose a peristaltic valve which can easily be adapted to various capacity requirements.

[0020] Accordingly, the present invention achieves said technical purpose and the aim specified with a peristaltic valve comprising the technical features described in one or more of claims herein.

[0021] Further characteristics and advantages of the present invention are more apparent from the nonlimiting description which follows of a preferred embodiment of a peristaltic pump, illustrated in the accompanying drawings, in which:

- Figure 1 is a schematic front view, partly in cross-section, of a peristaltic pump in accordance with the present invention in a first configuration;
- Figure 2 is a schematic front view, partly in cross-section, of the peristaltic pump of Figure 1 in a second configuration;
- Figure 3 is a schematic side view of the peristaltic pump of Figure 1 in the first configuration;
- Figure 4 is a schematic side view of the peristaltic pump of Figure 2 in the second configuration; and
- Figure 5 is a schematic side view, partly in cross-section, of the peristaltic pump of Figure 1 in the second configuration.

[0022] With reference to the accompanying drawings, the numeral 1 denotes as a whole a peristaltic pump in accordance with the present invention.

[0023] The peristaltic pump 1 comprises a main body 2 and a contact body 3 which is slidably connected to the main body 2.

[0024] A tube 4 made of flexible material is positioned between the main body 2 and the contact body 3.

[0025] As explained below, the tube 4 allows the transit of a fluid to be pumped from an intake section 5 to a delivery section 6.

[0026] The tube 4 comprises an intake coupling 7 located at the intake section 5 and a delivery coupling 8 located at the delivery section 6.

[0027] The peristaltic pump 1 also comprises a rotor 9 which is rotatably connected to the main body 2 and supports a plurality of rollers 10. The rotor 9 rotates about its own axis of rotation "A" which is perpendicular to a direction in which the tube 4 lies (Figures 1 and 2).

[0028] In the embodiment described, the rotor 9 comprises a central shaft 11 and two parallel triangular brackets 12 at whose vertices three rollers 10 are supported.

[0029] Each roller 10 is separated from the others by

an equal angle of 120° relative to the rotor 9 and lies with its own axis of rotation "B" substantially perpendicular to the direction in which the tube 4 lies and, therefore, substantially parallel with the axis of rotation "A" of the rotor 9.

[0030] The rotor 9, whose rotation is driven by drive means which are not illustrated, gives the rollers 10 a circular trajectory, which may have a clockwise or anti-clockwise direction when observing Figures 1 and 2.

[0031] The contact body 3 comprises a vaulted inner wall 13.

[0032] Said inner wall 13 has a section, made along a plane perpendicular to the axes of rotation "B" of the rollers 10, which substantially has the shape of an arc of a circle in such a way that its concavity is towards the rotor 9.

[0033] In more detail, the flexible tube 4 lies between the inner wall 13 of the contact body 3 and the rollers 10 of the rotor 9.

[0034] The contact body 3 can move by sliding between a first position and a second position towards/away from the rotor 9.

[0035] In detail, in the first position the contact body 3 lies in such a way that the inner wall 13 is at its closest to the rotor 9 (Figures 1 and 3). In particular, the inner wall 13 is at its closest to the rollers 10.

[0036] In this first position, the tube 4 lies compressed between the rollers 10 and the inner wall 13 in such a way that the rollers 10 press the tube 4 against the inner wall 13 so as to form local constrictions. In said case, the inner wall 13 at least partly forms a contact surface 14 for the tube 4.

[0037] In practice, the rotor 9 drives the rotation of the rollers 10 in which the corresponding constrictions move from the intake section 5 to the delivery section 6. In this way, a portion of fluid contained between two constrictions that come one after the other is conveyed from the intake section 5 to the delivery section 6.

[0038] In contrast, in the second position the contact body 3 lies in such a way that the inner wall 13 is at its furthest from the rotor 9 (Figures 2, 4 and 5). In particular, the inner wall 13 is at its furthest from the rollers 10.

[0039] In this second position, the constrictions are freed and a tube 4 access compartment 15 is formed, making tube extraction simple.

