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(54) **STEAM GENERATOR**

(57) The invention relates to a steam generator made from metal in the form of a evaporating chamber comprising a wall, which is heated to a temperature equal to or higher than the water steam point and is adjacent to a heat source, and at least one shaped element which is connected to said heated wall in such a way that together they form at least one cavity.

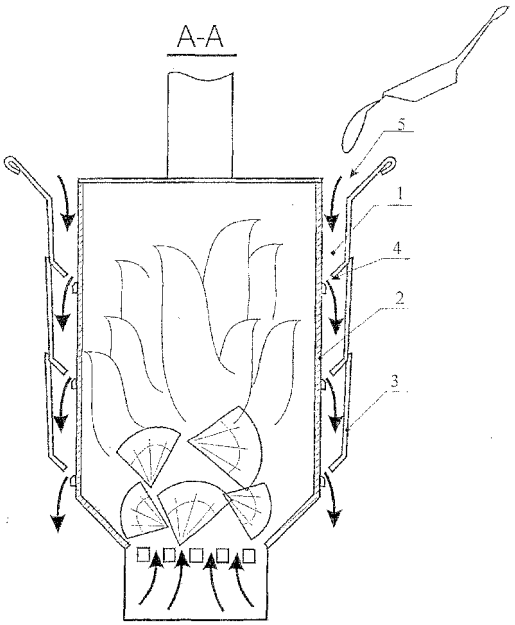

Fig.2

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Description

Field of the Invention

[0001] The invention relates to means for supplying steam to rooms of a different intended use, such as bath houses, green-houses, to mention only few.

Background art

[0002] In practice, widespread are steam generators in the form of a heat-retaining backfill, normally as stones, disposed in such a way as to provide heat directly from its source, a furnace, for example. Clean steam for steam procedures is generated by pouring hot water on the heat-retaining backfill. Thus, in a conventional Russian bath furnace called "kamenka", the heat-retaining backfill - stones - is placed directly on the level of a burner.

[0003] Known in the art is a steam generator for bath houses in the form of a heat-retraining backfill situated on the cover of a burner and also in special chambers provided at the side walls of the burner (RU 2087806), owing to which fact (a particular design of the steam generator) there can be generated greater volumes of steam, as compared to an ordinary "kamenka".

[0004] The same heat-retaining backfill in the form of stones is used in saunas.

For example, from EP 0343555 is known a steam generator in the form of a stone-filled open basket, with a heating appliance situated underneath and, depending on different operating conditions of a sauna, such as a dry sauna, a steam sauna or a bio-steam sauna, there is maintained a temperature to humidity relationship.

[0005] Heat-retaining filling steam generators have low efficiency because great amounts of heat are consumed for maintaining high stone temperature.

[0006] Known is a steam generator from DE 4132042, wherein the water is heated in a special tank, and steam is generated on a water surface. This method of steam generation likewise calls for greater amounts of heat utilization.

[0007] A more intensive heat generation is provided by steam generators made from metal. For example, from SU 10556 is known a bath steam generator which represents a water evaporation chamber made from metal, configured and designed as a box with a bottom slightly reclined toward water flow, and three portions of which an upper portion and a lower portion have a row of external lengthwise ribs for increasing a heating surface, and a mid-portion has a row of cross ribs to form a zigzag path-wary for passage of steam. The water is evaporated in the lower portion of the chamber and the steam is passed along the zigzag path-way formed within the chamber by the cross ribs.

[0008] The steam generator, as shown and described, has high specific quantity of metal and is complex in manufacture, because its ribs are made by casting, is inconvenient for use because of its position in a burner or chimney stack and has a low efficiency of steam generation because evaporation is effected from a water surface.

Disclosure of the Invention

[0009] An object of invention is to create a steam generator, having a simple design, a low price and a high efficiency of steam generation that is convenient is use.

[0010] Said object is accomplished owing to the fact that claimed is a steam generator for bath houses that is made from metal in the form of an evaporation chamber comprising a wall being heated to a temperature not lower than that of boiling water, which wall is adjacent to a heat source, and at least one shaped element connected to said heated wall in such a way as to form together at least one cavity.

[0011] For greater volumes of steam to be generated, an evaporation chamber can be comprised of several shaped elements, each one being connected with said heated wall to form a separate cavity and more than that said shaped elements are installed so that water from the preceding cavity is admitted to the subsequent cavity.

