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(54) Spray head

(57) A device for producing artificial snow comprises a core element (3), provided with nebulizing means (16, 41, 42, 50, 63) arranged for nebulizing a liquid and/or a gas/liquid mixture, and sleeve means (4) associated with said core element (3).

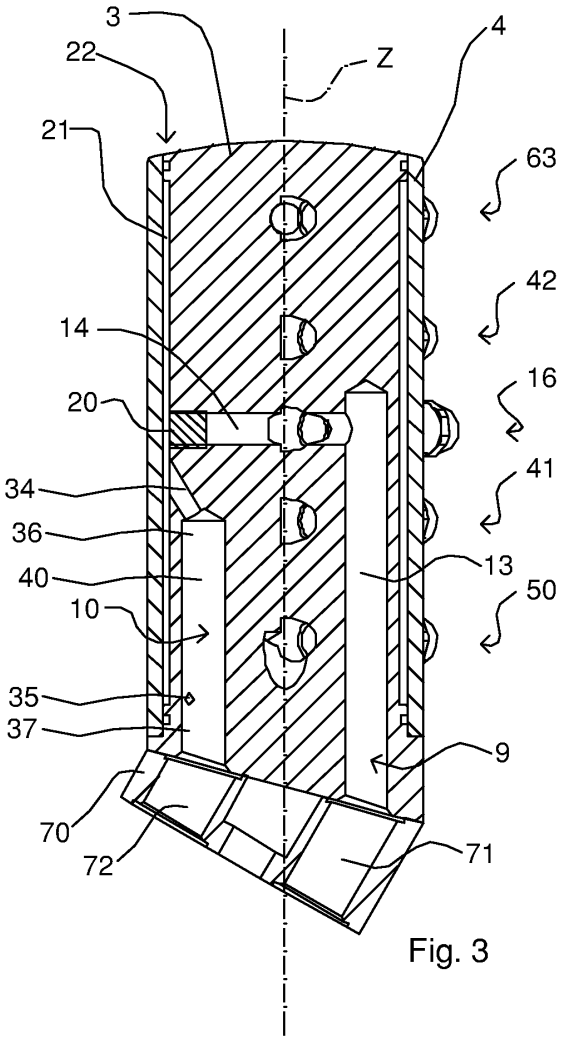

Fig. 3

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Description

[0001] The invention relates to a device for nebulizing liquids and/or gas/liquid mixtures.

[0002] In particular, the invention relates to a device for nebulizing water and/or an air/water mixture to produce artificial snow.

[0003] In nature, snow crystals are formed only in certain temperature and humidity conditions and if there are freezing nuclei in the atmosphere.

[0004] In order to reproduce in an open environment, such as, for example, a mountain slope, conditions that are favourable for forming snow crystals, as the temperature is hardly modifiable, it is thus necessary to intervene by suitably modifying the humidity of the air and promoting the generation of the freezing nuclei.

[0005] Devices are known for nebulizing water and/or an air/water mixture to produce artificial snow comprising a distributing body provided with nozzles.

[0006] The nozzles, projecting radially from the distributing body, comprise nucleating nozzles and dispensing nozzles.

[0007] The nucleating nozzles are supplied with a mixture of air and water from conduits obtained in the distributing body and are arranged for nebulizing the aforesaid mixture to generate the freezing nuclei.

[0008] The dispensing nozzles, supplied with water through further conduits obtained in the distributing body, are arranged for nebulizing the water in such a way as to supply the raw material necessary for making snow crystals and for suitably humidifying the air surrounding the nebulizing device.

[0009] In this way, in operation, the freezing nuclei generated by the nucleating nozzles interact with the nebulized water dispensed by the dispensing nozzles to form, in suitable temperature conditions, crystals of artificial snow.

[0010] A drawback of the known devices is that, owing to the low operating temperatures, which are typically below 0°C, both an external portion of the distributing body and the dispensing nozzles and the nucleating nozzles cool and promote freezing of the water during nebulizing.

[0011] This implies that the aforesaid device can have part or all of the nozzles obstructed by the solidified water, with frequent machine stops and the need for qualified personnel to intervene to unblock the nozzles, with consequent loss of efficiency and of money.

[0012] An object of the invention is to improve the devices for nebulizing liquids and/or a gas/liquid mixture, in particular, the devices for nebulizing water and/or an air/water mixture arranged for producing artificial snow.

[0013] A further object is to provide devices for nebulizing liquids and/or a gas/liquid mixture that are able to operate even in particularly difficult thermal conditions.

[0014] According to the invention, a device is provided for producing artificial snow, comprising a core element provided with nebulizing means arranged for nebulizing a liquid and/or a gas/liquid mixture, characterised in that it further comprises sleeve means associated with said core element.

[0015] In an embodiment of the invention, between said sleeve means and said core element, gap means is defined that is arranged for receiving said liquid.

[0016] In a further embodiment of the invention, said nebulizing means comprises at least a portion positioned in said gap means.

[0017] Owing to the invention, it is possible to maintain the nebulizing means and the sleeve means at a temperature above 0°C, sufficient for preventing freezing thereof.

[0018] In fact, the nebulizing means comprises at least a portion received in the gap means, said portion being lapped and heated by the liquid circulating in the latter.

[0019] In the same way, the sleeve means comprises a wall facing the gap means lapped and heated by the liquid circulating in the latter.

[0020] In this way it is possible to obtain nebulizing devices that are particularly effective even in temperature conditions that are much below 0°C.

[0021] The invention can be better understood and implemented with reference to the attached drawings that illustrate some embodiments thereof by way of non limiting example, in which:

Figure 1 is a frontal perspective view of a device for producing artificial snow;

Figure 2 is a side perspective view of the device in Figure 1;

Figure 3 is a section taken along the plane III-III of the device in Figure 1;

Figure 4 is a section taken along the plane IV-IV of the device in Figure 1;

Figure 5 is a section taken along the plane V-V of the device in Figure 1;

Figure 6 is a section taken along the plane VI-VI of the device in Figure 1;

Figure 7 is a section taken along the plane VII-VII of the device in Figure 1;

Figure 8 is a section taken along the plane VIII-VIII of the device in Figure 1;

Figure 9 is a section taken along the plane IX-IX of the device in Figure 1;

Figure 10 is a section taken along the plane X-X of the device in Figure 1;

Figure 11 is a longitudinal section of a dispensing device included in the device in Figure 1;

Figure 12 is a plan view with some sectioned details of a nucleating nozzle included in the device in Figure 1;

Figure 13 is a longitudinal section, with certain details removed to show better other details of the nucleating device in Figure 12;

Figure 14 is a section like the one in Figure 3 of a version of the device in Figure 1;

Figure 15 is a section like the one in Figure 4 of the

version in Figure 14;
Figure 16 is a section like the one in Figure 9 of the version in Figure 14;
Figure 17 is a section like the one in Figure 7 of the version in Figure 14;
Figure 18 is a cross section of the version in Figure 14.