[0040] The peristaltic pump 1 also comprises movement means 16 connected to the contact body 3 for moving it between the first and second positions.

[0041] In particular, the movement means 16 comprise a covering door 17 pivoting at the main body 2 and connected to the contact body 3.

[0042] The covering door 17 can rotate between a lowered position corresponding to the first position of the contact body 3 and a raised position corresponding to the second position of the contact body 3.

[0043] In more detail, when the covering door 17 lies in the lowered position, it covers a hollow space formed between the main body 2 and the contact body 3 when the latter lies in the first position.

[0044] Moreover, in the lowered position, the covering door 17 has a front surface 17a which, in conjunction with a front surface 2a of the main body 2, forms an uninterrupted front surface 1a of the peristaltic pump 1.

[0045] In the raised position, the covering door 17 lies distanced from the main body 2 and frees the access compartment 15 formed when the contact body 3 is in its second position.

[0046] It should also be noticed that rotation of the covering door 17 from the lowered position to the raised position causes the contact body 3 to move from the first position to the second position.

[0047] The covering door 17 comprises a front panel 18 and two parallel lateral shoulders 19 connected to opposite sides of the main body 2 and of the contact body 3.

[0048] In particular, the covering door 17 comprises pins 20 inserted in corresponding housing cavities 21 made in the main body 2 allowing rotation relative to the latter (Figures 3 and 4). In more detail, the pins 20 are made on the lateral shoulders 19 of the covering door 17.

[0049] The covering door 17 also comprises two projections 22 made on the shoulders 19 and eccentric relative to the pins 20. The projections 22 are slidably inserted in straight guides 23 made on opposite sides of the contact body 3.

[0050] When the covering door 17 rotates about its pins 20, the eccentric projections 22 slide along the guides 23, causing the contact body 3 to move between the first and second positions.

[0051] The contact body 3 comprises two tongues 24 located at its opposite sides and which can be housed in corresponding guide grooves 25 made in the main body 2.

[0052] Moreover, the contact body 3 comprises two central tabs 26 which are parallel with each other and housed in respective recesses 27 made in the main body 2.

[0053] The tongues 24 and the tabs 26 allow the contact body 3 to slide stably and efficiently relative to the main body 2.

[0054] When the contact body 3 is in the second position and the covering door 17 lies in the raised position, the cavities 21 for receiving the pins 20 and the straight guides 23 are aligned and communicating with each other. In this configuration, each pin 20 and each projection 22 is aligned with the corresponding guide 23.

[0055] In this case, the covering door 17 can be moved in such a way that the pins 20 can exit the receiving cavities 21 and enter the straight guides 23. In this way, the covering door 17 remains connected to the contact body 3 but it is disengaged from the main body 2. In other words, the contact body 3 can be moved away from the main body 2.

[0056] The peristaltic pump 1 also comprises a first sleeve 28 and a second sleeve 29 connected to the contact body 3 and open at the sides for housing respectively the intake coupling 7 and the delivery coupling 8 of the

tube 4 and keeping them in the correct position.

[0057] The intake coupling 7 and the delivery coupling 8 preferably lie parallel with each other.

[0058] Consequently, the first sleeve 28 and the second sleeve 29 also lie parallel with each other.

[0059] In this embodiment the contact surface 14 is semi-cylindrical. Advantageously, this allows the constrictions to be maintained for as long as possible so as to increase peristaltic pump 1 efficiency above all at high operating speeds.

[0060] The main body 2 comprises a supporting portion 30 and a base 31 which are fixed to each other. For example, the supporting portion 30 is fixed to the base 31 by screws.

[0061] The rotor 9 is rotatably connected between the base 31 and the supporting portion 30. In other words, the tube 4 is housed between the contact body 3 and the supporting portion 30 of the main body 2.

[0062] The contact body 3 slides on the base 31 towards and/or away from the supporting portion 30.

[0063] In the preferred embodiment, the base 31 comprises a curved wall 32 at least partly forming the contact surface 14 (Figures 2 and 5).

