(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 821 096 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
28.01.1998 Bulletin 1998/05

(51) Int. Cl.[6]: **D06F 75/12**, F22B 1/28

(21) Application number: **97106361.5**

(22) Date of filing: **17.04.1997**

(84) Designated Contracting States:
AT BE CH DE DK ES FI FR GB GR IE IT LI LU MC NL PT SE
Designated Extension States:
AL LT LV RO SI

(30) Priority: **26.07.1996 IT UD960143**

(71) Applicant: **ESSE85 S.r.l.**
I-31058 Susegana (IT)

(72) Inventor: **Barazza, Gino**
31015 Conegliano (TV) (IT)

(74) Representative: **Lanzoni, Luciano**
c/o Bugnion S.p.A.,
Via Pelliccerie, 2
33100 Udine (IT)

(54) Steam generator for irons and the like

(57) The present invention relates to a steam generator (1) consisting of a water tank (2) connected to a boiler (3) by a pipe (5) which has inserted inside it an electric delivery pump (6) which controls the supply of water, from the tank (2) to the boiler (3), when necessary. The boiler (3) comprises moreover a single heating plate (18) associated in a close-fitting manner on the outside thereof by means of pressure casting. The bottom (11) of the boiler (3) is inclined so as to have at least two portions, a lower portion (12) and an upper portion (13).

The heating plate (18) has mounted on it in the region of the upper portion (13) a thermostatic switch (16) located directly underneath an opening (15) connected to the supply pipe (5).

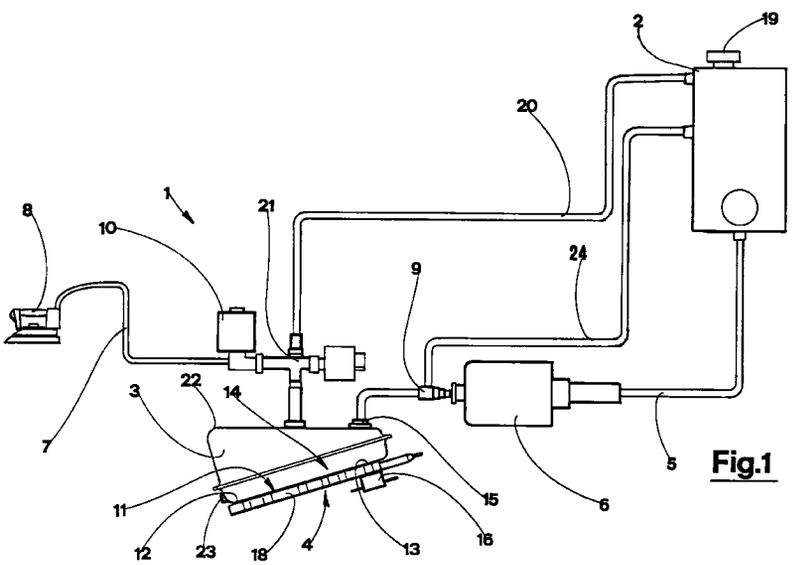

Fig.1

EP 0 821 096 A1

Description

The present invention relates to a steam generator intended to be associated with irons, steam-cleaning equipment, coffee-producing machines, saunas or the like.

More particularly, the invention relates to a steam generator consisting of a tank for the water, connected to a boiler by a pipe which has inserted inside it an electric delivery pump which controls the water supply from the tank to the boiler, when necessary. The boiler comprises, moreover, electric heating means.

These generators, in addition to simplifying and ensuring the total safety of the top-up operations, have the advantage that they do not require switching-off of the generator in order to be able to carry out topping-up of the water inside the tank.

In the known steam generators of the type defined above, the boiler has inside it an electric coil immersed in the water to be heated. This coil has associated with it, moreover, a thermostatic switch which controls the supply of new water when the level falls below a predetermined minimum value.

This solution, however, has the serious drawback of continuously stressing the coil with thermal shocks due to the alternation of extremely high temperatures - reached when the evaporating water partially uncovers the resistor which is thus immersed in the steam - with other relatively low temperatures - due to the supply of cold water - which cause, over time, breakage thereof. In particular, the zones where the coil is welded to the bushes for fixing to the boiler are subject to frequent breakages.

