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(54) OVERHEAD COMBUSTION HEATER

(57) The invention relates to heat engineering, and more particularly to the design of water-heating boilers which are intended for outputting a heat transfer agent into a heating and hot water supply system. The heater has a housing in which a fuel combustion chamber is arranged, a grating, a tank for receiving a heat transfer agent and supplying same to a consumer, and a device for supplying and distributing air, which is in the form of a cone and a hollow disc having nozzle openings with interchangeable nozzles oriented at various angles in the fuel direction and towards the wall of the combustion chamber. The device for supplying air is in the form of a telescopic pipe. The air supply volume is controlled with the aid of a mechanical flap. Gases which form are completely combusted by the formation of a gap between the hollow disc and the walls of the combustion chamber. The apparatus is reliable in operation, environmentally safe and efficient.

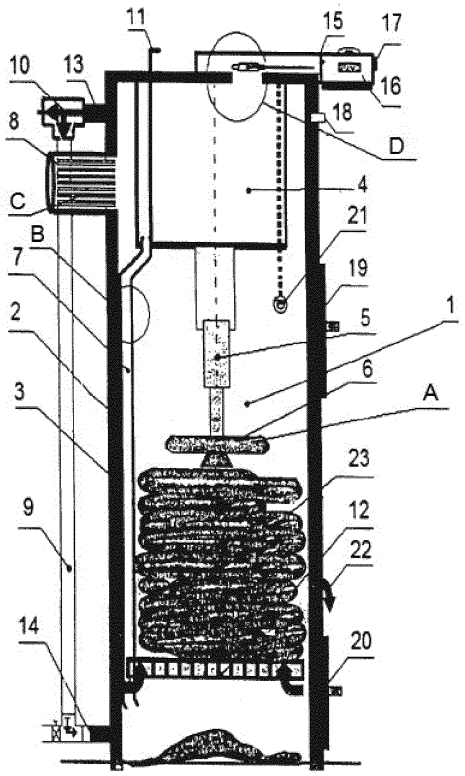

Fig. 1

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Description

[0001] The invention relates to a local heating system, in particular, to the construction of water heating boilers used for heating of buildings and hot water supply to consumers.

[0002] It is known a heater comprising a metal housing, a grating, a pipe for supply of secondary air capable of moving with respect to the grating surface. The side wall of the housing has an aperture equipped with an outer valve (copyright certificate No. 1048250, F23L9/02). A major shortcoming of the current design is low heat output of the heater due to its small dimensions, limited loading capacity and rapid fuel combustion. It requires frequent stoppages of the heater and disconnection of consumers from heating.

[0003] It is further known a heater for burning of granular solid fuel and heating of indoor air comprising a combustion chamber which centre is equipped with air feed pipes and a screw feeder. The air is fed to the combustion furnace from the above, and granular fuel is loaded from the bottom by means of a screw feeder (US4782765, F23N/00).

[0004] A disadvantage of such design of the heater is constant availability of power supply and consumption of energy, complexity of a duct design, unreliability of a screw feeder and the use of granular fuel only, which requires additional granulating press.

[0005] The closest prior art regarding the technical design and the result achieved is the heating unit of overhead combustion comprising a housing where a combustion chamber is incorporated, a grating, windows with sealable doors for fuel loading and ash removal, devices for air supply and its distribution in the combustion chamber (EA005303, 239P/02, 2004).

[0006] The disadvantage of this design is that the control of air supply is implemented by using of electronic sensors, what reduces the reliability of the design, as when in use, the heating unit emits untreated combustion products that pollute the environment.

[0007] The goal of the heater disclosed in the present invention is to reduce harmful emissions, increase the reliability of operating units of the heater without the use of power supply.

