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(54) **PARTIALLY-PREMIXED GAS BURNER APPLIANCE**

GASBRENNERVORRICHTUNG MIT TEILWEISE VORGEMISCHTEM GAS

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(73) Proprietor: **Pittway Sarl**
1180 Rolle (CH)

(72) Inventor: **MUNSTERHUIS, Sybrandus**
Tianjin 300457 (CN)

(74) Representative: **Sturm, Christoph**
Patentanwälte Sturm Weillnau Franke
Partnerschaft mbB
Unter den Eichen 5 (Haus C-Süd)
65195 Wiesbaden (DE)

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Description

[0001] The invention relates to a partially-premixed gas burner appliance.

[0002] In the technical filed of gas burner appliances there are in principle two different types of gas burner appliances, namely fully-premixed gas burner appliances and partially-premixed gas burner appliances. In both types of these gas burner appliances a mixture of gas and air becomes combusted within a combustion chamber of the respective gas burner appliance. The present invention relates to a partially-premixed gas burner appliance.

[0003] EP 0 390 964 B2 and US 2009 / 0 197 212 A1 disclose fully-premixed gas burner appliances. In fully-premixed gas burner appliances an air flow provided by a fan is fully premixed with a gas flow provided by a gas modulator before the resulting gas/air mixture is combusted. US 2012 / 0 058 439 A1 discloses another fully-premixed gas burner appliance,

[0004] EP 0 103 303 A2 discloses a partially-premixed gas burner appliance comprising a combustion chamber in which gas is combusted. A fan provides an air flow to the combustion chamber. The fan is assigned to an exhaust gas outlet port of the combustion chamber. Air is sucked into the combustion chamber when the fan being assigned to the exhaust gas outlet port is running, wherein the air enters into the combustion chamber through an air inlet port. An air flow restriction element is assigned to the air inlet port of the combustion chamber. A gas modulator provides a gas flow to the combustion chamber, namely to a gas burner rod positioned within the combustion chamber. In partially-premixed gas burner appliances only a first portion of the air flow provided by a fan is premixed with the gas flow before combustion takes place. In partially-premixed gas burner appliances a second portion of the air flow provided by the fan is mixed with the gas while the combustion of the gas takes place. JP S60 91135 A1 discloses another partially-premixed gas burner appliance.

[0005] US 5 630 408 A, EP 0 450 173 A1, GB 2 075 718 A, DE 22 47 559 A1, US 5 520 533 A1, DE 196 39 992 B4, DE 198 21 853 C1 and EP 2 123 979 B1 disclose other prior art.

[0006] Against this background, a novel partially-premixed gas burner appliance according to claim 1 is provided.

[0007] The novel partially-premixed gas burner appliance comprises a combustion chamber.

[0008] The novel partially-premixed gas burner appliance further comprises a fan being configured to provide air or an air flow to the combustion chamber. The fan is assigned to an air inlet port of the combustion chamber or to an air duct providing the air to the air inlet port.

[0009] The novel partially-premixed gas burner appliance further comprises an air flow restriction element assigned to the air inlet port of the combustion chamber or to the air duct. The air flow restriction element is

configured to cause a pressure drop so that the air pressure downstream of the air flow restriction element is lower than the air pressure of the air flow provided by the fan upstream of the air flow restriction element.

[0010] The novel partially-premixed gas burner appliance further comprises a gas modulator being configured to provide a gas flow to the combustion chamber.

[0011] A first portion of the air or air flow provided by the fan is premixed with the gas or gas flow before the gas is combusted. A second portion of the air or air flow provided by the fan is mixed with the gas while the gas is combusted.

[0012] The gas modulator of the novel partially-premixed gas burner appliance is a pneumatic gas control valve being configured to be used in a fully-premixed gas burner appliance. The pneumatic gas control valve has a main gas valve, a safety gas valve, a servo gas valve and a gas outlet pressure regulator. Such a pneumatic gas control valve is configured to be used in a fully-premixed gas burner appliance.

[0013] The gas outlet pressure regulator of the pneumatic gas control valve, namely a first chamber of the gas outlet pressure regulator in which a pressure is present that influences the nominal-value of the gas outlet pressure, is connected to the air inlet port of the combustion chamber or to the air duct upstream of the air flow restriction element such that the gas outlet pressure provided by the pneumatic gas control valve depends on the air pressure provided by the fan upstream of the air flow restriction element.

[0014] The present invention proposes to make use of a pneumatic gas control valve being configured to be used in a fully-premixed gas burner appliance within a partially-premixed gas burner appliance. The fan is assigned to the air inlet port of the combustion chamber or to an air duct providing the air to the air inlet port. The gas outlet pressure regulator of the pneumatic gas control valve, namely the first chamber of the same in which the pressure is present that influences the nominal-value of the gas outlet pressure, is connected to the air inlet port of the combustion chamber or to the air duct, namely upstream of the air flow restriction element. This makes it possible to provide a 1:1 ratio of the air pressure upstream of the air flow restriction element and the gas outlet pressure of the pneumatic gas control valve without the need of an electronic gas modulator. The present invention allows a very simple and reliable 1:1 gas-air control for a partially-premixed gas burner appliance.

[0015] According to a preferred embodiment, a gas burner rod having at least two segments is positioned within the combustion chamber, wherein the combustion chamber comprises for each segment of the gas burner rod an individual gas inlet port. The pneumatic gas control valve provides a gas flow to each of the individual gas inlet ports of the combustion chamber. A shut off valve may be assigned to at least one of the individual gas inlet ports to selectively open or close the respective gas inlet port thereby selectively operating the respective seg-

ment of the gas burner rod. Such a multiple segment configuration of the burner rod enables a high turn down ratio with a turn down in power input to the burner. A very effective operation of a the partially-premixed gas burner appliance can be provided.

[0016] Alternatively, the gas burner rod may not be segmented. A gas burner rod not being segmented does not require a shut off valve assigned to the gas inlet port.

