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(71) Applicant: **R.E.A. s.n.c. di Sassi e Baudin & C.**
Via Molino della Splua, 6
I-10028 Trofarello (Turin) (IT)

(72) Inventor: **Sassi, Stefano**
Strada Genova No. 131/Ter
I-10024 Moncalieri (Turin) (IT)
Inventor: **Sassi, Virginio**
Strada Genova No. 131/Ter
I-10024 Moncalieri (Turin) (IT)

(74) Representative: **Robba, Eugenio et al**
Studio "INTERPATENT"
via Caboto 35
I-10129 Turin (IT)

(54) Instantaneous single-stage steam generator.

(57) An aluminium plate (1) is disclosed, with outside resistances (3) and a network (5) of inside channels with two upstream pre-chambers (7) and (9) and one downstream compensation chamber (11); the first pre-chamber (7) is provided with an injector (13) formed by a drilled pipe (15) with a plurality of radially extending micro-holes (17); in the second pre-chamber (9) there occurs an evaporation of the overheated water coming from the first pre-chamber (7) at a suitable temperature for said evaporation; afterwards, a series of channels (21) is provided to form a network (5) allowing said fluid (water and gaseous substance) to be transformed into steam; said transformation occurring due to the continuous temperature increase to which said fluid is subject when ascending in the plate; at the end of the network (5) a compensation chamber (11) groups the outputs of network (5) together and conveys everything to a single passage (23) through an adequate compensation plenum chamber (25).

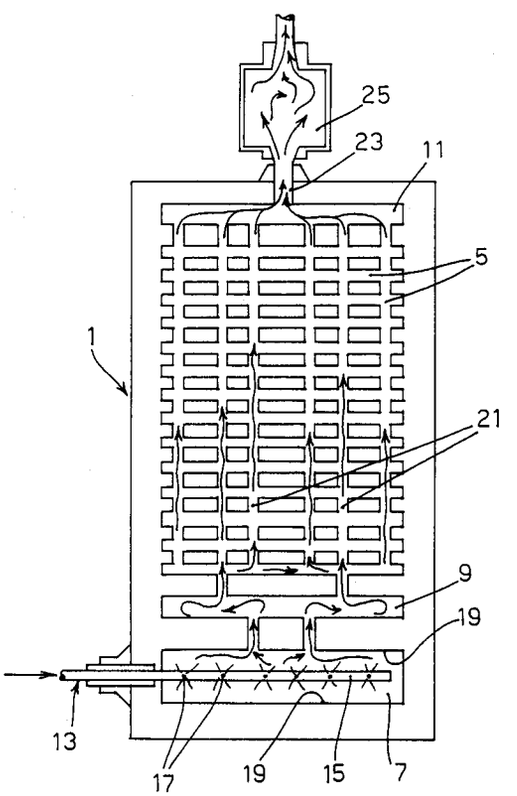

FIG. 3

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The present invention refers to an instantaneous single-stage steam generator, and particularly to a generator of the above-mentioned type with two or three resistances.

The most relevant prior art as regards the present invention is Italian Patent No. 1,162,966, filed on 21.10.83 in the name of Vaporcasa, that discloses an instantaneous steam generator; the inventor of said Patent is co-inventor of the present invention.

This steam generator, that, as said above, is the most relevant prior art, was formed by a single coil passage that required quite a high volume available, and further the volume of the produced steam was limited, since steam generation occurred in an exceedingly narrow space and with little expansion. This created a cooling action for the generator, especially in the first flow stages. This resulted in a limited volume of produced steam with respect to the amount of introduced water as well as in continuous pressure changes due to the said lack of expansion space.

Object of the present invention is to overcome the above-mentioned drawbacks by providing an instantaneous steam generator suitable for a better use of the amount of introduced water, so as to produce a greater amount of steam with limited temperature changes.