[0022] With reference to Figures 1 and 2, there is shown a device 1 for nebulizing water and an air/water mixture arranged for producing artificial snow.

[0023] The device 1 is provided with a dispensing head 2, having a substantially cylindrical shape.

[0024] The dispensing head 2 comprises a core element 3, or distributing body, extending along an axis Z, and a sleeve 4, which is substantially concentric to the aforesaid core element 3 and extends around the aforesaid axis Z (Figure 3).

[0025] The core element 3 comprises a first curvilinear surface 5 and a second curvilinear surface 6, the first curvilinear surface 5 and the second curvilinear surface 6 being connected by a first planar surface 7 and by a second planar surface 8.

[0026] The sleeve 4, having substantially a hollow cylindrical shape, is arranged for being removably fixed, for example by means of a threaded connection, to the core element 3, and comprises a substantially cylindrical side surface 23.

[0027] Between the first curvilinear surface 5, the second curvilinear surface 6, the first planar surface 7, the second planar surface 8 and the side surface 23, there is thus defined a gap 21, into which the water can flow.

[0028] In particular, the gap 21, by extending along the axis Z, is positioned near a peripheral zone 22 of the dispensing head 2 between the core element 3 and the sleeve 4.

[0029] In the core element 3 there are further obtained water and air intake conduits.

[0030] In particular, the core element 3 comprises an air intake conduit 9, a first water intake conduit 10, a second water intake conduit 11 and a third water intake conduit 12.

[0031] The air intake conduit 9 (Figure 3, and Figures 5 to 7) comprises a section 13 extending along a direction substantially paralleled to said axis Z, and a further section 14, the further section 14 being substantially perpendicular to the section 13.

[0032] The further section 14 is provided with a first distributing channel 15 arranged for conveying the air to nucleating nozzles 16, for example to two nucleating nozzles 16.

[0033] The nucleating nozzles 16 are mounted in respective seats obtained in the first planar surface 7 and in the second planar surface 8 of the core element 3 and project substantially radially from the sleeve 4.

[0034] The nucleating nozzles 16 each comprise a portion 30 positioned substantially at the gap 21.

[0035] The nucleating nozzles 16 are each provided with a converging conduit 17 and with a passage 18, the passage 18 being obtained in a rectilinear conduit 33 positioned downstream of the converging conduit 17.

[0036] In particular, the passage 18 is positioned substantially at the portion 30.

[0037] In use, the converging conduit 17 is arranged for accelerating a flow of the air coming from the intake conduit 13 in such a way as to create a vacuum substantially near the rectilinear conduit 33, the vacuum being sufficient to suck the water through the passage 18 that flows into the gap 21.

[0038] In this way in the nucleating nozzles 16 there is created a desired air/water mixture that is nebulized to generate freezing nuclei.

[0039] The further section 14 is further provided with a plug 20 that is substantially opposite the section 13 arranged for preventing the air flowing into the gap 21.

[0040] In an embodiment of the invention, shown in Figures 12 and 13, the nucleating nozzles 16 comprise a first passage 100 and a second passage 101 communicating with the rectilinear conduit 33, the first passage 100 and the second passage 101 being mutually opposite and positioned substantially at the portion 30.

[0041] In other words, the first passage 100 and the second passage 101 extend substantially perpendicularly and from opposite sides with respect to the rectilinear conduit 33.

[0042] In this embodiment, moreover, the nucleating nozzles 16 comprise a diverging conduit 103 positioned downstream of the rectilinear conduit 33 and connected to the distributing channel 15 through passage means 102.

[0043] In other words, the rectilinear conduit 33 is interposed between the converging conduit 17 and the diverging conduit 103.

[0044] In use, a first part of the flow of air coming from the air intake conduit 13 flows into the converging conduit 17, which accelerates the first part in such a way as to create a vacuum substantially near the rectilinear conduit 33, the vacuum being sufficient to suck the water that flows into the gap 21 through the first passage 100 and the second passage 101, whilst a second part of the flow of air flows from the first distributing channel 15 to the diverging conduit 103 through the passage means 102.

[0045] In this way, in the nucleating nozzles 16 a desired air/water mixture is created that is nebulized to generate freezing nuclei.

[0046] The first water intake conduit 10 comprises a main channel 40, extending along a further direction substantially parallel to the axis Z, a first channel 34 and a second channel 35 tilted with respect to the aforesaid axis Z (Figures 3, 5, 6 and 9).

[0047] In particular, the first channel 34 is positioned in an end zone 36 of the main channel 40, whilst the second channel 35 is located in a further end zone 37 of the main channel 40, opposite the end zone 36.

[0048] The first channel 34 and the second channel 35 are arranged for introducing water into the gap 21.

[0049] In particular, the first channel 34 and the second channel 35 are orientated and positioned in such a way as to induce motion in the water delivered into the gap 21 according to a preferential path.

[0050] The first water intake conduit 10, by introducing water into the gap 21, supplies first dispensing nozzles 41 and second dispensing nozzles 42 with water, the first dispensing nozzles 41 (Figure 9) and the second dispensing nozzles 42 each comprising for example a pair of nozzles.

[0051] The first dispensing nozzles 41 and the second dispensing nozzles 42 are positioned, with respect to a flow of water coming from a dispensing apparatus, respectively upstream and downstream of the nucleating nozzles 16.

[0052] The first dispensing nozzles 41 and the second dispensing nozzles 42 are mounted in further seats obtained in the first planar surface 7 and in the second planar surface 8 of the core element 3 and project substantially radially from the sleeve 4.

[0053] The first dispensing nozzles 41 and the second dispensing nozzles 42 each comprise a further portion 43 positioned substantially at the gap 21.

[0054] The further portion 43 is provided with holes 44 arranged for enabling the water present in the gap 21 to supply the first dispensing nozzles 41 and the second dispensing nozzles 42.

[0055] The first dispensing nozzles 41 and the second dispensing nozzles 42 are arranged for nebulizing water in such a way as to provide raw material for the freezing nuclei to make snow crystals.

[0056] In an embodiment of the invention, shown in Figure 11, shutting means 104 is provided that is positioned, and slidable, in a body 105 of the first dispensing nozzles 41 and of the second dispensing nozzles 42.

[0057] The shutting means 104 is arranged for shutting the holes 44 to adjust a flow of water from the gap 21 to the first dispensing nozzles 41 and to the second dispensing nozzles 42.

