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(54) METHOD FOR OPERATING A GAS BURNER APPLIANCE

(57) A gas burner appliance (10) comprises a gas burner (11) for combusting a gas/air mixture. The gas burner appliance (10) further comprises a primary heat exchanger (13) for heating service water (14) by the combustion of said gas/air mixture, and a secondary heat exchanger (18) for heating domestic water (19) by the heated service water (14). In a first or winter operation mode the heated service water (14) is provided to a heating system (15) and/or to the secondary heat exchanger (18). In a second or summer operation mode the heated service water (14) is only provided to the secondary heat exchanger (18). During burner-on phases the gas/air mixture having a defined mixing ratio of gas and air is provided to the gas burner (11). During burner-on phases the defined mixing ratio of gas and air of the gas/air mixture can be controlled and/or calibrated on basis of a signal provided by an electrical or electronic sensor (25). In the second or summer operation mode the calibration of the defined mixing ratio of gas and air is initiated in such a way that a value being representative of a number of burner starts and/or of an operating time and a temperature being representative of the gas burner temperature are monitored. If the value being representative of the number of gas burner starts and/or of the operating time reaches or crosses a first threshold, and if further the temperature being representative of the gas burner temperature reaches or falls below or is below a second threshold, then the gas burner (11) is started without presence of a heat demand to calibrate the defined mixing ratio of gas and air of the gas/air mixture.

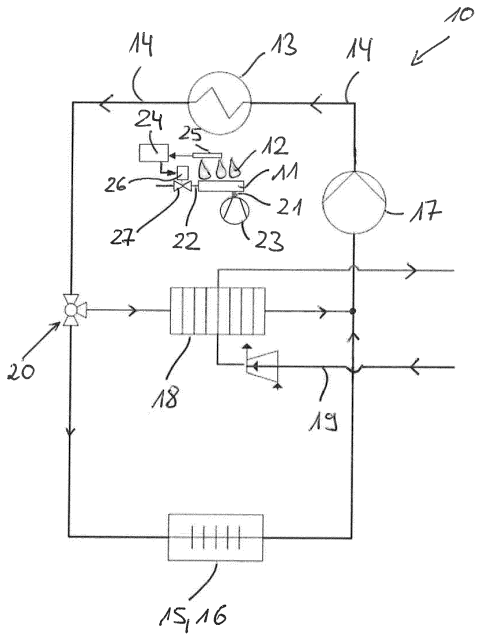

Fig. 1

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Description

[0001] The present application relates to a method for operating a gas burner appliance.

[0002] Figure 1 shows a schematic drawing of an exemplary embodiment of a gas burner appliance 10. The gas burner appliance 10 comprises a gas burner 11 for combusting a gas/air mixture. Figure 1 shows flames 12 resulting from the combustion of the gas/air mixture. The gas burner appliance 10 further comprises a primary heat exchanger 13 for heating service water 14 by the combustion of said gas/air mixture. The heated service water 14 can be provided to a heating system 15 having at least one radiator 16. A pump 17 circulates the service water 14. The gas burner appliance 10 further comprises a secondary heat exchanger 18 for heating domestic water 19 by the heated service water 14. The gas burner appliance 10 further comprises a valve 20.

[0003] In a first operation mode or winter operation mode of the gas burner appliance 10 the heated service water 14 is provided to the heating system 15 and/or to the secondary heat exchanger 18 depending on the position of the valve 20. If no heat demand for domestic hot water is present during the first operation mode or winter operation mode of the gas burner appliance 10, the heated service water 14 is only provided to the heating system 15 by switching the valve 20 to a first position. If a heat demand for domestic hot water is present during the first operation mode or winter operation mode of the gas burner appliance 10, the valve 20 is switched to a second position and the heated service water 14 is partially or completely provided to secondary heat exchanger 18.

[0004] In a second operation mode or summer operation mode of the gas burner appliance 10 the heated service water 14 is only provided to the secondary heat exchanger 18 to provide domestic hot water 19. In the second operation mode or summer operation mode there occurs no heat demand from the heating system. In the second or summer operation mode of the gas burner appliance 10 the gas burner 11 is usually only started if a heat demand for domestic hot water is present.

