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(54) NON CONDENSING PREMIX GAS BURNERS

NICHTKONDENSIERENDER GASSBRENNER MIT VORMISCHUNG

BRULEURS A GAZ A PREMELANGE SANS CONDENSATION

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(73) Proprietor: **BEKAERT COMBUSTION TECHNOLOGY BV**
8550 Zwevegem (BE)

(72) Inventors:
- **TEN HOEVE, Dirk**
NL-7961 LD Ruinerwold (NL)
- **VAN WIJK, Arnold**
NL-9405 PH Assen (NL)

(74) Representative: **Messely, Marc**
NV BEKAERT SA
Industrial Property Department - 6030
Bekaertstraat 2
8550 Zwevegem (BE)

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Description

Field of the invention.

[0001] The present invention relates to non condensing premix gas burners and methods to operate non condensing premix gas burners.

Background of the invention.

[0002] Premix gas burners are well known in the art. An advantage of premix burners is that low NOx and CO content is measured in the exhaust gasses and a relatively high efficiency may be obtained. The latter especially when the premix burner is fired using a lower firing load. According to the European standard EN297, well-defined efficiencies are to be met for gas burner systems having a specified maximum firing load Pn (expressed in kW).

[0003] The premix combustible gas mixture may be provided to the burner membrane in the premix burner in many different ways. Many improvements were made to the operation of such premix burners, e.g. to reduce the 'vibration' of the flame front by splitting the air stream in two parts, being separately conducted to the flame front as explained in US4752213.

[0004] An advantage of premix burners is that, when the firing load (or firing rate) is lower, the exhaust gasses are even more cooled, so the efficiency increases, when such premix burners are 'modulated' towards lower firing rates.

[0005] However, here also a disadvantage is met. Since the exhaust gasses are cooled to a lower temperature when being fired at lower firing rates, the exhaust gasses may condense. Such condensation occurs depending on the firing rate and the temperature of the heat exchanging unit. Usually, condensation may occur at firing rates of less than 40%. Condensation may also occur in the exhaust system.

[0006] To overcome this condensation , EP 0614045, as well as EP 0866270, described that the dewing point of the flue gas can be lowered by delivery of cool air to the chimney of the boiler or to the burning zone, respectively.

[0007] US 4087962 describes a combustor wherein low NOx emissions are attained by cooling of the flame by mixing secondary air, which inevitably also lowers the dewing point of the flue gases.

Summary of the invention.

[0008] The present invention has as an object to provide a method for operating non-condensing premix gas burners, firing premix combustible gas at lower firing rates, in the mean time reducing the dew point of the exhaust gas of the premix gas burner and obtaining an required efficiency at this firing rate, according to EN297, being more than 84+2*log(Pn) at full load Pn or "maximum firing rate" and preferably more than 84+3*log(Pn) at part load, being 30% of Pn according to EN 297. It is further an object of the present invention to provide a premix gas burner, being adapted to operated using such method of reducing the dew point of the exhaust gas.

[0009] According to the present invention a method for operating non-condensing premix gas burners comprises the step of draughting a total volume of exhaust gas Vtotal through the housing of the non-condensing premix gas burner. Typically for premix gas burners as subject of the invention, a forced draught is to be provided. Usually, but not necessarily, applying a draughting device such as a fan or ventilator in the chimney or exhaust evacuation system of the burner provides this forced draught. Alternatively, the air, for both premix mixture and secondary air, is blown into the burner house by an air supply device in stead of a draughting device. The air is then supplied by e.g. a fan of ventilator.

[0010] The method further comprises the step of combusting an amount of premix combustible gas. The amount is determined by the thermal energy, which is to be delivered by the non-condensing premix gas burner at that moment. This combustion operation provides an amount of flue gas Vp, which is provided in the burner house and which will be cooled on the heat exchanging device installed inside this burner house, between the burner membrane, where the combustion takes place, and the exhaust evacuation system. According to the type and dimensions of the heat exchanging device, the surface and combustion capacity of the burner membrane and the draughting device, the volume Vp may vary between a maximum volume Vpmax and a minimum volume Vpmin. When the maximum Vp is provided, the combustion is executed at a firing rate FR of 100%, or, in other words, at maximum firing rate FRmax or at full load Pn. When less Vp is provided, the firing rate is defined as FR= Vp/Vpmax*100.

[0011] The ratio air/gas of the premix combustible gas is set to a fixed value. Usually, an air excess in the range of 10% to 40%, most usually 30% of air excess is set, independent from the volume of premix combustible gas which is combusted. Such a. fixed ratio of air/gas of the premix combustible gas applied provides a flue gas which has a set dew point Tdp at an operational pressure in the burner house.

[0012] Usually, the minimum firing rate FRmin=Vpmin/Vpmax is not equal to 0%. This minimum firing rate is defined as the minimum FR to have a stable combustion process. FR less than FRmin do not guarantee an uninterrupted or stable combustion.

[0013] When a premix burner is operated as known in the art, there is however another lower limit for the firing rate which is defined by the efficiency at maximum firing rate (Ymax) and the minimum temperature which may occur on the heat exchanging unit (Tmin). The heat exchanging unit of a premix burner is dimensioned in such a way that for FR=100%, so for maximum firing load of Pn, a specified efficiency is obtained. Usually this efficiency is set according to EN297, being at least 84+2*log (Pn). For a premix burner operated as known in the art, for a certain lower firing rate FR1, the flue gas volume Vp1 would be cooled unto its dew point Tdp, due to this minimum temperature (Tmin) possible of the heat exchanger. The obtained efficiency is then increased even up to 100%. FR1 is larger than FRmin, and usually larger than 40%. This means that for presently known premx burners, the firing rate is to be at least Frmin, thus usually more than 40% of the maximum firing rate FR max. Modulation at firing rates usually lower than 40% of the maximum firing rate, is not recommended due to the risk on condensing of the flue gas.

[0014] The premix combustible mixture used sets Tdp. A combustible mixture comprising no air excess has a dew point of 58°C. An air excess of 30% causes a dew point of 53°C, whereas air excess of 100% causes a dew point of 48°C.

[0015] According to the present invention, a certain volume of secondary air Vs is introduced in the burner house. This is done in such a way that the main part of the secondary air does not take part in the combustion process. Vs and Vp are brought together to form the total exhaust gas volume Vtotal., said exhaust gas having a new dew point Tdtotal The introduction of relatively cold secondary air causes the dew point of Vtotal to be less than Tdp. The method further comprises the step of determining the level of the new dew point Tdtotal by tuning the ratio Rsp, Rsp being Vs divided by Vp.

[0016] The amount of Vs is adjusted in such a way that, for all applicable firing rates, the condensation of the exhaust gas is avoided at the surface of the heat exchanging unit, even when this heat exchanging unit is at its lowest temperature applicable. Since Vs does not take part in the combustion reaction, no major changes in Nox or CO production was noticed, as compared to operating without secondary air supply. One understands that Vtotal substantially equals Vp+Vs.

