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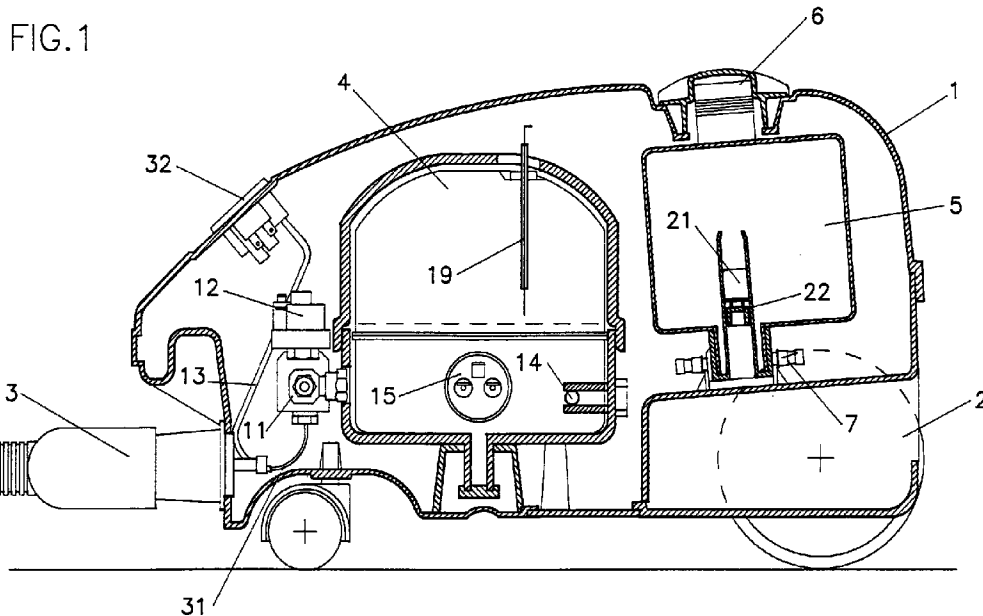
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(54) Steam generator for domestic use, in particular for cleaning tasks

(57) Steam generator for domestic use comprising:
a boiler (4) fitted with systems (15) designed to heat the water in the said boiler;
a tank (5) accessible from the exterior and separate from the said boiler;
a pump (8) designed to draw water from the said tank and introduce it into the said boiler;

a sensor (19) designed to detect reductions in the water level in the boiler;
a sensor (21) designed to detect a minimum level in the tank (5);
a control equipment (20) connected to the said sensors (19 and 21) for shutting down said pump when the water level in the tank falls below a set limit.



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Description

This invention relates to a steam generator for domestic use designed, for example, for cleaning tasks, in which the steam production boiler is separate from the water supply tank; the said generator is fitted with systems which constantly monitor the water level in the boiler and top it up continually during operation, drawing small amounts of water from the tank in order to keep the level approximately constant during use.

This eliminates the waiting time required by known appliances which must be allowed to cool when the boiler is empty before the fluid level can be topped up.

Because of its particular configuration, this appliance is far more practical and convenient to use than the current ones.

The appliance in accordance with the invention, which falls into the category of household cleaning appliances, is also much safer, because it is hardly ever necessary to open the boiler or operate parts which may be at a high temperature and pressure.

In the steam generators currently used, the boiler also constitutes the water storage tank.

This means it is necessary to fill the tank with enough water (usually 1-2 litres) to enable the appliance to operate for a reasonable period, switch the appliance on and wait for the water to reach the required temperature before the appliance can be used.

As work proceeds, the water level in the boiler of known appliances gradually falls, and when it is empty the appliance has to be switched off and left to cool before the water can be topped up.

This involves quite long waiting times, and means that the cap must be opened with some caution as there is always a degree of excess pressure in the boiler. The system also presents further drawbacks, such as the formation of a certain amount of condensation; when the boiler is opened, the condensation overflows and a little spills into the appliance.

Moreover, if the boiler is filled before it has properly cooled, there is a risk that the liquid will splash over into the appliance.

This type of appliance therefore requires some caution on the part of users, and consequently presents a degree of risk if used by inexperienced or imprudent persons.

For this reason, the need is felt in the industry for appliances which are practically risk-free and can be safely used even by persons with no experience whatever.

This problem is solved by the appliance in accordance with the invention, in which the tank is kept separate from the boiler and cold water is drawn from the tank and pumped into the boiler as the boiler fluid level falls.

