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(54) **FLUID HEATER, INSTALLATION FOR HEATING BY AIR DUCTS AND INSTALLATION FOR HEATING BY RADIATORS AND SANITARY HOT WATER (SHW) INCORPORATING SAID HEATER**

(57) A heater for a flow of fluid, incorporating an oxyhydrogen gas (HHO) generator device as a heat source, comprising a shell forming a cavity containing a quantity of electrolyte creating a contact between a number of electrode means suited for the generation of an electrolytic reaction within the cavity, where the shell is made from steel and its lateral wall forms the cathode of the electrode means, and a steel plate, surrounded by the lateral wall, forming the anode of the electrode means, in such a way that the lateral wall increases in temperature and releases heat toward a chamber of the heater through which the flow of fluid passes. An installation for heating by means of air ducts and an installation for heating by means of radiators and sanitary hot water (SHW) incorporating the aforementioned heater are likewise objects of the present invention.

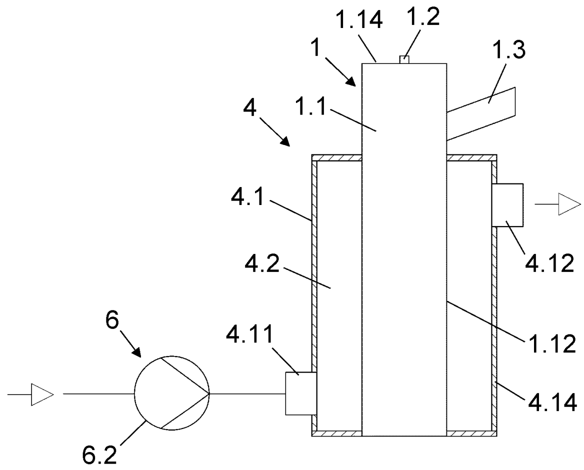

Fig.3

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Description

TECHNICAL FIELD OF THE INVENTION

[0001] The present invention is encompassed within the field of heat exchangers. In particular, it is related to a heater of a flow of fluid, for example, an air or water flow, incorporating an oxyhydrogen gas (HHO) generator device as a heat source, such as the one that is the object of patent application PCT/ES2019/07079.

[0002] Another object of the invention is an installation for heating by air ducts, as well as an installation for heating by radiators and sanitary hot water (SHW), incorporating the heater object of the present invention.

BACKGROUND OF THE INVENTION

[0003] As we know, our society is largely dependent on highly polluting fuels, which have led us to the current environmental problems. For this reason, non-polluting fuels that are being used to replace the current polluting fuels include oxyhydrogen gas (HHO) or Brown's gas, which can be produced simply from the electrolysis of water, an abundant resource found in nature.

[0004] Therefore, various devices and systems for generating oxyhydrogen gas (HHO) are known, that is, gaseous Oxygen (O_2) and Hydrogen (H_2). These devices are fundamentally based on an electrolytic cell made formed by a cavity, which contains a quantity of electrolyte, and the respective electrode means acting as a cathode and as an anode, respectively, which are spaced apart, arranged in contact with the electrolyte contained in the cavity. The electrolyte is usually sulphuric acid, sodium hydroxide, or potassium hydroxide diluted in water. By means of a continuous electric current, supplied either by a power supply or a battery, which is connected through the electrodes (anode and cathode) to the water, the decomposition of the water into Oxygen (O_2) and Hydrogen (H_2) gases is achieved. The gases produced by the electrolysis are collected in the upper part of the cavity, and are then passed through condensation means that allow the gases to be separated from the water vapour that accompanies them.

[0005] In the electrolytic cell of these devices, when the power supply output exceeds 3.5 volts, there is a significant increase in the temperature of the electrolyte of the cell. Thus, the electrolysis reaction that takes place in the cavity of the device not only produces oxyhydrogen gas (HHO), but also, said reaction begins to dissipate energy in temperature, where, in current devices, this heating effect is wasted.

[0006] With this, it is necessary to design, in a simple and economical way, a solution that allows overcoming the aforementioned technological bias.

DESCRIPTION OF THE INVENTION

[0007] The present invention is defined and characterised by the independent claims, while the dependent claims describe other characteristics thereof.

[0008] An object of the invention is a fluid heater comprising:

- a shell provided with an inlet and an outlet for a flow of fluid,
- a chamber that is formed inside the shell between the inlet and outlet, and
- a heat source, arranged inside the chamber, adapted to release heat to the flow of fluid as it passes through the chamber.

[0009] Where, the heat source is an oxyhydrogen gas (HHO) generator device, which comprises a shell that forms a cavity containing a quantity of electrolyte creating a contact between the respective electrode means adapted to act as a cathode and as an anode respectively in an electrolysis reaction within the cavity. The shell is made from steel and its lateral wall forms the cathode of the electrode means, and a steel plate, which is surrounded by the lateral wall, forming the anode of said electrode means, in such a way that the lateral wall is adapted to increase in temperature during the electrolysis reaction and release heat toward the chamber.

[0010] Preferably, the anode and the cathode of the electrode means of the oxyhydrogen (HHO) gas generator device are connected to the positive and negative terminals of a source of current with an output voltage between 3.5 volts and 4 volts. In this preferred voltage range, the electrolyte is heated without it coming to the boil and being dragged by excess vapour generated by direct contact between the electrolyte and the superheated cathode and anode, such as occurs when there is excess of applied voltage, for example, between 4 volts and 6.5 volts, at whose higher values, between 5 volts and 6.5 volts, a large amount of water vapour is produced, but at a very high energy cost. In addition, if the voltage applied to the electrode means is excessively high, for example, between 6.5 volts and 10 volts, the electrolytic cell short-circuits and deteriorates, causing destruction thereof and overheating of the electrolyte.

[0011] Thus, the preferred voltage range between 3.5 volts and 4 volts is ideal for taking advantage of the heating effect experienced by the lateral wall of the device in various applications, for example, in the following installations.

[0012] An installation for heating by air ducts, also object of the invention, which comprises a heater as described above comprising an oxyhydrogen gas (HHO) generator device as a heat source to be released into a flow of air, as flow of fluid, which passes through the heater chamber, where the heater is arranged upstream of a layout of air ducts that distributes the flow of heated air.

[0013] Additionally, another object of the invention is an installation for heating by radiators and sanitary hot water (SHW), which also comprises a heater such as the one described above incorporating an oxyhydrogen gas (HHO) generator device as a heat source to be released into a flow of water, as flow of fluid, which passes through the heater chamber, where the heater is arranged upstream of a number of radiators in a circuit of water radiators.

[0014] In any case, with the invention, it is possible to take advantage, as a heat source, of the increase in temperature undergone by the lateral wall of the oxyhydrogen gas (HHO) generator device during the electrolysis reaction, where said heat source is used to release heat into a flow of fluid that transfers through the heater chamber, whether it is a flow of air or water that can be heated, for example, up to a constant 75°C, with a minimum of energy consumption compared to current technologies; without forgetting that gaseous Oxygen (O_2) and Hydrogen (H_2) are also obtained as by-products of the hydrolysis reaction, which can be used as an auxiliary source of heat, as a source of electrical storage, etc.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The present specification is complemented by a set of figures which illustrate a preferred embodiment, and which in no way limit the invention.