[0005] As mentioned above, a gas/air mixture is combusted by the gas burner 11. The gas/air mixture has a defined mixing ratio of gas and air. The gas/air mixture having the defined mixing ratio of gas and air is provided by mixing an air flow 21 with a gas flow 22. The quantity of the gas/air mixture provided to the gas burner 11 is adjusted by a fan 23. So, the modulation of the gas burner load is effected by controlling the speed of the fan 23. The defined mixing ratio of gas and air within the gas/air mixture is controlled by a controller 24 on basis of a signal provided by an electrical or electronic sensor 25. In Figure 1, the electrical or electronic sensor 25 is provided by a flame ionization sensor. The controller 24 generates a control variable for an actuator 26 of a gas valve 27 to control the defined mixing ratio of gas and air of the gas/air mixture based on the signal provided by the electrical or electronic sensor 25.

[0006] A gas burner appliance making use of a signal provided by an electrical or electronic sensor to control the mixing ratio of gas and air within the gas/air mixture is also called electronic gas/air-control gas burner appliance.

[0007] It should be noted that other electrical or electronic sensors can be used to establish an electronic gas/air-control. Example given, a signal of a pressure sensor or flow meter or a signal of a temperature sensor can be provided to the controller 24 in order to generate the control variable for controlling the defined mixing ratio of gas and air within the gas/air mixture.

[0008] EP 1 084 369 B1 and EP 1 179 159 B1 each disclose a method to control the mixing ratio of gas and air within the gas/air mixture on basis of a signal provided by an electrical or electronic pressure sensor or flow meter. An actual value corresponding to a pressure ratio between a gas pressure in a gas duct and an air pressure in an air duct or corresponding to a pressure ratio between the gas pressure in the gas duct and the air pressure at the reference point is provided by the electrical or electronic sensor, wherein this actual value is compared with a nominal value. A control variable for a gas valve assigned to the gas duct is generated on basis of the control deviation between the actual value and nominal value, wherein the gas valve is adjusted on basis of this control variable in order to control the defined mixing ratio of gas and air in the gas/air mixture.

[0009] Electronic gas/air-control gas burner appliances need to be calibrated example given to compensate different gas qualities to ensure an optimum and complete combustion of the gas. DE 10 2004 051 270 A1 discloses a method to calibrate an electronic gas/air-control gas burner appliance on basis a signal provided by a flame ionization sensor. DE 10 2008 031 979 A1 also discloses a calibration of the defined gas air mixing ratio of a gas/air mixture to compensate different gas qualities on basis of a signal provided by a flame ionization sensor.

[0010] In EP 1 084 369 B1 and EP 1 179 159 B1 the calibration can be effected on basis of the signal provided by the electrical or electronic pressure sensor or flow meter.

[0011] In the first operation mode or winter operation mode of the gas burner appliance the calibration of a gas burner appliance, namely the calibration of the mixing ratio of gas and air within the gas/air mixture to e.g. compensate different gas qualities, can be effected without any loss of comfort for the end user when the gas burner is running in order to provide hot service water for the heating system.

[0012] However, in the second operation mode or summer operation mode of the gas burner appliance the calibration of a gas burner appliance would result into a loss of comfort for the end user, because the calibration requires a burner start which would usually only occurs when a heat demand for domestic hot water is present. During the calibration of the gas burner appliance a modulation of the burner load is not allowed which would then

cause the loss of comfort for the end user.

[0013] Against this background, a novel method for operating a gas burner appliance is provided.

[0014] The method for operating a gas burner according to the present application is defined in the claim 1.

[0015] In the second operation mode or summer operation mode of the gas burner appliance the calibration of the defined mixing ratio of gas and air of the gas/air mixture is initiated in such a way that a value being representative of a number of starts and/or of an operating time of the gas burner and a temperature being representative of the temperature of the gas burner are monitored.

[0016] If the value being representative of the number of gas burner starts and/or of the operating time reaches or crosses a first threshold, and if further the temperature being representative of the gas burner temperature reaches or falls below or is below a second threshold, then the gas burner is started without presence of a heat demand to calibrate the defined mixing ratio of gas and air of the gas/air mixture.

[0017] The method according to the present application allows the calibration of a gas burner appliance without loss of comfort for the end user.

