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(54) **FLUID HEATING DEVICE**

(57) The present invention is relative to a fluid heating device, suitable for heating at least one fluid circulating inside a heating structure, comprising at least one enclosure (10) made of a conductive material, inside which at least one resistive element is inserted, having respective terminals connected to relative electrical conductors connected to a power electronic circuit, the power electronic circuit is provided with at least one power switch (3), which is connected in turn, to at least one resistive element and to the power circuit; the electrical conductors emerge from said enclosure (10) passing through a fitting (1), which is placed coaxially with respect to the enclosure (10) and which is made of thermally conductive material; the power switch (3), made internally to said fitting (1), comprises a power dissipating element or diffuser (2), fixed and interposed between the power switch (3) and at least a portion of the inner walls (13) of the fitting (1) or the enclosure or pipe (10)

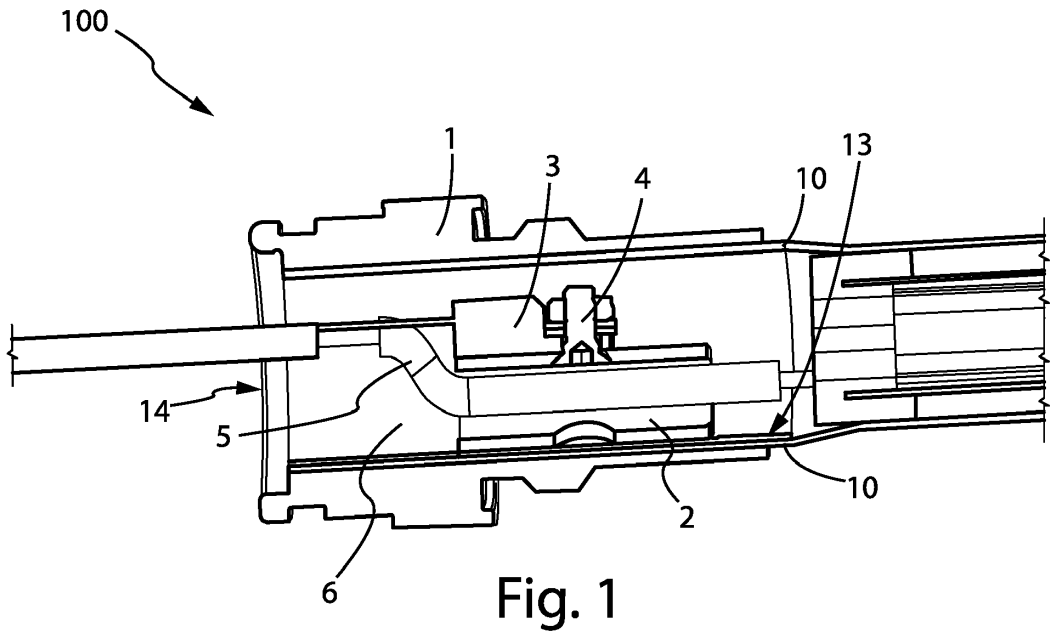

Fig. 1

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Description

[0001] The present invention generically relates to a fluid heating device, particularly for water, enclosed within airtight and/or watertight containers.

[0002] More particularly, the invention relates to a heating device suitablee for hot water tanks and/or water or oil radiator and/or a towel warmer.

[0003] Such a heating device normally includes a resistor or resistive element, which is placed within a tubular enclosure made of thermally conductive material and which is connected to a power circuit via a power electronic switch; alternatively, there may be double-walled heating devices, in which two thermally conductive tubular enclosures (and, therefore, two respective resistors) are arranged coaxially within each other.

[0004] The external enclosure of the heating device is inserted into the fluid present in the hermetically sealed container, while the upper end of this enclosure is mounted stably, for example by means of a suitable end flange, on the outside of the container, so that the electrical connection of the resistor can be made.

[0005] The end flange, within which the heating resistor is arranged, may be made of thermally conductive material, and in a suitable cavity in it may be placed the power circuit breaker (usually a TRIAC), so that the structure of the flange itself allows the dissipation of the heat generated, during the operation of the breaker or TRIAC, through the walls of the external enclosure.