Figure 1 depicts a schematic side view of the oxyhydrogen gas (HHO) generator device.

Figure 2 depicts an enlarged schematic front view of the device of Figure 1.

Figure 3 depicts a schematic sectional side view of a first embodiment of the fluid heater employing the device of Figure 1 as a heat source.

Figure 4A depicts a schematic sectional side view of a second embodiment of the fluid heater of Figure 3.

Figure 4B depicts section AA of Figure 4A.

Figure 5 depicts a schematic view of an installation for heating by air ducts incorporating the heater of Figure 4.

Figure 6 depicts a schematic view of an installation heating by radiators and sanitary hot water (SHW), incorporating the heater of Figure 3.

Figure 7 depicts an enlarged schematic view of the condensation means used in the installations of Figures 5 and 6.

DETAILED DESCRIPTION OF THE INVENTION

[0016] A first object of the present invention is a fluid heater incorporating an oxyhydrogen gas (HHO) generator device as a heat source.

[0017] As shown in figure 1, the oxyhydrogen gas (HHO) generator device (1) comprises a shell (1.1), which forms a cavity (1.11) adapted to contain a quantity of electrolyte. The electrolyte could be a mixture of water and sulphuric acid, sodium hydroxide, or potassium hydroxide. In a preferred embodiment, the electrolyte is a mixture of additivated distilled water, above 10 % and below 50 % of the total volume of electrolyte, with sodium hydroxide (caustic soda).

[0018] Additionally, the device (1) comprises respective electrode means (1.4) that act as cathode (1.41) and as anode (1.42) respectively, spaced apart and arranged in contact with the electrolyte contained in the cavity (1.11) .

[0019] For its part, the shell (1.1) is made from steel, for example, ANSI 316 steel, and its lateral wall (1.12) constitutes the cathode (1.41) of the electrode means (1.4). For example, the lateral wall (1.12) could consist of a tubular casing arranged in a vertical position, which could be closed at its upper part by a steel disc (1.14) welded at the top of said lateral wall (1.12). For its part, the base (1.13) of the shell (1.1) could be formed by a washer (disk-shaped piece) also made of steel, which is welded at the bottom of the lateral wall (1.12).

[0020] Likewise, the lateral wall (1.12) surrounds a steel plate (1.6), for example, ANSI 316 steel, which constitutes the anode (1.42) of said electrode means (1.4). The plate (1.6) can be inserted through the washer that forms the base (1.13) of the shell (1.1), with a view to arranging said plate (1.6) inside the cavity (1.11), for example, positioned in a longitudinal centre of the shell (1.1). On the other hand, the anode (1.42) (plate (1.6)) and the cathode (1.41) (lateral wall (1.12)) could be connected to respective positive (2.1) and negative (2.2) terminals, respectively, of a source of current (2), preferably, with an output voltage of between 3.5 volts and 4 volts, with a view to achieving water electrolysis, in such a way that the oxyhydrogen gas (HHO) is generated inside the cavity (1.11) formed in the shell (1.1), and in addition, there is a significant increase in the temperature of the lateral wall (1.12) of the shell (1.1) .

[0021] Preferably, the thickness of the plate (1.6) is equal to or less than the thickness of the lateral wall (1.12) of the shell (1.1), providing greater wear of the anode (1.42) compared to the wear of the casing that forms the cathode (1.41) in the same period of time of operation of the device (1). Thus, in extreme wear conditions due to corrosion of the anode (1.42) (plate (1.6)), which is positioned inside the cathode (1.41) (lateral wall (1.12)), there is still sufficient lateral wall thickness (1.12) to contain the electrolyte inside the cavity (1.11) of the shell (1.1); thus guaranteeing the full operating capabilities of the lateral wall (1.12) at the end of the service life of the device (1). For example, the plate (1.6) could have a thickness of 4 mm arranged inside the casing formed by the lateral wall (1.12), which could have a thickness of 3.5 mm. Thus, when the exposed sides of the plate (1.6) deteriorate, 2 mm on each side that make up the total 4 mm thickness of said plate (1.6), the lateral wall (1.12) still maintains 1.5 mm of thickness intact, keeping the electrolyte retained inside the cavity (1.11) of the shell (1.1).

[0022] With a view to detecting a low work intensity of a worn anode (1.42), devices for its control (not shown in the figures) could be installed inside the cavity (1.11) of the shell (1.1), such as anemometric clamps, pressure sensors, timers, or other types of devices suitable for controlling the intensity of electrical consumption within the established parameters, which are taken as indicative values of the actual state of wear inside the device (1) and are interpreted to take automatic actions already programmed in a computer (not shown in the figures) that controls the operation of the device (1), such as stopping its operation. Thus, it is possible to replace the device (1) many cycles before the end of its service life, with a view to avoiding unnecessary risks.

[0023] Additionally, the device (1) comprises a gas outlet duct (1.2), which is arranged at the top of the shell (1.1). Preferably, said gas outlet duct (1.2) is arranged in the lateral wall (1.12) of the shell (1.1), in such a way that it protrudes from the lateral wall (1.12) towards the cavity (1.11). However, the gas outlet duct (1.2) could be arranged in the steel disc (1.14), at the convenience of its assembly in an installation.

[0024] Likewise, the device (1) additionally comprises an electrolyte inlet duct (1.3), which also runs into the lateral wall (1.12) of the shell (1.1), between the gas outlet duct (1.2) and a level of electrolyte contained in the cavity (1.11).

[0025] Preferably, the electrolyte inlet duct (1.3) could be adapted to limit the level of electrolyte contained in the cavity (1.11), in other words, the lower edge of the electrolyte inlet duct (1.3) defines a maximum electrolyte level in the cavity (1.11). The electrolyte inlet duct (1.3) prevents said maximum electrolyte level from being exceeded when filling the cavity (1.11) with electrolyte. Likewise, the electrolyte inlet duct (1.3) additionally prevents electrolyte splashes from reaching the gas outlet duct (1.2), which are produced with the bubbling exit of the gas from within the electrolyte during the water electrolysis reaction.

[0026] With this, a primary condensation chamber (1.112) is also formed between the electrolyte inlet duct (1.3) and the gas outlet duct (1.2), which is not involved in the electrolysis. The primary condensation chamber (1.112) is an empty space filled with air where the first condensation of the water vapour that accompanies the generated gases takes place, gases which, being in contact with the steel disc (1.14), or with the portion of the lateral wall (1.12) corresponding to the primary condensation chamber (1.112) formed, part of the water vapour that accompanies the gases condenses and drains down said portion of the lateral wall (1.12) towards the electrolyte, while the rest of its composition leaves the cavity (1.11) through the gas outlet duct (1.2).

