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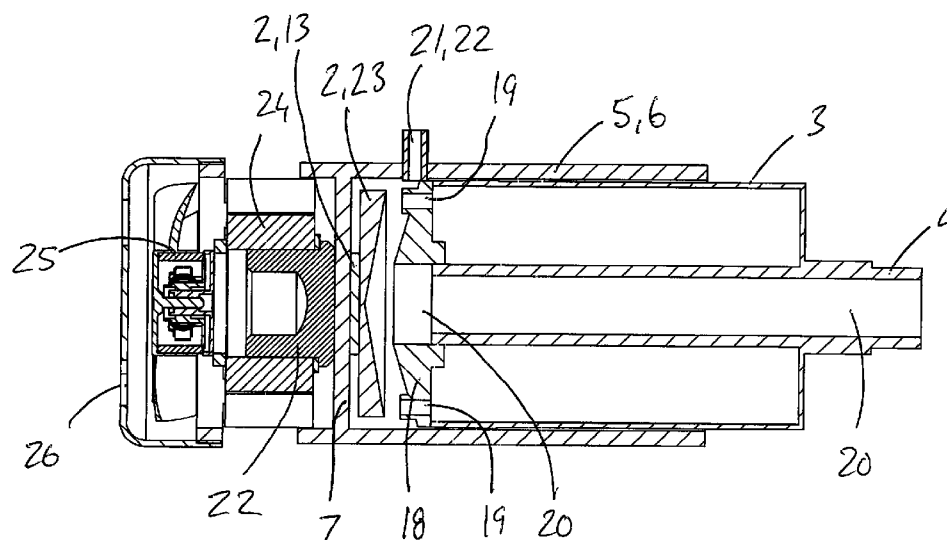


Fig. 2

(57) Abstract: Air-drying device (1) for drying air, gas, gases or similar in reservoirs in hydraulic systems in which a variable volume of liquid and air, gas or the like is stored. The treatment of air, gas or gases takes place in at least one first step with at least one refrigerant air dryer (2) in which drying occurs via the cooling effect from at least one cooling element (16). The treatment of air, gas or gases in alternative embodiments preferably also takes place in at least one second step in which separation of at least one substance occurs.

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Air-Drying Device

Field of the Invention

The present invention concerns an air-drying device (drying, moisture reducing filter) in accordance with the claims.

Background of the Invention

In several different circumstances and applications, there exists a need for drying (dehumidifying, removing moisture from) gas or gases such as for example air. One such need exists for example in connection with the drying of gases, such as air, that come into contact with buffer/barrier fluid (hydraulic fluid, oil) in a hydraulic reservoir (tank). Because the level of hydraulic fluid (oil) varies in conjunction with the use of the hydraulic system's various functions, an inflow of air to the reservoir (tank) occurs or an outflow of air from the reservoir (tank) occurs.

Moisture accompanies the air that flows into the reservoir from the surrounding atmosphere in conjunction with reductions in volume of hydraulic fluid in the reservoir. There is a considerable risk of moisture in the air being transferred to buffer/barrier fluid (hydraulic fluid) which in turn may cause several problems. For example, hydraulic fluid contaminated by moisture degrades more quickly. Another problem with moisture in hydraulic fluid is that the moisture in the hydraulic fluid runs the risk of freezing when the temperature drops below freezing which causes problems. Problems also arise because moisture in hydraulic fluid risks causing corrosion in the hydraulic system.

The problems mentioned above are especially problematic when using vegetable based buffer/barrier fluids (hydraulic fluids) in hydraulic systems. This is caused by the fact that vegetable based buffer/barrier fluids (hydraulic fluids) normally absorb a larger volume percentage of water compared with what non-vegetable based fluids absorb. When using vegetable based hydraulic fluids, there exists a need of improved techniques for drying air that comes into contact with the mentioned vegetable based buffer/barrier fluids (hydraulic fluids).

In order to alleviate the above mentioned problems, it is previously known to utilize filters that absorb moisture from air that flows into hydraulic reservoirs and similar. Known filters usually contain moisture absorbing pellets, moisture absorbing materials or similar which

absorb moisture from the air. These pellets may for example consist of moisture absorbing material such as calcium chloride, silica or other for the purpose suitable material. The use of this type of moisture absorbing filter causes several problems. One of the problems with existing air-drying devices that use moisture absorbing materials is that these filters must be regularly replaced or alternatively the moisture absorbing materials must be regularly replaced. There is a need for a design where the amount of desiccant can be reduced, and the interval for replacement can be extended, than is the case with earlier known designs. Known filters work best at relatively warm temperatures. Known filters do not usually function at a relative humidity below a certain level such as 40 percent. These filters also have the problem that when they are saturated with moisture, they can actually release moisture into relatively dry air that enters the hydraulic reservoir via the filter.

Another problem with these types of air-drying filters is that the user does not know if the moisture absorbing pellets in the filter are saturated with moisture or not. Another problem with existing filters, is the risk that the function of these degrades due to them freezing in cold climates whereby the filter function ceases, or at least is greatly reduced.

Another problem with paper filters is that if these are made of paper they function best at a temperature under a certain level.

Other designs for drying (dehumidifying) air are previously known. One example of an earlier known air-drying device that dehumidifies the air that moves in and out of a hydraulic reservoir containing buffer/barrier fluid (hydraulic fluid) is known via SE1400166. In the preferred embodiments of the air-drying device according to their description, at least one Peltier element is used for drying. Peltier elements have the technical effect that they release heat from one side of their element and have a cooling effect on the opposite side. This effect is achieved by a DC current flowing through the Peltier element's metals or semiconductors in accordance with previously known technology. Condensation occurs by the interior space being connected to the Peltier element's cooling side.

The design in accordance with SE1400166 differs significantly from the design in accordance with the present patent application. For example the design according to SE1400166 does not consist of a design which is intended to be coupled together with a filter with moisture-absorbing material.

Even other devices and systems for drying air have been developed. For example, air-drying devices that use negative pressure/vacuum in order to reduce the amount of moisture in hydraulic fluids, buffer/barrier oils have previously been developed. However, none of these previously developed systems and designs consist of a corresponding design in accordance with the present invention.

Purpose of the Invention

The main purpose of the present invention is to eliminate or at least reduce at least one of the previously mentioned problems with known types of air-drying devices. This is achieved with an air-drying device in accordance with the claims.

Brief Description of the Drawings

In the following description, the present invention will be describes in more detail with reference to the accompanying schematic drawings that in an exemplifying purpose show the current preferred embodiments.

Fig. 1 shows an air-drying device according to an exemplifying first embodiment.

Fig. 2 shows in a cross-sectional view (cut-away view) the air-drying device according to the first embodiment more in detail.

Fig. 3 shows in a cross-sectional view the first embodiment without the filter unit.

Fig. 4 shows the coupling unit in accordance with the first embodiment.

Figs. 5A to 5D show a second exemplifying embodiment.

Figs. 6A to 6D show a third exemplifying embodiment.

Figs. 7A and 7B show a fourth exemplifying embodiment.

Figs. 8A to 8C show a fifth exemplifying embodiment.

Figs. 9A and 9B show a sixth exemplifying embodiment.

Detailed Description of the Invention

With reference to the figures, an air-drying device 1 in accordance with the present invention will be described in more detail. The air-drying device is for example used for drying air in at

least one reservoir (container, tank) or the like in a hydraulic system. The reservoir may for example be a hydraulic reservoir. Alternatively, the reservoir may be of some other type of container (tank) than the mentioned reservoir.

Drying (dehumidification) in the air-drying device 1 occurs in at least one first step.

Preferably, dehumidification in the air-drying device 1 occurs in at least one first step and at least one second step. In the first step, dehumidification (drying) in the air-drying device 1 is achieved by at least one refrigerant air dryer 2 which uses a cooling effect for drying (dehumidifying) air, gases or gas.

In cases where the air-drying device is comprised of at least one second step, dehumidification is achieved, or in alternative embodiments, any other type of filtration, by at least one filter unit 3. The filter unit 3 may for example be comprised of absorbent material which preferably may be a water absorbing material. In alternative embodiments, the absorbent material in the filter unit 3 may consist of absorbent material which absorbs at least one other, or other substances than water. In further embodiments, the filter unit may lack absorbent material and filter air, gas or gases with other previously known technology.

