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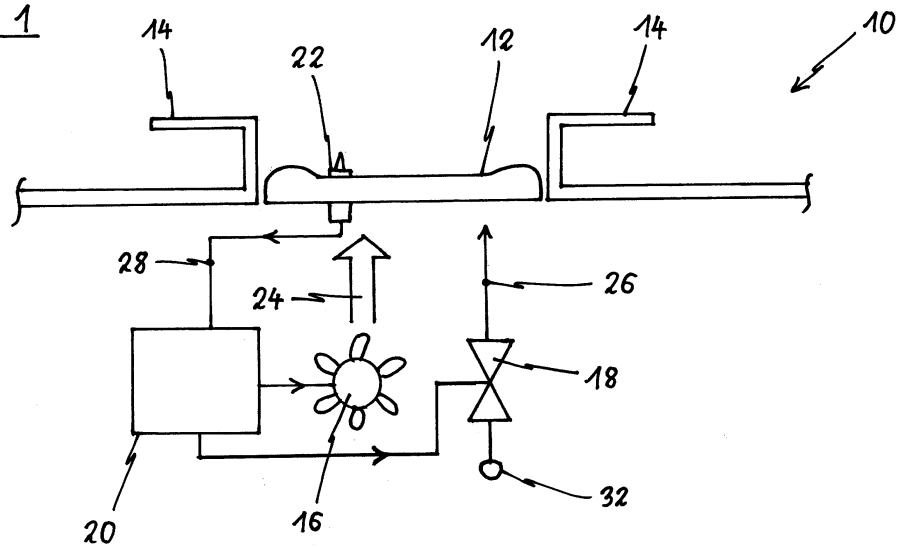
(54) GAS BURNER SYSTEM FOR A GAS COOKING HOB

(57) The present invention relates to a gas burner system (10) for a gas cooking hob, in particular for a domestic gas cooking hob. Said gas burner system (10) comprises a gas burner assembly (12) including a plurality of flame ports. At least one pot support (14) is arranged above and/or around the gas burner assembly (12) and defining a distance between said gas burner assembly (12) and a bottom of a cooking pot. At least one supply air fan (16) is provided for generating an air flow (24) to the gas burner assembly (12). A gas inlet (32) is connectable or connected to a gas supply. A gas regulator (18) is provided for regulating a gas flow from the gas inlet (32) to the gas burner assembly (12). A control unit (20) is provided for controlling the supply air fan (16) and the gas regulator (18). At least one thermocouple (22) is provided for detecting flames above the gas burner assembly (12) and for providing a flame signal (28) to the control unit (20).

FIG 1



EP 3 270 060 A1

Description

[0001] The present invention relates to a gas burner system for a gas cooking hob, in particular for a domestic gas cooking hob. Further, the present invention relates to a gas cooking hob, in particular a domestic gas cooking hob, comprising at least one gas burner system.

[0002] In a conventional gas cooking hob the mixture of gas and primary air for the gas burner assembly is generated by a mechanical system, e.g. a Venturi system. Usually, said mechanical system is designed to work in an optimal way within a given range of a gas flow rate. At a given power, the minimum amount of primary air depends on the distance between a cooking pot and flame port of the gas burner assembly, so that the combustion quality is compliant to the standards and the CO values are below the threshold values. Also the burner efficiency depends on the distance between a cooking pot and flame port of the gas burner assembly. The higher said distance, the lower the burner efficiency. The burner efficiency is the ratio between the amount of heat transferred to the cooking pot and the total heat of the burned gas.

[0003] Further, in the gas cooking hob an automatic extinguishing of the flames would be advantageous. Said extinguishing of the flames could be used in an automatic cooking process or for safety reasons.

[0004] It is an object of the present invention to provide a gas burner system for a gas cooking hob, which allows an improved efficiency of said gas burner system.

[0005] The object is achieved by the gas burner system according to claim 1.

[0006] According to the present invention the gas burner system for a gas cooking hob, in particular for a domestic gas cooking hob, comprises

- a gas burner assembly including a plurality of flame ports,
- at least one pot support arranged above and/or around the gas burner assembly and defining a distance between said gas burner assembly and a bottom of a cooking pot,
- at least one supply air fan for generating an air flow to the gas burner assembly,
- a gas inlet connectable or connected to a gas supply,
- a gas regulator for regulating a gas flow from the gas inlet to the gas burner assembly,
- a control unit for controlling the supply air fan and the gas regulator, and
- at least one thermocouple for detecting flames above the gas burner assembly and for providing a flame signal to the control unit.

[0007] The core of the present invention is the use of the supply air fan controlled by the control unit on the one hand and the thermocouple for detecting flames above the gas burner assembly and for providing a flame signal to the control unit on the other hand. The gas burner system according to the present invention allows an improved efficiency.