[0018] If the value being representative of the number of gas burner starts and/or of the operating time reaches or crosses a security threshold, and if no heat demand for domestic hot water is present, and if the temperature being representative of the gas burner temperature reaches or falls below or is below the second threshold, then the gas burner appliance is switched to the first or winter operation mode and thereafter the gas burner is started without presence of a heat demand for domestic hot water to calibrate the defined mixing ratio of gas and air of the gas/air mixture. This allows the calibration of a gas burner appliance without loss of comfort for the end user.

[0019] If the value being representative of the number of gas burner starts and/or of the operating time reaches or crosses the security threshold, and if a heat demand for domestic hot water is present, and if the temperature being representative of the gas burner temperature reaches or falls below or is below the second threshold, then the gas burner is started to calibrate the defined mixing ratio of gas and air of the gas/air mixture. However, if in this scenario the temperature being representative of the gas burner temperature is above the second threshold, then the gas burner start is delayed and the gas burner becomes started when the temperature being representative of the gas burner temperature reaches or falls below the second threshold. If the calibration has been started when a heat demand for domestic hot water is present, a modulation of the gas burner loads is delayed and allowed after the calibration is finished. This allows the calibration of a gas burner appliance with almost no loss of comfort for the end user.

[0020] The temperature being representative of the temperature of the gas burner is also monitored after the gas burner and the calibration have been started, wherein the gas burner is stopped either if the calibration is finished or if during calibration the temperature being representative of the gas burner temperature reaches or exceeds a third threshold. This avoids an overheating of the gas burner during calibration of the gas burner appliance.

[0021] Preferred developments of the invention are provided by the dependent claims and the description which follows. Exemplary embodiments are explained in more detail on the basis of the drawing, in which:

Figure 1 shows a schematic view of a gas burner appliance;

Figure 2 shows a schematic signal flow diagram illustrating the method according to present application.

[0022] As already explained above, Figure 1 shows a schematic drawing of an exemplary embodiment of a gas burner appliance 10.

[0023] The gas burner appliance 10 comprises a gas burner 11 for combusting a gas/air mixture. Figure 1 shows flames 12 resulting from the combustion of the gas/air mixture. The gas burner appliance 10 further comprises a primary heat exchanger 13 for heating service water 14 by the combustion of said gas/air mixture. The heated service water 14 can be provided to a heating system 15 having at least one radiator 16. A pump 17 circulates the service water 14.

[0024] The gas burner appliance 10 further comprises a secondary heat exchanger 18 for heating domestic water 19 by the heated service water 14. The gas burner appliance 10 further comprises a valve 20. The valve 20 is preferably a three-way valve.

[0025] The gas/air mixture provided to the gas burner 11 has a defined mixing ratio of gas and air. The gas/air mixture is provided by mixing an air flow 21 with a gas flow 22. The quantity of the gas/air mixture provided to the gas burner 11 is adjusted by a fan 23. So, the modulation of the gas burner load is effected by controlling the speed of the fan 23.

[0026] The defined mixing ratio of gas and air within the gas/air mixture provided to the gas burner 11 is controlled by a controller 24 on basis of a signal provided by an electrical or electronic sensor 25.

[0027] In Figure 1, the electrical or electronic sensor 25 is provided by a flame ionization sensor. The controller 24 generates a control variable for an actuator 26 of a gas valve 27 to control the defined mixing ratio of gas and air of the gas/air mixture based on the signal provided by the electrical or electronic sensor 25.

[0028] The gas burner appliance 10 can be operated in a first operation mode, also often called winter operation mode, or in a second operation mode, also often called summer operation mode. Usually, an end user chooses the operation manually by pressing a button on the controller 24.

[0029] In the first operation mode or winter operation mode of the gas burner appliance 10 the heated service water 14 is provided to the heating system 15 and/or to the secondary heat exchanger 18 depending on the position of the valve 20. In the first operation mode or winter operation mode of the gas burner appliance 10 there is usually a heat demand from the heating system 15 present causing that the gas burner 11 is started and running.

[0030] If no heat demand for domestic hot water is present during the first operation mode or winter operation mode of the gas burner appliance 10, the heated service water 14 is only provided to the heating system 15 by automatically switching the valve 20 to a first position.

[0031] If a heat demand for domestic hot water is present during the first operation mode or winter operation mode of the gas burner appliance 10, the valve 20 is automatically switched to a second position and the heated service water 14 is partially or completely provided to secondary heat exchanger 18.