[0027] Like the gas outlet duct (1.2), it is preferred that the electrolyte inlet duct (1.3) protrudes from the lateral wall (1.12), as a sill, towards the cavity (1.11). It is thus achieved that the condensates that drain down the portion of the lateral wall (1.12) corresponding to the primary condensation chamber (1.112) do not go into said ducts (1.2, 1.3), going back into the electrolyte contained in the cavity (1.11).

[0028] On the other hand, as shown in Figure 2, the base (1.13) of the shell (1.1) and the base (1.61) of the plate (1.6) could be fastened on a centring plate (1.7) made of insulating material. This plate (1.7) is called a centring plate because one of its functions is to centre the plate (1.6) with respect to the lateral wall (1.12) of the shell (1.1). For example, the centring plate (1.7) could be made of nylon or Teflon, depending on the conditions and power of the device (1), Teflon being used when very high performance is required. The bases (1.13, 1.61) are fastened to the centring plate (1.7) by means of bolts (7) that go through the latter, to which respective washers (8) and nuts (9) are screwed to carry out said fastening.

[0029] Preferably, between the bases (1.13, 1.61), of the shell (1.1) and of the plate (1.6), and the centring plate (1.7), a silicone sealing sheet (1.9) could be arranged.

[0030] Likewise, the bases (1.13, 1.61) on the centring plate (1.7) are covered with an insulation layer (1.8) made of an inert material not taking part in an electrolysis reaction, forming a bottom (1.111) of the cavity (1.11). For example, the insulation layer (1.8) could be made of bicomponent epoxy resin.

[0031] Additionally, it is preferred that the insulation layer (1.8), made of an inert material not taking part in an electrolysis reaction, forming the bottom (1.111) of the cavity (1.11) extends between 10 and 20 cm over a lower portion (1.62) of the plate (1.6), so that the lower portion (1.62) of the plate (1.6) and the bottom (1.111) of the cavity (1.11) form a cold chamber (1.113), which provides thermal and corrosive protection to the connection between the bases (1.13, 1.61), the shell (1.1) and the plate (1.6), and the centring plate (1.7).

[0032] The cold chamber (1.113), formed in the lower part of the cavity (1.1), constitutes a "dead" or unreactive space, that is, without electrolysis reaction, proportional to the length of the lower portion (1.62) of the plate (1.6) and the bottom (1.111) of the cavity (1.11), filled with cold electrolyte. In other words, said cold chamber (1.113) makes it possible to have two different densities and two very different thermal levels in a single liquid, that is, in the electrolyte contained in the cavity (1.11) of the shell (1.1). This prevents the high increase in temperature, produced by the electrolysis reaction, from reaching the centring plate (1.7), to which the bases (1.13, 1.61) of the shell (1.1) and of the plate (1.6) are fastened respectively, whose material is suitable for withstanding high pressures, but not high temperatures. And with all this, it is guaranteed that, during the operation of the device (1), the centring plate (1.7) is subjected to pressure, but not to high temperatures, so that its material is maintained at a temperature that ensures that the device (1) is watertight, without electrolyte spilling out of the device.

[0033] This particular design of the device (1) and combination of materials of its components, allows the electrical connection of its anode (1.42) through the lower part of the device (1) and avoids exposing the connections and delicate materials to very sudden thermal changes, thus prolonging the service life of the device (1), protecting the welding areas, joints and bolts, silicone gaskets, electrical power cables, etc. The cold chamber (1.113) is not only used to protect said elements, but also, it is easier to keep the device (1) hermetic in its lower part than in its upper part, that is, it is easier to retain water (the electrolyte) than to retain hydrogen (H_2).

[0034] Advantageously, the main components of the oxyhydrogen gas (HHO) generator device (1) can be manufactured from ANSI 316 STEEL, enhancing the safety and sustainability thereof.

[0035] For its part, as shown in Figure 3, the fluid heater (4), object of the invention, comprises:

- a shell (4.1) provided with an inlet (4.11) and an outlet (4.12) for a flow of fluid,
- a chamber (4.2) that is formed inside the shell (4.1) between the inlet (4.11) and outlet (4.12), and
- a heat source, arranged inside the chamber (4.2), adapted to release heat into the flow of fluid when it passes through the chamber (4.2).

[0036] Where, as mentioned above, the heat source of the heater (4) is the oxyhydrogen gas (HHO) generator device (1) described above, which comprises the shell (1.1) forming the cavity (1.11) containing a quantity of electrolyte creating a contact between the electrode means (1.4), which are adapted to act as cathode (1.41) and as anode (1.42) respectively in an electrolysis reaction within said cavity (1.11).

[0037] As mentioned above, advantageously, the shell (1.1) is made from steel and its lateral wall (1.12) forms the cathode (1.41) of the electrode means (1.4), and the plate (1.6) which is also made from steel, forms the anode (1.42) of said electrode means (1.4), in such a way that, during the electrolysis reaction, the lateral wall (1.12) increases in temperature and releases heat toward the chamber (4.2) of the heater (4).

[0038] Preferably, the shell (4.1) of the fluid heater (4) is formed by a tubular wall (4.14), in such a way as to favour the channeling of the flow of fluid through the chamber (4.2) formed inside it.

[0039] Additionally, as shown in Figure 4A, in a second embodiment of the heater (4), outside the lateral wall (1.12) of the shell (1.1) of the oxyhydrogen gas (HHO) generator device (1), heat dissipating means (5) could be arranged, which are configured to increase a heat transfer surface towards the flow of fluid that passes through the chamber (4.2). For example, the heat dissipating means (5) could be a plurality of metal sheets (5.1) arranged longitudinally on the lateral wall (1.12) parallel and equidistant from each other, for example, as shown in Figure 4B, covering the entire outer diameter of the lateral wall (1.12) of the shell (1.1) of the device (1).

[0040] In any case, the heater (4) could comprise drive means (6) adapted to force the channeling of the flow of fluid through the chamber (4.2).

[0041] For example, in the case of the second embodiment of the heater (4), shown in Figure 4A, the drive means (6) could be an axial fan (6.1) arranged inside the tubular wall (4.14), upstream of the heat dissipating means (5). Thus, this second embodiment of the heater (4) could be suitable for use in an installation for heating by air ducts, as shown in Figure 5. Where, the heater (4) is arranged upstream of a layout of air distribution ducts (7) of the heating installation, and includes an oxyhydrogen gas (HHO) generator device (1) of as a heat source to be released into the flow of air, as flow of fluid, that passes through the chamber (4.2) of the heater (4), on its way to the layout of the air distribution ducts (7) of the heating installation.

[0042] In this embodiment, the flow of cold air to be heated is passed through the chamber (4.2) of the heater (4), coming into contact with the metal sheets (5.1) of the heat dissipating means (5), which, accumulate thermal energy or heat by being in direct contact with the lateral wall (1.12) of the shell (1.1) of the oxyhydrogen gas (HHO) generator device (1). In other words, during the operation of the device (1), due to the increase in temperature developed by the electrolyte, there is a rise in the temperature of the lateral wall (1.12) of the steel shell (1.1) forming the cathode (1.41) of its electrode means (1.4), which translates into thermal energy or heat that is transferred to the flow of air, through the metal sheets (5.1) of the heat dissipating means (5), increasing the temperature of said flow of air.

