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(54) Multifunctional heating device

(57) A heating device (14) for heating a space (31) comprises:

a burner (19);
a first heat exchanger (1) with a first passage (15) and a second passage (16), which first passage (15) is connectable to a feed (20) for outside air for supplying fresh outside air to the burner (19), and which second passage (16) is connectable to a feed (21) for return air from said space (31) for discharging the return air to a discharge (22) to the outside;
a second heat exchanger (2) with a first passage (17) and a second passage (18);

which first passage (17) connects with its inlet to the outlet of the first passage (15) of the first heat exchanger (1) and connects with its outlet to a discharge (23) for heated air to said space (31);
the outlet of which first passage (15) also connects to the burner (19) for supplying combustion air thereto;
the discharge (24) of which burner (19) connects to the inlet of the second passage (18);
the outlets of which second passages (16,18) jointly connect onto the discharge (22);

fan means (11,12) for maintaining at least the air flow through the burner (19);
and is characterized by
a bypass (24) connected between the feed (20) and the discharge (23) for direct through-feed of a flow of outside air to the discharge (23), in which bypass (24) is accommodated a valve (4) adjustable by central control means (33);

a valve (5) placed between the outlet of the first passage (15) and the inlet of the first passage (17) which is adjustable by the central control means (3).

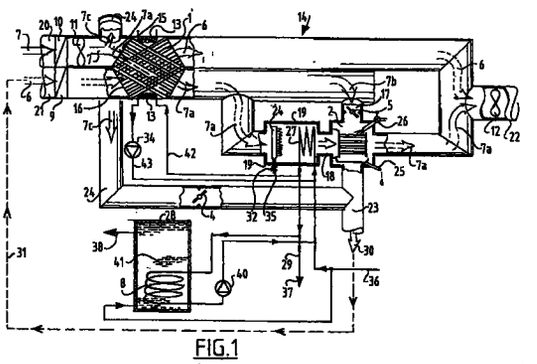

FIG.1

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Description

[0001] The invention relates to a heating device for heating a space, for instance a house, which device comprises:

a burner with a burner head;
a first heat exchanger of the gas-gas type with a first passage and a second passage thermally coupled thereto, which first passage is connectable to a feed for outside air for supplying fresh outside air to the burner, and which second passage is connectable to a feed for return air from said space for discharging said return air to a discharge to the outside;
a second heat exchanger of the gas-gas type with a first passage and a second passage thermally coupled thereto; and
which first passage connects with its inlet to the outlet of the first passage of the first heat exchanger and connects with its outlet to a discharge for heated air to said space;
the outlet of which first passage also connects to the burner for supplying combustion air thereto;
the discharge of which burner connects to the inlet of the second passage;
the outlets of which second passages jointly connect onto the discharge;
fan means for maintaining at least the air flow through the burner.

[0002] It is an object of the invention to embody a known heating device of this type such that it is capable of fulfilling a plurality of functions with simple means.

[0003] With a view to this objective, the heating device according to the invention is characterized by a bypass connected between the feed and discharge for direct through-feed of a flow of outside air to the discharge, in which bypass is accommodated a valve adjustable by central control means, and by a valve placed between the outlet of the first passage and the inlet of the first passage which is adjustable by the central control means.

[0004] The heating device according to the invention thus provides the option of admitting outside air directly into the relevant space via said bypass. This is particularly important if the outside air is cooler than the air present in the space. The space can then be cooled and ventilated directly by admitting the cool outside air. This operational mode can be set for instance at night. The central control means can be adapted to perform the switch-over in question automatically, depending on the relevant temperatures and the adjustment by an operating person.

[0005] A specific embodiment has the special feature that a condensation discharge connects onto the second heat exchanger. This option relates to the per se known high efficiency boilers.

[0006] As described above, selective opening and closing of the bypass provides the option of for instance cooling the space with relatively cool outside air. Alternatively or in combination therewith, the heating device can be embodied such that a feed for metered dispensing of water is added to the first passage of the second heat exchanger, which water can evaporate in the passing air flow and can thus cool this air flow. This embodiment has the further advantage that moisture is added to the passing air flow, which increases the relative humidity of the air in the relevant space.

[0007] A further variant has the special feature that a third heat exchanger through which water can flow is placed between the burner head and the second passage. The water flowing through this heat exchanger can be used for directly drawing off hot tap water or using hot water in other manner.

[0008] The heating device can further be embodied such that freezing up of the first heat exchanger at extremely low outside temperatures is prevented. In this respect the heating device can advantageously be embodied such that the third heat exchanger is connected to a fourth heat exchanger thermally coupled to the first heat exchanger for heating thereof.