[0032] In the second operation mode or summer operation mode of the gas burner appliance 10 the heated service water 14 is only provided to the secondary heat exchanger 18 to provide domestic hot water 19. In the second operation mode or summer operation mode of the gas burner appliance 10 the valve 20 is switched to a position in which the heated service water 14 is completely provided to secondary heat exchanger 18. In the second operation mode or summer operation mode there occurs no heat demand from the heating system 15. In the second operation mode or summer operation mode of the gas burner appliance 10 the gas burner 11 is usually only started if a demand for domestic hot water is present.

[0033] The present application relates to a method to calibrate the defined mixing ratio of gas and air of the gas/air mixture in the second operation mode or summer operation mode of the gas burner appliance 10, namely when the end user has chosen the second operation mode or summer operation mode and when no heat demand from the heating system 15 occurs.

[0034] For the calibration of the defined mixing ratio of gas and air of the gas/air mixture in the second operation mode or summer operation mode of the gas burner appliance 10 a value being representative of the number of starts of the gas burner 11 and/or being representative of the operating time of the gas burner 11 is monitored, and further a temperature being representative of the temperature of the gas burner 11 is monitored.

[0035] If the value being representative of the number of gas burner starts and/or being representative of the operating time of the gas burner 11 reaches or crosses a first threshold, and if further the temperature being representative of the gas burner temperature reaches or falls below or is below a second threshold, then the gas burner 11 is started for the calibration without presence of a heat demand for domestic hot water to calibrate the defined mixing ratio of gas and air of the gas/air mixture to compensate example given different gas qualities. This allows the calibration of a gas burner appliance 10 when the second operation mode or summer operation mode of the same has been chosen without loss of comfort for the end user.

[0036] Further details of the invention will be described under reference to the flow diagram 100 of Figure 2.

[0037] Preferably, a value being representative of a number of starts of the gas burner 11 is monitored. This can be accomplished by monitoring a value of a down counter which reduces the counter value by 1 with each burner start. It is also possible to monitor a value being representative of the operating time of the gas burner 11. In the following description making reference to Figure 2 it is assumed that a value being representative of a number of starts of the gas burner 11 is monitored.

[0038] Block 101 of Figure 2 illustrates that the value of the down counter is compared with a first threshold, In block 102 of Figure 3 the value of the down counter is compared with a security threshold being smaller than the first threshold.

[0039] If the value being representative of the number of gas burner starts reaches or crosses, namely falls below the first threshold (block 101 Y - YES), and if the value being representative of the number of gas burner starts does not reach the security threshold (block 102 N - NO), then in block 103 the temperature being representative of the gas burner temperature is compared with the second threshold.

[0040] If the temperature being representative of the gas burner temperature reaches or falls below or is below a second threshold (block 103 Y - YES), then for calibration the pump 17 is automatically started in block 104 and the gas burner 11 is automatically started in block 105 without presence of a heat demand for domestic hot water. A calibration routine becomes automatically executed. Calibration routines as such are known to the person skilled in the art.

[0041] After the gas burner 11 and calibration routine have been started and during the calibration routine is executed, the temperature being representative of the gas burner temperature is still monitored. In block 106 it is checked if the temperature being representative of the gas burner temperature reaches or exceeds a third threshold or if the temperature being representative of the gas burner temperature does not reach or exceed the third threshold.

[0042] If the temperature being representative of the gas burner temperature does not reach or exceed the third threshold (block 106 Y - YES) and if the calibration is in block 107 determined to be finished (block 107 Y - YES), then the gas burner 11, namely the combustion of the gas/air mixture by the gas burner 11, is stopped in block 108.

[0043] If the temperature being representative of the gas burner temperature reaches or exceeds the third threshold (block 106 N - NO), then then the gas burner

11, namely the combustion of the gas/air mixture by the gas burner 11, is also stopped in block 108.

[0044] If in block 107 the calibration is determined to be not finished (block 107 N - NO), the calibration is continued by turning back to block 106.

[0045] The gas burner appliance 10 may be operated in a comfort mode during the second operation mode or summer operation mode. Such a comfort mode keeps the secondary heat exchanger 18 at a defined temperature so that domestic hot water can be provided in a short time frame after a heat demand for domestic hot water occurs. If the gas burner appliance 10 can be operated in such a comfort mode, the comfort mode is automatically switched off in optional block 109 before block 103 is executed.