[0017] According to the present invention, the volume of secondary air Vs added at a FR less than FR1, will be set in such a way that for FR<FR1, the exhaust gas volume Vtotal cannot be cooled to its dew point Tdtotal not even under the circumstance that the heat exchanging unit would be at its lowest temperature Tmin possible. Most preferably, the lowest temperature to which the total exhaust gas volume is cooled by the heat exchanging unit, is Tdtotal+20K. However, the exhaust gas Vtotal may be cooled to a temperature Texhaust, which is higher than its dew point Tdtotal, but which is lower than the dew point Tdp. However Vs added at a FR less than FR1 will be restricted in such a way that the efficiency will be more than 84+2*log(Pn) or even more than 84+3*log (Pn). An efficiency of more than 84+3*log(Pn) is preferred when FR is equal or smaller than 30% of the maximum firing rate FR (which is the equivalent of the part load of 30% of Pn according to EN279).

[0018] It was found that to avoid this condensation in the firing rate range lower than FR1, and still being more than 84+2*log(Pn) or even more than 84+3*log(Pn), the ratio Rsp is to increase for decreasing FR in the range FRmin<FR<FR1. The tuning of Rsp determines the dew point Tdtotal.

[0019] The method of firing a premix burner as subject of the invention enables to modulate a premix burner in a range which is larger as known in the art, still at an acceptable efficiency. Another advantage is that the efficiency at FR=100% may be set to a higher value, meanwhile avoiding condensation of the exhaust gasses over a larger range of firing rates, which would occur when firing the premix burner without secondary air supply.

[0020] Suppose a volume of flue gas Vp1 is provided by a premix burner. The firing rate is FR1. According to the method as subject of the invention, the draughting device will conduct a gas volume Vtotal1=Vp1+Vs1 over the heat exchanger. This volume Vtotal1 will be cooled down, comparably as in the operating situation without secondary air. However, the mixture of flue gas and secondary air will not condense yet, since the total amount of H2O in this volume is lower as compared to the water content of the flue gas when no secondary air was supplied. Since relatively cold secondary air was added in the premix gas burner housing, the efficiency of the heat transfer of Vtotal on the heat exchanging unit was reduced to some extend. Depending on the ratio Rsp, this reduction of efficiency however is limited according to Rsp.

[0021] According to the present invention, the Rsp decreases for increasing FR in the range FR<FR1. For FR> FR1, there is even no need for secondary air, since there is no risk for condensing the flue gasses. Vs may even be 0 for this FR range. Preferably however, amounts of Vs are introduced when FR>FR1, typically in the FR range 40% to 100%, since it was found that, especially for high FR , the influence of this Vs on the efficiency is limited and the efficiency may be kept larger or equal to the efficiency as set for FR=100%. When FR is decreased to smaller firing rates of FR<FR1, e.g. less than 40%, the Rsp is increased.Preferably, the Rsp changes gradually, with changing FR, in the range of 0 to 2.5. For a firing rate FR<FR1, the Rsp is preferably more than 1, e.g. more than 1.5 or even more than 2 such as 2.5. For Fr more than FR1, the Rsp is preferably less than 1, or even lower than 0.5 such as 0.42.

[0022] It is also an object of the present invention to provide a premix burner which may be operated according to the operating method as described above.

[0023] A premix burner comprises a burner house, a burner membrane, a premix combustible gas inlet and a premix combustible gas mixing unit. The premix combustible gas mixing unit provides premix combustible gas to the burner membrane via the premix combustible gas inlet. A premix burner as subject of the invention, being operated according to the present invention, comprising extra means to enable secondary air to enter the burner house, e.g. by calibrated apertures in the burner house and comprises means to adjust the Rsp according to the possible firing rates.

[0024] In order to avoid that a substantial part of the secondary air takes part in the combustion reaction, the means to provide secondary air to the premix gas burner are located sufficiently remote from the burner membrane, preferably a distance of more than 30mm is taken into account. Advantageously, the means being apertures, these apertures are located substantially above the burner membrane, e.g. at a height, being more than 10mm or even more than 15mm above the burner membrane. Alternatively, a barrier encircling the burner membrane and extending above the burner membrane is provided. This barrier preferably extends more than 10 mm or even more than 15mm above the burner membrane. The secondary air cannot flow directly from the apertures, which may be located closer tot he burner membrane, to the flame front at the burner membrane, but this secondary air has to flow above the barrier to meet the flue gas.

[0025] A premix burner as subject of the invention further comprises different elements.

[0026] It comprises a burner house, an exhaust evacuation system, a premix combustible gas inlet and a burner membrane. A premix combustible gas mixing unit, preferably a ventury system, is mounted to the premix combustible gas inlet. The premix combustible gas is conducted to the burner membrane. Possibly, a mixing chamber and/or a gas diffuser system is present between premix combustible gas inlet and burner membrane.

[0027] At one side of the burner membrane, the premix gas is combusted. This combustion side of the burner membrane is pointing inwards the burner house.

[0028] A draughting unit, e.g. a fan or ventilator, may be mounted to the exhaust evacuation system and evacuates a certain amount of gas volume out of the burner house.

[0029] A heat exchanging unit is mounted between the exhaust evacuation system and the burner membrane. The gas volume evacuated by the draughting device is forced to flow over or through the heat exchanging unit.

[0030] According to the present invention, a premix burner further may comprise a certain number of slots or apertures in its burner house and a valve, installed in the premix combustible gas inlet, which can change the opening of the premix combustible gas inlet by opening or closing. This valve is hereafter referred to as "premix valve". The dimensions of the apertures or slots are calibrated and defined, together with the closing characteristics of the premix valve, in such a way that the premix burner is operated according to the method as subject of the invention.

[0031] A first type of premix burner is equipped with a draughting device, of which the volume of draughted gas is adjusted according to the required firing rate at a certain moment. E.g. a fan with adjustable motor speed may be used. Due to the draughting device, a depression is provided in the burner housing. Between premix combustible gas inlet and premix combustible gas mixing unit, a premix valve is installed, which opens or closes according to the depression, which is applied at the downstream side of the valve. The force, used to close the valve when the depression is decreased, may be e.g. the gravity force or caused by a spring system. Further, a gas inlet duct is used to provide combustion gas to the premix combustible gas mixing unit, preferably a ventury system. In this gas inlet duct, a valve controlling the amount of gas being supplied to the premix combustible gas mixing unit is used. This valve is hereafter referred to as "gas valve". This gas valve is controlled in such a way that, according to the volume passing through the premix combustible gas mixing inlet, an amount of gas is supplied to the premix combustible gas mixing unit to ensure the correct ratio air/gas of the premix combustible gas mixture. Usually, 30% of excess air is provided.

