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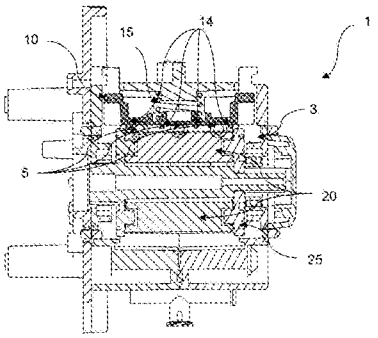
(54) **PERISTALTIC PUMP.**

(57) The present disclosure relates to a peristaltic pump and provides a peristaltic pump, comprising a motor and a cassette with a rotor that is connected to the motor, wherein the rotor comprises a plurality of rollers, wherein at least one tube which surrounds the rotor partially is located between the plurality of rollers and a pressure plate which is mounted to a housing, wherein a spring is located between pressure plate and a housing cover for applying a force to the pressure plate against the at least one tube, wherein the pressure plate comprises guiding ribs located on the inner surface of the pressure plate facing the at least one tube and the guiding ribs are located on both sides of the at least one tube

FIG. 1



PERISTALTIC PUMP

DESCRIPTION

Field of the Invention

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

Brief description of the related art

[0002] Automated analyser systems for use in clinical diagnostics and life sciences are produced by a number of companies. For example, STRATEC® SE, Birkenfeld, Germany, produces a number of devices for specimen handling and detection for use in automated analyser systems and other laboratory instrumentation.

[0003] Different liquids are used during analytical assay in such analytical systems. Liquid waste results from the processing of samples with which have to be removed from the system, e.g. by pumps. Usually, the liquids are inhomogeneous and represent thus a potential risk for many pump technologies. As a result, the pumps wear out very quickly, which leads to increased maintenance effort and thus higher costs. In addition, potential leakage increases the risk of contamination in the unit.

[0004] Various pump technologies are commonly known from the prior art comprising gear pumps, diaphragm pumps, piston pumps, and peristaltic pumps. Many pump types are often unsatisfactory in terms of fault susceptibility.

[0005] Common faults are caused by deposits in the pump head and thus an insufficient delivery rate, pressure or lack of backflow resistance up to a complete failure of the pump. These faults can occur when pumping liquids that are corrosive, tend to precipitate or flocculate, contain particles or tend to deposit or stick together.

[0006] A backflow of liquid waste through the pump is a potential contamination risk for the patient sample and would negatively influence running assays so that they must be prevented at all costs.

[0007] Sticking or clogging of the valves by e.g. particles (blood, stool, etc...) in the liquid or by proteins or other sticky components from the patient samples and/or the reagents represent a risk for pump failure when using piston pumps or diaphragm pumps. Gearbox or gear pumps are basically very robust, but they have no backflow-proof.

[0008] In peristaltic pumps, the peristaltic hose is subject to increased wear due to the pump working principle and they must be replaced regularly as part of maintenance intervals. Since an incorrectly inserted hose can lead to a pump malfunction or loss of backflow resistance, this is a critical step. Therefore, hose replacement is reserved for a trained service technician. Nevertheless, errors can also occur here, which in the worst case can affect the running analysis.

[0009] The present invention is intended to prevent pump errors.

Object of the Invention

[0010] It is therefore the object of this invention to provide an improved peristaltic pump regarding durability and usability or misuse as well as modularity. The invention is intended to prevent errors when changing hoses and at the same time to simplify this step so that the hose can be changed by the standard or trained operator. Thus, a costly and time-consuming service call is eliminated.

Summary of the Invention

[0011] The present invention provides a peristaltic pump, comprising a motor and a cassette with a rotor that is connected to the motor, wherein the rotor comprises a plurality of rollers, wherein at least one tube which surrounds the rotor partially is located between the plurality of rollers and a pressure plate which is mounted to a housing, wherein a spring is located between

pressure plate and a housing cover for applying a force to the pressure plate against the at least one tube, wherein the pressure plate comprises guiding ribs located on the inner surface of the pressure plate facing the at least one tube and the guiding ribs are located on both sides of the at least one tube.

[0012] Another aspect of a peristaltic pump according to the present disclosure relates to the cassette comprising a maximum to three tubes which are located next to each other and separated by the guiding ribs of the pressure plate.

[0013] In another embodiment of a peristaltic pump according to the present disclosure, both ends of the at least one tube are each connected to an external connector.

[0014] It is further envisaged that the external connector may comprise in its upper part a vertical tube connector for receiving a tube's end.

[0015] The peristaltic pump of any one of claims 1 to 4, wherein a bridge comprising a grip is located below the tube connector.

[0016] Another embodiment of a peristaltic pump of claim 5 provides a bridge comprising at both ends connecting elements and housing plates arranged at both sides of the housing cover comprise a recess for receiving the connecting elements.

[0017] The tube connectors of neighbouring tubes may join in a horizontal collector tube. In a peristaltic pump according to the present invention.

[0018] The peristaltic pump may comprise a collector tube that comprises a maximum of three downwards projecting outlets.

[0019] The three cassettes of a peristaltic pump according to the present invention can be attached to another by bayonet couplings and the motor axis is extended by an axis, wherein the axis may comprise on its end cross-shaped couplings for their connection.

[0020] In another embodiment of a peristaltic pump according to the present invention, the housing cover of a cassette can be fixed with a lid that is configured for locking, wherein the lid can be locked by rotation.

[0021] The peristaltic pump may further comprise at least two attached cassettes to the motor, wherein a gearing is arranged between the at least two cassettes.

[0022] Still other aspects, features, and advantages of the present invention are readily apparent from the following detailed description, simply by illustrating preferable embodiments and implementations. The present invention is also capable of other and different embodiments and its several details can be modified in various obvious respects, all without departing from the spirit and scope of the present invention. Accordingly, the drawings and descriptions are to be regarded as illustrative in nature, and not as restrictive. Additional objects and advantages of the invention will be set forth in part in the description which follows and in part will be obvious from the description, or may be learned by practice of the invention.

Summary of the Figures

[0023] The invention will be described based on figures. It will be understood that the embodiments and aspects of the invention described in the figures are only examples and do not limit the protective scope of the claims in any way. The invention is defined by the claims and their equivalents. It will be understood that features of one aspect or embodiment of the invention can be combined with a feature of a different aspect or aspects of other embodiments of the invention, in which:

[0024] FIG. 1 shows a sectional view through a peristaltic pump with tubes which are separated from another by guiding ribs.

[0025] FIG. 2 shows a sectional view through a peristaltic pump.

[0026] FIG. 3 shows a pressure plate with guiding ribs.

[0027] FIG. 4A shows a peristaltic pump comprising one cassette.

[0028] FIG. 4B shows a peristaltic pump comprising two cassettes.

[0029] FIG. 4C shows a peristaltic pump comprising three cassettes.

[0030] FIG. 5 shows a cassette comprising three tubes and an external connector with a single outlet.

[0031] FIG. 6 an embodiment of a cassette with three tubes and an external connector with three outlets.

[0032] FIG. 7 shows an embodiment of a cassette with two tubes and an external connector with a single outlet.

[0033] FIG. 8 an embodiment of a cassette with a single tube and an external connector with a single outlet.

[0034] FIG. 9 shows a perspective view onto a cassette with bayonet connector for a cap.

[0035] FIG. 10 shows a motor with two cassettes, wherein the inner cassette is blanked for showing the connecting axis.

[0036] FIG. 11 shows the complete arrangement of motor with two attached cassettes and a gearbox located between the two cassettes.

[0037] FIG. 12 shows a sectional view through a motor and two cassettes which are attached to the motor and a gearbox between the two cassettes.

[0038] FIG. 13 shows a perspective view onto a housing plate for attaching external connectors.

[0039] FIG. 14 shows a sectional view through a housing plate with external connectors as shown in FIG. 13.

[0040] FIG. 15 shows the interaction between a housing cover and the connecting elements of a bridge.

[0041] FIG. 16 shows a correctly locked housing cover of a cassette.

[0042] FIG. 17 shows an unfixed housing cover with lockable lid.

[0043] FIG. 18 shows a locked lid with a not correctly applied housing cover.