[0008] The goals and technical results are achieved by proposing the heater of overhead combustion incorporating a housing equipped with a combustion chamber, a grating, windows with sealable doors for fuel loading and ash removal, a cavity for heat-transfer agent and its output to the consumer, a device for air supply and its distribution within the combustion chamber, wherein the air distributor is connected by means of a telescopic pipe or metal bellow with the air heating chamber, said air is fed to the chamber by a pneumatic pump or natural traction of the chimney; the heating chamber is connected with a pipe the other end of which is installed beneath the grating; heat-transfer agent input lines and its output lines to consumers are equipped with three-way valves between which the pipe for recirculation of heat-transfer agent in its cavity is installed; the air distributor is designed as a conical tip with a hollow disc mounted over forming an annular gap between the disc and the inner walls of the combustion chamber; the walls of the disc have holes in the form of nozzles for uniform distribution of the consumable volume of air supplied through said telescopic pipe or metal bellow.

[0009] The heater is represented in the drawings, wherein:

- Fig. 1 shows a general view with a section along a vertical axis;
- Fig. 2 shows a part A - a air distributor of Fig. 1;
- Fig. 3 shows unit B of Fig. 1;
- Fig. 4 shows a part C - a replaceable catalytic cartridge of Fig. 1;
- Fig. 5 shows unit D of Fig. 1;
- Fig. 6 shows a unit E of Fig. 5;
- Fig. 7 shows a air supply control unit.

[0010] The overhead combustion heater, comprising a housing equipped with a combustion chamber, a grating, windows with sealable doors for fuel loading and ash removal, a gas outlet, a cavity for the heat-transfer agent with nipples for its input and output to consumers, a air supply unit and its distribution within a combustion chamber, wherein the air distributor is connected with the air heating chamber fed to said chamber, moreover the cavity of the air heating chamber is connected by a conduit with the underneath of the grating chamber, is characterized in that the nipples for input and output of heat-transfer agent are equipped with three-way temperature-dependent adjustable valves for the recirculation of heat-transfer agent inside the cavity; the air distributor is designed as a hollow truncated cone on an upper part of which is arranged a hollow disc with holes in the walls for changeable nozzles oriented at different angles towards the fuel and walls; the annular gap between the disc and the inner walls of the combustion chamber is in a range of 10-20% of cross-sectional area of the combustion chamber; the gas outlet has a replaceable cartridge for cleaning of gases formed during the combustion of fuel; the air supply volume to the heater is controlled with the aid of a mechanical flap, 30-40% of the supplied air is distributed through the air distributor and 60-70% through a conduit directed to the underneath the grating chamber.

[0011] The heater is also characterized in that the air distributor is connected to the heating chamber by means of metal bellow or a telescopic pipe.

[0012] The heater is further characterized in that the replaceable cartridge is equipped with a catalyst for the purification of flue gases.

[0013] The heater is yet further characterised in that the air supply unit comprises a control unit in a form of a mechanical lever with a rod and an adjusting screw interacting with a air flap.

[0014] The heater comprises a combustion chamber 1 in a form of a vertically oriented cylinder or polyhedron. The chamber 1 has a double wall, thus forming a cavity 2 for heat-transfer agent, and an outer wall 3 with thermal insulation shielded with a metal sheet. Inside the heater there is a air heating chamber 4 connected with a telescopic pipe or metal bellow 5 with a air distributor 6 fixed to its end. The chamber 4 is connected to the pipe 7 for air supply from the underneath. The upper part of the heater is equipped with a chimney having a replaceable catalytic cartridge 8, and the external part of the heater comprises the heat-transfer agent return pipe 9 which goes from the adjustable three-way valve 10. The chamber 4 of the heater is equipped with a flap 11 for switching the direction of air flow through the pipe 7. The lower part of the heater is equipped with a grating 12. The output of the heat-transfer agent from the heater is performed through a nipple 13, and the input of the heat-transfer agent to the heater is performed through a nipple 14. The heater is equipped with an electric air valve 15 by means of which is controlled the volume of air supplied to the heater. The air is fed by a pneumatic pump or fan 16 which is controlled by a thermostat sensor 17. The wall of the heater comprises an opening 18 with a thermometer incorporated therein. The heater has two openings in its wall with sealable doors 19 and 20 for fuel loading and for ash removal, respectively. The heater is equipped with a cable 21, a part of the cable is outside the housing, another end of the cable is connected to the telescopic pipe or metal bellow 6. The cable 21 is fixed to the wall of the heater by a hook 22. The heater is loaded with any type of fuel 23.