[0043] Obviously, the heat transfer between the lateral wall (1.12) of the shell (1.1) of the device (1) and the metal sheets (5.1) of the heat dissipating means (5) varies depending on the thermal conductivity properties of the metal used in the manufacture of heat dissipating means (5). In the same way, manufacturing said heat dissipating means (5) with a metal that can chemically react with the electrolyte and form harmful gases must be avoided.

[0044] As for the first embodiment of the heater (4), shown in Figure 3, a centrifugal pump (6.2) could be used as drive means (6), which is arranged upstream of the chamber (4.2), with a view to making possible that this other embodiment of the heater (4) be adapted for use in an installation for heating by radiators and sanitary hot water (SHW), as shown in Figure 6. Where, the heater (4) is arranged upstream of a number of radiators (8.1) in a circuit of water radiators (8) of said installation, and includes an oxyhydrogen gas (HHO) generator device (1) as a heat source to be released into a flow of water, as flow of fluid, which passes through the chamber (4.2) of the heater (4), on its way to the radiators (8.1) of the heating installation.

[0045] In this embodiment, the flow of cold water to be heated is passed through the chamber (4.2) of the heater (4), coming into direct contact with the lateral wall (1.12) of the shell (1.1) of the oxyhydrogen gas (HHO) generator device (1), which accumulates thermal energy or heat during the operation of said device (1). As explained above, due to the increase in temperature that the electrolyte develops during the operation of the device (1), there is a rise in the temperature of the lateral wall (1.12) of the steel shell (1.1) forming the cathode (1.41) of its electrode means (1.4), which translates into thermal energy or heat that, in this case, is transferred to the flow of water directly, through said lateral wall (1.12), increasing the temperature of said flow of water.

[0046] Additionally, in both embodiments, with a view to carrying out the condensation of the vapours that accompany the oxyhydrogen gas (HHO) generated by the device (1) used as a heat source in the corresponding heater (4), as shown in Figure 7, condensation means (3) could be provided, which are arranged downstream of the gas outlet duct (1.2) of the device (1).

[0047] These condensation means (3) could comprise a coil section (3.1) in fluid communication with the gas outlet duct (1.2) of the device (1). The condensation means (3) could comprise a fan (3.4), which generates a flow of air over the coil section (3.1), favouring the condensation of the water vapour that accompanies the oxyhydrogen gas (HHO) that runs at through said coil section (3.1).

[0048] Additionally, with a view to momentarily accumulating the condensed water vapour both through the gas outlet duct (1.2) and in the coil section (3.1), additionally, the condensation means (3) could comprise a condensate chamber (3.2), which is connected to an outlet (3.11) of the coil section (3.1).

[0049] Likewise, with a view to achieving safe use of the oxidising gas (oxyhydrogen gas (HHO)), the condensation means (3) could comprise a silica filter (3.3) connected to an outlet (3.21) of the condensate chamber (3.2). The silica filter (3.3) is suitable for retaining moisture from non-condensable gases. All the solid electrolyte particles dragged by the Oxygen (O_2) and Hydrogen (H_2), the water vapour that still continues accompanying these generated gases, as well as flashbacks attempting to enter the device (1), are retained in the silica filter (3.3), which is the last step of the condensation means (3). When the silica filter (3.3) is not capable of retaining more water vapour condensates, these are released into the condensate chamber (3.2) in the form of condensed drops, as if it were the excess of a sponge, allowing the deposit of the condensate in said chamber (3.2) .

[0050] In this way, the condensation means (3) are advantageously configured comprising, a coil section (3.1), a condensate chamber (3.2) and a silica filter (3.3), connected in series. Thus, when the fouled oxyhydrogen gas (HHO) leaves the device (1), it previously passes through the coil section (3.1), with a view to liquefying the water vapour that accompanies the gas, and retaining it in the condensate chamber (3.2). As the coil section (3.1) and the condensate chamber (3.2) are not usually enough to filter and purify the gas generated, the silica filter (3.3) is provided, which retains the rest of the moisture and solids dragged by the oxyhydrogen gas (HHO) generated.

[0051] Likewise, when the device (1) stops working, the latter cools down, which produces a negative pressure coefficient that forces the entry, inversely, of a flow of air through the silica filter (3.3) to compensate in balance with the outside atmospheric pressure, producing the return of the condensate accumulated in the condensate chamber (3.2) towards the cavity (1.11) of the shell (1) of the device (1), also dragging with it the condensate existing in the coil section (3.1), said condensate being introduced into the cavity (1.11) through the gas outlet duct (1.2) of the device (1).

[0052] Thus, the chamber forming the silica filter (3.3) constitutes a safe space for combustion in the event of flashback. When for some reason detonation is generated, said chamber filled with silica allows said detonation to develop in a safe and controlled manner, generating a vacuum and a discontinuity of the exit of the oxyhydrogen gas (HHO), which stops the flame, while the system does not stop producing said oxyhydrogen gas (HHO), whereby it is possible to immediately cut off possible flame propagation towards the inside of the device (1).

[0053] Preferably, the silica filter (3.3), which constitutes a flashback arrestor, comprises two chambers, a lower one (3.31) that is hollow and empty, and an upper one (3.32) that houses a portion of silica (not shown in the figures). This upper chamber (3.32) has a lower inlet protected by fibreglass and steel wool membranes (3.321) that pressure-retain the portion of silica inside it against a copper wire filter section (3.322), the latter, arranged at the upper outlet of the silica filter (3.3). The copper wire filter section is provided as the last filtering step, with a view to retaining the microparticles released when the oxyhydrogen gas (HHO) passes through the silica in a dry state.

[0054] For its part, as shown in Figure 5, in the case of the installation for heating by air ducts, it is preferred that the coil section (3.1) of the condensing means (3) is arranged inside the tubular wall (4.14) of the shell (4.1) of the heater (4). Preferably, arranged downstream of the oxyhydrogen gas (HHO) generator device (1), so that the coil section (3.1) is used to transfer additional heat to the flow of air that passes through the chamber (4.2) of the heater (4).

[0055] In other words, the coil section (3.1) arranged inside the tubular wall (4.14) of the shell (4.1) of the heater (4) has two functions. The first of these is to take advantage of the temperature of the water vapour that flows through its interior, at more than 80°C, as a heat source for a second heating step of the flow of air to be heated, which, after passing through the heat dissipating means (5), inside the chamber (4.2) of the heater (4), must make their way through the outer surface of the coil section

(3.1), on the way to the layout of air distribution ducts (7) of the heating installation. The second function of the coil section (3.1) is to condense the water vapour and drag it toward the condensate chamber (3.2) in the form of low temperature water together with the oxyhydrogen gas (HHO) generated by the device (1). The water accumulated in the condensate chamber (3.2) can be returned to the device (1) through a connection regulated by a valve (not shown in the figures) that communicates the lower part of the condensate chamber (3.2) with the upper part of the shell (1.1) of the device (1).

