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(54) Gas burner, method for operating the same and multi gas burner system

(57) Method for operating a gas burner (10), wherein during burner-on phases a gas/air mixture having a defined mixing ratio of gas and air is provided to a burner chamber (11) of the gas burner (10) for combusting the gas/air mixture with the burner chamber (11), wherein the gas/air mixture is provided by mixing an air flow provided by an air duct (15) with a gas flow provided by a gas duct (16), wherein the defined mixing ratio of the

gas/air mixture is controlled by comparing an actual value provided by an electrical or electronic sensor (23) coupled to the gas duct (16) with a nominal value and by generating a control variable for a gas valve (17) assigned to the gas duct (16) on basis of the control deviation between the actual value and the nominal value, and wherein during burner-off phases the actual value provided by the electrical or electronic sensor (23) is used to determine backflow.

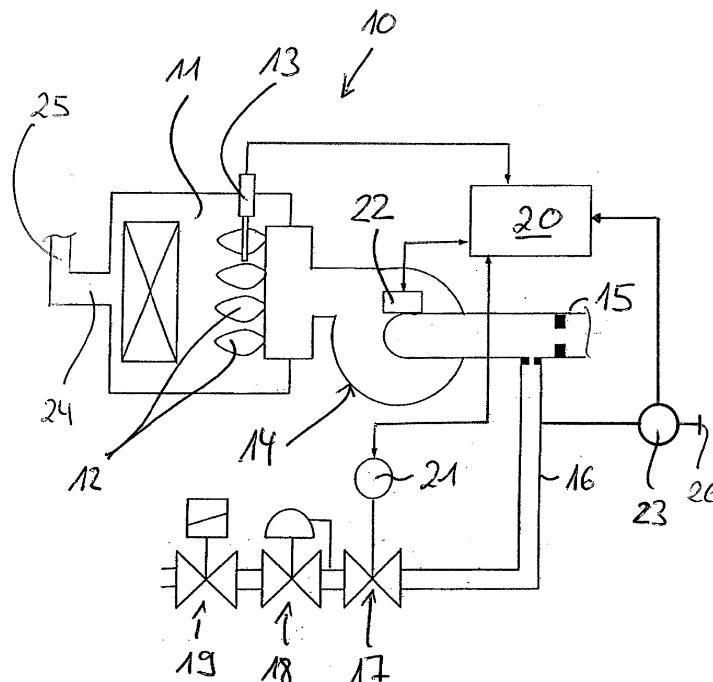


Fig. 1

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Description

[0001] The present patent application relates to a method for operating a gas burner. Further on, the present patent application relates to a gas burner and a multi gas burner system.

[0002] EP 1 084 369 B1 and EP 1 179 159 B1 each disclose a method for operating a gas burner. According to this prior art documents, during burner-on phases of the respective gas burner a gas/air mixture having a defined mixing ratio of gas and air is provided to a burner chamber of the gas burner. The gas/air mixture is provided by mixing an air flow provided by an air duct with a gas flow provided by a gas duct using a mixing device. The quantity of the air flow is adjusted by a fan. The defined mixing ratio of the gas/air mixture is controlled by a controller on basis of a signal provided by an electrical or electronic sensor. According to EP 1 084 369 B1, the electrical or electronic sensor is coupled to the gas duct and to the air duct. According to EP 1 179 159 B1, the electrical or electronic sensor is coupled to the gas duct and to a reference point. The electrical or electronic sensor is especially designed as a flow-meter. An actual value corresponding to a pressure ratio between the gas pressure in the gas duct and the air pressure in the 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 provide the defined mixing ratio of gas and air in the gas/air mixture.

[0003] During burner-on phases of a gas burner exhaust gas resulting from the combustion of the gas/air mixture within the burner chamber of the gas burner is flowing into an exhaust pipe. During burner-off phases of a gas burner under certain conditions air or exhaust gas might flow back into the burner chamber. This is especially critical when several gas burners of a multi gas burner system are connected to a common exhaust pipe. Backflow of air or exhaust gas can cause deposit of condensate in the fan, in the mixing device or in other components of the gas burner, or even spillage of exhaust gas.

[0004] In order to avoid such a backflow of air or exhaust gas, gas burners known from prior art are fitted with mechanical devices like flapper valves. The prior art document US 2010/0330512 A1 discloses a multi gas burner system having several gas burners connected to a common exhaust pipe, wherein each gas burner comprises a damper to prevent backflow of exhaust gas. Such mechanical devices like flapper valves or dampers are costly and not always reliable.