[0012] For the water of the preceding evaporation chamber cavity to enter the next one and for the excess of water not to be retained therein, the shaped elements of the evaporation chamber may have openings.

[0013] A shaped element may have any sectional shape. For example, it is desired to be made as an angle piece forming an angle between sides of not less than 90°. Such elements are installed one after another for an evaporator to be provided with few water evaporation cavities.

[0014] It is also possible to provide a multicavity shaped element having a sectional shape of successively repeating concave portions to form separate cavities which are communicated therebetween so that water from the preceding cavity enters to the subsequent cavity, with each cavity provided with openings for steam to escape. It can be produced from a metal sheet by stamping.

[0015] It is desirable to use stainless steel as metal for manufacturing an evaporation chamber, as being resistant to aggressive media and having high heat-transfer coefficient.

[0016] For water to be used effectively during steam generation without spilling, shaped elements are desired to be arranged in the horizontal plane or angularly to the horizontal.

[0017] An evaporation chamber can also be provided with one or two end walls which can be made as separate elements or an extension of the respective burner walls, in which particular case evaporation chambers have four defining walls, which results in an increase in the surface area of the evaporation chamber and in the increased temperature therein and ultimately - improved steam generation efficacy. It is also worth remembering that if all the junctions of the evaporation chamber walls and shaped elements are hermetically sealed there can

be produced overheated steam.

[0018] A heat source can be open flame produced in a furnace burner in consumption of fuel, say, firewood and also an electrical heater and other conventional means suitable for the purpose.

[0019] Fig. 1 and Fig. 2 show an alternative embodiment of a steam generator installed on the outside surface of the wall of a bath furnace burner which is likewise the heated wall of an evaporation chamber 2. The evaporation chamber comprises several shaped elements 3, shaped as horizontally installed angles whose one side is vertical and the other forms an acute angle of the wall being heated to form together several cavities situated one under another.

[0020] The shaped elements of an evaporation chamber are provided in the lower portion thereof with openings 4 to allow for water to overflow from its upper cavity to the lower cavities. The inlet to the evaporation chamber is an inlet to an upper open cavity 5.

[0021] This steam generator is operated in the following manner.

[0022] A furnace burner is pre-heated to a temperature not less than boiling water, preferably to higher temperatures, for example 300°C - this temperature is also shown by the heat source adjacent metal wall
of the burner. Inasmuch as shaped elements are also made of metal and join with said wall to be heated, by, say, welding and also due to an IR radiation, their temperature is likewise elevated to the desired level. Into the upper portion of a chamber I, from above into an upper open cavity thru the inlet 5 is supplied water mostly falling onto the heated wall 2 and partially - on the shaped element 3 and is evaporated, the steam thus produced is passed along the shaped element of the evaporation chamber, being further heated and admitted to a room afterwards. It will be recalled that steam can further be admitted to the room thru the existing slots if the evaporation chamber is nonhermetic. The excess of water not evaporated in the upper cavity of the evaporation chamber thru the openings 4 in the shaped element 3 of a first cavity along the path-way of water arrives in a second cavity situated below the first cavity of the evaporation chamber, wherein a portion of water is likewise evaporated and the steam so produced goes in the room. More, the remaining water enters a third cavity of the chamber along the pathway of water, wherein similar processes take place and steam is generated. If the water has not evaporated completely, it comes out of the evaporation chamber thru the openings in the bottom shaped element. Thus, steam generation occurs on all the surfaces of the evaporation chamber.

[0023] To prevent water from running out from the ends of the shaped elements 3, the end walls of an evaporation chamber can be installed (not shown). Varying a width of the shaped elements and a sectional shape thereof, a size, number and form of openings therein as well as an amount of water to be delivered to the evaporation chamber, there can be obtained different steam parameters - from wet to superheated. Superheated steam is produced particularly well in the evaporation chamber having the end walls, with all the seams of the chamber made hermetically sealed. In this case, the junctions of vertical walls of the shaped elements having a shape of an angle should also be made hermetically sealed. And there is formed a forward wall of the evaporation chamber, and a backward wall of the evaporation chamber is the heated wall 2 and the side walls of the evaporation chamber - said end walls. The interior volume of this evaporation chamber includes several communication cavities. Given this embodiment of the evaporation chamber, high temperature is maintained therein owing to which fact the water is vigorously evaporated therein and the steam is fast heated to rise thru the openings 4 upwards into a first cavity along the pathway of water to enter a room.