[0009] As already discussed above, a third heat exchanger can be placed between the burner head and the second passage. This variant can be particularly embodied such that the third heat exchanger is connected to hot water provisions such as a hot water tank, optionally via a fifth heat exchanger, a hot tap water conduit or the like.

[0010] A preferably exchangeable filter can be arranged in the feed for outside air and/or the feed of return air to the device. The filter of the return air can be of importance in protecting the device against dust accumulations and the like. The filter for the fresh outside air can be important for similar reasons, particularly in the case where allowance must be made for somewhat contaminated air. Exchangeable filters are generally known and may for instance comprise replaceable porous structures which are readily removed and replaced.

[0011] A specific embodiment has the special feature that the fan means comprise a fan accommodated in the discharge. Because this fan is connected in suction arrangement to the device, a possible leakage in this device, particularly in the heat exchangers, cannot result in combustion gases from the heating device or contaminated air from the space being fed back to this space.

[0012] The device can further have the special feature that the fan means comprise a fan accommodated in the feed. For the reason described above it is recommended that, in the case of a combination of an inlet fan and an outlet fan, the outlet fan causes a suction which is stronger than the pressing action of the inlet ventilator. Also ensured in this case is that there is no danger of the described feedback of undesired gases to the

space.

[0013] A specific embodiment has the special feature that the central control means are adapted to adjust the valves in at least more or less mutually complementary manner. With such an adjustment and under the influence of the program control by the central control means an optimum balance can be found between the heating of the air supplied by the device to the space and the supply of fresh outside air to this space.

[0014] A further embodiment has the special feature that the central control means are also adapted to adjust the capacity of the burner by means of an adjustable valve and the central control means are also adapted and connected to adjust the valve subject also to said burner capacity.

[0015] In addition, the central control means can generally adjust said valves in mutual positions such that, taking into account the capacity of the burner, the attempted objectives of the central control means are simultaneously realized as well as possible.

[0016] The invention will now be elucidated with reference to the annexed drawings. Herein:

figure 1 shows a partly broken-away and highly schematic view of a device according to the invention; and
figure 2 shows a block diagram of the central control means.

[0017] The figures show a heating device 14 for heating a space which is indicated symbolically with the air flow 31. This space can be for instance a house. The device comprises a burner 19 with a burner head 24. This burner head is received in a housing. The device further comprises a first heat exchanger 1 of the gas-gas type with a first passage 15 and a second passage 16 thermally coupled thereto. The first passage 15 is connectable to a feed 20 for outside air for supplying fresh outside air 7a to burner 19. The second passage 16 is connectable to a feed 21 for return air 6 from said space 31 for discharging said return air 6 to a discharge 22 to the ambient. The device further comprises a second heat exchanger 2 of the gas type with a first passage 17 and a second passage 18 thermally coupled thereto. It is noted that both heat exchangers can be of any suitable type. It will be apparent that the second heat exchanger must be suitable for withstanding the very high temperatures of the hot combustion gases coming from burner 19. The first passage 17 connects with its inlet onto the outlet of the first passage 15 of the first heat exchanger 1 and connects with its outlet onto a discharge 23 for heated air 30 to the space 31. The outlet of the first passage 15 also connects onto burner 19 for supplying combustion air 7a to this burner 19. Discharge 24 of burner 19 connects onto the inlet of the second passage 18. The outlets of said second passages connect jointly onto discharge 22. Device 14 further comprises fan means 11, 12 for maintaining the air flow 7a through burner 19 and the air flow through space 31 which is designated symbolically in the drawing and forms the coupling between the flow of heated air 30 and the flow of return air 6.

[0018] The device according to the invention further comprises a bypass 24 connected between feed 20 and discharge 23 for direct through-feed of a flow 7c of outside air to discharge 23, in which bypass 24 is accommodated a valve 4 adjustable by central control means 33 (see figure 2) and a valve 5 placed between the outlet of the first passage 15 and the inlet of the first passage 17 and adjustable by central control means 33.

[0019] It is noted that for the sake of the transparency of figure 1 the central control means 33 are not shown. By way of example however, figure 2 clearly shows which components of figure 1 can be controlled by central control means 33.

[0020] In the shown embodiment a condensation discharge 25 connects onto the second heat exchanger 2.

[0021] In this embodiment the feed 26 for metered dispensing of water is added to the first passage 17 of the second heat exchanger 2, which water can evaporate in the passing air flow 7b and can thus cool and moisten this air flow 7b.

[0022] In the drawn embodiment the heating device 14 is further embodied such that a third heat exchanger 27 through which water can flow is placed between burner head 24 and the second passage 18. In this embodiment this heat exchanger can comprise a spirally wound copper tube which is provided for instance with pressed-on fins.