A further disadvantage of this known solution is due to the well-known formation of scale on the coil which alters the technical characteristics thereof, resulting in it becoming unusable with the passing of time.

It is also known of a solution in which the electric coil is replaced by two heating plates located inside the boiler, one in the vertical position and the other in the horizontal position. This solution, however, is unable to overcome the drawbacks mentioned above since these plates are also subject not only to the phenomenon of deposition of the calcium present in the water, but also to the action of thermal shock.

Finally, it is known of a steam generator comprising a boiler consisting of a long vertical tube, in which the electric heating means consist of an electric spiral applied to the outside of the boiler by means of welding.

This solution partially solves the aforementioned drawbacks, but is not directly applicable to irons, the limited vertical dimensions of which are not compatible with the form shown. Moreover, this solution, in addition to being extremely costly in terms of its pratical realization, is subject to slight delays during the production of steam, after new cold water has been added, due to the delay with which the new cold water is brought up to temperature.

None of the solutions of the known type, finally, is able to produce constantly steam without interruption.

An object of the present invention is therefore that of overcoming the said drawbacks displayed by the devices of the known type, by providing a steam generator for irons or the like, which, in addition to its functional nature, is also economical in terms of production and operation thereof.

A further object achieved is that of making the best possible use of the little space which is available inside irons or the like by providing a generator which is able to supply, within a short time after switching-on, an abundant continuous supply of steam.

Another object is that of reducing the times for heating of the new cold water added into the boiler during use so as not to create any interruption in the supply of steam.

Moreover, an object is that of speeding up the reaction times of the thermostatic switch, limiting at the same time the thermal fluctuations of the heating plate.

A further object of the present invention is that preventing, during the normal conditions of use of the generator, that the latter is able to supply, together with the steam, also water which is not yet evaporated.

Another object of the present generator is that of limiting the formation of solid residue inside the boiler.

Last but not least, an object of the invention is that of configuring the boiler so that the generation of steam is never interrupted even when, during particularly critical operating conditions, the supply of new cold water should occur with a certain delay.

These and other objects are all achieved by a steam generator for irons or the like as described in the claims which follow.

In particular, there is provided a boiler with an inclined bottom onto which the heating plate is externally mounted. A thermostatic switch which controls the supply of new cold water to the boiler is mounted in a top zone of the plate. The hole via which the water enters is arranged preferably in the region of the zone where the thermostatic switch is mounted, so as to obtain the double advantage of heating the water very rapidly, bringing it into direct contact with the superheated surface of the boiler which is located above the water level, and cooling equally rapidly the heating plate so as to rapidly enable the command regulating the supply of new water.

As a result of this particular mutual arrangement of the thermostatic switch with respect to the water supply hole, the generator is extremely sensitive to the temperature variations and is able to provide steam at a constantly high pressure.

In this way the temperatures inside the boiler are kept lower, also limiting the formation of calcium.

As a result of the inclined configuration of the boiler, finally, it is ensured that the latter always has inside it a little water for ensuring the continuity in the steam production so that it is not subject to interruptions even if

the water level should fall below the minimum preset level.

Further characteristic features and advantages of the present invention will emerge more clearly from the detailed description which follows of a preferred embodiment, illustrated purely by way of a non-limiting example, in the accompanying drawings, in which:

- Figure 1 shows a schematic view of a steam generator for irons or the like according to the present invention;
- Figure 2 shows a constructional variant of the boiler according to Figure 1.

With reference to Figure 1, 1 denotes schematically in its entirety a steam generator intended to be associated for example with a steam iron 8 or a steam cleaning apparatus or else a coffee-producing machine or similar equipment.

The generator 1, which is usually arranged inside a casing not shown, comprises a water tank 2 provided at the top with a filling plug 19, and a boiler 3 for generating steam under pressure, connected to the tank 2 via a water supply pipe 5 which contains a delivery pump 6, normally an electromagnetic pump or equivalent type.

The tank 2 and the boiler 3 are also connected together via a flowback pipe 20 which has associated with it, in a manner known per se, an overpressure valve 21.

Between the delivery pump 6 and the boiler 3 there is arranged a non-return valve 9 communicating with the tank 2 via a return pipe 24.

