

GAS COOKER

The present invention relates to a gas cooker with automatic gas supply cutting-off action.

According to the invention, there is provided a gas cooker
5 which comprises two burners, a gas valve controlling the supply of gas to the burners, a control knob for operating the gas valve, and two thermo-couples which are located adjacent to the burners, respectively, to detect the presence or absence of flame at the burners, the arrangement being such
10 that the gas valve will be closed in response to the absence of flame at either one or both of the burners detected by the corresponding thermo-couple or thermo-couples.

Preferably, the gas valve comprises a valve seat and a valve member which is biased by a spring into engagement with the
15 valve seat, thereby closing the gas valve, and is movable away from the valve seat, thereby opening the gas valve, against the action of the spring by an electro-magnet energized by a said thermo-couple.

A preferred arrangement of the gas cooker is such that the gas
20 valve will be closed only in response to the absence of flame at both burners.

In a preferred embodiment, the gas cooker further comprises another gas valve, wherein each gas valve is provided for controlling the supply of gas to a corresponding said burner

and is associated with a corresponding said thermo-couple so that each gas valve will be closed independently of the other gas valve in response to the absence of flame at the corresponding burner detected by the corresponding thermo-
5 couple.

Advantageously, both gas valves are operable by the same control knob.

It is preferred that the gas cooker further comprises a subsidiary gas valve which is provided in the path of gas
10 supply to one of the burners for turning off the said burner.

Preferably, the subsidiary gas valve includes a press knob for operation.

Advantageously, the press knob is arranged to return automatically to an inoperative position upon the control knob
15 being returned manually to an inoperative position, both inoperative position corresponding to cutting-off of gas supply.

Another preferred arrangement of the gas cooker is such that the gas valve will be closed in response to the absence of
20 flame at the burner or either one or both of the burners which is or are intended to be in use.

In another preferred embodiment, the gas cooker further

comprises means arranged to adjust automatically upon manual operation of the control knob the tension of the spring of the gas valve so that the gas valve can be held open by the electro-magnet and the thermo-couple or thermo-couples when
5 the corresponding burner or burners is or are intended to be in use but not by the electro-magnet and only one thermo-couple when both burners are intended to be in use.

Preferably, the gas valve comprises an operating shaft rotatable by the control knob, the spring being a coil spring
10 and disposed co-axially on the shaft, and said means comprises a stop between which and an abutment on the shaft the spring is co-acting to bias the gas valve into the closed position, the stop being movable axially but not angularly by the shaft upon rotation of the shaft so that when the shaft
15 is rotated the tension of the spring is adjusted automatically by virtue of the change in separation between the stop and the abutment.

In a further preferred embodiment, the gas cooker further comprises means arranged to adjust automatically upon manual
20 operation of the control knob the current to be generated by the thermo-couple or thermo-couples so that the gas valve can be held open by the electro-magnet and the thermo-couple or thermo-couples when the corresponding burner or burners is or are intended to be in use but not by the electro-magnet and
25 only one thermo-couple when both burners are intended to be in use.

It is preferred that said means comprises two variable resistor units which are connected electrically in series in the corresponding circuits of the thermo-couples, said resistor units being adjustable automatically upon manual
5 operation of the control knob to a low resistance value or to a high resistance value when the gas cooker is switched to one burner or two burners, respectively.

Advantageously, the thermo-couples have substantially the same rating, the resistor units are operable to provide
10 substantially the same resistance value, and each resistor unit is so adjustable between a specific resistance value and half of that value.

Preferably, the gas cooker further comprises a time delay element in the circuit of each thermo-couple so as to reduce
15 the speed of de-energization of the corresponding thermo-couple when the corresponding burner is extinguished.

The invention will now be more particularly described, by way of example only, with reference to the accompanying drawings, in which:

20 Figure 1 is a fragmentary schematic sectional view of a first embodiment of a gas cooker in accordance with the invention;

Figure 2 is a fragmentary schematic sectional view of a second embodiment of a gas cooker in accordance with the invention;

Figure 3 is a fragmentary schematic sectional view of a third embodiment of a gas cooker in accordance with the invention;

Figures 4A to 4C show the operating positions of a gas valve of the gas cooker of Figure 3;

5 Figures 5A to 5B are fragmentary schematic sectional views of the gas valve of the gas cooker of Figure 3; and

Figure 6 is a fragmentary schematic sectional view of a fourth embodiment of a gas cooker in accordance with the invention.

