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(54) **GAS DEVICE FOR COOKING FOOD AND METHOD FOR OPERATING SAID DEVICE**

(57) A gas device for cooking food is provided with:
• a main gas supply duct (2; 22) configured to be coupled to a domestic gas supply circuit (3; 23);
• at least one gas burner (4; 24) connected to the main gas supply duct (2; 22) by at least one respective connection valve (5; 25);
• an ignition device (7; 27) configured to selectively generate a spark (11d) in the area of said at least one burner (4; 24);
• a safety assembly (9; 29) comprising:
• a first safety system comprising a flame sensor (16; 36), which is arranged close to the burner (4; 24), and a first control device, which is configured to close the respective connection valve (5; 25) when the flame sensor (16; 36) detects that the flame has extinguished;
• a second safety system comprising:
- a safety valve (12; 32) of the ON/OFF type located along the main gas supply duct (2; 22) upstream of said at least one connection valve (5; 25);
- at least one control element (16; 36, 37); and
- a second control device (13; 33) configured to regulate the position of the safety valve (12; 32); the second control device (13; 33) being configured to open the safety valve (12; 32) when the ignition device (7; 27) is activated and to close the safety valve (12; 32) in response to the operating conditions of the control element (16; 36, 37) .

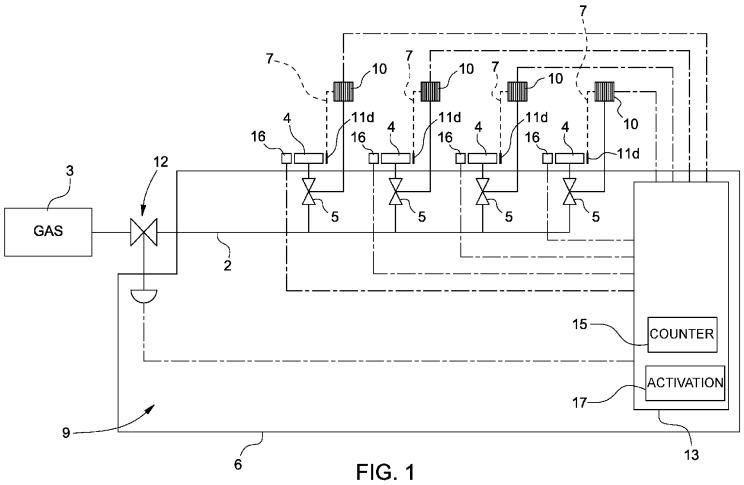


FIG. 1

EP 3 771 865 A1

Description

CROSS-REFERENCE TO RELATED APPLICATIONS

[0001] This Patent Application claims priority from Italian Patent Application No. 102019000013521 filed on July 31, 2019.

TECHNICAL FIELD

[0002] The invention relates to a gas device for cooking food and to a method for operating a gas cooking device. In particular, the invention relates to gas cooking devices such as stoves, ovens and kitchens.

BACKGROUND ART

[0003] Gas food cooking devices are usually provided with one or more safety systems, which are designed to avoid dangerous situations. For example, one of the most common safety system entails interrupting the supply of gas to the burner in which the flame is extinguished, which is generally detected by means of a flame sensor.

[0004] However, in case of fault of traditional safety systems, the risks of an uncontrolled gas outflow or of an unsafe operation of the device are high.

[0005] Documents WO2009146730A2 and JP2011047611, for example, describe stoves provided with traditional safety systems.

DISCLOSURE OF INVENTION

[0006] Therefore, the object of the invention is to provide a gas food cooking device, which is not affected by the drawbacks of the prior art discussed above; in particular, the object of the invention is to provide a gas food cooking device, which is safer than currently known devices and forbids uncontrolled gas outflows.

[0007] In accordance with these objects, the invention relates to a gas device for cooking food comprising:

- a main gas supply duct, which is configured to be coupled to a domestic gas supply circuit;
- at least one gas burner, which is connected to the main gas supply duct by means of at least one respective connection valve;
- an ignition device, which is configured to selectively generate a spark in the area of said at least one burner;
- a safety assembly comprising:
  - a first safety system comprising a flame sensor, which is arranged close to the burner, and a first control device, which is configured to close the respective connection valve when the flame sensor detects that the flame has extinguished;
  - a second safety system comprising:
    a safety valve of the ON/OFF type located along the main gas supply duct upstream of said at least one connection valve;
    at least one control element;
    a second control device, which is configured to adjust the position of the safety valve; the second control device being configured to open the safety valve when the ignition device is activated and to close the safety valve in response to the operating conditions of the control element.

[0008] Advantageously, the installation of an automatic general blocking valve blocking the supply of gas and located just downstream of the connection to the domestic line ensures the totally safe operation of the cooking device.

[0009] In case of fault of the first safety system, indeed, the second safety system ensures the complete safety of the cooking device.

[0010] Furthermore, the object of the invention is to provide a method for operating a gas food cooking device, which is safe compared to known methods and forbids uncontrolled gas outflows.

[0011] In accordance with these objects, the invention relates to a method for operating a gas food cooking device as claimed in claim 10.

BRIEF DESCRIPTION OF THE DRAWINGS

[0012] Further features and advantages of the invention will be best understood upon perusal of the following description of non-limiting embodiments thereof, with reference to the accompanying drawings, wherein:

- figure 1 is a schematic representation of a gas cooking device according to the invention;
- figure 2 is a schematic representation of a detail of figure 1 according to a first embodiment;
- figure 3 is a flowchart concerning a step of the method for operating a gas cooking device according to the invention;
- figure 4 is a flowchart concerning a further step of the method for operating a gas cooking device according to the invention;
- figure 5 is a schematic representation of a gas cooking device according to a variant of the invention.

