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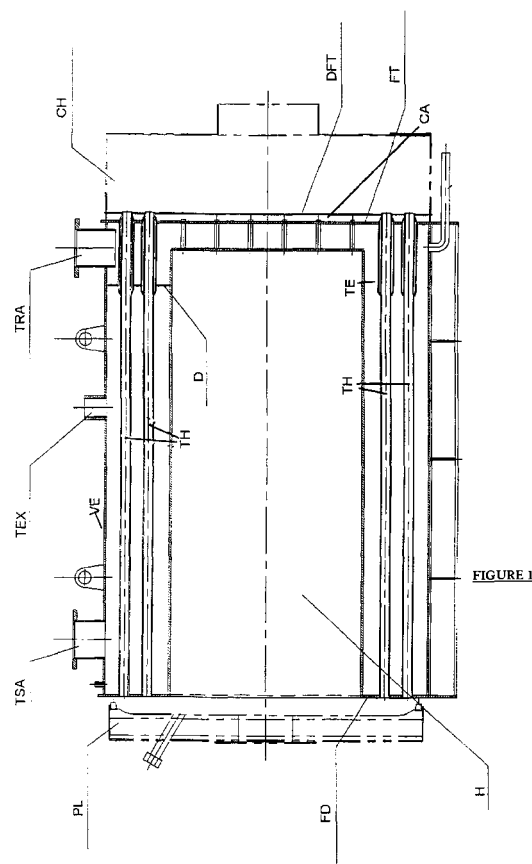
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(54) **Hot water generator for operation at low temperature**

(57) A hot water generator for operation at low temperature, of the pyrotubular type with a pressurized furnace and two stages of combustion gases. Among the generator's components there is a tubular bundle made up of steam pipes (TH) through which the combustion gases circulate, and enveloping pipes (TE) with a diameter greater than that of the steam pipes (TH) and mounted concentrically with respect to the said steam pipes (TH). Helicoidal gas turbulators (TG) travel through the inside of the steam pipes (TH) and have an external diameter equal to the internal diameter of the steam pipes (TH). The function of these gas turbulators (TG) is to put the combustion products into a turbulent state, thus obtaining a greater exchange between the gases and the exchange surfaces. It also has a double wall (DFT) situated between the steam box (CH) and the external rear wall (FT), as well as a deflector (D) which makes the circulating water move in a zig-zag.



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Description

[0001] The present invention refers to a hot water generator for operation at low temperature, being of the pyrotubular type with a pressurized furnace and two gas stages.

[0002] A series of systems for heating water are already known, such as heating boilers, whether domestic or industrial.

[0003] Thus, the Spanish patent No. 2012161, filed on December 2, 1988, in the name of Genaro Arana Uriarte, describes a water heating system which consists of two water circulation circuits, one of which is made up of two parallel vertical pipes connected with other horizontal pipes of smaller diameter. The second circuit has an inlet pipe wound helicoidally around the first circuit. This winding is continued in a spiral and finally descends along a vertical outlet section. The focus of heat, defined by gas burners, is situated below the tubular bundle of the first water circulation circuit.

[0004] The European patent 0 387 584, filed on September 19, 1990 in the name of Dr. Hans Viessmann, describes gas-fired piping intended particularly for low-temperature boilers, in which several gas-fired pipes from a combustion chamber or a supply chamber are arranged horizontally inside the mantel of the boiler, through which water circulates, meeting in a steam-collecting chamber. Each set of gas-fired pipes is made up of two adjacent pipes, of which the outer pipe, on the side adjoining the steam outlet, is firmly supported upon the inner pipe which transmits the heat, and the outer pipe is provided with radial ribs. The gas-fired piping is designed in such a way that in the steam outlet area, between the outer pipe and the inner one there is a metallic sleeve which transmits the heat to both pipes, the wall thickness of the sleeve being thinner than that of the pipes.

[0005] The European patent 0 397 586, filed on November 14, 1990, in the name of De Dietrich Thermique, describes a heating body for a low-temperature boiler. This boiler has a frontal facade and a rear facade, and a plurality of channels for steam circulation. It is characterised in that the frontal facade has at least one changing support, provided with peaks directed towards the plane of the facade and, moreover, at least one water circulation channel placed against the said supports and in contact with the furnace.

[0006] The European patent No. 0 573 742, in the name of Interdomo GmbH & Co. Heizungs und Wärmetechnik, filed on December 15, 1993, claims a heating boiler for low-temperature heating installations. This boiler is provided with a primary circuit and a secondary circuit, the boiler being configured as a three-fired boiler and the exhaust gases channel proper is found inside the primary circuit.