[0032] The draughting device, causing a certain depression in the burner house, draughts a volume Vtotal through the burner house. Vtotal will be determined by the required firing rate. According to the characteristics of the premix valve which opens to certain extend, the surface of the opening of the premix combustible gas mixing inlet will be set. According to this surface of the premix combustible gas mixing inlet, a certain amount of premix combustible gas mixture will be draughted through the premix combustible gas inlet and will be combusted providing Vp. An amount of secondary air Vs will be draughted through the additional openings in the burner house, in order to balance Vtotal=Vp+Vs. This volume Vtotal will be cooled on the heat exchanging unit, being at a temperature higher or equal to Tmin, to a temperature Texhaust. For firing rate FR, the ratio Rsp=Vs/Vp will be set to a certain value in such a way that Tdtotal<Texhaust, meanwhile providing a heat exchanging efficiency between heat exchanging unit and exhaust gas being more than 84+2*log(Pn) or even more than 84+3*log(Pn). An efficiency of more than 84+3*log(Pn) is preferred when FR is equal or smaller than 30% of the maximum firing rate FR . By controlling Rsp, these conditions for operating the premix burner as subject of the invention may be met.

[0033] When Vtotal is increased (since a higher FR is demanded), the depression will be increased and the premix valve will open to a larger extend. Vp increases accordingly, and Rsp may decrease or stay constant. In case the premix valve was already fully open, due to the higher depression, still more premix combustible gas mixture will be draught through the premix combustible gas mixing inlet, so again Vp will increase. Since the same depression change will cause a same proportional increase of Vs, Rsp will stay substantially constant.

[0034] When Vtotal is decreased (FR decreases), the premix valve will close due to the smaller depression. The surface of the premix combustible gas mixing inlet decreases, while the surface of the additional apertures for secondary air supply stay constant. Therefor Vp will decrease proportionally more than Vs, so, for decreasing Vtotal, Rsp=VsVp will increase. For a certain firing rate range, firing rates being relatively low, and depending on the temperature of the heat exchanging unit, the exhaust gas may be cooled to a temperature Texhaust<Tdp, Tdp being the dew point of the flue gas.

[0035] There is a certain firing rate FRmin, which is the lower limit of a stable operation of the premix burner. For this FRmin,

$$Vtotalmin=Vpmin+Vsmin.$$

[0036] A second type of premix burner is equipped with a draughting device, of which the volume of draughted gas is constant, independent to the required firing rate at a certain moment. E.g. a fan with constant motor speed may be used. Due to the draughting device, a depression is provided in the burner housing. In the premix combustible gas inlet, a premix valve is installed, which opens or closes according to the required firing rate. The force, used to control the valve when the depression is decreased, may be e.g. a stepper motor. Further, a gas inlet duct is used to provide combustion gas to the premix combustible gas mixing unit, preferably a ventury system. In this gas inlet duct, a valve controlling the amount of gas being supplied to the premix combustible gas mixing unit is used. This valve is hereafter referred to as "gas valve". This gas valve is controlled in such a way that, according to the volume of gas passing through the premix combustible gas mixing inlet, an amount of gas is supplied to the premix combustible gas mixing unit to ensure the correct ratio air/gas of the premix combustible gas mixture. Usually, 30% of excess air is provided.

[0037] The draughting device, causing a certain depression in the burner house, draughts a volume Vtotal through the burner house. According to the settings of the premix valve which opens to certain extend due to a demanded firing rate, the surface of the premix combustible gas mixing inlet will be set. According to this surface of the premix combustible gas mixing inlet, a certain amount of premix combustible gas mixture will be combusted providing Vp. An amount of secondary air Vs will be draughted through the additional openings in the burner house, in order to balance Vtotal=Vp+Vs. This volume Vtotal will be cooled on the heat exchanging unit, being at a temperature higher or equal to Tmin, to a temperature Texhaust. For firing rate FR, the ratio Rsp=Vs/Vp will be set to a certain value in such a way that Tdtotal<Texhaust, meanwhile providing a heat exchanging efficiency between heat exchanging unit and exhaust gas being more than 84+2*log(Pn) or even more than 84+3*log(Pn). An efficiency of more than 84+3*log(Pn) is preferred when FR is equal or smaller than 30% of the maximum firing rate FR . By controlling Rsp, these conditions for operating the premix burner as subject of the invention may be met.

[0038] When a higher FR is demanded, the premix valve will open further. Vp is increased accordingly, and Rsp may decrease or stay constant.

[0039] When a lower firing rate FR is required, the premix valve will close due to the changing in setting of the valve. The surface of the premix combustible gas mixing inlet decreases, while the surface of the additional apertures for secondary air supply stay constant. Therefor Vp will decrease proportionally whereas Vs, due to the increasing depression, will increase. As a result Rsp increases. Preferably the Rsp is adjusted to the range of 1 to 1.5 . For a certain firing rate range, firing rates being relatively low, and depending on the temperature of the heat exchanging unit, the exhaust gas may be cooled to a temperature Texhaust<Tdp, Tdp being the dew point of the flue gas.

[0040] There is a certain firing rate FRmin, which is the lower limit of a stable operation of the premix burner. For this FRmin,

$$Vtotalmin=Vpmin+Vsmin.$$

[0041] For this type of premix burners as subject of the invention, the premix valve may be adjusted directly depending on the firing load required, However, the valve may be adjusted indirectly, depending on a certain volume of gas, which is provided via the gas valve. This gas valve is adjusted according to the FR required. After the gas valve, or in the premix combustible gas inlet, the obtained pressure is measured. According to this pressure, the premix valve is opened, in order to provide a premix combustible gas mixture, having the correct ratio air/gas. The premix valve may be controlled by e.g. a spring system or a stepper motor. A control unit may control the opening or closing of the premix valve via this spring system or stepper motor.

[0042] An alternative premix gas burner uses the same elements as of a premix gas burner as described above, but the draughting device is not present. The air, for both premix mixture and secondary air, is blown into the burner house by an air supply device in stead of draughted into it by a draughting device. The air is supplied by e.g. a fan of ventilator to the apertures or slots and to the gas mixing unit.

Brief description of the drawings.

[0043] The invention will now be described into more detail with reference to the accompanying drawings wherein

- FIGURE 1 is a schematically view of a premix gas burner as subject of the invention.
- FIGURE 2, FIGURE 3, FIGURE 4, FIGURE 5 and FIGURE 6 are alternative embodiments of a premix gas burner as subject of the invention.

Description of the preferred embodiments of the invention.

[0044] A premix burner as subject of the invention, and being able to be operated using a method to reduce the dew point of the exhaust gas, is schematically shown in FIGURE 1. A premix gas burner comprises a burner house 101, an exhaust evacuation system 102, in which a drafting device 103 is comprised, and a heat exchanging unit 104. The premix gas burner further comprises a burner membrane 105, to which a premix combustible gas mixture is provided via a premix combustible gas inlet 106. Premix combustible gas is mixed in the premix combustible gas mixing unit 107, being e.g. a ventury system. A mixing and diffusion chamber 108 may be installed between premix combustible gas inlet 106 and burner membrane 105. According to the present invention, the burner house comprises apertures 109 and a premix valve 110. The draughting device 103 forces a total volume of exhaust gas into the exhaust evacuation system 102 (as indicated with arrow 120), draughting this volume through the heat exchanging unit 104. Controlling device 130, which e.g. controls the speed of the draughting device, in case the device is a fan, in function of the firing rate required, controls this volume the volume Vtotal is partially draught through the apertures 109, and partially through the premix combustible gas mixing unit 107. A volume of secondary air Vs is draught through the apertures 109 as indicated with arrow 121. The amount of air, draught through the premix combustible air mixing unit 107 (as indicated with arrow 122) requires a certain volume of gas, to be supplied and mixed with this air in order to provide the premix combustible gas. This gas volume is provided via gas inlet 111.