The air-drying device 1 in the exemplifying embodiment is preferably suitable for connection to a hydraulic reservoir or similar. In alternative embodiments, the air-drying device 1 may be connected to another device, system or the like where a corresponding need for drying (dehumidification) is present. The air-drying device 1 is comprised of at least one connection device 4 or the like with which the air-drying device is connected to the hydraulic reservoir or the like. The connection device consists, for example, of at least one threaded pipe (tube), at least one pipe fitting or the like, at least one screw joint or consist of some other for the purpose suitable connection device. In alternative embodiments, the refrigeration air dryer 2 may be used separately without the filter unit 3. A refrigerant air dryer 2 is connected in these cases, directly or indirectly, to a hydraulic reservoir (tank) or other type of container or the like where moisture in the air, gases or gas is to be reduced.

The refrigerant air dryer 2 and the filter unit 3 are connected together, or positioned mutually with at least one coupling unit 5, coupling device or the like. The coupling unit 5, in accordance with Figures 1 to 4, is comprised of a cylindrical part 6 which has a diving intermediate wall (partition) 7 which separates the cylindrical inner space 8 in at least one first subspace 9 and at least one second subspace 10.

The filter unit 3 may for example consist of a previously known type of filter unit 3 which is connectable to the coupling unit (part) 5, housing (casing) or the like. The filter unit 3 preferably has a cylindrical shape which is connected to the first subspace 9 in the coupling unit. The filter unit 3 may for example consist of filters which are marketed by Parker under the name Triceptor or marketed as the registered trademark RMF Systems. Alternatively the filter unit may be connected to another part of the air-drying device.

The refrigerant air dryer 2 and the filter unit 3 are in the exemplifying embodiment connected to the coupling unit's 5 first subspace 9. In the exemplifying embodiment the filter unit 3 is for example held together with the coupling unit (coupling part) 5 through the friction between the coupling unit's 5 inner wall 11 and the outside 12 of the filter unit's filter housing (casing). In alternative embodiments, the connection (cohesion) between the filter unit and the coupling unit may be achieved with the other for the purpose suitable technology. In alternative embodiments, for example, the filter unit is connected to the air-drying device with at least one threaded pipe or with at least one other for the purpose suitable connecting device.

The refrigerant air dryer 2 is comprised of at least one cooling element or the like. The cooling element consists preferably of at least one Peltier element 13 which has a relatively warm (hot) surface 14 and a relatively cold (cool) surface 15. The Peltier element's 13 functions are preferably controlled via at least one control system or the like. With the control system it is possible, if necessary, to invert the warm and cold sides so that the warm side becomes the cold side and vice versa.

The Peltier element 13 is preferably connected to the intermediate wall 7 at the side toward the first inner space 8. Preferably, the Peltier element's 13 warm side 14 connects against the intermediate wall 7. At least one cooling element 16 is preferably connected to the Peltier element's 13 relatively cooler side 15. The cooling element's design may vary within the scope of protection of the invention. The cooling element may be comprised of at least one surface, at least one cooling flange or other for the purpose suitable design. The refrigerant air dryer 2 is comprised of at least one condensation space 17 in which condensation of moisture in the air, gas or gases takes place. The condensation space in the exemplifying embodiment is separated by the intermediate wall 7 and a partition (barrier) 18, wall or the like. In alternative embodiments, the condensation space is formed by at least one wall, partition or the like which completely or partially encloses the condensation space 17. The condensation

space 17 communicates via at least one first channel **19**, inlet, pipe or the like directly or indirectly to the surrounding atmosphere.

The condensation space 17 in the exemplifying embodiment is in direct or indirect communication (contact) with the surrounding atmosphere. The condensation space 17 is further also in contact with the internal space of a container such as a hydraulic reservoir. The condensation space 17 is in communication (contact) with at least one second channel **20**, connecting line or the like with the inner space of a hydraulic reservoir or the like.

The condensation space 17 is further comprised of at least one outlet **21** for the condensed liquid or the like. The condensed liquid is discharged via the outlet 21 to the surrounding atmosphere or the like. The outlet 21 may be comprised of at least one channel **22**, at least one opening, at least one tube (pipe) or the like. In alternative embodiments the condensed liquid is collected into at least one reservoir, tank (not shown in the figures) or another for the purpose suitable collection device. In the exemplifying embodiment, the outlet is placed in a tube (pipe) that extends (protrudes) outward a bit from the condensation space 17

The Peltier element 13 gives off heat to the intermediate wall 7 which in turn is transmitted to the cylindrical part 6 of the coupling unit 5 which completely or partly encloses the filter unit's 3 casing (filter housing). The filter unit's 3 temperature may be advantageously controlled by the above design. The best effect of the device is achieved if the filter unit 3 is properly tempered. Properly tempered refers to the temperature range where the device functions optimally, or relatively optimally.

In the exemplifying embodiment, the device is comprised of at least one cooling unit **23**, which if necessary cools the Peltier element's 13 relatively warmer side by way of the intermediate wall. The cooling unit 23 includes at least one cooling flange **24** and in variants of the invention at least one cooling fan **25**. In the exemplifying embodiment, the air-drying device also consists of at least one protective cover **26** or the like for the fan.

In one exemplifying embodiment of the present invention, the air-drying device 1 is connected to a hydraulic reservoir in a hydraulic system whose relative buffer/barrier fluid level in the hydraulic reservoir's interior space (or interior spaces), varies depending on which functions are used in the hydraulic system. During use of the present air-drying device, air flows in and out of the reservoir via the air-drying device during a level reduction of buffer/barrier fluid in the hydraulic reservoir and an increase of the buffer/barrier fluid in the

hydraulic reservoir. When air enters the reservoir, the refrigerant air dryer will condense the moisture in the air that passes through the refrigerant air dryer. After the refrigerant air dryer, the air passes the filter unit 3.

Referring to Figures 5A to 5C, a second exemplifying embodiment of the present air-drying device 1 is shown. In the embodiment, the air-drying device 1, like the first embodiment, is comprised of at least one Peltier element 13. The Peltier element 13 includes at least one relatively warm surface (side) and a relatively cold surface (side).

The air-drying device is comprised of at least one condensation space 17 which is separated by at least one wall, partition or the like 18 which encloses all or parts of the condensation space 17.

In the condensing space is found at least one surface consisting of at least one cooling element 16, which is directly or indirectly connected to, or consisting of, a Peltier element's cold surface (side). The condensation space 17 is directly or indirectly connected with the surrounding atmosphere via at least one first channel 19, opening or the like. The Peltier element's 13 warm surface 14 is directly or indirectly connected to at least one cooling unit 23 that is for example comprised of at least one or more cooling flanges. The embodiment may in alternative variants include at least one cooling fan.

The condensation space 17 includes preferably at least one outlet 21 consisting for example of at least one channel 22, at least one opening, at least one tube (pipe) or the like. Referring to Figures 5C and 5D, an air-drying device is shown that includes a second step comprised of at least one filter unit 3. The filter unit 3 may consist of the aforementioned filter units or other suitable for the purpose filter units. The air-drying device preferably includes at least one connection device 4.

Referring to Figures 6A to 6D, a third exemplifying embodiment of the present air-drying device 1 is shown. In the embodiment the air-drying device 1 is comprised of at least one first refrigerant air dryer 2 and at least one second refrigerant air dryer 2. Each respective refrigerant air dryer 2 is comprised of at least one Peltier element 13. The Peltier element 13 is comprised of at least one relatively warm surface (side) and one relatively cold surface (side). The air-drying device is comprised of at least one condensation space 17 which is separated by at least one wall, partition 18 or the like which completely or partially encloses the condensation space 17.

In the condensation space is found at least one surface consisting of at least one cooling element 16, which is directly or indirectly connected to, or consisting of, a Peltier element's cold surface (side). The condensation space 17 is directly or indirectly connected with the surrounding atmosphere via at least one first channel 19, opening or the like. The Peltier element's 13 warm surface 14 is directly or indirectly connected to at least one cooling unit 23 that is for example comprised of at least one or more cooling flanges or another suitable for the purpose cooling unit. The condensation space 17 preferably includes at least one outlet 21 for example consisting of at least one channel 22, at least one opening, at least one tube (pipe) or the like. The embodiment may in alternative variants include at least one fan. Referring to Figures 6C and 6D, an air-drying device 1 is shown that comprises at least one second step for dehumidification (drying) or separation (filtering).

The second step comprises at least one filter unit 3. The filter unit may be of earlier mentioned types of filters or other suitable for the purpose filters or filter units. The air-drying device is comprised of at least one connection device 4. Figure 6D shows the connection device connected to a hydraulic reservoir 27 or the like.