[0064] More precisely, when the contact body 3 lies in the first position described, the curved wall 32 made in the base 31 is alongside the inner wall 13 of the contact body 3. In this way, the curved wall 32 and the inner wall 13 form, in conjunction with each other, a single contact surface 14. In other words, the constrictions formed by the rollers 10 in conjunction with the contact body 3 also partly extend in the base 31, lying on the curved wall 32.

[0065] The curved wall 32 has a predetermined width so that when the curved wall 32 is drawn near the inner wall 13, the overall length of the contact surface 14 is substantially equal to the width of the tube 4 at the constrictions. Similarly, the rollers 10 have a length substantially equal to the width of the tube 4 at the constrictions.

[0066] If the peristaltic pump 1 capacity has to be changed, the tube 4 must be substituted. In detail, it should be noticed that one of the things on which the capacity of the peristaltic pump 1 depends is the internal diameter of the tube 4. If the capacity must be increased, the tube 4 must be substituted with another tube that has a bigger diameter. Similarly, if the capacity must be reduced, the tube 4 is substituted with a tube having a smaller diameter.

[0067] In any case, the width of the contact surface 14 must be substantially equal to the width of the tube 4 at the constrictions. Consequently, after changing the tube 4 the width of the contact surface 14 must also be adapted.

[0068] Advantageously, in the embodiment described, the width of the contact surface 14 is adapted simply and rapidly by changing only the base 31.

[0069] A plurality of bases 31 may be prepared, each having the curved wall 32 with a predetermined and distinct width, so that, in conjunction with the inner wall 13 of the contact body 3, the width of the contact surface 14

is adapted according to the diameter of the tube 4.

[0070] As a result, if the peristaltic pump 1 capacity must be changed, it is sufficient to substitute, as well as the tube 4, only the base 31 and the rotor 9, without working on any other parts of the peristaltic pump 1.

[0071] In another embodiment, not illustrated, the peristaltic pump 1 comprises a spacer which is positioned between the base 31 and the supporting portion 30.

[0072] In this case, the curved wall 32 is made on the spacer. To change the capacity of the peristaltic pump 1 by changing the tube 4, only the spacer needs substituting.

[0073] The invention achieves the preset aims and brings important advantages.

[0074] Since the peristaltic pump comprises a contact body which can move by sliding relative to the main body, the tube can be checked and substituted, if necessary, in an extremely simple and rapid fashion. It is sufficient to move the contact body along the main body to move the inner wall away from the rotor, creating the access compartment and freeing the tube.

[0075] This operation is simple to perform, since it only involves lifting the covering door to cause the contact body to slide.

[0076] Another advantage indicated above relates to the angling of the intake and delivery couplings. Since said couplings are parallel with each other, the constrictions produced by the rollers cover an arc of a circle substantially equivalent to 180°. As already indicated, this increases peristaltic pump efficiency both at low and high speeds, and means that the pump is much more compact than prior art pumps.

[0077] Another advantage of the peristaltic pump in accordance with the present invention relates to the contact surface which is partly formed by the inner wall of the contact body and partly formed by the curved surface of the base of the main body.

Claims

1. A peristaltic pump, **characterised in that** it comprises:

- a main body (2);
- a contact body (3) slidably connected to the main body (2) and having at least one vaulted inner wall (13) for at least partly forming a contact surface (14);
- a flexible tube (4) positioned at least partly inside the main body (2), allowing the transit of a fluid from an intake section (5) to a delivery section (6);
- at least two rollers (10) positioned inside the main body (2) and able to move along a circular trajectory to press the tube (4) against the contact surface (14) and produce corresponding constrictions moving from the intake section (5)