The bottom 11 of the boiler 3 has an inclined zone 14, as can be clearly seen from Figure 1. The boiler 3 is provided with electric heating means 4 associated therewith. These comprise a heating plate 18 mounted externally and connected in a close-fitting manner to the boiler 3 itself in order to optimize transmission of the heat in both directions, from the plate 18 to the water and vice versa. This connection may be achieved for example, in practice, by means of bolting with the application, in between, of a thermally conductive paste (not shown).

The inclined bottom 11 has two portions, a lower portion 12 and an upper portion 13, one being arranged at the lowest point inside the boiler 3 and the other in the vicinity of the highest internal zone which is still in contact with the heating plate 4. The heating plate 4, which is single, extends substantially over the entire bottom 11 and has mounted on it a thermostatic sensor located in the region of the upper portion 13.

This thermostatic switch 16 interrupts the electric power supply when the heating plate 18 reaches or exceeds a preset operating temperature and reactivates it as soon as the temperature falls back below this limit.

The bottom 11 which is thus inclined has a considerable heating surface area which comes into contact with the water, certainly greater than that of an ordinary flat bottom.

The boiler 3 has an opening 15 formed substantially along the vertical of the thermostatic switch 16 and connected to the water supply pipe 5.

The single thermostatic switch 16 present is of the bivalent type; it is in fact able to control two different operating temperatures. The first is the one detected when the water, evaporating, partially frees the surface of the upper portion 13, causing its temperature to increase. The second temperature level which the thermostatic switch 16 is able to detect is the limit temperature which the heating plate 18 should never exceed. It therefore consists of a safety temperature beyond which the thermostatic switch 16 intervenes, interrupting the electric power supply to the plate 18, whatever the operating condition of the generator 1 in that given instant.

The thermostatic switch 16 therefore acts as a detector of the level of the water inside the boiler. In fact, when the water level falls, freeing partially the upper portion 13, the latter is surrounded by steam. Owing to the altered heat exchange coefficient, which is drastically worsened, the temperature of the plate 18 rises rapidly and this rise in temperature causes tripping of the thermostatic switch 16.

The boiler 3 moreover has connected to it a steam delivery pipe 7 which terminates in the iron 8 and which has inserted inside it a steam valve 10 which can be operated so as to cause steam 8 to flow out towards the iron 8 whenever necessary.

The boiler 8 has, moreover, a discharge plug 23 arranged in the vicinity of the lower portion 12 for removal therefrom of the scale which inevitably forms inside it with time.

Figure 2 shows a constructional variant of the boiler 3'.

In it the inclined bottom is replaced by a flat bottom from which there rises an upper portion 13' formed in the manner of an upturned "U". In this case, also, the heating plate 18' is shaped so as to match exactly the shape of the bottom of the boiler so as to heat the entire surface of the bottom itself.

It should be noted that the pipes for supplying the water 5' and delivering the steam 7' are inverted with respect to that shown in Figure 1. This is done so that the supply pipe 5'is arranged along the vertical of the upper portion 13'.

16' denotes the thermostatic switch arranged, in this case also, in the region of the upper portion 13'.

Following the mainly structural description provided above, let us now consider the operating mode of the present invention.

Upon switching-on, the heating plate 18,18' is supplied electrically by control means (not shown since they form part of the known art), independently of the presence or otherwise of water inside the boiler 3,3'. At this point there are 3 extreme situations:

- the boiler is empty;

- the boiler contains water;
- the boiler is full of water.

In the first case, i.e. the one where the boiler is empty, the temperature rapidly increases since there is no water to be heated and trips the thermostatic switch 16 which causes entry of the water via the opening 15 by operating the pump 6. The water falls directly onto the upper portion 13,13' which is very hot and rapidly heats, cooling at the same time the zone controlled by the thermostatic switch 16. The latter then trips again causing switching-off of the delivery pump 6. This operation is automatically repeated several times until the water level is brought up to a preset level.

The thermostatic switch 16 causes this automatic operation as a result also of its well-known feature of opening the contacts at one temperature, but closing them again at a slightly different temperature.

As soon as the water contained inside the boiler 3,3' reaches the boiling temperature, the steam is produced in the desired amount.

