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(54) **Flame failure gas cut-off valve.**

(57) A flame failure gas cut-off valve (1) and a gas hob (not shown) incorporating such a valve are described, the valve (1) comprising a thermally operated pressure release valve (20) for controlling the operation of the main valve (5) between a gas inlet (3) and gas outlet (5) thereof. The valve (1) is provided with a momentarily operated push button (41) which causes the main valve (1) to be opened for a time period which is dependent upon the air flow into a chamber (22) of the valve which is partially evacuated when the push button (41) is operated.

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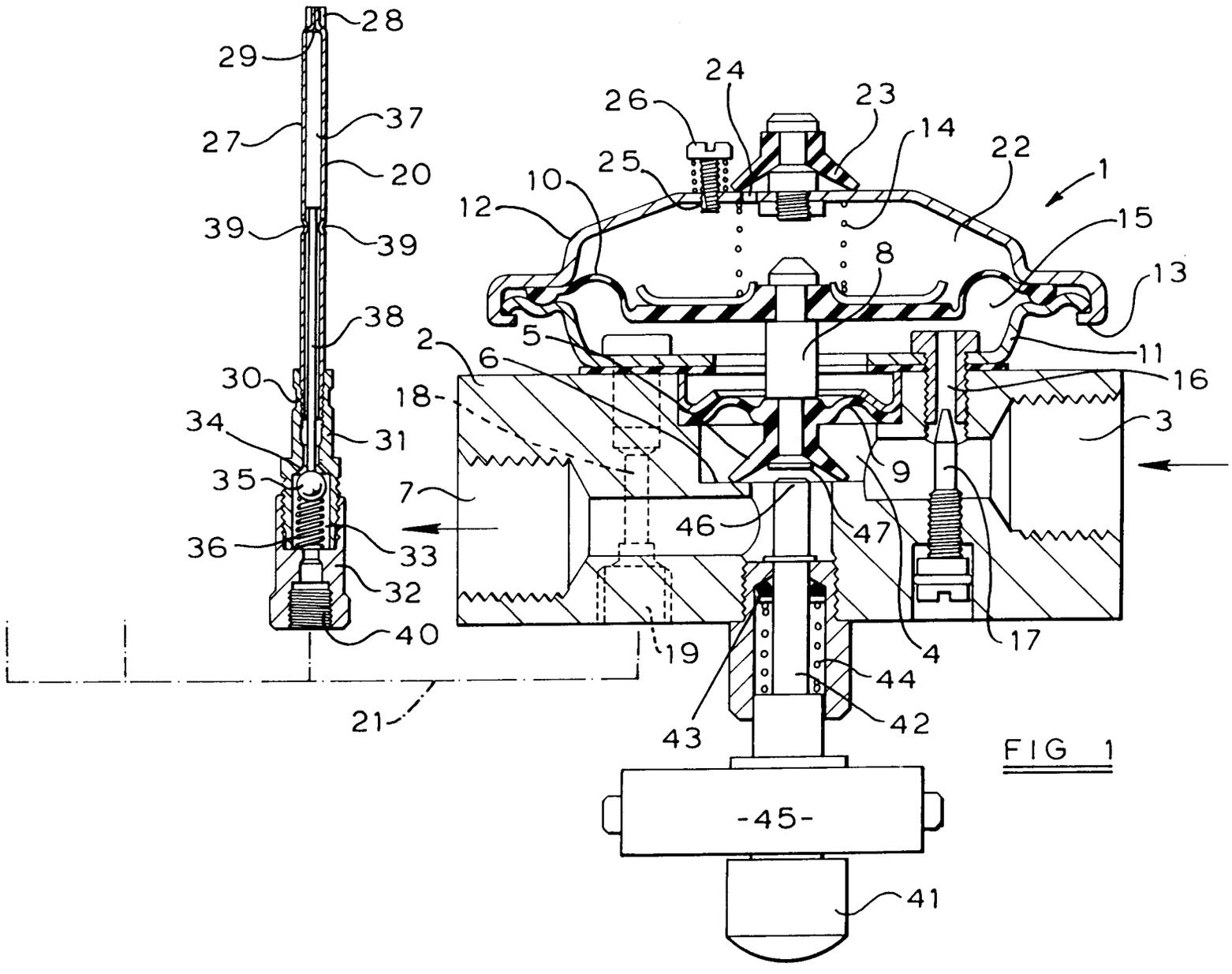
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FIG 1

This invention relates to a flame failure gas cut-off valve especially for use in gas hobs, and also to gas hobs incorporating such a valve.