The steam generator of the present invention comprises a plate made of aluminium or other suitable material, a set of outside plate resistances and a network of inside channels with at least two upstream pre-chambers and one downstream compensation chamber;

said first pre-chamber being provided with an injector formed by a drilled pipe equipped with a plurality of micro-holes extending radially towards the walls of the pre-chamber, in order to allow an immediate impact of the water molecules with a high temperature surface, an immediate expansion occurring in said pre-chamber due to the volume increase of the water molecules because of the temperature change;

said second pre-chamber, downstream of and smaller than the first one, being adapted to receive the volume of overheated water generated in said first pre-chamber, at a suitable temperature for the following evaporation occurring in said second pre-chamber;

after said second pre-chamber, the fluid starting to flow through a network of channels of much smaller size, in order to allow said fluid, water and gaseous substance to be transformed into steam; said transformation occurring due to the rate of reaction to the continuous temperature increase to which said fluid is subject when ascending with respect to the first pre-chamber;

a compensation chamber being provided at the end of said network, said compensation chamber grouping network outputs together and conveying everything to a single passage that leads to a compensation plenum chamber, provided downstream of the path, since it is unadvisable to make the steam go out immediately after the last chamber, because an unbalance would occur in the ratio between the amount of water introduced into the generator and the steam produced by reaction.

It must be noted that the resistances provided outside the generator are proportional to the sizes and power of the generator; the same applying also to the plenum chamber, which is sized depending on the sizes of the generator plate.

In a preferred embodiment of the invention, there are provided three plate resistances.

It must also be noted that the mentioned arrangement allows to operate with a single body rather than with a set of members as it is the case with the above-mentioned prior art instantaneous generator.

The invention will now be described in detail with particular reference to the accompanying drawings, provided as a non-limiting example, in which:

Figure 1 is a front view of the steam generator according to the invention;

Figure 2 is a side elevation view of the generator in Figure 1;

Figure 3 is a front view showing the scheme of the inside of the generator.

As shown in the Figures, the steam generator of the present invention comprises a plate 1 made of aluminium or other suitable material, a set of outside plate resistances 3 and a network 5 of inside channels with at least two upstream pre-chambers 7 and 9 and one downstream compensation chamber 11.

Said first pre-chamber 7 is provided with an injector 13 formed by a drilled pipe 15 equipped with a plurality of micro-holes 17 extending radially towards the walls 19 of the pre-chamber 7, in order to allow an immediate impact of the water molecules with a high temperature surface, an immediate expansion occurring in said pre-chamber 7 due to the volume increase of the water molecules because of the temperature change.

In said second pre-chamber 9, downstream of the first one, the small volume of overheated water generated in the first pre-chamber is already at an acceptable temperature for the following evaporation that occurs in said second pre-chamber 9, of smaller size than the first one.

After said second pre-chamber 9, a series of channels 21 of much smaller size is provided to form a network, or labyrinth, allowing said water molecules, now mixed with gaseous substance, to be transformed into steam; said transformation oc-

curring due to the rate of reaction to the continuous temperature increase to which said molecules are subject when ascending with respect to the first pre-chamber 7.

A compensation chamber 11 is provided at the end of said network 5, said compensation chamber 11 grouping the outputs of said network 5 together and conveying everything to a single passage 23 that leads to a compensation plenum chamber 25, provided downstream of the path, since it is unadvisable to make the steam go out immediately after the last chamber 11, because an unbalance would occur in the ratio between the amount of water introduced into the generator and the steam produced by reaction.

The resistances 3 provided outside the generator are proportional to the sizes and power thereof, and in the example described and shown three such resistances are provided. The same applies also to the plenum chamber 25, which is sized depending on the sizes of the generator plate 1.

It must also be noted that the mentioned arrangement allows to operate with a single body rather than with a set of members as it is the case with the above-mentioned prior art instantaneous generator.

Claims

1. Instantaneous single-stage steam generator characterized in that it comprises a plate (1) made of aluminium or other suitable material, a set of outside plate resistances (3) and a network (5) of inside channels with at least two upstream pre-chambers (7) and (9) and one downstream compensation chamber (11);

said first pre-chamber (7) being provided with an injector (13) formed by a drilled pipe (15) equipped with a plurality of micro-holes (17) extending radially towards the walls (19) of the pre-chamber (7), in order to allow an immediate impact of the water molecules with a high temperature surface, an immediate expansion occurring in said pre-chamber (7) due to the volume increase of the water molecules because of the temperature change;

said second pre-chamber (9), downstream of and smaller than the first one, being adapted to receive the volume of overheated water generated in said first pre-chamber (7), at a suitable temperature for the following evaporation occurring in said second pre-chamber (9);

after said second pre-chamber (9), the fluid starting to flow through a network (5) of channels (21) of much smaller size, in order to allow said fluid, water and gaseous substance to be transformed into steam; said transformation occurring due to the rate of reaction to the continuous temperature increase to which said fluid is subject when ascending with respect to the first pre-chamber (7);

a compensation chamber (11) being provided at the end of said network (5), said compensation chamber (11) grouping the outputs of said network (5) together and conveying everything to a single passage (23) that leads to a compensation plenum chamber (25), provided downstream of the path, since it is unadvisable to make the steam go out immediately after the last chamber (11), because an unbalance would occur in the ratio between the amount of introduced water and the produced steam.