[0058] In other words, the shutting means 104, driven by suitable pneumatic or hydraulic driving means, which is not shown, prevents/enables the water in the gap 21 to pass through the holes 44 to supply the first dispensing nozzles 41 and the second dispensing nozzles 42.

[0059] In this way it is possible to drive, according to the quantity of snow that it is desired to make, only the first dispensing nozzles 41, or only the second dispensing nozzles 42, or both.

[0060] The second water intake conduit 11 (Figures 4 to 6 and 10) is tilted with respect to the axis Z and is arranged for supplying with water third dispensing nozzles 50, comprising for example a pair of nozzles.

[0061] The third dispensing nozzles 50 are positioned, with respect to the aforesaid flow of water, upstream of the first dispensing nozzles 41.

[0062] The third dispensing nozzles 50 are mounted in still further seats obtained in the first planar surface 7 and in the second planar surface 8 of the core element 3 and are projected substantially radially from the sleeve 4.

[0063] The third dispensing nozzles 50 each comprise a still further portion 51 positioned substantially at the gap 21.

[0064] The third dispensing nozzles 50, which are driven in the event of greater demand for water, are arranged for nebulizing water in such a way as to supply further raw material to the freezing nuclei for making snow crystals.

[0065] The third water intake conduit 12 comprises another section 60 extending substantially along a further direction substantially parallel to said axis Z, and another further section 61, the other further section 61 being substantially perpendicular to the other section 60 (Figures 4 to 6 and 8).

[0066] The other further section 61 is provided with a second distributing channel 62 arranged for conveying the water to fourth dispensing nozzles 63, for example two fourth dispensing nozzles 63.

[0067] The fourth dispensing nozzles 63 are positioned, with respect to the aforesaid flow of water, downstream of the second dispensing nozzles 42.

[0068] The fourth dispensing nozzles 63 are mounted in still other seats obtained in the first planar surface 7 and in the second planar surface 8 of the core element 3 and are projected substantially radially from the sleeve 4.

[0069] The fourth dispensing nozzles 50 each comprise another portion 64 positioned substantially at the gap 21.

[0070] The fourth dispensing nozzles 63, driven in the event of still greater demand for water, are arranged for nebulizing water in such a way as to provide further raw material to the freezing nuclei to make snow crystals.

[0071] The other further section 61 is further provided with a further plug 65 that is substantially opposite the other section 60 arranged for preventing the water from flowing into the gap 21.

[0072] With reference to Figures 14 to 18, there is shown an alternative embodiment of the device 1.

[0073] In this embodiment, in the core element 3 there is obtained a third channel 110, a fourth channel 111, a fifth channel 112, a sixth channel 113, and a seventh channel 120, tilted with respect to the axis Z.

[0074] In particular, the third channel 110 and the fourth channel 111 enables the water in the gap 21 to flow to a third distributing channel 114 arranged for conveying the water to the first dispensing nozzles 41, the third channel 110 and the fourth channel 111 being positioned on opposite sides with respect to the third distributing channel 114.

[0075] The fifth channel 112 and the sixth channel 113 enable the water in the gap 21 to flow to a fourth distributing channel 115 arranged for conveying the water to the second dispensing nozzles 41, the fifth channel 112 and the sixth channel 113 being positioned on opposite sides with respect to the fourth distributing channel 115.

[0076] This means that both the first dispensing nozzles 41 (Figure 16), and the second dispensing nozzles 42 (Figure 18) are devoid of the holes 44 in the further portion 43 positioned substantially at the gap 21, inasmuch as the first dispensing nozzles 41 and the second dispensing nozzles 42 are supplied with water respectively by the third distributing channel 114 and by the fourth distributing channel 115.

[0077] The seventh channel 120 enables the water in the gap 21 to flow to a fifth distributing channel 121 arranged for conveying the water to the nucleating nozzles 16.

[0078] This means that the nucleating nozzles 16 are devoid of the passage 18, or of the first passage 100 and of the second passage 101 in the respective portions 30 positioned substantially at the gap 21.

[0079] In this embodiment, moreover, the further section 14 of the air intake conduit 9 comprises a first part 130 and a second part 131, the first part 130 and the second part 131 being positioned on an opposite side with respect to the portion 13 of the air intake conduit 9 and being substantially perpendicular with respect to the seventh channel 120.

[0080] In this way, the first part 130 and the second part 131 enable the flow of air coming from the air intake conduit 9 to flow into the nucleating nozzles 16.

[0081] It should be noted that the third channel 110, the fourth channel 111, the fifth channel 112, the sixth channel 113 and the seventh channel 120 are orientated and positioned in such a way as to improve the motion of the water in the gap 21 and to promote the emptying of the dispensing head 2.

[0082] In an embodiment of the invention, which is not illustrated, there is provided further shutting means, positioned and slidable, in the core element 3.

[0083] The further shutting means is arranged for shutting the third distributing channel 114 and the fourth distributing channel 115 for adjusting a flow of water from the gap 21 to the first dispensing nozzles 41 and the second dispensing nozzles 42.

[0084] In other words, the further shutting means, driven by suitable pneumatic or hydraulic driving means, prevents/enables water in the gap 21 to pass through the third distributing channel 114 and the fourth distributing channel 115 to supply the first dispensing nozzles 41 and the second dispensing nozzles 42.

[0085] In this way it is possible to drive, according to the quantity of snow that it is desired to make, only the first dispensing nozzles 41, or only the second dispensing nozzles 42, or both.

[0086] In a still further embodiment of the invention, which is not shown, the third channel 110, the fourth channel 111, the fifth channel 112, the sixth channel 113, and the seventh channel 120 are substantially perpendicular to the axis Z.

[0087] The device 1 further comprises a connection 70, or base body, fixed to the dispensing head 2, arranged for being connected to the water and air dispensing apparatus, which is not shown.

[0088] The connection 70 is provided with an air inlet passage 71 and with water inlet passages (Figures 3 and 4).

[0089] The water inlet passages comprise a first water inlet passage 72, a second water inlet passage 73 and a third water inlet passage 74.

[0090] The air inlet passage 71 is connected, in use, to the air intake conduit 9, whilst the first water inlet passage 72, the second water inlet passage 73 and the third water inlet passage 74 are connected respectively to the first water intake conduit 10, the second water intake conduit 11 and the third water intake conduit 12.

[0091] It should be noted that in use the nucleating nozzles 16, the first dispensing nozzles 41, the second dispensing nozzles 42, the third dispensing nozzles 50 and the fourth dispensing nozzles 63 are provided respectively with the portion 30, with the first portion 43, with the still further portion 51 and with the other portion 64, positioned in the gap 21.

[0092] In turn, in use, the sleeve 4 comprises the side surface 23 facing the gap 21.