Referring to Figures 7A to 7B, a fourth exemplifying embodiment of the present air-drying device 1 is shown. In this embodiment of the air-drying device 1, it is comprised of, as with previously described embodiments of the air-drying device, at least one Peltier element 13. The Peltier element 13 includes at least one relatively warm surface (side) and one relatively cold surface (side). The air-drying device is comprised of at least one condensation space 17 which is separated by at least one wall, partition 18 or the like which encloses all or parts of the condensation space 17.

In the condensation space is found at least one surface consisting of at least one cooling element 16, which is directly or indirectly connected to, or consisting of, a Peltier element's cold surface (side). The condensation space 17 is directly or indirectly connected with the surrounding atmosphere via at least one first channel 19, opening or the like. The condensation space 17 preferably includes at least one outlet 21 for example consisting of at least one channel 22, at least one opening, at least one tube (pipe) or the like. The Peltier element's 13 warm surface 14 is directly or indirectly connected to at least one cooling unit 23 that is for example comprised of at least one or more cooling flanges or another suitable for the purpose cooling unit. The air-drying device is comprised of at least one connection device 4. Preferably, the air-drying device in accordance with the embodiment includes at

least one filter unit 3. The filter unit 3 may consist of the aforementioned filter units or other suitable for the purpose filter units.

Referring to Figures 8A to 8C, a fifth exemplifying embodiment of the present air-drying device is shown. The air-drying device 1 according to this embodiment is comprised of at least one condensation space 17 which is separated by at least one wall, partition 18, barrier or the like enclosing all or parts of the condensation space 17. This embodiment uses at least one cooling circuit, cooling coil for the purpose suitable shape to create a relatively cold surface in the condensation space. In the cooling circuit, cooling coil flows a relatively cold fluid, medium, or the like. The flow of fluid may take place via at least one air conditioning unit. The condensation space 17 communicates (connects) with the surroundings atmosphere via at least one first channel 19, opening or the like. The condensation space 17 preferably consists of at least one outlet 21 for example consisting of at least one channel 22, at least one opening, at least one tube (pipe) or the like. The air-drying device includes at least one connection device 4. The air-drying device according to this embodiment includes, in alternative embodiments, at least one filter unit (not shown in the figures). The filter unit may consist of the aforementioned filter units or other suitable for the purpose filter units.

Referring to Figures 9A and 9B, a sixth exemplifying embodiment of the air-drying device 1 is shown. In this embodiment the air drying device 1, like the first embodiment, has at least one Peltier element 13. The Peltier element 13 includes at least one relatively warm surface (side) and one relatively cold surface (side). The air-drying device is comprised of at least one condensation space 17 which is separated by at least one wall, partition 18 or the like which surrounds all or part of the condensation space 17. The condensation space has at least one surface consisting of at least one cooling element 16 which is directly or indirectly connected to, or consists of, a Peltier element's cold surface (side). The condensation space 17 communicates with the surrounding atmosphere via at least one first channel 19, opening or the like. The condensation space 17 preferably includes at least one outlet 21 that for example consists of at least one channel 22, at least one opening, at least one tube (pipe) or the like. The Peltier element's 13 warm surface 14 is directly or indirectly connected to at least one cooling unit 23 that for example includes at least one or more cooling flanges or another cooling unit suitable for the purpose. This embodiment may in alternative variants include at least one cooling fan.

In the detailed description of the present invention, design details may have been omitted which are apparent to persons skilled in the art of the field of the device. Furthermore, design details which are described in one embodiment may be included in another embodiment.

Even if certain preferred embodiments have been described in detail, variations and modifications of the method and device may become apparent for specialists in the field of the invention. All such modifications and variants are regarded as falling within the scope of the following claims.

Advantages of the Invention

The present invention achieves several advantages. The most advantageous advantage of the present invention is that at least one of the previously mentioned problems is eliminated or substantially reduced.

Claims

1. Air-drying device (1) for drying air, gas, gases or similar in reservoirs in hydraulic systems in which a variable volume of liquid and air, gas or the like is stored **characterized in** that the air-drying device is comprised of at least one refrigerant air dryer (2), in which the treatment of air, gas or gases takes place in at least one first step, said refrigerant air dryer (2) being comprised of at least one cooling element (16) in at least one condensation space (17), said condensation space (17) via at least one first channel (19) being in direct or indirect communication with the surrounding atmosphere and via at least one second channel (20) being in direct or indirect communication with the reservoir's inner space and that the air-drying device (1) is comprised of at least one filter unit (3) with which a separation of at least one substance from air, gas or gases takes place in a second step and that the refrigerant air dryer (2) and the filter unit (3) are connected to each other via at least one coupling unit (5).
2. Air-drying device (1) in accordance with claim 1 **characterized in** that the refrigerant air dryer (2) is comprised of at least one Peltier element (13) with at least one relatively warm surface (14) and at least one relatively cold surface (15) whose cold surface is connected directly or indirectly with the cooling element.
3. Air-drying device (1) in accordance with at least one of the previous claims **characterized in** that the condensation space (17) includes at least one outlet (21) consisting for example of at least one channel (22) at least one tube or similar.
4. Air-drying device (1) in accordance with at least one of the previous claims **characterized in** that the air-drying device is comprised of at least one cooling unit (23) which is directly or indirectly connected with the Peltier element's (13) warm surface (14).
5. Air-drying device (1) in accordance with at least one of the previous claims **characterized in** that the filter unit (3) includes at least one type of absorbing material.
6. Air-drying device (1) in accordance with at least one of the previous claims **characterized in** that the absorbing material in the filter unit (3) absorbs moisture.

7. Air-drying device (1) in accordance with claim 6 **characterized in** that the absorbing material in the filter unit (3) absorbs oil.
8. Air-drying device (1) in accordance with at least one of the previous claims **characterized in** that the cooling unit (23) is comprised of or connected to at least one cooling fan (25).
9. Air-drying device (1) in accordance with at least one of the previous claims **characterized in** that the reservoir consists of hydraulic reservoir.
10. Air-drying device (1) in accordance with at least one of the previous claims **characterized in** that the coupling unit (5) is comprised of a cylindrical part (6) whose inner space is separated by at least one intermediate wall (7) which separates the inner space (8) in at least one first subspace (9) and at least one second subspace (10).