If, on the other hand, the boiler 3,3' should already contain water during the initial switch-on phase, the intervention time of the thermostatic switch 16 becomes slightly longer since the thermal energy produced by the plate 18 is first of all absorbed by the water. As soon as the level of the water falls below the upper portion 13,13', the thermostatic switch 16 intervenes in the manner already described.

The last case is that where the boiler 3,3' is already full of water at the moment of switching on. Similarly to that which has already been seen, in this case also, it is the thermostatic switch 16 which causes the supply of new water, but this is triggered only after part of the generated steam is made to flow towards the iron 8, by opening the steam valve 10.

With the configuration of the steam generator indicated in the present invention it is therefore possible to produce quickly and continously the steam required. In particular it is possible to obtain extremely short times for heating of the new water which positively influence the overall operation of the generator. In fact, since the upper, extremely hot portion 13,13' of the boiler 3,3' is directly struck by the water, the times for heat exchange and reaction of the thermostatic switch are shortened considerably. The boiler is therefore extremely sensitive to the variations in level and temperature inside it; substantially this results in a little water being loaded into it, but at frequent intervals.

This constructional feature moreover prevents the temperature of the boiler from remaining for long periods of time at very high values. This has a positive effect on the quantity of calcium which is deposited inside the boiler, reducing, as is well known, this calcareous formation with a reduction in the temperature.

The fact that the boiler 3 is inclined ensures, moreover, that there is always a little water in the inside thereof, thus avoiding non-economical interruptions in the generation of the steam flow. The same advantages are obviously obtained also with the alternative configuration shown in Figure 2, operation of which is entirely similar.

Obviously the invention thus conceived may be subject to numerous modifications and variations, all of which falling within the inventive scope which characterizes it.

Claims

1. Steam generator for irons or the like, comprising:

   - a water tank (2);
   - a boiler (3);
   - electric heating means (4) associated on the outside of the boiler (3,3');
   - a water supply pipe (5,5') which connects the tank (2) to the boiler (3) and which has inserted inside it a delivery pump (6) and a non-return valve (9);
   - a steam delivery pipe (7,7') which connects the boiler (3) to the user apparatus (8) and which has inserted inside it a controllable steam valve (10);

   characterized in that said heating means comprise at least one heating plate (18,18') associated in a close-fitting manner with a bottom (11,11') of the boiler (3), said bottom (11,11') having at least two portions, a lower portion (12,12') and an upper portion (13,13') arranged at different heights and both heated by the said heating plate (18,18').

2. Generator according to Claim 1, characterized in that said heating plate (18,18') extends substantially over the entire surface of the bottom (11,11').

3. Generator according to Claim 1, characterized in that said bottom (11) comprises an inclined zone (14).

4. Generator according to Claim 1, characterized in that said lower portion (12') is configured in the form of a substantially horizontal flat zone and said upper portion (13') is configured in the manner of a raised zone which is situated above said lower portion (12').

5. Generator according to the preceding claims, characterized in that said heating plate (18,18') is associated in a close-fitting manner with the bottom (11,11') by means of bolting with the application, in between, of a thermally conductive paste.

6. Generator according to the preceding claims, characterized in that said electric heating means (18,18') comprise a thermostatic switch (16)

arranged in the region of the said upper portion (13,13').

7. Generator according to Claim 6, characterized in that the boiler (3,3') has an opening (15) arranged substantially in the region of the said upper portion (13,13'), for connection to the water supply pipe (5).

8. Generator according to Claim 7, characterized in that said opening (15) is arranged and configured so that the water coming from the supply pipe (5,5') directly hits said upper portion (13,13').

9. Generator according to Claim 8, characterized in that said opening (15) is arranged substantially along the vertical of the thermostatic switch (16).

10. Generator according to Claim 1, characterized in that said electric heating means (4) associated on the outside of the boiler (3') comprise a single heating plate (18').

11. Generator according to the preceding claims, characterized in that the boiler (3) comprises a discharge stopper (23).