[0008] Preferably, the supply air fan is provided for switching off the gas burner assembly by making the flames lift and/or moving the flames aside, so that the thermocouple is not detecting the flames above the gas burner assembly anymore and the appropriate flame signal is sent to the control unit. The supply air fan allows an automatic extinguishing of the flames on the gas burner assembly. After the flame signal is sent to the control unit, said control unit stops the gas flow from the gas inlet to the gas burner assembly. For example, during an automatic cooking process the flames are automatically extinguished after a predetermined time. Further, the flames may be automatically extinguished for safety reasons. For example, if no cooking pot is detected on the pot support, then the flames are automatically extinguished by the air flow. The shutdown of the gas burner assembly by the air flow is realized by low costs, since fans are usually cheaper than gas valves. Moreover, in a premix system a fan is already present and can be used for extinguishing the flames.

[0009] In particular, the gas regulator comprises a gas tap interconnected between the gas inlet and the gas burner assembly, wherein said gas tap is closed by the control unit, if the thermocouple detects no flames above the gas burner assembly.

[0010] For example, the gas burner system is provided for an automatic cooking process, wherein the gas burner assembly is switched off after a predetermined time.

[0011] Further, the gas burner system may comprise at least one pot sensor for detecting the presence of a cooking pot on the pot support, wherein said pot sensor provides the control unit with a pot signal, and wherein the gas burner assembly is switched off, if no cooking pot is detected on the pot support.

[0012] Preferably, the gas burner system comprises means for detecting and/or estimating the pressure and/or the temperature of the air flow, wherein preferably said means are connected or connectable to the control unit.

[0013] Moreover, the gas burner system may comprise means for detecting and/or estimating the pressure, the temperature and/or the flow rate of the gas flow, wherein preferably said means are connected or connectable to the control unit.

[0014] According to one embodiment, the gas burner system comprises a mixer unit for receiving the air flow from the supply air fan and the gas flow from the gas inlet, wherein said mixer unit generates an air-gas mixture and provides the gas burner assembly with said air-gas mixture.

[0015] According to one example, the air flow from the supply air fan depends on the gas flow from the gas inlet, wherein said gas flow is adjusted or adjustable by a user, and wherein preferably the gas flow is read or estimated on the basis of the knob for adjusting the gas flow, by a gas flow sensor or by an electronic gas valve actuator.

[0016] According to another example, the gas burner system comprises a gas dosing valve interconnected between the gas inlet and the mixer unit.

[0017] In the latter case, the gas flow from the gas inlet may depend on the air flow from the supply air fan, wherein said air flow is adjusted or adjustable by the user and read by the means for detecting and/or estimating the pressure and/or the temperature of the air flow, and wherein the gas flow is automatically adjusted by the gas dosing valve.

[0018] Preferably, the gas flow adjusted by the gas dosing valve is proportional to the air flow from the supply air fan.

[0019] According to a further embodiment, the gas burner system comprises a Venturi system for receiving the air flow from the supply air fan and the gas flow from the gas inlet, wherein said Venturi system generates an air-gas mixture and provides the gas burner assembly with said air-gas mixture.

[0020] The total amount of air is provided via the Venturi system to the gas burner assembly, while air to the Venturi system is provided by a pressurized gas tank or a further fan, wherein preferably said pressurized gas tank or further fan, respectively, is integrated in a closed loop and keeps a pressure in a lower box of the Venturi system at a constant value.

[0021] At last, the present invention relates to a gas cooking hob, in particular a domestic gas cooking hob, wherein the gas cooking hob comprises at least one gas burner system mentioned above.

[0022] Novel and inventive features of the present invention are set forth in the appended claims.

[0023] The present invention will be described in further detail with reference to the drawings, in which

FIG 1 illustrates a schematic side view of a gas burner system for a gas cooking hob according to a first embodiment of the present invention,

FIG 2 illustrates a schematic side view of the gas burner system for the gas cooking hob according to a second embodiment of the present invention,

FIG 3 illustrates a schematic side view of the gas burner system for the gas cooking hob according to a third embodiment of the present invention, and

FIG 4 illustrates a schematic side view of the gas burner system for the gas cooking hob according to a fourth embodiment of the present invention.

[0024] FIG 1 illustrates a schematic side view of a gas burner system 10 for a gas cooking hob according to a first embodiment of the present invention.

[0025] The gas burner system 10 comprises a gas burner assembly 12, a pot support 14, a supply air fan 16, a gas tap 18 and a gas inlet 38. The gas burner assembly 12 includes a plurality of flame ports. The pot support 14 is arranged above and/or around the gas burner assembly 12 and defines the distance between the gas burner assembly 12 and the bottom of a cooking pot. The supply air fan 16 and the gas tap 18 are arranged beneath the gas burner assembly 12. The supply air fan 16 generates an air flow 24 to the gas burner assembly 12. The gas inlet 38 is connected or connectable to a gas supply. The gas tap 18 is interconnected between the gas inlet 38 and the gas burner assembly 12. The gas tap 18 lets pass a gas flow 26 from the gas inlet 38 to the gas burner assembly 12. Preferably, the gas tap 18 is a mechanical tap.