Referring to Figure 1 of the drawings, there is shown a first
10 embodiment of a gas cooker 10 according to the invention which comprises an inner burner piece 11, an outer burner piece 12 in the form of a ring surrounding the inner burner piece 11, and a top piece 13 which serves to support, for example, a pot or pan to be heated by the gas cooker 10. Gas is to be
15 supplied to the burner pieces 11 and 12 through a gas valve 14, a chamber 15 and finally two passages 16 and 17 leading to the corresponding burner pieces 11 and 12. The gas valve 14 is electro-magnetically operated by a pair of thermo-couples 18 and 19 located adjacent to the corresponding burner
20 pieces 11 and 12.

The gas valve 14 comprises a casing 20 which has an inlet 21 for gas intake and an outlet 22 through which the casing 20 and the chamber 15 communicate with each other. At the outlet

22, there are provided a fixed valve seat 2 and a valve member 24 carried on a valve-operating shaft 25. The shaft 25 is connected at its far end to a turning control knob 26 by means of which the gas valve 14 can be operated by a user.

5 The near end of the shaft 25 is located within the casing 20 and carries a soft iron (ferro-magnetic) piece 27. An electro-magnet 28 is located behind the soft iron piece 27 in the casing 20, and has a coil winding to which the thermo-couples 18 and 19 are connected electrically in parallel.

10 The gas valve 14 is biased into a closed position, in which the valve member 24 bears tightly against the valve seat 23, by a coil spring 29 which is disposed co-axially on the shaft 25 and between the valve member 24 and an abutment 30 fixed on the shaft 25. Thus the gas valve 14 is normally closed,

15 but is arranged to be held open by electro-magnetic attraction between the electro-magnet 28 and the soft iron piece 27. The electro-magnet 28 draws the soft iron piece 27 close and in turn withdraws via the shaft 25 the valve member 24 away from the valve seat 23, when either one of the thermo-couples 18

20 and 19 is heated by flame at the corresponding burner piece 11 or 12.

The gas cooker 10 further comprises a subsidiary gas valve 31 located within the chamber 15 and in the path of gas supply to the burner piece 12. The subsidiary gas valve 31 comprises

25 a fixed valve seat 32 and a co-operating valve member 33 which is movable by means of a press knob 34 via an operating shaft

35. Inside the press knob 34 there is provided a spring (not shown) which biases the shaft 35 outwardly so as to maintain the subsidiary gas valve 31 normally open. To turn off the outer burner piece 12, the press knob 34 is pressed by a user
5 in order to close the subsidiary gas valve 31. The press knob 34 will hold the gas valve 31 in the closed position until it is released by the control knob 26 when the latter is rotated back to its original inoperative position.

To use the gas cooker 10, a user is to firstly press the
10 control knob 26 to open the gas valve 14 and immediately thereafter rotate the control knob 26 fully clockwise to ignite the burner pieces 11 and 12. Although this is not illustrated in the drawings, ignition is achieved by means of a piezo-electric ignitor as generally known in the art. The
15 control knob 26 must be held pressed for typically one to two seconds until the thermo-couples 18 and 19 are sufficiently heated up. At this stage, the thermo-couples 18 and 19 will be generating sufficiently large electric current to energize the electro-magnet 28 to hold by itself the soft iron piece
20 27, maintaining the gas valve 14 open.

The degree of separation between the valve member 24 and the valve seat 23 determines the rate of gas supply and in turn the size of the flame at the burner pieces 11 and 12. This
25 degree of separation is adjustable by the user turning the control knob 26 anti-clockwise for decrement or at a later stage clockwise for increment. It is arranged so that in

either case where the said degree of separation is at its minimum or maximum, corresponding to the minimum or maximum size of flame at the burner pieces 11 and 12 respectively, the thermo-couples 18 and 19 are sufficiently heated during
5 operation to ensure holding back of the valve member 24 from the valve seat 23 so as to maintain the gas valve 14 open.

It is appreciated that when both burner pieces 11 and 12 of the gas cooker 10 are intended to be in use but are extinguished accidentally by, for example, wind or splitting-
10 over of liquid from above of the gas cooker 10, the thermo-couples 17 and 18 will no longer be heated. This results in the loss of electro-magnetic attraction between the electro-magnet 28 and the soft iron piece 27 of the gas valve 14. As a consequence, the gas valve 14 returns to the closed position
15 under the action of the biasing spring 29, thereby cutting off the gas supply for safety. The same will happen in the case when only the inner burner piece 11 is in use, the outer burner piece 12 being deliberately turned off by means of the press knob 34, but accidentally extinguished.