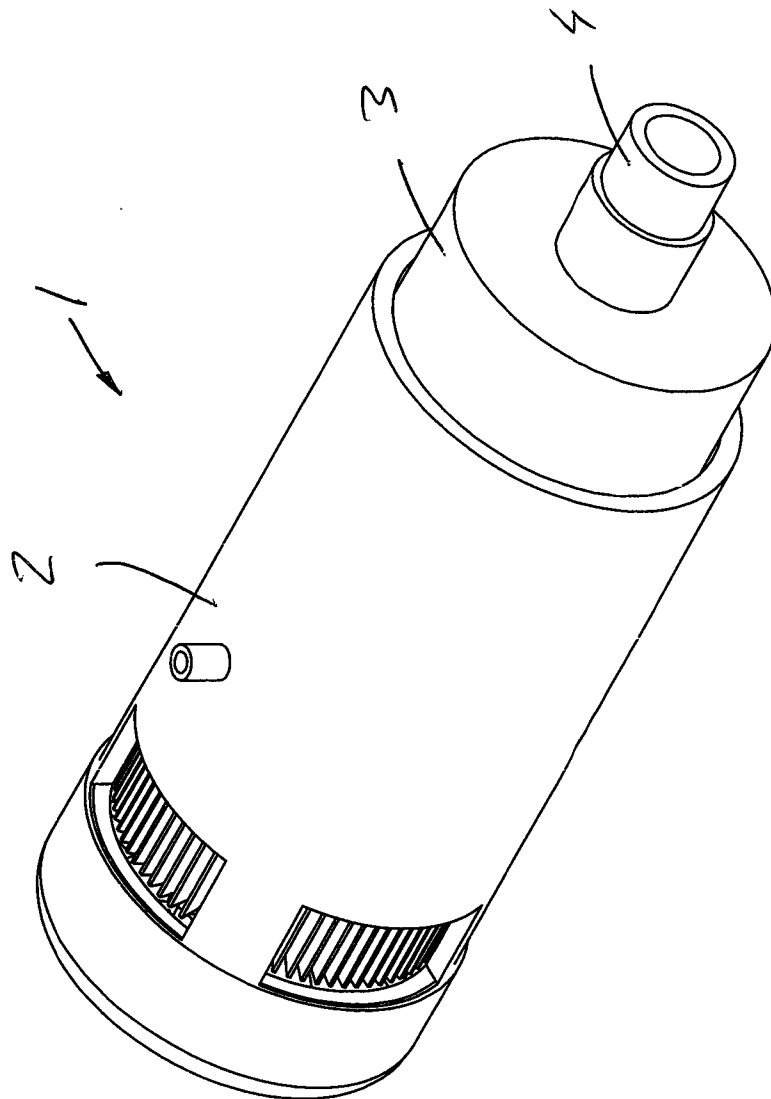


FIG 1

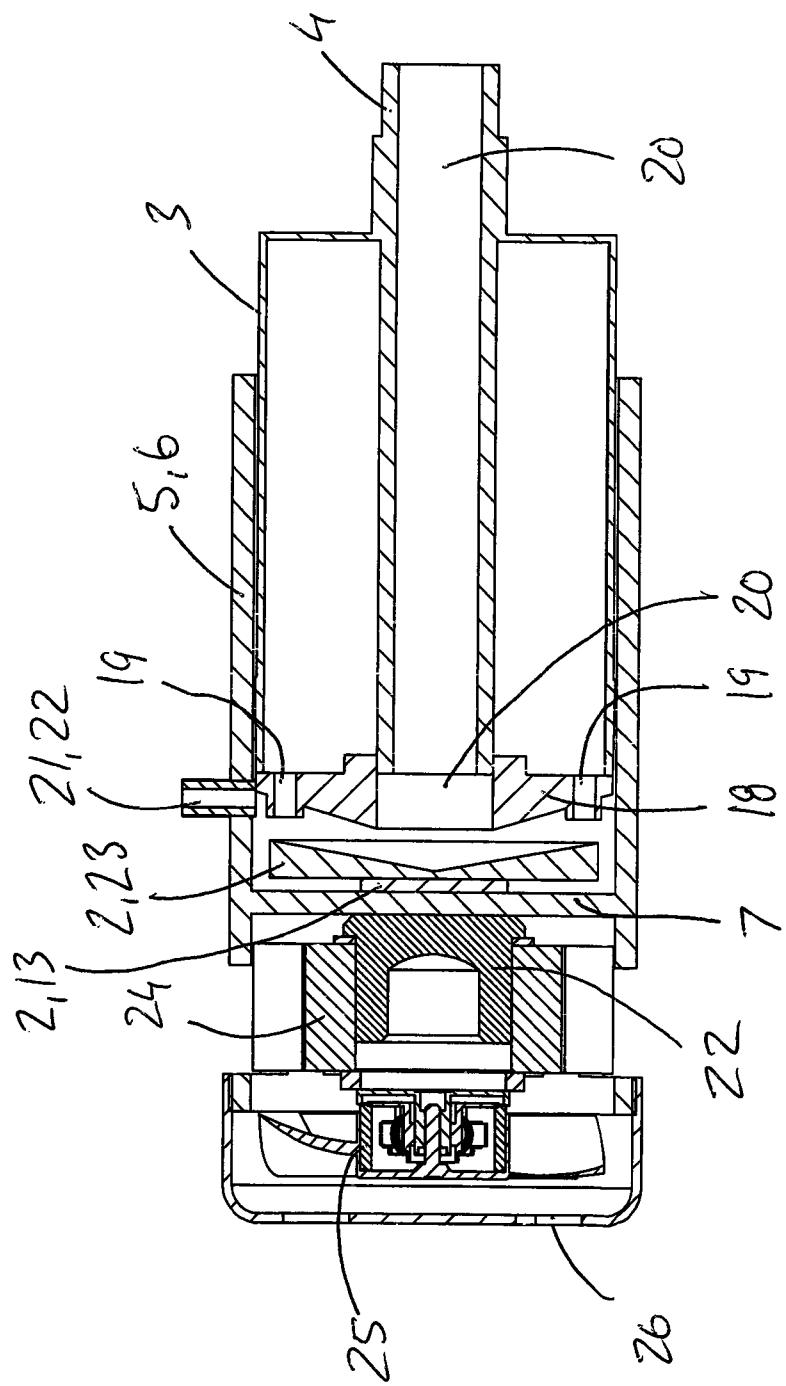


FIG. 2

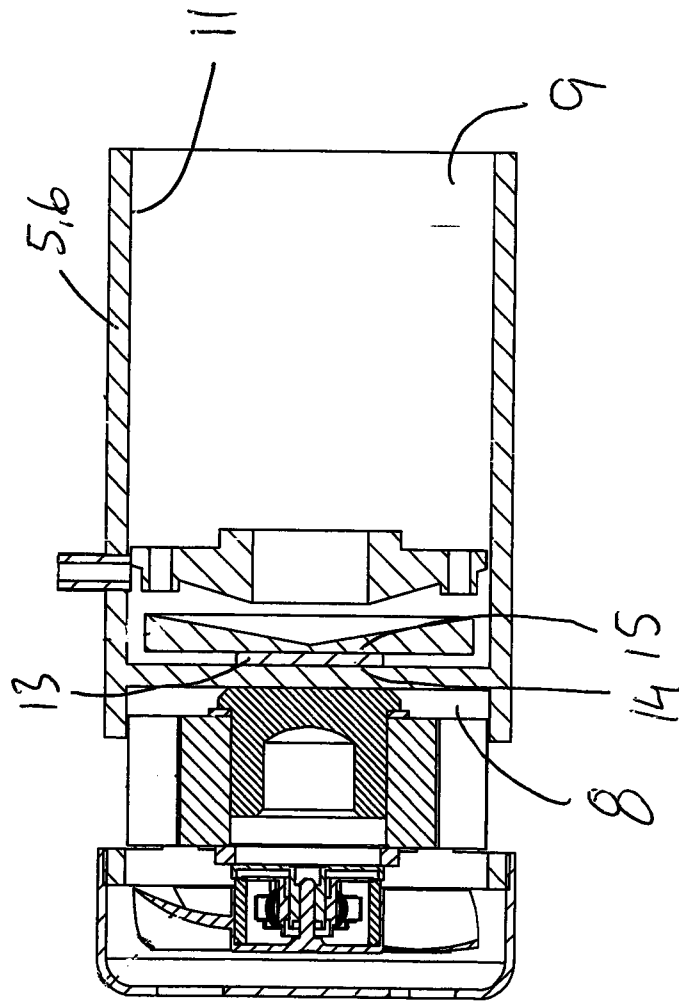


FIG. 3

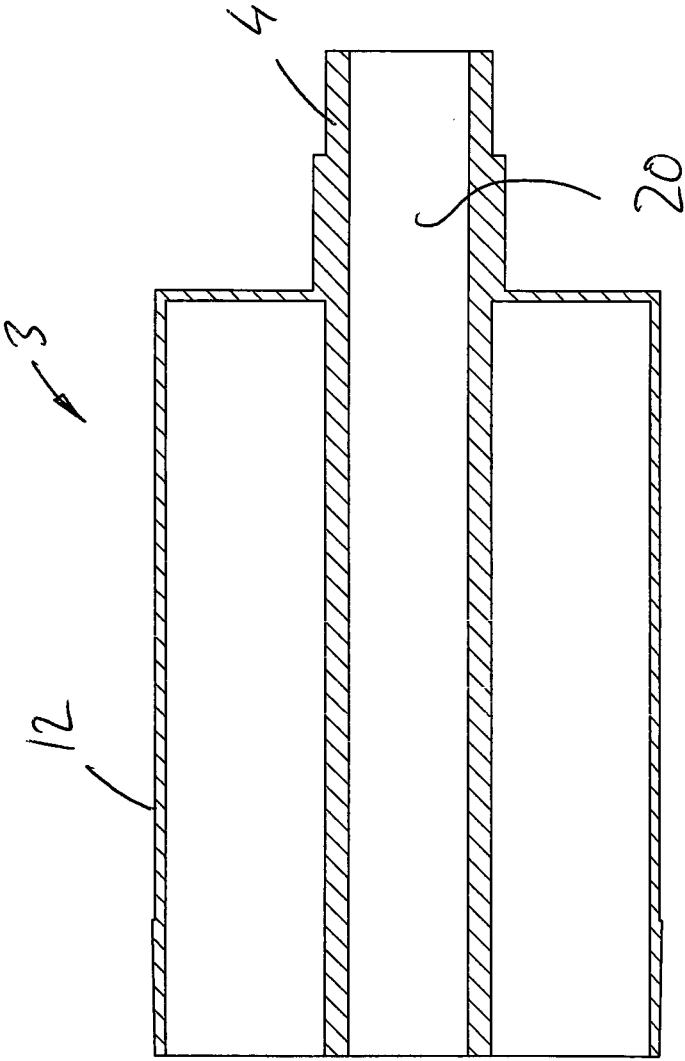


FIG. 4

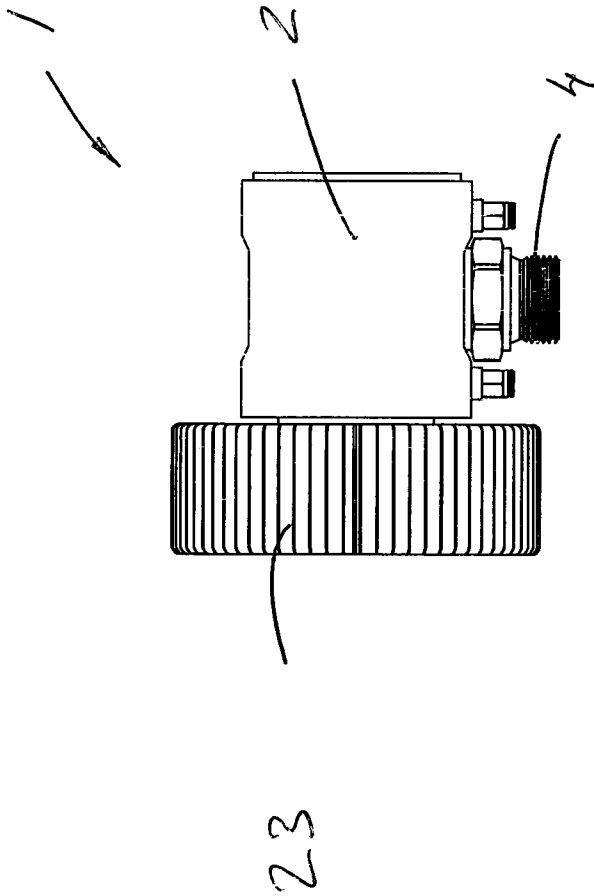


FIG 5A

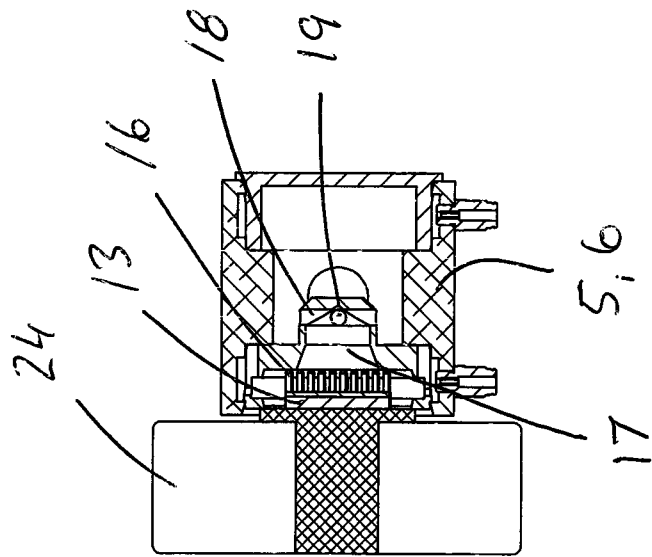


FIG 5B

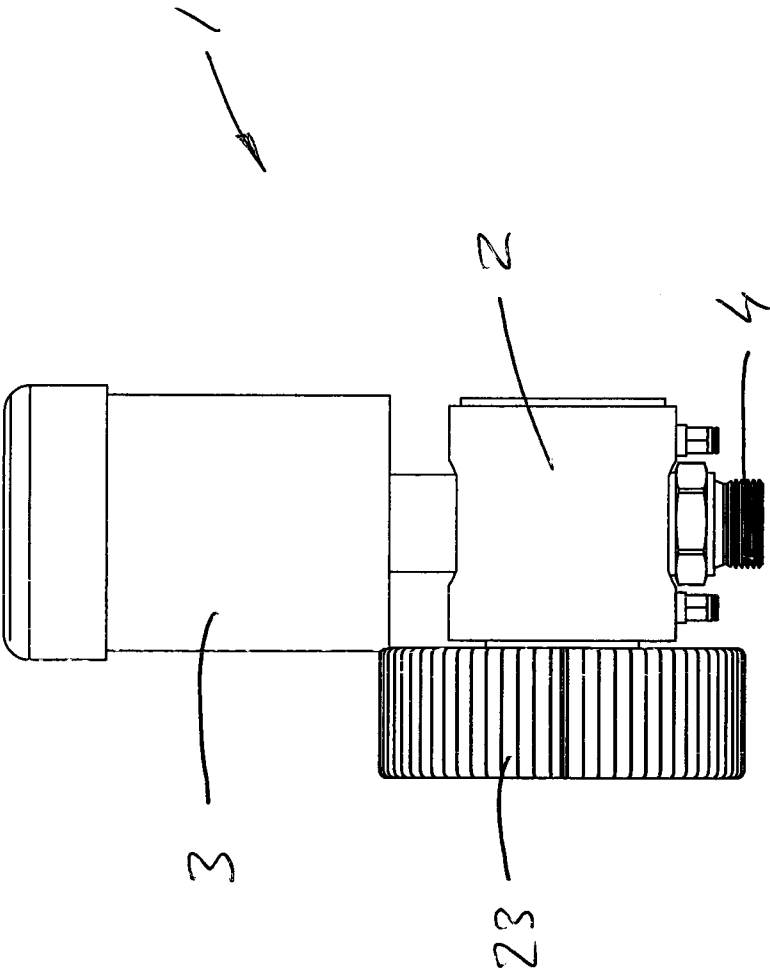


FIG 5C

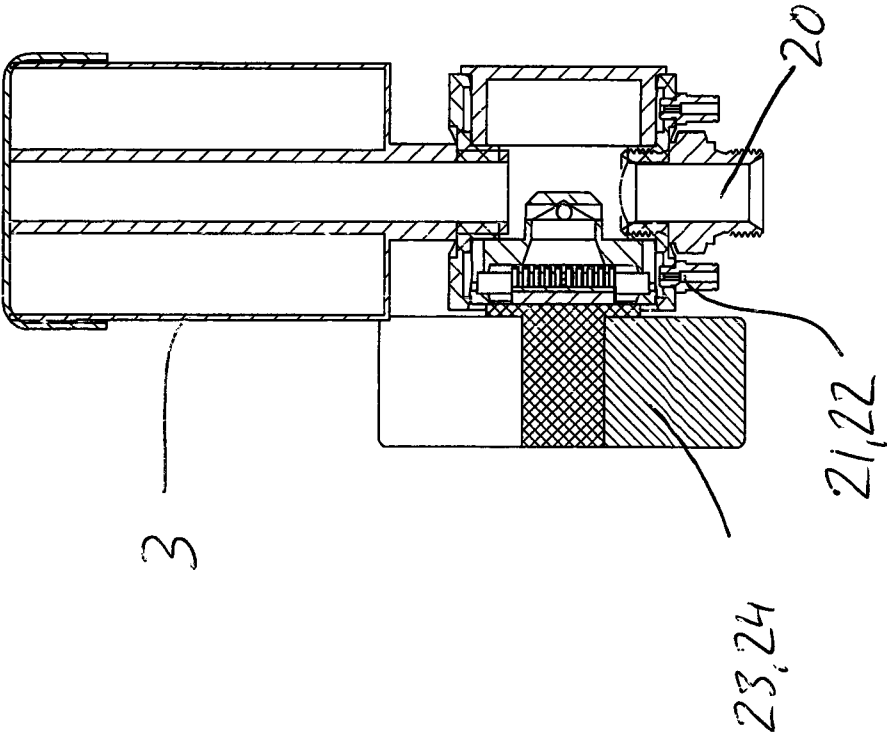


FIG 5D

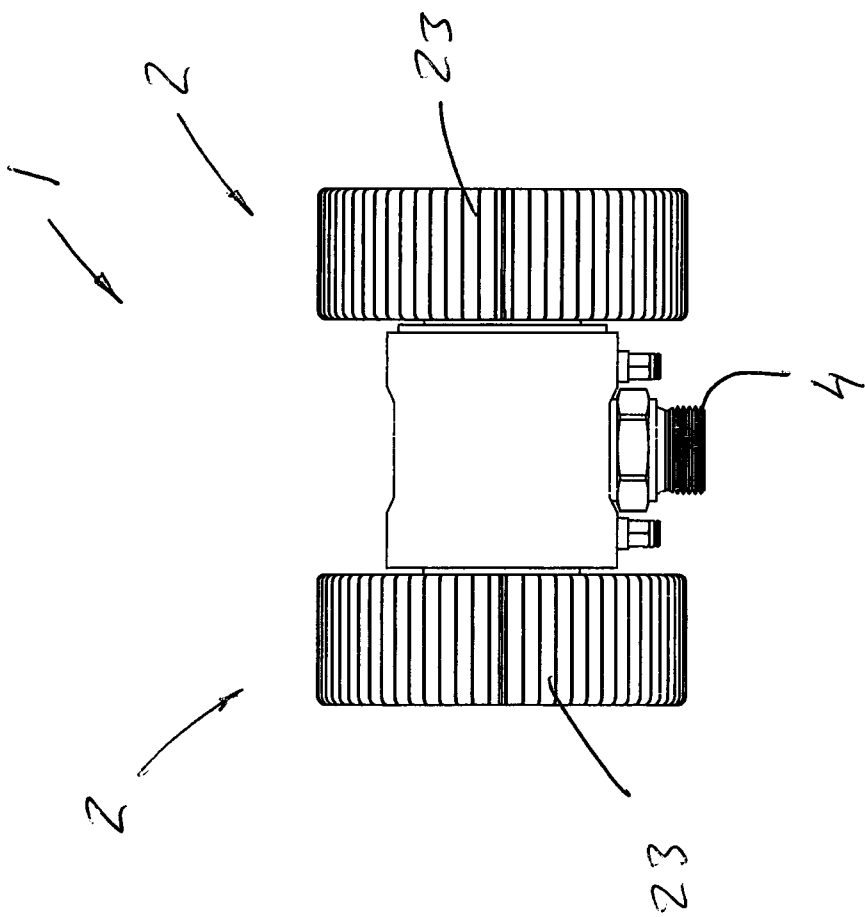


FIG 6A

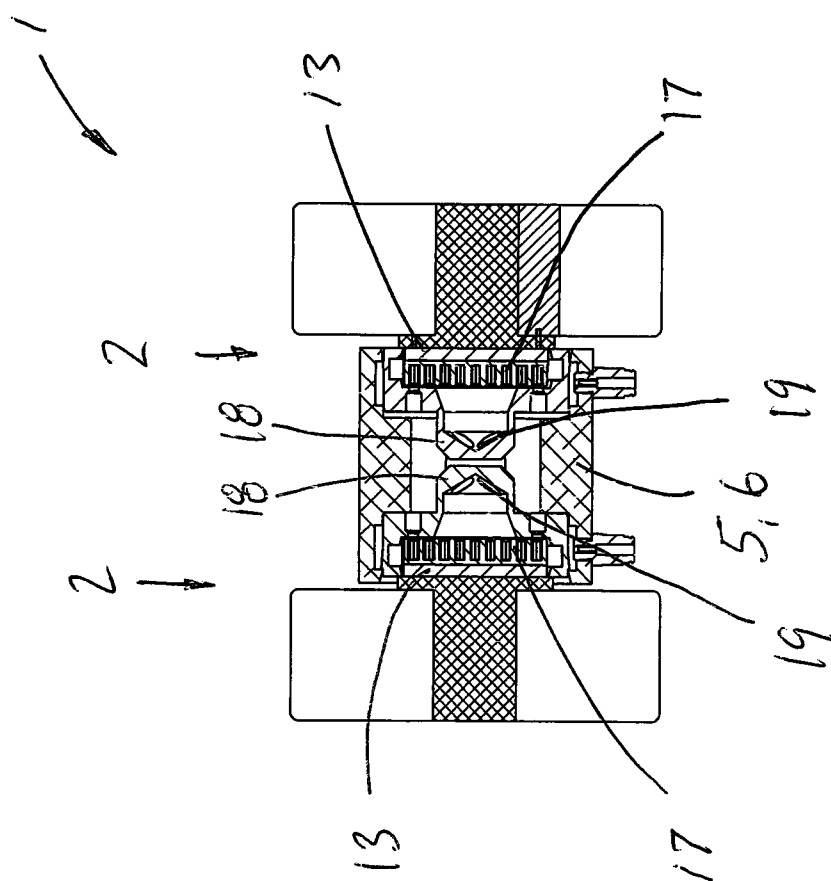


FIG 6B

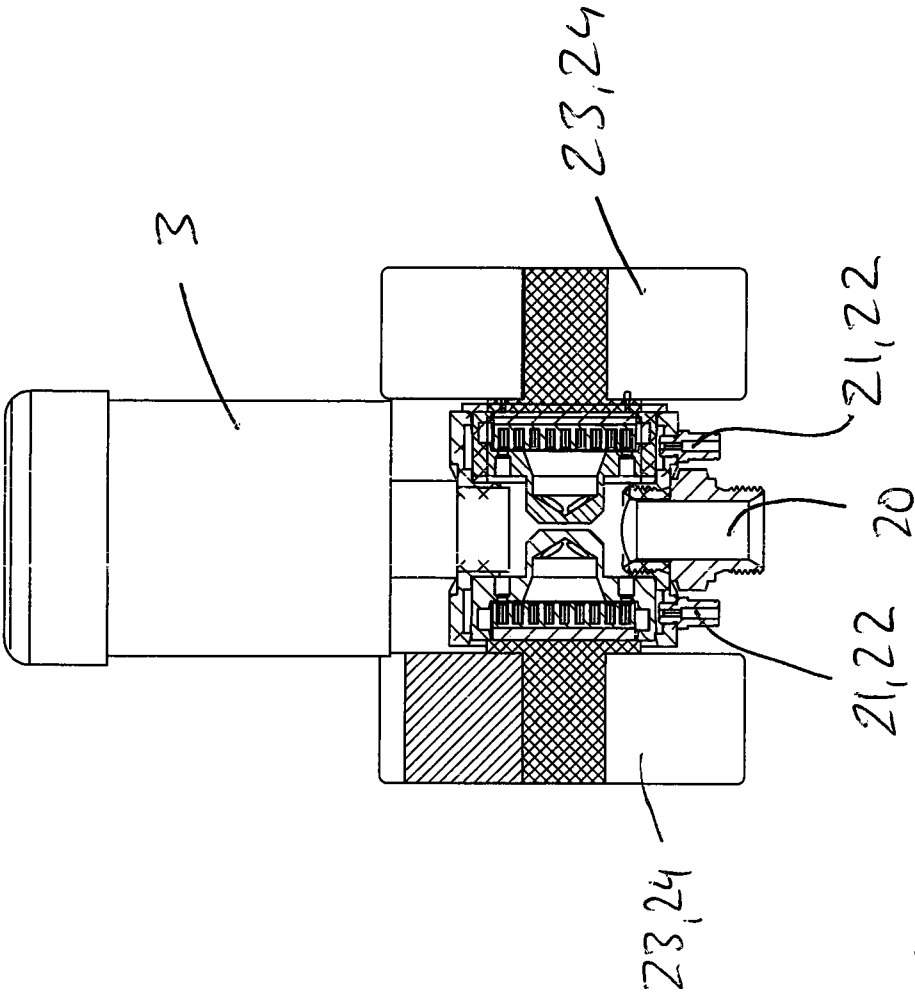


FIG. 6C

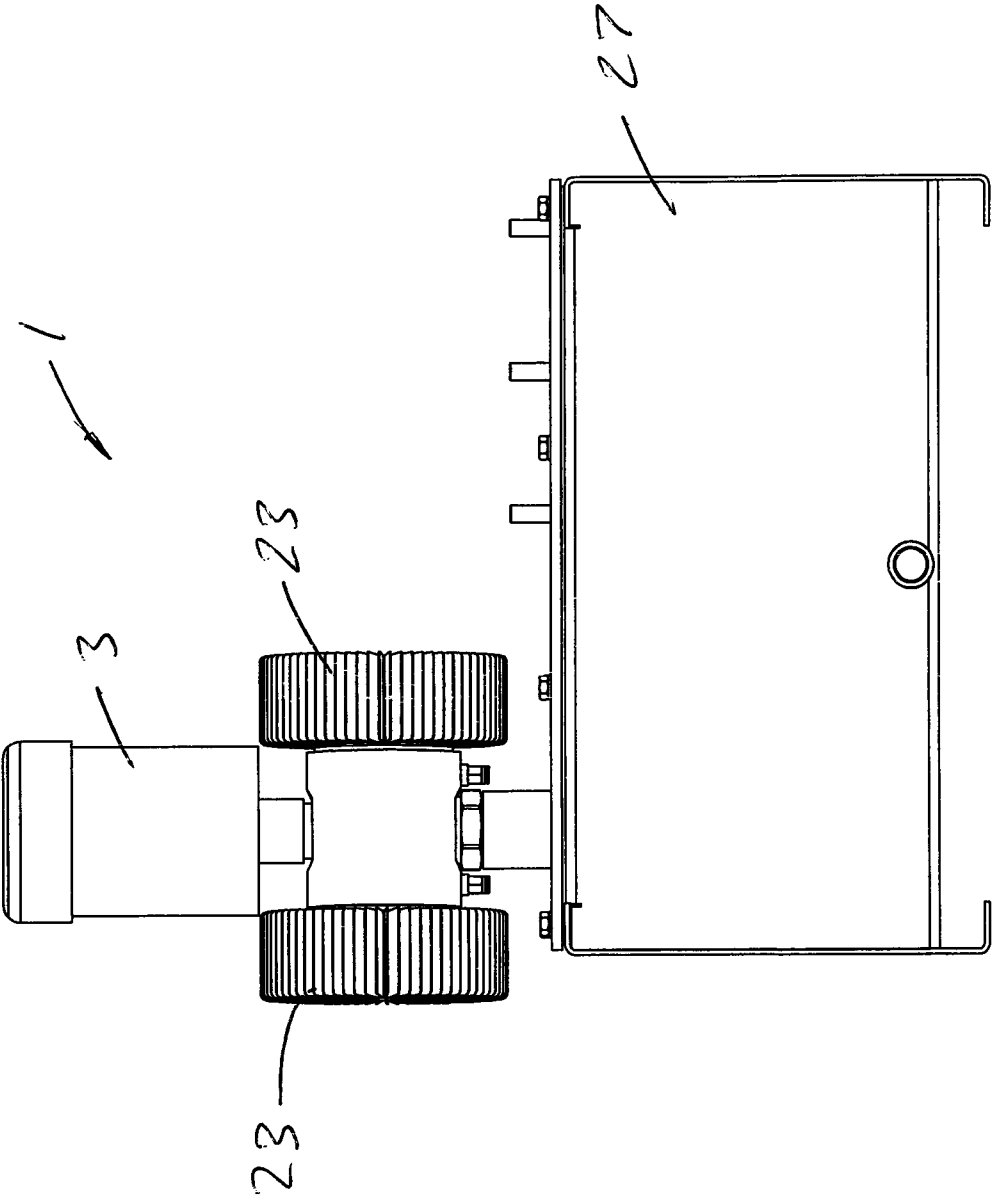


FIG 6D

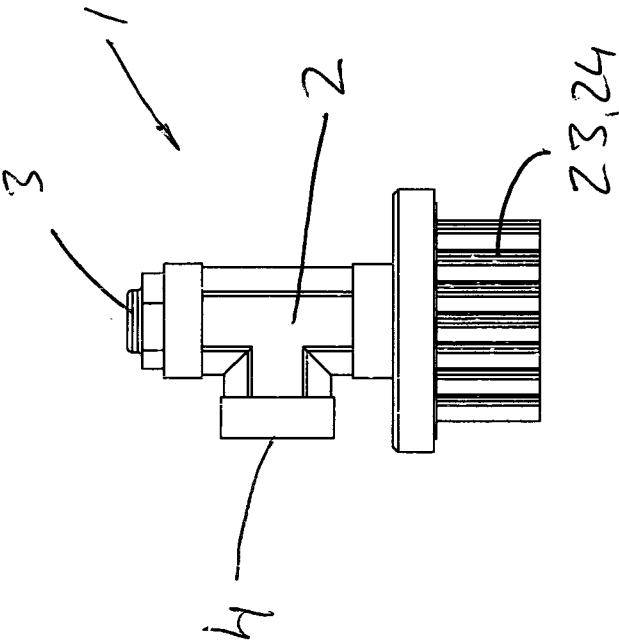


FIG. 7A