- to the delivery section (6);
the contact body (3) being able to move between a first position, in which the inner wall (13) is at its closest to the rollers (10), and a second position, in which the inner wall (13) is at its furthest from the rollers (10) and a tube (4) access compartment (15) is formed.
2. The pump according to claim 1, **characterised in that** it also comprises movement means (16) connected to the contact body (3) for moving the latter between said first and second positions.
 3. The pump according to claim 2, **characterised in that** the movement means (16) comprise a covering door (17) pivoting at the main body (2) and connected to the contact body (3); the covering door (17) being able to move by rotating between a lowered position to define the first position of the contact body (3) and a raised position to define the second position of the contact body (3).
 4. The pump according to claim 3, **characterised in that** the covering door (17) comprises a pin (20) inserted in a receiving cavity (21) made in the main body (2) for rotating relative to the latter and at least one projection (22) which is eccentric relative to the pin (20) and slides in a guide (23) made in the contact body (3).
 5. The pump according to claim 4, **characterised in that** the receiving cavity (21) is aligned with the guide (23) when the contact body (3) is in its second position.
 6. The pump according to claim 5, **characterised in that** the pin (20) can move from a first position in which it lies in the cavity (21) to a second position in which it is outside the cavity (21), allowing the contact body (3) to be separated from the main body (2).
 7. The pump according to any of the foregoing claims, **characterised in that** the contact body (3) comprises at least one tongue (24) which can be inserted in a guide groove (25) made in the main body (2), allowing the contact body (3) to move relative to the main body (2).
 8. The pump according to any of the foregoing claims, **characterised in that** it also comprises a first sleeve (28) for supporting the tube (4) at the intake section (5) and a second sleeve (29) for supporting the tube (4) at the delivery section (6).
 9. The pump according to any of the foregoing claims, **characterised in that** it also comprises a rotor (9) which is rotatably connected to the main body (2) for supporting the rollers (10).
 10. The pump according to any of the foregoing claims, **characterised in that** the flexible tube (4) comprises an intake coupling (7) and a delivery coupling (8) which are positioned parallel with each other.
 11. The pump according to claim 10, **characterised in that** the inner wall (13) of the contact body (3) is semi-cylindrical.
 12. The pump according to any of the foregoing claims, **characterised in that** the main body (2) comprises a supporting portion (30) and a base (31) which are fixed to each other; the contact body (3) sliding on the base (31) towards and/or away from the supporting portion (30).
 13. The pump according to claim 12, **characterised in that** the base (31) comprises a curved wall (32) at least partly forming the contact surface (14).
 14. The pump according to claim 13, **characterised in that** the curved wall (32) lies alongside the inner wall (13) when the contact body (3) lies in the first position, thus forming the contact surface (14) in conjunction with the vaulted inner wall (13) of the contact body (3).
 15. The pump according to any of the claims from 12 to 14, **characterised in that** it also comprises a spacer which can be inserted between the base (31) and the supporting portion (30); the spacer comprising a curved wall which can be aligned with the inner wall (13) of the contact body (3).
 16. A peristaltic pump, **characterised in that** it comprises:
 - a main body (2);
 - a contact body (3) slidably connected to the main body (2) and having at least one vaulted inner wall (13) for at least partly forming a contact surface (14);
 - a flexible tube (4) positioned at least partly inside the main body (2), allowing the transit of a fluid from an intake section (5) to a delivery section (6);
 - at least two rollers (10) positioned inside the main body (2) and able to move along a circular trajectory to press the tube (4) against the contact surface (14) and produce corresponding constrictions moving from the intake section (5) to the delivery section (6);
 the contact body (3) being able to move between a first position, in which the inner wall (13) is at its closest to the rollers (10), and a second position, in which the inner wall (13) is at its furthest from the rollers (10) and a tube (4) access compartment (15) is formed; the flexible tube (4)

comprising an intake coupling (7) and a delivery coupling (8) which are positioned parallel with each other.

17. A peristaltic pump, **characterised in that** it comprises: 5

- a main body (2);
 - a contact body (3) slidably connected to the main body (2) and having at least one vaulted inner wall (13) for at least partly forming a contact surface (14); 10
 - a flexible tube (4) positioned at least partly inside the main body (2), allowing the transit of a fluid from an intake section (5) to a delivery section (6); 15
 - at least two rollers (10) positioned inside the main body (2) and able to move along a circular trajectory to press the tube (4) against the contact surface (14) and produce corresponding constrictions moving from the intake section (5) to the delivery section (6); 20
- the contact body (3) being able to move between a first position, in which the inner wall (13) is at its closest to the rollers (10), and a second position, in which the inner wall (13) is at its furthest from the rollers (10) and a tube (4) access compartment (15) is formed; the main body (2) comprising a supporting portion (30) and a base (31) which are fixed to each other; the contact body (3) sliding on the base (31) towards and/or away from the supporting portion (30); the base (31) comprising a curved wall (32) at least partly forming the contact surface (14). 25 30 35