BEST MODE FOR CARRYING OUT THE INVENTION

[0013] In figure 1, reference number 1 indicates a gas food cooking device according to the invention.

[0014] In the example shown in figure 1, the cooking device is a stove.

[0015] The cooking device 1 comprises a main gas supply duct 2, which is configured to be coupled to a domestic gas supply circuit 3 (which is schematically shown), at least one gas burner 4, which is connected to

the main gas supply duct 2 by means of at least one connection valve 5, an ignition device 7, which is configured to selectively generate a spark 11d in the area of the burner 4, a safety assembly 9 and a casing 6 (which is schematically shown).

[0016] In the non-limiting example shown and described herein, the device 1 comprises a plurality of gas burners 4, each connected to the main gas supply duct 2 by means of a respective connection valve 5.

[0017] Each connection valve 5 is an adjustment valve, which is controlled by a respective actuator 10. In the non-limiting embodiment shown and described herein, the actuator 10 is a knob.

[0018] In use, the manual adjustment of the actuator 10 determines the adjustment of the position of the respective connection valve 5. In this way, the quantity of gas supplied to the burner 4 and, as a consequence, the flame of the burner 4 are adjusted.

[0019] The ignition device 7 is schematically shown in figure 1 by a broken line, whereas it is better visible in figure 2.

[0020] With reference to figure 2, the ignition device 7 comprises a catenary 8, which comprises a pair of power supply cables 11a and a plurality of control switches 11b, which are connected in parallel between said cables 11a. In particular, the catenary comprises one switch 11b for each actuator 10.

[0021] Each switch 11b is operated by a respective actuator 10. When a pressure is applied to the actuator 10, this normally determines the closing of the respective switch 11b of the catenary 8. In this way, an electrical connection is established between the power supply cables 11a so as to activate a known igniting circuit 11c, which ignites a series of sparks 11d in the area of the respective burner 4.

[0022] When the actuator 10 is released, the respective switch 11b opens. The switches of the catenary 8 basically work as normally open switches.

[0023] With reference to figure 1, the casing 6 houses at least one portion of the main gas supply duct 2, the connection valves 5, the ignition device 7 and, preferably, also part of the safety device 9, as discussed more in detail below. On the outside of the casing 6 there are the burners 4 and the actuators 10.

[0024] The safety assembly 9 comprises a safety valve 12 and a control device 13, which is configured to adjust the position of the safety valve 12.

[0025] The safety valve 12 is an ON/OFF valve located along the main gas supply duct 2 upstream of said at least one connection valve 5. In the case discussed herein by way of example, there are different connection valves 5 and the safety valve 12 is located upstream of all connection valves 5.

[0026] In particular, the safety valve 12 is located just downstream of the connection to the domestic gas supply circuit 3. The safety valve 12 is preferably arranged at a safety distance from the burners 4 or from possible hot areas of the cooking device 1. The safety valve 12 is preferably housed outside the casing 6.

[0027] More preferably, the body of the safety valve 12 is outside the casing 6, whereas the electric drive of the safety valve 12 and the control device 13 are preferably housed inside the casing 6.

[0028] The control device 13 is configured to open the safety valve 12 when the ignition device 7 is activated and to close the safety valve 12 when given conditions occur.

[0029] In particular, the control device 13 is configured to open the safety valve 12 when at least one switch 11b of the catenary 8 of the ignition device 7 is closed by means of the respective actuator 10.

[0030] The safety valve 12 is a normally closed solenoid valve, which is opened when the ignition device 7 is activated.

[0031] As a consequence, in the absence of current, the safety valve 12 is always closed.

[0032] Once the safety valve 12 has been opened, the closing is regulated by the control device 13.

[0033] In particular, the control device 13 is configured to close the safety valve 12 in response to the operating conditions of at least one control element.

[0034] In the non-limiting example described and shown herein, the control device 13 is configured to close the safety valve 12 based on the value of at least one operating parameter detected by means of at least one sensor 16.

[0035] In the non-limiting example described and shown in figure 3, the control device 13 receives signals from a plurality of sensors 16.

[0036] In the non-limiting example described and shown in figure 3, the sensor 16 is a flame sensor arranged close to a respective burner 4. In other words, each burner 4 is associated with a sensor 16. The flame sensor 16 is in an OFF state when it does not detect any flame, whereas it is in an ON state when it detects the presence of a flame. Each flame sensor 16 preferably comprises a thermocouple.

[0037] In the non-limiting example described and shown herein, the control device 13 is configured so as to close the safety valve 12 if all sensors 16 do not detect any flame following an attempt of ignition.

[0038] In other words, the safety valve 12 is closed if an attempt of ignition (by means of the activation of the ignition device 7) is not followed by an actual ignition.

[0039] With reference to figure 3, if all flame sensors 16 remain in the OFF state after the ignition device 7 has been activated, the safety valve 12 (which was opened upon activation of the ignition device 7) is immediately closed.

[0040] Furthermore, the control device 13 is preferably configured to activate the ignition device 7 when the flame extinguishes during the operation of at least one burner 4.

[0041] In other words, if at least one sensor flame 16 shifts from an ON state to an OFF state, the control device 13 activates the ignition device 7. In particular, the control device 13 is provided with an activation module 17

(shown in figure 1), which is configured to activate the ignition device 7.