2. Instantaneous steam generator according to Claim 1, characterized in that the resistances (3) provided outside the generator and proportional to the sizes and power thereof, are at least three.

3. Instantaneous steam generator according to Claim 1, characterized in that also the compensation plenum chamber (25) is sized depending on the sizes of the generator plate (1).

4. Instantaneous steam generator according to any of the previous Claims, characterized in that with said generator it is possible to operate with a single body.

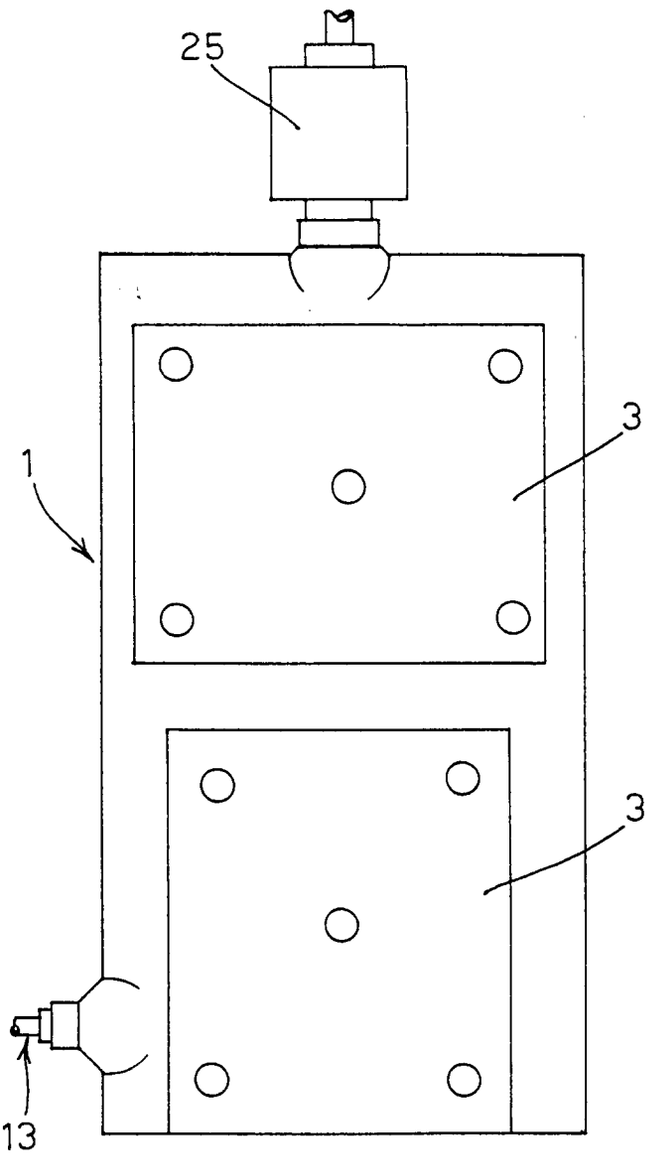

FIG. 1

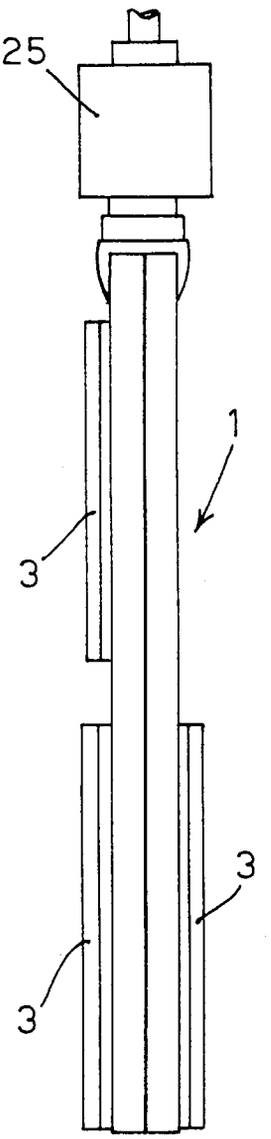

FIG. 2

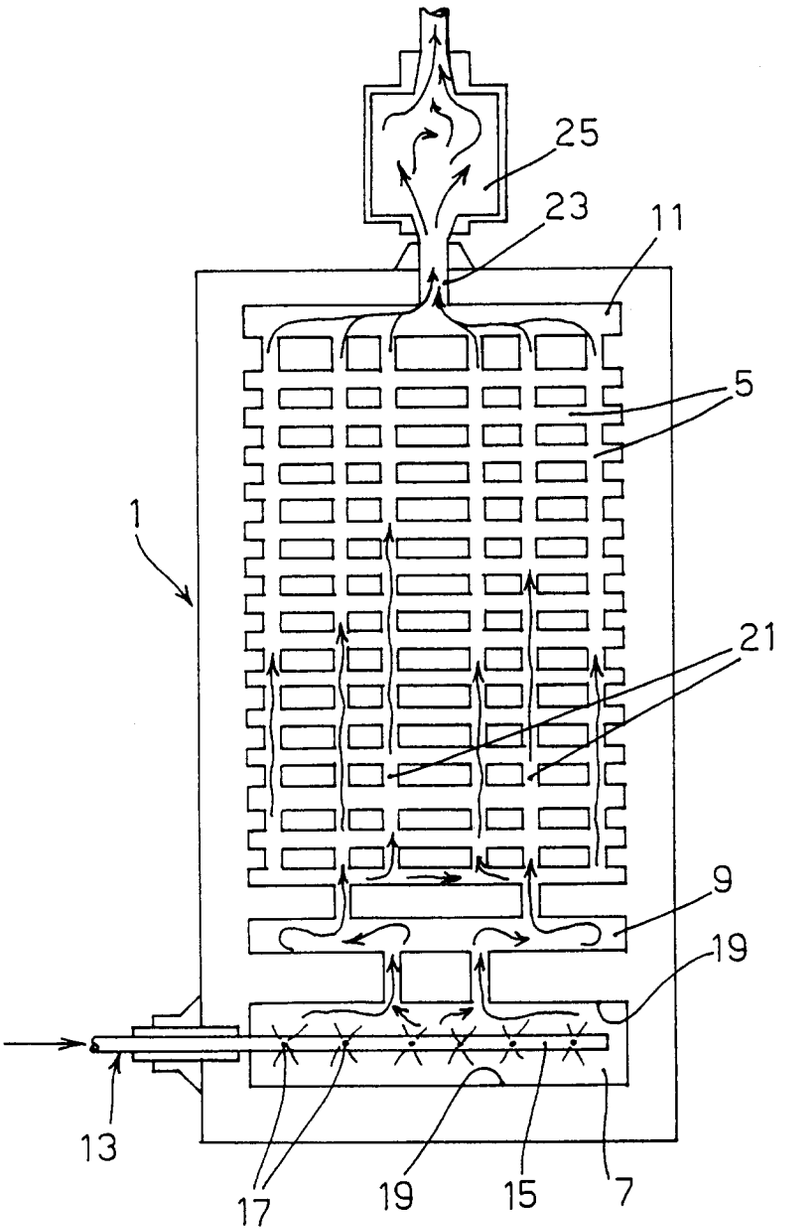

FIG. 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 95 10 0832

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP-A-0 347 196 (BLACK & DECKER) * column 9, line 2 - column 10, line 4; figures * ---	1	F22B1/28 F22B27/16
A	EP-A-0 268 477 (BLACK & DECKER) * column 14, line 8 - line 17; figures * ---	1	
A	US-A-4 616 122 (BURIAN) * column 6, line 10 - line 33; figures 10-14 * ---	1	
A	EP-A-0 533 358 (BLACK & DECKER) * abstract; figures * ---	1	
A	US-A-5 208 895 (HOOVER) * column 4, line 40 - line 68; figures * ---	1	
A	US-A-4 878 458 (NELSON) * column 2, line 36 - line 55; figures * -----	1	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6) F22B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	28 July 1995	Van Gheel, J

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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