[0045] Possibly, this gas volume is controlled via a control device 112, e.g. a manometer, measuring the pressure in the premix combustible gas mixing unit at point 113. Depending on the pressure, the gas valve 114 is opened or closed. The premix combustible gas mixture is provided to and burned at the burner membrane 105, providing a volume of flue gas Vp as indicated with arrow 123. The volume of secondary air, which main part does not take part in the combustion reaction, is brought together with the flue gas volmume Vp in the burner house reducing the dew point of the exhaust gas as compared to the dew point of the flue gas. Dependent on the total volume Vtotal as demanded by the drafting device 103, the premix valve 110 will open or close to a certain extend. This premix valve may be closed by e.g. gravity force, or this force may be provided by e.g. a spring.the level of opening or closing of the premix valve 110 according to the volume Vtotal, controls the ratio Rsp, being Vs/Vp.

[0046] An alternative premix gas burner is shown in FIGURE 2. The burner functions in an identical way as shown in FIGURE 1, except that this burner does not comprise a draughting device. The burner comprises an air supply device 115, which provided a certain amount of air to apertures 109 and to the premix combustible gas mixing unit 107. The amount of air is controlled by a control device 130, which controls the amount of air supplied to the burner as indicated with arrow 124.

[0047] An alternative premix gas burner is shown in FIGURE 3. The burner functions in an identical way as shown in FIGURE 1, except that the draught device 103 constantly draughts the same volume of exhaust gas. The gas valve 114 is controlled by a control device, which adjusts the opening of the gas valve according to the required firing rate. Dependent on the amount of gas which passes through the gas valve, a control device 116, e.g. a manometer, controls the setting of the premix valve 110. The opening of the premix valve will control the ratio Rsp, being Vs/Vp.

[0048] Another alternative premix gas burner is shown in FIGURE 4. The burner functions in an identical way as shown in FIGURE 1, except that the premix valve 110 is controlled directly by a control device 130 and that the draughting device draughts a constant exhaust gas volume. The premix valve 110 is opened or closed according to the required firing rate, e.g. by using a stepper motor. The opening of the premix valve will control the ratio Rsp, being VsIVp.

[0049] Another alternative premix gas burner as subject of the invention is shown in FIGURE 5. The apertures 109, providing secondary air to the premix gas burner, are located significantly remote and above the burner membrane at a height 501 of at least 15mm.

[0050] The secondary air, which is flowing in the as indicated with arrow 121, does not take part in the combustion reaction.

[0051] Another alternative premix gas burner as subject of the invention is shown in FIGURE 6. The apertures 109, providing secondary air to the premix gas burner, are located closer to the burner membrane but around the burner membrane, a barrier 601 (e.g. a metal flange) is provided. This barrier 601 extends at least over a height 602 of 15mm above the burner membrane 105.at the time the secondary air, flowing in as indicated with arrow 121, reaches the flue gas above the barrier, the combustion reaction has already been completed.

Claims

1. A method of decreasing the dew point of the exhaust gas of a premix burner, said method comprising the steps of:

    - providing a volume of flue gas Vp by combusting a premix combustible gas mixture, said flue gas having a dew point Tdp;
    - introducing a volume of secondary air Vs in said burner house, wherein the main part of said secondary air does not take part in the combustion of said premix combustible gas mixture;
    - bringing said volume of flue gas Vp and said volume of secondary air together to form a total

volume of exhaust gas Vtotal, said exhaust gas having a new dew point Tdtotal, which is lower than said dew point Tdp of said flue gas
• determining the level of said new dew point Tdtotal by tuning the ratio Rsp, Rsp being Vs divided by Vp.

2. A method according to claim 1, further comprising the step of cooling said exhaust gas over heat exchanging unit.

3. A method according to claim 2, said cooling is done with efficiency of more than 84+2*log(Pn), said Pn being the full load of said premix gas burner.

4. A method according to claim 2 or 3, said cooling is done with efficiency of more than 84+3*log(Pn), when said premix burner is fired at a firing load of 30% of Pn.

5. A method according to claim 2 to 4, said exhaust gas is cooled to a temperature T lower than Tdp, said T is higher than Tdtotal.

6. A premix burner as for applying a method of operation as in one of the preceding claims, said burner comprising a burner house (101), a burner membrane (105), a premix combustible gas inlet (106) and a premix combustible gas mixing unit (107), said premix combustible gas mixing unit (107) providing premix combustible gas to said burner membrane (105) via said premix combustible gas inlet (106), said burner house (101)comprising apertures (109).to introduce a secondary air volume Vs, **characterized in that** said burner comprising a premix valve (110), said premix valve (110) being installed between premix combustible gas mixing unit (107) and premix combustible gas inlet (106), said premix valve (110) controlling ratio Rsp, said Rsp being Vs divided by Vp.

7. A premix burner as in claim 6, said premix valve (110) being closed by the gravity force.

8. A premix burner as in claim 6, said premix valve (110) being controlled by a spring system.

9. A premix burner as in claim 6, said premix valve (110) being controlled by a stepper motor.

10. A premix burner as in claim 6 to 9, said burner comprising a heat exchanging unit (104).

11. A premix burner as in claim 6 to 10, said burner comprising a draughting device (103).

12. A premix burner as in claim 6 to 10, said burner comprising an air supply device (115).

Patentansprüche

1. Verfahren zur Verringerung des Taupunkts des Abgases eines Vormischbrenners, wobei das Verfahren die folgenden Schritte umfasst:

- Bereitstellen eines Rauchgasvolumens Vp durch Verbrennung eines brennbaren Vormischgasgemisches, wobei das Rauchgas einen Taupunkt Tdp aufweist;
- Einleiten eines Sekundärluftvolumens Vs in das Brennergehäuse, wobei der Hauptteil des Sekundärgases nicht an der Verbrennung des brennbaren Vormischgasgemisches teilnimmt;
- Zusammenbringen des Rauchgasvolumens Vp und des Sekundärluftvolumens zur Bildung eines Gesamtabgasvolumens Vtotal, wobei das Abgas einen neuen Taupunkt Tdtoal aufweist, der niedriger ist als der Taupunkt Tdp des Rauchgases,
- Bestimmen der Höhe des neuen Taupunkts Tdtoal durch Einstellung des Verhältnisses Rsp, wobei Rsp Vs geteilt durch Vp ist.

2. Verfahren nach Anspruch 1, das weiterhin den Schritt des Kühlens des Abgases an der Wärmeaustauscheinheit umfasst.

3. Verfahren nach Anspruch 2, wobei das Kühlen mit einem Wirkungsgrad von mehr als 84+2*log(Pn) erfolgt, wobei Pn die volle Last des Vormischgasbrenners ist.