[0026] Further, the gas burner system 10 comprises a control unit 20 and a thermocouple 22. The control unit 20 is provided for controlling the supply air fan 16 in order to regulate the air flow 24 to the gas burner assembly 12. Moreover, the control unit 20 is provided for controlling the gas tap 18 in order to regulate the gas flow 26 to the gas burner assembly 12. The thermocouple 22 is arranged within, besides or above the gas burner assembly 12 and provided for detecting the temperature and/or the presence of the flames escaping from said gas burner assembly 12. The thermocouple 22 is connected to the control unit 20 and provides said control unit 20 with a flame signal 28.

[0027] The air flow 24 generated by the supply air fan 16 could be primary air, part of a combustion mixture or an independent air flow. The air flow 24 is directed towards the flames of the gas burner assembly 12. In particular, the air flow 24 is provided for switching off the gas burner assembly 12 by making the flames lift and/or moving the flames aside, so that the thermocouple 22 is not sensing the flames anymore and an appropriate flame signal 28 is sent to the control unit 20. In this case, the control unit 20 closes the gas tap 18, so that the gas flow 26 to the gas burner assembly 12 is stopped.

[0028] The shutdown of the gas burner assembly 12 by the air flow 24 is realized by low costs, since fans are usually cheaper than gas valves. Moreover, in a premix system a fan is already present and can be used for extinguishing the flames.

[0029] The supply air fan 16 allows an automatic extinguishing of the flames on the gas burner assembly 12. For example, during an automatic cooking process the flames are automatically extinguished after a predetermined time. Further, the flames may be automatically extinguished for safety reasons. For example, if no cooking pot is detected on the pot support 14, then the flames are automatically extinguished by the air flow 24.

[0030] FIG 2 illustrates a schematic side view of the gas burner system 10 for the gas cooking hob according to a second embodiment of the present invention.

[0031] The gas burner system 10 comprises the gas burner assembly 12, the pot support 14, the supply air fan 16, the control unit 20, the thermocouple 22 and the

gas inlet 32. The gas burner assembly 12 includes the plurality of flame ports. The pot support 14 is arranged above and/or around the gas burner assembly 12 and defines the distance between the gas burner assembly 12 and the bottom of the cooking pot.

[0032] Further, the gas burner system 10 comprises a mixer unit 30. The supply air fan 16 and the mixer unit 34 are arranged beneath the gas burner assembly 12. The supply air fan 16 generates an air flow 24 of primary air to the mixer unit 30. Through the gas inlet 32 the gas flow 26 is delivered to the mixer unit 30. In the mixer unit 30 an air-gas mixture 34 is composed of the air flow 24 and the gas flow 26. Then, the air-gas mixture 34 is delivered to the gas burner assembly 12.

[0033] The control unit 20 is provided for controlling the supply air fan 16 in order to regulate the air flow 24 from the supply air fan 16 to the mixer unit 30. The thermocouple 22 is arranged at the gas burner assembly 12 and detects the temperature and/or the presence of the flames escaping from the gas burner assembly 12. The thermocouple 22 is connected to the control unit 20 and provides said control unit 20 with the flame signal 28.

[0034] The pressure Pg, the temperature Tg and the flow rate Φg of the gas flow 26 are detected, and the correspondent values are delivered to the control unit 20. Further, the pressure Pa and the temperature Ta of the air flow 24 are detected, and the correspondent values are delivered to the control unit 20. Moreover, the pressure Pm and the temperature Tm of the air-gas mixture 34 are detected, and the correspondent values are delivered to the control unit 20.

[0035] The flow rate Φg of the gas flow 26 may be estimated on the basis of a knob for adjusting said gas flow 26, by a gas flow sensor and/or by an electronic gas valve actuator. The control unit 20 is provided for controlling the speed of the supply air fan 16 in order to regulate the air flow 24 on the basis of the pressure Pg, the temperature Tg and the flow rate Φg of the gas flow 26 and/or on the basis of the pressure Pa and the temperature Ta of the air flow 24. The air density of said air flow 24 may be estimated on the basis of the pressure Pa and the temperature Ta of said air flow 24.

[0036] In this embodiment, the gas flow 26 is set by the user, while the air flow 24 blown by the supply air fan 16 depends on said gas flow 26. The gas flow 26 is read or estimated on the basis of the knob for adjusting the gas flow 26, by the gas flow sensor or by the electronic gas valve actuator. Then, the control unit 20 regulates the speed of the supply air fan 16 on the basis of the pressure Pg, the temperature Tg and the flow rate Φg of the gas flow 26 and/or on the basis of the pressure Pa and the temperature Ta of the air flow 24. Thus, the air flow 24 depends on the gas flow 26.