The waiting time required by known appliances when the boiler needs to be filled is therefore eliminated, and above all, risks of all kinds are eliminated because the tank is always filled with fluid at ambient temperature, with no need to open the boiler to introduce fresh liquid. restores the original level immediately, with no need to

The invention will now be described in detail, by way of example but not of limitation, by reference to the annexed figures in which:

- 5 - figure 1 is a vertical cross-section of an appliance in accordance with the invention
- figure 2 is a plan view of the uncovered appliance.

In figure 1, no. 1 indicates the body of the appliance, 10 which is mounted on wheels 2 and fitted with a connector 3 for a steam outlet pipe.

Body 1 houses steam production boiler 4 connected to a tank 5, closed by a cap 6, which is accessible from the outside of the appliance.

15 The outlet of tank 5, on which a catalytic filter 7 is fitted, is connected to a pump 8 (fig. 2) which draws liquid from the bottom of the tank and introduces it into boiler 4 through an inlet 9.

20 Boiler outlet 10 leads to a solenoid valve 11 which opens and closes the connection between the boiler and a pipe 31, leading to the union of outlet 3.

A pressure switch 12, a connector 13 for a pressure gauge 32, and a flow rate regulation tap are fitted on the pipe which connects the boiler to the solenoid valve.

25 The water in the boiler is heated by a resistor 15, the power supply to which is controlled in a known manner by pressure switch 12 and a pair of thermostats 13 and 14.

30 Thermostat 13 detects the temperature in the boiler and acts as safety switch in the event of malfunction of pressure switch 12, while thermostat 14 detects the resistor temperature, and comes into operation if the resistor is powered while the boiler is empty.

35 As well as controlling power to resistor 15, the pressure switch also controls the switching on and off of a warning lamp on the casing of the appliance, not illustrated in the figure, which indicates when it is ready for use.

40 Pressure switch 12 also includes a safety valve which discharges water directly into tank 5 through a pipe not illustrated in the figure in the event of excess pressure.

The power circuit of resistor 15 also includes a diode 17, activated by a microswitch 30, which monitors and 45 limits the power supply to the resistor.

A sensor of known type which monitors the water level in the boiler is also fitted to boiler 4.

Sensor 19 is connected to an SCR diode 20 which powers the drive motor of pump 8.

50 When the water level falls below a pre-set minimum value, the SCR diode activates the motor of the pump, which draws a small amount of water from tank 5 through catalytic filter 7 and introduces it into the boiler.

55 As soon as the water level returns to its original value the SCR diode, driven by the signal supplied by probe 19, cuts off power to the motor of pump 8.

Thus whenever the water level in the boiler falls after steam is drawn off, the pump comes into operation and wait for the boiler to cool.

The fact that small amounts of water are introduced into the boiler as soon as the level tends to fall means that the temperature in the boiler can be maintained within a very narrow range, so that the appliance works more efficiently.

To prevent pump 8 from operating dry with the risk that it is damaged, the appliance is fitted with systems which warn when the water level in tank 5 is approaching the minimum and shut down the machine before the water runs out.

For this purpose, the tank contains a float 21 with a built-in magnetic element whose presence is sensed by a Hall probe fixed to the body of tank 5 and also connected to the SCR diode.

If the water level in tank 5 falls below a certain threshold, float 21 descends, approaching the Hall probe which generates a signal sent to the SCR diode; the SCR diode then cuts off power to the motor of pump 8 and solenoid valve 11.

The appliance operates as follows:

Assuming that the water in boiler 4 is already at the level set, the machine is switched on and powers electrical resistor 15 which heats the water until the required temperature is reached, when pressure switch 12 cuts off the power supply.

At the same time the pressure switch deactivates the warning light on the control panel, indicating that the appliance is ready for use.

In the event of malfunction of the pressure switch the thermostat comes into operation, though with less precision, to cut off power to resistor 15.

When the user draws off steam through the pipe connected to connector 3, the level in boiler 4 falls slightly, and this variation is detected by sensor 19 connected to the SCR diode.

The SCR diode then activates the motor of pump 8 which draws water from tank 5 through catalytic filter 7 and pumps it into boiler 4 until the original level is restored.

When the water in the boiler returns to the previous level, this situation is detected by sensor 19, and the SCR diode deactivates the motor of pump 8.

With this system, water is introduced into the boiler gradually as steam is used; the power developed by resistor 15 is sufficient to heat these small amounts of water quickly and to maintain the temperature, and therefore the pressure, in the boiler within a range which allows continuous use of the appliance.