[0017] According to a preferred embodiment, the first chamber of the gas outlet pressure regulator of the pneumatic gas control valve is connected to the air inlet port of the combustion chamber through a pipe or duct. This provides a very simple and reliable way to balance the air pressure drop with the gas pressure drop.

[0018] According to a preferred embodiment, the gas outlet pressure regulator of the pneumatic gas control valve comprises a diaphragm. The first chamber of the gas outlet pressure regulator of the pneumatic gas control valve is positioned on a first side of said diaphragm such that the air pressure being present within the within first chamber acts on the first side of said diaphragm. A second chamber of the gas outlet pressure regulator of the pneumatic gas control valve is positioned on a second side of said diaphragm, wherein the second chamber of the gas outlet pressure regulator is connected to a gas outlet chamber of the pneumatic gas control valve such that the gas outlet pressure being present within the within second chamber acts on the second side of said diaphragm. The gas outlet pressure regulator further comprises a first spring and a second spring, wherein a spring force provided by the first spring acts on the first side of said diaphragm and a spring force provided by the second spring acts on the second side of said diaphragm. The gas outlet pressure regulator of the pneumatic gas control valve further comprises a presetting unit acting on the first spring to adapt the spring force acting on the first side of said diaphragm thereby adapting the nominal-value of the gas outlet pressure. It is possible to provide a very simple and reliable 1:1 gas-air control for a partially-premixed gas burner appliance without the need of an electronic gas modulator.

[0019] Preferred developments of the invention are provided by the dependent claims and the description of the drawings. Exemplary embodiments are explained in more detail on the basis of the drawing, in which:

Figure 1 shows a preferred embodiment of a partially-premixed gas burner appliance according to the invention;

Figure 2 shows a cross section through a pneumatic gas control valve of the partially-premixed gas burner appliance of Figure 1.

[0020] The present invention relates to a partially-premixed gas burner appliance 10.

[0021] The partially-premixed gas burner appliance 10 comprises a combustion chamber 11 in which gas G is combusted. In the shown embodiment, a gas burner rod

12 having at least two segments 12a, 12b is positioned within the combustion chamber 11. Gas G is provided to the gas burner rod 12 for combustion. The combustion of the gas G takes place under the presence of air A. The combustion of the gas G results into flames 13 and exhaust-gas E. Alternatively, the gas burner rod 12 may not be segmented in multiple segments.

[0022] In the shown embodiment, a heat exchanger 14 is positioned within the combustion chamber 11. The heat exchanger 14 is used to heat e. g. sanitary water or central heating water W for a water consumer.

[0023] The water W to be heated within the heat exchanger 14 is provided by a supply pipe 15 to the heat exchanger 14. Water W which has been heated within the heat exchanger 14 is flowing through a return pipe 16 to the respective water consumer.

[0024] The partially-premixed gas burner appliance 10 comprises a fan 17.

[0025] The fan 17 provides a flow of air A to the combustion chamber 11. The fan 17 is assigned to an air inlet port 11A of the combustion chamber 11 or to an air duct 18 providing the air A to the air inlet port 11A.

[0026] The novel partially-premixed gas burner appliance 10 further comprises an air flow restriction element 19 assigned to the air inlet port 11A of the combustion chamber 11 or to the air duct.

[0027] The air flow restriction element 19 causes a pressure drop so that the pressure downstream of the air flow restriction element 19 within the combustion chamber 11 is lower than the pressure of the air flow provided by the fan 17 upstream of the air flow restriction element 19. The air flow restriction element 19 can be provided by an orifice plate or by a venturi nozzle.

[0028] The novel partially-premixed gas burner appliance 10 further comprises a gas modulator 20 providing a flow of gas G to the combustion chamber 11, namely through at least one gas inlet port 11G of the combustion chamber 11. For each segment 12a, 12b of the gas burner rod 12 the combustion chamber 11 may have an individual gas inlet port 11G. For a gas burner rod 12 not be segmented or for each segment 12a, 12b of the gas burner rod 12 the combustion chamber 11 may have multiple gas inlet ports 11G.

[0029] A gas flow restriction element 40 is assigned to each of the gas inlet ports 11G. Such a gas flow restriction element 40 causes a pressure drop such that the gas pressure upstream of the gas flow restriction element 40 is greater than the pressure downstream of the gas flow restriction element 40 within the combustion chamber 11. The gas flow restriction element 40 can be provided by an orifice plate or by a venturi nozzle.

[0030] In the embodiment of Figure 1, a shut off valve 41 is assigned to the gas inlet port 11G providing gas G to the segment 12b of the gas burner rod 12. This makes it possible to selectively open or close the gas inlet port 11G thereby selectively operating the segment 12b of the gas burner rod 12.

[0031] It would also be possible to assign such a shut

off valve 41 the gas inlet port 11G providing gas G to the segment 12a of the gas burner rod 12.

[0032] The exhaust-gas E flows out of the combustion chamber 11 through an exhaust-gas outlet port 11E of the combustion chamber 11.

[0033] A first portion A1 of the air flow or air A provided by the fan 17, which enters the combustion chamber 11 through the air inlet port 11A, is premixed with the gas G provided by gas modulator 20 before the gas G is combusted.

[0034] A second portion A2 of the air A provided by the fan 17, which enters the combustion chamber 11 through the air inlet port 11A, is mixed with the gas G while the gas G is combusted.

[0035] The gas modulator 20 is provided by a pneumatic gas control valve. Said pneumatic gas control valve 20 is configured to be used in fully-premixed gas burner appliance.

[0036] The pneumatic gas control valve 20 comprises a housing 21 providing an inlet gas chamber 21a, an outlet gas chamber 21b and an intermediate gas chamber 21c coupled between the inlet gas chamber 21a, an outlet gas chamber 21b.

[0037] The pneumatic gas control valve 20 comprises further a main gas valve 22, a safety gas valve 23, a servo gas valve 24 and gas outlet pressure regulator 25.