[0044] FIG. 19 shows a sectional view through the depiction of FIG. 18.

Detailed Description of the Invention and the Figures

[0045] The technical problem is solved by the independent claims. The dependent claims cover further specific embodiments of the invention.

[0046] The terms tube and hose are used synonymously. The term fluid comprises liquids and gasses which may comprise solids.

[0047] The present invention is based on the use of a peristaltic pump for handling liquid waste as described above without causing damage or impairing performance of the system. One important element of the present invention is the peristaltic tube, which forms chambers by constrictions. These chambers are moved along the hose by peristalsis and thus generate the flow. The pump does not need any further flow-directing elements such as switch-over or non-return valves. The peristaltic hose, as a wearing element, can be replaced regularly.

[0048] In addition to the above-mentioned advantages, there are also some design-related disadvantages of the solutions from the prior art which are solved by the present invention in order to convey the problematic liquids occurring in analytical systems in a process-safe manner.

[0049] The peristaltic tube is subject to an increased wear in addition to the usual mechanical wear of a pump mechanism, caused by:

- Abrasion on the inner cross-section of the hose due to the peristaltic movements.
- Abrasion on the outside of the hose to the rollers of the rotor which generate the peristaltic movement on the hose.
- Abrasion on the outside of the hose towards the pressure surface.
- Abrasion due to the relative movement when two hoses arranged next to each other touch inside the pumping chamber

A device according to the present invention provides guiding ribs that at the surface of a pressure plate directed towards the tubes for preventing the peristaltic tubes from moving sideways and thus from touching neighbouring tubes. Thus, the tubes are properly positioned for preventing any collisions between neighbouring tubes. The pressure plate is spring-mounted. The contact pressure between pressure plate and hoses is configured for ensuring a safe, backflow-proof operation. At the same time, however, the contact pressure is configured that the hose is sufficiently squeezed by the rollers, so that the inner contour is just completely closed. The pressure has to be adjusted that it is not too low, so that the hose is not completely closed, and the pump performance deteriorates and the pump is no longer backflow-proof. On the other hand, if the pressure is too high, the wear of the hose increases. In essence, the pressure is depending on the properties of the hose with respect to its diameter, material, the thickness of the walls etc. Thus, the pressure is adjusted to the minimal required contact pressure so that the rollers will close the hose completely during pressing it to the pressure plate.

[0050] A device according to the present disclosure does not comprise flow direction indicating elements such as change-over or non-return valves. A backflow resistance is solely generated by the sealing fit of the compressed peristaltic tube. This contact pressure is generated by a helical spring. The force is transmitted to a upper pressure plate which finally presses the peristaltic tubes onto the rotor or the pressure rollers, respectively, underneath.

[0051] In addition to reducing the wear, the spring-loaded upper pressure plate is related to further advantages: The nominal flow rate of a peristaltic pump is determined by the speed, the number of rotors and the internal cross-section of the peristaltic tube. The latter add up to the volume that can be pumped per revolution. The contact pressure has also an influence on the delivery rate. By using a helical spring as the element that causes the contact pressure, the contact pressure on the peristaltic tube can be kept constant by selecting a spring with a suitable spring characteristic curve, even if its dimensions vary within the usual production tolerances. It will also be possible to compensate manufacturing and assembly-related tolerances via this mechanism.

[0052] A device according to the present disclosure provides further a higher flexibility of the pump in analysis systems. Depending on the system, the number of required channels and the

flow rates per channel may change. In principle, several channels or pumps can be combined in all common peristaltic pumps in order to multiply the flow rate. However, this increases the complexity of the peripheral tubing.

[0053] In the present invention, the number of channels of the pump can be configured arbitrarily between 1 to 9 channels with a maximum of three so-called cassettes with three tubes in each cassette. A single cassette can hold between 1 to 3 channels, i.e. peristaltic tubes. Thus, a maximum of three pumps (cassettes) are driven by one motor. The connection between the housings of adjacent cassettes is made via a bayonet lock, which is additionally secured against rotation by means of a screw.

[0054] The axle is connected via a cross-shaped coupling which is male on one side and female on the other side. Within a cassette, this axle is only supported on the output side (away from the motor), the input side support is provided by the output side support of the previous cassette, or in the case of the first cassette, by the motor.

[0055] To reduce the complexity of the peripheral tubing and to save installation space, it is possible to combine all channels per cassette. Conversely, it is also possible to distribute from one common channel to three channels. Thus, for example, up to nine individual channels can be extracted. Only three channels must be discharged on the pressure side. It is also possible to combine the channels on the suction and pressure sides. This means that three channels can be used in parallel, which also triples the volume flow.

[0056] If only one tube is used in a cassette, a lower contact pressure is necessary, which is the reason for adjusting or reducing the spring force of the contact plate in this case. The cassettes of this alternative (cover, tube kit, cassette housing) are color-coded for a better differentiation and thus for reducing assembly errors (for instance: green= cassette for one tube, black = cassette for two and three tubes).

[0057] Furthermore, the speed of the following cassettes can be reduced by a ratio of 1:3 via a gear stage between two cassettes. Using a suitable channel configuration, ratios between 1:1 and 1:10 can be achieved. This means that the pump is also capable of producing mixing ratios beyond its pure application as a suction pump.

[0058] The device according to the present disclosure is not only directed to merely solve technical disadvantages but for solving disadvantages of known devices regarding the user interface. The present invention is intended to enable a trained user to independently replace the peristaltic tube as a wearing element within the scope of the usual maintenance intervals.

[0059] Currently available peristaltic pumps are related to the following discussed faults that can occur due to incorrect operation.

[0060] A problem may result from a peristaltic hose which is not correctly installed when it is replaced. This leads to an undefined contact pressure between the roller and the hose and thus to an undefined delivery volume and a pump that may not be resistant to backflow. It is possible that the pump still functions normally directly after the hose package has been replaced and only loses its function afterwards.

[0061] The present invention solves this first problem by having latching elements at both attachment points for the hose assemblies, which initially provide a haptic feedback for a correct installation of the hose. In addition, the housing cover cannot be closed if the peristaltic tube elements are not placed in the correct position, because the cover will collide with the retaining elements of the tubes.

[0062] A further problem in devices known from the prior art may result from a housing cover that is not correctly mounted or closed. As a result, the correct contact pressure will not be generated on the peristaltic tubes and the pump does thus not deliver correctly and/or is no longer non-refluxing. In this case, it is also conceivable that the pump still functions correctly initially and only gradually loses its function.

[0063] The pump according to the present disclosure has a central locking element, a bayonet lock, for avoiding this condition. Such a locking element allows basically only two states, open and closed. If the cover is closed, the full pressure is applied to the peristaltic tubes and the pump delivers correctly. If the lid is open, the pump does not deliver any liquid at all. This can be detected more easily by a downstream sensor system as an incorrect flow rate. The locking lever of the bayonet lock of a device according to the present disclosure has roughened grip surfaces and pictograms (open and closed lock) for simple and intuitive operation.

[0064] In addition to the purely mechanical issues mentioned above, there are also solutions in the field of electronics or embedded software which will be discussed below.

[0065] The peristaltic pump is driven by a stepper motor. The drive torque can be adjusted via the current intensity. The revolutions are monitored via a home sensor. This results in the following advantages:

- Overload protection and conveying process monitoring: An initialisation position is determined by the home sensor. The stepper motor can be used to count the number of steps it takes to reach the home sensor position again. A drive torque is predefined via the current intensity. If the motor does not reach the home position, an error is output and the pump stops operating. This could be the case, for example, if the resistance torque exceeds the drive torque due to a mechanical defect or a pressure-side blockage of the fluidic periphery.
- Avoidance of a memory effect in the peristaltic tube: If the drive of the pump always runs full revolutions (360°), this would mean that the rollers of the rotor would always be engaged in the same position of the peristaltic tube at standstill. Since the hose is an elastomer, it is also subject to the usual properties of the material. In the case of a constant, local pressure load, the material would be permanently deformed. For the inner cross-section, this would mean a permanent reduction. This in turn would have an effect on the delivery rate of the pump. To counteract this form of ageing, the stepper motor basically rotates through the 360° equivalent of steps plus one additional step. This distributes the local pressure load on the peristaltic tube over as large an area as possible.
- Predictive maintenance of the peristaltic tubes and pump mechanics: The embedded software carries out checks at regular intervals. During these checks, the current of the motor is gradually reduced until a loss of step can be detected. This allows changes in the mechanical system to be detected. These changes in turn result from wear in the pump mechanics, but mainly from wear of the hose. By constantly recording this current value over time in connection with suitable machine learning algorithms, a failure of the peristaltic tube as a maintenance part as well as a failure of the entire module can be predicted. In this way, timely maintenance can be initiated, and the downtime of the entire system can be reduced.