[0056] For its part, the oxyhydrogen gas (HHO) generated can be used to be burned as an extra energy supply, or it can be stored for use in other applications, or safely released into the atmosphere through a flashback arrestor system.

[0057] With regard to the installation for heating by radiators and sanitary hot water (SHW), shown in Figure 6, it is preferred that it comprises a three-way valve (9) arranged in the gas outlet duct (1.2), preferably, upstream of the condensing means (3).

[0058] The three-way valve (9) is configured to selectively connect the gas outlet duct (1.2) with a first outlet (9.1) and with a second outlet (9.2). The first outlet (9.1) is connected to a coil (10) arranged inside a hot water thermo-accumulator (11) which is arranged upstream of a sanitary hot water network (SHW) (12), where the water vapour at more than 80°C, coming from the device (1), is passed through the inside of the coil (10) releasing heat into the water contained in the thermo-accumulator (11), thus increasing its temperature before being led through the sanitary hot water (SHW) network (12) to the different consumption points (12.1) thereof. Additionally, it is preferred that an outlet (10.1) of the coil (10) be connected to the condensate chamber (3.2), as a bypass with respect to the coil section (3.1) of the condensing means (3), with a view to also momentarily accumulating in the condensate chamber (3.2), the condensed water vapour in the coil (10).

[0059] For its part, the second outlet (9.2) of the three-way valve (9) is connected to the coil section (3.1) of the condensation means (3), on the way to the condensate chamber (3.2).

[0060] Thus, by means of the three-way valve (9), overheating of the water stored in the hot water thermo-accumulator (11) is avoided. Once the water stored in the thermo-accumulator (11) is at the optimum working temperature for the sanitary hot water (SHW) network that it feeds, the oxyhydrogen gas (HHO) and the water vapour that accompanies it, rising through the gas outlet duct (1.2) from the device (1), are diverted through the second outlet (9.2) of the three-way valve (9) towards the coil section (3.1) of the condensation means (3). Subsequently, when an increase of the temperature of the water contained in the thermo-accumulator (11) is again required, then, the three-way valve (9) is activated again, connecting the gas outlet duct (1.2) with the first outlet (9.1) that gives access to the coil (10).

[0061] In both cases, the aim is to condense the vapour, either in the coil (10) arranged inside the hot water thermo-accumulator (11) or in the coil section of the condensing means (3), and drag it towards the condensate chamber (3.2) in the form of low temperature water together with the oxyhydrogen gas (HHO) generated by the device (1). The water accumulated in the condensate chamber (3.2) can be returned to the device (1) through a connection pipe regulated by a valve (not shown in the figures) that communicates the lower part of the condensate chamber (3.2). with the upper part of the shell (1.1) of the device (1). For its part, the oxyhydrogen gas (HHO) generated can be used to be burned as an extra energy supply, or it can be stored for use in other applications, or safely released into the atmosphere through a flashback arrestor system.

Claims

1. Fluid heater (4) comprising:

    - a shell (4.1) provided with an inlet (4.11) and an outlet (4.12) for a flow of fluid,
    - a chamber (4.2) that is formed inside the shell (4.1) between the inlet (4.11) and outlet (4.12), and
    - a heat source, arranged inside the chamber (4.2), adapted to release heat into the flow of fluid when it passes through the chamber (4.2),

    characterised in that the heat source is an oxyhydrogen gas (HHO) generator device (1) comprising a shell (1.1) forming a cavity (1.11) containing a quantity of electrolyte creating a contact between the respective electrode means (1.4) adapted to act as cathode (1.41) and as anode (1.42) respectively in an electrolysis reaction within the cavity (1.11), where the shell (1.1) is made from steel and its lateral wall (1.12) forms the cathode. (1.41) of the electrode means (1.4), and a steel plate (1.6), which is surrounded by the lateral wall (1.12), forms the anode (1.42) of said electrode means (1.4), in such a way that the lateral wall (1.12) is adapted to increase in temperature during the electrolysis reaction and release heat toward the chamber (4.2) .

2. Heater according to claim 1, wherein the anode (1.42) and the cathode (1.41) of the electrode means (1.4) of the oxyhydrogen gas (HHO) generator device (1) are connected to respective positive (2.1) and negative (2.2) terminals of a source of current (2) with an output voltage between 3.5 volts and 4 volts.

3. Heater according to claim 1, wherein the shell (4.1) is formed by a tubular wall (4.14), in such a way that it favours the channeling of the flow of fluid through

the chamber (4.2) formed inside it.

4. Heater according to claim 3, comprising drive means (6) adapted to force the channeling of the flow of fluid through the chamber (4.2).

5. Heater according to claim 1, wherein heat dissipating means (5) configured to increase a heat transfer surface towards the flow of fluid that passes through the chamber (4.2) are arranged outside the lateral wall (1.12) of the shell (1.1) of the oxyhydrogen gas (HHO) generator device (1) .

6. Heater according to claim 5, wherein the heat dissipating means (5) are a plurality of metal sheets (5.1) arranged longitudinally on the lateral wall (1.12) parallel and equidistant from each other.

7. Heater according to claims 4 and 5, wherein the drive means (6) are an axial fan (6.1) arranged inside the tubular wall (4.14), upstream of the heat dissipating means (5).

8. Heater according to claim 4, wherein the drive means (6) are a centrifugal pump (6.2) arranged upstream of the chamber (4.2).

9. Installation for heating by air ducts, **characterised in that** it comprises a heater (4), according to any of claims 1 to 7, incorporating an oxyhydrogen gas (HHO) generator device (1) as a heat source to be released into a flow of air as flow of fluid that passes through a chamber (4.2) of the heater (4), where the heater (4) is arranged upstream of a layout of air distribution ducts (7) .

10. Installation according to claim 9, comprising condensation means (3) arranged downstream of a gas outlet duct (1.2) of the oxyhydrogen gas (HHO) generator device (1), where the condensation means (3) comprise a coil section (3.1), a condensate chamber (3.2) and a silica filter (3.3), connected in series.

11. Installation according to claim 10, wherein the coil section (3.1) is arranged inside a tubular wall (4.14) of a shell (4.1) of the heater (4), downstream of the oxyhydrogen gas (HHO) generator device (1), so that the coil section (3.1) transfers additional heat to the flow of air that passes through the chamber (4.2) of the heater (4).

12. Installation for heating by radiators and sanitary hot water (SHW), **characterised in that** it comprises a heater (4), according to any of claims 1 to 4 and 8, incorporating an oxyhydrogen gas (HHO) generator device (1) as a heat source to be released into a flow of water as flow of fluid that passes through a chamber (4.2) of the heater (4), where the heater (4) is arranged upstream of a number of radiators (8.1) in a circuit of water radiators (8).