[0042] If the flame sensor does not switch again to the ON state within a given amount of time T (defined by a counter 15 shown in figure 1) and if the remaining flame sensors 16 are all in the OFF state, the safety valve 12 is immediately closed. In case there is at least one flame sensor 16 in the ON state (cooking currently happening), the safety valve 12 remains open and the connection valve 5 supplying the burner 4 is closed so that the latter cannot be ignited again. The closing of the connection valve 5 is preferably regulated by a further control (not shown), which is directly associated with the flame sensor 16. This logic is schematically shown in the flowchart of figure 4.

[0043] Basically, the safety assembly 9 is provided with a first safety system and with a second safety system. The first safety system comprises a flame sensor 16 and a respective first control device (not shown), which is configured to close the respective connection valve 5 when the flame sensor detects that the flame has extinguished.

[0044] The second safety system comprises the ON/OFF safety valve 12 located along the main duct 2 upstream of said at least one connection valve 5; at least one control element and a second control device 13, which is configured to adjust the position of the safety valve 12 in response to the operating conditions of the control element. The second control device 13 is independent of the first control device. The second control device 13 operates in an independent manner and in parallel relative to the first control device.

[0045] In this way, even in case of a fault of the first safety system, safety is ensured by the second safety system.

[0046] Basically, if the flame accidentally extinguishes, the safety device 9 tries to re-ignite it in order to continue the cooking. If this attempt is not successful, the connection valve 5 and the safety valve 12 are closed so as to avoid uncontrolled gas outflows.

[0047] Obviously, different logics can be implemented in order to obtain the closing of the safety valve 12, based on the same sensors 16. Furthermore, the control device 13 can receive signals from further and/or different control elements and can be configured to close the safety valve 12 based on the conditions of these control elements.

[0048] According to a variant, for example, the control device can also be configured to close the safety valve 12 after a given amount of time starting from the opening of the safety valve 12. In other words, the control device 13 closes the safety valve 12 when the counter 15 (whose count is activated simultaneously with the opening of the safety valve 12) reaches a given value. For example, the programmed count can be of at least 4 hours.

[0049] In this way, the risk of accidents due to possible oversights of the user (for example, burners that were accidentally left turned on) or faults is significantly reduced.

[0050] Figure 5 schematically shows a different cooking device 20. The cooking device 20 is a gas oven, which comprises a main gas supply duct 22, which is configured to be coupled to a domestic gas supply circuit 23 (which is schematically shown), at least one gas burner 24, which is connected to the main gas supply duct 22 by means of at least one connection valve 25, an ignition device 27, which is configured to selectively generate a spark 11d in the area of the burner 24, a safety assembly 29 and a casing 26 (which is schematically shown).

[0051] In the non-limiting example described and shown herein, the device 20 comprises a burner 24, which is arranged so as to heat a cooking chamber 30. According to a variant, which is not shown herein, the device 20 comprises more than one burner.

[0052] The connection valve 25 is an adjustment valve, which is controlled by an actuator 31. In the non-limiting embodiment shown and described herein, the actuator 31 is a knob.

[0053] In use, the manual adjustment of the actuator 31 determines the adjustment of the position of the respective connection valve 25. In this way, the quantity of gas supplied to the burner 24 and, as a consequence, the flame of the burner 24 are adjusted.

[0054] The ignition device 27 is schematically shown by a broken line and substantially has a structure that is similar to the one of the ignition device 7 described with reference to the cooking device 1.

[0055] The casing 26 houses at least one portion of the main gas supply duct 22, the connection valve 25, the ignition device 27 and, preferably, also part of the safety device 29, as discussed more in detail below. On the outside of the casing 6 there is the actuator 31.

[0056] The safety assembly 29 comprises a safety valve 32 and a control device 33, which is configured to adjust the position of the safety valve 32.

[0057] The safety valve 32 is an ON/OFF valve located along the main gas supply duct 22 upstream of said at least one connection valve 25.

[0058] In particular, the safety valve 32 is located just downstream of the connection to the domestic gas supply circuit 23. The safety valve 32 is preferably arranged at a safety distance from the burners 24 or from possible hot areas of the cooking device 20 (such as for example the cooking chamber 30). The safety valve 32 is preferably housed outside the casing 26.

[0059] More preferably, the body of the safety valve 32 is outside the casing 26, whereas the electric drive of the safety valve 32 and the control device 33 are preferably housed inside the casing 26.

[0060] The control device 33 is configured to open the safety valve 32 when the ignition device 27 is activated and to close the safety valve 32 based on the conditions of at least one control element.

[0061] The safety valve 32 is a normally closed valve, which is opened when the ignition device 27 is activated.

[0062] As a consequence, in the absence of current,

the safety valve 32 is always closed.

[0063] Once the safety valve 32 has been opened, the closing is regulated by the control device 33.

[0064] In the non-limiting example described and shown herein, the control device 33 is substantially configured similarly to the control device 13 of the cooking device 1.

[0065] Therefore, the control device 33 is configured to close the safety valve 32 in response to the operating conditions of at least one control element.

[0066] In the non-limiting example described and shown herein, the control device 33 is configured to close the safety valve 12 based on the value of at least one operating parameter detected by means of at least one sensor 36.

[0067] The sensor 36 preferably is a flame sensor, which is located close to the burner 24. The flame sensor 36 is in an OFF state when it does not detect any flame, whereas it is in an ON state when it detects the presence of a flame. Each flame sensor 36 preferably comprises a thermocouple.