[0007] Finally, the Viessmann organisation has developed a three-stage steam boiler with multiple wall heating surfaces in which the large water chambers allow

internal recirculation and heat transmission. Gas combustion is carried out with reduced pollution emission as it uses two-stage, fan-assisted burners for gasoil/gas.

[0008] In comparison with the foregoing, the object of the present invention is to develop an improved hot water generator for operation at low temperature, being a pyrotubular generator with a pressurised furnace and two gas stages. The first of these is made up of the furnace proper, from the generator's supply to the blind part of the furnace made up of the internal rear wall, and the gases return at this point to be inverted at the cleaning door of the generator, between the front wall and the fireproof cement of the said door.

[0009] The second stage is from the cleaning door to the gas box, passing through the steam pipes, and subsequently the gases are expelled through the chimney.

[0010] Thus, the object of the present invention is a hot water generator for operation at low temperature, of the pyrotubular type with a pressurised furnace and two stages of gas combustion, of which the first is made up of the furnace, which is water-cooled, from the generator's supply to the blind part of the furnace formed by the internal rear wall where the combustion gases return to be inverted at the generator's cleaning door; the second stage takes place in the generator, from the cleaning door to the combustion gases door, where these gases pass through steam pipes and are subsequently expelled through the chimney. The generator is characterised in that it has a circuit of gases made up of the elements that are in contact with the combustion gases, namely the furnace designed to house the development of the flame, a tubular bundle made up of steam pipes through which the combustion gases circulate, enveloping pipes with a greater diameter than that of the steam pipes and installed concentrically with respect to the said steam pipes with their ends slightly extruded and welded to the steam pipes, gas turbulators of helicoidal shape, with an external diameter equal to the internal diameter of the steam pipes, and a double wall situated between the steam box and the external rear wall. The generator also has a water circuit made up of the elements of the generator which are in contact with the water, such as a water outlet tap situated in the upper generatrix of the enveloping part or external ferrule for taking the water from the generator to the heating circuit, a return water tap situated in the rear area of the generatrix of the external ferrule, for taking the water from the heating circuit to the generator, a deflector situated inside the external ferrule between the outlet and return turbulators, and a safety tap situated in the central area of the external ferrule.

[0011] According to the invention, between the steam pipes and the enveloping pipes a completely watertight air chamber is formed, which allows the temperature difference to be increased between the steam pipe and the wall that is in contact with the water at low temperature in the enveloping pipe.

[0012] The gas turbulators of the generator that is the

object of the invention put the products of combustion in a turbulent state, which creates a greater exchange between the gases and the exchange surfaces.

[0013] Moreover, the double wall of the generator creates an air chamber between the external rear wall and the steam box, which increases the temperature difference between the cold side of the water circuit and the cold side of the gases.

[0014] The deflector of the generator that is the object of this application is arranged in such a way that the circulating water moves in a zig-zag, and thus a better heat exchange is obtained between gases and water.

[0015] Below, a preferred embodiment will be described of the hot water generator for operation at low temperature that is the object of this application. It must be understood that this embodiment serves simply as an illustration and example and must not restrict in any way the scope of the invention.

[0016] The drawings show the following:

- figure 1 is a cross section view of the hot water generator in accordance with the invention; and
- figure 2 is a cross section view of the generator's double lined pipe in accordance with the invention.

[0017] With reference to figure 1, this shows a cross section view of the hot water generator for operation at low temperature that is the object of the invention. As may be observed, this generator is made up of two stages of combustion gases. The first of these is the furnace (H) comprising from the generator's supply to the blind part of the furnace (H), the latter being formed by the internal rear wall (FT), and the gases return at this point to be inverted at the cleaning door (PL) of the generator, between the front wall (FD) and the fireproof cement of the said cleaning door (PL).

[0018] The second stage is located in the generator and goes from the cleaning door (PL) to the steam box (CH) through the steam pipes (TH), and is subsequently expelled through the chimney (not shown).

[0019] The generator in accordance with the invention has two totally differentiated circuits, which are the gases circuit and the water circuit. The first of these is formed by the parts of the generator that are in contact with the combustion gases, such as the furnace (H), which is the part designed to house the development of the flame, this part being completely cooled by water that is not located in the centre of the generator.

[0020] The gases circuit also has a tubular bundle which is made up of steam pipes (TH), enveloping pipes (TE), gas turbulators (TG) (see figure 2) and a double rear wall (DFT).