[0006] This structure makes it possible to substantially limit the power dissipation and thus the excessive heating of the TRIAC; however, in order to achieve this, it is necessary to specially design the end flange of the heating device and to provide for its sufficient thickness to mount the TRIAC, with the inevitable consequence given that the whole structure is extremely bulky and results in relative costs and difficulties of electrical connections, which it would be desirable to reduce.

[0007] It is also well known to use heating device resistors, which are enclosed within an insulating material and are connected to a power source, via a temperature sensor; the sensor is placed within the insulating material and is capable of interrupting the power supply to the resistor depending on the temperature detected.

[0008] However, such devices still have some drawbacks in limiting the power and heat dissipation of the power circuit connected to the heating element, as the temperature sensor must be able to detect a temperature value as close as possible to that reached by the resistor and, therefore, there is no need to dissipate power and/or heat in the proximity of such a sensor element.

[0009] Another drawback of fluid heating devices according to the prior art is that heat transfer between the power circuit breaker or TRIAC and the metal fitting does not occur effectively, creating unnecessary heat loss.

[0010] Finally, a further drawback of the known fluid heating devices is the absence of mechanical fasteners or stable mechanical coupling systems that provide long-term stability.

[0011] The aim of the present invention is, therefore, to obviate the drawbacks of the above-mentioned prior art and, in particular, to realize a fluid heating device, in particular circulating within radiators and/or towel warmers, which allows for adequate dissipation of the power and related heat generated by the power switch (TRIAC) connected to the resistive element supply circuit, which is itself arranged within the enclosure of thermally conductive material.

[0012] Another aim of the invention is to realize a fluid heating device, which can be used particularly for radiators and/or towel warmers, and which allows for a compact and space-saving structure, compared with the known technique.

[0013] Another aim of the invention is to realize a fluid heating device, which is particularly effective, reliable, convenient and economical, compared to the prior art, both from the point of view of assembly and from the point of view of the electrical connections to be made.

[0014] It is a further aim of the present invention to realize a fluid heating device with a power electronic switch, by way of example a TRIAC, within the heating element, as well as to provide a heating device capable of working at a temperature in accordance with its technical specifications.

[0015] Another aim of the invention is to make a heating device having a diffuser, interposed between the switch and the fitting, so as to increase the contact surface area between the switch and the fitting and effectively transfer heat from the switch to the fitting.

[0016] Finally, a further aim of the present invention is to provide a fluid heating device that is capable of monitoring and/or controlling the temperature of the power electronic switch.

[0017] These and other aims are achieved by a fluid heating device, particularly for radiators and/or towel warmers, according to the appended claim 1; further detailed technical features of the heating device object of the invention are set forth in the corresponding dependent claims.

[0018] Advantageously, according to the present invention, it is contemplated to place the power electronic circuit breaker (TRIAC) within a specific fitting, made of thermally conductive material and connected to the tubular heating resistor containment element.

[0019] This provides maximum mechanical protection for the power electronic switch. Additionally, the contact between the switch and the diffuser allows for effective dissipation of electrical power and heat between the switch and the stand, during the operation of the entire device.

[0020] More specifically, the physical connection between the fitting and the diffuser allows, by enlarging the contact surface, better power and heat dissipation.

[0021] Finally, the use of the fitting enables a highly protective function, both mechanically and from the point of view of electrical insulation of the power electronic

switch, as well as facilitates its electrical connections.

[0022] Thus, it is thus possible to increase the average service life of the switch and the entire power electronic circuit, compared with known solutions.