[0093] In this way, in use, the water that flows into the gap 21 according to a preferential path determined by a suitable orientation of the first channel 34 and of the second channel 35 transfers a quantity of heat to the aforesaid portions and to the side surface 23, heating the aforesaid portions and the side surface 23.

[0094] In other words, the water that flows into the gap 21 with a suitable turbulent flow transfers heat to the nucleating and dispensing nozzles and to the sleeve 4, heating the nucleating and dispensing nozzles and the sleeve 4 and preventing freezing of the dispensing head 2.

Claims

1. Device for producing artificial snow, comprising a core element (3) provided with nebulizing means (16, 41, 42, 50, 63) arranged for nebulizing a liquid and/or a gas/liquid mixture, **characterised in that** it further comprises sleeve means (4) associated with said core element (3).

2. Device according to claim 1, wherein said core element (3) is surrounded by said sleeve means (4) in such a way that between said core element (3) and said sleeve means (4), there is defined a single gap (21).

3. Device according to claim 2, wherein said single gap (21) extends between a base body (70) of said core element (3) that enables a liquid and/or a gas to be dispensed to pass through and that part of said nebulizing means (63) further away from said base body (70).

4. Device according to any preceding claim, wherein

said nebulizing means is a plurality of nebulizers (16, 41, 42, 50, 63) all communicating with said single gap (21).

5. Device according to claim 4, wherein said nebulizers (16, 41, 42, 50, 63) comprise first nozzle means (16) arranged for nebulizing said gas/liquid mixture, said first nozzle means (16) being provided with first passage means (33) and with second passage means (102) for enabling respectively said gas/liquid mixture and said gas to flow into said first nozzle means (16).

6. Device according to claim 5, wherein said second passage means comprises a plurality of passages (102).

7. Device according to any one of claims 4 to 6, wherein said nebulizers (16, 41, 42, 50, 63) comprises second nozzle means (41, 42, 50, 63) arranged for nebulizing said liquid.

8. Device according to claim 7, wherein said second nozzle means (41, 42, 50, 63) is provided with hole means (44) positioned substantially at said single gap (21) for enabling said liquid to flow into said second nozzle means (41, 42, 50, 63).

9. Device according to claim 7, wherein said second nozzle means (41, 42, 50, 63) is provided with conduit means (111, 112, 113, 114, 115, 120) positioned in said core element (3) and communicating with said single gap (21) for enabling said liquid to flow into said second nozzle means (41, 42, 50, 63).

10. Device according to any one of claims 7 to 9, and comprising shutting means (104) arranged for adjusting a flow of said liquid from said single gap (21) to said second nozzle means (41, 42, 50, 63).

11. Device according to claim 10, as claim 10 is appended to claim 8, wherein said shutting means (104) is positioned, and is slidable, in a body (105) of said second nozzle means (41, 42, 50, 63) for shutting said hole means (44).

12. Device according to claim 10, as claim 10 is appended to claim 9, wherein said shutting means is positioned, and is slidable, in said core element (3) for shutting said conduit means (111, 112, 113, 114, 115, 120).

Amended claims in accordance with Rule 86(2) EPC.

1. Device for producing artificial snow, comprising a core element (3) provided with nebulizing means (16, 41, 42, 50, 63) arranged for nebulizing a liquid and/or a gas/liquid mixture, sleeve means (4) associated with said core element (3) and leaving a gap (21) between said core element (3) and said sleeve means (4), so that at least part of said nebulizing means (16, 41, 42, 50, 63) can be supplied with water passing through said gap (21), **characterised in that** said gap is a single gap (21) extending between a base body (70) of said core element (3) that enables a liquid and/or a gas to be dispensed to pass through and that part of said nebulizing means (63) further away from said base body (70).

2. Device according to any preceding claim, wherein said nebulizing means is a plurality of nebulizers (16, 41, 42, 50, 63) all communicating with said single gap (21).

3. Device according to claim 2, wherein said nebulizers (16, 41, 42, 50, 63) comprise first nozzle means (16) arranged for nebulizing said gas/liquid mixture, said first nozzle means (16) being provided with first passage means (33) and with second passage means (102) for enabling respectively said gas/liquid mixture and said gas to flow into said first nozzle means (16).

4. Device according to claim 3, wherein said second passage means comprises a plurality of passages (102).

5. Device according to any one of claims 2 to 4, wherein said nebulizers (16, 41, 42, 50, 63) comprises second nozzle means (41, 42, 50, 63) arranged for nebulizing said liquid.

6. Device according to claim 5, wherein said second nozzle means (41, 42, 50, 63) is provided with hole means (44) positioned substantially at said single gap (21) for enabling said liquid to flow into said second nozzle means (41, 42, 50, 63).

7. Device according to claim 5, wherein said second nozzle means (41, 42, 50, 63) is provided with conduit means (111, 112, 113, 114, 115, 120) positioned in said core element (3) and communicating with said single gap (21) for enabling said liquid to flow into said second nozzle means (41, 42, 50, 63).

8. Device according to any one of claims 5 to 7, and comprising shutting means (104) arranged for adjusting a flow of said liquid from said single gap (21) to said second nozzle means (41, 42, 50, 63).

9. Device according to claim 8, as claim 8 is appended to claim 6, wherein said shutting means (104) is positioned, and is slidable, in a body (105) of said second nozzle means (41, 42, 50, 63) for shutting said hole means (44).

10. Device according to claim 8, as claim 8 is appended to claim 7, wherein said shutting means is positioned, and is slidable, in said core element (3) for shutting said conduit means (111, 112, 113, 114, 115, 120).