[0066] FIG. 1 shows a sectional view through a peristaltic pump 1 with tubes 5 which are separated from another by guiding ribs 14. Tubes 5 are pressed against roller 20 of the rotor 25 by pressure plate 10. A helical spring 15 provides a constant pressure of pressure plate 10 against tubes 5.

[0067] FIG. 2 shows a sectional view through a peristaltic pump 1, wherein the sectional plane is rotated by 90° in comparison to FIG. 1. The rotor 25 carries four rollers 20 in the shown embodiment. Pressure plate 10 is pressed by the force of helical spring 15 against tube 5.

[0068] FIG. 3 shows a pressure plate 10 with guiding ribs 14.

[0069] FIG. 4A shows a peristaltic pump 1 with an attached cassette 50. FIG. 4B shows a peristaltic pump 1 with two attached cassettes 50 and FIG. 4C shows a peristaltic pump 1 with three attached cassettes 50.

[0070] FIG. 5 shows a cassette 50 comprising three tubes 5 and an external connector 55 with a single outlet. The liquids are distributed to the three tubes 5 to a single outlet 56.

[0071] FIG. 6 shows an embodiment of a cassette 50 with three tubes 5. Each tube 5 is coupled to the connector 55 providing a separate outlet 56 for each tube 5.

[0072] FIG. 7 shows an embodiment of a cassette 50 with two tubes 5 and a single external connector 55 with a single outlet 56. The middle tube connector 6 is closed so that no liquid will leak.

[0073] FIG. 8 shows an embodiment of a cassette 50 with a single tube 5 connected to an external connector 55 with a single outlet 56. The two outer tubes are missing and consequently the external connector 55 does not provide the possibility to connect tubes at the two outer positions.

[0074] FIG. 9 shows a perspective view onto a cassette 50 with bayonet connector 51 for attaching further cassettes or a cap 52.

[0075] FIG. 10 shows in its upper right part a motor 2 with is coupled to two cassettes 50, wherein the housing of the cassette 50 next to the motor 2 is blanked out so that axis 7 becomes

visible which connects the axis 7 of neighbouring cassettes 50 by a cross-shaped coupling also to the rotary axis of the motor 2. The lower part of FIG 10 shows two connected axis 7 in more detail.

[0076] FIG. 11 shows the complete arrangement of a peristaltic pump 1 with two cassettes 50 attached to the motor 2 and a gearbox 60 located between the two cassettes 50. The gearbox 60 may be used to reduce the speed between neighbouring cassettes 50 in a defined ratio, which may be for instance in a range between 1:1 to 1:10.

[0077] FIG. 12 shows a sectional view through a motor 2 and two cassettes 50 which are attached to the motor 2 and a gearbox 60 between the two cassettes 50.

[0078] FIG. 13 shows a perspective view onto a housing plate 3 belonging to a cassette housing (not shown) for attaching external connectors 55 and cassettes (not shown). On its upper end, the external connector 55 provides three tube connectors 6 which are located above a bridge 8, wherein the tube connectors 6 extend downwards into a substantially horizontal collector tube 9. The external connector 55 in FIG. 13 provides a single outlet 56 extending substantially downwards from the substantially horizontal collector tube 9. A bridge 8 provides outwardly directed grips 13 for their handling. The ends of bridge 8 further comprise on their outer ends connecting elements 123 which engage into recesses 16 of housing plate 3 for the of the external connectors 55.

[0079] FIG. 14 shows a sectional view through a housing plate 3 with external connectors 55 as shown in FIG. 13, where interaction of connecting elements 123 and recesses 16 can be seen in more detail.

[0080] FIG. 15 shows in more detail that housing 12 cannot fit correctly when the external connectors 55 has not been fitted correctly by inserting connecting elements 123 into recesses 16. Thus, the connection between the connecting elements 123 and recesses 16 can be regarded as safety features for a correct assembly of a cassette with the external connectors.

[0081] FIG. 16 shows an embodiment of a cassette 50 with a correctly mounted housing 12 and a correctly locked lid 4.

[0082] FIG. 17 shows an embodiment of a cassette 50 with a housing cover 12 which is not correctly locked so that no pressure will be applied to the tubes, resulting in a loss of functionality of the peristaltic pump. A gap can be seen between housing cover 12 and the bridge 8 of the external connector due to the unlocked lid 4. Additionally, lid 4 is arrange in a kind of 45° with respect to housing cover 12 so that a user can easily realize that the hosuing cover 12 is not correctly closed.

[0083] FIG. 18 shows a cassette 50 with a lid 4 in a locked position, but again, a gap is visible between bridge 8 and housing cover 12 so that it can easily perceived that the housing cover 12 is not mounted correctly and a loss of function will result. In addition to the position of lid 4 or the gap between housing cover 12 and bridge 8, the pump will not work so that the device according to the present invention provides three features which will directly make a user aware of the fact that the device is not in an operation mode.

[0084] FIG. 19 shows a sectional view through the assembly shown in FIG. 18.

[0085] The advantages of a device according to the present invention can be summarised as follows:

- a reduced wear due to spring-loaded pressure plate;
- a reduced wear due to guide ribs on the pressure plate;
- a compensation of production-related tolerances through spring-loaded pressure plate;
- a clear positioning of the tube kit reduces the risk of errors and increases usability;
- a clear positioning of the housing cover with pressure plate reduces risk of error and increases usability:
- a high variability due to:
    i. number of cassettes;
    ii. number of channels per cassette;
    iii. combining or distributing of or to up to three channels; and
    iv. reduction of the speed between two cassettes by means of a gear stage
- operation monitoring by step counting; and
- predeterminable maintenance intervals.

[0086] The foregoing description of the preferred embodiment of the invention has been presented for purposes of illustration and description. It is not intended to be exhaustive or to limit the invention to the precise form disclosed, and modifications and variations are possible considering the above teachings or may be acquired from practice of the invention. The embodiment was chosen and described to explain the principles of the invention and its practical application to enable one skilled in the art to utilize the invention in various embodiments as are suited to the particular use contemplated. It is intended that the scope of the invention be defined by the claims appended hereto, and their equivalents. The entirety of each of the aforementioned documents is incorporated by reference herein.

Reference Numerals

1	peristaltic pump
2	motor
3	housing plate
4	lid
5	tube
6	tube connector
7	axis
8	bridge
9	collector tube
10	pressure plate
11	connecting tube
12	housing cover
13	grip
14	guiding rib
15	helical spring
16	recess
20	roller
25	rotor
50	cassette
51	bayonet coupling
52	cap
55	external connector
56	outlet
60	gearbox
123	connecting element

CLAIMS

1. A peristaltic pump, comprising a motor and a cassette with a rotor that is connected to the motor, wherein the rotor comprises a plurality of rollers, wherein at least one tube which surrounds the rotor partially is located between the plurality of rollers and a pressure plate which is mounted to a housing, wherein a spring is located between pressure plate and a housing cover for applying a force to the pressure plate against the at least one tube, wherein the pressure plate comprises guiding ribs located on the inner surface of the pressure plate facing the at least one tube and the guiding ribs are located on both sides of the at least one tube.

2. The peristaltic pump of claim 1, wherein the cassette comprises a maximum to three tubes which are located next to each other and separated by the guiding ribs of the pressure plate.

3. The peristaltic pump of claim 1 or 2, wherein both ends of the at least one tube are each connected to an external connector.

4. The peristaltic pump of any one of claims 1 to 3, wherein the external connector comprises in its upper part a vertical tube connector for receiving a tube's end.