[0038] When the safety gas valve 23 is closed, the inlet gas chamber 21a and the intermediate gas chamber 21c are fluidically separated from each other. When the safety gas valve 23 is opened, the inlet gas chamber 21a and the intermediate gas chamber 21c are fluidically connected to each other.

[0039] The safety gas valve 23 is opened by an actuator 26 against a closing force provided by a spring 36. When the safety gas valve 23 is opened, also the servo gas valve 24 becomes opened. Safety gas valve 23 and servo gas valve 24 are both opened by the actuator 26.

[0040] When the main gas valve 22 is closed, the intermediate gas chamber 21c and the outlet gas chamber 21b are fluidically separated from each other.

[0041] When the main gas valve 22 is opened, the intermediate gas chamber 21c and the outlet gas chamber 21b are fluidically connected to each other.

[0042] The main gas valve 22 comprises a diaphragm 27 and a spring 28. The diaphragm 27 separates the outlet gas chamber 21b from a servo pressure chamber 29. The servo pressure chamber 29 is fluidically connected to the servo gas valve 24.

[0043] The gas outlet pressure being present in the outlet gas chamber 21b and a spring force provided by the spring 28 of the main gas valve 22 act on a first side of the diaphragm 27 of the main gas valve 22 tending to close the main gas valve 22.

[0044] A servo gas pressure being present within the servo gas chamber 29 acts on the second side of the diaphragm 27 of the main gas valve 22 tending to open the main gas valve 22.

[0045] The servo gas chamber 29 is further fluidically

connected to the gas outlet pressure regulator 25 of the pneumatic gas control valve 20 through a pressure relief valve 38.

[0046] The gas outlet pressure regulator 25 of the pneumatic gas control valve 20 comprises a diaphragm 30 and two springs 31, 32. The diaphragm 30 of the gas outlet pressure regulator 25 separates a first chamber 33 of the gas outlet pressure regulator 25 from a second chamber 34 of the same.

[0047] The pressure being present within the first chamber 33 of the gas outlet pressure regulator 25 influences the nominal-value of the gas outlet pressure within the outlet gas chamber 21b of the pneumatic gas control valve 20. The pressure being present within the first chamber 33 of the gas outlet pressure regulator 25 acts on a first side of the diaphragm 30 of the gas outlet pressure regulator 25. Further on, a spring force provided by the spring 31 acts on a first side of the diaphragm 30.

[0048] The second chamber 34 of the gas outlet pressure regulator 25 is positioned on a second side of said diaphragm 30, wherein the second chamber 34 of the gas outlet pressure regulator 25 is fluidically connected to the gas outlet chamber 11b of the pneumatic gas control valve 20 such that the gas outlet pressure being present within the gas outlet chamber 21b and within the second chamber 34 of the gas outlet pressure regulator 25 acts on the second side of the diaphragm 30 of the gas outlet pressure regulator 25. Further on, a spring force provided by the spring 32 acts on a second side of the diaphragm 30.

[0049] The gas outlet pressure regulator 25 of the pneumatic gas control valve 20 further comprises a presetting unit 35 acting on the first spring 31 to adapt the spring force acting on the first side of said diaphragm 30. With the presetting unit 35 the nominal-value of the gas outlet pressure of the pneumatic gas control valve 20 can be adapted. The presetting unit 35 can be used to provide an offset or a delta between the pressure on either side of the diaphragm 30 of the gas outlet pressure regulator 25 and as a result an offset or a delta between the generated air pressure and the gas outlet pressure.

[0050] The pressure relief valve 38 through which the servo gas chamber 29 is fluidically connected to the gas outlet pressure regulator 25 of the pneumatic gas control valve 20 is integrated into the diaphragm 30 of the gas outlet pressure regulator 25.

[0051] According to the present invention, the gas outlet pressure regulator 25 of the pneumatic gas control valve 20, namely the first chamber 33 of the gas outlet pressure regulator 25 in which the pressure is present that influences the nominal-value of the gas outlet pressure, is permanently fluidically connected to the air inlet port 11A of the combustion chamber 11 or to the air duct providing the air A to the air inlet port 11A upstream of the air flow restriction element 18 such that the gas outlet pressure provided by pneumatic gas control valve 20 depends on to the air pressure provided by the fan 17 upstream of the air flow restriction element 18.

[0052] As shown in the Figures, the first chamber 33 of the gas outlet pressure regulator 25 of the pneumatic gas control valve is connected to the air inlet port 11A of the combustion chamber 11 or to the air duct 18 through a pipe or duct 37.

[0053] The pneumatic gas control valve 20 features a positive servo system. The main gas valve 22 is closed by the spring 28 in the normal shut down position and can only be opened when pressure within the servo gas chamber 29 is sufficient to overcome the spring force of the spring 28. This ensures the main gas valve 22 will automatically close in the event of power or gas supply failure.

[0054] An element of the pneumatic gas control valve 20 is the gas outlet pressure regulator 25 which comprises the pressure relief valve 38 integrated in the diaphragm 30 which controls the main gas valve 22.

[0055] When the safety gas valve 22 and the servo gas valve 24 are both opened by the actuator 26, then gas flows through the servo gas valve 24 into the servo pressure chamber 29 and to the pressure relief valve 38. This gas pressure within the servo pressure chamber 29 moves the main valve diaphragm 27 upwards enough to open the main gas valve 22. As soon as the main gas valve 22 has opened, the outlet gas pressure will be sensed by the regulator diaphragm 20 via a feedback channel 39 connecting the second chamber 34 of the gas outlet pressure regulator 25 to the gas outlet chamber 21b pneumatic gas control valve 20.