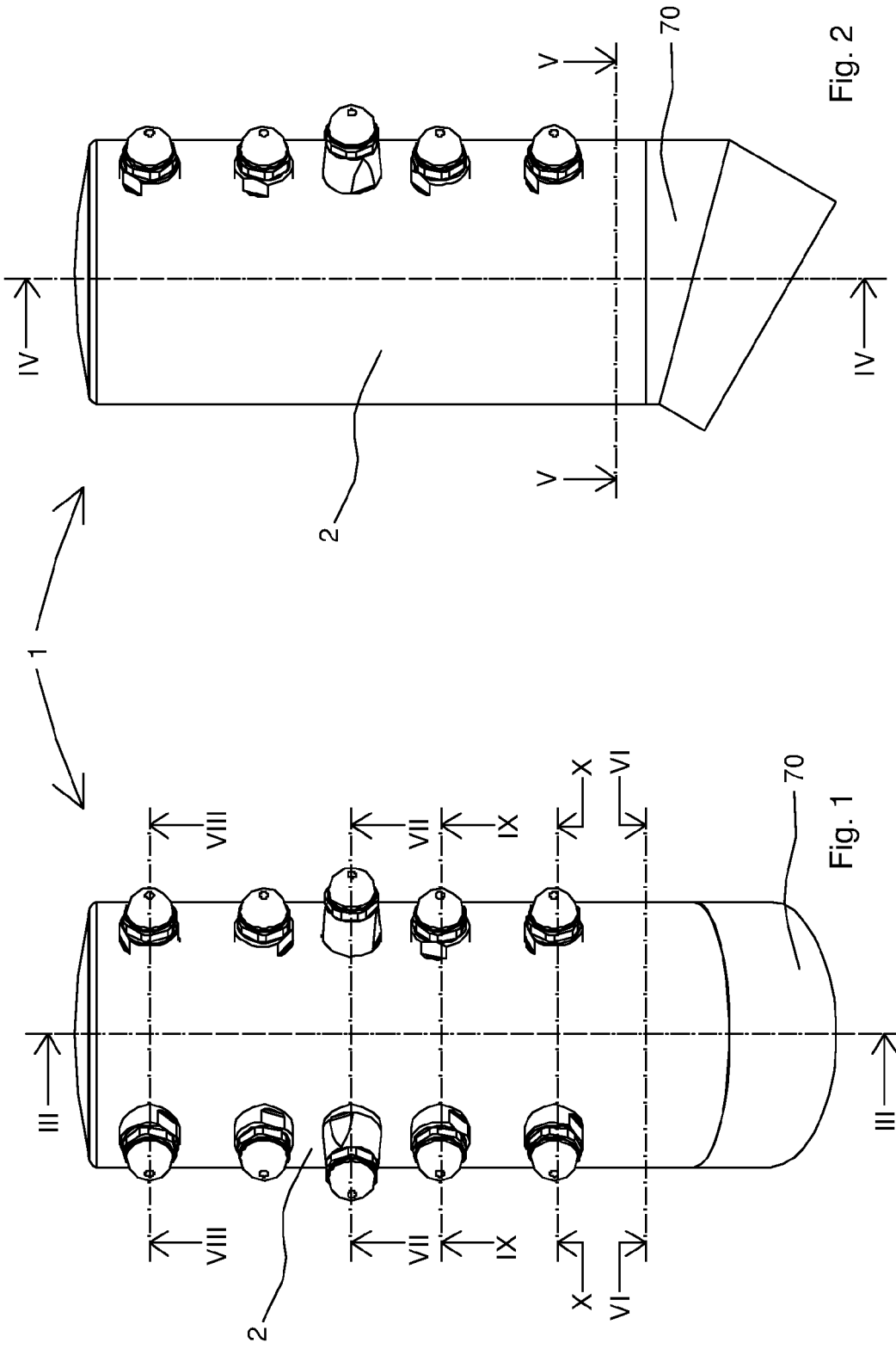

Fig. 1

Fig. 2

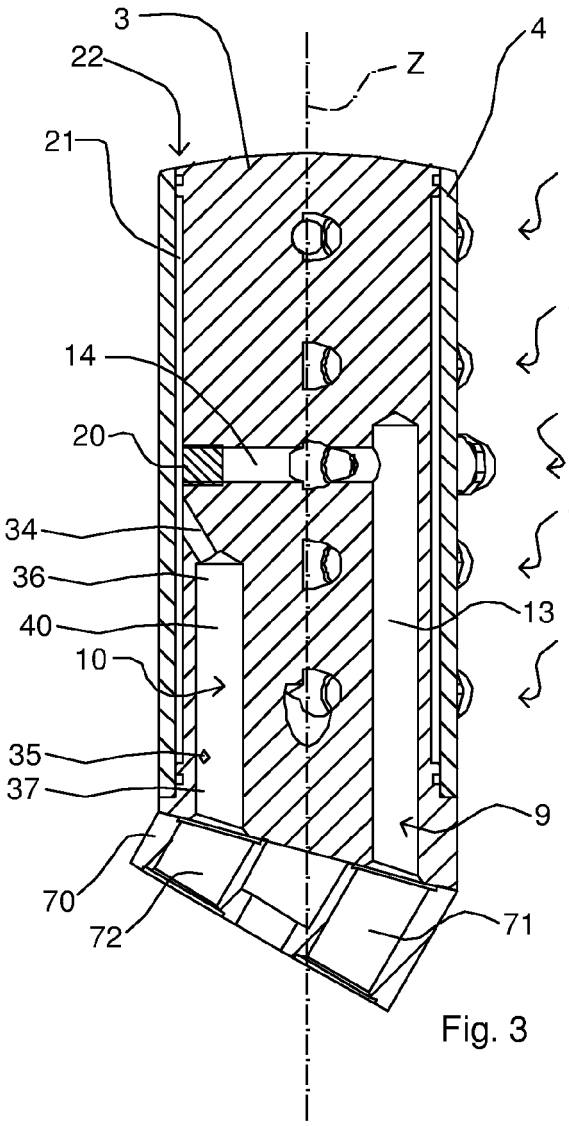

Fig. 3

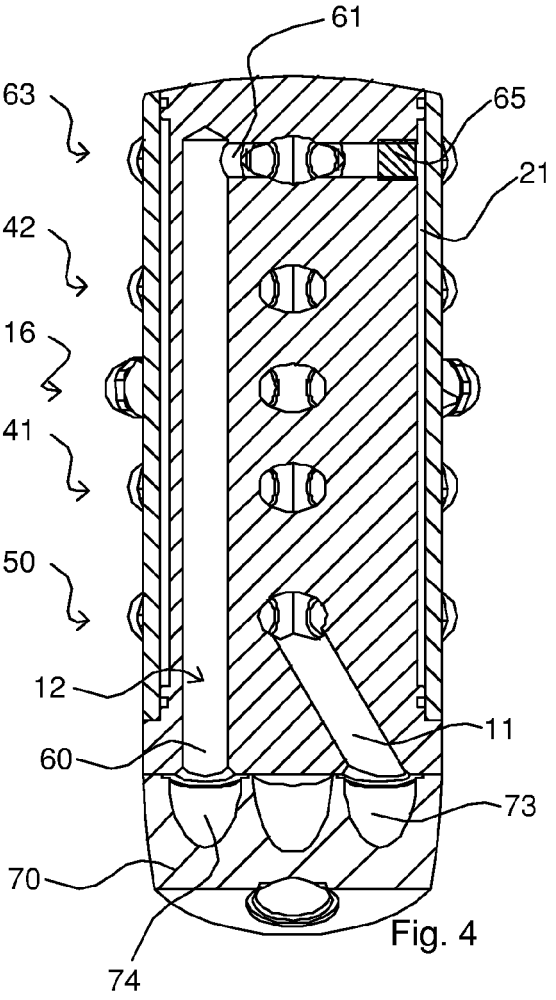

Fig. 4

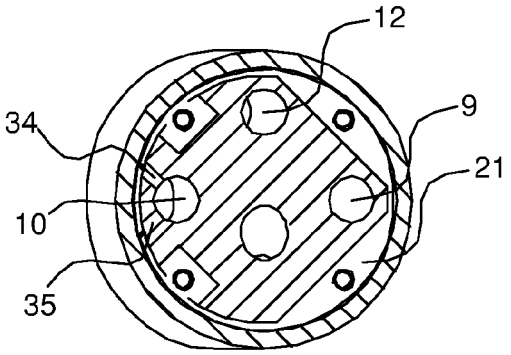

Fig. 5

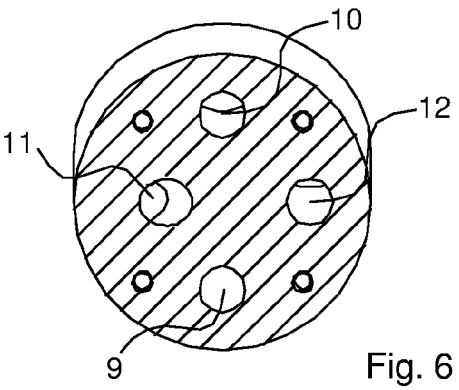

Fig. 6

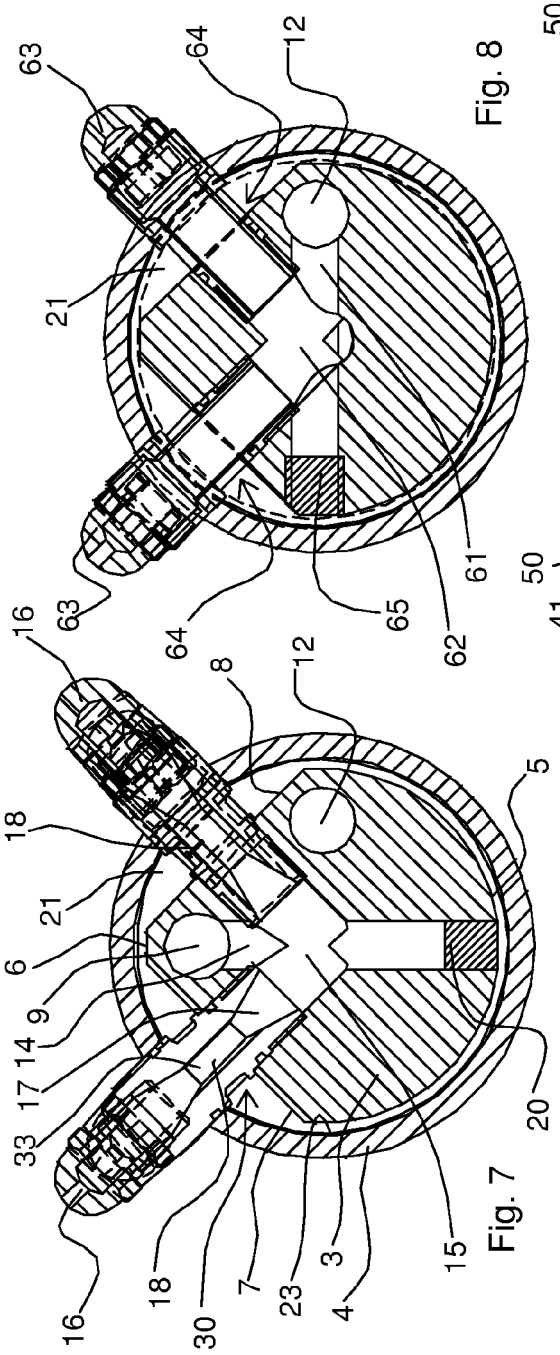

Fig. 7

Fig. 8