5. The peristaltic pump of any one of claims 1 to 4, wherein a bridge comprising a grip is located below the tube connector.

6. The peristaltic pump of claim 5, wherein the bridge comprises at both ends connecting elements and housing plates arranged at both sides of the housing cover comprise a recess for receiving the connecting elements.

7. The peristaltic pump of any one of claims 1 to 6, wherein the tube connectors of neighbouring tubes join in a horizontal collector tube.

8. The peristaltic pump of claim 7, wherein the collector tube comprises a maximum of three downwards projecting outlets.

9. The peristaltic pump of any one of claims 1 to 8, wherein up to three cassettes are attached to another by bayonet couplings and the motor axis is extended by an axis.

10. The peristaltic pump of claim 9, wherein the axis comprises on its end cross-shaped couplings for their connection.

11. The peristaltic pump of any one of claims 1 to 10, wherein the housing cover of a cassette is fixed with a lid that is configured for locking.

12. The peristaltic pump of claim 11, wherein the lid is locked by rotation.

13. The peristaltic pump of any one of claims 1 to 12, comprising at least two cassettes attached to the motor, wherein a gearing is arranged between the at least two cassettes.

ANSPRÜCHE

1. Eine peristaltische Pumpe, die einen Motor und eine Kassette mit einem Rotor aufweist, der mit dem Motor verbunden ist, wobei der Rotor eine Vielzahl von Rollen aufweist, wobei mindestens ein Schlauch, der den Rotor teilweise umgibt, zwischen der Vielzahl von Rollen und einer Druckplatte angeordnet ist, die an einem Gehäuse befestigt ist, wobei eine Feder zwischen der Druckplatte und einem Gehäusedeckel angeordnet ist, um eine Kraft auf die Druckplatte gegen den mindestens einen Schlauch auszuüben, wobei die Druckplatte Führungsrippen aufweist, die auf der inneren Oberfläche der Druckplatte angeordnet sind, die dem mindestens einen Schlauch zugewandt ist, und die Führungsrippen auf beiden Seiten des mindestens einen Schlauchs angeordnet sind.

2. Die peristaltische Pumpe nach Anspruch 1, wobei die Kassette maximal drei Schläuche umfasst, die nebeneinander liegen und durch die Führungsrippen der Druckplatte getrennt sind.

3. Die peristaltische Pumpe nach Anspruch 1 oder 2, wobei beide Enden des mindestens einen Schlauchs jeweils mit einem externen Anschluss verbunden sind.

4. Die peristaltische Pumpe nach einem der Ansprüche 1 bis 3, wobei der externe Anschluss in seinem oberen Teil einen vertikalen Schlauchanschluss zur Aufnahme eines Schlauchendes aufweist.

5. Die peristaltische Pumpe nach einem der Ansprüche 1 bis 4, wobei sich unterhalb des Schlauchanschlusses eine Brücke mit einem Griff befindet.

6. Die peristaltische Pumpe nach Anspruch 5, dadurch gekennzeichnet, dass die Brücke an beiden Enden aus Verbindungselementen besteht und an beiden Seiten des Gehäusedeckels angeordnete Gehäuseplatten eine Ausnehmung zur Aufnahme der Verbindungselemente aufweisen.

7. Die peristaltische Pumpe nach einem der Ansprüche 1 bis 6, bei der sich die Schlauchanschlüsse benachbarter Schläuche zu einem horizontalen Sammelrohr verbinden.

8. Die peristaltische Pumpe nach Anspruch 7, wobei das Sammelrohr maximal drei nach unten ragende Auslässe aufweist.

9. Die peristaltische Pumpe nach einem der Ansprüche 1 bis 8, wobei bis zu drei Kassetten durch Bajonettkupplungen miteinander verbunden sind und die Motorachse um eine Achse verlängert ist.

10. Die peristaltische Pumpe nach Anspruch 9, wobei die Achse an ihrem Ende kreuzförmige Kupplungen zu ihrer Verbindung aufweist.

11. Die peristaltische Pumpe nach einem der Ansprüche 1 bis 10, wobei der Gehäusedeckel einer Kassette mit einem verschließbaren Deckel befestigt ist.

12. Die peristaltische Pumpe nach Anspruch 11, wobei der Deckel durch Drehung verriegelbar ist.

13. Die peristaltische Pumpe nach einem der Ansprüche 1 bis 12, mit mindestens zwei am Motor befestigten Kassetten, wobei zwischen den mindestens zwei Kassetten ein Getriebe angeordnet ist.