[0046] If the value being representative of the number of gas burner starts reaches or crosses, namely falls below the first threshold (block 101 Y - YES), and if the value being representative of the number of gas burner starts reaches or crosses the security threshold (block 102 Y - YES), then in block 110 the presence of a heat demand for domestic hot water is checked. If the gas burner appliance 10 can be operated in a comfort mode, the comfort mode is automatically switched off in optional block 109 before block 110 is executed.

[0047] In no heat demand for domestic hot water is present (block 110 N - NO), then in block 103 the temperature being representative of the gas burner temperature is compared with the second threshold.

[0048] If the temperature being representative of the gas burner temperature reaches or falls below or is below a second threshold (block 103 Y - YES), then the gas burner appliance 10 is switched in block 111 automatically to the first operation mode or winter operation mode by switching the valve 20 to the first position, and afterwards blocks 104, 105, 106, 107 and 108 are executed as described above.

[0049] The switching of the gas burner appliance 10 to the first operation mode or winter operation mode while no heat demand for domestic hot water is present is allowed only for a limited number of times, preferably only once. So, the blocks framed by dashed lines in Figure 1 will therefore be executed only for the limited number of times, preferably only once.

[0050] If the value being representative of the number of gas burner starts reaches or crosses, namely falls below the first threshold (block 101 Y - YES), and if the value being representative of the number of gas burner starts reaches or crosses the security threshold (block 102 Y - YES), and if no heat demand for domestic hot water is present is (block 110 N - NO), and if the limited number of times is reached, then is it assumed a heat demand would be present and block 110 is continued with the path Y-YES.

[0051] Is a heat demand for domestic hot water is present or assumed to be present (block 110 Y - YES), then in block 103 the temperature being representative of the gas burner temperature is compared with the second threshold.

[0052] If the temperature being representative of the gas burner temperature reaches or falls below or is below a second threshold (block 103 Y - YES), then the pump 17 is automatically started in block 104 and the gas burner 11 and calibration is automatically started in block 105.

[0053] If the temperature being representative of the gas burner temperature is above the second threshold (block 103 N - NO) while a heat demand for domestic hot water is present or assumed to be present (block 110 Y - YES), then the pump 17 is automatically started in block 104 and the start of gas burner 11 in block 105 is delayed until it is detected in block 103a that the temperature being representative of the gas burner temperature reaches or falls below the second threshold.

[0054] After the gas burner 11 and calibration 11 have been started in block 105 than blocks 112, 113 become executed.

[0055] In block 112 (corresponding to block 106) it is checked if the temperature being representative of the gas burner temperature reaches or exceeds a third threshold or if the temperature being representative of the gas burner temperature does not reach or exceed the third threshold.

[0056] In block 113 (corresponding to block 107) it is checked in the calibration is finished.

[0057] If it is detected that the temperature being representative of the gas burner temperature does not reach or exceed the third threshold (block 112 Y - YES) and if it is further detected that the calibration is finished (block 113 Y - YES), then in block 114 the modulation of the gas burner load is allowed to provide domestic hot water according to the corresponding heat demand.

[0058] If it is detected that the temperature being representative of the gas burner temperature reaches or exceeds the third threshold (block 112 N - NO), then the gas burner appliance 10 is switched in block 111 automatically to the first operation mode or winter operation mode by switching the valve 20 to the first position, and afterwards blocks 112a and 113a are executed as described above. Block 112a corresponds to block 112 and block 113a corresponds to block 113.

[0059] After the calibration is finished (block 113a Y - YES), then in block 115 the gas burner appliance 10 is switched back in block 115 automatically to the second operation mode or summer operation mode by switching the valve 20, and afterwards in block 114 the modulation of the gas burner load is allowed to provide domestic hot water according to the corresponding heat demand.

[0060] If it is detected that the temperature being representative of the gas burner temperature reaches or exceeds the third threshold (block 112a N - NO), then the gas burner 11 is stopped in block 108.