[0056] When the force provided by the pressure within the second chamber 34 of the gas outlet pressure regulator 25 is greater than the force provided by the pressure within the first chamber 33 and by the presetting unit 35, the pressure relief valve 38 opens relieving some of the working pressure within the servo pressure chamber 29. This reduces the force against the main valve spring 28 allowing the main gas valve 22 to close proportionally. Thus, the main gas valve 22 limits the gas outlet pressure. As a result, the gas outlet pressure is continuously maintained by comparing the gas outlet pressure being present in the second chamber 34 of the gas outlet pressure regulator 25 with the pressure being present in the first chamber 33 of the gas outlet pressure regulator 25 and adjusting the position of the main gas valve 22 accordingly.

[0057] The fan 17 is located at the air inlet of the combustion chamber 11. The air pressure which is generated by the fan 17 is transferred to first chamber 33 of the gas outlet pressure regulator 25 to generate the outlet gas pressure. This allows to provide a very simple and reliable 1:1 gas-air control for a partially-premixed gas burner appliance.

[0058] The gas outlet pressure and thereby the gas flow provided by the pneumatic gas control valve 20 is a function of air pressure generated by the fan 17. An offset or a delta between the pressure on either side of the diaphragm 30 of the gas outlet pressure regulator 25 may be provided by the presetting unit 35. At any speed of the

fan 17 the pressure drop over air flow restriction 19 equals the pressure drop over the or each gas flow restriction 40. So, the air flow and the gas flow are controlled proportionally. With presetting unit 35 the gas flow can be influenced to adjust to desired gas and air ratio setting.

List of reference signs

10 [0059]

10	partially-premixed gas burner appliance
11	combustion chamber
11A	air inlet port
15 11G	gas intel port
11E	exhaust-gas outlet port
12	gas burner rod
12a	segment
12b	segment
20 13	flame
14	heat exchanger
15	supply pipe
16	return pipe
17	fan
25 18	air duct
19	air flow restriction element
20	gas modulator / pneumatic gas control valve
21	housing
21a	intel gas chamber
30 21b	outlet gas chamber
21c	intermediate gas chamber
22	main gas valve
23	safety gas valve
24	servo gas valve
35 25	gas outlet pressure regulator
26	actuator
27	diaphragm
28	spring
29	servo pressure chamber
40 30	diaphragm
31	spring
32	spring
33	chamber
45 34	chamber
35	presetting unit
36	spring
37	duct
38	pressure relief valve
50 39	feedback channel
40	gas flow restriction element
41	shut off valve

Claims

- 55 1. Partially-premixed gas burner appliance (10), comprising:

a combustion chamber (11),
 a fan (17) being configured to provide an air flow
 to the combustion chamber (11),
 wherein the fan (17) is assigned to an air inlet
 port (11A) of the combustion chamber (11) or to
 an air duct (18) being configured to provide the
 air to the air inlet port (11A),
 an air flow restriction element (19) being as-
 signed to the air inlet port (11A) of the combus-
 tion chamber (11) or to the air duct (18) and being
 configured to provide a pressure drop so that the
 pressure downstream of the air flow restriction
 element (19) is lower than the pressure up-
 stream of the air flow restriction element (19),
 a gas modulator (20) being configured to provide
 a gas flow to the combustion chamber (11),

wherein a first portion of the air provided by
 the fan (17) is premixed with the gas flow
 before the gas is combusted,
 wherein a second portion of the air provided
 by the fan (17) is mixed with the gas while
 the gas is combusted,
 wherein the gas modulator (20) is a pneu-
 matic gas control valve configured to be
 used in a fully-premixed gas burner appli-
 ance, the pneumatic gas control valve hav-
 ing a main gas valve (22), a safety gas valve
 (23), a servo gas valve (24) and gas outlet
 pressure regulator (25),
 wherein the gas outlet pressure regulator
 (25), namely a first chamber (33) of the gas
 outlet pressure regulator (25) in which a
 pressure is present that influences the nom-
 inal-value of the gas outlet pressure of the
 pneumatic gas control valve, is connected
 to the air inlet port (11A) or to the air duct (18)
 upstream of the air flow restriction element
 (19) such that the gas outlet pressure pro-
 vided by the pneumatic gas control valve
 depends on the air pressure provided by the
 fan (17) upstream of the air flow restriction
 element (19).

2. Partially-premixed gas burner appliance as claimed
 in claim 1, wherein the first chamber (33) of the gas
 outlet pressure regulator (25) of the pneumatic gas
 control valve is connected to the air inlet port (11A) of
 the combustion chamber (11) or to the air duct (18)
 through a pipe or duct (37).
3. Partially-premixed gas burner appliance as claimed
 in claim 1 or 2, wherein

the gas outlet pressure regulator (25) of the
 pneumatic gas control valve comprises a dia-
 phragm (30),
 the first chamber (33) of the gas outlet pressure

regulator (25) is positioned on a first side of said
 diaphragm (30) such that the pressure being
 present within the within first chamber (33) acts
 on the first side of said diaphragm (30),
 a second chamber (34) of the gas outlet pres-
 sure regulator (25) is positioned on a second
 side of said diaphragm (30), wherein the second
 chamber (34) of the gas outlet pressure regula-
 tor (25) is connected to a gas outlet chamber
 (21b) of the pneumatic gas control valve such
 that the gas outlet pressure being present within
 the within second chamber (34) acts on the
 second side of said diaphragm (30).

4. Partially-premixed gas burner appliance as claimed
 in claim 3, wherein

the gas outlet pressure regulator (25) comprises
 a first spring (31), wherein a spring force pro-
 vided by the first spring (31) acts on the first side
 of said diaphragm (30),
 the gas outlet pressure regulator (25) comprises
 a second spring (32), wherein a spring force
 provided by the second spring (32) acts on the
 second side of said diaphragm (30),
 the gas outlet pressure regulator (25) comprises
 a presetting unit (35) being configured to act on
 the first spring (31) and to adapt the respective
 spring force acting on the first side of said dia-
 phragm (30).