[0037] The supply air fan 16 increases the amount of primary air fed to the gas burner assembly 12. Said increased amount of primary air allows a lower pot support 14 in order to achieve higher burner efficiencies. The burner efficiency is the ration between the amount of heat transferred to the cooking pot and the total heat of the burned gas. Further, the lower pot support 14 is advantageous for the design of the gas cooking hob. Moreover, the lower pot support 14 facilitates the cleanability of the gas cooking hob.

[0038] During a warm-up phase of the gas burner system 10, wherein the gas burner assembly is relative cold, the supply of primary air should be reduced. The ideal amount of primary air may be computed by a temperature function and/or by the time elapsed from the shut-off of the flames.

[0039] Optionally, a boost function may be activated, wherein the power is increased instantly for a predetermined or programmable time by pressing a button. The boost function may be implemented by the electronic gas valve actuator.

[0040] Preferably, the supply air fan 16 or a further air fan is provided for switching off the gas burner assembly 12 by making the flames lift and/or moving the flames aside, so that the thermocouple 22 is not sensing the flames anymore and an appropriate flame signal 28 is sent to the control unit 20. Then, the control unit 20 interrupt the supply of the gas inlet 32, so that the gas flow 26 to the mixer unit 30 is stopped. The shutdown of the gas burner assembly 12 by the air flow 24 is realized by low costs, since the supply air fan 16 is already present and can be used for extinguishing the flames.

[0041] The supply air fan 16 allows the automatic extinguishing of the flames on the gas burner assembly 12. In particular, during an automatic cooking process the flames are automatically extinguished after a predetermined time or for safety reasons. For example, if no cooking pot is detected on the pot support 14, then the flame is automatically extinguished by the air flow 24.

[0042] FIG 3 illustrates a schematic side view of the gas burner system 10 for the gas cooking hob according to a third embodiment of the present invention. The gas burner system 10 of the third embodiment is similar as that of the second embodiment.

[0043] The gas burner system 10 of the third embodiment comprises the same components as that of the second embodiment. Additionally, the gas burner system 10 of the third embodiment comprises a gas dosing valve 36 interconnected between the gas inlet 32 and the mixer unit 30.

[0044] In this embodiment, the air flow 24 blown by the supply air fan 16 depends on the position of the gas knob, while the amount of the gas flow 26 is dosed proportionally to the air flow 24 by the gas dosing valve 36. Thus, the gas flow 26 depends on the air flow 24.

[0045] Also in this embodiment, the supply air fan 16 or another air fan is provided for switching off the gas burner assembly 12 by making the flames lift and/or moving the flames aside, so that the thermocouple 22 is not sensing the flames anymore and an appropriate flame signal is sent to the control unit 20. In this case, the control unit 20 closes the gas dosing valve 36, so that the gas flow 26 to the mixer unit 30 is stopped. The shutdown of

the gas burner assembly 12 by the supply air fan 16 may be realized by low costs, since said supply air fan 16 is already present and can be used for extinguishing the flames.

[0046] The supply air fan 16 allows the automatic extinguishing of the flames on the gas burner assembly 12. In particular, during an automatic cooking process the flames are automatically extinguished after a predetermined time or for safety reasons. For example, if no cooking pot is detected on the pot support 14, then the flame is automatically extinguished by the air flow 24.

[0047] FIG 4 illustrates a schematic side view of the gas burner system 10 for the gas cooking hob according to a fourth embodiment of the present invention.

[0048] The gas burner system 10 comprises the gas burner assembly 12 with the plurality of flame ports, the pot support 14, the supply air fan 16, the control unit 20, the thermocouple 22 and the gas inlet 32. The pot support 14 is arranged above and/or around the gas burner assembly 12 and defines the distance between the gas burner assembly 12 and the bottom of the cooking pot.

[0049] Furthermore, the gas burner system 10 comprises a Venturi system 38. The supply air fan 16 and the Venturi system 38 are arranged beneath the gas burner assembly 12. The supply air fan 16 generates the air flow 24 of primary air to the gas burner assembly 12 and to the Venturi system 38. Through the gas inlet 32 the gas flow 26 is delivered to the Venturi system 38. In the Venturi system 38 an air-gas mixture 34 is composed of the air flow 24 and the gas flow 26. Then, the air-gas mixture 34 is delivered to the gas burner assembly 12.

[0050] The control unit 20 is provided for controlling the supply air fan 16 in order to regulate the air flow 24 from the supply air fan 16 to the mixer unit 30 and to the gas burner assembly 12. The thermocouple 22 is arranged at the gas burner assembly 12 and detects the temperature and/or the presence of the flames escaping from the gas burner assembly 12. The thermocouple 22 is connected to the control unit 20 and provides said control unit 20 with the flame signal 28.