[0023] Further aims and advantages of the present invention will become more clear from the following description of a preferred embodiment of the fluid heating device of the invention, provided by way of illustration and example, and the accompanying drawings, also provided by way of preferred and non-limiting example only, wherein:

- Figure 1 is a schematic view of the side section of the fluid heating device, in a first embodiment, according to the present invention;
- Figures 2A and 2B are perspective views of the internal components of the insulation system of the fluid heating device of figure 1, according to the present invention;
- Figure 3 is a schematic view of the front section of the fluid heating device of figure 1, according to the present invention;
- Figure 4 is a schematic view of the side section of the fluid heating device, in a second embodiment, according to the present invention;
- Figure 5 is a schematic view of the front section of the fluid heating device in figure 4, according to the present invention;
- Figures 6A and 6B are perspective views of the internal components of the insulation system of the fluid heating device of figure 4, according to the present invention;
- Figure 7 is a schematic view of the front section of the fluid heating device of figure 4, according to the present invention.

[0024] Referring to the above figures, the fluid heating device according to the invention, in a first embodiment thereof, is generically indicated by the numerical reference 100, while, in a second embodiment thereof, according to the present invention, it is generically indicated by the numerical reference 200.

[0025] It should first be noted that even though the description and the attached drawings refer to a single resistive element, suitable for heating a circulating fluid within a heating structure, such as a water or oil radiator and/or a towel warmer, the invention is similarly extendable to the use of multiple resistive elements, of whatever form and connected in different ways to each other.

[0026] With reference to the attached figures, the fluid heating device 100, 200, which is the object of the present invention, comprises a reinforced electrical heating element, which includes a tubular enclosure or tube 10, made of electrically conductive material and, in particular metal, inside which a resistive element (not shown in detail in the attached figures) is inserted.

[0027] The resistive element is then usually placed inside an electrically insulating powder or compound, compacted within the enclosure or tube 10, and has two terminals, connected to respective electrical conductors, which emerge from the enclosure or tube 10, passing through the fitting 1, made of thermally conductive material, to be connected to a power electronic circuit, placed outside the heating device which results connected to a power switch 3.

[0028] The power switch 3 of the electronic circuit may consist of a TRIAC and results connected to the resistive element on one side and to the rest of the power circuit on the other side by means of appropriate cables 5.

[0029] Such cables 5 may be power and/or signal cables in double or single insulation.

[0030] In particular, according to the present invention, the power switch or TRIAC 3 is inserted within an opening 14, preferably with a cylindrical shape, drilled centrally to the fitting 1, so that said TRIAC 3 is in contact with a power dissipating element or diffuser 2 in which, the said power dissipator or diffuser 2 is interposed between the TRIAC 3 and one of the inner walls 13 of the fitting 1, as visible, for example, in figures 4 and 7 and/or between the TRIAC 3 and the enclosure or tube 10 as visualized in the attached figures 1 and 3.

[0031] In more detail, the diffuser 2, at a first portion of it, is in contact with a inner wall 13 of the fitting 1 and, at a second portion of it, is in contact with the TRIAC 3.

[0032] In even more detail, the diffuser 2 can be designed to allow power or signal cables 5 to pass through it.

[0033] Advantageously, diffuser 2 transfers heat from TRIAC 3 to fitting 1 and is appropriately sized to mate with the hole in fitting 1 and hold the construction in place. Its dimensions are such as to allow heat dissipation and ensure a zone temperature compatible with the components present.

[0034] In order to maintain the contact of the lower surface of the TRIAC 3 with the portion of the inner wall 13 of the fitting 1 over time, the TRIAC 3 is advantageously fixed, by means of a mechanical fixing system or mechanical coupling 4, to the fitting 1 and/or to the enclosure or tube 10.

[0035] In a first embodiment of the device 100, a screw may be used, as illustrated in figures 1, 2A and 2B, or, in a second embodiment of the device 200, a mechanical coupling of the parts is used, as illustrated in figures 5, 6B AND 7, or additional fastening systems, such as rivets, tape and/or glue, may be used.

[0036] The TRIAC 3, diffuser 2, cables 5 and mechanical fixing system 4 may also be enclosed within insulation device 6, such as a thin, thermally and electrically insulating sheet or sheath, in order to increase the insulation between the power switch or TRIAC 3 itself and the resistive element contained in the tubular enclosure or tube 10.