It is a requirement of some European countries that gas cooking hobs must be provided with a safety device, such as a gas cut-off valve which affords protection against gas leakage should the flame of a gas burner become extinguished for some reason, e.g. due to spillage.

Existing gas cooking hobs make use of a thermo-electric valve which is incorporated into each of the gas taps of the hob, each thermo-electric valve being provided with a thermal probe which is inserted into the flame of the respective gas burner and which generates an emf which is applied to the thermo-electric valve and is sufficient to hold the thermo-electric valve open when a gas burner flame is present. Should the gas burner flame be extinguished for any reason, the thermal probe will cool such that the required emf will not be generated thereby causing the thermo-electric valve to close to cut-off the gas supply to the gas burner.

When a gas burner is initially lit it is necessary to provide a manual over-ride for the thermo-electric valve and this requires that the gas tap is manually held ON for a period of time sufficient for the thermal probe to be heated by the gas burner flame to generate the required emf necessary to hold the thermo-electric valve open.

The holding ON of the gas tap, which can take in the order of fifteen seconds, is inconvenient and it is an object of the present invention to provide a flame failure cut-off valve which obviates the need for a gas tap to be held ON. It is also an object of the present invention to provide a gas hob which incorporates such a valve.

According to one aspect of the present invention there is provided a flame failure gas cut-off valve comprising a main valve member for controlling the supply of gas from a gas inlet to a gas outlet, a spring operated diaphragm operatively connected to said main valve member for urging it to its closed position, said diaphragm defining the wall of a first chamber on one side thereof which is connected to the gas flow path to cause pressure build-up in said first chamber for urging said main valve member into its open position, and a thermally operated pressure release valve connected to said first chamber, said pressure operated release valve when heated causing pressure to build-up in said first chamber to cause said main valve member to operate to its open position and said pressure release valve when not heated being effective for preventing the build-up of pressure in said first chamber to cause said main valve member to operate to its closed position, said diaphragm also defining the wall of a second chamber on the other side thereof, said second chamber being provided with an air outlet valve and with a relatively small air inlet passage, manually operated control means being provided for causing said main valve member to be opened and for causing said diaphragm to be operated to expel air from said second chamber, return movement of said diaphragm and of said main valve member being controlled by said air inlet passage whereby said main valve member is maintained in its open position for a period of time following the manual operation of said control means.

In this way it may be arranged that the main valve member is maintained in its open position for a period of time which is sufficient for the thermally operated pressure release valve to be heated to cause pressure build-up in said first chamber to maintain said main valve member in its open position, thereby obviating the need for an associated gas tap or the manually operated control means to be held ON.

In carrying out the invention according to the aforesaid first aspect it may be arranged that said air outlet valve takes the form of a one-way outlet valve, and that said air inlet passage takes the form of a restricted air inlet passage.

In one arrangement it may be arranged that the manually operated control means acts directly on said main valve member for causing it to be opened and for causing said diaphragm to be operated.

Advantageously, the manually operated control means is spring biassed, and it may be arranged that electrical switch means is provided which is operated when said manually operated control means is operated.

In another arrangement it may be arranged that the manually operated control means acts indirectly on said main valve member for causing it to be opened and for causing said diaphragm to be operated, in which case a gas valve may be provided which is caused to be opened when said manually operated control means is operated, said gas valve being effective for supplying gas from said gas inlet into said first chamber for causing gas pressure therein to cause said diaphragm to be operated and to cause said main valve member to be opened.

In a preferred arrangement it will be arranged that a plurality of thermally operated pressure release valves will be provided connected to said first chamber.

According to another aspect of the present invention there is provided a gas hob comprising a flame failure gas cut-off valve according to said first aspect of the invention, said gas hob conveniently comprising a plurality of gas burners each having a gas tap for controlling gas flow thereto, and a gas supply for said gas taps, said flame failure gas cut-off valve being connected to said gas supply for said gas taps, each of said gas burners having a thermally operated pressure release valve heated thereby, said pressure release valves being connected to said first chamber of said gas cut-off valve.

It may be arranged that each of said pressure

release valves is connected to said first chamber of said gas cut-off valve via a further gas valve operated by the gas tap relating to the gas burner of the respective pressure release valve, and ignition means may be provided associated with each of said gas burners and ignition generation means provided for energising said ignition means, said ignition generation means being operated by electrical switch means operated by said manually operated control means of said valve.

In this way, should the flame of any gas burner be extinguished e.g. due to spillage, the pressure operated release valve associated with that gas burner will cool down to release the pressure build-up in the first chamber of the flame failure gas cut-off valve to cause the main valve member to operate to its closed position to cut-off the gas supply to all of the gas burners of the gas hob.