FIG. 1

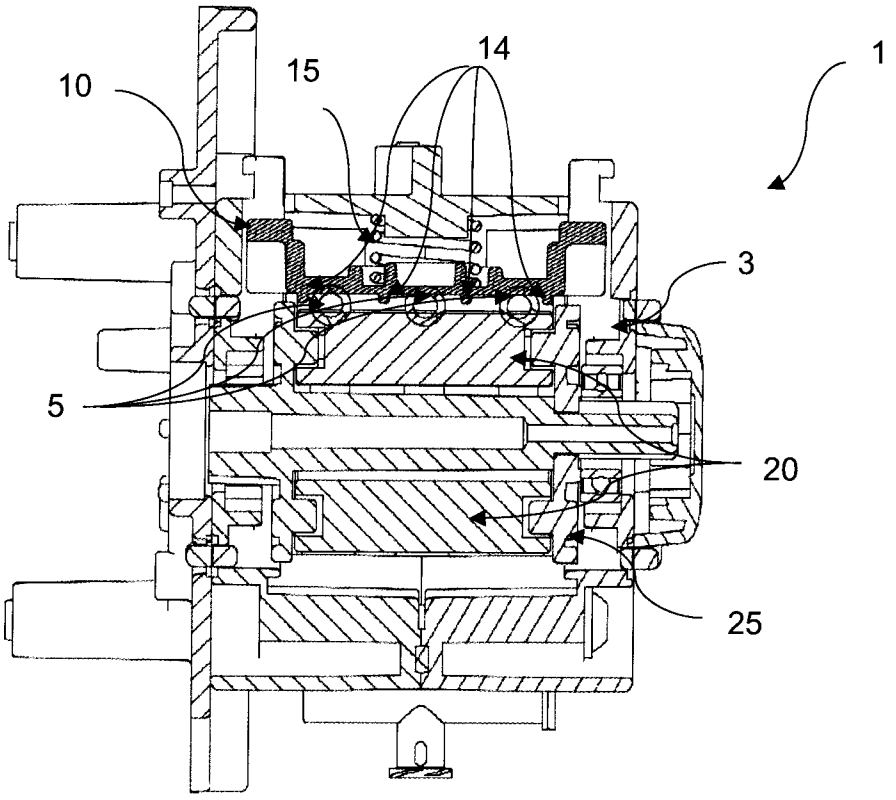


FIG. 2

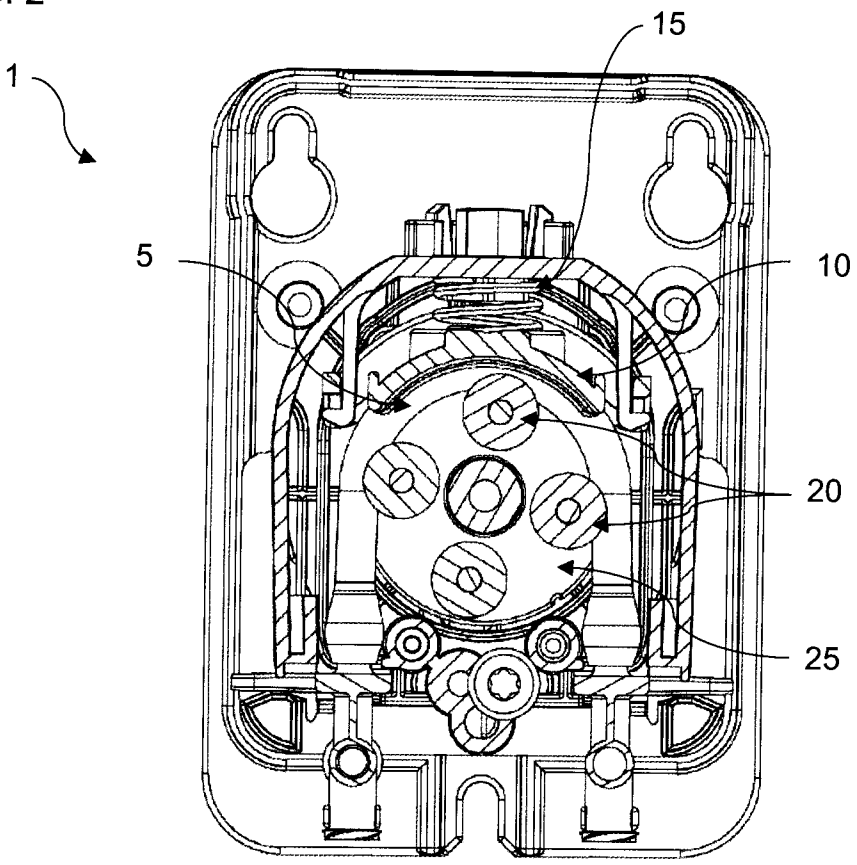


FIG. 3

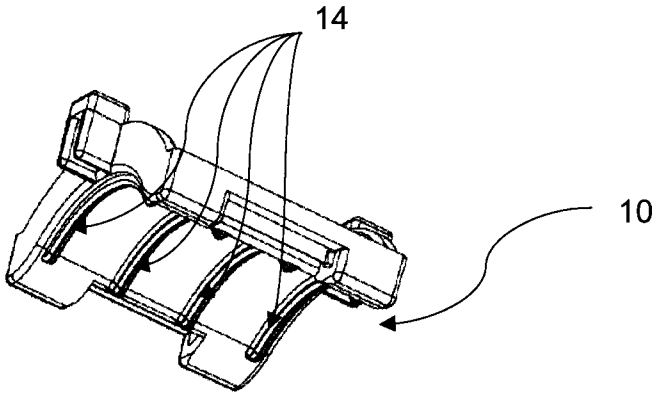
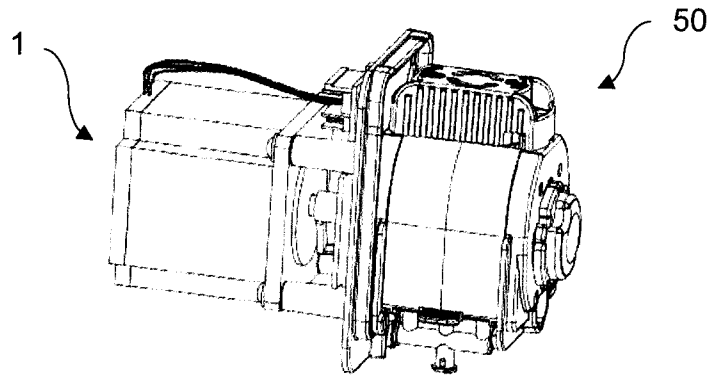
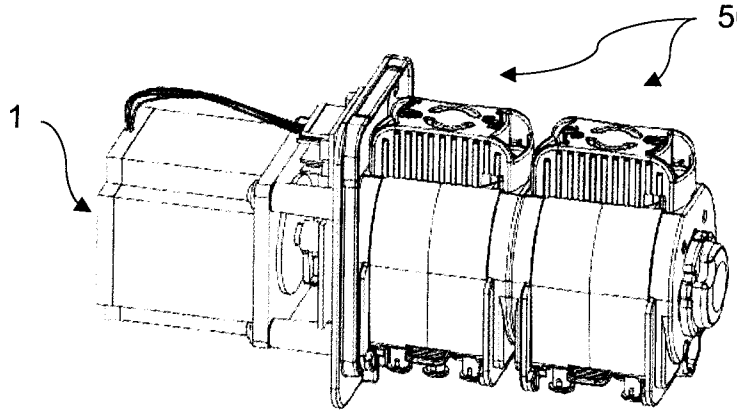