[0068] In the non-limiting example described and shown herein, the control device 33 is configured so as to close the safety valve 32 if the sensor 36 does not detect any flame following an attempt of ignition.

[0069] In other words, the safety valve 32 is closed if an attempt of ignition (by means of the activation of the ignition device 27) is not followed by an actual ignition.

[0070] If the sensor 36 remains in the OFF state after the ignition device 27 has been activated, the safety valve 32 (which was opened upon activation of the ignition device 27) is immediately closed.

[0071] The closing of the connection valve 5 is preferably regulated by a further control, which is directly associated with the flame sensor 36.

[0072] Furthermore, the control device 33 is preferably configured to activate the ignition device 27 when the flame extinguishes during the operation of the burner 24.

[0073] In other words, if the sensor flame 36 shifts from an ON state to an OFF state, the control device 33 activates the ignition device 27. If the flame sensor 36 does not switch to the ON state within a given amount of time T, the safety valve 32 is immediately closed.

[0074] Basically, if the flame accidentally extinguishes, the safety device 29 tries to re-ignite it in order to continue the cooking. If this attempt is not successful, the safety valve 32 is closed so as to avoid uncontrolled gas outflows.

[0075] In case of an oven provided with different burners (a variant which is not shown herein), the closing logic of the safety valve 32 is the same as the one adopted for the stove 1. In other words, if there are different burners, the safety valve 32 is closed only if the remaining burners are in an OFF state as well, otherwise the sole connection valve 25 supplying the burner that cannot be re-ignited is closed.

[0076] Basically, the safety assembly 29 is provided with a first safety system and with a second safety system. The first safety system comprises the flame sensor 36 and a respective first control device (not shown in detail), which is configured to close the respective connection valve 25 when the flame sensor detects that the flame has extinguished. The second safety system comprises the ON/OFF safety valve 32 located along the main duct 22 upstream of said at least one connection valve 25; at least one control element and a second control device 33, which is configured to adjust the position of the safety valve 32 in response to the operating conditions of the control element. The second control device 33 is independent of the first control device. The second control device 33 operates in an independent manner and in parallel relative to the first control device.

[0077] In this way, even in case of a fault of the first safety system, safety is ensured by the second safety system.

[0078] Obviously, different logics can be implemented in order to obtain the closing of the safety valve 32, based on the sensor 36. Furthermore, the control device 33 can receive signals from further and/or different control elements and can be configured to close the safety valve 32 based on the conditions of these control elements.

[0079] According to a variant, for example, the control device 33 can also be configured to close the safety valve 32 after a given amount of time starting from the opening of the safety valve 32.

[0080] According to a further variant, for example, the control device 33 can also be configured to close the safety valve 32 based on the temperature value detected by a suitable temperature sensor 37 located so as to detect a temperature value related to the temperature on the inside of the cooking chamber 30. In other words, the temperature sensor 37 can be located on the inside or on the outside of the cooking chamber 30.

[0081] In the non-limiting embodiment described and shown herein, the temperature sensor 37 is the thermocouple of the flame sensor 36.

[0082] If the temperature sensor 37 detects a temperature value exceeding a given threshold value, the control device 33 closes the safety valve 32.

[0083] Finally, it is clear that the cooking device and the method described herein can be subjected to changes and variations, without for this reason going beyond the scope of protection set forth in the appended claims.

Claims

1. Gas device for cooking food comprising:

   - a main gas supply duct (2; 22) configured to be coupled to a domestic gas supply circuit (3; 23);
   - at least one gas burner (4; 24) connected to the main gas supply duct (2; 22) by at least one respective connection valve (5; 25);
   - an ignition device (7; 27) configured to selec-

tively generate a spark (11d) at the at least one burner (4; 24) ;
• a safety assembly (9; 29) comprising:

• a first safety system comprising a flame sensor (16; 36), which is arranged close to the burner (4; 24), and a first control device, which is configured to close the respective connection valve (5; 25) when the flame sensor (16; 36) detects that the flame has extinguished;
• a second safety system comprising:

- a safety valve (12; 32) of the ON/OFF type located along the main gas supply duct (2; 22) upstream of the at least one connection valve (5; 25);
- at least one control element (15; 16; 36, 37);
- a second control device (13; 33) configured to regulate the position of the safety valve (12; 32); the second control device (13; 33) being configured to open the safety valve (12; 32) when the ignition device (7; 27) is activated and to close the safety valve (12; 32) in response to the operating conditions of the control element (15; 16; 36, 37).

2. Device according to claim 1, comprising a casing (6; 36), which houses at least one portion of the main gas supply duct (2; 22), said at least one connection valve (5; 25) and the ignition device (7; 27); the safety valve (12; 32) being housed outside the casing (6; 36).

3. Device according to claim 1, wherein the safety valve (12; 32) is a normally closed solenoid valve.

4. Device according to any of the previous claims, wherein the control element is a counter (15) configured to start a count when the safety valve is opened (12; 32) and the second control device (13; 33) is configured to close the safety valve (12; 32) when the count of the counter (15) reaches a programmed value.

5. Device according to any of the previous claims, wherein the control element (16; 36, 37) is a sensor and the second control device (13; 33) is configured to close the safety valve (12; 32) on the basis of the data collected by the sensor (16; 36, 37).

6. Device according to claim 5, wherein the sensor (16; 36) is a flame sensor located near the burner (4; 24); the second control device (13; 33) being configured to close the safety valve (12; 32) when the flame sensor (16; 36) does not detect any flame in the burner (4; 24).