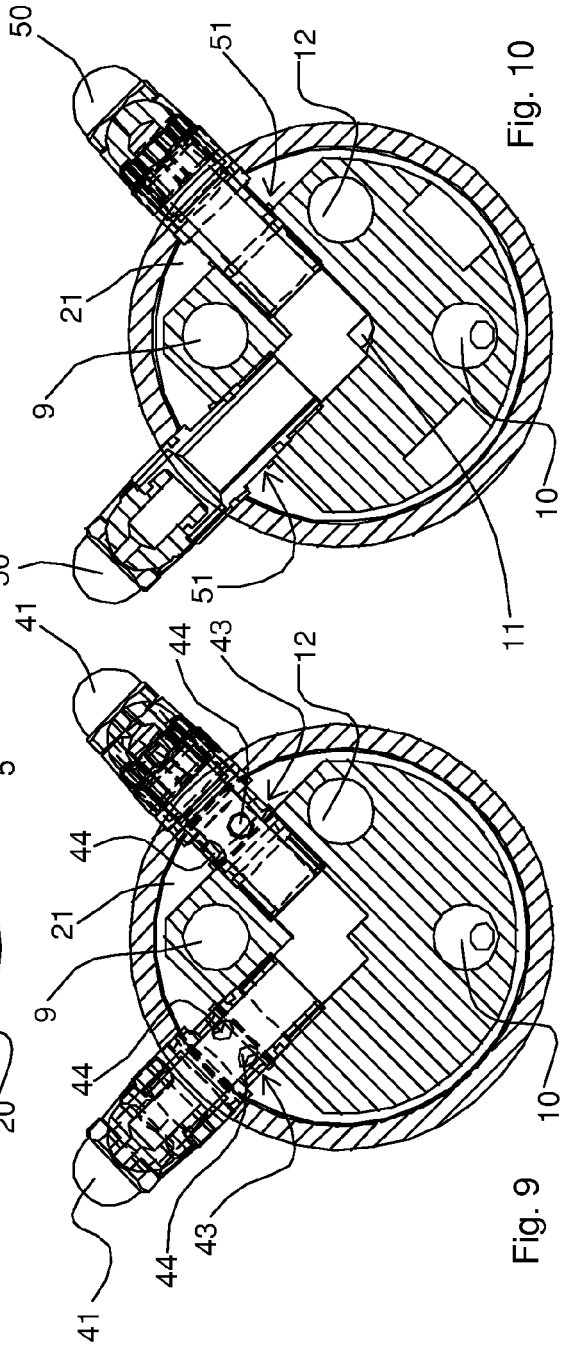

Fig. 9

Fig. 10

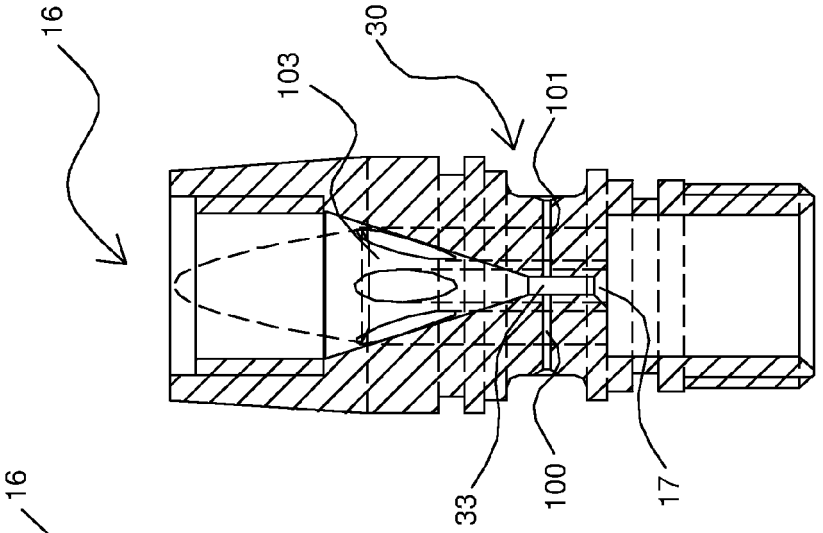

Fig. 13

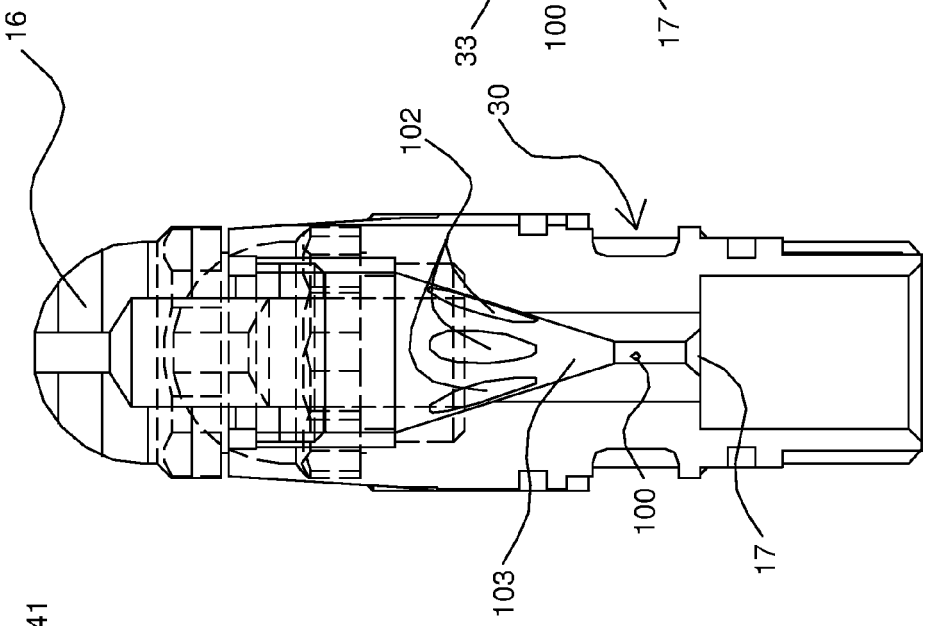

Fig. 12

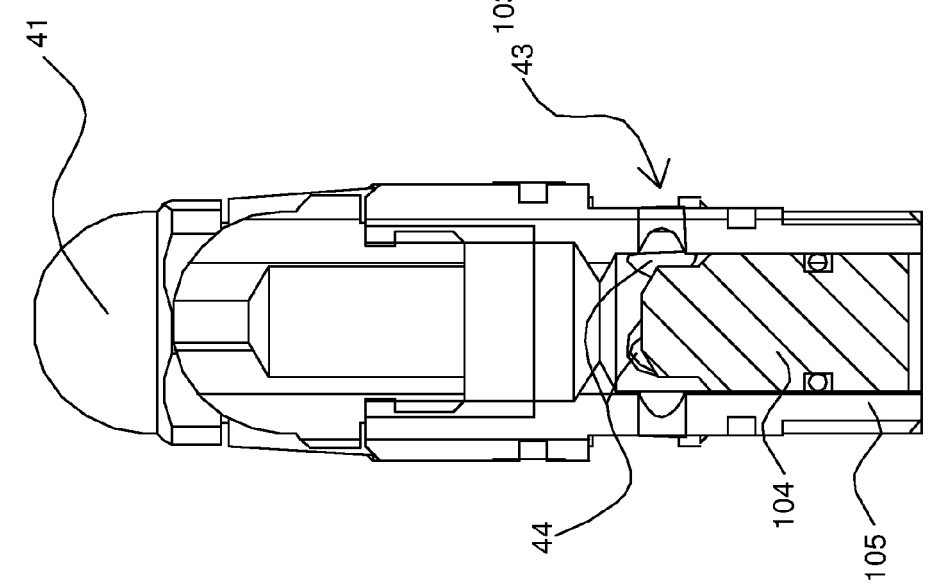

Fig. 11

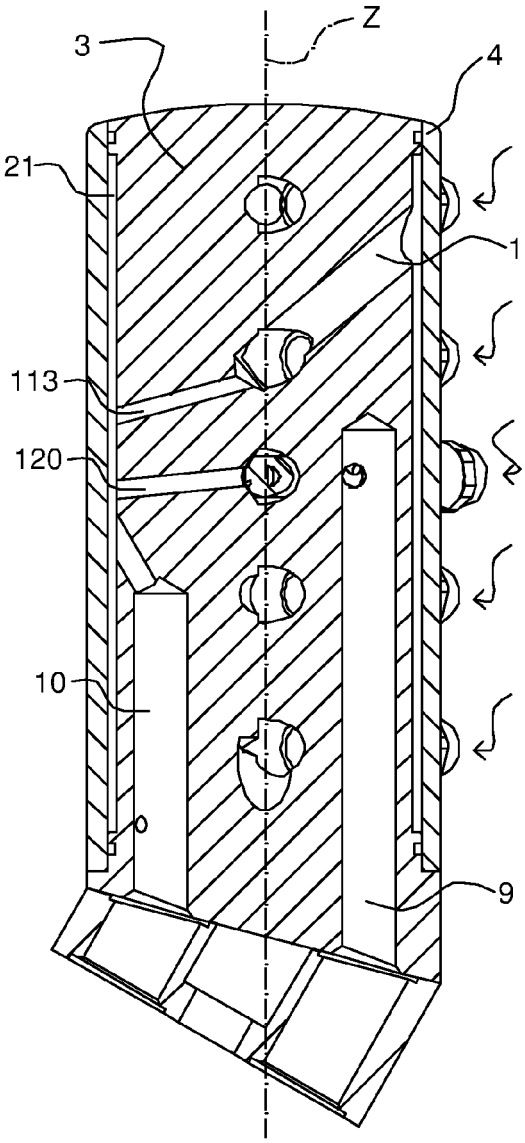

Fig. 14

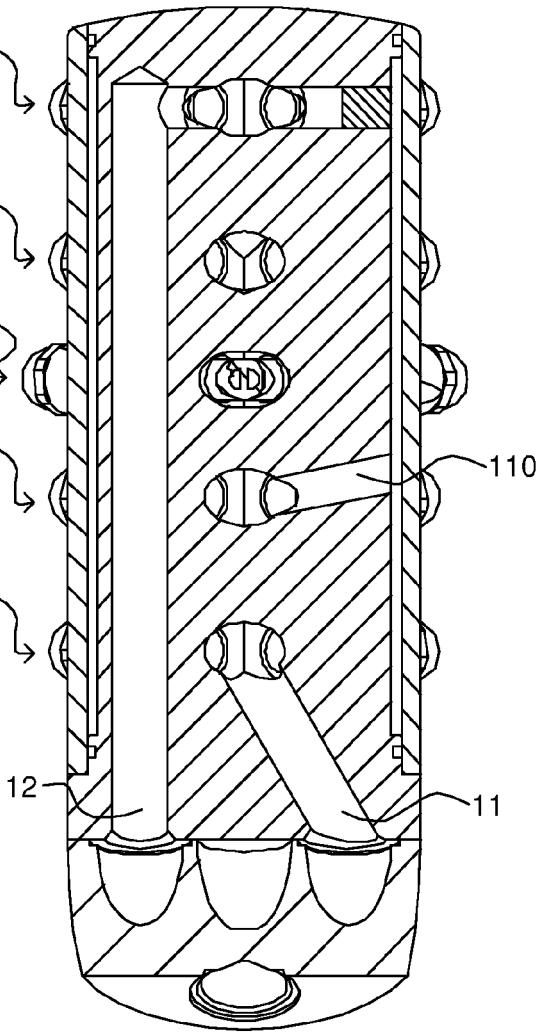

Fig. 15