[0015] The air distributor 6 comprises a cone shaped tip 24 with the air supply channel 25, with the hollow metal disk 26 mounted over so as to obtain an open annular space in the form of an annular gap between the disc 26 and the inner wall of the combustion chamber 1. Said annular gap makes 20-30% of the cross sectional area of the chamber 1. The hollow disc 26 has openings 27 in the form of nozzles for distribution of the air: about 40% through the tip 24 and about 60% through the nozzles 27. The distributor 6 has support legs 28 for the placement onto the fuel 23 with some clearance. The housing of the replaceable catalytic cartridge 29 has a multichannel porous catalyst 30, the channels are made of metal or ceramic, arranged along the housing 29 and covered with the chemical composition acting as a catalyst, preferably Palladium or analogues, for the combustion products. A thermo-independent rod 32 is connected to a housing of the heater by means of a bolt 31 and is further connected from the underneath to a flat lever of the mechanical air flap 33, from the above the lever is pinned down by an adjusting screw 34 inserted into the support elbow 35.

[0016] Operation of the heater is implemented as follows. The fuel 23 is loaded into the chamber 1 through the door 19; a kindling material is placed on top and set on fire. A ring of a metal cable 21 is removed from the hook 22 and lifted up; as a result, the air distributor 6 goes down on the fuel 23. The door 19 is tightly closed. The fan 16 is turned on, and the air is fed through an electrical air valve 15 and mechanical air flap 33 to the heating chamber 4. From the heating chamber 4 the air is distributed into two flows: the upper and lower in the following proportions: 30 - 40% through the air distributor 6, and 60 - 70% through the pipe 7. The air heated in the chamber 4 goes down the telescopic pipe or metal bellow towards the distributor 6, providing the combustion area with oxygen from the above. The air distributor 6 descends on the telescopic pipe or metal bellow due to burning-out of the fuel 23, ensuring the combustion only in the upper area. The lower air flow, passing through the pipe 7 to the cavity of the chamber 1, becomes very hot and, getting under the grating 12, rushes up drying the fuel 23 on its way and providing a combustion area with oxygen. Thus, the efficiency is increased by 10-20%, the fuel is dried, heated and the power is not required. The output of the combustion products occurs through the chimney with a catalytic cartridge 8. The remnants of unburned substances of CO, CH, NO, passing through the channels of the catalyst 30, interact with its surface and oxidize, thus burning completely out. The heat thus produced contributes to further process of oxidation and purification of the products of combustion emitted during the operation of the heater, in this way improving the environmental safety of the heater. The heat-transfer agent supply nipple 13 is equipped with a temperature-controlled three-way valve 10, which serves to ensure rapid heating and stable operation of the heater. During the heating process of the heater, the valve 10 directs the flow of the heat-transfer agent through the recirculation pipe 9. Upon reaching the operating temperature of the heater, the valve 10 gradually starts forwarding the heated heat-transfer agent to the heating supply system, thus the heater operates stably and economically. Once the heater reaches the operating temperature, the thermostat disconnects the fan 17 and the electric air valve 15 closes the access of air into the cavity of the heater. In order to prevent the heater from overheating and possible breakdown due to of sudden power failure, the heater is equipped with a mechanical air flap 33. A metal housing of the heater expands when heated under the physical properties of the metal, a part of the heater located above the bolt 31 stretches upwards, and a thermo-independent rod 32 remains in the same position. The pressure from the rod 32 onto the lever of the mechanical air flap 33 weakens and the flap 33 descends, cutting off the air flow into the heater. The travel range of a lever of the mechanical flap 33 is regulated by a screw 34. In this way the heater can control the operating temperature without power supply, what significantly enhances its application and safety. The heating system operates stably, and in the event of the drop of heat-transfer agent temperature, the operation process of the heater is reactivated as described above.