20 In the presence of, for example, a pot or pan placed on the top piece 13 of the gas cooker 10, any accidental extinguishing of either one (but not both) of the burner pieces 11 and 12, which are intended to be in use, will unlikely cause any real danger because in the confined space
25 underneath the pot or pan the extinguished burner piece 11 or 12 will almost always be immediately ignited again by the

flame remaining at the other burner piece 12 or 11.

Figure 2 shows a second embodiment of a gas cooker 36 according to the invention, which is modified to provide independent gas supply cutting off action in relation to each burner piece. The construction of the gas cooker 36 is similar to that of the gas cooker 10, with like parts designated like numerals (except otherwise stated), except that it has two gas valves 14 and 14' for controlling independently the supply of gas to the burner pieces 12 and 11, respectively. The gas valves 14 and 14' are identical with each other, except that the gas valve 14' is smaller than the gas valve 14 and that inlet 21' of the gas valve 14' is not designed to be connected directly to an external gas supply but indirectly through the casing 20 of the gas valve 14, as shown.

The thermo-couples 18 and 19 are separately connected to the gas valves 14' and 14, respectively, so that each of them is arranged to detect the presence or absence of flame at the associated burner piece 11 or 12. It will be appreciated that the rating of each thermo-couple 18 or 19 and the strength of the biasing spring of the corresponding gas valve 14' or 14 are compromised so that the electro-magnetic force generated by means of each thermo-couple through the corresponding electro-magnet is sufficiently large to overcome the counter-acting force of the corresponding biasing spring.

In operation, the gas supply to the or each burner piece 11 or 12 which is intended to be in use but accidentally extinguished will be automatically cut off for safety independently of the condition of the other burner piece 12
5 or 11.

Figure 3 shows a third embodiment of a gas cooker 37 according to the invention, which gas cooker 37 employs only a single gas valve 38 but is still capable of providing, inter alia, automatic gas supply cutting-off action in situation
10 where only one of the two burner pieces intended to be in use is accidentally extinguished without, for example, a pot or pan placed on the gas cooker 37.

The construction of the gas cooker 37 is similar to that of the gas cooker 10, with like parts designated like numerals
15 (except otherwise stated), except having a modified gas valve 38 and gas supply chamber 39. The chamber 39 is partitioned into two distinct sub-chambers 40 and 41 for gas supply to the burner pieces 11 and 12, respectively. The gas valve 38 comprises a casing 42 which has an outlet 43 divided into two
20 sides opening via two holes 44 and 45 to the corresponding sub-chambers 40 and 41.

The gas valve 38 comprises a valve member 46 fixed on a valve operating shaft 48, and a valve seat 47 in the form of plate being two holes 50 and 51. The valve seat place 47 is located
25 behind and always in ultimate contact with the outlet 43, and

is rotatable by the shaft 48.

Referring also to Figures 4A to 4C, the holes 50 and 51 of the valve seat plate 47 are arranged so as to come in alignment with the corresponding outlet holes 44 and 45 one after the other, as shown. Engagement between the valve member 46 and the valve seat plate 47 renders the gas valve 38 closed, irrespective of the said alignment of the holes 44, 45, 50 and 51.

The gas valve 38 further comprises an abutment unit 52 disposed around the shaft 48 and behind the valve member 46, and a coil spring 53 disposed co-axially on the shaft 48 and co-acting between the abutment unit 52 and the valve member 46, thereby biasing the valve member 46 into engagement with the valve seat plate 47 and in turn closing the gas valve 38. The abutment unit 52 comprises a ring bracket 54 fixed to the gas valve casing 42, and a nut 55 supported slidably but not rotatably within the ring bracket 54. The nut 55 is screw-threadedly engaged with a screw-threaded section of the shaft 48 so that rotation of the shaft 48 will slide the nut 55 co-axially in one direction or the other with respect to the shaft 48.