5. Partially-premixed gas burner appliance as claimed
 in claim 4, wherein the presetting unit (35) is config-
 ured to adapt the nominal-value of the gas outlet
 pressure of the pneumatic gas control valve.
6. Partially-premixed gas burner appliance as claimed
 in claims 3, 4 or 5, wherein
 the main gas valve (22) of the pneumatic gas control
 valve comprises a diaphragm (27) and a spring (28),

wherein the gas outlet pressure provided by the
 pneumatic gas control valve and a spring force
 provided by the spring (28) of the main gas valve
 (22) act on a first side of the diaphragm (27) of
 the main gas valve (22) tending to close the main
 gas valve (22),
 wherein a servo gas chamber (29) is positioned
 on a second side of the diaphragm (28) of the
 main gas valve (22), wherein a servo gas pres-
 sure being present within the servo gas chamber
 (28) acts on the second side of the diaphragm
 (27) of the main gas valve (22) tending to open
 the main gas valve (22),
 wherein the servo gas chamber (29) is con-
 nected to the servo gas valve (24) of the pneu-
 matic gas control valve and to the gas outlet
 pressure regulator (25) of the pneumatic gas

control valve.

7. Partially-premixed gas burner appliance as claimed in claim 6, wherein the servo gas chamber (29) is connected to the gas outlet pressure regulator (25) through a pressure relief valve (38) integrated in the diaphragm (30) of the gas outlet pressure regulator (25). 5
8. Partially-premixed gas burner appliance as claimed in one of claims 1 to 7, wherein 10
- a gas burner rod (12) having at least two segments (12a, 12b) is positioned within the combustion chamber (11), 15
- the combustion chamber (11) comprises for each segment (12a, 12b) of the gas burner rod (12) at least one individual gas inlet port (11G),
- the pneumatic gas control valve provides a gas flow to each of the individual gas inlet ports (11G) of the combustion chamber (11). 20
9. Partially-premixed gas burner appliance as claimed in claim 8, wherein 25
- a shut off valve (41) is assigned to at least one of the individual gas inlet ports (11G) to selectively open or close the respective gas inlet port (11G) thereby selectively operating the respective segment (12a, 12b) of the gas burner rod (12). 30

Patentansprüche

1. Teilvormischgasbrennervorrichtung (10), umfassend: 35
- eine Brennkammer (11),
- ein Gebläse (17), das dazu ausgelegt ist, einen Luftstrom zu der Brennkammer (11) bereitzustellen, 40
- wobei das Gebläse (17) einem Lufteinlassanschluss (11A) der Brennkammer (11) oder einem Luftkanal (18) zugeordnet ist, der dazu ausgelegt ist, die Luft zu dem Lufteinlassanschluss (11A) bereitzustellen, 45
- ein Luftstrombegrenzungselement (19), das dem Lufteinlassanschluss (11A) der Brennkammer (11) oder dem Luftkanal (18) zugeordnet und dazu ausgelegt ist, einen Druckabfall bereitzustellen, so dass der Druck stromabwärts des Luftstrombegrenzungselements (19) niedriger ist als der Druck stromaufwärts des Luftstrombegrenzungselements (19), 50
- einen Gasmodulator (20), der dazu ausgelegt ist, einen Gasstrom zu der Brennkammer (11) bereitzustellen, 55

wobei ein erster Teil der durch das Gebläse (17) bereitgestellten Luft mit dem Gasstrom vorgemischt wird, bevor das Gas verbrannt wird,

wobei ein zweiter Teil der durch das Gebläse (17) bereitgestellten Luft mit dem Gas gemischt wird, während das Gas verbrannt wird,

wobei der Gasmodulator (20) ein pneumatisches Gassteuerventil ist, das dazu ausgelegt ist, in einer Vollvormischgasbrennervorrichtung verwendet zu werden, wobei das pneumatische Gassteuerventil ein Hauptgasventil (22), ein Sicherheitsgasventil (23), ein Servogasventil (24) und einen Gasauslassdruckregler (25) aufweist, wobei der Gasauslassdruckregler (25), nämlich eine erste Kammer (33) des Gasauslassdruckreglers (25), in der ein Druck vorhanden ist, der den Nominalwert des Gasauslassdrucks des pneumatischen Gassteuerventils beeinflusst, mit dem Lufteinlassanschluss (11A) oder mit dem Luftkanal (18) stromaufwärts des Luftstrombegrenzungselements (19) verbunden ist, so dass der durch das pneumatische Gassteuerventil bereitgestellte Gasauslassdruck von dem durch das Gebläse (17) stromaufwärts des Luftstrombegrenzungselements (19) bereitgestellten Luftdruck abhängt.

2. Teilvormischgasbrennervorrichtung nach Anspruch 1, wobei die erste Kammer (33) des Gasauslassdruckreglers (25) des pneumatischen Gassteuerventils über ein Rohr oder einen Kanal (37) mit dem Lufteinlassanschluss (11A) der Brennkammer (11) oder mit dem Luftkanal (18) verbunden ist.

3. Teilvormischgasbrennervorrichtung nach Anspruch 1 oder 2, wobei

der Gasauslassdruckregler (25) des pneumatischen Gassteuerventils eine Membran (30) umfasst,

die erste Kammer (33) des Gasauslassdruckreglers (25) auf einer ersten Seite der Membran (30) positioniert ist, so dass der innerhalb der ersten Kammer (33) vorhandene Druck auf die erste Seite der Membran (30) wirkt,

eine zweite Kammer (34) des Gasauslassdruckreglers (25) auf einer zweiten Seite der Membran (30) positioniert ist, wobei die zweite Kammer (34) des Gasauslassdruckreglers (25) mit einer Gasauslasskammer (21b) des pneumatischen Gassteuerventils verbunden ist, so dass der innerhalb der zweiten Kammer (34) vorhandene Gasauslassdruck auf die zweite Seite der

Membran (30) wirkt.