In addition, when the steam is used in small amounts and the quantity of cold water introduced into the boiler is therefore minimal (e.g. when the appliance is connected to a steam iron), the appliance can be operated at low power by activating diode 17 which limits the amount of current sent to resistor 15.

When the water in tank 5 is about to run out, float 21 descends, bringing the magnet into contact with the Hall probe which generates a signal sent to the SCR diode; the SCR diode then inhibits the operation of solenoid

valve 11 and pump 8, preventing the use of the appliance to ensure that the pump does not operate dry.

The user can then add more liquid to tank 5 through cap 6, with no need to wait for the appliance to cool because tank 5 is always at ambient temperature.

The above description clearly indicates that the appliance in accordance with the invention is far more practical than known appliances, eliminating the time wasted because the machine has to be cooled before refilling, and eliminating all the risks associated with the use of an appliance containing parts at high temperatures.

Moreover, as the water level in the boiler is continually topped up, the boiler can contain a small amount of water (approx. 500-800 cc), which reduces the initial heating time.

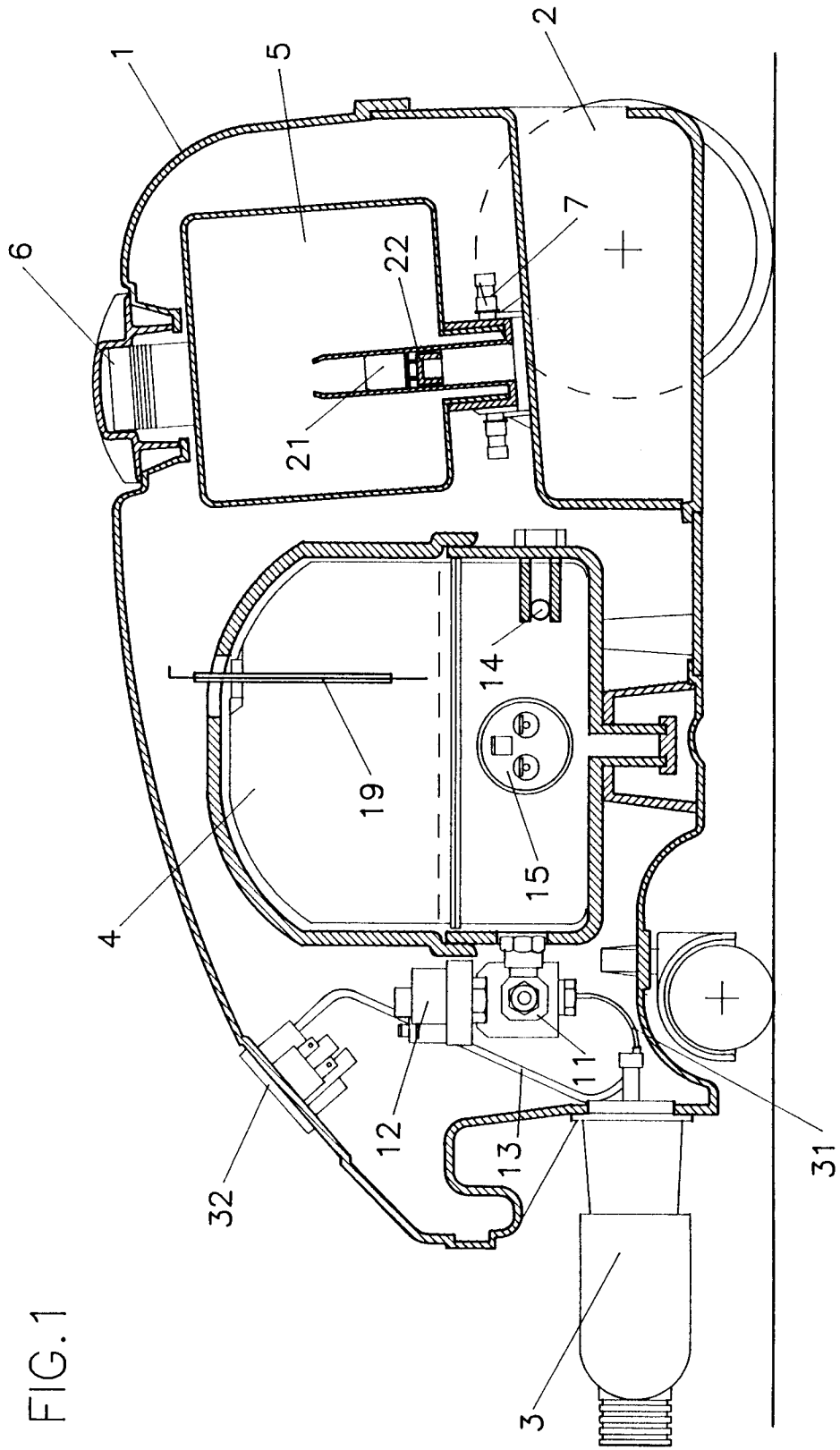
The steam generator in accordance with the invention could also be used to manufacture various appliances such as irons, sterilisers, humidifiers, dishwashers, inhalers, etc., while still remaining within the ambit of the invention.