[0021] The steam pipes (TH) are, in this embodiment, made of high-quality drawn steel without welding (St.) 35.8.1, in accordance with the DIN 17175 standard. They are heat-resistant pipes through which the gases that are produced by combustion circulate, either from liquid or gaseous fuel.

[0022] The enveloping pipes (TE) are made of high-quality drawn steel without welding (St.) 35.8.1, in accordance with the DIN 17175 standard. The enveloping pipes (TE) are of greater diameter than that of the steam pipes (TH), and they are installed concentrically with respect to the said steam pipes (TH), the ends of the same being slightly extruded (see figure 2), so that there will be a perfect coupling between the two pipes (TH) and (TE). The steam pipes (TH), the enveloping pipes (TE) and the gas turbulators (TG) will be explained with greater detail in relation to figure 2.

[0023] The fourth element that makes up the tubular bundle is that formed by a double wall (DFT) located between the steam box (CH) and the external rear wall (FT). The function of this fourth element of the gas circuit is to prevent excessive cooling of the gases by creating an air chamber (CA) between the external rear wall (FT) and the steam box (CH), thereby increasing the temperature difference between the cold side of the water circuit and the cold side of the gases.

[0024] As indicated hereinbefore, the generator in accordance with the invention has also a water circuit which is made up of the parts of the generator which are in contact with the water. In this circuit one may distinguish a water outlet tap (TSA) which is situated in the upper generatrix of the enveloping part or external ferrule (VE). This water outlet tap (TSA) is likewise situated in the frontal area of the generator, this being the area where the highest temperatures are reached in the hydraulic circuit, and its function is to take the water from the generator to the heating circuit. Also, there is a water return tap (TRA) situated in the rear area of the generatrix of the external ferrule (VE). This area has the lowest temperature in the hydraulic circuit and its function is to take the water from the heating circuit to the generator.

[0025] Inside the external ferrule (VE) and between the water outlet tap (TSA) and the water return tap (TRA) there is a deflector (D), which gives the water from the heating circuit a zig-zag movement. This movement produces a better heat exchange between the combustion gases and the water, and also prevents the cold water from the return tap (TRA) from going directly to the water outlet tap (TSA), which would result in a poorer performance on the part of the generator. This deflector is particularly recommended for hot water generators at low temperature, as is the case of the generator that is the object of the application.

[0026] In the central area of the external ferrule (VE), in its upper generatrix, there is an expansion or safety tap (TEX) whose function is to install in the same a safety valve of the relief type (not shown), which is capable of evacuating all the fluid produced, without a pressure increase inside the generator of more than 10% of the pre-set pressure of the generator.

[0027] With reference to figure 2 of the drawings, this shows a detail of some elements (TH, TE, TG) of the gases circuit. As may be observed in this figure, on the

steam pipe (TH) an enveloping pipe (TE) is mounted concentrically with its ends slightly extruded so as to obtain a perfect coupling between the two pipes. In the said extrusion there is a completely watertight weld (S), thus achieving a completely watertight air chamber (CA') whose function is to increase the temperature difference between the steam pipe (TH) and the wall that is in contact with the water at low temperature in the enveloping pipe (TE), thus preventing condensation of the combustion products. Inside the steam pipe (TH) there is a gas turbulator (TG), which is made up of a calibrated steel disc manufactured in a helicoidal shape and with the same external diameter as the internal diameter of the steam pipe (TH). This gas turbulator (TG) has the function of putting the combustion gases in a turbulent state, thus obtaining a greater exchange between the gases and the exchange surfaces. In this figure one may also observe the double rear wall (DFT) located between the steam box (TH) (see figure 1) and the external rear wall (FT).

