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(54) Heating device

(57) A heating device comprises a tubular body (4) interposed between a first end element (2) and a second end element (3) so as to define a chamber (5) suitable for receiving a fluid to be heated, said first end element

(2) being fixed to said second end element (3) by removable fixing means (22) that extends between a central zone (10) of said first end element (2) and a further central zone (20) of said second end element (3).

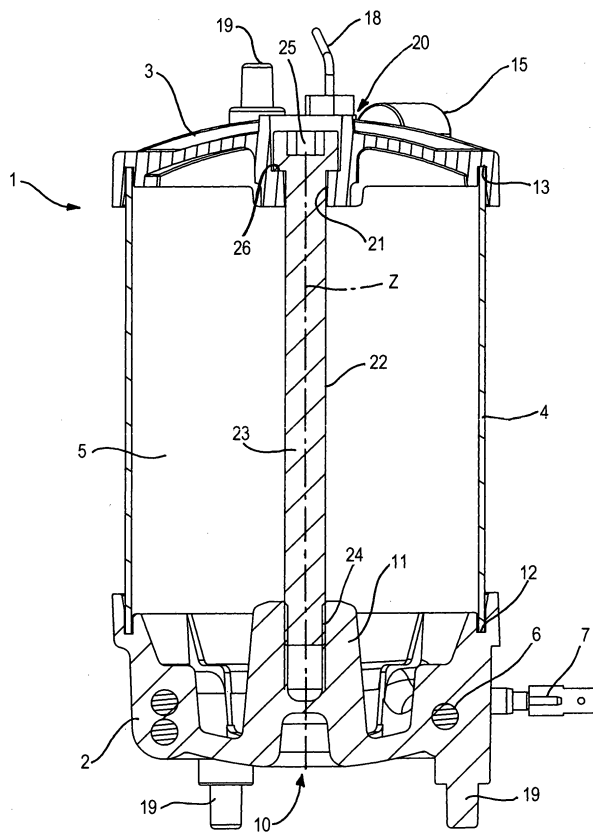


Fig. 1

Description

[0001] The invention relates to a heating device, particularly a steam generator usable in a cleaning apparatus.

[0002] Steam generators are known comprising a lower and an upper part, both made of steel, coupled with one another along a joining line by welding. Within the thus joined lower part and upper part a chamber is defined in which a liquid, for example water, is heated to be transformed into steam. As the weld is a permanent connecting means, these steam generators cannot be dismantled, for example if a fault occurs. Furthermore, if welding has not been performed correctly or if the steam pressure that is generated inside the chamber is excessive, the steam generator may be subject to explosions.

[0003] Steam generators are furthermore known in which the lower part and the upper part are joined together along respective flanges by a plurality of screws. These steam generators do not have the drawbacks discussed above with regard to welded steam generators. Nevertheless, the corresponding assembly and disassembly operations are laborious inasmuch as it is necessary to tighten or loosen a large number of screws, for example ten.

[0004] Lastly, steam generators are known comprising a central tubular body provided with two ends to which respective rings are welded. On each ring a plurality of threaded elements is welded, for example four threaded elements. To one end of the central tubular body a lid is fixed in a removable manner, using a plurality of nuts that engage the corresponding threaded elements. In a similar way, a bottom wall is on the other hand fixed to the opposite end.

[0005] The steam generators of the latter type, whilst being dismantlable for conducting maintenance or repair tasks, nevertheless comprise welds that have the drawbacks discussed previously with reference to the risk of explosion or difficulties of manufacture. Furthermore, in order to mount the lid and the bottom wall, it is necessary to act on a plurality of nuts, which takes a relatively long time.

[0006] An object of the invention is to improve heating devices, particularly steam generators.

[0007] A further object is to provide a heating device that does not present risks of explosion.

[0008] A still further object is to provide a heating device that can be rapidly dismantled to perform maintenance or repair tasks.

[0009] According to the invention, a heating device is provided comprising a tubular body interposed between a first end element and a second end element so as to define a chamber suitable for receiving a fluid to be heated, characterised in that said first end element is fixed to said second end element by removable fixing means that extends between a central zone of said first end element and a further central zone of said second end element.

[0010] The removable fixing means enables the first

end element, the second end element and the tubular body interposed between them to be locked in a reciprocal fixed position without resorting to welding that is difficult to perform and which involves a risk of explosion.

Furthermore, the removable fixing means enables the heating device to be dismantled to perform maintenance and/or repair operations and enables it to be then reassembled. Lastly, as the removable fixing means extends between a central zone of the first end element and a further central zone of the second end element, it is possible to obtain a sufficiently stable connection even by using a single fixing element.