[0051] The pressure Pg and the temperature Tg of the gas flow 26 are detected, and the correspondent values are delivered to the control unit 20. In a similar way, the pressure Pa and the temperature Ta of the air flow 24 are detected, and the correspondent values are delivered to the control unit 20.

[0052] The Venturi system 38 provides a part of the total amount of air, while the remaining part of air is provided by the supply air fan 16. Alternatively or additionally, the remaining part of air is provided by a pressurized gas tank and/or by another fan. The pressurized gas tank and/or the other fan are integrated in a closed loop and keep the pressure in a lower box of the Venturi system 38 at a constant value. The lower box is sufficiently sealed in order to allow an increase of the ambient pressure.

[0053] The supply air fan 16 and the Venturi system 38 allow a lower pot support 14 in order to achieve higher burner efficiencies, which is the ratio between the amount of heat transferred to the cooking pot and the total heat of the burned gas. Further, the lower pot support 14 provides an advantageous design of the gas cooking hob. Moreover, the lower pot support 14 facilitates the cleanability of the said cooking hob. A warm up phase with special corrections is not required. The increased power of the gas burner system 10 avoids long Venturi pipes.

[0054] In particular, the supply air fan 16 or another air fan is provided for switching off the gas burner assembly 12 by making the flames lift and/or moving the flames aside, so that the thermocouple 22 is not sensing the flames anymore and an appropriate flame signal 28 is sent to the control unit 20. Then, the control unit 20 interrupt the supply of the gas inlet 32, so that the gas flow 26 to the Venturi system 38 is stopped. The shutdown of the gas burner assembly 12 by the air flow 24 is realized by low costs, since the supply air fan 16 is already present and can be used for extinguishing the flames.

[0055] The supply air fan 16 allows the automatic extinguishing of the flames on the gas burner assembly 12. In particular, during an automatic cooking process the flames are automatically extinguished after a predetermined time or for safety reasons. For example, if no cooking pot is detected on the pot support 14, then the flame is automatically extinguished by the air flow 24.

[0056] Although illustrative embodiments of the present invention have been described herein with reference to the accompanying drawings, it is to be understood that the present invention is not limited to those precise embodiments, and that various other changes and modifications may be affected therein by one skilled in the art without departing from the scope or spirit of the invention. All such changes and modifications are intended to be included within the scope of the invention as defined by the appended claims.

List of reference numerals

[0057]

10	gas burner system
12	gas burner assembly
14	pot support
16	supply air fan
18	gas tap
20	control unit
22	thermocouple
24	air flow
26	gas flow
28	flame signal
30	mixer unit
32	gas inlet
34	air-gas mixture
36	gas dosing valve
38	Venturi system
Pa	pressure of the air flow 24
Ta	temperature of the air flow 24

Pg pressure of the gas flow 26
Tg temperature of the gas flow 26
Φg flow rate of the gas flow 26

Claims

1. A gas burner system (10) for a gas cooking hob, in particular for a domestic gas cooking hob, which gas burner system (10) comprises

- a gas burner assembly (12) including a plurality of flame ports,
- at least one pot support (14) arranged above and/or around the gas burner assembly (12) and defining a distance between said gas burner assembly (12) and a bottom of a cooking pot,
- at least one supply air fan (16) for generating an air flow (24) to the gas burner assembly (12),
- a gas inlet (38) connectable or connected to a gas supply,
- a gas regulator (18; 30; 36; 38) for regulating a gas flow (26) from the gas inlet (38) to the gas burner assembly (12),
- a control unit (20) for controlling the supply air fan (16) and the gas regulator (18; 30; 36; 38), and
- at least one thermocouple (22) for detecting flames above the gas burner assembly (12) and for providing a flame signal (28) to the control unit (20).

2. The gas burner system according to claim 1,
characterised in that
the supply air fan (16) is provided for switching off the gas burner assembly (12) by making the flames lift and/or moving the flames aside, so that the thermocouple (22) is not detecting the flames above the gas burner assembly (12) anymore and the appropriate flame signal (28) is sent to the control unit (20).

3. The gas burner system according to claim 1 or 2,
characterised in that
the gas regulator (18; 30; 36; 38) comprises a gas tap (18) interconnected between the gas inlet (32) and the gas burner assembly (12), wherein said gas tap (18) is closed by the control unit (20), if the thermocouple (22) detects no flames above the gas burner assembly (12).

4. The gas burner system according to any one of the preceding claims,
characterised in that
the gas burner system (10) is provided for an automatic cooking process, wherein the gas burner assembly (12) is switched off after a predetermined time.