Claims

1. Overhead combustion heater comprising a housing equipped with a combustion chamber, a grating, openings with sealable doors for fuel loading and ash removal, a gas outlet, a cavity for heat-transfer agent with inlet and outlet nipples to transfer a heat-transfer agent to a consumer, a device for air supply and its distribution in the combustion chamber, where the air distributor is connected to the air heating chamber to feed the air into the chamber, moreover the cavity of the air heating chamber is connected by a conduit with the underneath of the grating chamber, **characterized in that** the nipples (13, 14) for output and input of heat-transfer agent are equipped with three-way temperature-dependent adjustable valve (10) for the recirculation of the heat-transfer agent in the cavity (2); the air distributor (6) is designed as a hollow truncated cone (24) on an upper part of which is arranged a hollow disc (26) with holes in the walls for changeable nozzles (27) oriented at different angles towards the fuel (23) and the walls; the annular gap between the disc (26) and the inner wall of the combustion chamber (1) is in the range of 10-20% of cross-sectional area of the combustion chamber (1); the gas outlet has a replaceable cartridge (8) for cleaning of gases formed during the combustion of fuel; the volume of air supplied to the heater is controlled with the aid of a mechanical flap (33), 30-40% of the supplied air is distributed through the air distributor (6) and 60-70% through the conduit (7) directed to the underneath of the grating chamber.

2. The heater according to claim 1, **characterized in that** the air distributor (6) is connected to the air heating chamber (4) through a metal bellow or telescopic pipe (5).

3. The heater according to claim 1, **characterized in that** the replaceable cartridge (8) comprises a catalyst for the purification of flue gases.

4. The heater according to claim 1, **characterized in that** the air supply system comprises a control unit (D) designed as a mechanical lever with a rod (32) and an adjusting screw (34) interacting with the air flap (33).