List of reference signs

[0061]

10 gas burner appliance
11 gas burner
12 flame
13 primary heat exchanger
14 service water
15 heating system
16 radiator
17 pump
18 secondary heat exchanger
19 domestic water
20 valve
21 air flow
22 gas flow
23 fan
24 controller
25 ionization sensor
26 actuator
27 gas valve

100 flow diagram
101 block
102 block
103 block
103a block
104 block
105 block
106 block
107 block
108 block
109 block
110 block
112 block
112a block
113 block
113a Block
114 block
115 block

Claims

1. Method for operating a gas burner appliance (10), wherein

said gas burner appliance (10) comprises a gas burner (11) for combusting a gas/air mixture,
said gas burner appliance (10) further comprises a primary heat exchanger (13) for heating service water (14) by the combustion of said gas/air mixture, and a secondary heat exchanger (18) for heating domestic water (19) using the heated service water (14),

wherein in a first operation mode or winter operation mode of the gas burner appliance (10) the heated service water (14) is provided to a heating system (15) and/or to the secondary heat exchanger (18),

wherein in a second operation mode or summer operation mode of the gas burner appliance (10) the heated service water (14) is only provided to the secondary heat exchanger (18), during burner-on phases caused by a heat demand of the gas burner (11) the gas/air mixture having a defined mixing ratio of gas and air is provided to the gas burner (11),

during burner-on phases caused by a heat demand of the gas burner (11) the defined mixing ratio of gas and air of the gas/air mixture can be controlled and/or calibrated on basis of a signal provided by an electrical or electronic sensor (25),
characterized in that
in the second operation mode or summer operation mode of the gas burner appliance (10) the calibration of the defined mixing ratio of gas and air of the gas/air mixture is initiated in such a way that

a value being representative of a number of starts and/or of an operating time of the gas burner (11) is monitored,
a temperature being representative of the temperature of the gas burner (11) is monitored,
if the value being representative of the number of gas burner starts and/or of the operating time reaches or crosses a first threshold, and
if further the temperature being representative of the gas burner temperature reaches or falls below or is below a second threshold,
then the gas burner (11) is started without presence of a heat demand to calibrate the defined mixing ratio of gas and air of the gas/air mixture.

2. Method according to claim 1, **characterized in that**

if the value being representative of the number of gas burner starts and/or of the operating time reaches or crosses a security threshold, and
if no heat demand is present, and
if the temperature being representative of the gas burner temperature reaches or falls below or is below the second threshold,
then the gas burner appliance (10) is switched to the first or winter operation mode and thereafter the gas burner (11) is started without presence of a heat demand to calibrate the defined mixing ratio of gas and air of the gas/air mixture.

3. Method according to claim 2, **characterized in that**

the switching of the gas burner appliance (10) to the first operation mode or winter operation mode while no heat demand is present is allowed only for a limited number of times, preferably only once.

4. Method according to one of claims 1 to 3, **characterized in that**

if the value being representative of the number of gas burner starts and/or of the operating time reaches or crosses a security threshold, and
if a heat demand is present, and
if the temperature being representative of the gas burner temperature reaches or falls below or is below the second threshold,
then the gas burner (11) is started to calibrate the defined mixing ratio of gas and air of the gas/air mixture.

5. Method according to one of claims 1 to 4, **characterized in that**

if the value being representative of the number of gas burner starts and/or of the operating time reaches or crosses a security threshold, and
if a heat demand is present, and
if the temperature being representative of the gas burner temperature is above the second threshold,
then the gas burner start is delayed and the gas burner (11) becomes started when the temperature being representative of the gas burner temperature reaches or falls below the second threshold.

6. Method according to one of claims 1 to 5, **characterized in that** the temperature being representative of the temperature of the gas burner (11) is also monitored after the gas burner and the calibration have been started, wherein the gas burner (11) is stopped either if the calibration is finished or if during calibration the temperature being representative of the gas burner temperature reaches or exceeds a third threshold.

7. Method according to claim 6, **characterized in that**

if the calibration has been started when a heat demand is present, and
if during calibration the temperature being representative of the gas burner temperature reaches or exceeds a third threshold,
then the gas burner appliance (10) is switched to the first operation mode or winter operation mode, the calibration is continued and the temperature being representative of the temperature of the gas burner (11) is monitored, wherein the gas burner (11) is stopped either if the calibration is finished or if the temperature being representative of the gas burner temperature remains above the third threshold.

8. Method according to one of claims 4 to 7, **characterized in that** if the gas burner and the calibration have been started when a heat demand is present and if the gas burner appliance (10) has been switched to the first operation mode or winter operation mode for calibration, then the gas burner appliance (10) is switched back to the second operation mode or summer operation mode before modulating of the gas burner load.