5. The gas burner system according to any one of the preceding claims,
characterised in that
the gas burner system (10) comprises at least one pot sensor for detecting the presence of a cooking pot on the pot support (14), wherein said pot sensor provides the control unit (20) with a pot signal, and wherein the gas burner assembly (12) is switched off, if no cooking pot is detected on the pot support (14).

6. The gas burner system according to any one of the preceding claims,
characterised in that
the gas burner system (10) comprises means for detecting and/or estimating the pressure (Pa) and/or the temperature (Ta) of the air flow (24), wherein preferably said means are connected or connectable to the control unit (20).

7. The gas burner system according to any one of the preceding claims,
characterised in that
the gas burner system (10) comprises means for detecting and/or estimating the pressure (Pg), the temperature (Tg) and/or the flow rate (Φg) of the gas flow (26), wherein preferably said means are connected or connectable to the control unit (20).

8. The gas burner system according to any one of the preceding claims,
characterised in that
the gas burner system (10) comprises a mixer unit (30) for receiving the air flow (24) from the supply air fan (16) and the gas flow (26) from the gas inlet (38), wherein said mixer unit (30) generates an air-gas mixture (34) and provides the gas burner assembly (12) with said air-gas mixture (34).

9. The gas burner system according to any one of the preceding claims,
characterised in that
the air flow (24) from the supply air fan (16) depends on the gas flow (26) from the gas inlet (38), wherein said gas flow (26) is adjusted or adjustable by a user, and wherein preferably the gas flow (26) is read or estimated on the basis of the knob for adjusting the gas flow (26), by a gas flow sensor or by an electronic gas valve actuator.

10. The gas burner system according to claim 8 or 9,
characterised in that
the gas burner system (10) comprises a gas dosing valve (36) interconnected between the gas inlet (32) and the mixer unit (30).

11. The gas burner system according to any one of the preceding claims,

characterised in that
the gas flow (26) from the gas inlet (32) depends on the air flow (24) from the supply air fan (16), wherein said air flow (24) is adjusted or adjustable by the user and read by the means for detecting and/or estimating the pressure (Pa) and/or the temperature (Ta) of the air flow (24), and wherein the gas flow (26) is automatically adjusted by the gas dosing valve (36).

12. The gas burner system according to claim 10 or 11,
characterised in that
the gas flow (26) adjusted by the gas dosing valve (36) is proportional to the air flow (24) from the supply air fan (16).

13. The gas burner system according to any one of the preceding claims,
characterised in that
the gas burner system (10) comprises a Venturi system (38) for receiving the air flow (24) from the supply air fan (16) and the gas flow (26) from the gas inlet (38), wherein said Venturi system (38) generates an air-gas mixture (34) and provides the gas burner assembly (12) with said air-gas mixture (34).

14. The gas burner system according to any one of the preceding claims,
characterised in that
air is provided by a pressurized gas tank or a further fan, wherein preferably said pressurized gas tank or further fan, respectively, is integrated in a closed loop and keeps a pressure in a lower box of the Venturi system (38) at a constant value.

15. A gas cooking hob, in particular a domestic gas cooking hob,
characterised in that
the gas cooking hob comprises at least one gas burner system (10) according to any one of the claims 1 to 14.