An exemplary embodiment of the invention will now be described reference being made to the accompanying drawings, in which:

Fig. 1, is a cross-sectional view of a flame failure gas cut-off valve in accordance with the present invention;

Fig. 2, is a schematic plan view of a gas hob according to the present invention, incorporating the flame failure gas cut-off valve of Fig. 1; and

Fig. 3, is a cross-sectional view of a modified form of the flame failure gas cut-off valve of Fig. 1.

The flame failure gas cut-off valve 1 shown in Fig. 1 of the drawings is based on the flame failure device which forms the basis of G.B. Patent No. 2047921B which includes a full description of the basic construction and operation of the valve.

The valve 1 shown in Fig. 1 has a body 2 with a gas inlet passage 3 for conveying gas to a chamber 4 at the bottom of which is a main valve 5 which can seat against a valve seat 6 to control the flow of gas from the chamber 4 to a gas outlet passage 7 in the body 2.

The main valve 5 is connected by means of a stem 8 extending through the chamber 4 and through a sealing diaphragm 9 which is secured in the body 2 to a main diaphragm 10, the periphery of which is clamped between the edges of a lower cover member 11 which is secured to the body 2 and an upper cover member 12, the peripheral edge 13 of which is turned under to secure it to the lower cover member 11. The main valve 5 is biassed against the valve seat 6 by means of a compression spring 14 disposed between the main diaphragm 10 and the upper cover member 12.

The underside of the main diaphragm 10 together with the lower cover member 11 and the sealing diaphragm 9 define a first chamber 15 which is connected to the gas inlet passage 3 via a passage 16 having a screwed restrictor 17 which permits a very small flow of gas from the gas inlet passage 3 to the first chamber 15. The first chamber 15 is also provided with a bleed passage 18 between it and a bleed pipe connection 19 to which is coupled a number of thermally operated pressure release valves 20, only one of which is shown, via a bleed pipe shown by the broken line 21.

The upper side of the main diaphragm 10 together with the upper cover member 12 define a second chamber 22 which is vented to atmosphere via a one-way air outlet valve 23 having a vent hole 24 and via a restricted vent passage 25 controlled by a restricting screw 26.

The thermally operated pressure release valves 20, only one of which is shown, which are connected to the bleed pipe connection 19 via the bleed pipe 21 each takes the form of a hollow tube 27 which is closed at one end 28 by three-point crimping to define an abutment 29 and the other end 30 of which is externally screw threaded for screw threaded engagement with a complementary internal screw thread on a mount which forms a first valve part 31 of the valve 20. The valve part 31 is externally screw threaded and fits inside a correspondingly threaded support part 32 of the valve 20.

As can be seen from the drawing, the valve part 31 has an internal bore 33 which is stepped to provide a valve seat 34. The wider part of the bore 33 contains a movable valve member in the form of a ball 35 and resilient means in the form of a compression spring 36 which urges the ball 35 against the valve seat 34, and closes the wider part from the narrower part of the bore 33. The tube 27 contains an elongate member in the form of a rod 37 of a non-heat sensitive material, e.g. of fused silica, and a second elongate member in the form of a rod 38 of heat sensitive material. The rod 37 is arranged to be a close sliding fit within the tube 27 and is engageable by the abutment 29. The rod 38 is interposed between the ball 35 and the rod 37 and is of non-matching cross-section with the tube 27 and is typically of square cross-section with the tube 27 being of circular cross-section. The tube 27 has two vents 39 which are near to the junction between the rods 37 and 38 and the passages between the rod 38 and the inner surface of the tube 27 provide, when the ball 35 is disengaged from the valve seat 34, communication between the bore 33 of the valve part 31 and the vents 39. The support part 32 has a bore 40 aligned with the bore 33 and is internally threaded to receive the bleed pipe 21.

The valve 1 thus far described operates as follows. In the cold condition (no flame) gas from the gas inlet passage 3 enters and fills chamber 4. Gas also flows through the passage 16 with the restrictor 17 into the first chamber 15. Gas from the first chamber 15 flows via the bleed passage 18 and the bleed pipe 21 to the thermally operated pressure release valve 20. Because the valve 20 is cold, the ball 35 is prevented from seating on the valve seat 34 and so gas

in the bleed pipe 21 is vented to atmosphere. This flow of gas prevents the build-up of pressure in the first chamber 15 and the main valve 5 remains closed.