4. Teilvormischgasbrennervorrichtung nach Anspruch 3, wobei

der Gasauslassdruckregler (25) eine erste Feder (31) umfasst, wobei eine durch die erste Feder (31) bereitgestellte Federkraft auf die erste Seite der Membran (30) wirkt, der Gasauslassdruckregler (25) eine zweite Feder (32) umfasst, wobei eine durch die zweite Feder (32) bereitgestellte Federkraft auf die zweite Seite der Membran (30) wirkt, der Gasauslassdruckregler (25) eine Voreinstelleinheit (35) umfasst, die dazu ausgelegt ist, auf die erste Feder (31) zu wirken und die jeweilige auf die erste Seite der Membran (30) wirkende Federkraft anzupassen.

5. Teilvormischgasbrennervorrichtung nach Anspruch 4, wobei die Voreinstelleinheit (35) dazu ausgelegt ist, den Nominalwert des Gasauslassdrucks des pneumatischen Gassteuerventils anzupassen.

6. Teilvormischgasbrennervorrichtung nach Anspruch 3, 4 oder 5, wobei

das Hauptgasventil (22) des pneumatischen Gassteuerventils eine Membran (27) und eine Feder (28) umfasst, der durch das pneumatische Gassteuerventil bereitgestellte Gasauslassdruck und eine durch die Feder (28) des Hauptgasventils (22) bereitgestellte Federkraft auf eine erste Seite der Membran (27) des Hauptgasventils (22) wirken, was dazu tendiert, das Hauptgasventil (22) zu schließen, eine Servogaskammer (29) auf einer zweiten Seite der Membran (27) des Hauptgasventils (22) positioniert ist, wobei ein innerhalb der Servogaskammer (29) vorhandener Servogasdruck auf die zweite Seite der Membran (27) des Hauptgasventils (22) wirkt, was dazu tendiert, das Hauptgasventil (22) zu öffnen, wobei die Servogaskammer (29) mit dem Servogasventil (24) des pneumatischen Gassteuerventils und mit dem Gasauslassdruckregler (25) des pneumatischen Gassteuerventils verbunden ist.

7. Teilvormischgasbrennervorrichtung nach Anspruch 6, wobei die Servogaskammer (29) durch ein in die Membran (30) des Gasauslassdruckreglers (25) integriertes Druckentlastungsventil (38) mit dem Gasauslassdruckregler (25) verbunden ist.

8. Teilvormischgasbrennervorrichtung nach einem der Ansprüche 1 bis 7, wobei

ein Gasbrennerstab (12) mit mindestens zwei Segmenten (12a, 12b) innerhalb der Brennkammer (11) positioniert ist, die Brennkammer (11) für jedes Segment (12a, 12b) des Gasbrennerstabs (12) mindestens einen einzelnen Gaseinlassanschluss (11G) umfasst, das pneumatische Gassteuerventil einen Gasstrom zu jedem der einzelnen Gaseinlassanschlüsse (11G) der Brennkammer (11) bereitstellt.

9. Teilvormischgasbrennervorrichtung nach Anspruch 8, wobei ein Absperrventil (41) mindestens einem der einzelnen Gaseinlassanschlüsse (11G) zugeordnet ist, um den jeweiligen Gaseinlassanschluss (11G) selektiv zu öffnen oder zu schließen, wodurch das jeweilige Segment (12a, 12b) des Gasbrennerstabs (12) selektiv betrieben wird.

Revendications

1. Appareil de type brûleur à gaz partiellement prémélangé (10), comprenant :

une chambre de combustion (11),
un ventilateur (17) conçu pour fournir un flux d'air à la chambre de combustion (11),
le ventilateur (17) étant associé à un orifice d'entrée d'air (11A) de la chambre de combustion (11) ou à un conduit d'air (18) conçu pour fournir de l'air à l'orifice d'entrée d'air (11A),
un élément de restriction de flux d'air (19) associé à l'orifice d'entrée d'air (11A) de la chambre de combustion (11) ou au conduit d'air (18) et conçu pour fournir une chute de pression de sorte que la pression en aval de l'élément de restriction de flux d'air (19) soit inférieure à la pression en amont de l'élément de restriction de flux d'air (19),
un modulateur de gaz (20) conçu pour fournir un flux de gaz à la chambre de combustion (11),

une première partie de l'air fourni par le ventilateur (17) étant prémélangée au flux de gaz avant que le gaz ne soit brûlé,
une seconde partie de l'air fourni par le ventilateur (17) étant mélangée au gaz pendant que le gaz est brûlé,
le modulateur de gaz (20) étant une soupape de régulation de gaz pneumatique conçue pour être utilisée dans un appareil de type brûleur à gaz entièrement prémélangé, la soupape de régulation de gaz pneumatique ayant une soupape de gaz principale (22), une soupape de gaz de sécurité (23), une soupape de gaz asservie