FIG. 4

A



B



C

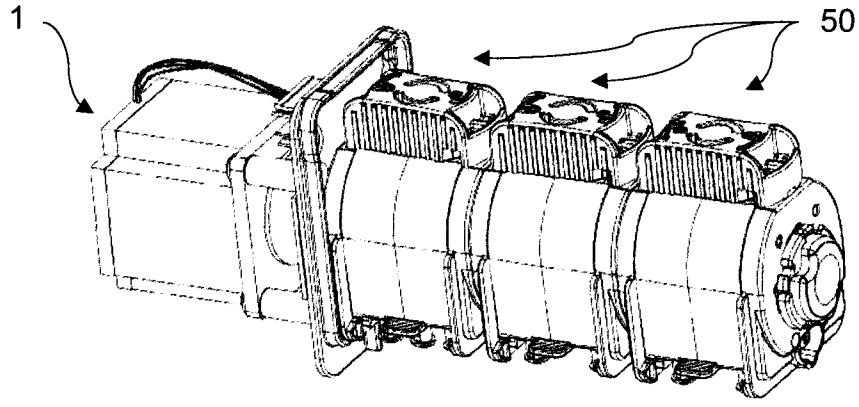


FIG. 5

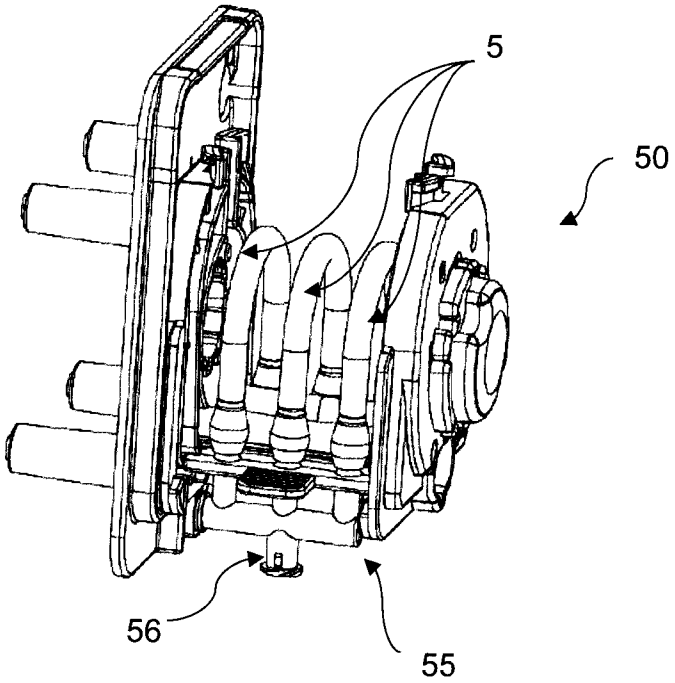


FIG. 6

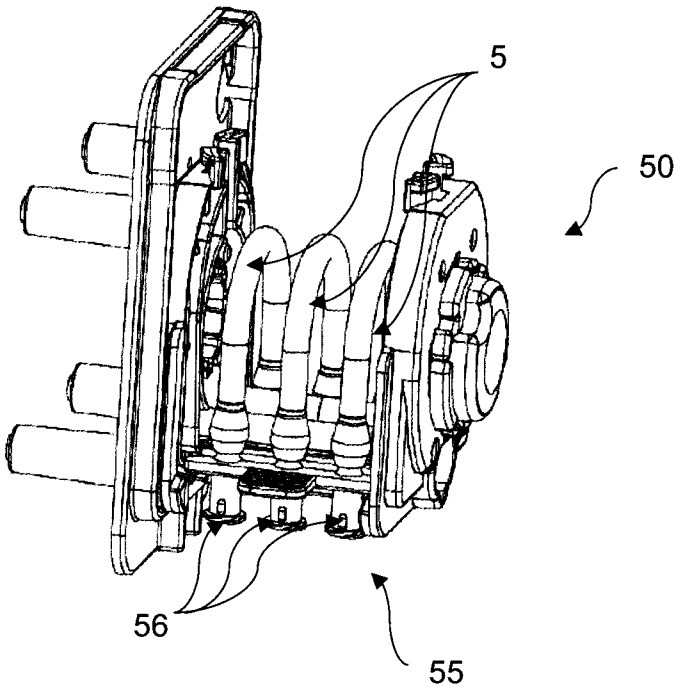


FIG. 7

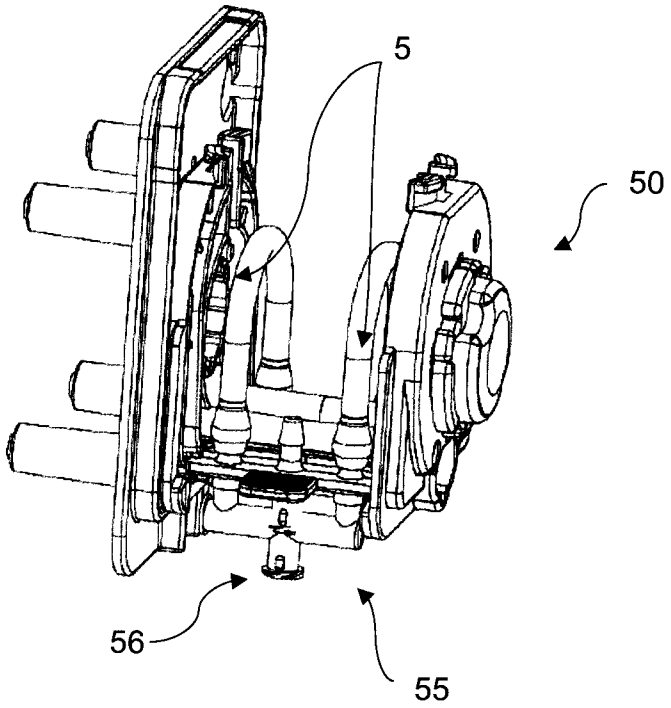


FIG. 8

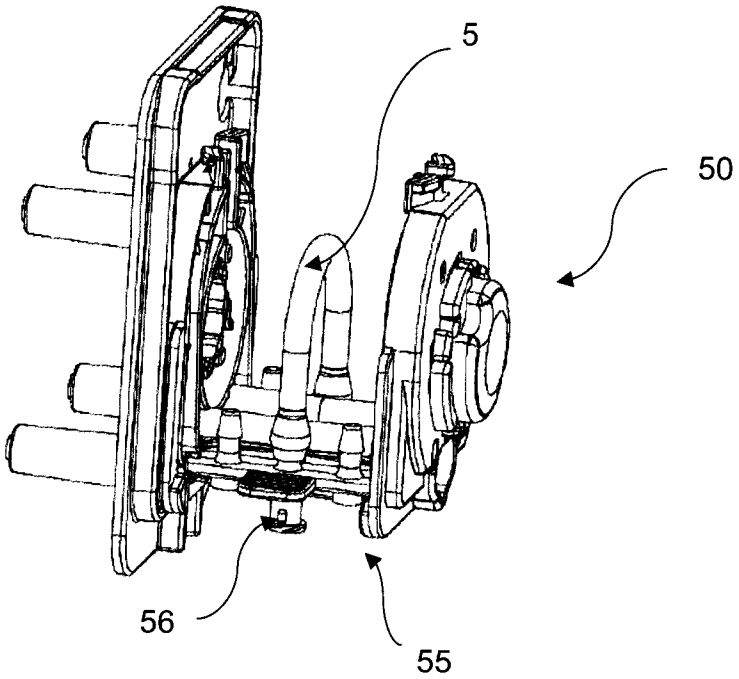