[0037] From the point of view of the installation procedure, it is beyond simple, practical and quick, as well as safe for the operator.

[0038] The TRIAC 3 is inserted into the fitting 1 through the opening 14, internally to the insulation device 6, to-

gether with a mechanical fixing system 4, which, inserted between the TRIAC 3 and the inner wall opposed to the inner wall 13, determines the stability of the TRIAC 3 and of the diffuser 2, which are thus embedded and forced to maintain their position inside the fitting 1.

[0039] Such insertion facilitates the electrical connection of the TRIAC 3 to the resistive element placed inside the tubular enclosure or tube 10, as well as the stable positioning of the TRIAC 3 itself at a portion of the diffuser 2 in contact with one of the inner walls 13 of the fitting 1, so as to ensure effective dissipation of the heat generated by the TRIAC 3, during its operation, directly through the outer perimeter wall of the fitting 1.

[0040] Advantageously, in a second embodiment, the device 200 may include, in addition to the power switch 3, additional electronic components 7 suitable for enhancing the functionality of the device 200.

[0041] Such electronic components may include, as an example, an NTC-type temperature sensor with the function of controlling the temperature of the TRIAC 3 itself. Therefore, from the description made, the characteristics of the fluid heating device, which is the object of the present invention, are clear, as are its advantages. Finally, it is clear that numerous other variations may be made to the heating device object of the invention, without departing from the principles of novelty inherent in the inventive idea, just as it is clear that, in the practical implementation of the invention, the materials, shapes and sizes of the details illustrated may be any as required and the same may be substituted for equivalent ones.

[0042] Where the constructional features and techniques mentioned in the attached claims are followed by reference marks or numbers, such reference marks have been introduced for the sole purpose of increasing the intelligibility of the claims and, consequently, they have no limiting effect on the interpretation of each element identified, by way of example only, by such reference marks.

Claims

1. Fluid heating device, particularly suitable for heating at least one fluid circulating inside a heating structure, such as a water or oil radiator and/or a towel warmer, comprising at least one enclosure or tube (10) made of a conductive material, inside which at least one resistive element is inserted, having respective terminals connected to relative electrical conductors connected to a power electronic circuit, said power electronic circuit being provided with at least one power switch (3), which is connected in turn, on one side, to said at least one resistive element and, on the other side, to said power circuit, wherein said electrical conductors emerge from said enclosure or tube (10) by passing through a fitting (1), which is coaxially placed with respect to said enclosure or tube (10) and which is made of thermally conductive material, and wherein said power switch (3) is made internally to said fitting (1) **characterized in that** it comprises a power dissipating element or diffuser (2), which is attached to said power switch (3) and which is interposed between said power switch (3) and at least a portion of the inner walls (13) of said fitting (1) and/or said enclosure or tube (10).

2. Fluid heating device as at claim 1, **characterized in that** said opening (14) has a cylindrical shape.

3. Fluid heating device as to at least one of the preceding claims, **characterized in that** said at least one resistive element is placed within an electrically insulating powder or compound, compacted within said enclosure (10).

4. Fluid heating device as to at least one of the preceding claims, **characterized in that** said power switch (3) comprises an electronic device, such as a TRIAC.

5. Fluid heating device as to at least one of the preceding claims, **characterized in that** said power dissipating element or diffuser (2) is fixed to said power switch (3) by means of a mechanical fixing system (4) in such a way that said power switch (3) and said power element or diffuser (2) are locked inside said fitting (1) and/or enclosure or tube (10) maintaining contact with said inner walls (13) of said fitting (1).

6. Fluid heating device as to at least one of the preceding claims, **characterized in that** said power switch (3) and said mechanical fixing system (4) are enclosed within a thermal and electrical insulation device (6).

7. Fluid heating device as to at least one of the preceding claims, **characterized in that** said power dissipating element or diffuser (2) is able to effectively dissipate heat generated during operation of said power switch (3), through at least a portion of an outer perimeter wall of said fitting (1) and/or enclosure or tube (10).