13. Installation according to claim 12, comprising condensation means (3) arranged downstream of a gas outlet duct (1.2) of the oxyhydrogen gas (HHO) generator device (1), where the condensation means (3) comprise a coil section (3.1), a condensate chamber (3.2) and a silica filter (3.3), connected in series.

14. Installation according to claim 13, comprising a three-way valve (9) arranged in the gas outlet duct (1.2) upstream of the condensation means (3), the three-way valve (9) being configured to selectively connect the gas outlet duct (1.2) with a first outlet (9.1) and with a second outlet (9.2), where the first outlet (9.1) is connected to a coil (10) arranged inside of a hot water thermo-accumulator (11) that is arranged upstream of a sanitary hot water (SHW) network (12), and the second outlet (9.2) is connected to the coil section (3.1) of the condensation means (3).

15. Installation according to claim 14, wherein an outlet (10.1) of the coil (10) is connected to the condensate chamber (3.2), as a bypass with respect to the coil section (3.1) of the condensation means (3).

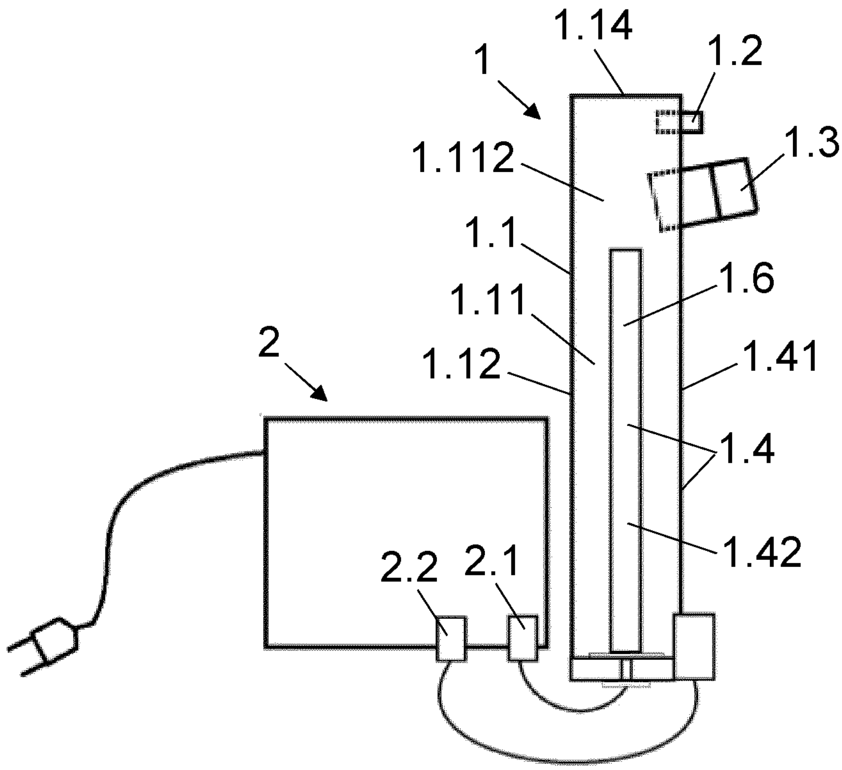
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Fig.1

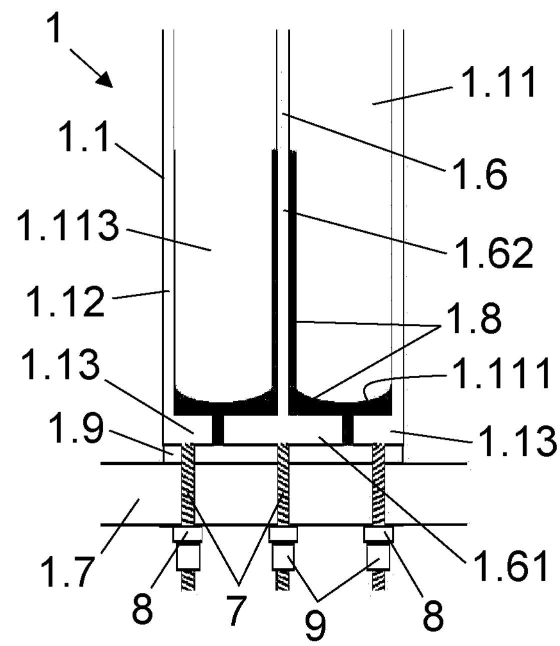
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Fig.2