7. Device according to claim 6, comprising a plurality of burners (4) and a plurality of flame sensors (16), each of which is located near a respective burner (4); the second control device (13, 33) being configured to close the safety valve (12, 32) when all the flame sensors (16) do not detect any flame in their respective burners (4) .

8. Device according to claim 6 or 7, wherein the second control device (13; 33) comprises an activation module (17) configured to activate the ignition device (7; 27) when at least one flame sensor (16; 36) detects a switching-off of the ignited flame of the respective burner (4; 24).

9. Device according to anyone of the claims from 5 to 8, comprising a cooking chamber (30) heated by at least one burner (24); the sensor (37) being a temperature sensor arranged to detect a temperature value related to the temperature in the cooking chamber (30); the second control device (32) being configured to close the safety valve (32) when the temperature detected by the temperature sensor (37) exceeds a certain threshold value.

10. Method to operate a gas device for cooking food; the device comprising:

• a main gas supply duct (2; 22) configured to be coupled to a domestic gas supply circuit (3; 23);
• at least one gas burner (4; 24) connected to the main gas supply duct (2; 22) by at least one respective connection valve (5; 25);
• an ignition device (7; 27) configured to selectively generate a spark (11d) at the at least one burner (4; 24) ;
• a safety assembly (9; 29) comprising:

• a first safety system comprising a flame sensor (16; 36), which is arranged close to the burner (4; 24);
• a second safety system comprising:
a safety valve (12; 32) of the ON/OFF type located along the main gas supply duct (2; 22) upstream of the at least one connection valve (5; 25); and a control element (15; 16; 36, 37);
the method comprising:

closing the respective connection valve (5; 25) when the flame sensor (16; 36) detects that the flame has extinguished;
opening the safety valve (12; 32) when the ignition device (7; 27) is activated;

and
closing the safety valve (12; 32) in response to the operating conditions of the control element (15; 16; 36, 37) .

11. Method according to claim 10, wherein the control element is a counter (15) configured to start a count when the safety valve (12; 32) is opened; the method comprises closing the safety valve (12; 32) when the count of the counter (15) reaches a programmed value.

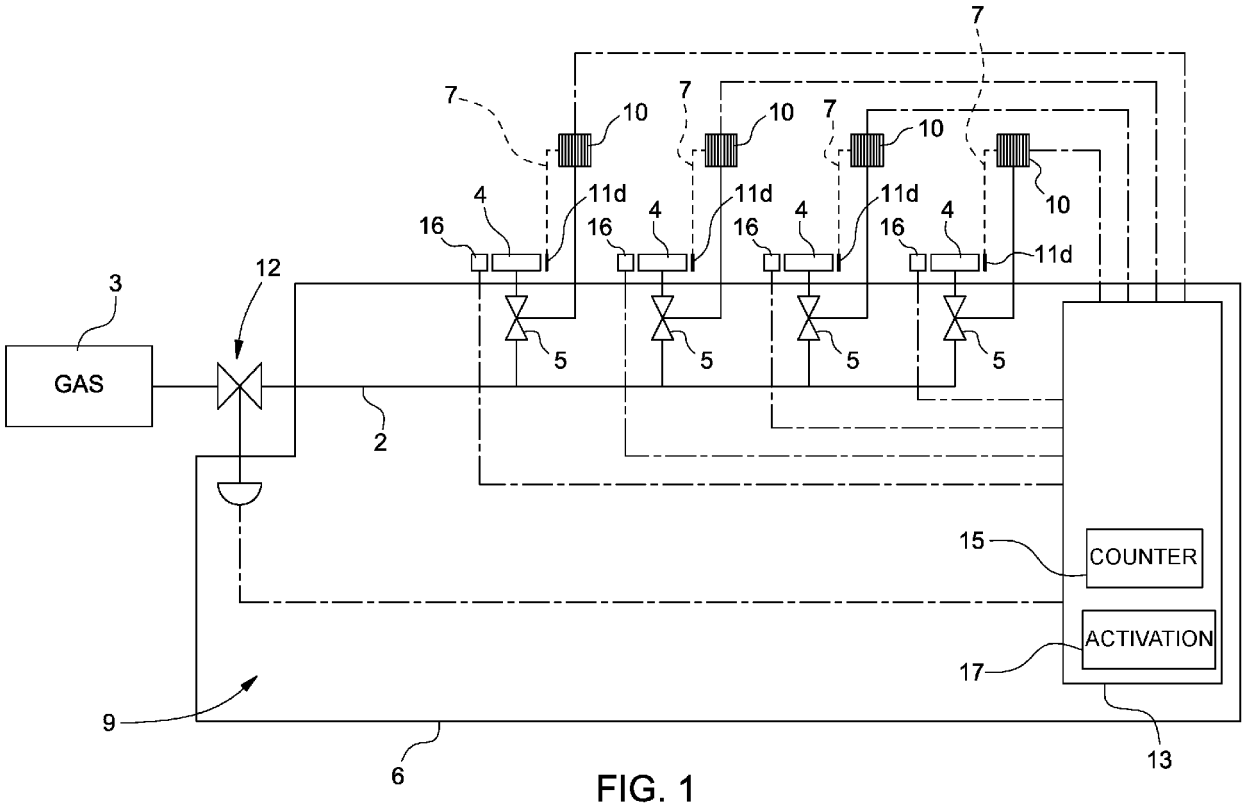
12. Method according to claim 10 or 11, wherein the control element (16; 36, 37) comprises at least one sensor; the method comprising closing the safety valve (12; 32) on the basis of the data collected by the sensor (16; 36, 37).