8. Fluid heating device as to at least one of the preceding claims, **characterized in that** said opening (14) is practiced in a substantially central position of said fitting (1).

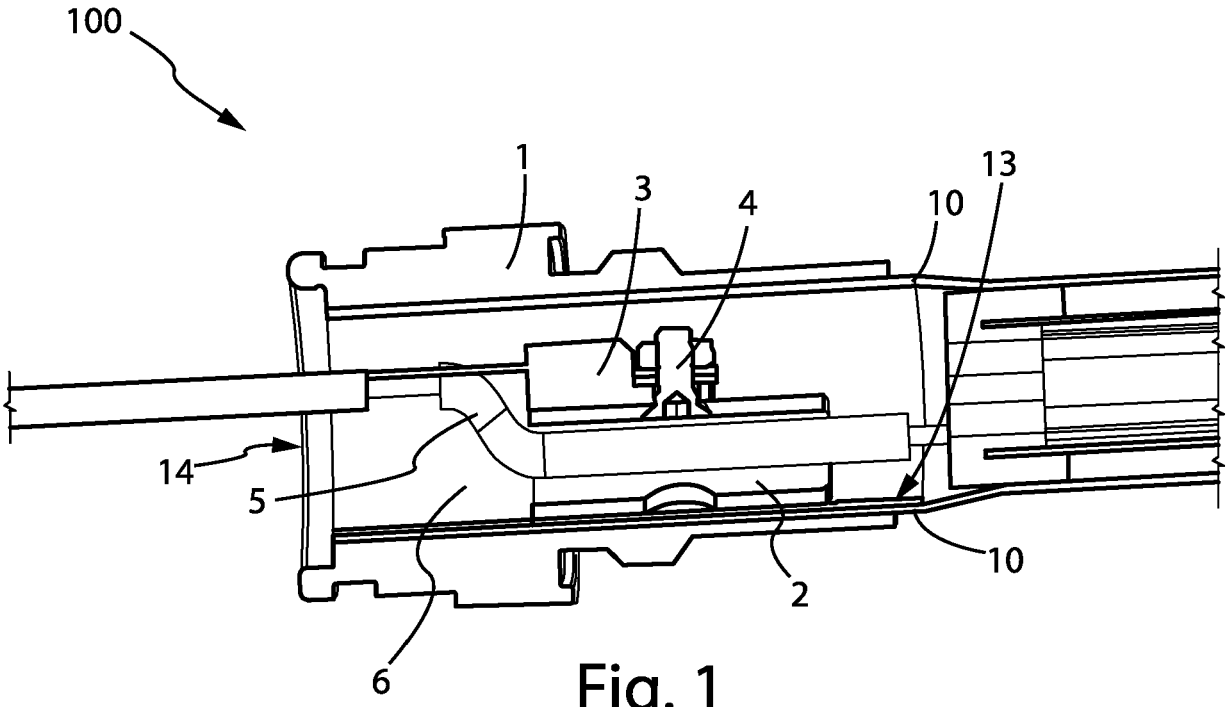

Fig. 1