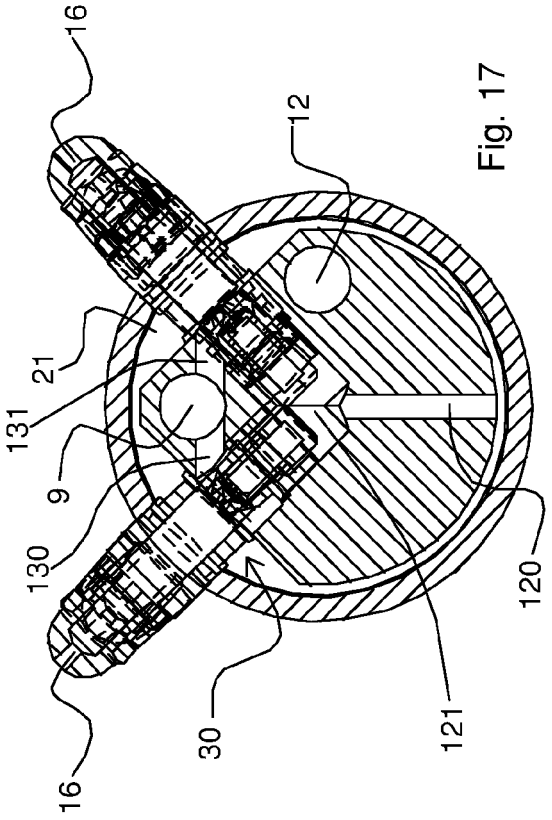

Fig. 17

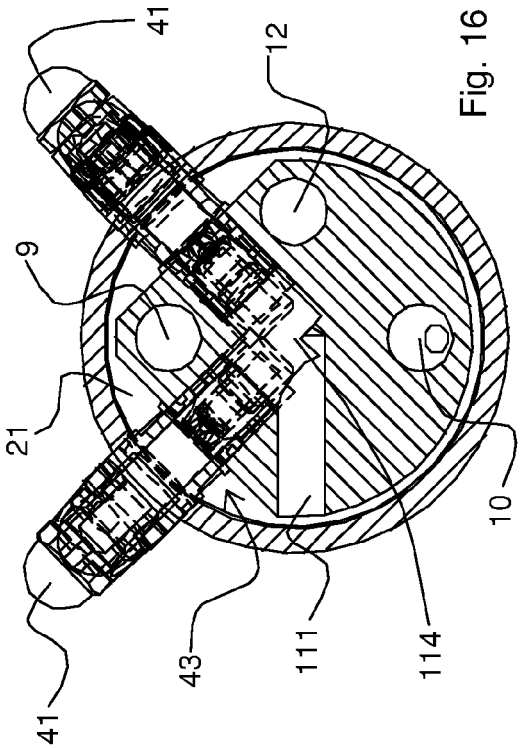

Fig. 16

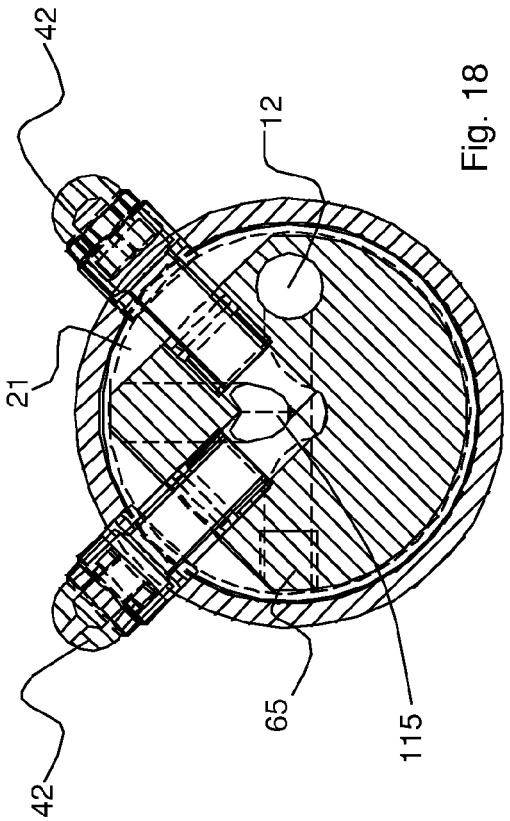

Fig. 18

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EUROPEAN SEARCH REPORT

Application Number
EP 06 12 3993

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
X	US 6 719 209 B1 (PERGAY BERNARD [FR] ET AL) 13 April 2004 (2004-04-13) * the whole document * -----	1-12	INV. F25C3/04

TECHNICAL FIELDS SEARCHED (IPC)

F25C

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	30 January 2007	Eberwein, Michael

CATEGORY OF CITED DOCUMENTS

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