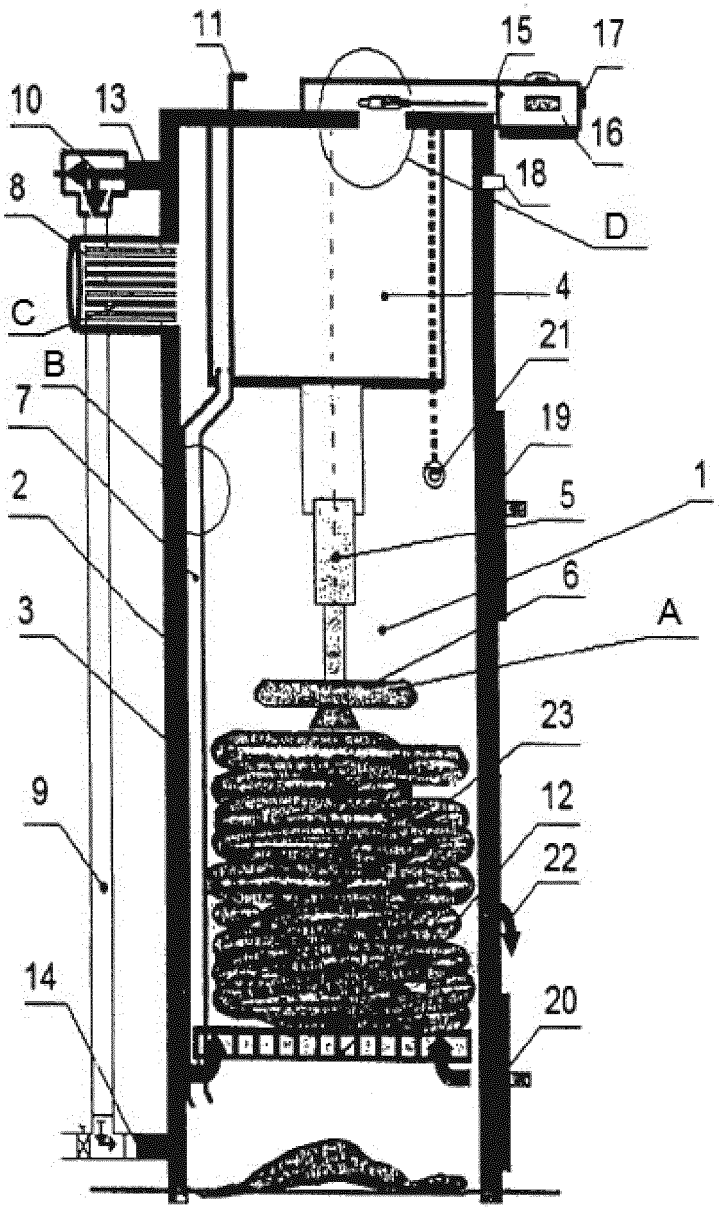

Fig. 1

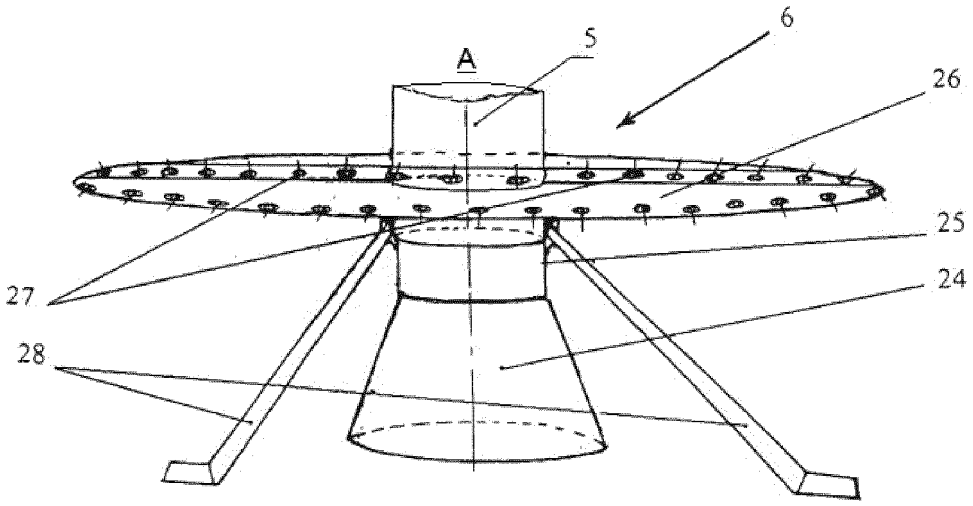

Fig. 2

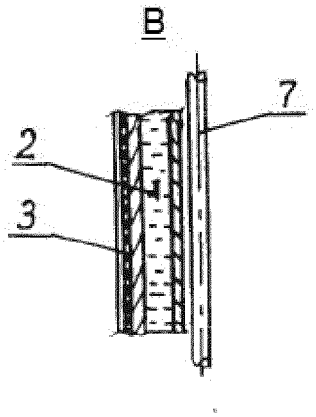

Fig. 3

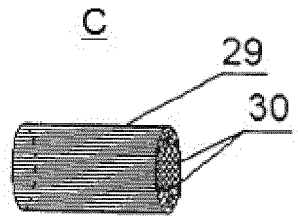

Fig. 4

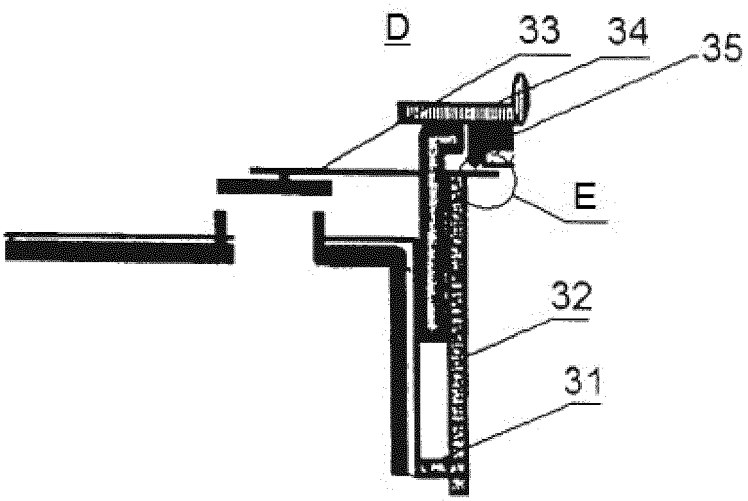

Fig. 5

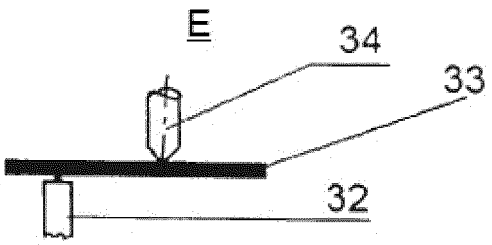

Fig. 6

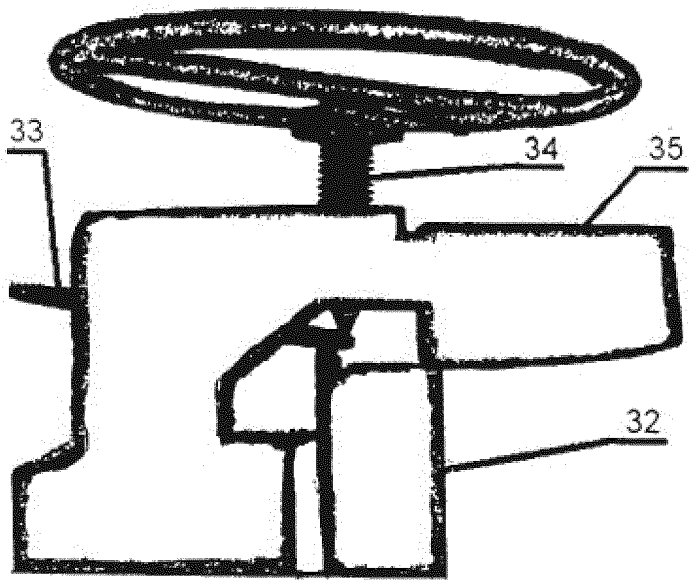

Fig. 7

INTERNATIONAL SEARCH REPORT

International application No.
PCT/RU 2014/000543

A. CLASSIFICATION OF SUBJECT MATTER

F24H1/00 (2006.01) F23L 1/00 (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)

F24H 1/00-1/52, F23L 1/00, 9/00-9/06, 13/00-13/10, F23B 101/00

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)

PatSearch (RUPTO internal), USPTO, PAJ, Esp@cenet, DWPI, EAPATIS, PATENTSCOPE, Information Retrieval System of FIPS

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO2002/086390 (STRUPAITIS EDMUND AS), 31.10.2002	1-4
A	RU 2459145 C1 (ILIODOROV VLADIMIR ALEKSANDROVICH), 20.08.2012	1-4
A	RU 121042 U1 (ZAKRYTOE AKTSIONERNOE OBSHCHESTVO «KALVIS»), 10.10.2012	1-4
A	US 4782765 A (MCC RESEARCH & DEVELOPMENT CORPORATION), 08.11.1988	1-4

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
11 November 2014 (11.11.2014)	13 November 2014 (13.11.2014)
Name and mailing address of the ISA/	Authorized officer
Facsimile No.	Telephone No.

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REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- US 4782765 A **[0003]**