- (24) et un régulateur de pression de sortie de gaz (25),
le régulateur de pression de sortie de gaz (25), à savoir une première chambre (33) du régulateur de pression de sortie de gaz (25) dans laquelle est présente une pression qui influence la valeur nominale de la pression de sortie de gaz de la soupape de régulation de gaz pneumatique, étant raccordé à l'orifice d'entrée d'air (11A) ou au conduit d'air (18) en amont de l'élément de restriction de flux d'air (19) de sorte que la pression de sortie de gaz fournie par la soupape de régulation de gaz pneumatique dépende de la pression d'air fournie par le ventilateur (17) en amont de l'élément de restriction de flux d'air (19).
2. Appareil de type brûleur à gaz partiellement prémélangé selon la revendication 1, la première chambre (33) du régulateur de pression de sortie de gaz (25) de la soupape de régulation de gaz pneumatique étant raccordée à l'orifice d'entrée d'air (11A) de la chambre de combustion (11) ou au conduit d'air (18) par l'intermédiaire d'un tuyau ou d'une conduite (37).
3. Appareil de type brûleur à gaz partiellement prémélangé selon la revendication 1 ou 2,
le régulateur de pression de sortie de gaz (25) de la soupape de régulation de gaz pneumatique comprenant une membrane (30),
la première chambre (33) du régulateur de pression de sortie de gaz (25) étant positionnée sur un premier côté de ladite membrane (30) de sorte que la pression présente à l'intérieur de la première chambre (33) agisse sur le premier côté de ladite membrane (30),
une seconde chambre (34) du régulateur de pression de sortie de gaz (25) étant positionnée sur un second côté de ladite membrane (30), la seconde chambre (34) du régulateur de pression de sortie de gaz (25) étant raccordée à une chambre de sortie de gaz (21b) de la soupape de régulation de gaz pneumatique de sorte que la pression de sortie de gaz présente dans la seconde chambre (34) agisse sur le second côté de ladite membrane (30).
4. Appareil de type brûleur à gaz partiellement prémélangé selon la revendication 3,
le régulateur de pression de sortie de gaz (25) comprenant un premier ressort (31), une tension de ressort fournie par le premier ressort (31) agissant sur le premier côté de ladite membrane (30),
le régulateur de pression de sortie de gaz (25) comprenant un second ressort (32), une tension de ressort fournie par le second ressort (32) agissant sur le second côté de ladite membrane (30),
le régulateur de pression de sortie de gaz (25) comprenant une unité de pré réglage (35) conçue pour agir sur le premier ressort (31) et pour adapter la tension de ressort respective agissant sur le premier côté de ladite membrane (30).
5. Appareil de type brûleur à gaz partiellement prémélangé selon la revendication 4, l'unité de pré réglage (35) étant conçue pour adapter la valeur nominale de la pression de sortie de gaz de la soupape de régulation de gaz pneumatique.
6. Appareil de type brûleur à gaz partiellement prémélangé selon la revendication 3, 4 ou 5,
la soupape de gaz principale (22) de la soupape de régulation de gaz pneumatique comprenant une membrane (27) et un ressort (28),
la pression de sortie de gaz fournie par la soupape de régulation de gaz pneumatique et une tension de ressort fournie par le ressort (28) de la soupape de gaz principale (22) agissant sur un premier côté de la membrane (27) de la soupape de gaz principale (22) tendant à fermer la soupape de gaz principale (22),
une chambre de gaz asservie (29) étant positionnée sur un second côté de la membrane (28) de la soupape de gaz principale (22), une pression de gaz asservie présente à l'intérieur de la chambre de gaz asservie (28) agissant sur le second côté de la membrane (27) de la soupape de gaz principale (22), tendant à ouvrir la soupape de gaz principale (22),
la chambre de gaz asservie (29) étant raccordée à la soupape de gaz asservie (24) de la soupape de régulation de gaz pneumatique et au régulateur de pression de sortie de gaz (25) de la soupape de régulation de gaz pneumatique.
7. Appareil de type brûleur à gaz partiellement prémélangé selon la revendication 6, la chambre à gaz asservie (29) étant raccordée au régulateur de pression de sortie de gaz (25) par l'intermédiaire d'une soupape de décharge (38) intégrée dans la membrane (30) du régulateur de pression de sortie de gaz (25).
8. Appareil de type brûleur à gaz partiellement prémélangé selon l'une des revendications 1 à 7,
une tige de brûleur à gaz (12) comportant au moins deux segments (12a, 12b) étant placée à l'intérieur de la chambre de combustion (11),

la chambre de combustion (11) comprenant pour chaque segment (12a, 12b) de la tige de brûleur à gaz (12) au moins un orifice d'entrée de gaz (11G) individuel,

la soupape de régulation de gaz pneumatique 5
fournissant un flux de gaz à chacun des orifices d'entrée de gaz (11G) individuels de la chambre de combustion (11).

9. Appareil de type brûleur à gaz partiellement prémélangé selon la revendication 8, une soupape d'arrêt (41) étant associée à au moins un des orifices d'entrée de gaz (11G) individuels pour ouvrir ou fermer sélectivement l'orifice d'entrée de gaz (11G) respectif, actionnant ainsi sélectivement le segment (12a, 12b) respectif de la tige de brûleur à gaz (12). 10
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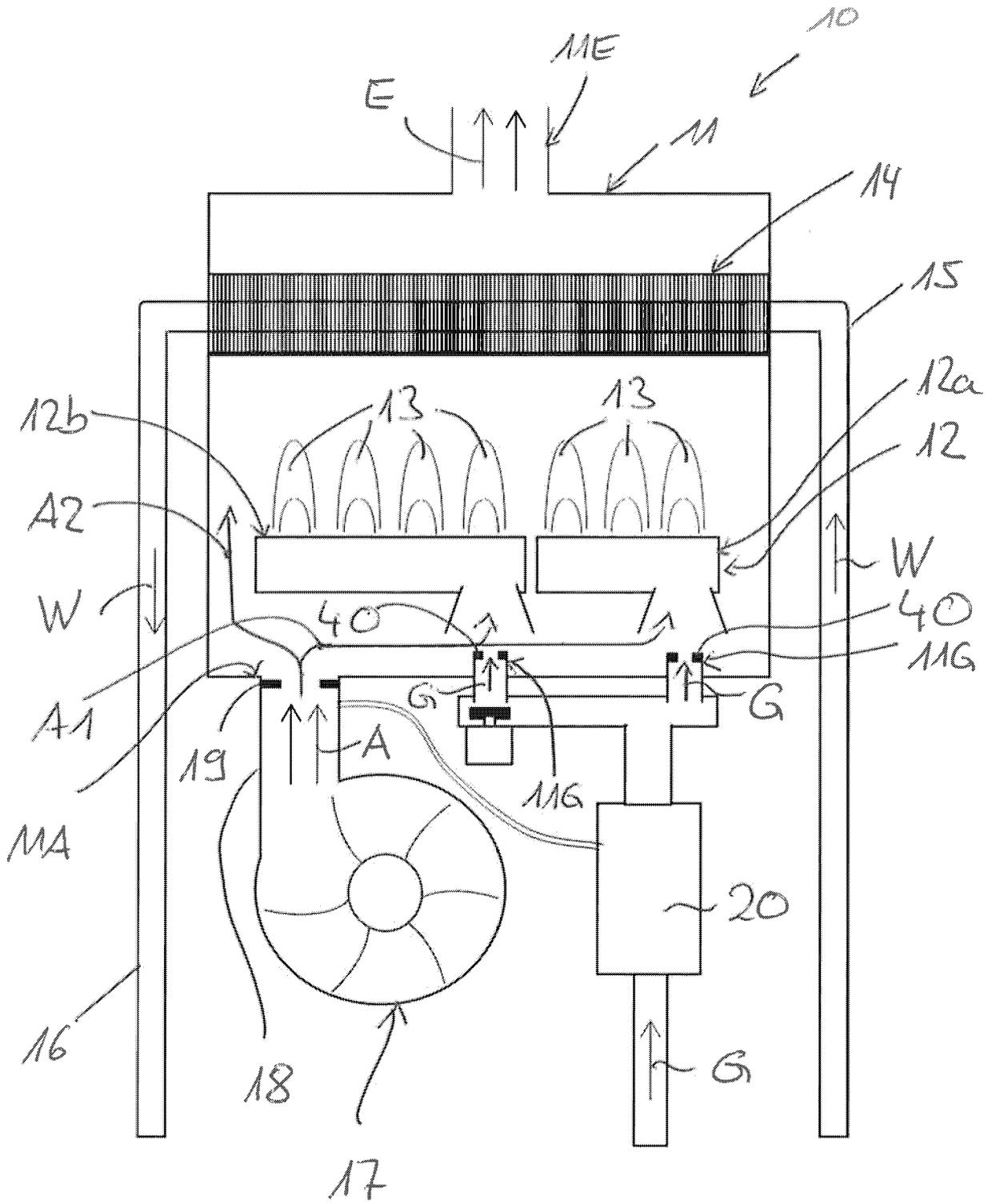