FIG. 9

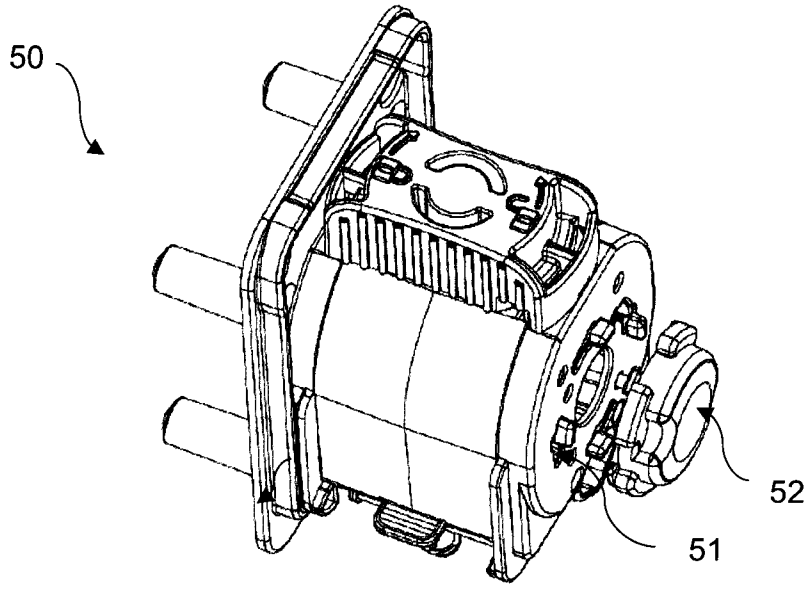


FIG. 10

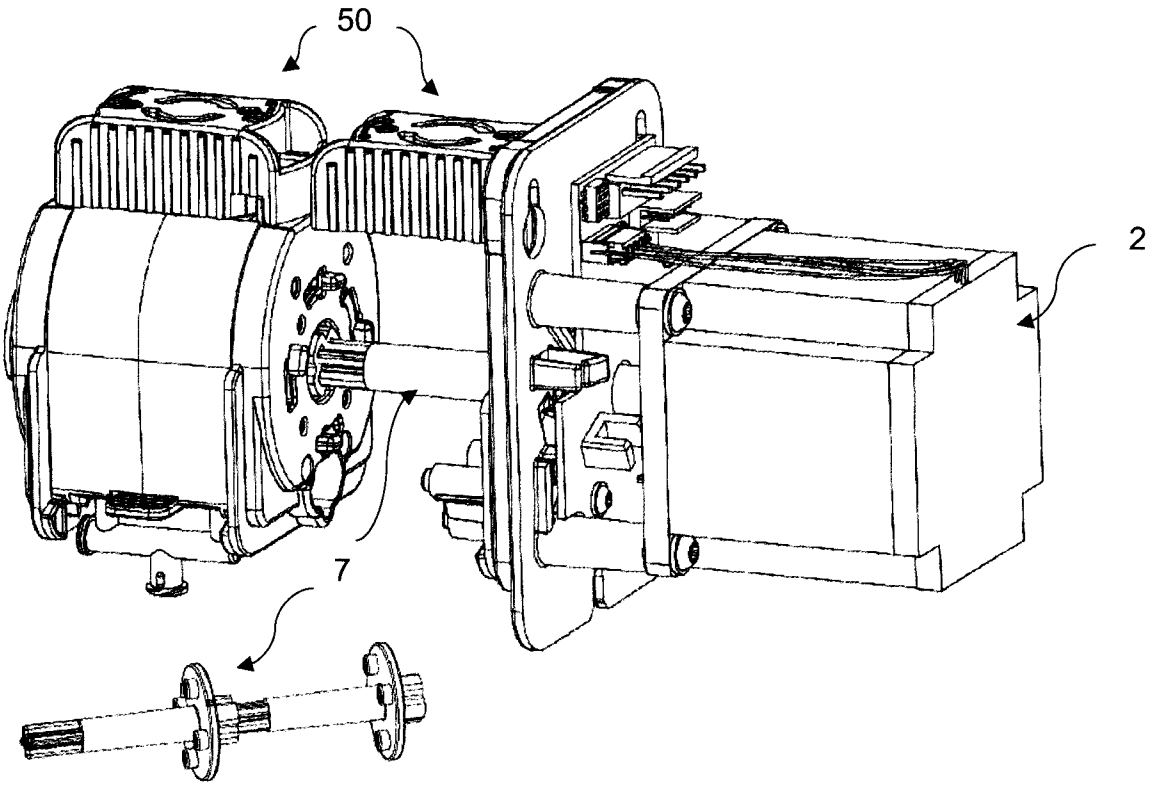


FIG. 11

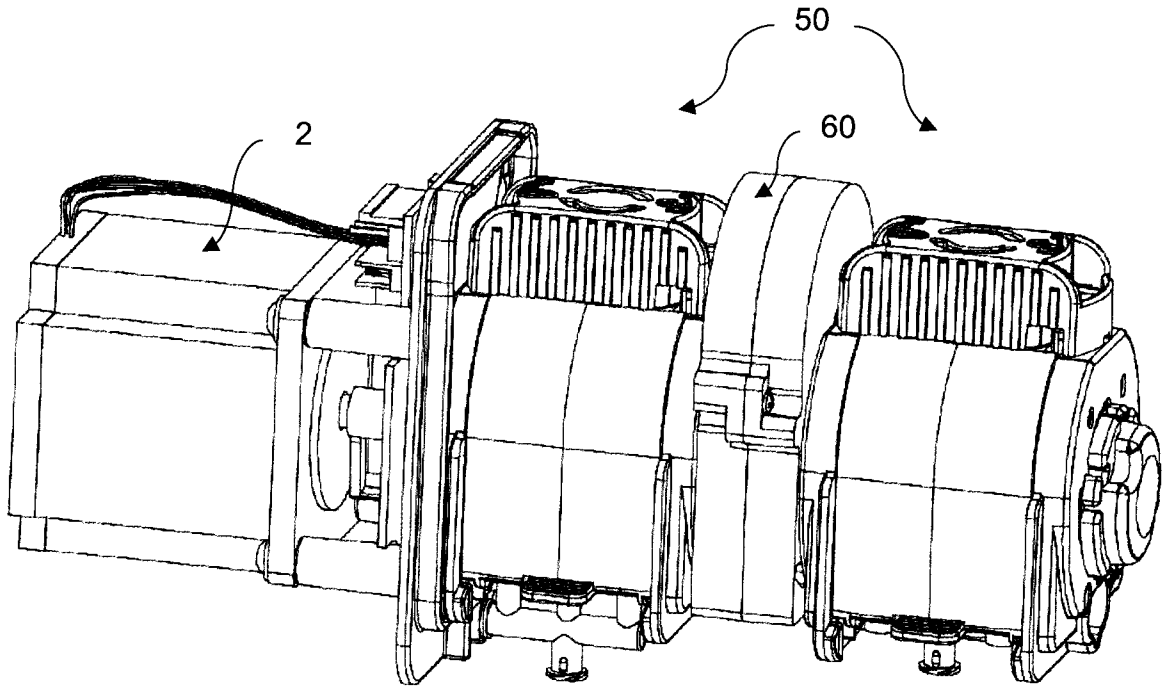


FIG. 12

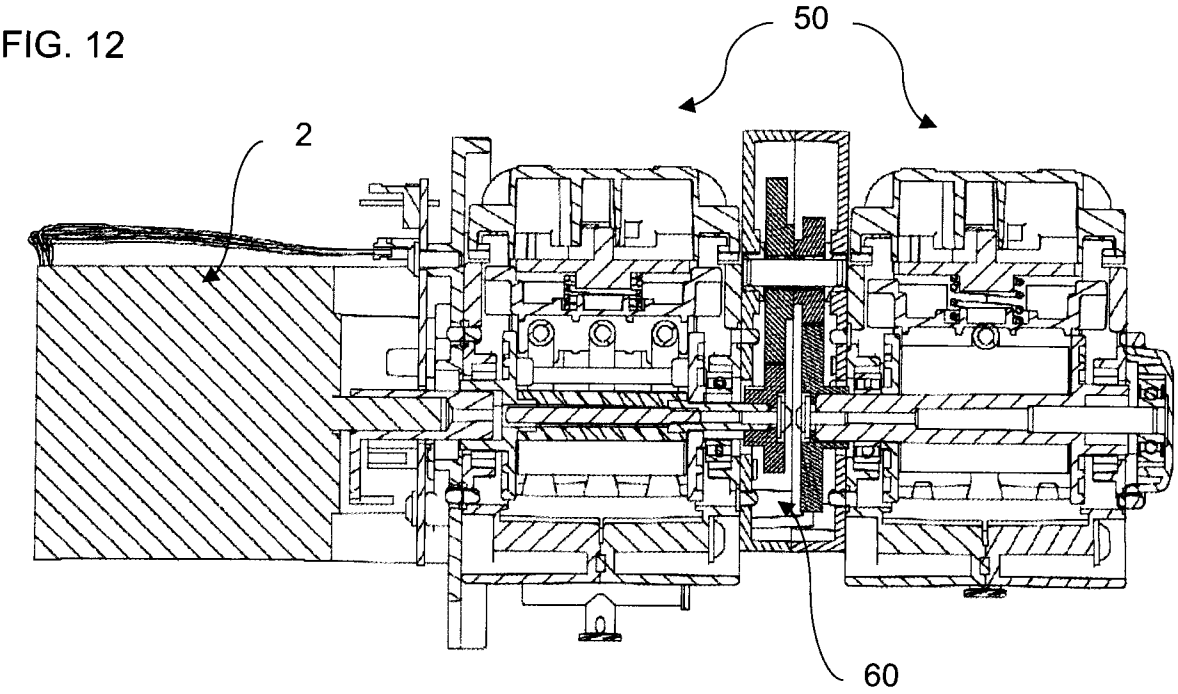


FIG. 13

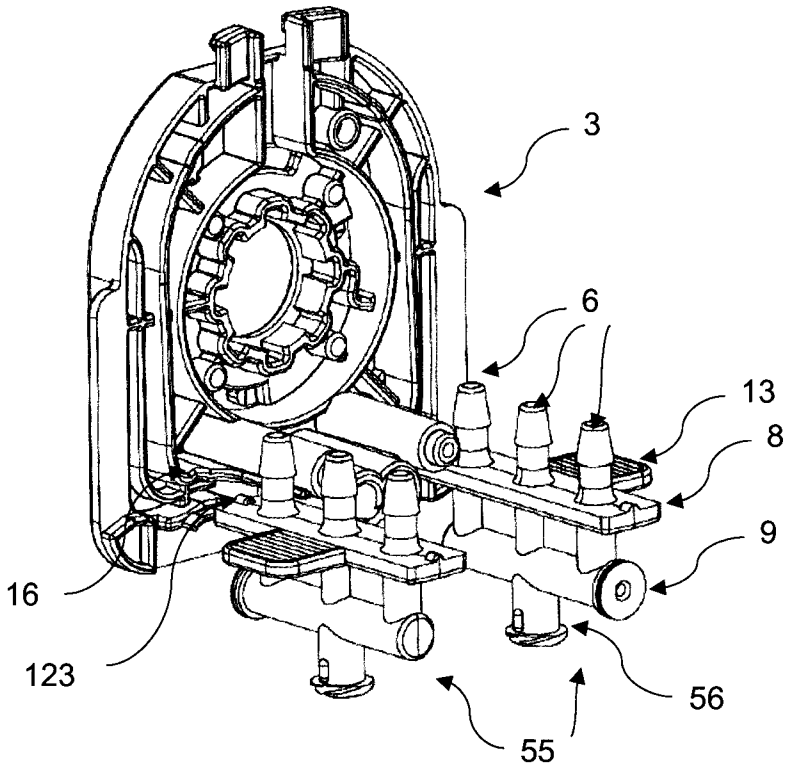