[0005] Against this background, a novel method for operating a gas burner, a novel gas burner and a novel multi

gas burner system are provided.

[0006] The method for operating a gas burner is defined in the claim 1. During burner-off phases the actual value provided by the electrical or electronic sensor is used to determine backflow.

[0007] The method of the present patent application allows the determination of backflow of air or exhaust gas during burner-off phases on basis of a signal provided by the electrical or electronic sensor, whereby this electrical or electronic sensor is used during burner-on phases to control the mixing ratio of gas and air in the gas/air mixture. No, additional devices are need to determine backflow.

[0008] When backflow of air or exhaust gas is determined during burner-off phases, the fan is turned on. This prevents further backflow.

[0009] According to a preferred embodiment of the invention, the fan is turned on in such a way that the fan compensates the backflow resulting in a zero flow. This way of operating the fan during burner-off phases is very efficient. An electrical power consumption of the fan at low fan speeds is very low. Further on, this way of operating the fan keeps noises caused by the fan at a minimum.

[0010] The gas burner is defined in the claim 7 and the multi gas burner system is defined in the claim 11.

[0011] 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; and
Figure 2 shows a schematic view of a multi gas burner system.

[0012] Figure 1 shows a schematic view of a gas burner 10. The gas burner comprises a burner chamber 11 in which combustion of a gas/air mixture takes place during burner-on phases of the gas burner 10. The combustion of the gas/air mixture results into flames 12 monitored by e.g. an ionization sensor 13.

[0013] The gas/air mixture is provided to the burner chamber 11 of the gas burner 10 by mixing an air flow with a gas flow. A fan 14 sucks in air flowing through an air duct 15 and gas flowing through a gas duct 16. A gas valve 17 for adjusting the gas flow through the gas duct 16 and safety valves 18, 19 are assigned to the gas duct 16.

[0014] The gas/air mixture having a defined mixing ratio of gas and air is provided to the burner chamber 11 of the gas burner 10. The gas/air mixture is provided by mixing the air flow provided by an air duct 15 with a gas flow provided by a gas duct 16.

[0015] The air flow and the gas flow become preferably mixed by a mixing device. Such a mixing device can be designed as a Venturi nozzle (not shown).

[0016] The quantity of the air flow and thereby the quantity of the gas/air mixture flow is adjusted by the fan

14, namely by the speed of the fan 14. The fan speed can be adjusted by an actuator 22 of the fan 14.

[0017] The defined mixing ratio of the gas/air mixture is controlled by a controller 20 on basis of a signal provided by an electrical or electronic sensor 23. In the shown embodiment, the electrical or electronic sensor 23 is coupled to the gas duct 16 and to a reference point 26. The electrical or electronic sensor 23 is designed as a flow-meter.

[0018] An actual value corresponding to a pressure ratio between the gas pressure in the gas duct 16 and the air pressure air pressure at the reference point 26 is provided by the electrical or electronic sensor 23. This actual value is compared by the controller 20 with a nominal value stored in the controller 20. The controller 20 generates a control variable for the gas valve 17, namely for an actuator 21 of the gas valve 17, on basis of the control deviation between the actual value provided by the electrical or electronic sensor 23 and the nominal value stored in the controller 20. The gas valve position of the gas valve 17 is adjusted by the actuator 21 of the same on basis of this control variable in order to provide the defined mixing ratio of gas and air in the gas/air mixture.

[0019] Exhaust gas resulting from the combustion of the gas/air mixture within the burner chamber 11 during burner-on phases of the gas burner 10 is leaving the burner chamber 11 through an exhaust outlet 24 of the burner chamber 11. The exhaust gas flows than into an exhaust pipe 25.

[0020] During burner-off phases the actual value provided by the electrical or electronic sensor 23 is used to determine backflow, namely backflow of exhaust gas or air.

[0021] During burner-off phases the electrical or electronic sensor 23 provides the actual value to the controller 20 and the controller 20 determines from this actual value and a nominal value valid for burner-off phases the presence of backflow of exhaust gas or air.

[0022] When backflow is determined during burner-off phases, the fan 14 of the gas burner 10 is turned on. The controller 20 generates a signal for the actuator 22 of the fan 14 in order to turn the same on during burner-off phases when back flow was detected.