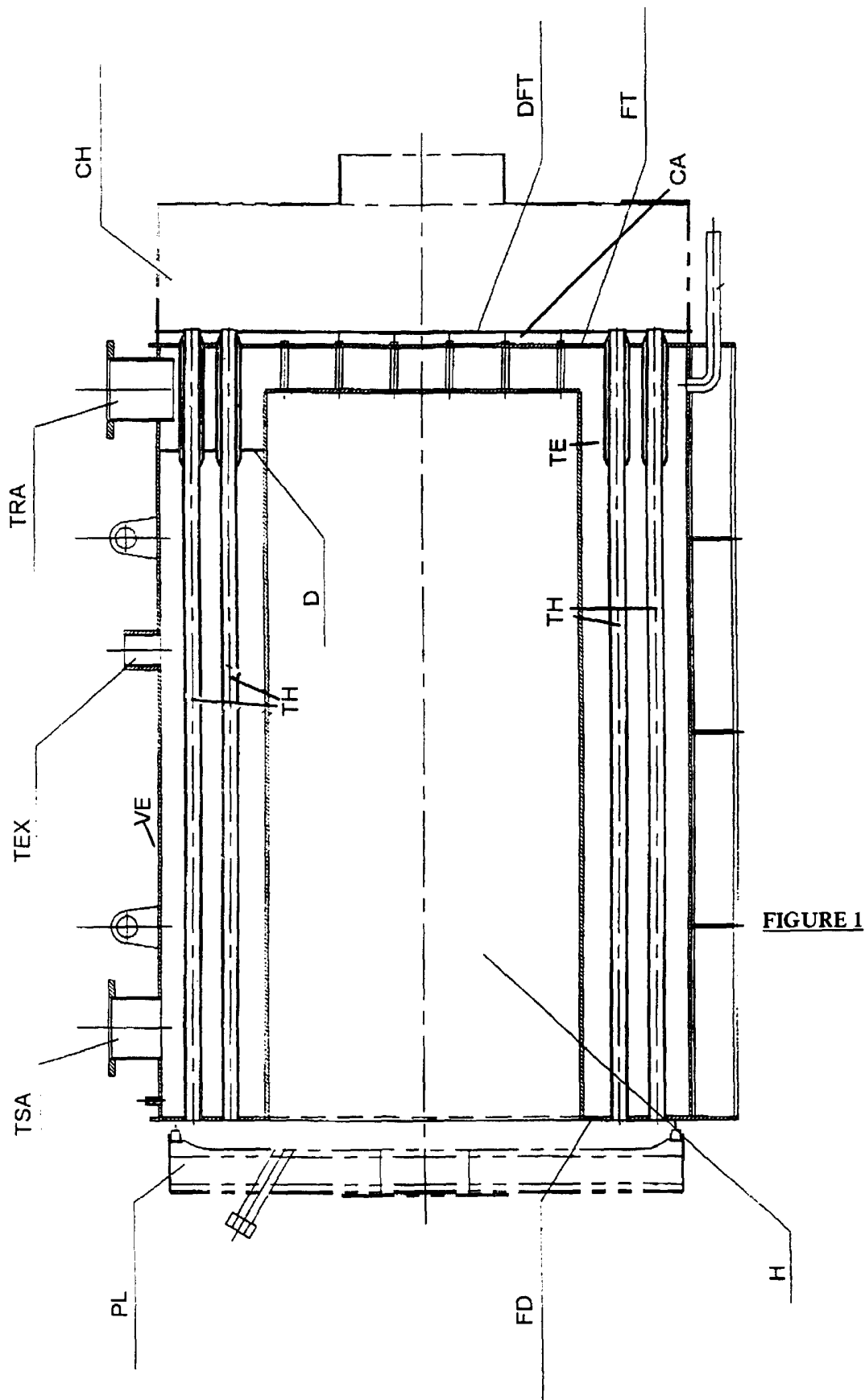
[0028] It must be understood that the foregoing description constitutes a preferred embodiment of the generator that is the object of the invention, and it must also be understood that experts in the art may carry out a series of modifications of the generator, which must be considered as included within the scope of the present invention, which is only delimited by the attached claims.

Claims

1. A hot water generator for operation at low temperature, of the pyrotubular type, with a pressurised furnace and two stages of combustion gases, of which the first is made up of the water-cooled furnace, which goes from the generator's supply to the blind part of the furnace formed by an internal rear wall in which the combustion gases return to be inverted at the generator's cleaning door, and the second stage is situated in the generator and goes from the cleaning door to the combustion gases box, where these gases pass through steam pipes to be subsequently expelled through the chimney, characterised in that the generator has a gases circuit made up of the elements that are in contact with the combustion gases, such as the furnace (H) designed to house the development of the flame, a tubular bundle made up of steam pipes (TH) through which the combustion gases circulate, enveloping pipes (TE) with a diameter greater than that of the steam pipes (TH) and mounted concentrically with respect to the said steam pipes (TH) with their ends slightly extruded and welded (S) to the steam pipes (TH), gas turbulators (TG) with a helicoidal shape, and with an external diameter equal to the internal diameter of the steam pipes (TH), and a double wall (DFT) situated between the steam box (CH) and the external rear wall (FT); and the generator also has

a water circuit made up of the generator's elements that are in contact with the water, such as a water outlet tap (TSA) situated in the upper generatrix of the enveloping part or external ferrule (VE), designed to take the water from the generator to the heating circuit, a return water tap (TRA) situated in the rear area of the generatrix of the external ferrule (VE), designed to take the water from the heating circuit to the generator, a deflector (D) arranged between the interior of the external ferrule (VE) between the outlet tap and the return tap (TSA, TRA), and a safety tap (TEX) situated in the central area of the external ferrule (VE).