[0011] The invention can be better understood and implemented with reference to the attached drawings that illustrate an embodiment thereof by way of non-limitative example, in which:

Figure 1 is a section view, taken along a longitudinal axis of a heating device;

Figure 2 is a perspective view of a first end element of the heating device in Figure 1;

Figure 3 is a perspective view of a second end element of the heating device in Figure 1.

[0012] With reference to Figure 1, a heating device is shown, particularly a steam generator 1 suitable for receiving a cleaning fluid, for example water, and for heating it to change it into steam. The steam generator 1 can be used in a cleaning apparatus suitable for cleaning a surface by dispensing a jet of steam, or in an apparatus that is able both to deliver a jet of steam and suck substances from a surface to be cleaned. Furthermore, the steam generator 1 can be used both in cleaning apparatuses for domestic use and in apparatuses for industrial use. In the latter case, it is possible to increase the dimensions of the steam generator 1 or use a plurality of steam generators 1.

[0013] The steam generator 1 comprises a first end element acting as a base 2 and a second end element acting as a lid 3. Between the base 2 and the lid 3 a tubular body 4 is interposed within which a chamber 5 is defined that is suitable for receiving the water to be heated to generate the steam.

[0014] With the base 2 heating means is associated, comprising a resistance 6 that, in the example in Figures 1 and 2, is sunk inside the material constituting the base 2. The latter can, for example, consist of die-cast aluminium; in this case the resistance 6 is positioned inside a die into which the molten aluminium is subsequently inserted so as to incorporate the resistance 6 into the aluminium, as shown in Figure 1. The resistance 6 is intended to be supplied electrically by two electrodes 7 to heat the water contained in the chamber 5.

[0015] In an embodiment that is not shown, the heating means can simply be rested on the base 2 or be positioned at any point of the chamber 5. Furthermore, even if the aluminium is a material that is particularly suitable for housing the heating means owing to the good heat-

conducting properties thereof, the base 2 can be made of materials different from aluminium and using different techniques from die-casting.

[0016] On the base 2 a hole 8 is obtained, which may be arranged in a radial position, for the entry of the water into the chamber 5. Two fittings 9 are furthermore provided that are arranged on the bottom of the base 2 and are suitable for receiving respective thermostats that enable the temperature of the water in the steam generator 1 to be controlled.

[0017] The base 2 has a substantially concave shape and is provided, in a central zone 10 thereof, with an internally threaded hub 11, the function of which will be disclosed more fully below.

[0018] Above the base 2 the tubular body 4 is fitted, that is provided with a lower end received in a groove 12 obtained in an upper portion of the base 2. The tubular body 4 may be formed of a segment of commercially obtainable pipe and may be made of stainless steel.

[0019] At an upper end of the tubular body 4 the lid 3 is arranged that is peripherally provided with a furrow 13 which this upper end engages. As shown in Figure 3, the lid 3 is provided with a flanged hole 14 in which a solenoid valve can be mounted for the exiting of the steam. This solenoid valve is operable by the user when the latter wishes to dispense steam onto the surface to be cleaned. An opening 15 is furthermore provided in which a safety valve can be fitted that is drivable by a control device that is not shown and is arranged to enable the steam contained in the chamber 5 to be discharged in the environment if an excessive pressure develops within the chamber 5.

[0020] On the lid 3 a first hole 16 and a second hole 17 are furthermore obtained. In the first hole 16 a pressure switch can be fitted that is not shown to detect the pressure inside the chamber 5 and transmit the detected pressure value to the control device. In the second hole 17, on the other hand, a sensor level can be housed comprising, for example, a rod 18, shown in Figure 1, that enables the level of water in the chamber 5 to be detected. The signal detected by the level sensor is sent to the control device, which makes water enter the chamber 5, in such a way as to keep the level of water as constant as possible.

[0021] The lid 3 can be made of aluminium, for example by die casting or chilled casting, or of other types of metal or also of plastics.

[0022] Both on the base 2 and on the lid 3 support pins 19 are provided on which heat-insulating bushes are mounted that are not shown and which are used to support the steam generator 1 on the cleaning apparatus.

[0023] In a further central zone 20 of the lid 3 a through hole 21 is obtained that is suitable for receiving removable fixing means comprising a fixing element 22 shown in Figure 1. The fixing element 22 may comprise a screw provided with a shank 23 interposed between a threaded portion 24 suitable for being screwed into the hub 11 and a head 25 suitable for being received in the through hole

21, engaging an abutting surface 26 obtained therein.