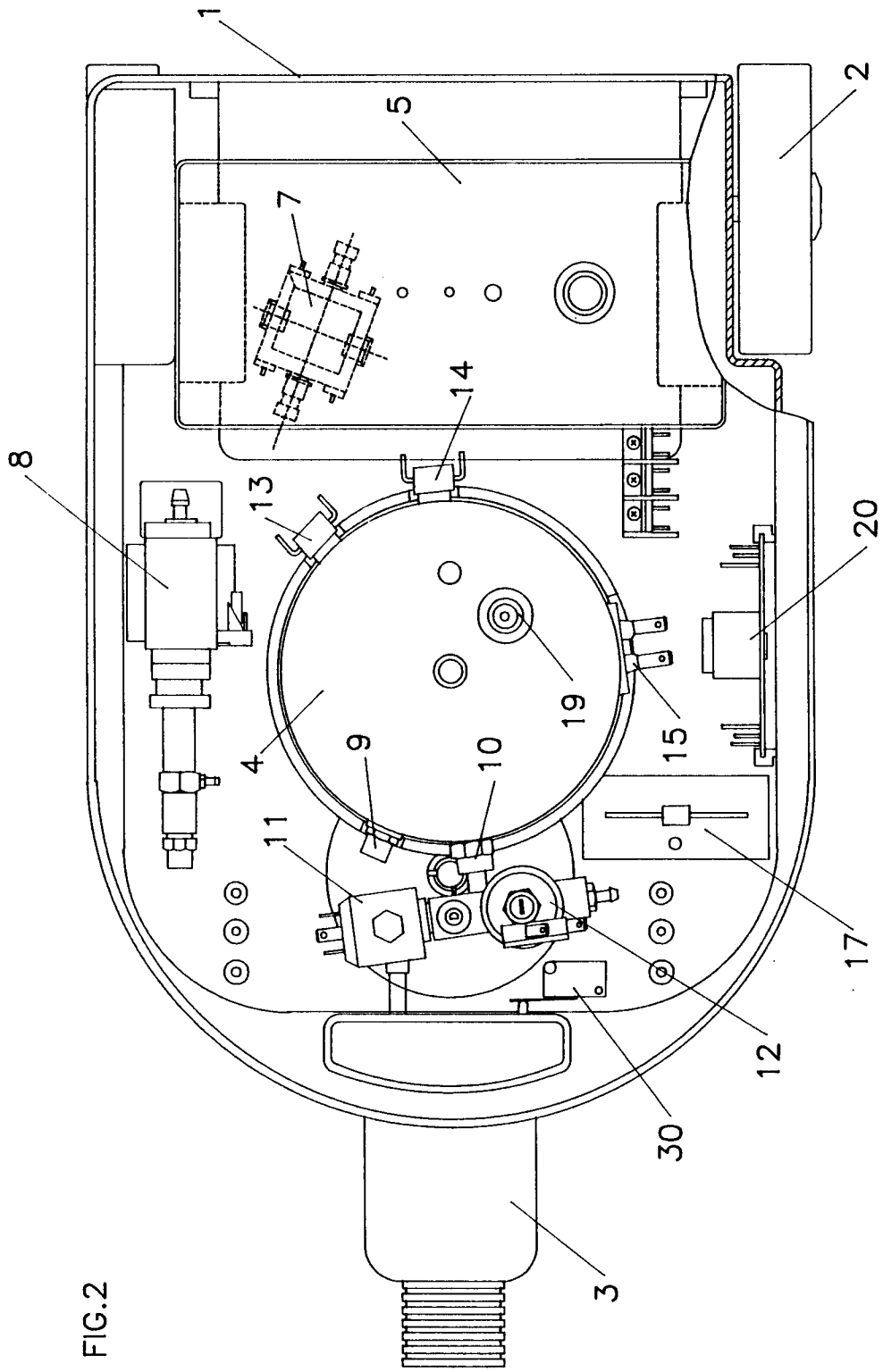
The dimensions and materials used can obviously be varied as required by the use to which the appliance is put.