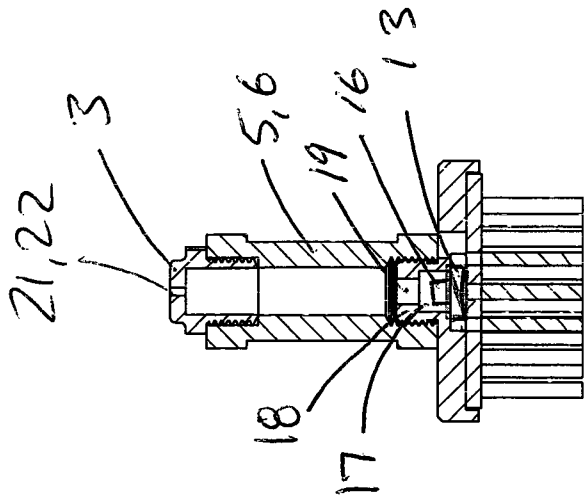


FIG. 7B

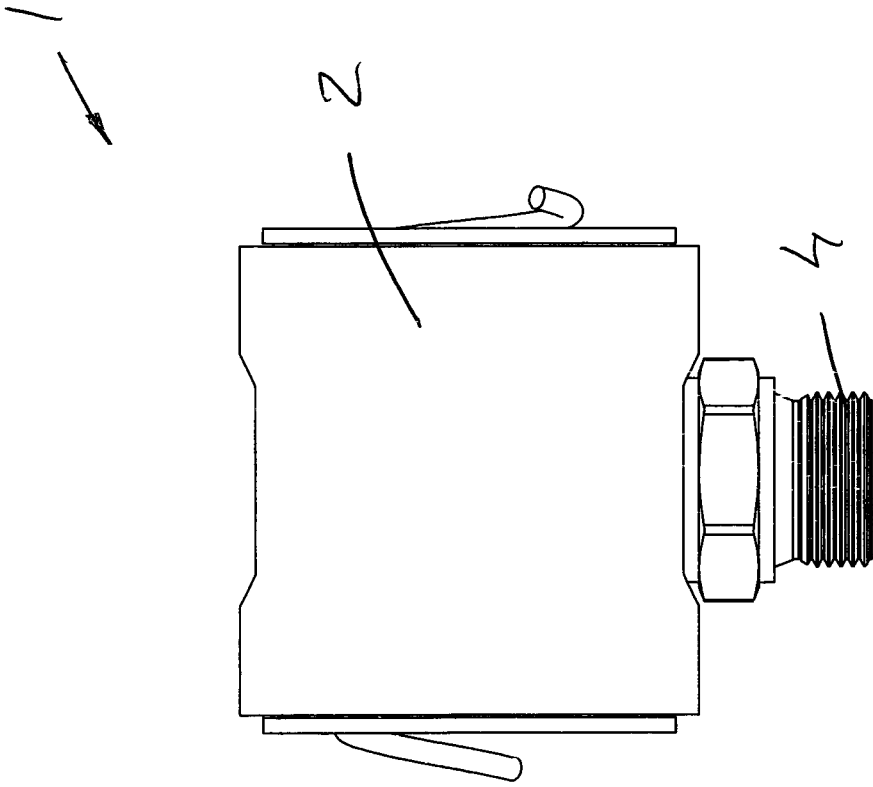


FIG 8A

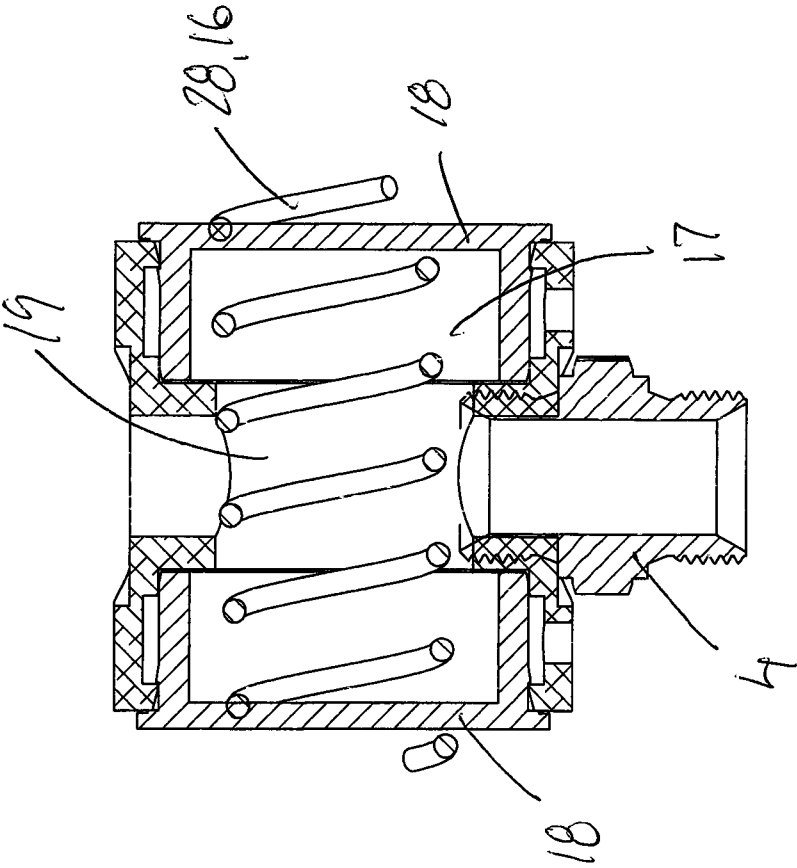


FIG. 8B

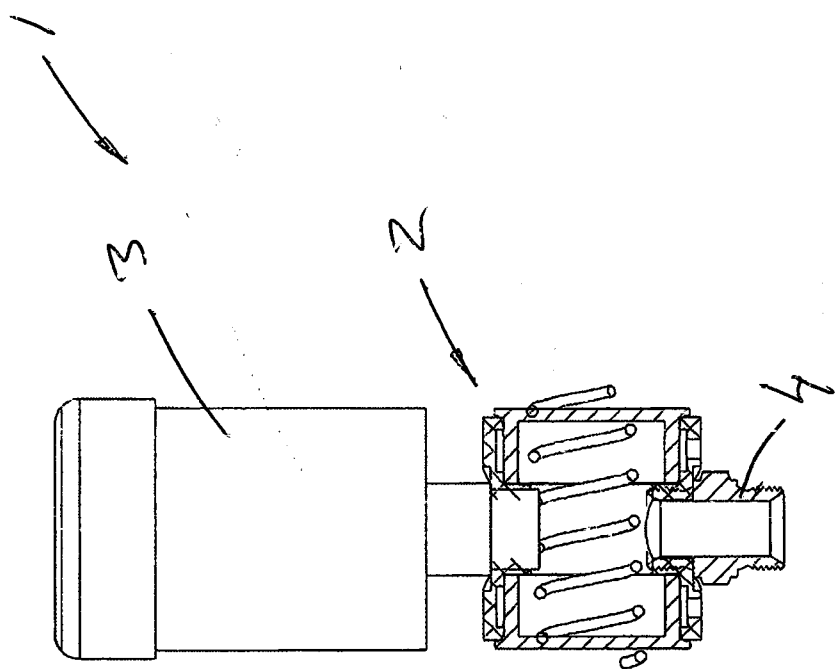


FIG 8C

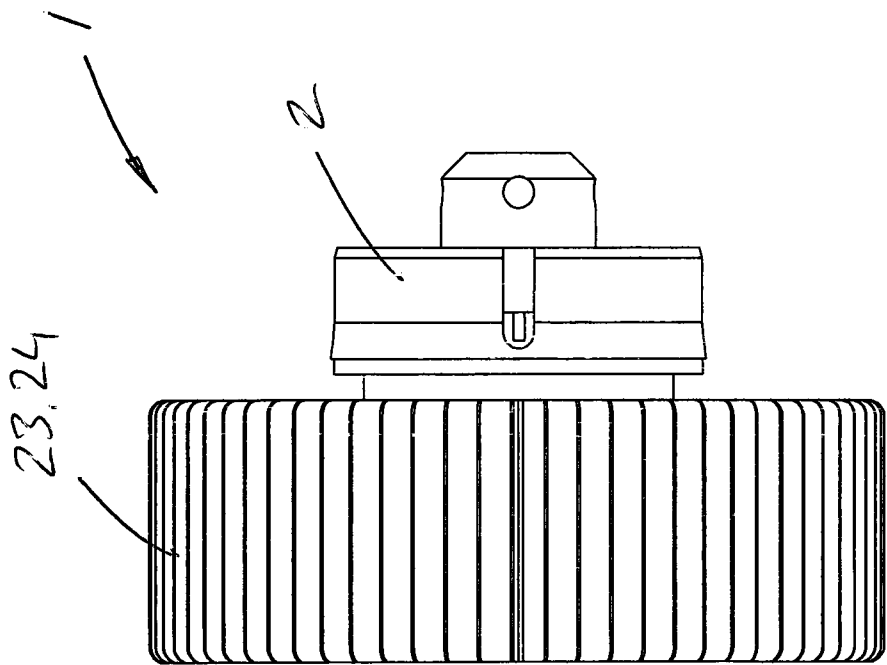


FIG 9A

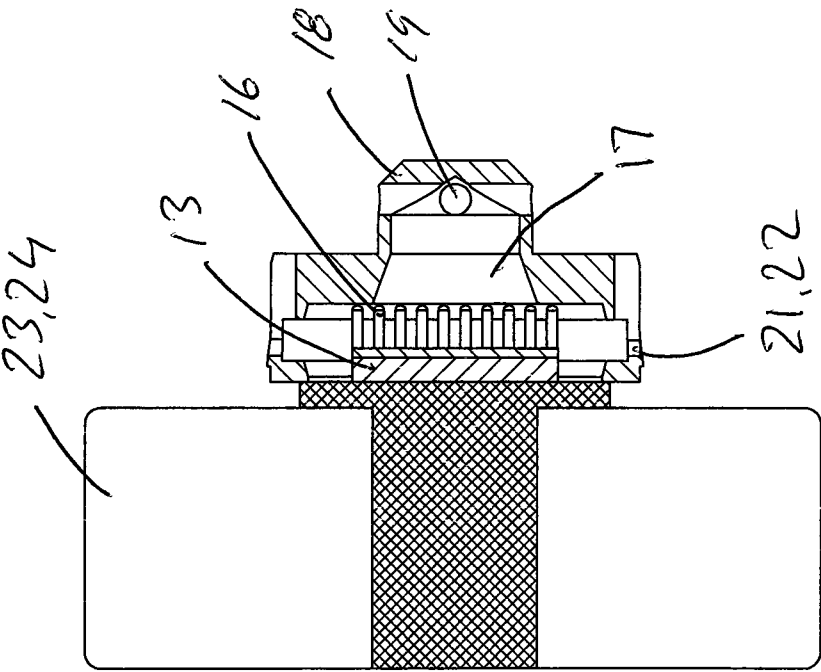


FIG. 9B

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2016/000052

A. CLASSIFICATION OF SUBJECT MATTER

IPC: see extra sheet

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B01D, B60T, F15B

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

SE, DK, FI, NO classes as above

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