[0024] In order to mount the steam generator 1, the lower end of the tubular body 4 is initially positioned in the groove 12. The lid 3 is subsequently rested on the upper end of the tubular body 4 in such a way that this end is received in the furrow 13. In order to avoid undesired escaping of water and/or steam from the steam generator 1, between the ends of the tubular body 4 and respectively the base 2 and the lid 3 a sealing substance is applied, for example silicone, which can be removed if it is necessary to access the inside of the chamber 5. As an alternative to the sealing substance, between the ends of the tubular body 4 and respectively the base 2 and the lid 3 respective seals can be interposed, of deformable type, such as, for example, an O-ring, or of rigid type. The base 2, the tubular body 4 and the lid 3 are finally coupled together by the fixing element 22. The latter is arranged operationally along a longitudinal axis Z around which the tubular body 4 extends. In the configuration shown in Figure 1, the longitudinal axis Z is vertical. By tightening the threaded portion 24 in the hub 11, it is possible, in a single operation, to firmly anchor together the base 2, the tubular body 4 and the lid 3. In an equally simple manner, with a single unscrewing operation the steam generator 1 can be dismantled if maintenance tasks have to be performed. The position of the fixing element 22, which extends between the central zone 10 of the base 2 and the further central zone 20 of the lid 3, in fact provides a reliable fixing system without resorting to a plurality of screws.

[0025] The steam generator 1 can be produced and assembled in a particularly rapid time not only because a single fixing element 22 is provided but also because no further welding operations are requested. The tubular body 4, if made with a commercially available pipe, is furthermore easy to find at low cost.

[0026] The steam generator 1 is able to operate in a particularly safe manner if the tubular body 4 is made of stainless steel and the lid 3, as also the base 2, are made of aluminium. In this case, in fact, if excessive steam pressure develops in the chamber 5, the base 2 and the lid 3 are damaged before the tubular body 4, which is provided with greater structural resistance. Owing to the properties of aluminium, the base 2 and the lid 3 tend to break gradually, splitting progressively. The risks of explosion present in welded-steel steam generators are thus substantially eliminated.

[0027] On the internal surfaces of the base 2 and of the lid 3 antioxidant treatment can be carried out in such a way as to prevent the formation of oxides.

Claims

1. Heating device comprising a tubular body (4) interposed between a first end element (2) and a second end element (3) so as to define a chamber (5) suitable for receiving a fluid to be heated, **characterised**

in that said first end element (2) is fixed to said second end element (3) by removable fixing means (22) that extends between a central zone (10) of said first end element (2) and a further central zone (20) of said second end element (3).

2. Device according to claim 1, wherein said fixing means comprises a single fixing element (22). 5
3. Device according to claim 2, wherein said fixing element (22) is substantially coaxial with said tubular body (4). 10
4. Device according to any one of claims 1 to 3, wherein said first end element (2) is provided with groove means (12) arranged to receive an end of said tubular body (4). 15
5. Device according to claim 4, wherein said groove means (12) extends in a peripheral region of said first end element (2). 20
6. Device according to any preceding claim, wherein said second end element (3) is provided with furrow means (13) suitable for receiving a further end of said tubular body (4). 25
7. Device according to claim 6, wherein said furrow means (13) is obtained in a further peripheral region of said second end element (3). 30
8. Device according to any preceding claim, wherein said tubular body (4) has the shape of a hollow cylinder. 35
9. Device according to any preceding claim, wherein said tubular body (4) is made of stainless steel.
10. Device according to any preceding claim, wherein said fixing means comprises a threaded element (22). 40
11. Device according to claim 10, wherein said first end element (2) is provided with a threaded seat suitable for receiving a threaded portion (24) of said threaded element (22). 45
12. Device according to claim 11, wherein said threaded seat is obtained on a hub (11) that is projected from said first end element (2) into said central region (10). 50
13. Device according to any preceding claim, wherein said second end element is provided, in said further central region (20), with a through hole (21) suitable for being traversed by said fixing means (22). 55
14. Device according to any preceding claim, wherein said first end element comprises a base (2) and said

second end element comprises a lid (3).

15. Device according to any preceding claim, wherein said first end element (2) is made of aluminium.
16. Device according to any preceding claim, wherein said second end element (3) is made of aluminium.
17. Device according to any preceding claim, and furthermore comprising inlet means (8) for said liquid and outlet means (14) for a steam produced by heating said liquid.