[0023] In order to prevent freezing of the first heat exchanger 1 at extremely low outside temperatures, the third heat exchanger 27 is connected in the drawn embodiment to a fourth heat exchanger 13 thermally coupled to the first heat exchanger 1 for heating thereof. The two said heat exchangers are mutually connected for this purpose with respectively a feed conduit 42 and a return conduit 43. A pump 34 is arranged in return conduit 43.

[0024] The third heat exchanger 27 is connected to hot water provisions. As shown, these hot water provisions comprise a hot water tank 28 in which is arranged a fifth heat exchanger 8. Hot water flows herethrough by means of a pump 40 to heat water 41 present in tank 28. Tank 28 is connected to the water main 36. The hot water discharge from tank 28 is designated with 38. The third heat exchanger 27 is further connected to a direct hot tap water conduit 29. The outlet thereof is designated with 37. The entry side of the third heat exchanger 27 is likewise connected to water main 36.

[0025] A filter is arranged in both feed 20 and feed 21. These filters are designated 10 and 9 respectively. The filters are of replaceable type.

[0026] A suction fan 12 is received in discharge 22, while a pressing fan 11 is placed in the feed 20 for outside air.

[0027] Central control means 33 are for instance

adapted to adjust valves 4 and 5 in at least more or less mutually complementary manner.

[0028] Central control means 33 are also adapted in this embodiment to adjust the capacity of burner 19 by means of an adjustable valve 32 which is accommodated in the conduit between gas connection 35 and burner head 34. Central control means 33 are also adapted and connected to adjust valve 5 subject also to said burner capacity.

[0029] Figure 2 shows by way of example which components in the device of figure 1 can be controlled by central control means 33, for instance a microprocessor. In this embodiment these components are the valves 4, 5, 32, fans 11, 12, pumps 34 and 40 and water feed 26. The multiple input 39 of the central control means can receive input signals from inter alia a control panel with which the user can adjust the device as required, a thermostat with temperature sensor, a time switch, an outdoor temperature sensor, external programming means, temperature sensors in the diverse air and water conduits, the water storage tank 28 and so on.

[0030] It will be apparent that the heating device according to the invention is a very high-quality device which combines a high degree of technical flexibility and multi-functionality with an essentially simple structure.

Claims

1. A heating device (14) for heating a space (31), for instance a house, which device comprises:

   a burner (19) with a burner head (24);
   a first heat exchanger (1) of the gas-gas type with a first passage (15) and a second passage (16) thermally coupled thereto, which first passage (15) is connectable to a feed (20) for outside air (7) for supplying fresh outside air (7a) to the burner (19), and which second passage (16) is connectable to a feed (21) for return air (6) from said space (31) for discharging said return air (6) to a discharge (22) to the outside;
   a second heat exchanger (2) of the gas-gas type with a first passage (17) and a second passage (18) thermally coupled thereto;
   which first passage (17) connects with its inlet to the outlet of the first passage (15) of the first heat exchanger (1) and connects with its outlet to a discharge (23) for heated air (30) to said space (31);
   the outlet of which first passage (15) also connects to the burner (15) for supplying combustion air (7a) thereto;
   the discharge (24) of which burner (19) connects to the inlet of the second passage (18);
   the outlets of which second passages (16 and 18) jointly connect onto the discharge (22); and
   fan means (11, 12) for maintaining at least the air flow (7a) through the burner (19);
   characterized by
   a bypass (24) connected between the feed (20) and the discharge (23) for direct through-feed of a flow (7c) of outside air to the discharge (23), in which bypass (24) is accommodated a valve (4) adjustable by central control means (33); and
   a valve (5) placed between the outlet of the first passage (15) and the inlet of the first passage (17) which is adjustable by the central control means (33).

2. Heating device as claimed in claim 1, wherein a condensation discharge (25) connects onto the second heat exchanger (2).

3. Heating device as claimed in claim 1, wherein a feed (26) for metered dispensing of water is added to the first passage (17) of the second heat exchanger (2), which water can evaporate in the passing air flow (7b) and can thus cool this air flow (7b).

4. Heating device as claimed in claim 1, wherein a third heat exchanger (27) through which water can flow is placed between the burner head (24) and the second passage (18).

5. Heating device as claimed in claim 4, wherein the third heat exchanger (27) is connected to a fourth heat exchanger (13) thermally coupled to the first heat exchanger (1) for heating thereof.

6. Heating device as claimed in claim 4, wherein the third heat exchanger (27) is connected to hot water provisions such as a hot water tank (28), optionally via a fifth heat exchanger (8), a hot tap water conduit (29) or the like.