When the tube 27 of the thermally operated pressure release valve 20 is heated by a flame (not shown) in the region between the vents 39 and the end 28, it expands rapidly thus moving the abutment 29 in a direction away from the valve seat 34 and as the rod 37 only expands by a relatively small amount, the ball 35 is enabled to seat on the valve seat 34 due to the effect of the spring 36 to thereby close the valve 20 and prevent gas from being vented via the vent holes 39. Because the valve 20 is closed, pressure is caused to build-up in the first chamber 15 thereby exerting an upwards force on the main diaphragm 10 until a point is reached where the main valve 5 is lifted from the valve seat 6 and permits gas flow from the gas inlet passage 3 to the gas outlet passage 7.

If the flame which is heating the tube 27 of the thermally operated pressure release valve 20 is extinguished for any reason, the tube 27 thereof cools down and contracts causing the rods 37 and 38 to unseat the ball 35 from the valve seat 34 to open valve 20. The gas in the first chamber 15 is then vented via the vent holes 39, thereby reducing the pressure in the chamber 15 until a point is reached where it is insufficient to hold the main valve 5 open, which therefore closes under the action of the spring 14 to cut-off the gas flow between the gas inlet passage 3 and the gas outlet passage 7.

In a practical situation, the end of the thermally operated pressure release valve 20 of Fig. 1 would be positioned within the flame of a gas burner, for example, of a gas hob. When the gas burner is first lit, the valve 20 starts from cold and takes a finite time, e.g. 15 seconds, for it to warm up sufficiently for it to operate and to allow pressure build-up in the chamber 15 of the valve 1 sufficient to cause the valve 1 to open. During this finite time it is necessary to bypass the valve 1 in order that gas can be supplied to the gas burner to heat the valve 20.

This is achieved in the valve 1 shown in Fig. 1, by providing a manually operable push button 41 which is attached to a spindle 42 which passes through a gas seal 43 held under pressure by a spring 44 which also acts as a return spring for the push button 41. On spindle 42 is slideably mounted an electric switch 45, the purpose of which will be explained hereinafter, which is activated when the push button 41 is operated.

The action of pushing the push button 41 causes the opposite end 46 of the spindle 42 to contact the end 47 of the stem 8 on which the main valve 5 is mounted. Thus, when the push button 41 is operated, the main valve 5 is lifted from the valve seat 6 and gas flows from the gas inlet passage 3 via the chamber 4 to the gas outlet passage 7.

Movement of the stem 8 also causes the main diaphragm 10 to be moved upwards as viewed in the drawing and this causes air in the second chamber 22 to be vented to atmosphere via the one-way valve 23. When this happens, and the push button 41 is then released, the main diaphragm 10 is urged downwards under the action of the spring 14, but its movement is limited by the amount of air which is allowed to re-enter the second chamber 22 via the restricted vent passage 25. Thus, there is a delay between the time the push button 41 is operated and released and the time the diaphragm returns to the position where the main valve 5 closes on the valve seat 6. The time of this delay can be varied by adjusting the restricting screw 26.

Thus, when push button 41 is operated manually, the valve 1 is opened for a time period determined by the restricted vent passage 25 and allows gas to be supplied to a gas burner for a time period sufficient to heat the thermally operated pressure release valve 20, which will then maintain the valve 1 open due to the pressure build-up in the first chamber 15 thereof.

In Fig. 2 of the drawings there is depicted a gas hob incorporating the flame failure gas cut-off valve 1 of Fig. 1.

The gas hob of Fig. 2 comprises three gas burners 50, each of which is supplied with gas from a gas rail 51 via a respective gas tap 52. Mounted on the inlet side 53 of the gas rail 51 is a flame failure gas cut-off valve 1 as described with reference to Fig. 1 which controls the gas supply to the gas taps 52. The valve 1 is provided with three bleed pipes 21 which are connected to respective thermally operated pressure release valves 20, as described with reference to Fig. 1, the pressure release valves 20 being disposed in the flame of the gas burners 50 and being connected to the respective bleed pipe 21 via a respective ON/OFF gas valve 54 which is coupled to the gas tap 52 of the appropriate gas burner 50, the gas valves 54 being normally OFF but which are turned ON when the appropriate gas tap 52 is turned ON. The gas valves 54 prevent gas from being continuously vented to atmosphere.

The valve 1 of the gas hob of Fig. 2 also comprises the push button 41 and the electric switch 45 as described with reference to Fig. 1, the electric switch 45, when it is operated by the push button 41 causing an ignition generator 55 to be operated to cause ignition sparks to be generated at ignition electrodes 56 disposed adjacent each of the gas burners 50.

The gas hob of Fig. 2 operates as follows:
When all the gas taps 52 are OFF, the valves 20 will be cold but bleed gas from the valve 1 will be prevented from being given off by the normally OFF gas valves 54.