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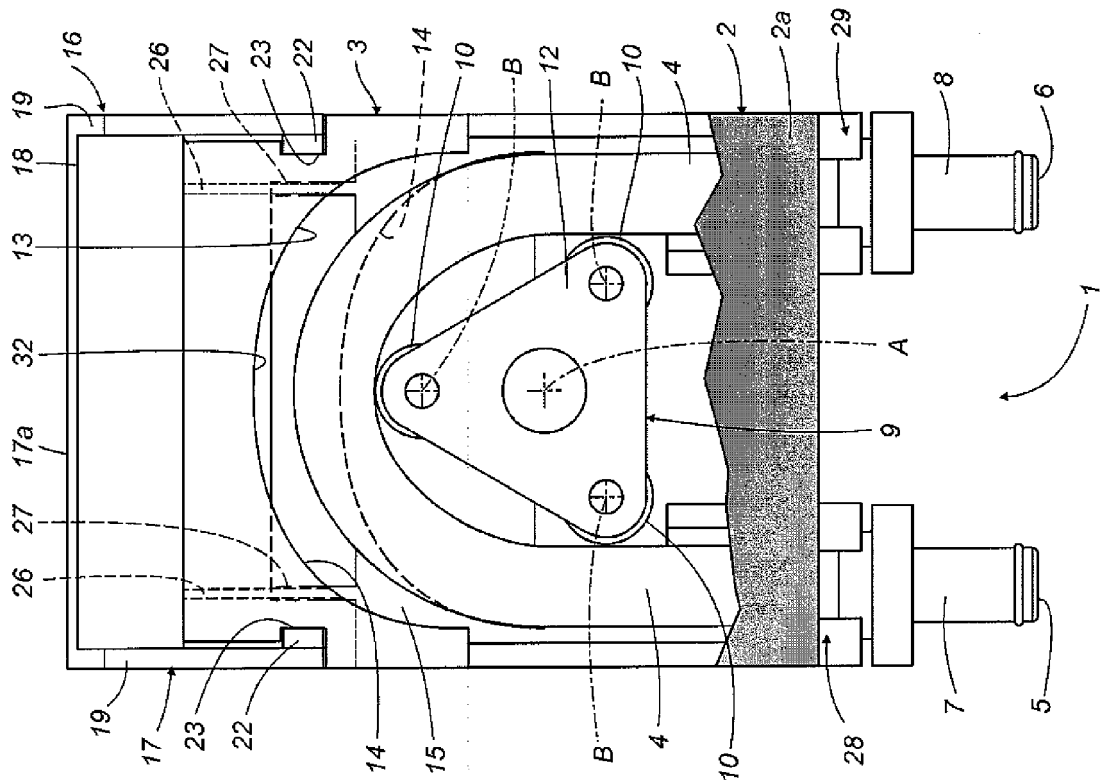