Claims

1. Steam generator for domestic use, especially for cleaning tasks, characterised by the fact that the water tank is separate from the boiler, and that the said appliance is fitted with systems designed to top up the water level in the boiler by drawing water from the tank while the appliance is being used.
2. Appliance in accordance with claim 1, characterised by the fact that the said systems include a sensor able to detect reductions in the water level, the said sensor being connected to the control equipment of a pump located between the said tank and the said boiler.
3. Appliance in accordance with claim 1, characterised by the fact that it includes a pump 8 designed to draw water from a tank 5 and introduce it into a boiler 4, equipment 20 which controls the operation of the said pump, and a sensor 19 designed to detect reductions in the water level in the boiler, the said sensor 19 being connected to the said pump control equipment 20.
4. Appliance in accordance with claim 3, in which the said pump control equipment consists of an SCR diode.
5. Appliance in accordance with the preceding claims, characterised by the fact that it includes a pressure switch 12 designed to cut off the power to a boiler water heating resistor 15 when the required temperature is reached.

6. Appliance in accordance with claims 1 to 4, characterised by the fact that it includes systems designed to shut down the machine when the water level in the tank falls below a pre-set value, in order to prevent the pump from operating dry. 5
7. Appliance in accordance with claim 6, characterised by the fact that the said systems consist of a float 21 and a sensor 22 designed to detect the position of the said float, the said sensor being connected to the said pump control equipment 20. 10
8. Appliance in accordance with claim 7, in which the said float 21 is fitted with a magnetic element and the said sensor 22 is a Hall probe. 15
9. Appliance in accordance with claims 7 and 8, characterised by the fact that it includes systems designed to shut down the pump and the solenoid valve in response to a signal from the said sensor 22 when the level in tank 5 falls below a set limit. 20
10. Steam generator for domestic use comprising:
- a boiler 4 fitted with systems 15 designed to heat the water in the said boiler 25
 - a tank 5 accessible from the exterior and separate from the said boiler
 - a pump 8 designed to draw water from the said tank and introduce it into the said boiler 30
 - a sensor 9 designed to detect reductions in the water level in the boiler
 - pump control equipment 20 connected to the said sensor. 35
11. Appliance in accordance with claim 10, in which the said equipment 20 is constituted by an SCR diode.
12. Appliance in accordance with claims 10 and 11, characterised by the fact that it includes an electronic circuit which also controls the power to a steam drawing solenoid valve 11. 40
13. Appliance in accordance with claim 12, characterised by the fact that it includes equipment designed to detect reductions in the water level in the tank and send a signal to the said diode 20. 45
14. Appliance in accordance with claim 13, in which the said sensor is a Hall sensor. 50
15. Appliance in accordance with the preceding claims, characterised by the fact that it includes equipment designed to connect the boiler outlet with the cold water tank in the event of excess pressure in the said boiler. 55







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EUROPEAN SEARCH REPORT

Application Number
EP 95 10 4039

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)
X	EP-A-0 478 508 (SAMMARINESI) * column 2, line 48 - column 4, line 5; figures * ---	1-3,5-7, 9,10,12, 13	F22B1/28
X	US-A-2 627 015 (HACKMAN) * column 2, line 43 - column 3, line 25 * * column 5, line 45 - column 6, line 19; figures * ---	1-3,5,10	
A	US-A-5 216 288 (GREENE) * abstract; figures * ---	4,11	
A	DE-A-41 28 178 (DEUTSCHE AIRBUS) * abstract; figures * ---	8,14	
P,X	EP-A-0 638 767 (SATIBER) * column 3, line 22 - line 43 * * column 4, line 34 - column 5, line 12 * ---	1-3,5,10	
A	WO-A-89 03496 (TERMOZETA ELETTRODOMESTICI) ---		TECHNICAL FIELDS SEARCHED (Int.Cl.6)
A	FR-A-2 544 054 (CAVALLI) ---		F22B
A	US-A-4 948 947 (KANG) -----		
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 2 January 1996	Examiner Van Gheel, J
<p>CATEGORY OF CITED DOCUMENTS</p> <p>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</p> <p>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</p>			

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