When one of the gas taps 52 is turned ON, the respective valve 54 is turned ON and bleed gas is given off by valve 20 coupled thereto. If the push but-

ton 41 is then pushed momentarily, the valve 1 will be opened to allow gas to flow from the gas rail 51 via the gas tap 52 which has been turned ON to the respective gas burner 50. Operation of the push button 41 also causes the electric switch 45 to be operated which in turn causes the ignition generator 55 to be operated to cause ignition sparks to be generated at the spark electrodes 56 of each of the gas burners 50. This causes the gas burner which is being supplied with gas to be ignited and will cause the respective thermally operated valve 20 to be heated. Because the cut-off valve 1 remains ON for a finite period whilst air is being let into the second chamber 22 of the valve 1 of Fig. 1, sufficient time is allowed for the valve 20 to be operated to its OFF position in which pressure build-up occurs in the first chamber 15 of the valve 1 which subsequently holds the valve 1 ON.

Should the flame of the gas burner which is alight be extinguished for any reason, e.g. due to spillage, the thermally operated pressure release valve 20 associated with it will cool down until such time as it opens to allow bleed gas to escape therefrom, this causing the build-up pressure in the first chamber 15 of valve 1 to fall to subsequently cause the valve 1 to close.

Thus a flame failure facility is obtained without the need to hold on any gas taps as is the case with existing prior art hobs.

The gas hob of Fig. 2 incorporating the flame failure gas cut-off valve 1 of Fig. 1 is very satisfactory and is ideal for gas hobs where the gas taps extend across the front of the gas hob, this requiring the gas supply to be brought to the front of the hob and enables the cut-off valve 1 also to be positioned at the front of the gas hob.

However, in some gas hobs the gas taps extend down one side of the gas hob so that the gas supply is at the rear of the hob, thereby necessitating the gas cut-off valve 1 to be positioned at the rear of the gas hob. In Fig. 3 of the drawings there is depicted a modification of the flame failure gas cut-off valve 1 of Fig. 1 which obviates the need for the manually operable push button 41 to act directly on the gas cut-off valve 1 and enables the push button 41 to be positioned at any convenient position on the hob irrespective of the position of the gas cut-off valve 1.

The flame failure gas cut-off valve 1 of Fig. 3 is basically the same as that of Fig. 1 and like parts have been given the same reference numerals. In Fig. 3, the gas valve 54 of the gas hob of Fig. 2 is shown in greater detail connected between the bleed pipe 21 and the thermally operated pressure release valve 20, the gas valve 54 being operated by the spindle 52′ of a gas tap (not shown).

In the gas cut-off valve 1 of Fig. 3, the main valve 5 is not manually operated directly by the manually operated push button 41, but instead the push button 41, having the electric switch 45 coupled to it, is used to operate a normally closed gas valve 57 which has a gas inlet 58 coupled by means of a pipe 59 to an outlet 60 connecting to the gas inlet passage 3 of the valve 1, and a gas outlet 61 which is coupled to the bleed line 21 and thence, via the bleed pipe connection 19 and bleed passage 18, to the first chamber 15 on the underside of the main diaphragm 10.

Thus, when the manually operated push button 41 is operated, the gas valve 57 is caused to open to allow gas from the gas inlet passage 3 to be introduced into the first chamber 10, the gas pressure acting on the diaphragm 10 causing it to be moved upwards so that the main valve 5 is lifted from the valve seat 6 to allow gas flow from the gas inlet passage 3 via the chamber 4 to the gas outlet passage 7, and also causing air in the second chamber 22 of the valve 1 to be vented to atmosphere via the one-way valve 23. As in the case of the gas valve 1 of Fig. 1, when the push button 41 is released, the main diaphragm 10 is urged downwards under the action of the spring 14, but its movement is limited by the amount of air which is allowed to re-enter the second chamber 22 via the restricted vent passage 25. Thus, when push button 41 is operated manually and released, the valve 1 is opened for a time period determined by the restricted vent passage 25 and allows gas to be supplied to a gas burner, as in the gas hob of Fig. 2, for a time period sufficient to heat the thermally operated pressure release valve 20 which will then maintain the valve 1 open due to the pressure build-up in the first chamber 15 thereof.

It will be appreciated that the arrangement of Fig. 3 enables the manually operated push button 41 to be positioned remotely from the valve 1 so that it can be positioned at any convenient location on a gas hob irrespective of the positioning of the flame failure gas cut-off valve 1.