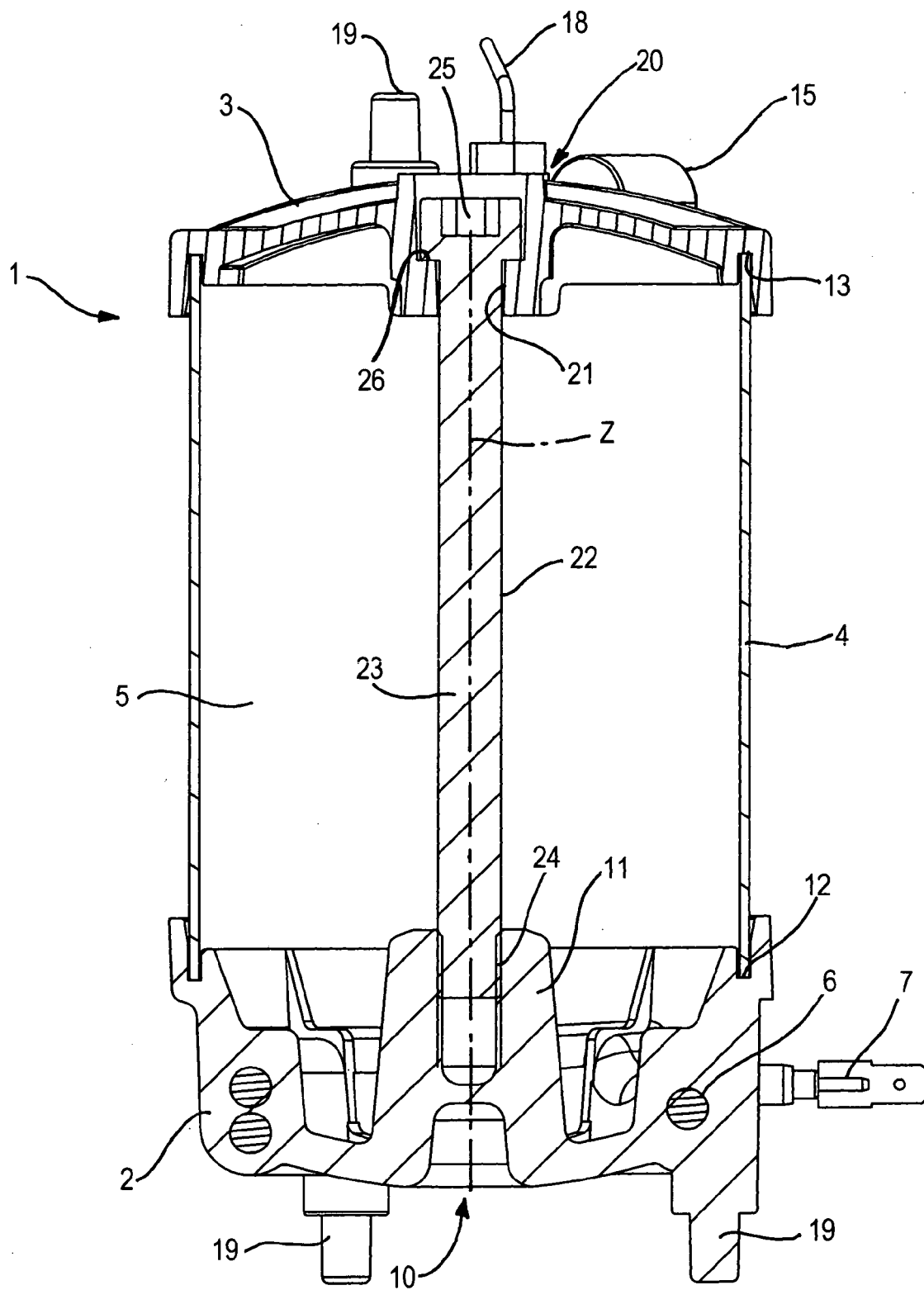


Fig. 1

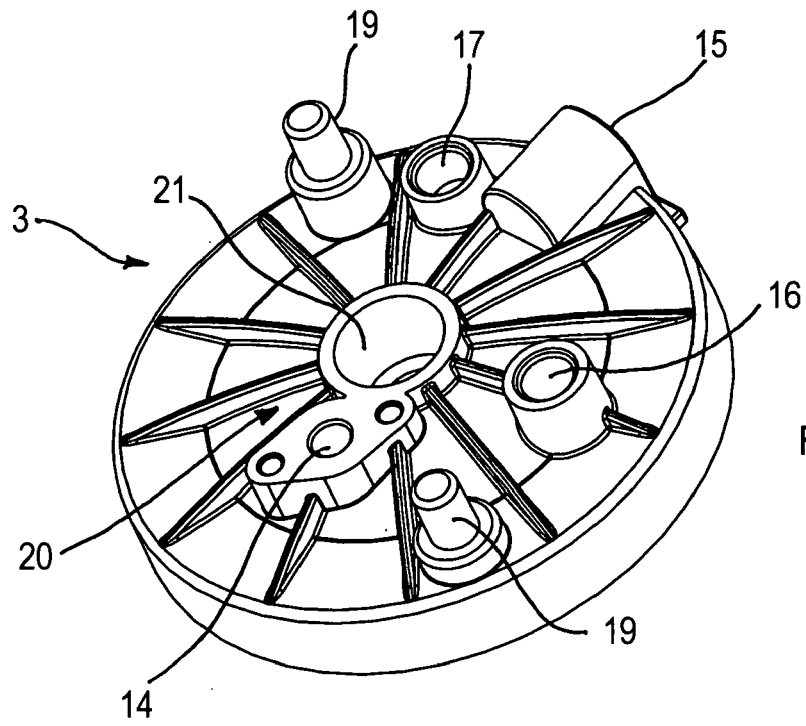


Fig. 3

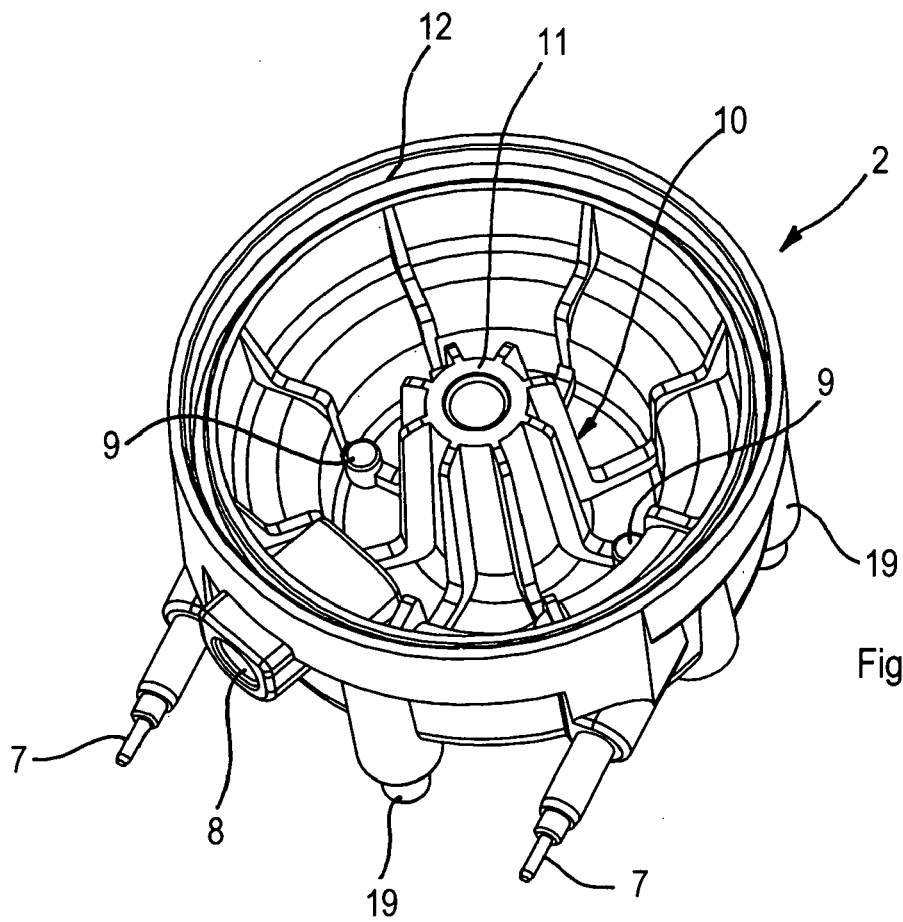


Fig. 2



European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 05 02 8135

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	NL 94 899 C (N.V. METAALINDUSTRIE POST & EGER) 16 July 1960 (1960-07-16) * column 2, line 26 - column 3, line 44; figure *	1-17	INV. F22B1/28
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			TECHNICAL FIELDS SEARCHED (IPC)
			F22B
The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
Munich		23 June 2006	Zerf, G
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**ANNEX TO THE EUROPEAN SEARCH REPORT
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EP 05 02 8135

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The members are as contained in the European Patent Office EDP file on
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23-06-2006

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