EPO-Internal, PAJ, WPI data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2015147718 A1 (THORDAB AB), 1 October 2015 (2015-10-01); abstract; page 1, line 19 - line 24; page 3, line 11 - line 12; page 2, line 20 - page 6, line 15; figures 2-4c; claims 1,8,9 --	1-10
A	DE 19817997 A1 (SAFEMATIC SCHMIERTECHNIK GMBH), 4 November 1999 (1999-11-04); abstract; figure 1; claims 1-3 --	1-10
A	US 20150034173 A1 (PAOLUCCIO JOHN J ET AL), 5 February 2015 (2015-02-05); paragraphs [0067]-[0069]; figures 1,2,4 --	1-10

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

* Special categories of cited documents:	"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A" document defining the general state of the art which is not considered to be of particular relevance	"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E" earlier application or patent but published on or after the international filing date	"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"&" document member of the same patent family
"O" document referring to an oral disclosure, use, exhibition or other means	
"P" document published prior to the international filing date but later than the priority date claimed	

Date of the actual completion of the international search 23-02-2017	Date of mailing of the international search report 23-02-2017
Name and mailing address of the ISA/SE Patent- och registreringsverket Box 5055 S-102 42 STOCKHOLM Facsimile No. + 46 8 666 02 86	Authorized officer Lena Nilsson Telephone No. + 46 8 782 28 00

INTERNATIONAL SEARCH REPORT

International application No.
PCT/SE2016/000052

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 5775103 A (INGVAST HAKAN), 7 July 1998 (1998-07-07); abstract; column 3, line 4 - line 6; column 3, line 24 - line 28; figures 3-9 -- -----	1-10

Continuation of: second sheet

International Patent Classification (IPC)

F15B 21/04 (2006.01)

B01D 53/26 (2006.01)

F15B 1/26 (2006.01)

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.

PCT/SE2016/000052

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