Claims

1. A flame failure gas cut-off valve comprising a main valve member for controlling the supply of gas from a gas inlet to a gas outlet, a spring operated diaphragm operatively connected to said main valve member for urging it to its closed position, said diaphragm defining the wall of a first chamber on one side thereof which is connected to the gas flow path to cause pressure build-up in said first chamber for urging said main valve member into its open position, and a thermally operated pressure release valve connected to said first chamber, said pressure operated release valve when heated causing pressure to build-up in said first chamber to cause said main valve member to operate to its open position and said pressure release valve when not heated being effective for preventing the build-up of

pressure in said first chamber to cause said main valve member to operate to its closed position, said diaphragm also defining the wall of a second chamber on the other side thereof, said second chamber being provided with an air outlet valve and with a relatively small air inlet passage, manually operated control means being provided for causing said main valve member to be opened and for causing said diaphragm to be operated to expel air from said second chamber, return movement of said diaphragm and of said main valve member being controlled by said air inlet passage whereby said main valve member is maintained in its open position for a period of time following the manual operation of said control means.

2. A valve as claimed in claim 1, in which said air outlet valve takes the form of a one-way outlet valve.

3. A valve as claimed in claim 1 or claim 2, in which said air inlet passage takes the form of a restricted air inlet passage.

4. A valve as claimed in any preceding claim, in which the manually operated control means acts directly on said main valve member for causing it to be opened and for causing said diaphragm to be operated.

5. A valve as claimed in any preceding claim, in which the manually operated control means is spring biassed.

6. A valve as claimed in any of claims 1 to 3, in which the manually operated control means acts indirectly on said main valve member for causing it to be opened and for causing said diaphragm to be operated.

7. A valve as claimed in claim 6, comprising a gas valve which is caused to be opened when said manually operated control means is operated, said gas valve being effective for supplying gas from said gas inlet into said first chamber for causing gas pressure therein to cause said diaphragm to be operated and to cause said main valve member to be opened.

8. A valve as claimed in any preceding claim, comprising electrical switch means which is operated when said manually operated control means is operated.

9. A valve as claimed in any preceding claim, comprising a plurality of thermally operated pressure release valves connected to said first chamber.

10. A gas hob comprising a flame failure gas cut-off valve as claimed in any preceding claim.

11. A gas hob as claimed in claim 10, comprising a plurality of gas burners each having a gas tap for controlling gas flow thereto, and a gas supply for said gas taps, said flame failure gas cut-off valve being connected to said gas supply for said gas taps, each of said gas burners having a thermally operated pressure release valve heated thereby, said pressure release valves being connected to said first chamber of said gas cut-off valve.

12. A gas hob as claimed in claim 11, in which each of said pressure release valves is connected to said first chamber of said gas cut-off valve via a further gas valve operated by the gas tap relating to the gas burner of the respective pressure release valve.

13. A gas hob as claimed in any of claims 10 to 12, comprising ignition means associated with each of said gas burners and ignition generation means for energising said ignition means, said ignition generation means being operated by electrical switch means operated by said manually operated control means of said valve.