[0024] Figs. 3, 4 show an alternative embodiment of a steam generator installed on the outside surface of the burner wall of a bath furnace which is likewise a heated wall of the evaporation chamber 2. The evaporation chamber comprises the shaped element 3 having a sectional shape
of sequential repetitive concave sections forming individual cavities communicated therebetween such that the water of the preceding cavity is admitted to the subsequent cavity via connecting channels 7 thereof, each evaporator cavity being provided with openings for steam to escape 6.

[0025] To the upper open cavity of an evaporation chamber thru the inlet 5 is supplied water that falls on a heated metal to be evaporated in part and further enters the subsequent cavity via the channels 7, wherein it is likewise partially evaporated, and the water steam so produced comes out into a room thru the openings 6. Similarly the remaining water is admitted to the next in advance-direction cavity to partiality evaporate there and so on, and so forth.

[0026] Thus, the claimed steam generator has a simple construction, is simple in manufacture; shaped elements can, for example, be made be bending from sheet steel without complex casting operations, simply by welding, for example, it is mounted on the wall of a furnace or burner and calls for no airtightness in general cases. The low materials consumption of a steam generator contributes to its low cost. At the same time, the steam generator features a high effectiveness of steam generation, since water is placed in contact substantially with the entire surface of an evaporation chamber whose all elements have a temperature sufficient for intensive water evaporation. Besides, said steam generator is convenient in operation as
allowing for substantially all of the water delivered therein evaporating while the remaining matter flows out of its cavities without standing too long.

[0027] Furnaces equipped with such a steam generator can be manufactured with or without a place for a heat-retaining backfill (stones). They have lower time lag

vs. a conventional furnace provided with the heat-retaining backfill because the stones may not require to be heated. Practically the thinker the metal of a furnace construction, the faster is heating of the surfaces of an evaporation chamber and as is steam generation, and water evaporation from metal surfaces is more intensive due to higher heat conductivity. Likewise, the materials consumption and weight of the furnace are reduced appreciably. Given the hermetically sealed seams of the chamber, the steam generator permits producing overheated steam.

Brief Description of Figures in Drawings

[0028] Fig. 1 shows a steam generator (front view) having several elements shaped as angles that is installed on the lateral surface of a furnace burner in which a heat source is flame. Fig. 2 - view of a steam generator installed on the lateral surface of a furnace burner, A-A section, as shown in Fig. 1.

[0029] Fig. 3 - steam generator, front view, having one shaped element with concave sections, installed on the lateral surface of a furnace burner in which a heat source is flame. Fig. 4 -
steam generator installed on the lateral surface of a furnace burner, B-B section, as shown in Fig. 3.

[0030] Said Figures show:

1 - evaporation chamber;
2 - evaporation chamber heated wail;
3 - evaporation chamber shaped element;
4 - opening in a shaped element for communication of adjacent cavities;
5 - inlet to an evaporation chamber;
6 - opening in a shaped element for steam, to escape;
7 - channels connecting adjacent cavities.

Best Mode of Carrying out the Invention

[0031] A steam generator for baths is configured as an evaporation chamber I of stainless steel. A flat wall of a furnace burner 2 is located in a vertical plane near a heat source - flame such that it can be heated by hot gasses and IR radiation from the flame. On the outside surface of the burner wall are installed three shaped elements 3 by welding in a horizontal plane in the form of equal angles forming an angle of 120° between the sides to form three cavities with the burner wall. The shaped elements are arranged one under the other such that one side of each angle is vertical and the other forms an acute angle of the surface of the heated wall 2. The up-standing walls of the angles are
weldingly interconnected to define together the leading wall of a three-cavity-type evaporation chamber.

[0032] On each end face, an evaporation chamber is provided with side walls which are made as elements (extension) of the leading and trailing walls of a furnace burner.

[0033] The trailing wall of an evaporation chamber is the correspondingly heated wall of a furnace burner.

[0034] In a bottom part, the shaped elements - angles are provided with openings 4 to allow for water to move from the upper cavity of an evaporation chamber to lower cavities and steam - from a lower cavity to the upper ones.