2. A hot water generator, as claimed in claim 1, characterised in that between the steam pipes (TH) and the enveloping pipes (TE) there is a completely watertight air chamber (CA') which allows the temperature difference to be increased between the steam pipe (TH) and the wall that is in contact with the water at low temperature in the enveloping pipe (TE).
3. A hot water generator, as claimed in claim 1, characterised in that the helicoidal gas turbulators (TG) put the combustion products in a turbulent state, which creates a greater exchange between the gases and the exchange surfaces.
4. A hot water generator, as claimed in claim 1, characterised in that the double wall (DFT) creates an air chamber (CA) between the external rear wall and the steam box (CCH), which increases the temperature difference between the cold side of the water circuit and the cold side of the gases.
5. A hot water generator, as claimed in claim 1, characterised in that the deflector (D) is arranged in such a way that the circulating water moves in zig-zag, thus obtaining a better heat exchange between gases and water.



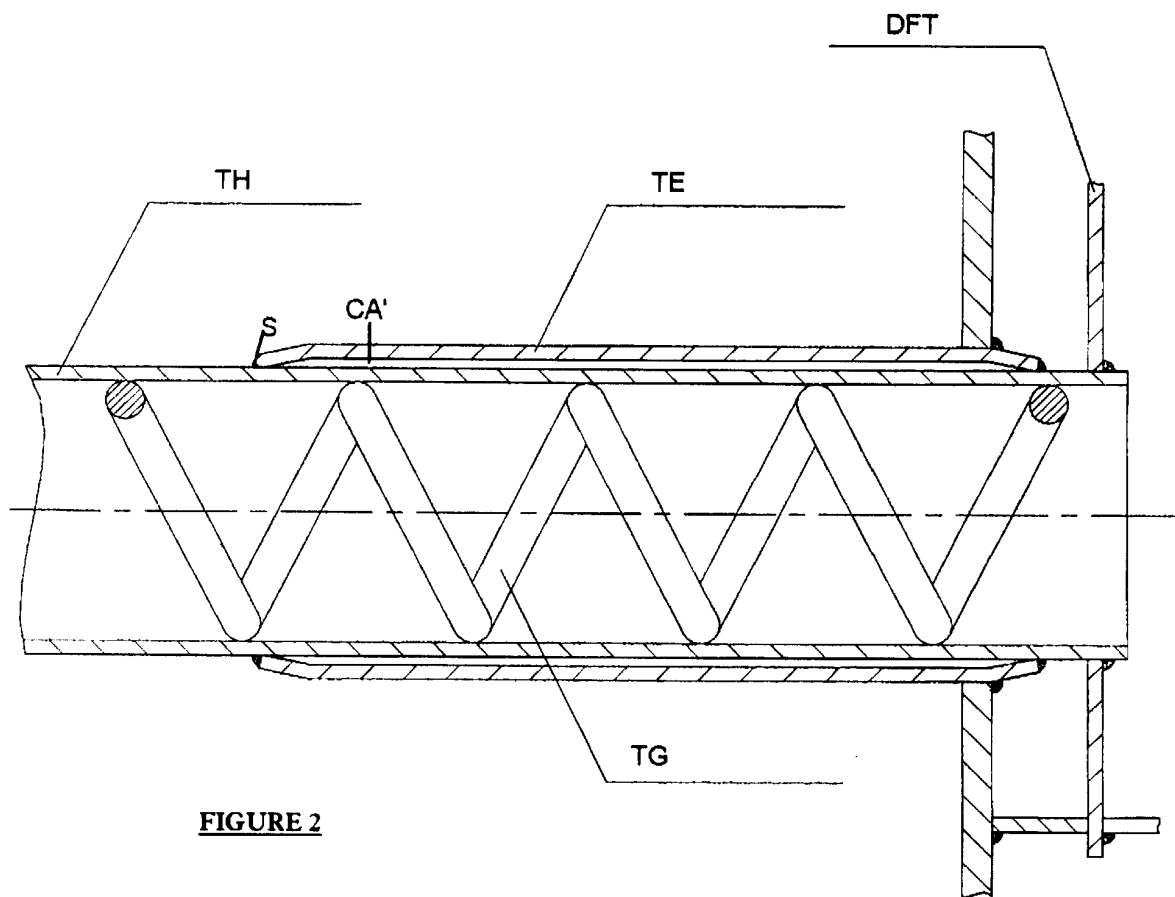


FIGURE 2