4. Verfahren nach Anspruch 2 oder 3, wobei das Kühlen mit einem Wirkungsgrad von mehr als 84+3*log (Pn) erfolgt, wenn der Vormischbrenner mit einer Befeuerungsbeladung von 30% der Pn befeuert wird.

5. Verfahren nach Anspruch 2 bis 4, wobei das Abgas auf eine Temperatur T gekühlt wird, die niedriger ist als Tdp, wobei T höher ist als Tdtotal.

6. Vormischbrenner zur Durchführung eines Betriebsverfahrens nach einem der vorhergehenden Ansprüche, wobei der Brenner ein Brennergehäuse (101), eine Brennermembran (105), einen Einlass (106) für brennbares Vormischgas und eine Mischeinheit (107) für brennbares Vormischgas umfasst, wobei die Mischeinheit (107) für brennbares Vormischgas der Brennermembran (105) über den Einlass (106) für brennbares Vormischgas brennbares Vormischgas zuführt, wobei das Brennergehäuse (101) Öffnungen (109) aufweist, um ein Sekundärluftvolumen Vs einzuleiten, **dadurch gekennzeichnet, dass** der Brenner ein Vormischventil (110) umfasst, wobei das Vormischventil (110) zwischen der Mischeinheit (107) für brennbares Vormischgas und dem Einlass (106) für brennbares Vormischgas installiert ist, wobei das Vormischventil (110) das Verhältnis Rsp steuert, wobei Rsp Vs geteilt durch Vp ist.

7. Vormischbrenner nach Anspruch 6, wobei das Vormischventil (110) durch Schwerkraft geschlossen wird.

8. Vormischbrenner nach Anspruch 6, wobei das Vormischventil (110) durch ein Federsystem gesteuert wird.

9. Vormischbrenner nach Anspruch 6, wobei das Vormischventil (110) durch einen Schrittmotor gesteuert wird.

10. Vormischbrenner nach Anspruch 6 bis 9, wobei der Brenner eine Wärmeaustauscheinheit (104) umfasst.

11. Vormischbrenner nach Anspruch 6 bis 10, wobei der Brenner ein Sauggehäuse (103) umfasst.

12. Vormischbrenner nach Anspruch 6 bis 10, wobei der Brenner eine Luftzufuhrvorrichtung (115) umfasst.

Revendications

1. Procédé pour diminuer le point de rosée du gaz d'échappement d'un brûleur à prémélange, ledit procédé comprenant les étapes suivantes :

- fournir un volume de gaz de fumée Vp en brûlant un mélange de gaz combustible de prémélange, ledit gaz de fumée ayant un point de rosée Tdp ;
- introduire un volume d'air secondaire Vs dans le boîtier dudit brûleur, la majeure partie dudit air secondaire ne participant pas à la combustion dudit mélange de gaz combustible de prémélange ;
- combiner ledit volume de gaz de fumée Vp et ledit volume d'air secondaire pour former un volume total de gaz d'échappement Vtotal, ledit gaz d'échappement ayant un nouveau point de rosée Tdtotal, qui est inférieur audit point de rosée Tdp dudit gaz de fumée,
- déterminer le niveau dudit nouveau point de rosée Tdtotal en ajustant le rapport Rsp, Rsp étant Vs divisé par Vp.

2. Procédé selon la revendication 1, comprenant en outre l'étape consistant à refroidir ledit gaz d'échappement sur une unité d'échange de chaleur.

3. Procédé selon la revendication 2, dans lequel ledit refroidissement est effectué avec une efficacité de plus de 84+2*log(Pn), Pn étant la charge totale dudit brûleur à gaz à prémélange.

4. Procédé selon la revendication 2 ou 3, dans lequel ledit refroidissement est effectué avec une efficacité de plus de 84+3*log(Pn), lorsque ledit brûleur à prémélange fonctionne à une charge de combustion de 30% de Pn.

5. Procédé selon les revendications 2 à 4, dans lequel ledit gaz d'échappement est refroidi à une température T inférieure à Tdp, ladite T étant supérieure à Tdtotal.

6. Brûleur à prémélange pour mettre en oeuvre un procédé de fonctionnement selon l'une quelconque des revendications précédentes, ledit brûleur comprenant un boîtier de brûleur (101), une membrane de brûleur (105), une entrée de gaz combustible de prémélange (106), et une unité de mélange de gaz combustible de prémélange (107), ladite unité de mélange de gaz combustible de prémélange (107) fournissant du gaz combustible de prémélange à ladite membrane de brûleur (105) par le biais de ladite entrée de gaz combustible de prémélange (106), ledit boîtier de brûleur (101) comprenant des ouvertures (109) pour introduire un volume d'air secondaire Vs, **caractérisé en ce que** ledit brûleur comprend une soupape de prémélange (110), ladite soupape de prémélange (110) étant installée entre l'unité de mélange de gaz combustible de prémélange (107) et l'entrée de gaz combustible de prémélange (106), ladite soupape de prémélange (110) contrôlant le rapport Rsp, ledit Rsp étant Vs divisé par Vp.

7. Brûleur à prémélange selon la revendication 6, dans lequel ladite soupape de prémélange (110) est fermée par la force de gravité.

8. Brûleur à prémélange selon la revendication 6, dans lequel ladite soupape de prémélange (110) est commandée par un système de ressort.

9. Brûleur à prémélange selon la revendication 6, dans lequel ladite soupape de prémélange (110) est commandée par un moteur pas à pas.

10. Brûleur à prémélange selon l'une quelconque des revendications 6 à 9, ledit brûleur comprenant une unité d'échange de chaleur (104).

11. Brûleur à prémélange selon l'une quelconque des revendications 6 à 10, dans lequel ledit brûleur comprend un dispositif de ventilation (103).

12. Brûleur à prémélange selon l'une quelconque des revendications 6 à 10, ledit brûleur comprenant un dispositif d'alimentation en air (115).