7. Heating device as claimed in claim 1, comprising a filter (10) arranged in the feed (20).

8. Heating device as claimed in claim 1, comprising a filter (9) arranged in the feed (21).

9. Heating device as claimed in claim 1, wherein the fan means comprise a fan (12) accommodated in the discharge (22).

10. Heating device as claimed in claim 1, wherein the fan means comprise a fan (11) accommodated in the feed (20).

11. Heating device as claimed in claim 1, wherein the central control means (33) are adapted to adjust the valves (4 and 5) in at least more or less mutually complementary manner.

12. Heating device as claimed in claim 1, wherein the central control means (33) are also adapted to adjust the capacity of the burner (19) by means of an adjustable valve (32) and the central control means (33) are also adapted and connected to adjust the valve (5) subject also to said burner capacity.

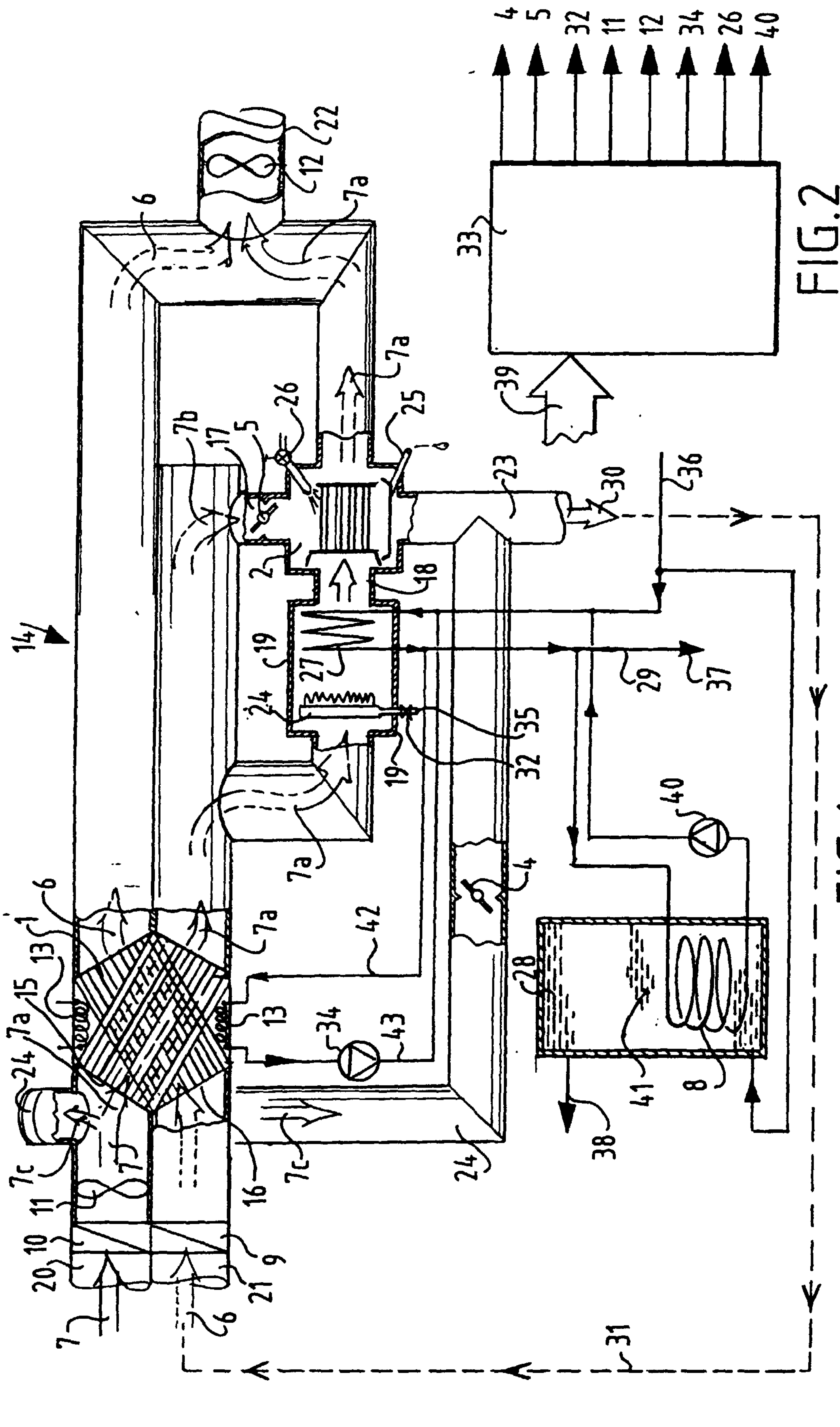
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FIG.2
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FIG.1

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EUROPEAN SEARCH REPORT

Application Number
EP 98 20 3420

DOCUMENTS CONSIDERED TO BE RELEVANT

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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	7 January 1999	Van Gestel, H

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