FIG. 14

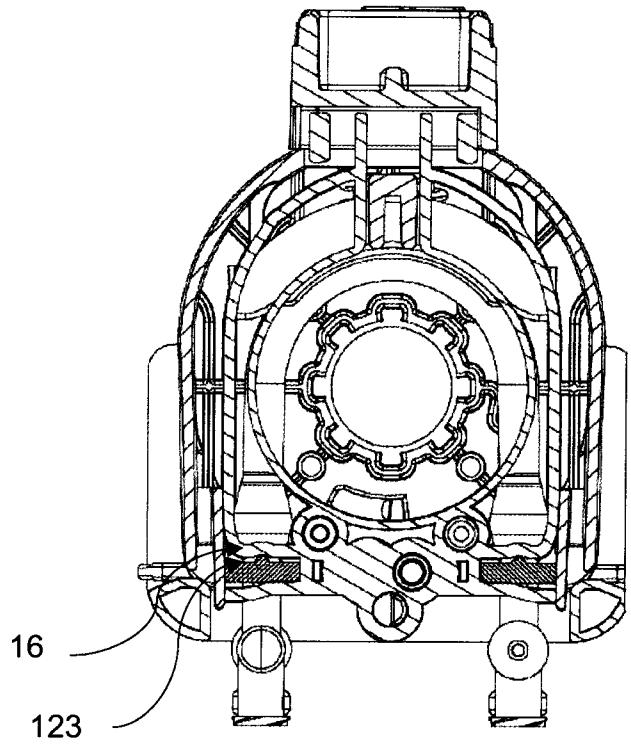


FIG. 15

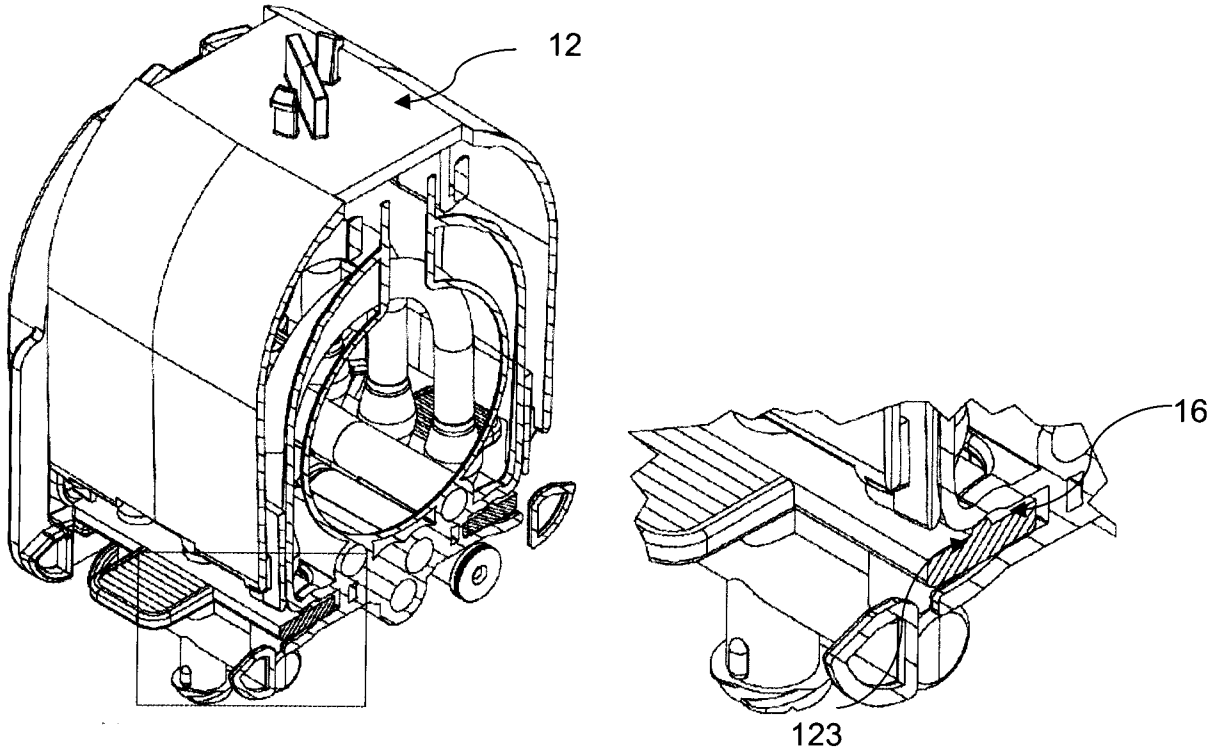


FIG. 16

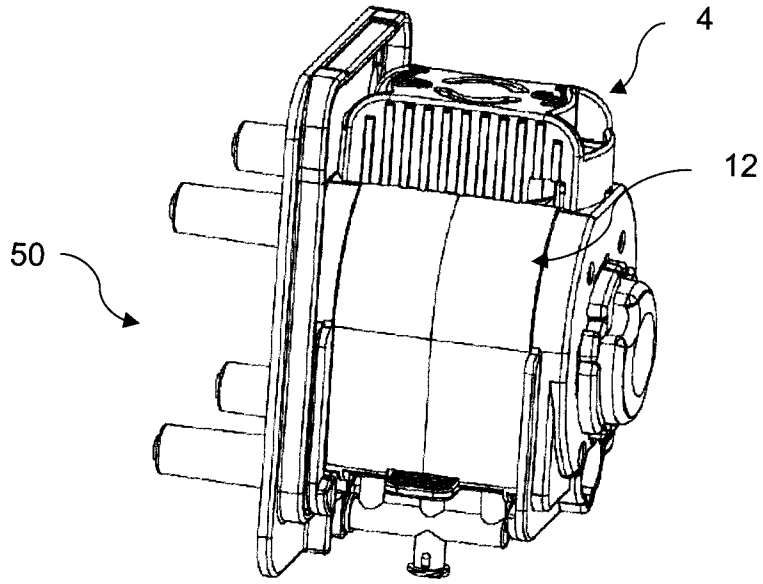


FIG. 17

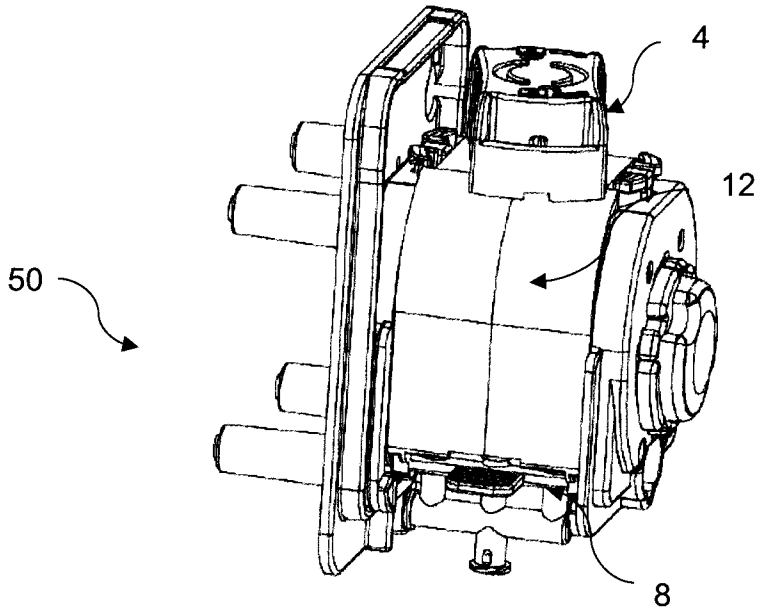


FIG. 18

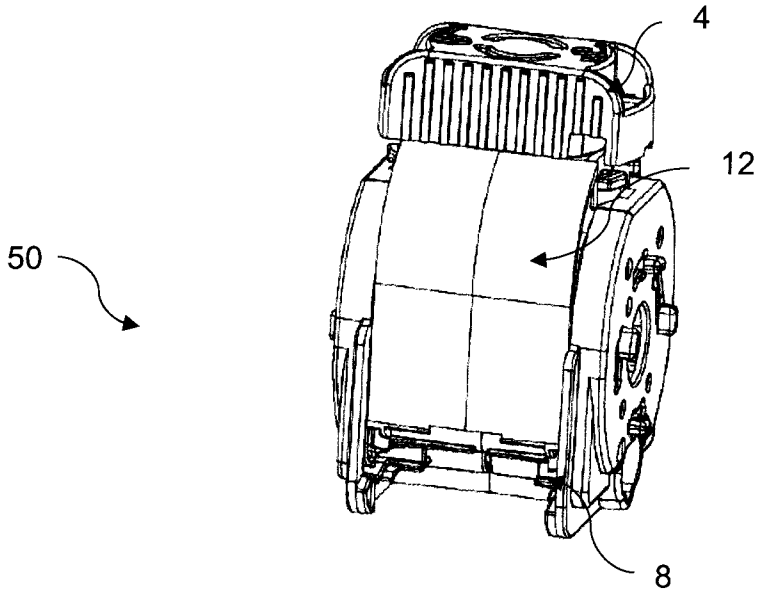


FIG. 19