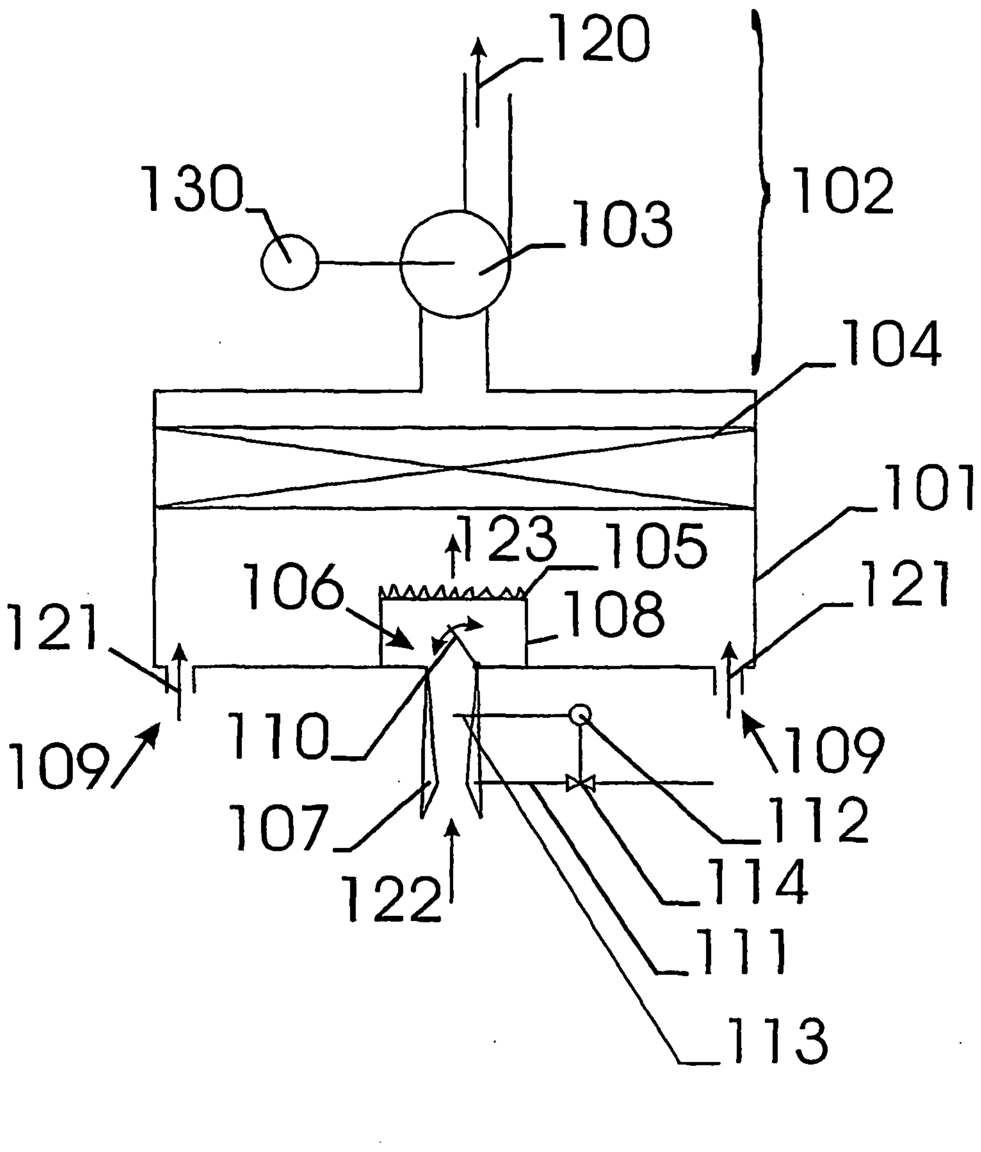
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Fig. 1

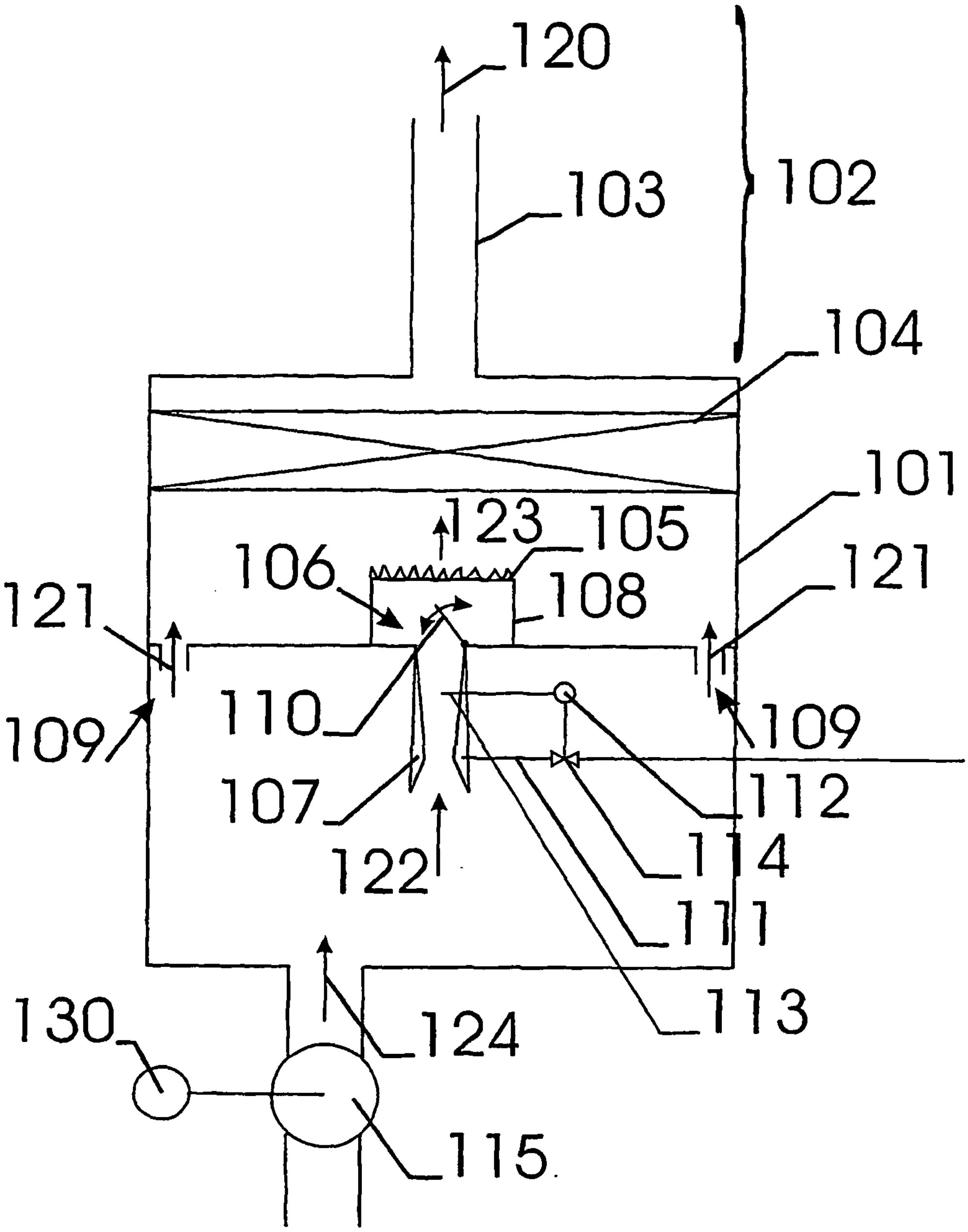
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Fig. 2