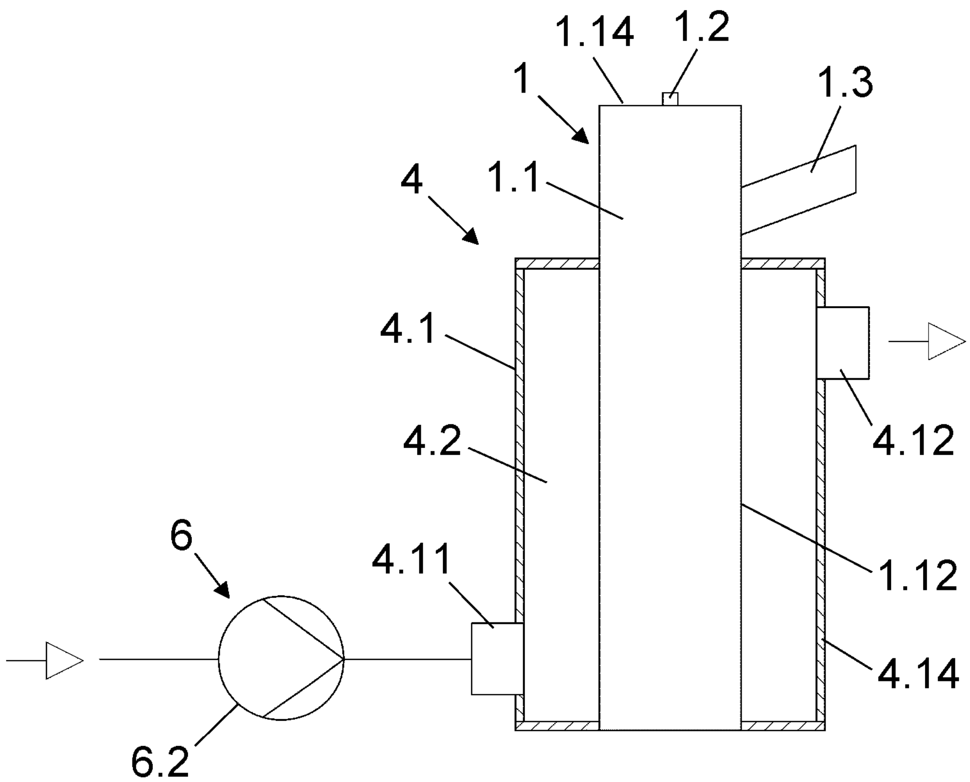

Fig.3

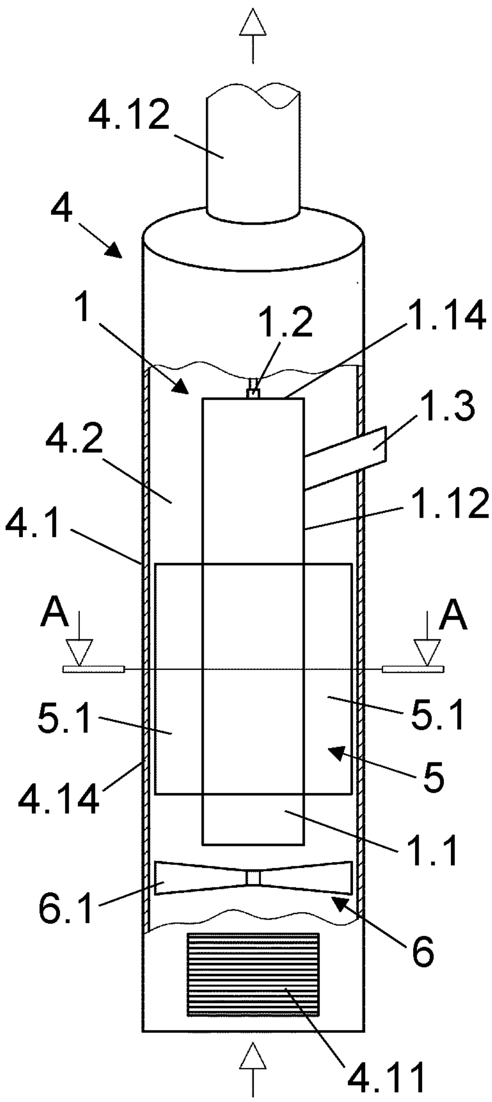
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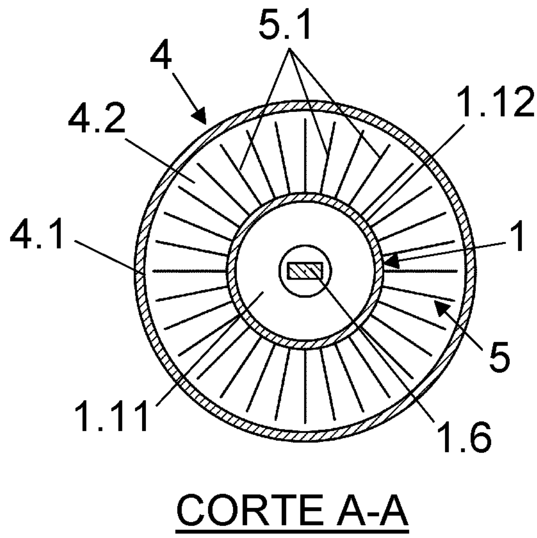
Fig.4A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CORTE A-A