The operation of the gas valve 38 will now be described with reference also to Figures 5A and 5B. To turn on both burner pieces 11 and 12, the control knob 26 and in turn the shaft 48 is turned clockwise until the holes 50 and 51 of the valve

seat plate 49 align with the corresponding holes 44 and 45 at the outlet 43 (Figure 4C), thereby permitting supply of gas at full rate to the burner pieces 11 and 12 which are ignited at the same time by a piezo-electric ignitor (not shown) associated with the control knob 26. This starting condition is shown in Figure 5A, in which the nut 55 is in its closest operating position in the ring bracket 54 relative to the valve member 46 so that the spring 53 is at its maximum operating tension. On the other hand, the thermo-couples 18 and 19 are both subject to heat and their operating electric current add together to generate a sufficiently large electromagnetic force by means the electro-magnet 28 to hold the valve member 46 from the valve seat plate 47 against the action of the spring 53. The rating of the thermo-couples 18 and 19 is such that under this condition both thermo-couples 18 and 19 are required to operate to overcome the spring 53, and that only one of them will not suffice in the event that one of the burner pieces 11 and 12 is accidentally extinguished.

To turn off the outer burner piece 12, the control knob 26 is turned anti-clockwise until the valve member 46 and the valve seat plate 47 reach the relative position as shown in Figure 4B, in which the holes 50 and 44 remain in alignment but the hole 51 is completely out of alignment with the hole 45, thereby cutting off the gas supply to the outer burner piece 12. Under this condition, as shown in Figure 5B, the nut 55 is in its farthest operating position in the ring bracket 54

relative to the valve member 46 so that the spring 53 is at its minimum operating tension. Such a minimum operating tension is sufficiently small to be overcome by the electromagnetic force generated by means of the electro-magnet 28 and the thermo-couple 18 of the inner burner piece 11, thereby maintaining gas supply to the inner burner piece 11. If follows that if the inner burner piece 11 is at any time extinguished accidentally, the gas supply thereto will be cut off automatically by the gas valve 38 under the action of the spring 53.

As an alternative to the self-adjustment of the tension of the gas valve spring, the operating current of the thermo-couples can instead be self-adjusted according to the operating condition of the gas cooker, i.e. with either one or both of burner pieces being in use, in order to achieve the same function.

A fourth embodiment of a gas cooker 56 according to the invention is shown in Figure 6, which is similar to the gas cooker 37, with like parts designated like numerals (except otherwise stated), except that the tension of the gas valve spring 53 is not self-adjustable. In addition, a variable resistor unit 57 is connected electrically in series with the thermo-couples 18 and 19. Operating member 58 of the resistor unit 57 is mechanically coupled to the control knob 26 in a known manner so that turning of the control knob 26 will automatically move the operating member 58 and in turn to

adjust the resistance value of the resistor unit 57. In this particular embodiment, the two thermo-couples have substantially the same rating and the resistor unit 57 is designed to switch between a specific resistance value (the high value) and half of that resistance value (the low value).

The resistor unit 57 is set to the high resistance value when two burner pieces 11 and 12 are used, but is set to the low resistance value when only one burner piece 11 or 12 is used. It is understood that in either operating condition of the gas cooker 56, the resulting electric current flowing through the electro-magnet 28 in the gas valve 14 will remain roughly at the same value which is sufficient to overcome the biasing force of the gas valve spring 53.

It is appreciated that the same current control arrangement can be applied to the gas cooker 10 in order for the automatic gas supply cutting-off system to distinguish between the situation where only one burner is intended to be in use and the situation where one burner is accidentally extinguished when both burners are intended to be in use. To do this, the resistor unit is to be mechanically coupled to the press knob 34.

It is also appreciated that the resistor unit 57 can be replaced by other equivalents, such as a transistor circuit.

The gas cookers 36, 37 and 56 are safer than the gas cooker

10, in that automatic gas supply cutting-off action will take place when accidental extinguishing of only one of the burner pieces 11 and 12 occurs in the absence of, for example, a pot or pan on the gas cooker 36. Concerning the situation where
5 accidental extinguishing of only one of the burner pieces 11 and 12 occurs with say a pot or pan placed on the gas cooker 36, 37 or 56, whether automatic gas supply cutting-off action will occur depends on the response speed of the cutting-off action in relation to the re-ignition speed. In an effort to
10 maintain or resume the intended cooking condition, a time delay element, such as an inductor, may be connected electrically in series in the or each thermo-couple circuit so as to reduce the response speed of the automatic gas supply cutting-off action by, say, half a second.