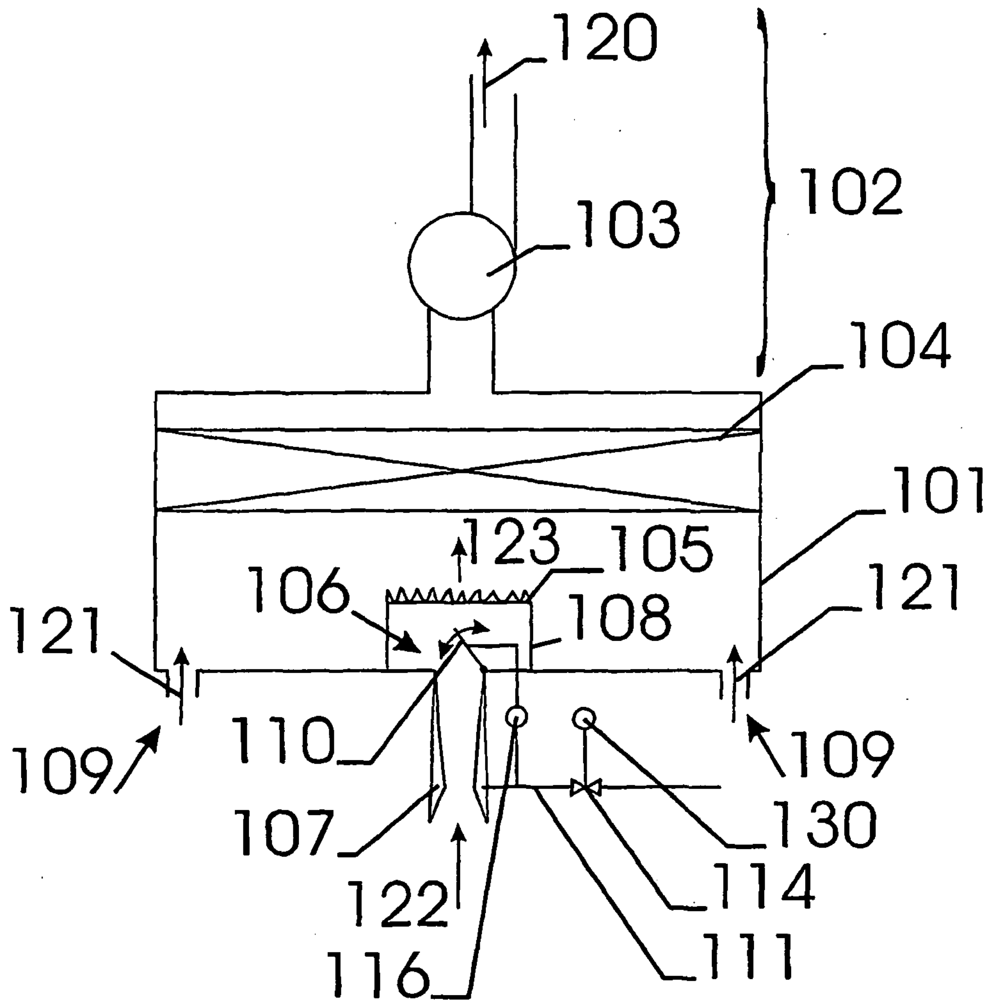
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Fig. 3

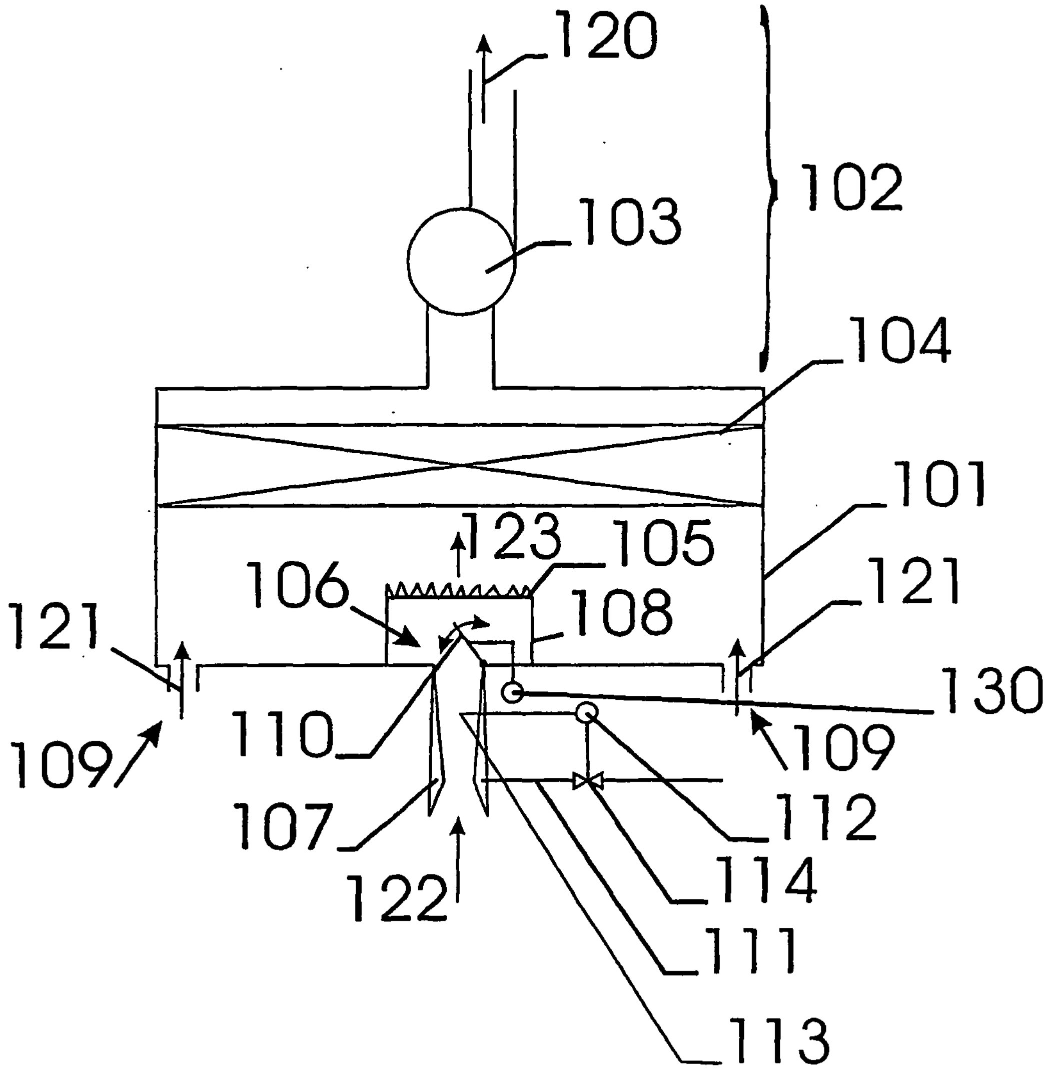
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Fig. 4