Fig.4B

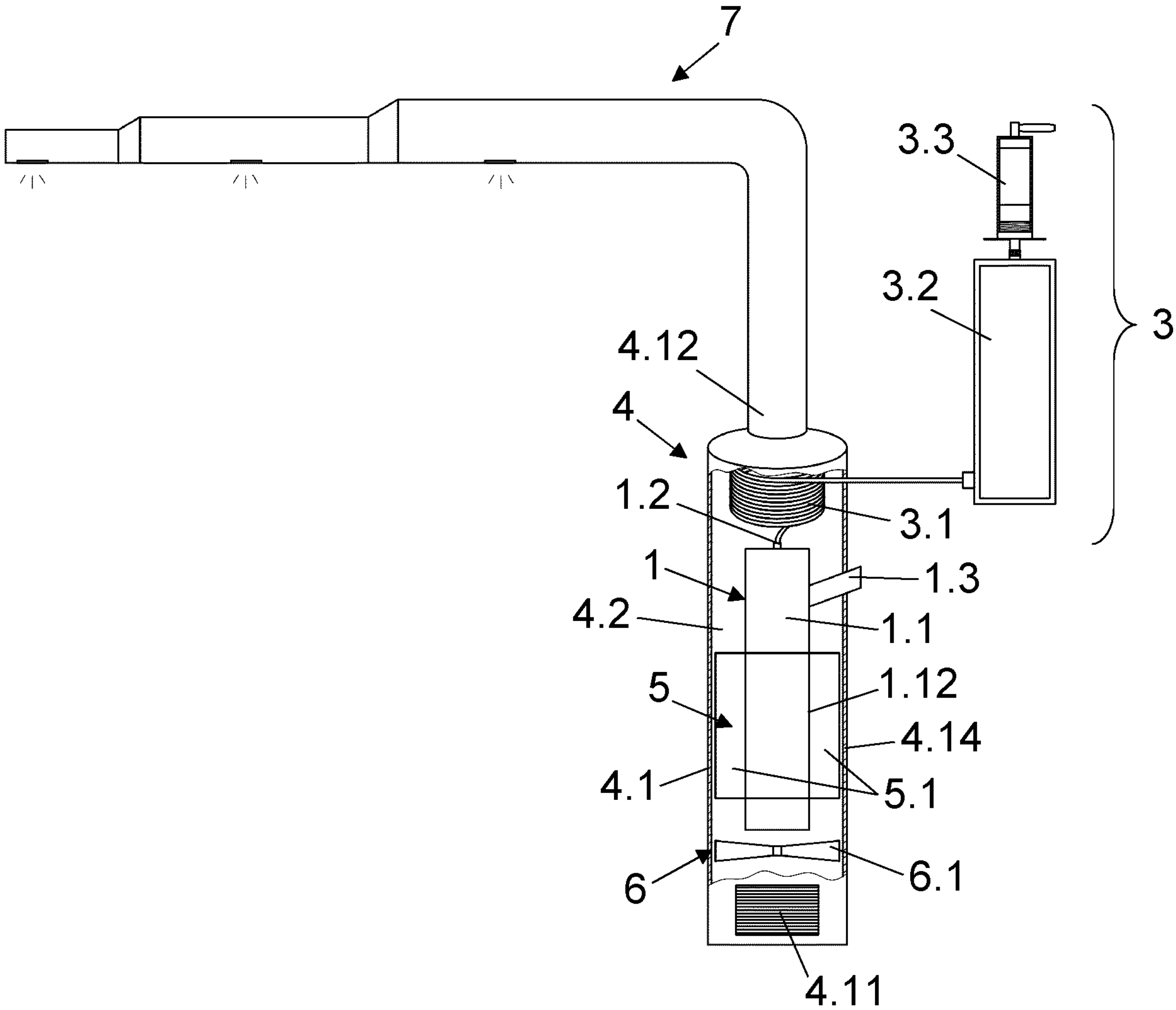

Fig.5

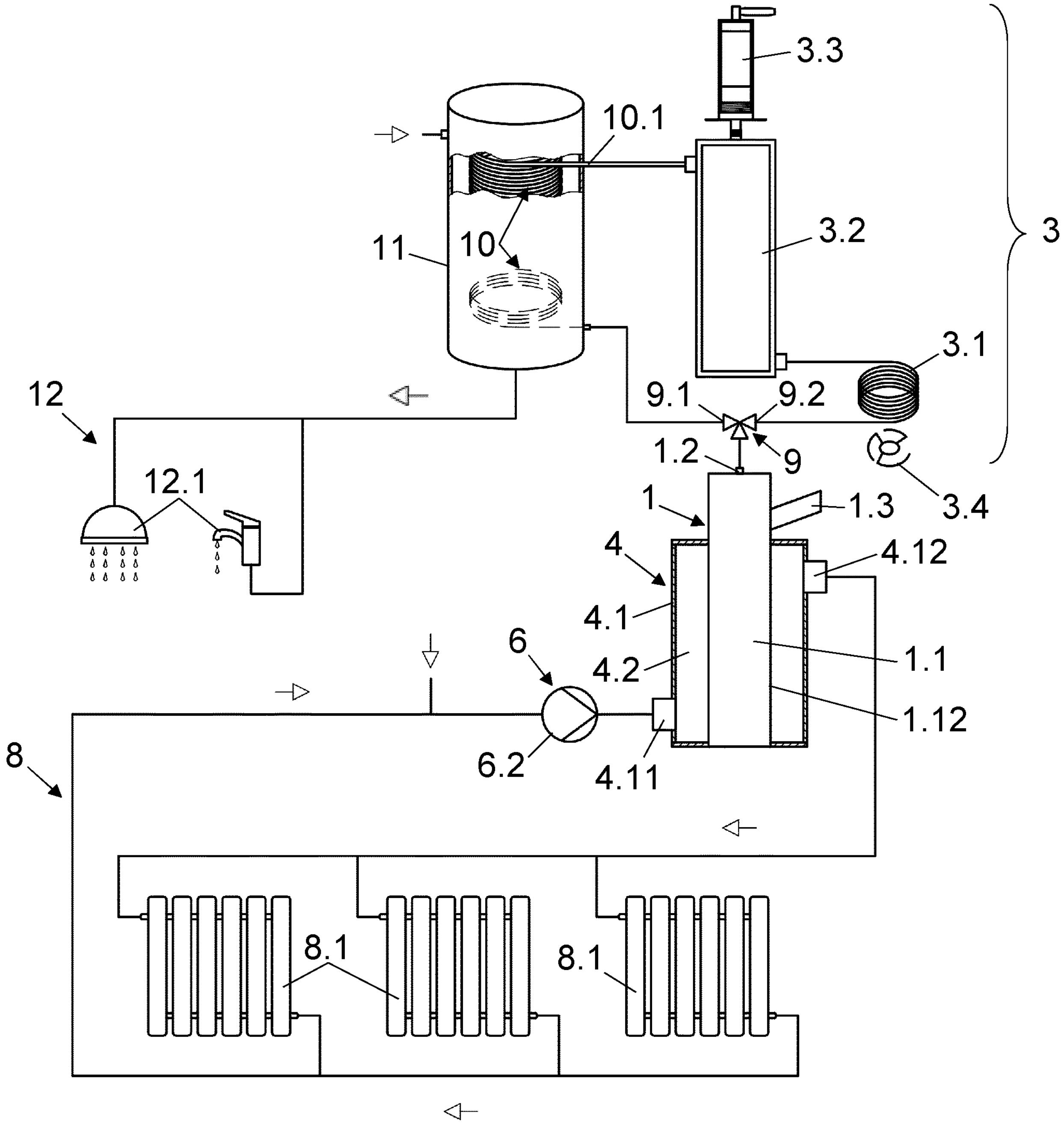
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Fig.6

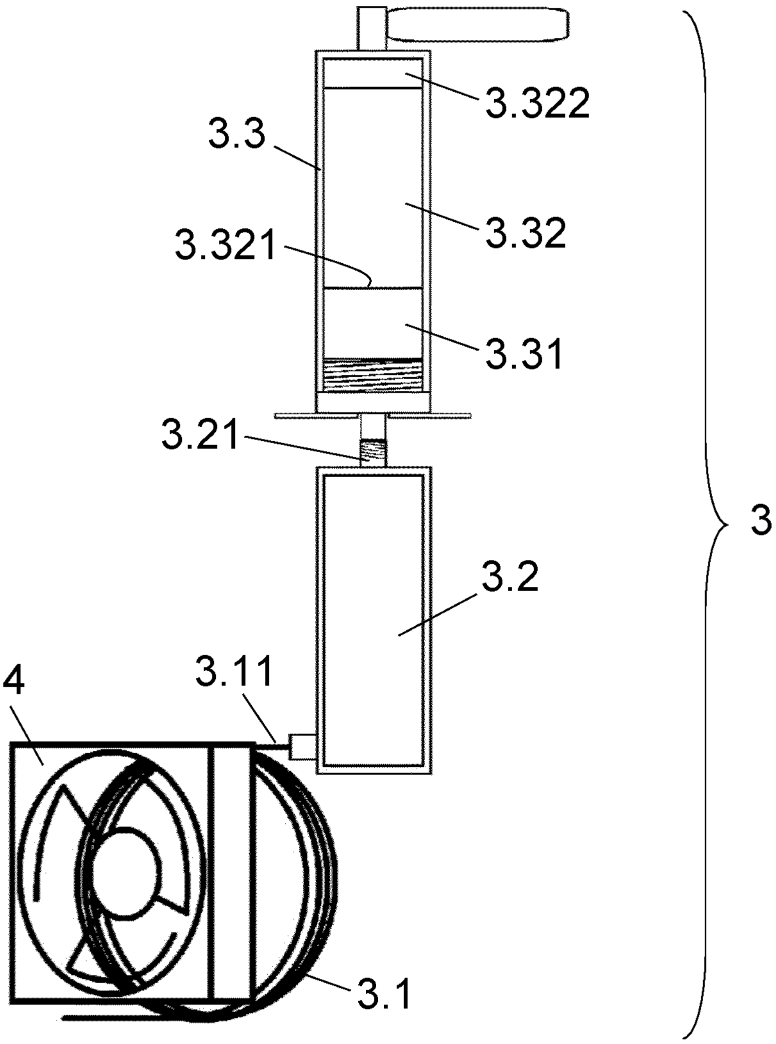

Fig.7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/ES2020/070717

A. CLASSIFICATION OF SUBJECT MATTER

F24H7/02 (2006.01)
C25B1/04 (2021.01)
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)
F24H

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

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

EPODOC, INVENES, WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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Date of the actual completion of the international search	Date of mailing of the international search report
18/02/2021	**(19/02/2021)**
Name and mailing address of the ISA/ OFICINA ESPAÑOLA DE PATENTES Y MARCAS Paseo de la Castellana, 75 - 28071 Madrid (España) Facsimile No.: 91 349 53 04	Authorized officer B. Aragón Urueña Telephone No. 91 3493277

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INTERNATIONAL SEARCH REPORT

International application No.
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C (continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
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