[0035] The inlet to an evaporation chamber is an upper open cavity 5 formed by a top shaped element -- angle and the heated trailing wall of the evaporation chamber.

Industrial Applicability

[0036] The invention can be used in individual and collective bath houses, saunas, shower baths, stationary and mobile, for producing steam, wherein said steam is used for hygienic purposes, recreation, relaxation and health care as well as greenhouses and hothouses for the purpose of maintaining temperature and humidity as desired.

Claims

1. A steam generator made of metal, configured and designed as an evaporation chamber, **characterized in that** the evaporation chamber comprises a wall to be heated to a temperature not less than that of boiling water, which is adjacent to a heat source, and at least one shaped element connectable with said heated wall in such a way as to form together at least one cavity.

2. The steam, generator according to claim 1, **characterized in that** an evaporation chamber comprises several shaped elements, each one being connected with said heated wall to form a separate cavity, and said shaped elements are provided with openings and installed such that water from the preceding cavity is admitted to the next.

3. The steam generator according to claim 1 or 2, **characterized in that** a sectional element is shaped as an angle to form an angle of no less than 90° between sides.

4. The steam generator according to claim 1, **characterized in that** a shaped element is shaped in section as sequential repetitive concave sections to form separate cavities which are interconnected so that water is admitted from the preceding cavity to the subsequent one, each cavity having openings for steam to escape.

5. The steam generator according to claim 1, **characterized in that** a metal for making an evaporation chamber is stainless steel.

6. The steam generator according to claims 1, 2 or 4,

characterized in that a shaped element is in a horizontal position.

7. The steam generator according to claims 1, 2 or 4, **characterized in that** a shaped element forms an angle of the horizontal.

8. The steam generator according to claims 1, 2 or 4, **characterized in that** an evaporation chamber is provided with end walls.