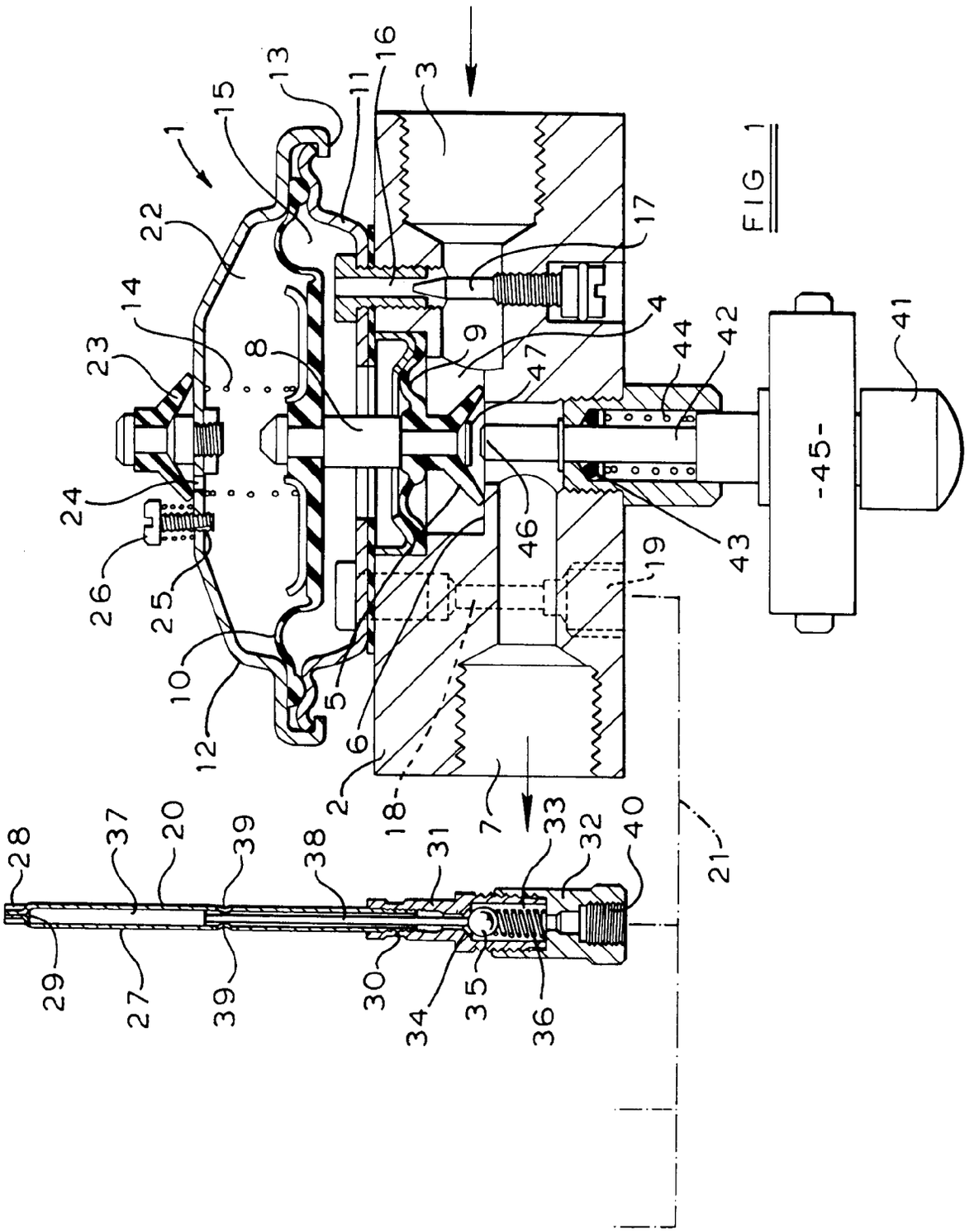
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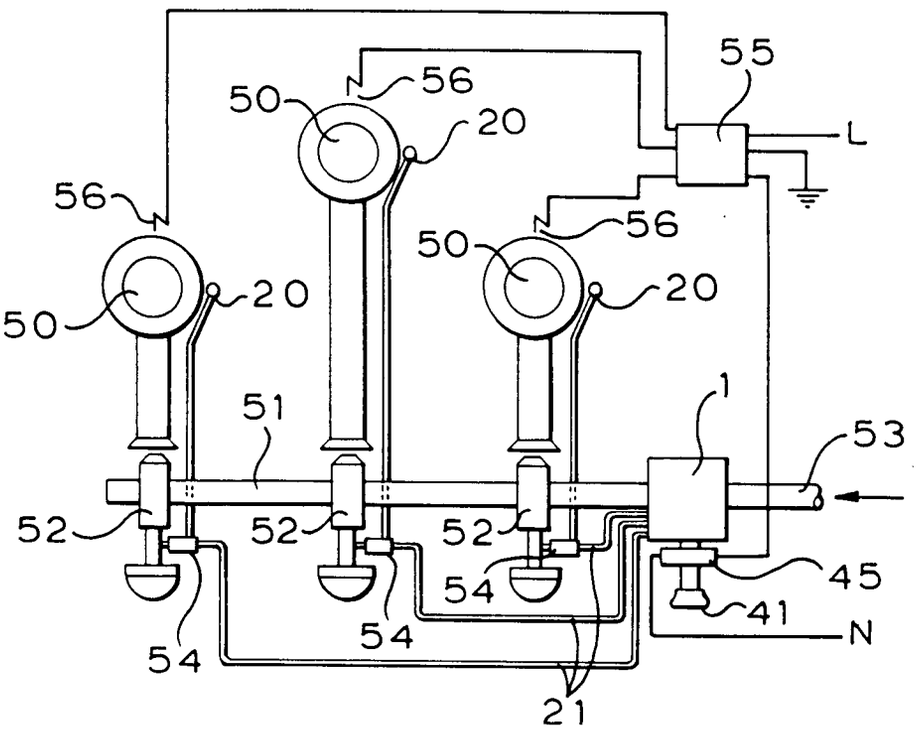
FIG 1