FIG. 2

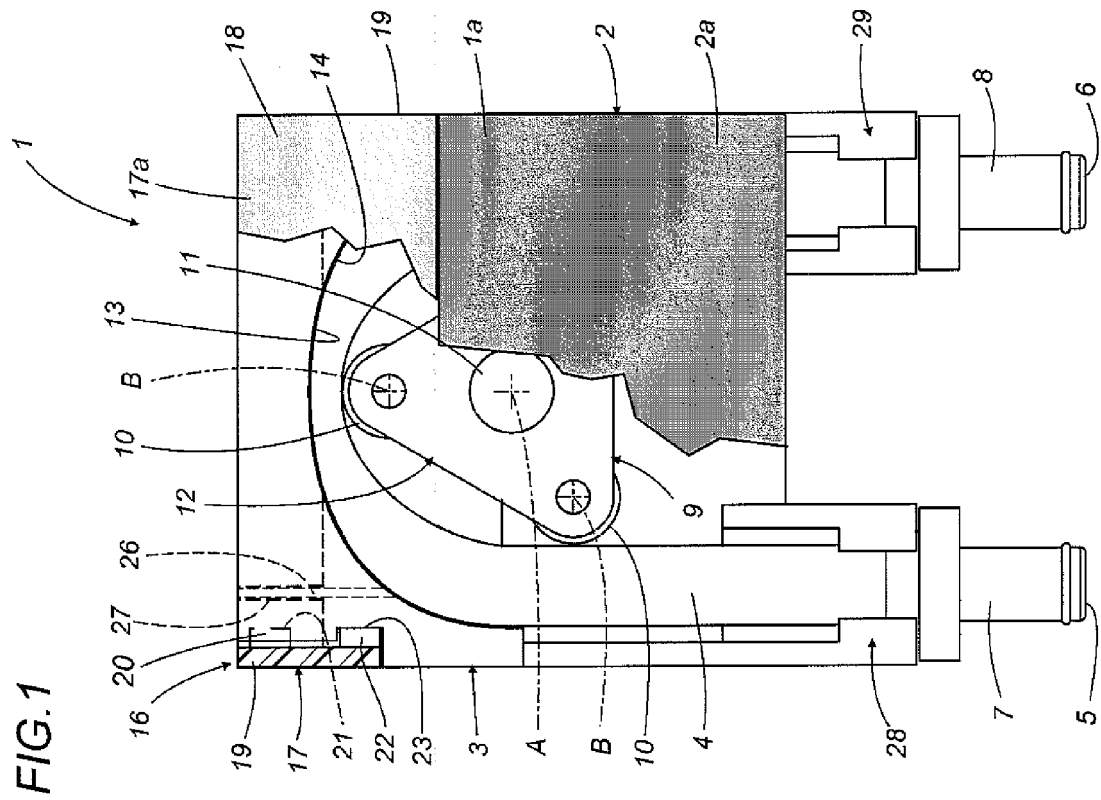
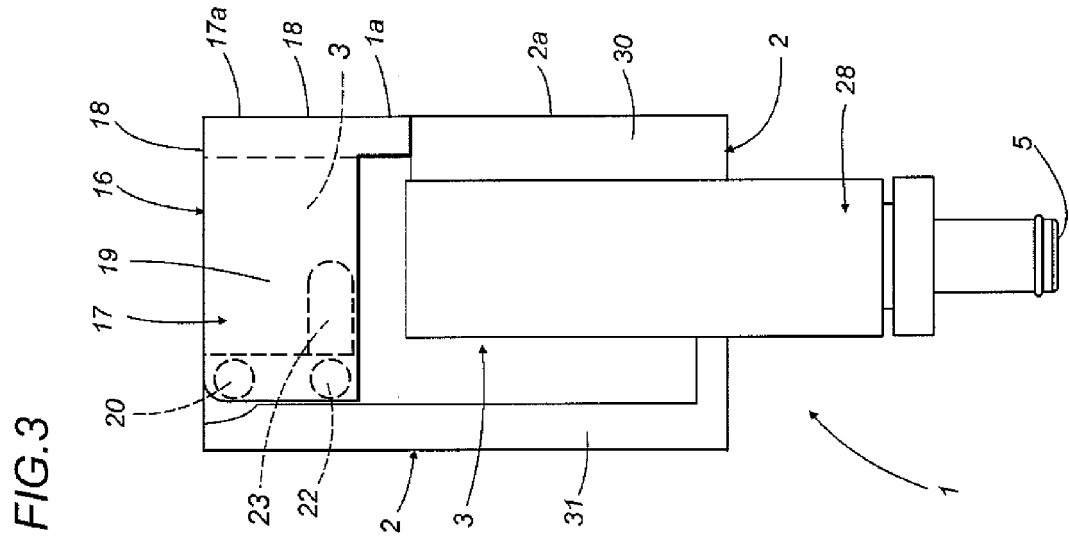
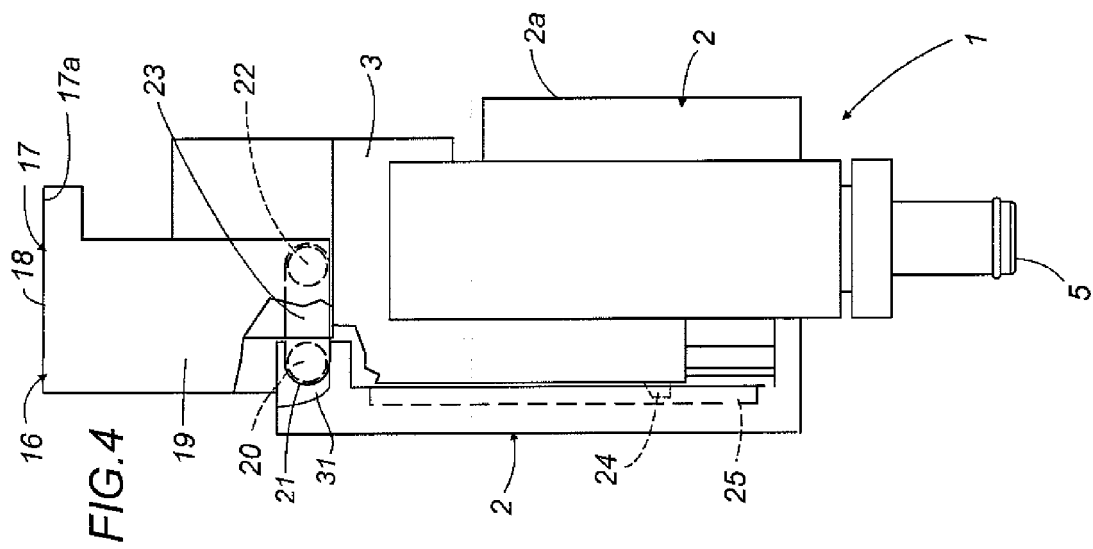
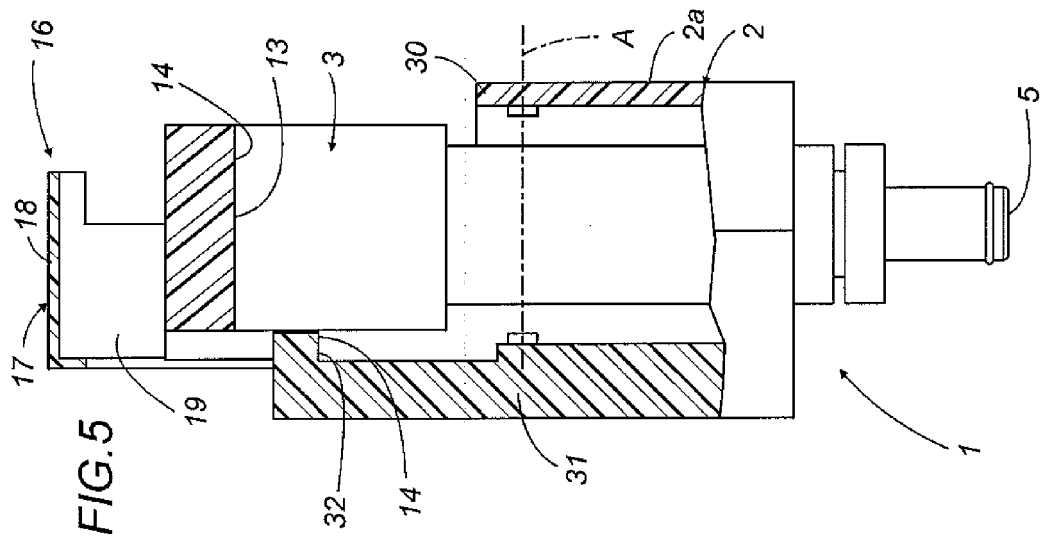


FIG. 1





EUROPEAN SEARCH REPORT

Application Number
EP 09 15 4479

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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 09 15 4479

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