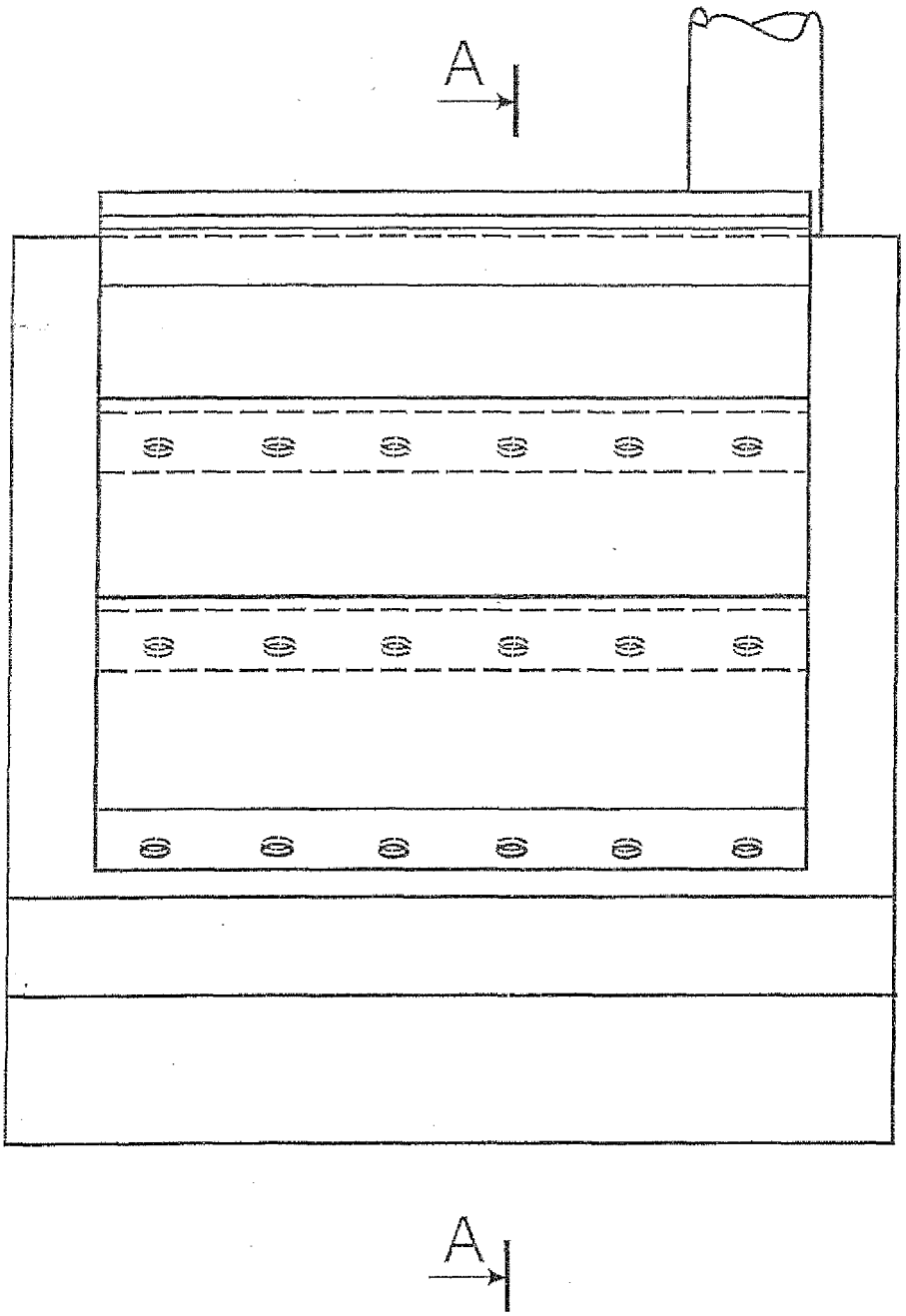

Fig.1

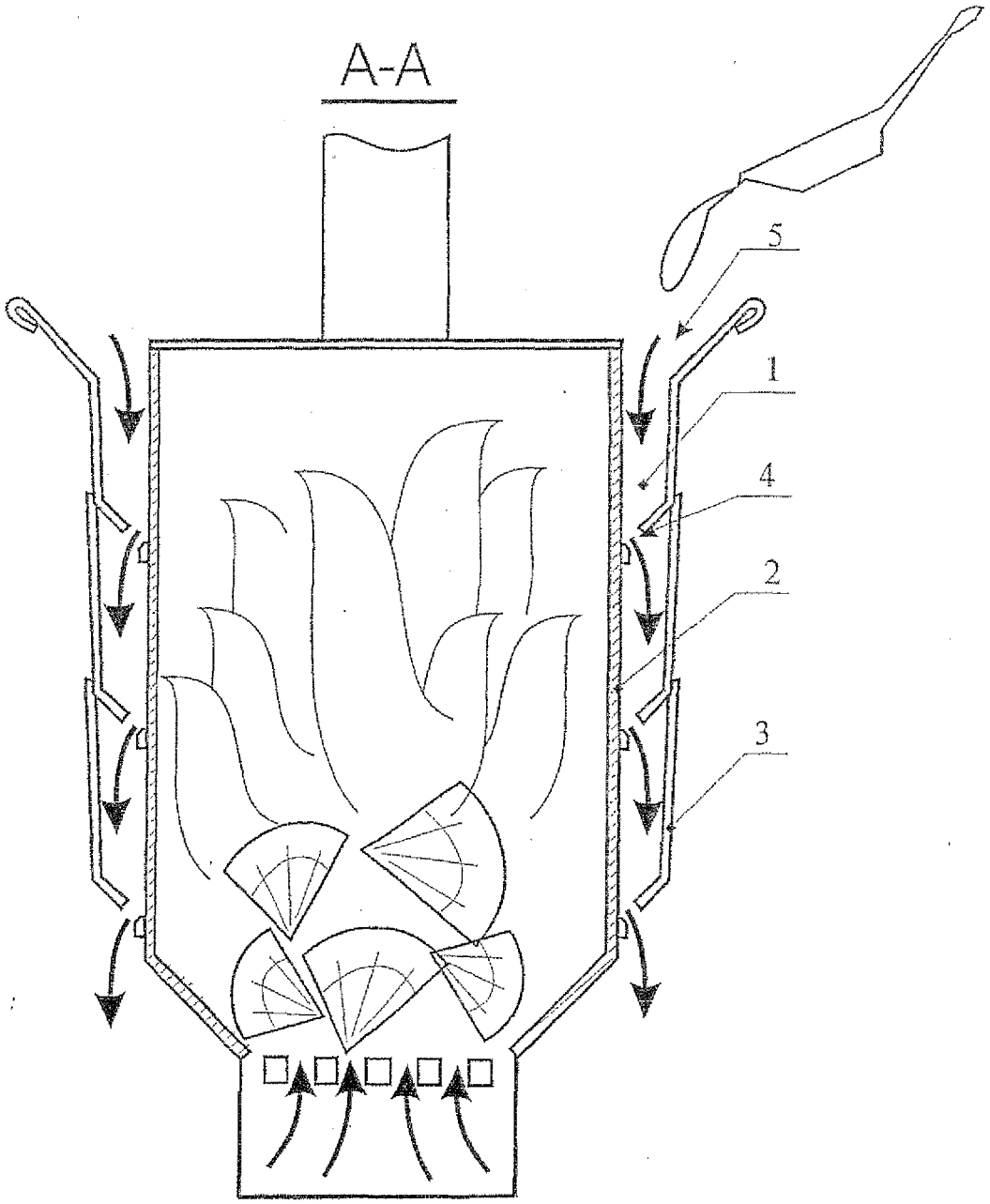

Fig.2

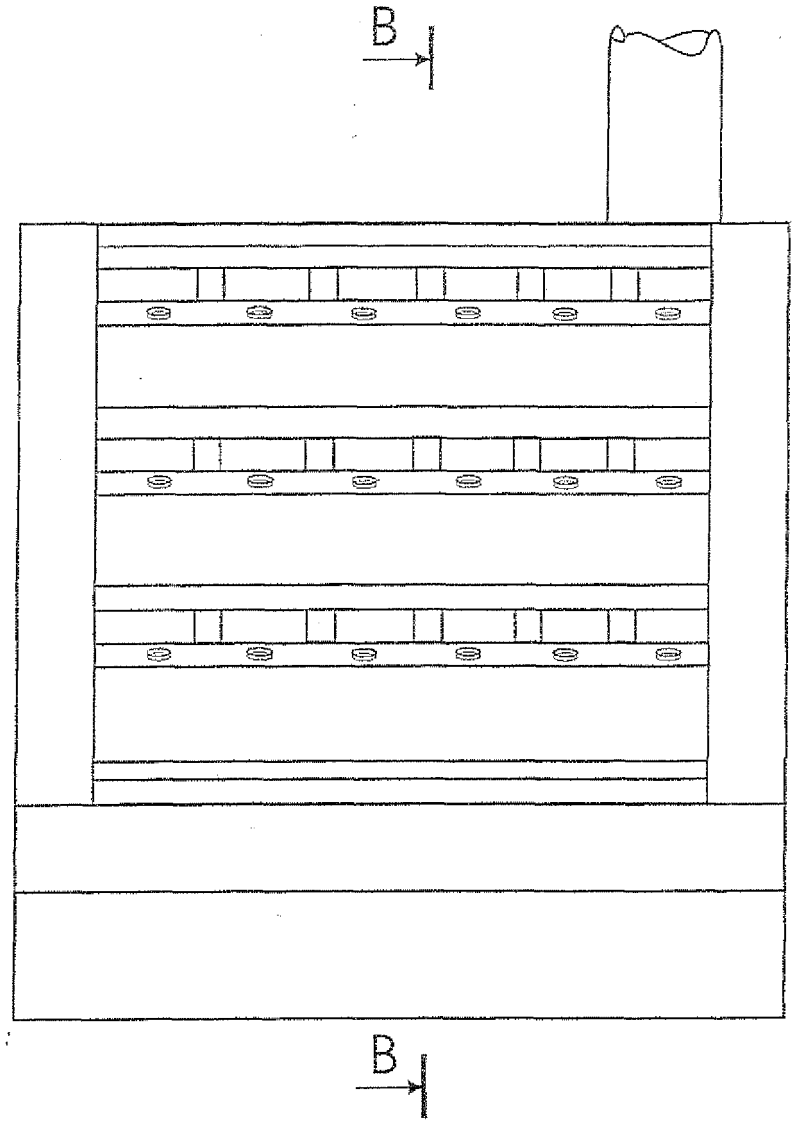

Fig.3

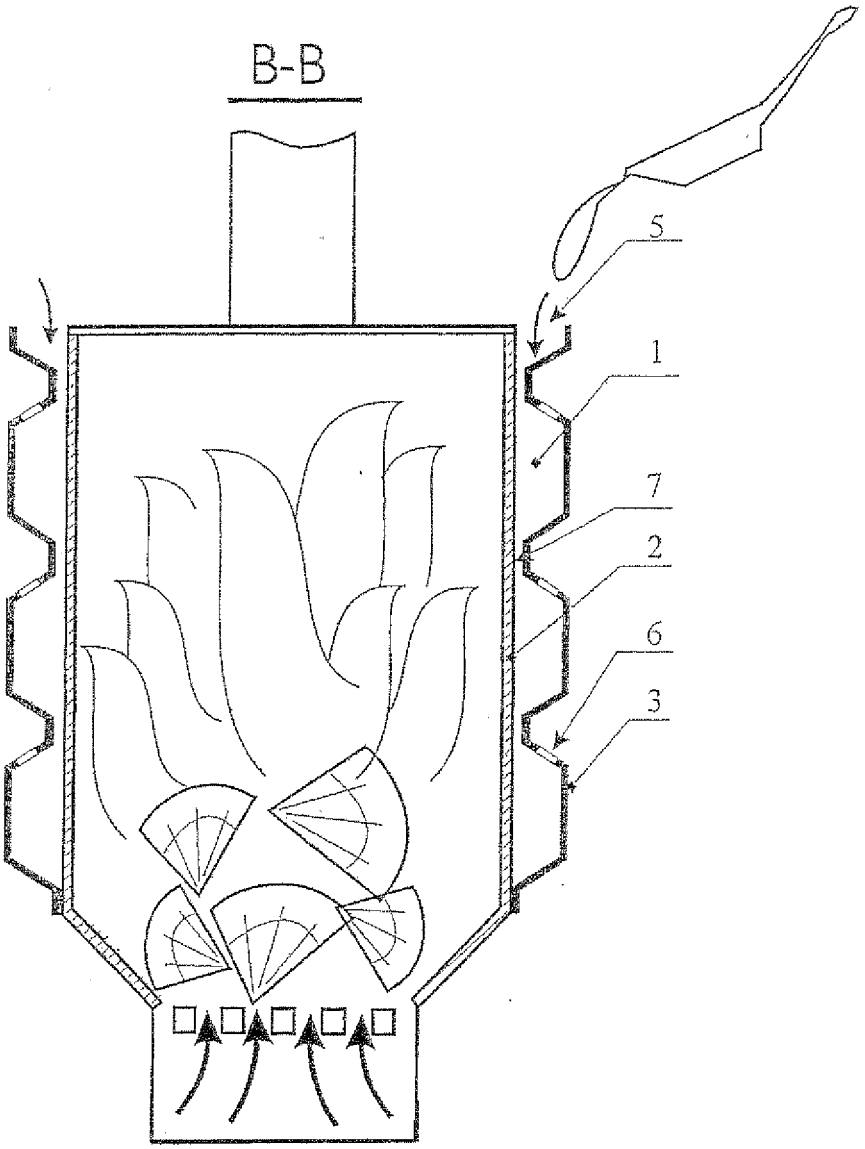

Fig.4

INTERNATIONAL SEARCH REPORT

International application No.
PCT/RU 2007/000249

A. CLASSIFICATION OF SUBJECT MATTER

F24C 13/00 *(2006.01)*
F24B 9/00 *(2006.01)*
A61H 33/06 *(2006.01)*

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)

A61 H 33/00, 33/06, F24B 9/00, F24C 13/00, F24B 1/00, 1/02, 1/18, 1/183, F24B 9/02

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)

RUPAT, RUPAT OLD, RUABRU, PatFT, PAJ, Esp@cenet, EPATIS, USPTO DB

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	RU 2005134410 A (LEVCHUK JU.S.) 20.05.2007, the claims	1-2, 4-8 3
Y	SU 10556 A (KRUMING E.I.) 31.07.1929, figure 1	3
A	GB 1077578 A (BAHCO AB) 02.08.1967	1-8
A	US 3557389 A (ROBERT SCOBEY) 26.01.1971	1-8
A	DE 3615194 A 1 (JANSON SVEN-OLOF) 06.1 1.1986	1-8

☐ 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
13 September 2007	22 November 2007
Name and mailing address of the ISA/ RU Facsimile No.	Authorized officer Telephone No.

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- RU 2087806 **[0003]**
- EP 0343555 A **[0004]**
- DE 4132042 **[0006]**
- SU 10556 **[0007]**