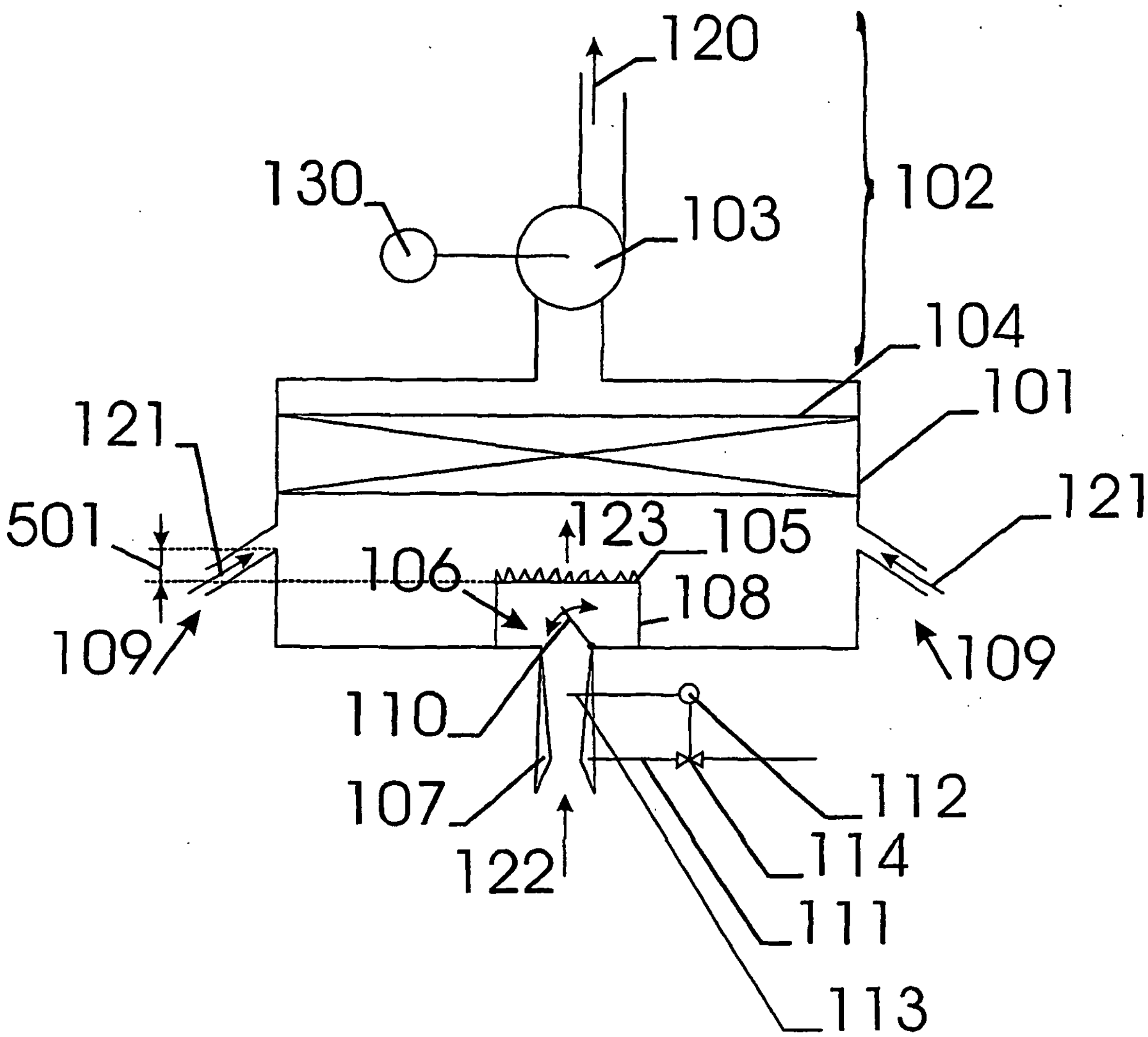
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Fig. 5

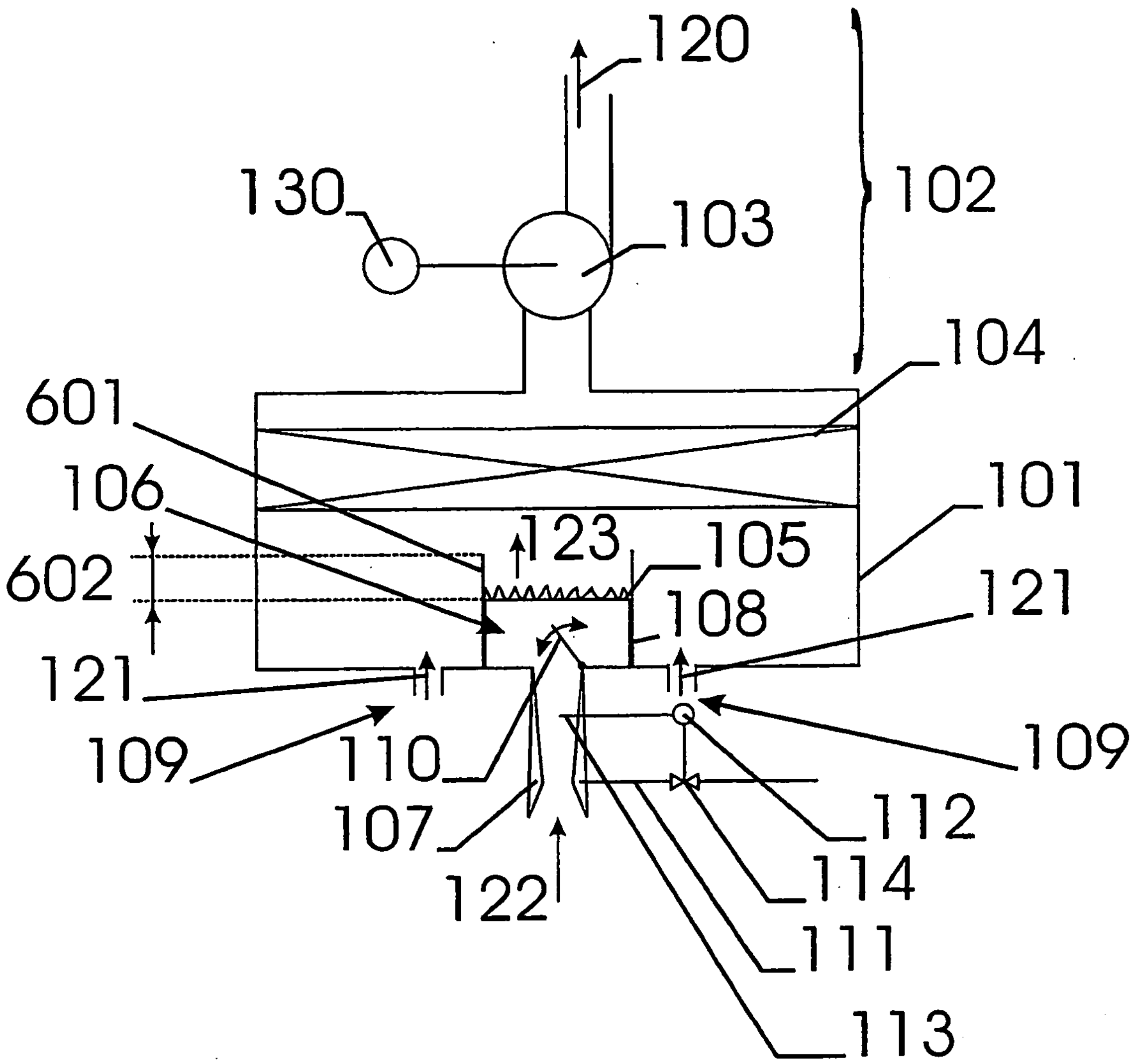
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Fig. 6

REFERENCES CITED IN THE DESCRIPTION

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