[0023] According to a first embodiment, the fan 14 is turned on in such a way that the fan 14 provides a flow through the burner chamber 11 opposite to the direction of the backflow.

[0024] According to a second embodiment, the fan 14 is turned on in such a way that the fan 14 merely compensates the backflow resulting in a zero flow through the burner chamber 11. This way of operating the fan 14 during burner-off phases is energy efficient. An electrical power consumption of the fan at a low fan speed is very low. Further on, this way of operating the fan 14 keeps noises caused by the fan 14 at a minimum.

[0025] Figure 2 shows a multi gas burner system having at least two gas burners 10. The gas burners 10 are connected to a common exhaust pipe 25. At least one of

the gas burners 10, preferably all gas burners 10, of the multi gas burner system comprise the functionality as described above. The detection of backflow is particularly of advantage in such a multi gas burner system. In such multi gas burner system the risk of backflow of exhaust gas is significantly higher than in a single gas burner application. By turning on the fan of the gas burner 10 for which backflow has been detected, further backflow into the same can be avoided.

[0026] The present patent application avoids the use of mechanical devices like flapper valves or dampers to stop backflow.

List of reference signs

[0027]

- 10 gas burner
- 11 burner chamber
- 12 flame
- 13 ionization sensor
- 14 fan
- 15 air duct
- 16 gas duct
- 17 regulating valve
- 18 safety valve
- 19 safety valve
- 20 controller
- 21 actuator
- 22 actuator
- 23 sensor
- 24 exhaust outlet
- 25 exhaust pipe
- 26 reference point

Claims

1. Method for operating a gas burner (10), wherein during burner-on phases a gas/air mixture having a defined mixing ratio of gas and air is provided to a burner chamber (11) of the gas burner (10) for combust-

- ing the gas/air mixture with the burner chamber (11), wherein the gas/air mixture is provided by mixing an air flow provided by an air duct (15) with a gas flow provided by a gas duct (16), and wherein the defined mixing ratio of the gas/air mixture is controlled by comparing an actual value provided by an electrical or electronic sensor (23) coupled to the gas duct (16) with a nominal value and by generating a control variable for a gas valve (17) assigned to the gas duct (16) on basis of the control deviation between the actual value and the nominal value, **characterized in that** during burner-off phases the actual value provided by the electrical or electronic sensor (23) is used to determine backflow.
2. Method as claimed in claim 1, **characterized in that** during burner-off phases the actual value provided by the electrical or electronic sensor (23) is used to determine backflow of exhaust gas or air.
 3. Method as claimed in claim 1 or 2, **characterized in that** when backflow is determined during burner-off phases, a fan (14) of the gas burner (10) is turned on.
 4. Method as claimed in claim 3, **characterized in that** the fan (14) is turned on in such a way that the fan (14) provides a flow opposite to the direction of the backflow.
 5. Method as claimed in claim 3, **characterized in that** the fan (14) is turned on in such a way that the fan (14) compensates the backflow resulting in a zero flow.
 6. Method as claimed in one of claims 1 to 5, **characterized in that** the gas burner (10) is part of a multi gas burner system having several gas burners (10) being connected to a common exhaust pipe (25).
 7. Gas burner, comprising a burner chamber (11) for combusting a gas/air mixture, and further comprising a controller (20), wherein during burner-on phases a gas/air mixture having a defined mixing ratio of gas and air is provided to the burner chamber (11) of the gas burner (10) by mixing an air flow provided by an air duct (15) with a gas flow provided by a gas duct (16), and wherein the controller (20) controls the defined mixing ratio of the gas/air mixture by comparing an actual value provided by an electrical or electronic sensor (23) being coupled to the gas duct (16) with a nominal value and by generating a control variable for a gas valve (17) assigned to the gas duct (16) on basis of the control deviation between the actual value and the nominal value, **characterized in that** during burner-off phases the controller (20) uses the actual value provided by the electrical or electronic sensor (23) to determine backflow.
 8. Gas burner as claimed in claim 7, **characterized in that** during burner-off phases the controller (20) uses the actual value provided by the electrical or electronic sensor (23) to determine backflow of exhaust gas or air.
 9. Gas burner as claimed in claim 7 or 8, **characterized in that** when the controller (20) determines backflow during burner-off phases on a fan (14) of the gas burner is turned on by the controller (20).
 10. Method as claimed in claim 9, **characterized in that** the fan (14) is turned on in such a way that the fan (14) provides a flow opposite to the direction of the backflow.
 11. Method as claimed in claim 9, **characterized in that** the fan (14) is turned on in such a way that the fan (14) compensates the backflow resulting in a zero flow.
 12. Multi gas burner system comprising several gas burners (10) being connected to a common exhaust pipe (25), **characterized by** at least one gas burner (10) according to one of claims 7-11.