FIG 1

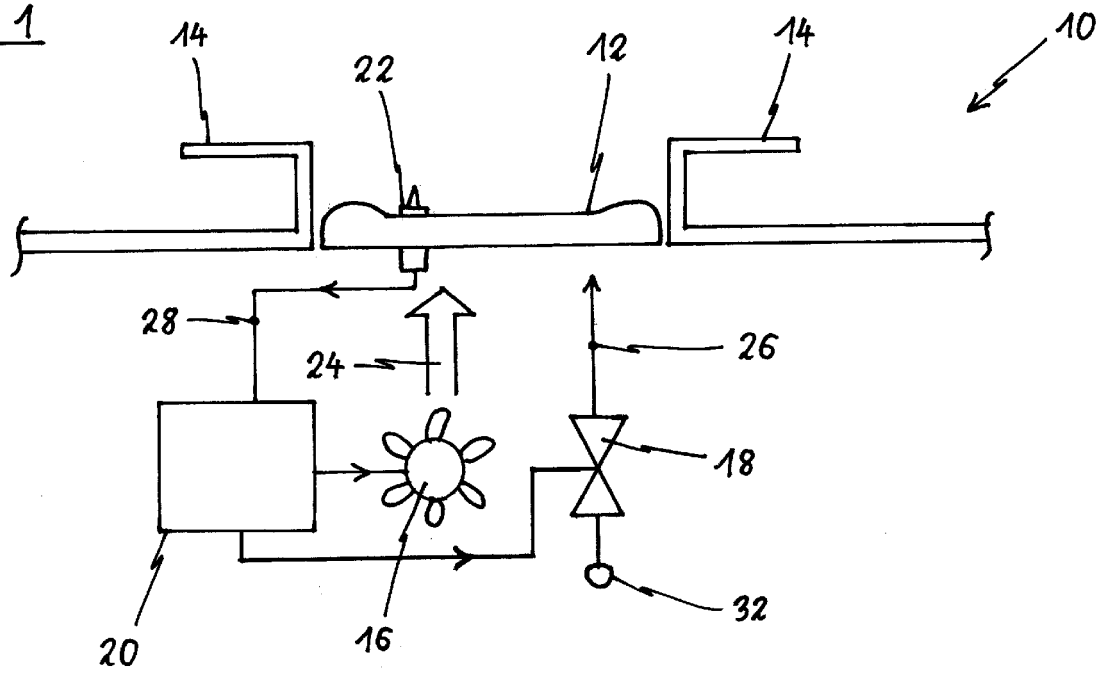


FIG 2

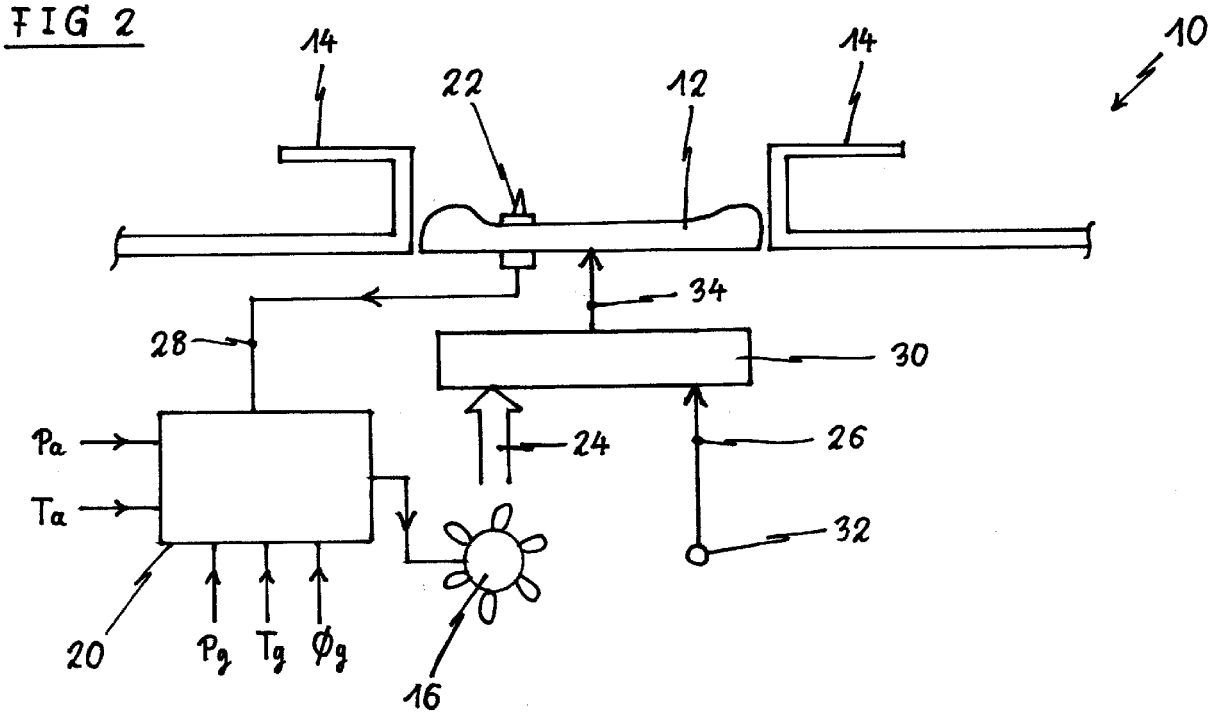


FIG 3

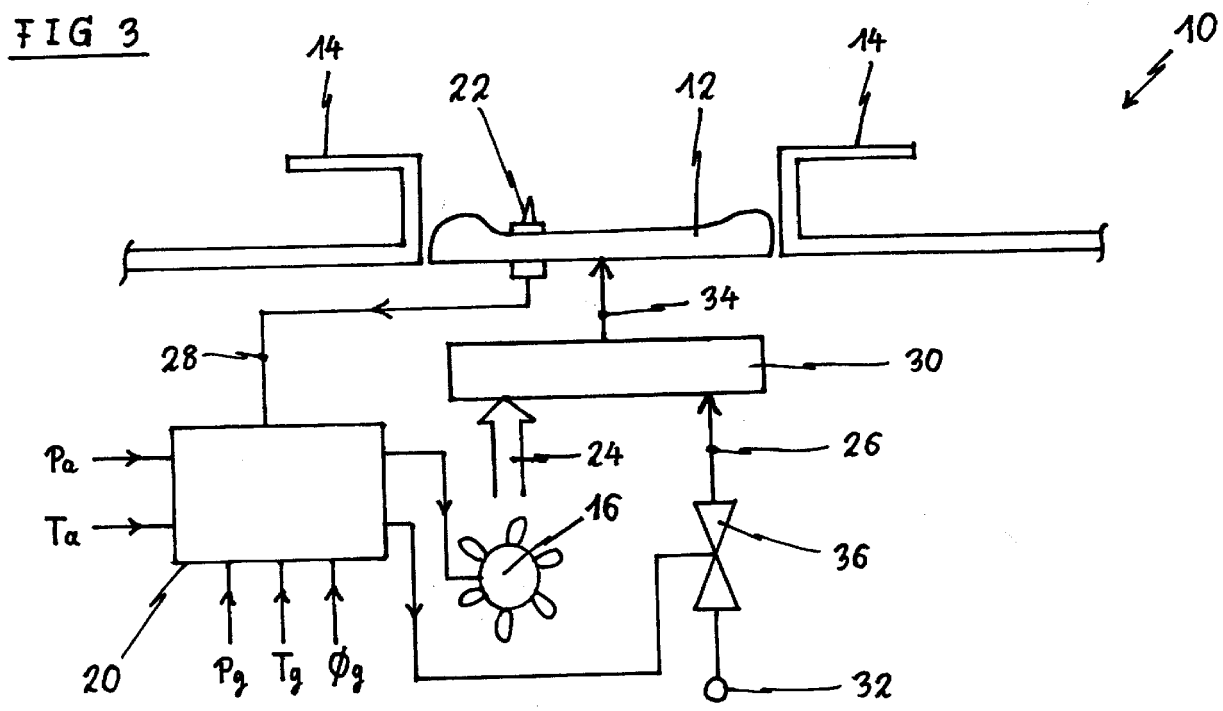
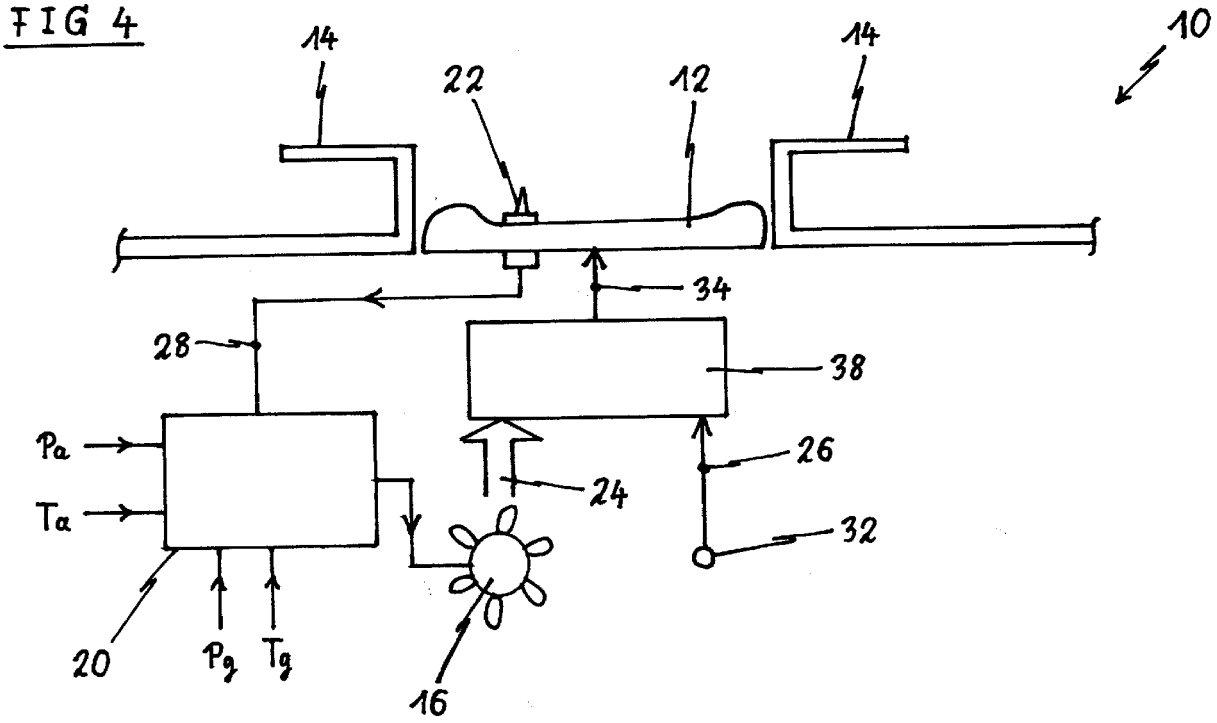


FIG 4



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EUROPEAN SEARCH REPORT

Application Number
EP 16 17 8768

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (IPC)
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