13. Method according to claim 12, wherein the sensor (16; 36) is the flame sensor located near the burner (4; 24); the method comprising closing the safety valve (12; 32) when the flame sensor (16; 36) does not detect any flame in the burner (4; 24).

14. Method according to claim 12, wherein the cooking device comprises a plurality of burners (4) and the control element (16) comprises a plurality of flame sensors (16), each of which is located near a respective burner (4); the method comprising closing the safety valve (12) when all the flame sensors (16) do not detect any flame in their respective burners (4).

15. Method according to claim 13 or 14, comprising activating the ignition device (7; 27) when at least one flame sensor (16; 36) detects a switching-off of the ignited flame of the respective burner (4; 24).

16. Method according to any of the claims 12 to 15, comprising a cooking chamber (30) heated by at least one burner (24); the sensor (37) being a temperature sensor arranged so as to detect a temperature value related to the temperature in the cooking chamber (30); the method comprising closing the safety valve (32) when the temperature detected by the temperature sensor (37) exceeds a certain threshold value.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4
11d
16
11d
3
12
GAS
5
5
5
5
2
15
COUNTER
ACTIVATION
17
9
6
13

FIG. 1

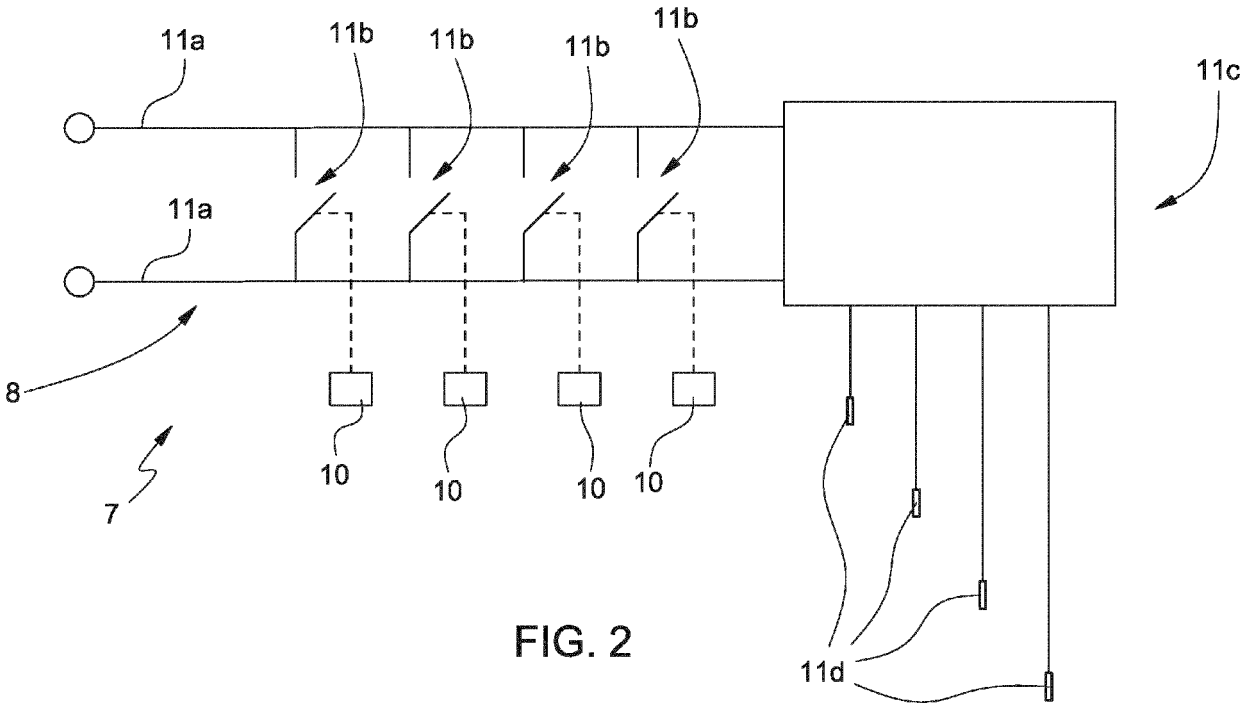

FIG. 2

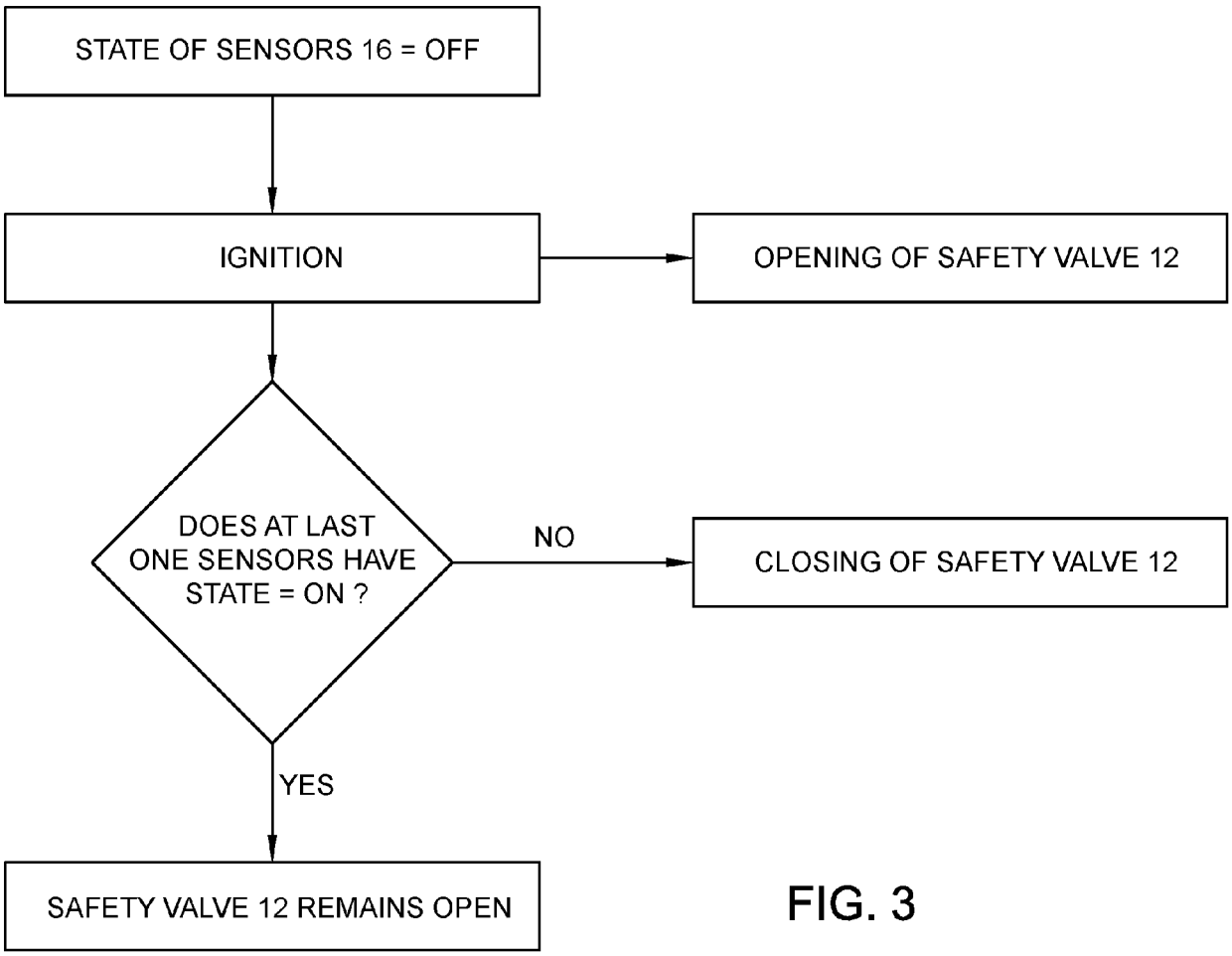
STATE OF SENSORS 16 = OFF
IGNITION
OPENING OF SAFETY VALVE 12
DOES AT LAST ONE SENSORS HAVE STATE = ON ?
NO
CLOSING OF SAFETY VALVE 12
YES
SAFETY VALVE 12 REMAINS OPEN

FIG. 3

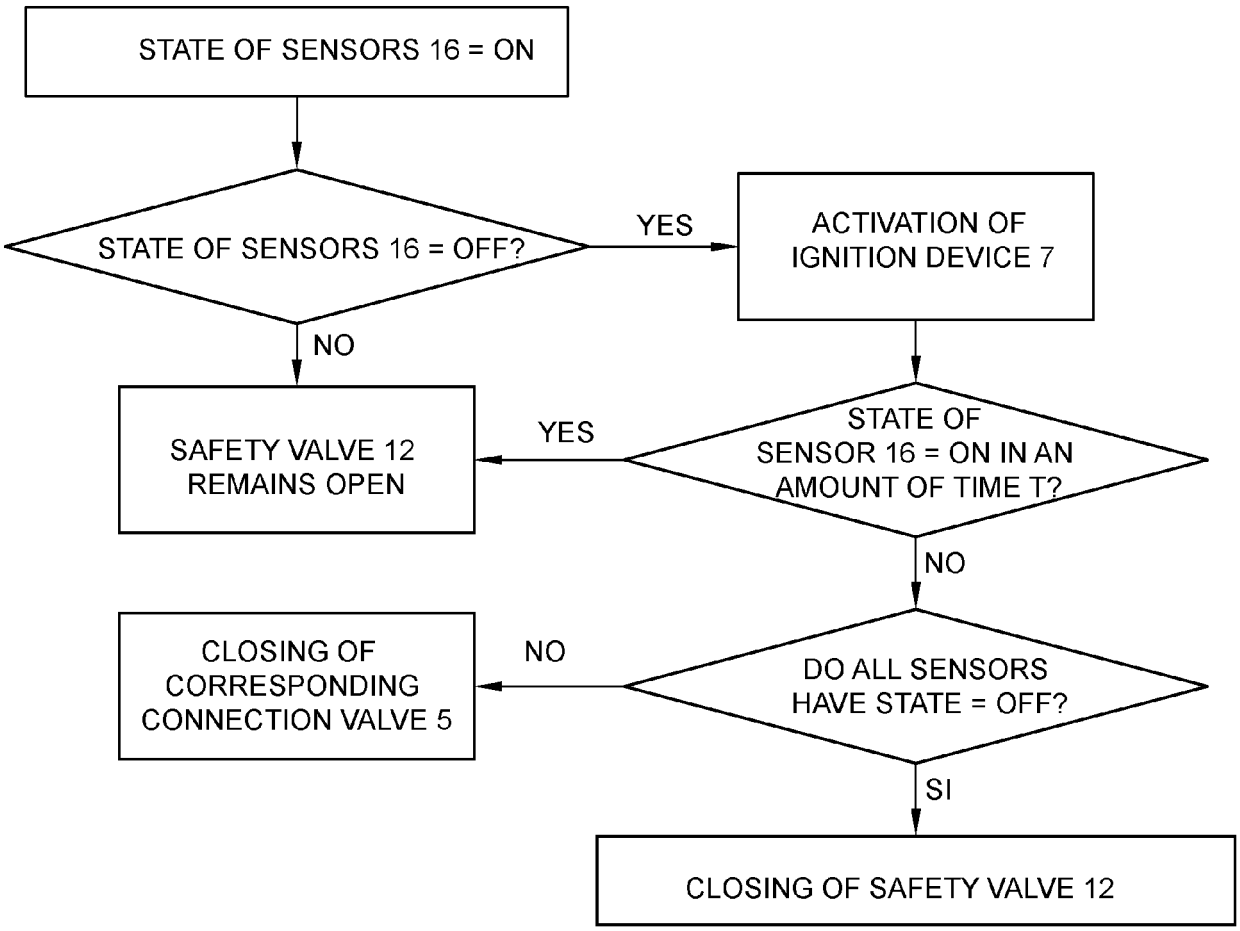
STATE OF SENSORS 16 = ON
STATE OF SENSORS 16 = OFF?
YES
ACTIVATION OF IGNITION DEVICE 7
NO
SAFETY VALVE 12 REMAINS OPEN
YES
STATE OF SENSOR 16 = ON IN AN AMOUNT OF TIME T?
NO
CLOSING OF CORRESPONDING CONNECTION VALVE 5
NO
DO ALL SENSORS HAVE STATE = OFF?
SI
CLOSING OF SAFETY VALVE 12