15 Various other modifications of and/or alterations to the described embodiments may be made by persons skilled in the art without departing from the scope of the invention as specified in the appended claims.



CLAIMS

1. A gas cooker comprising two burners, a gas valve controlling the supply of gas to the burners, a control knob for operating the gas valve, and two thermo-couples which are
5 located adjacent to the burners, respectively, to detect the presence or absence of flame at the burners, the arrangement being such that the gas valve will be closed in response to the absence of flame at either one or both of the burners detected by the corresponding thermo-couple or thermo-couples.
- 10 2. A gas cooker as claimed in claim 1, wherein the gas valve comprises a valve seat and a valve member which is biased by a spring into engagement with the valve seat, thereby closing the gas valve, and is movable away from the valve seat, thereby opening the gas valve, against the action of the
15 spring by an electro-magnet energized by a said thermo-couple.
3. A gas cooker as claimed in claim 1 or claim 2, wherein the arrangement is such that the gas valve will be closed only in response to the absence of flame at both burners.
4. A gas cooker as claimed in claim 1 or claim 2, further
20 comprising another gas valve, wherein each gas valve is provided for controlling the supply of gas to a corresponding said burner and is associated with a corresponding said thermo-couple so that each gas valve will be closed independently of the other gas valve in response to the



absence of flame at the corresponding burner detected by the corresponding thermo-couple.

5. A gas cooker as claimed in claim 4, wherein both gas valves are operable by the same control knob.

5 6. A gas cooker as claimed in any one of claim 3 to claim 5, further comprising a subsidiary gas valve which is provided in the path of gas supply to one of the burners for turning off the said burner.

7. A gas cooker as claimed in claim 6, wherein the
10 subsidiary gas valve includes a press knob for operation.

8. A gas cooker as claimed in claim 7, wherein the press knob is arranged to return automatically to an inoperative position upon the control knob being returned manually to an inoperative position, both inoperative position corresponding
15 to cutting-off of gas supply.

9. A gas cooker as claimed in claim 1 or claim 2, wherein the arrangement is such that the gas valve will be closed in response to the absence of flame at the burner or either one or both of the burners which is or are intended to be in use.

20 10. A gas cooker as claimed in claim 9 when dependant upon claim 2, further comprising means arranged to adjust automatically upon manual operation of the control knob the

tension of the spring of the gas valve so that the gas valve can be held open by the electro-magnet and the thermo-couple or thermo-couples when the corresponding burner or burners is or are intended to be in use but not by the electro-magnet and only one thermo-couple when both burners are intended to be in use.

11. A gas cooker as claimed in claim 10, wherein the gas valve comprises an operating shaft rotatable by the control knob, the spring being a coil spring and disposed co-axially on the shaft, and said means comprises a stop between which and an abutment on the shaft the spring is co-acting to bias the gas valve into the closed position, the stop being movable axially but not angularly by the shaft upon rotation of the shaft so that when the shaft is rotated the tension of the spring is adjusted automatically by virtue of the change in separation between the stop and the abutment.

12. A gas-cooker as claimed in claim 9 when dependent upon claim 2, further comprising means arranged to adjust automatically upon manual operation of the control knob the current to be generated by the thermo-couple or thermo-couples so that the gas valve can be held open by the electro-magnet and the thermo-couple or thermo-couples when the corresponding burner or burners is or are intended to be in use but not by the electro-magnet and only one thermo-couple when both burners are intended to be in use.



13. A gas cooker as claimed in claim 12, wherein said means comprises two variable resistor units which are connected electrically in series in the corresponding circuits of the thermo-couples, said resistor units being adjustable
5 automatically upon manual operation of the control knob to a low resistance value or to a high resistance value when the gas cooker is switched to one burner or two burners, respectively.

14. A gas cooker as claimed in claim 13, wherein the thermo-
10 couples have substantially the same rating, the resistor units are operable to provide substantially the same resistance value, and each resistor unit is so adjustable between a specific resistance value and half of that value.

15. A gas cooker as claimed in any one of the preceding
15 claims, further comprising a time delay element in the circuit of each thermo-couple so as to reduce the speed of de-energization of the corresponding thermo-couple when the corresponding burner is extinguished.

16. A gas cooker substantially as hereinbefore described with
20 reference to Figure 1, Figure 2, Figures 3 to 5, or Figure 6 of the accompanying drawings.