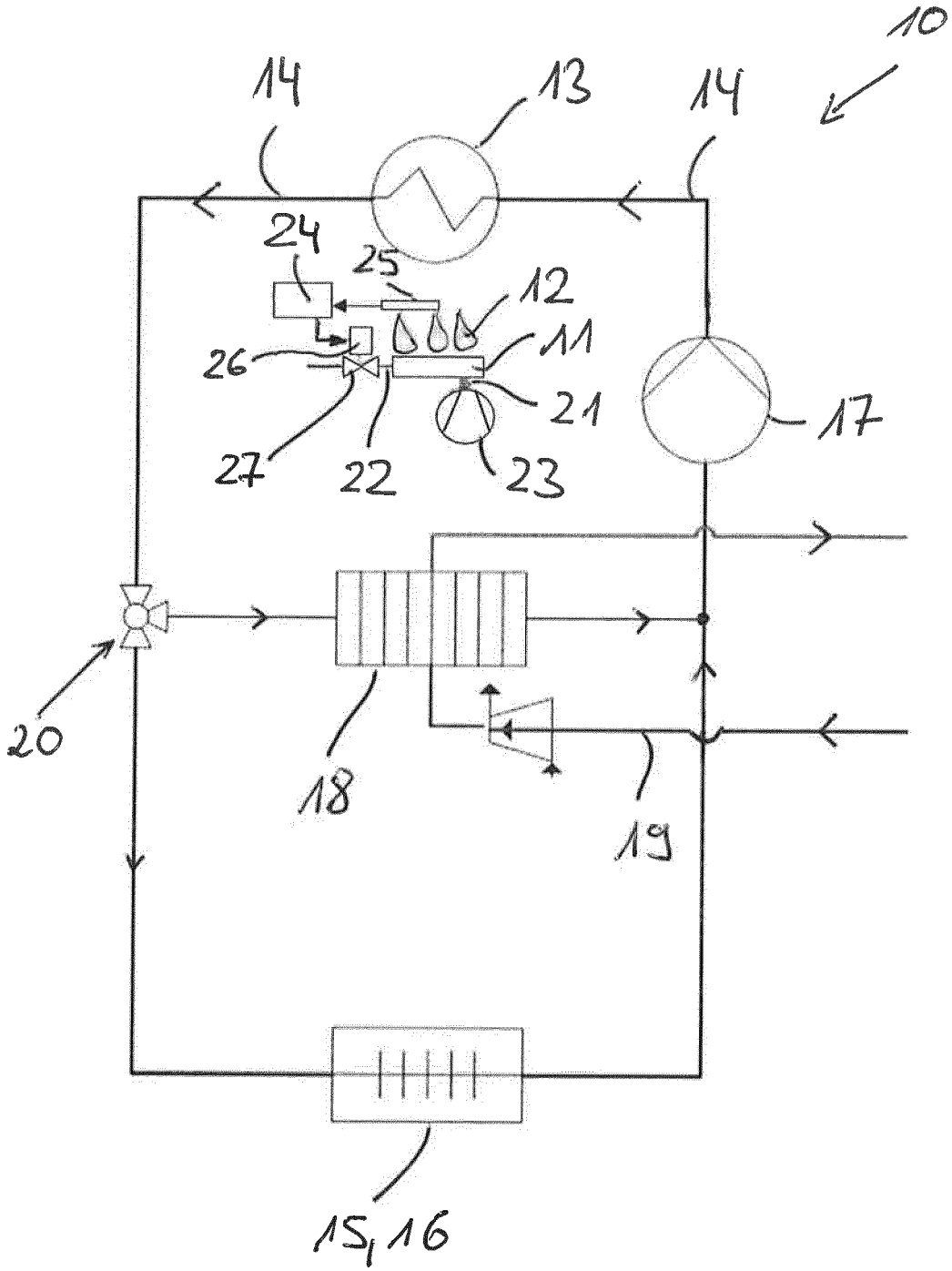
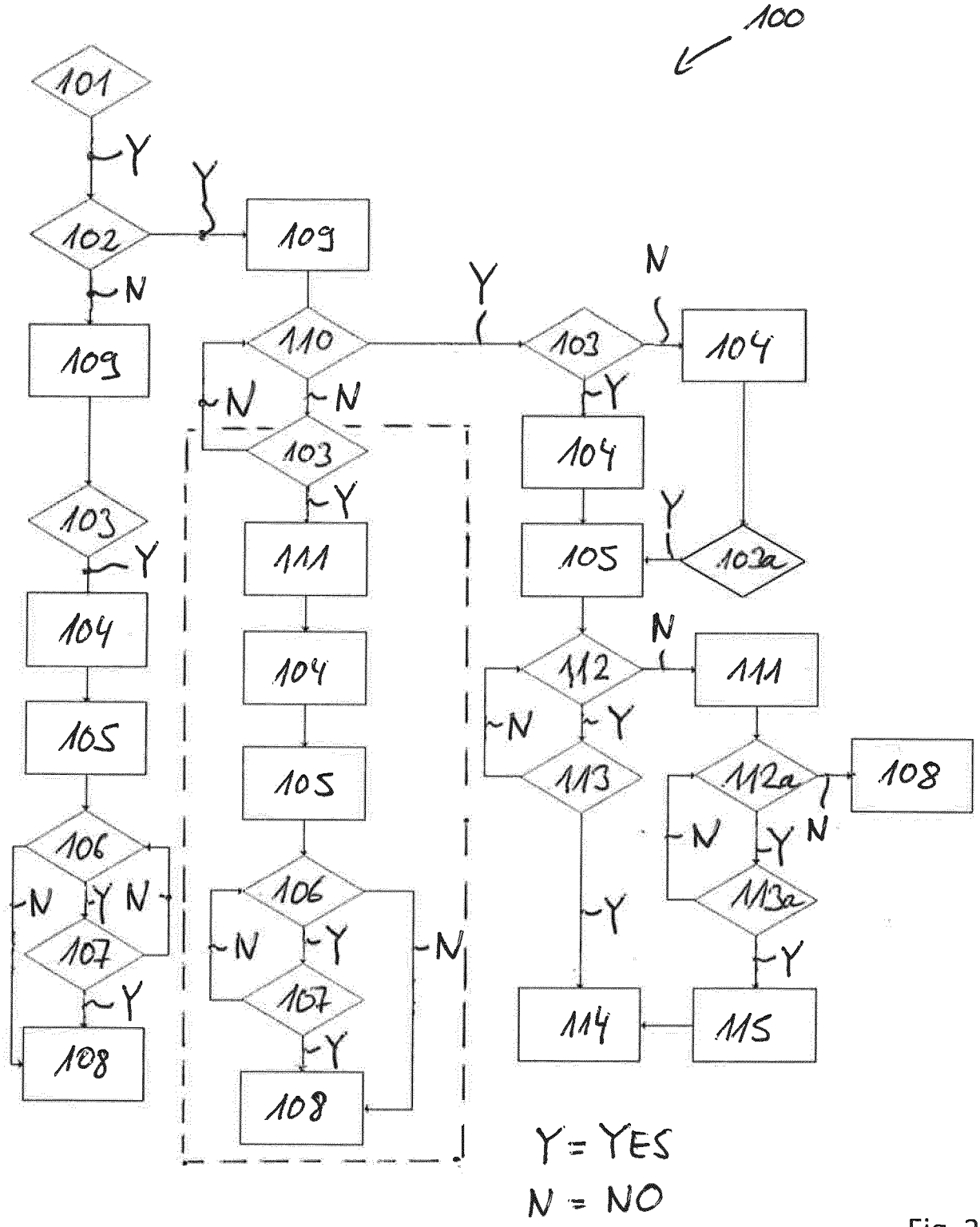


Fig. 1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112a
113a
102a
114
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N
Y = YES
N = NO

Fig. 2

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EUROPEAN SEARCH REPORT

Application Number
EP 17 19 8609

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
A	US 5 775 582 A (HAMMER JACK [US]) 7 July 1998 (1998-07-07) * column 4, line 8 - column 6, line 46 * * figures 1-4 *	1-8	INV. F23N5/24 F23N1/02 F23N5/02 F23N5/12 F24D3/08
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A	US 2017/292698 A1 (LANGIUS GERWIN [NL] ET AL) 12 October 2017 (2017-10-12) * page 2, paragraph 26 - page 4, paragraph 69 * * figures 1-5 *	1-8	
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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
Munich	17 April 2018	Rudolf, Andreas

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
O : non-written disclosure
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EPO FORM 1503 03.82 (P04C01)

ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 17 19 8609

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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17-04-2018

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