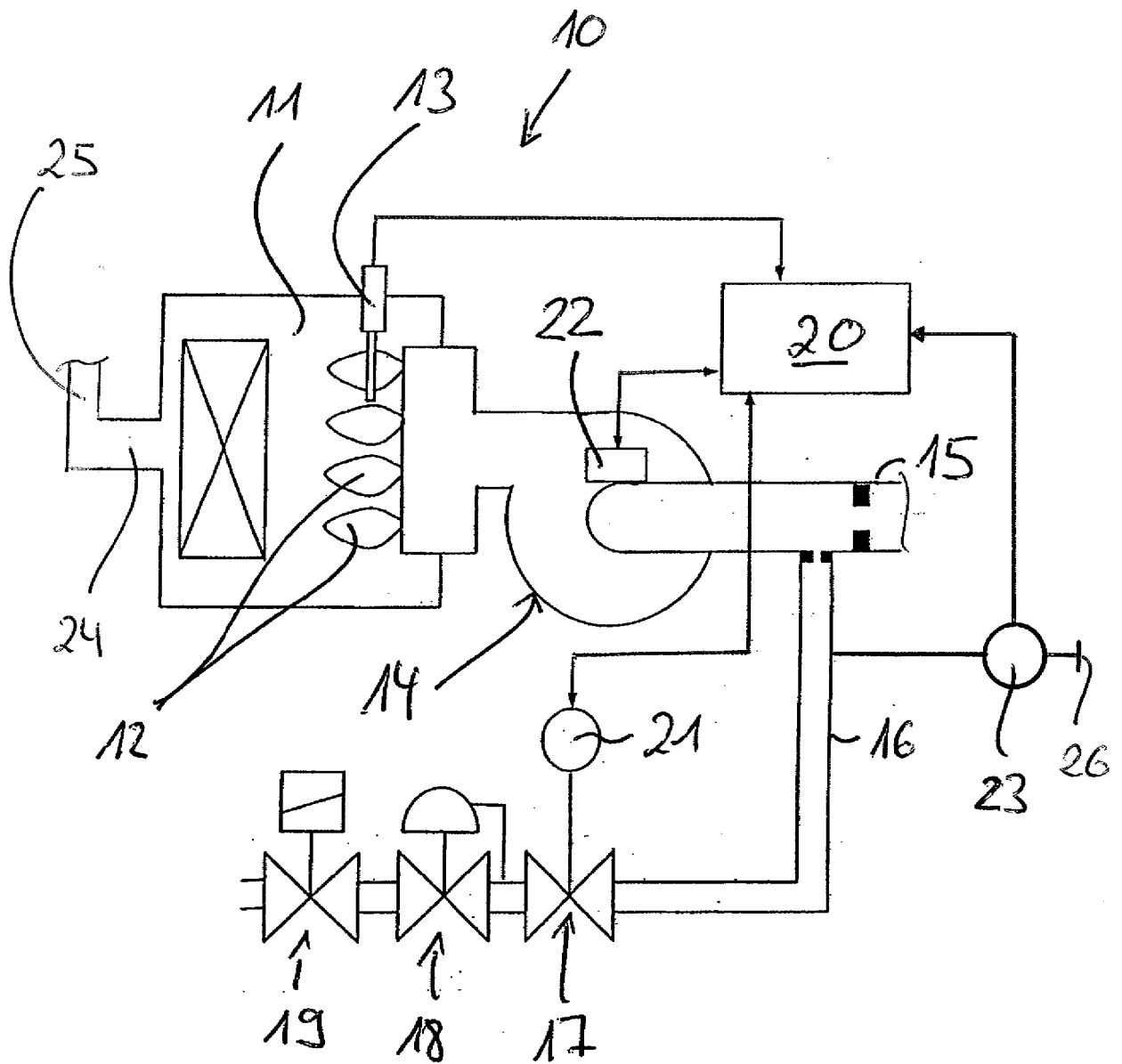


Fig. 1

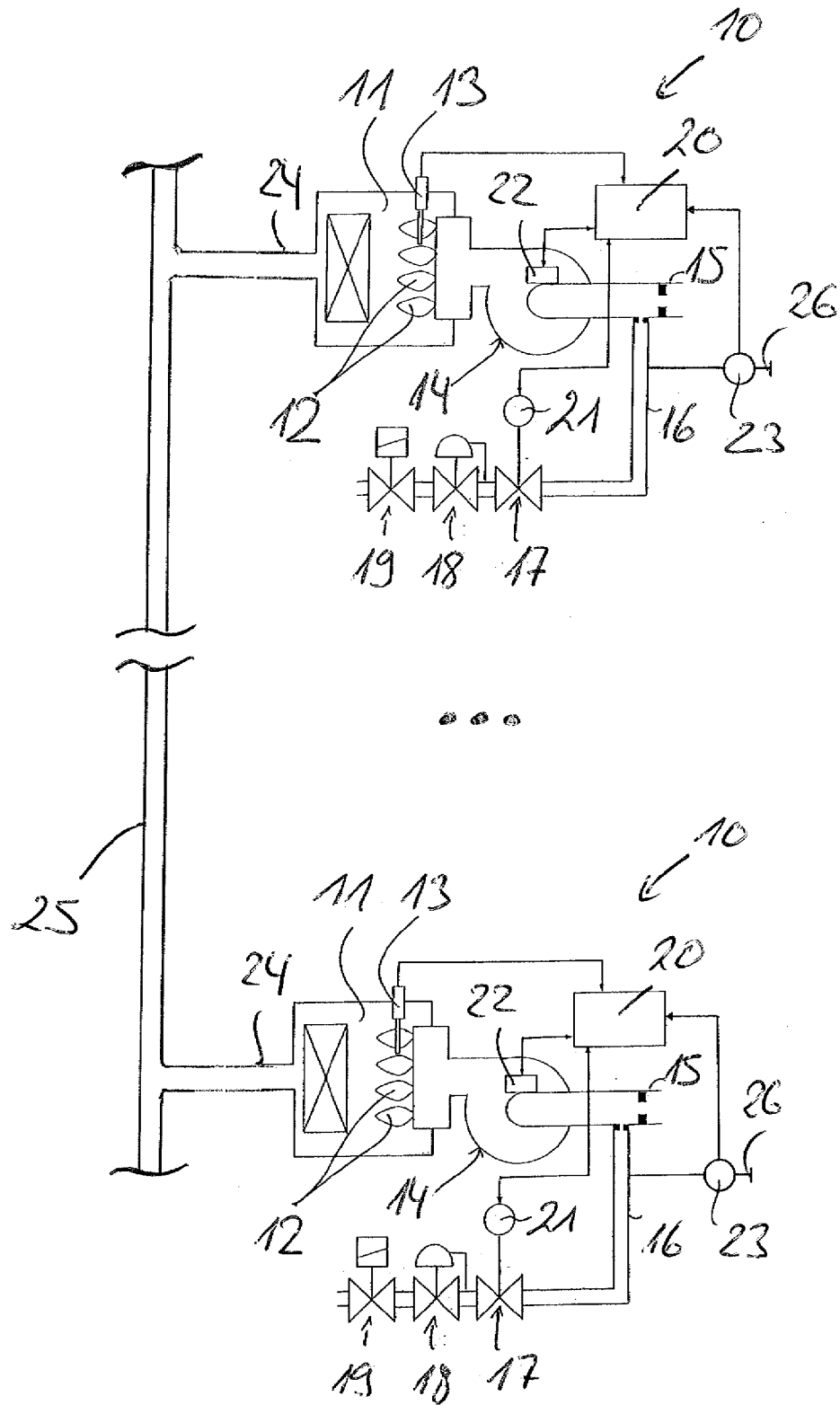


Fig. 2



EUROPEAN SEARCH REPORT

Application Number
EP 12 15 3790

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X	EP 1 084 369 A1 (HONEYWELL BV [NL]) 21 March 2001 (2001-03-21) * paragraph [0020]; claim 1; figures *	1,2,7,8	
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The present search report has been drawn up for all claims			
Place of search The Hague		Date of completion of the search 2 July 2012	Examiner Haegeman, Marc
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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EPO FORM 1503 03.82 (P04C01)

**ANNEX TO THE EUROPEAN SEARCH REPORT
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This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
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