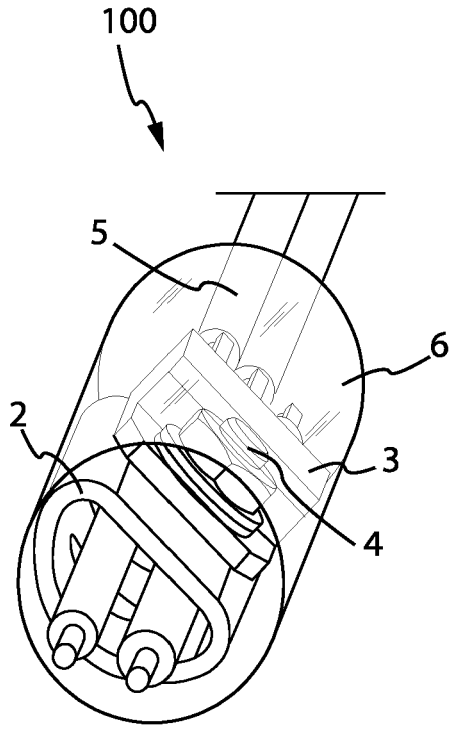

Fig. 2A

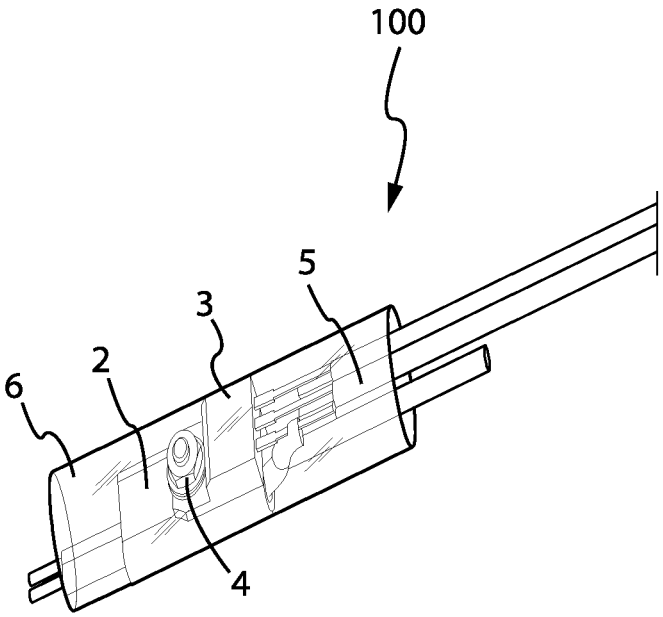

Fig. 2B

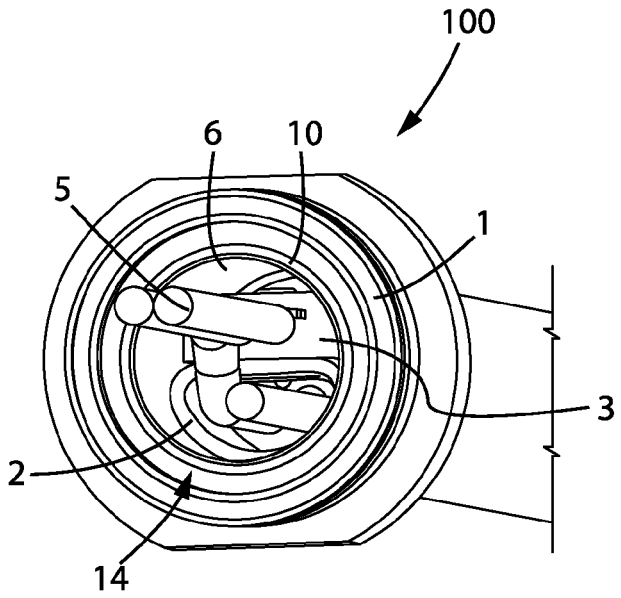

Fig. 3

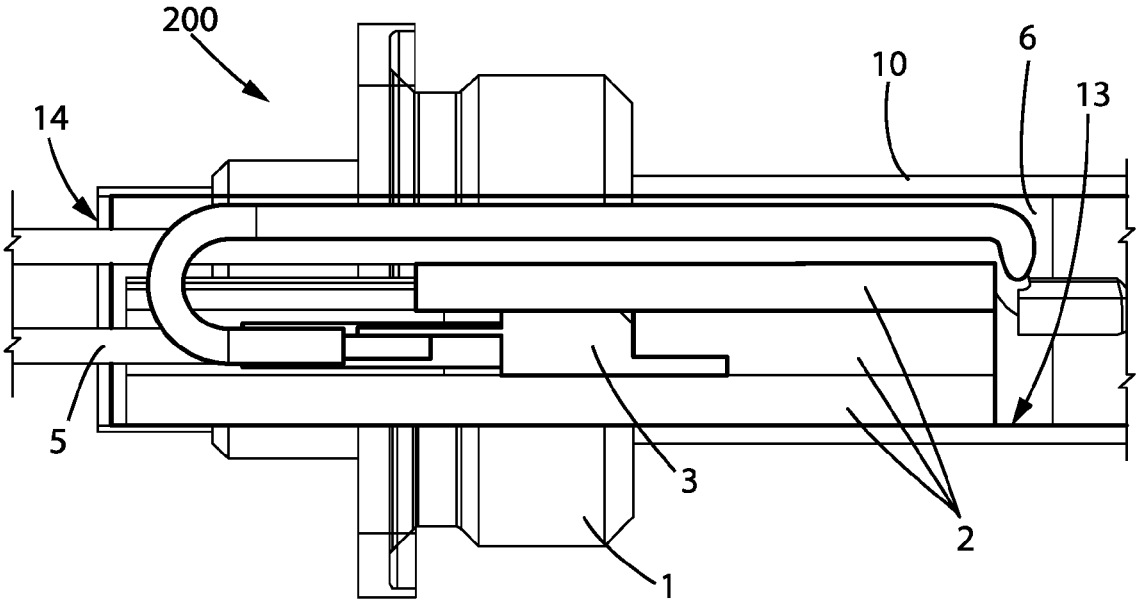

Fig. 4

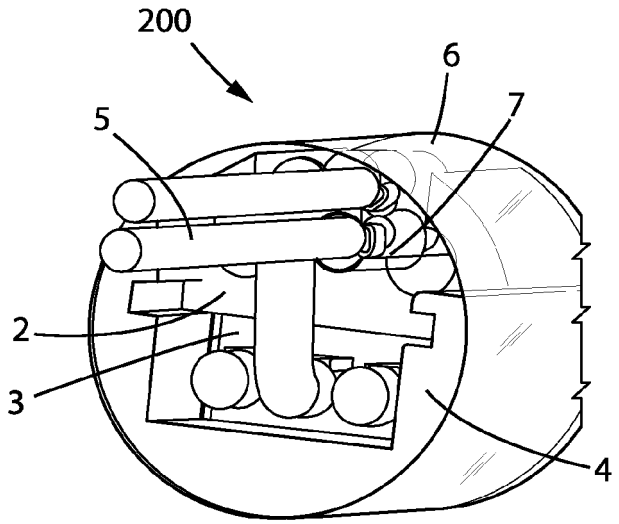