Fig. 1

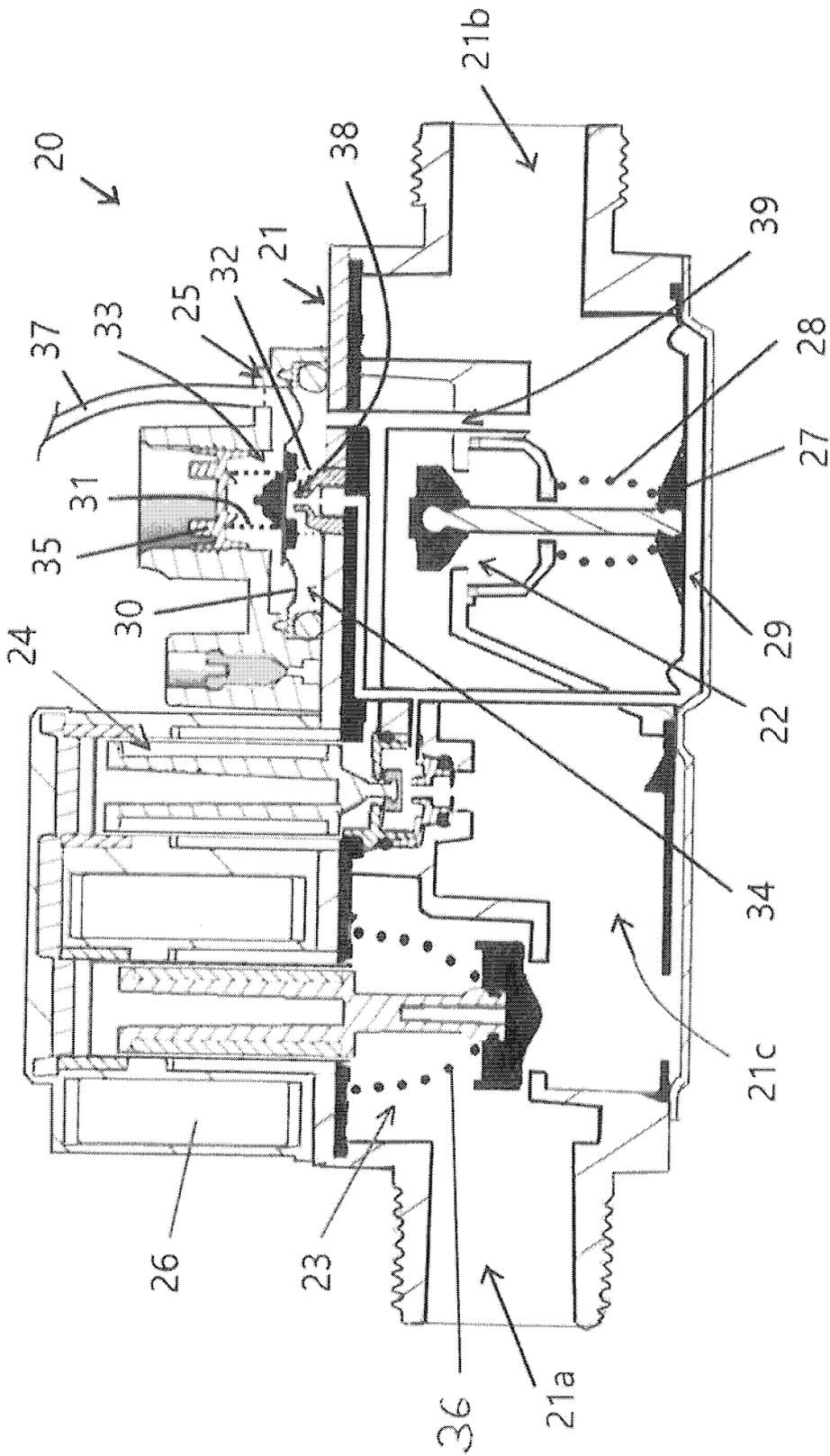


Fig. 2

REFERENCES CITED IN THE DESCRIPTION

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