FIG. 4

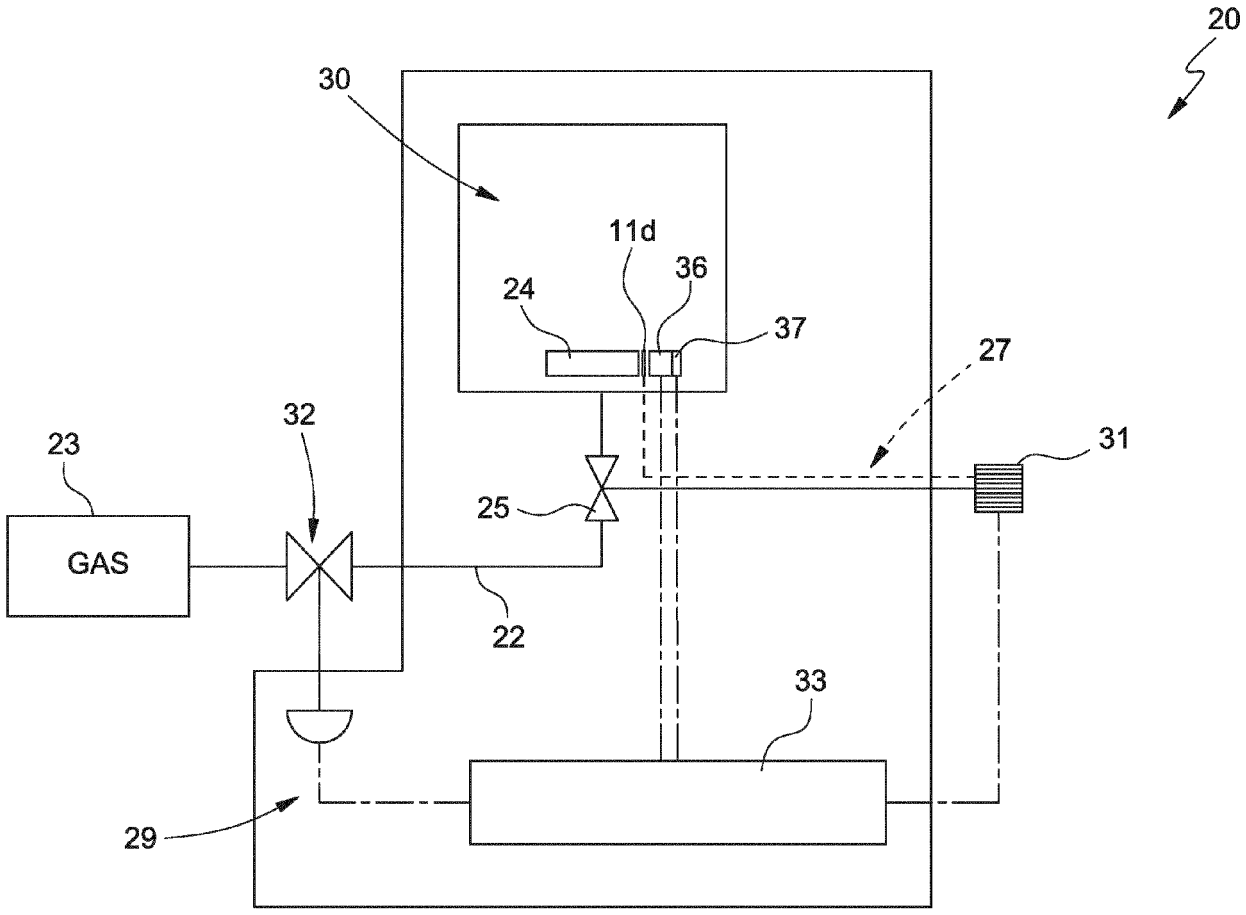

FIG. 5

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EUROPEAN SEARCH REPORT

Application Number
EP 20 18 8841

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Place of search	Date of completion of the search	Examiner
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