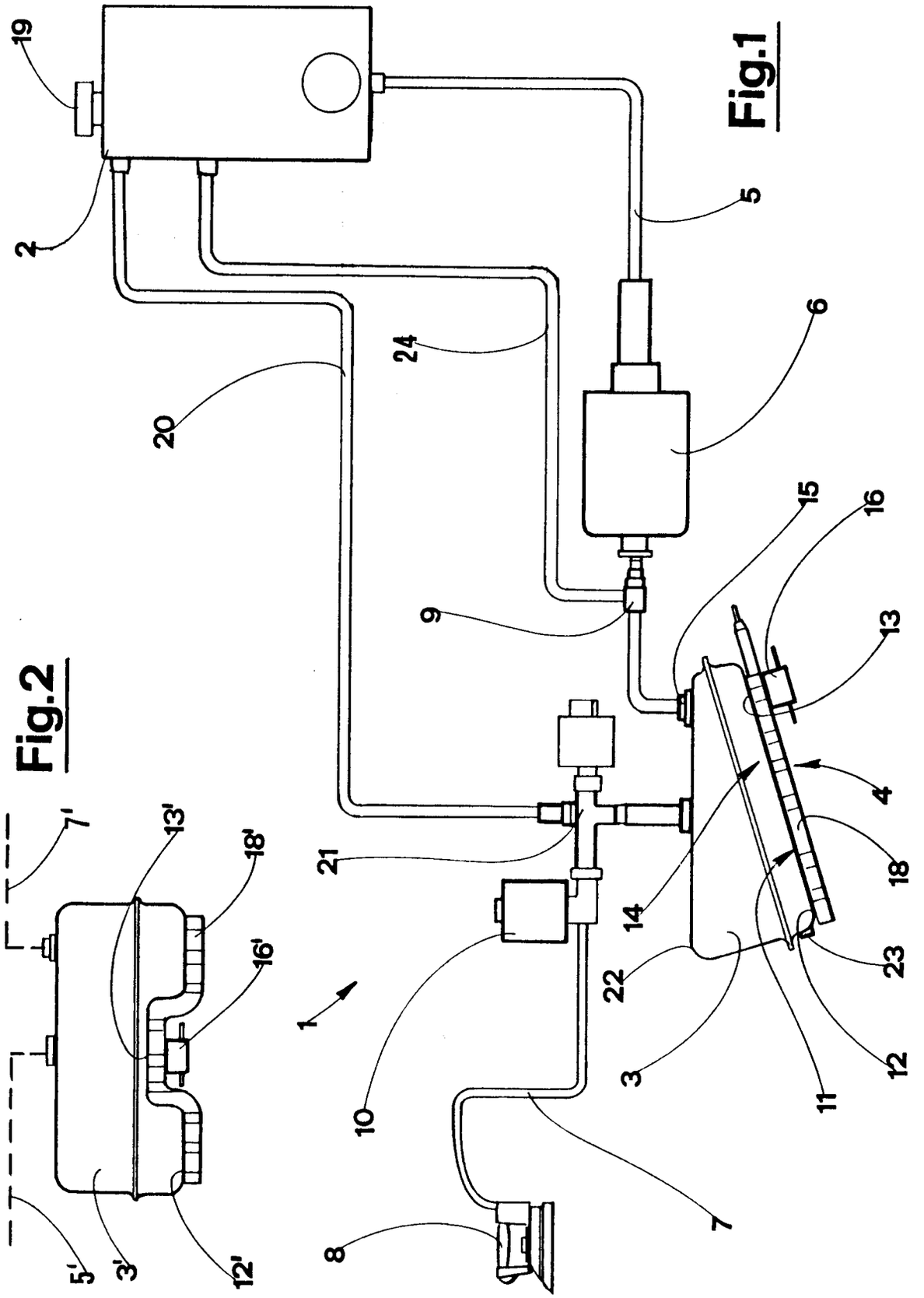

Fig.1

Fig.2

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 97 10 6361

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)
Y A	EP 0 638 684 A (MOULINEX S.A.) * the whole document * ---	1 2-4	D06F75/12 F22B1/28
Y A	FR 2 714 149 A (SEB S.A.) * claims; figures * ---	1 2,5,6,10	
Y	EP 0 438 112 A (METALNOVA DI DARIO PIETRO E MAURILIO & C. S.N.C.) * column 2, line 54 - column 4, line 14 * -----	1	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

D06F
F22B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	25 September 1997	Courrier, G

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
P : intermediate document

T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
L : document cited for other reasons

& : member of the same patent family, corresponding document

EPO FORM 1503 03.82 (P04C01)