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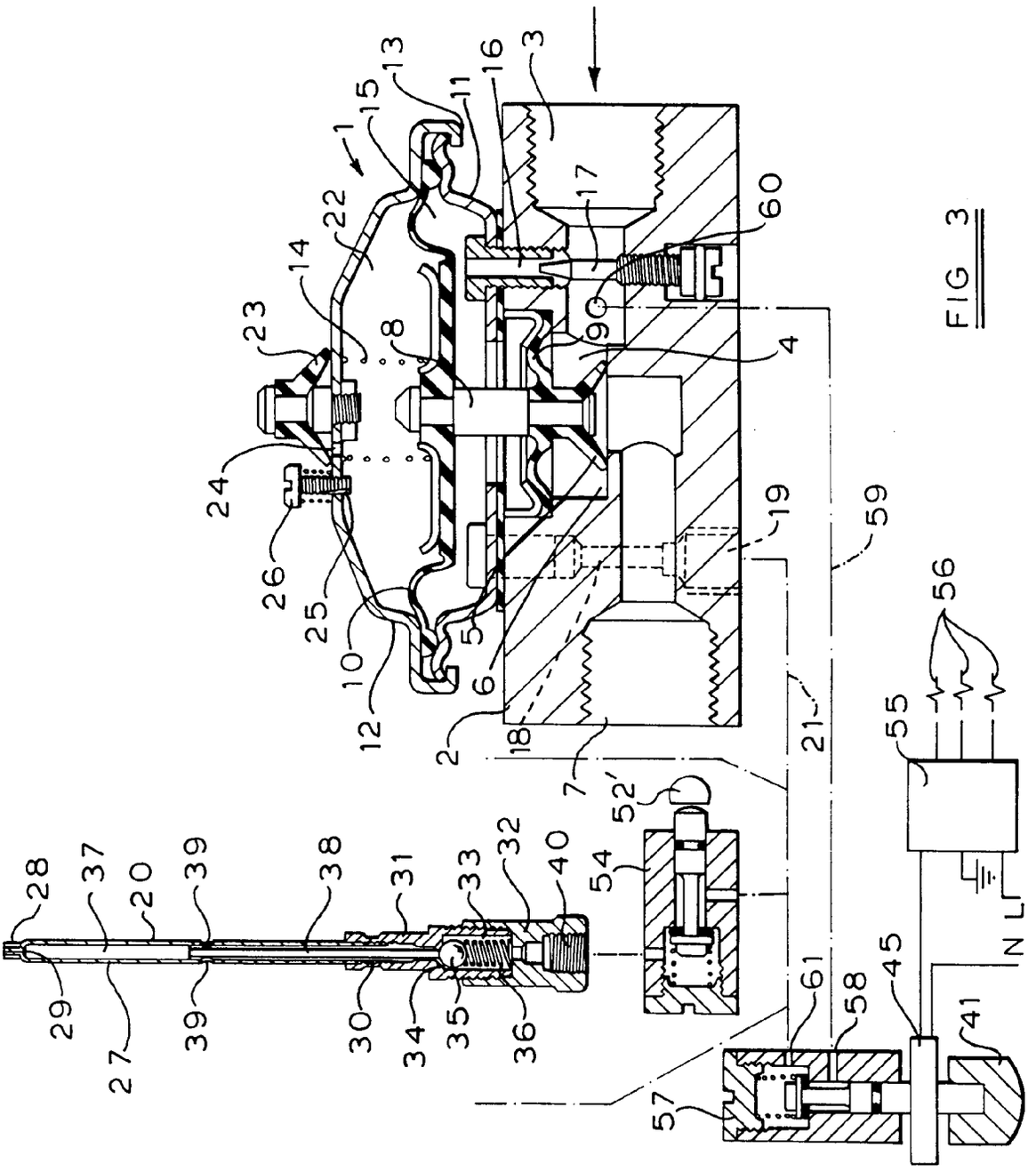
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FIG 3

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 91 30 6724

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y,D	GB-A-2 047 921 (T.I. DOMESTIC APPLIANCES) * the whole document * ---	1,5,10	F23N5/22 F23N5/02
Y	JP-A-1 189 418 (RINNAI) July 28, 1989 * figures * & PATENT ABSTRACTS OF JAPAN vol. 13, no. 477 (M-885)(3825) October 27, 1989 * the whole document * ---	1,5,10	
A	US-A-4 060 370 (FLEER) * column 3, line 15 - line 25; figures * ---	1-3	
A	GB-A-1 135 441 (IDEAL- STANDARD) -----		

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
F23N R23N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	26 SEPTEMBER 1991	KOOIJMAN F.G.M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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