Fig. 5

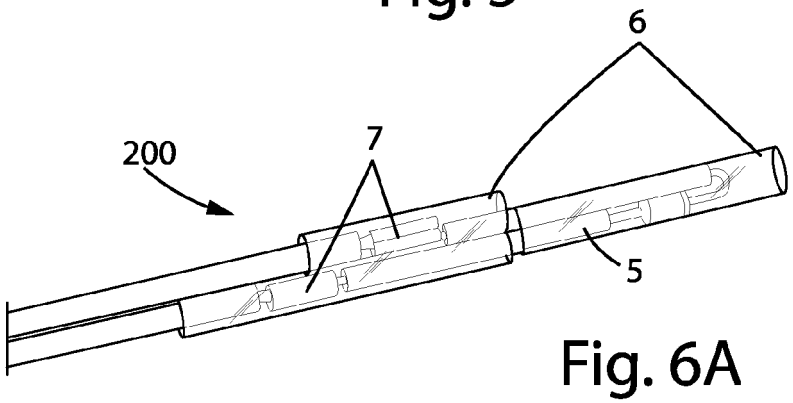

Fig. 6A

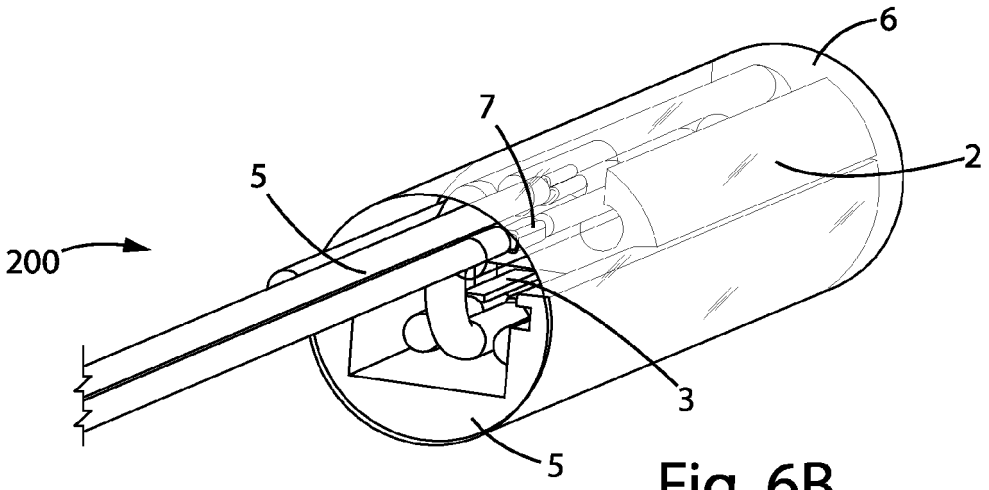

Fig. 6B

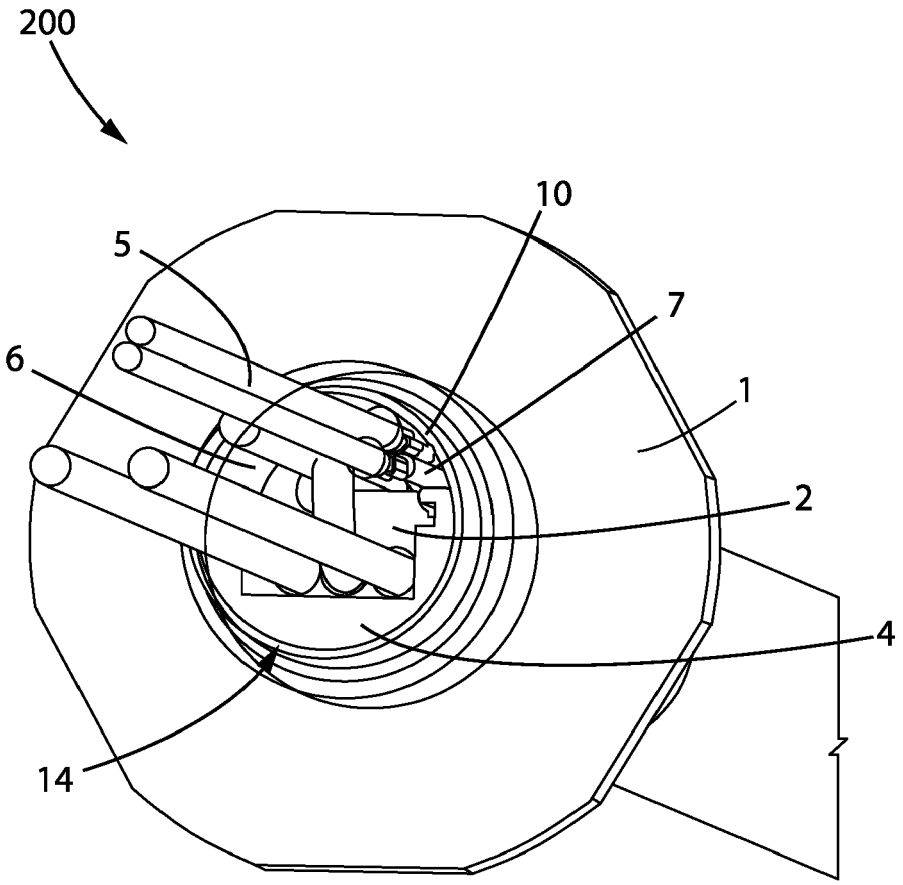

Fig. 7

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EUROPEAN SEARCH REPORT

Application Number
EP 23 16 7523

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
Munich	15 September 2023	Gea Haupt, Martin

CATEGORY OF CITED DOCUMENTS

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