

Description

Title of Invention: SAFETY KNOB FOR GAS COOKTOPS

Technical Field

- [0001] The subject matter described herein, in general, relates to safety knob for gas cooktop, and, more particularly to safety knob for gas cooktops, which senses the absence of flame on the burner and gets switched “Off” automatically to cut-off the gas supply to the burner.

Background Art

- [0002] Hydrocarbon gasses such as Natural Gas or Liquefied Petroleum Gas (LPG) have been a popular fuel for domestic cooking in majority countries of the world. Safety in appliances such as gas cooktops are of paramount importance since the hydrocarbon gases are highly flammable. In many countries especially in South Asia, South-East Asia, Africa etc., the gas cooktops used in domestic cooking is highly unsafe. Many incidents have been reported in countries like India where fire accidents involving domestic cooking happen because of the unsafe cooking practices.
- [0003] Many times, it happens that the user switches the knob to “On” position of the Gas Cooktop and forgets to ignite the gas coming through the burner of the Gas Cooktop. This becomes a source of gas leaking through the burner. This is a hazardous situation where gas starts filling up the surroundings and becomes a potential source for explosion.
- [0004] It might also happen that the flame over the burner gets extinguished by the sudden gush of wind or by food spill-over while the knob is still in “On” position. This again becomes a potential source of gas leak through the burner and can lead to explosion. In the background of foregoing limitations, and to avoid such hazardous situations, it becomes important that gas cooktops should be enabled with safety technology to detect the gas leak through the burner and immediately cut-off the gas supply to the burner.

Objects Of The Invention

- [0005] The primary object of the present disclosure is to provide a safety knob for gas cooktop that is capable of automatically cut-off the gas supply to the burner in any hazardous situation.
- [0006] Another object of this disclosure is to provide a safety knob for gas cooktop that is capable of sensing the absence of flame on the burner so that it can be switched off in case of any unsafe event.
- [0007] Yet another object of the disclosure is to provide a safety knob that can be retrofitted to any gas cooktop.

- [0008] Yet other object of the present disclosure is to provide a safety knob that can control existing gas supply valve to the burner, which renders the entire apparatus inherently safe in its operation.
- [0009] In yet another embodiment, the disclosure provides a simple, albeit a sophisticated safety knob that does not require any electric power in form of battery or from any external source for its operation.
- [0010] In yet another embodiment of present system, a cost effective and scalable safety knob is provided that can be produced in bulk.
- [0011] These and other objects will become apparent from the ensuing description of the present invention.

Summary of Invention

- [0012] The present invention is directed to a safety knob of gas cooktop, comprising of a wheel and a circular spring that is configured to store potential energy when the wheel is rotated. It further comprises of a ratchet provided at back side of the wheel; a lever assembly that further comprises of a claw and a metallic cylinder, wherein the claw is configured to allow tooth of the ratchet to pass therethrough when the wheel is rotated and a knob configured to be rotated by a user for turning on/off or switching the safety knob between plurality of positions.
- [0013] In one aspect of present disclosure, the safety knob further comprises of a thermocouple with solenoid that is configured to function as an electromagnet and attract the metallic cylinder causing the claw to latch with one of teeth of the ratchet when the wheel is already rotated. In one other aspect, a support structure of safety knob is operable to host the wheel, the lever assembly and the thermocouple with the solenoid.
- [0014] These and other aspects, features and advantages of the present invention will be described or become apparent from the following detailed description of preferred embodiments.

Brief Description of Drawings

- [0015] [Fig.1] depicts the front view of the full assembly of safety knob, in accordance with one preferred embodiment of present disclosure.
- [0016] [Fig.2] shows support structure of safety knob, in accordance with one preferred embodiment of present disclosure.
- [0017] [Fig.3] demonstrates support structure holding wheel, in accordance with one preferred embodiment of present disclosure.
- [0018] [Fig.4] exhibits lever assembly of safety knob linked to support structure of safety knob, in accordance with one preferred embodiment of present disclosure.
- [0019] [Fig.5] shows thermocouple with solenoid linked to support structure of safety knob, in accordance with one preferred embodiment of present disclosure.

- [0020] Figs. 6(a), (b), (c) and (d) show wheel structure and arrangement of circular spring, in accordance with one preferred embodiment of present disclosure.
- [0021] Figs. 7(a), 7(b), 7(c) and 7(d) illustrate lever assembly, and structures appended thereto, in accordance with one preferred embodiment of present disclosure.
- [0022] Figs. 8(a), (b) and (c) depict knob, in accordance with one preferred embodiment of present disclosure.
- [0023] [Fig.9] shows thermocouple with solenoid, in accordance with one preferred embodiment of present disclosure.
- [0024] [Fig.10] shows knob rotation in one particular direction, in accordance with one preferred embodiment of present disclosure.
- [0025] [Fig.11] depicts wheel rotation along with the knob, in accordance with one preferred embodiment of present disclosure.
- [0026] Fig. 12(a) and 12(b) shows movement of lever assembly, in accordance with one preferred embodiment of present disclosure.
- [0027] [Fig.13] demonstrates rotation of knob in anti-clockwise direction(rotational direction reference- when seen from the front side of the gas cooktop 55), in accordance with one preferred embodiment of present disclosure.
- [0028] Figs. 14(a) and 14(b) illustrate rotation of knob in clockwise direction(rotational direction reference- when seen from the front side of the gas cooktop 55), in accordance with one preferred embodiment of present disclosure.
- [0029] Figs. 15(a), 15(b) and 15(c) show closing of knob when flame on burner is off, in accordance with one preferred embodiment of present disclosure.

Description of Embodiments

- [0030] It has to be understood and acknowledged for this specification and claims, that the term "safety knob" refers, though not limiting, only to depicted full assembly of safety knob for gas cooktops that is provided with a whole host of other components and support structure, but can be extended to accommodate other obvious alterations to the disclosed apparatus/system.
- [0031] Before the present design and configuration of safety knob for gas cooktop is described, it is to be understood that this disclosure is not limited to the particular system, as described, since it may vary within the specification indicated. It is also to be understood that the terminology used in the description is for describing the particular versions or embodiments only and is not intended to limit the scope of the present invention, which will be limited only by the appended claims. The words "comprising," "having," "containing," and "including," and other forms thereof, are intended to be equivalent in meaning and be open ended in that an item or items following any one of these words is not meant to be an exhaustive listing of such item

or items, or meant to be limited to only the listed item or items. The disclosed embodiments are merely exemplary methods of the invention, which may be embodied in various forms.

[0032] Broadly, in accordance with one preferred embodiment of present disclosure, full assembly of safety knob 50 attached to the gas cooktop 55 is described, as can be seen in front view of gas cooktop 55 shown in [Fig.1]. Primarily, there are five components which form the full assembly of safety knob 50, namely, support structure 10, wheel 20 and circular spring 25, lever assembly 30, knob 35 and a thermocouple 40 with solenoid 45.

[0033] Now referring to [Fig.2], a support structure 10 is depicted. As can be seen in [Fig.2], it is planar in shape. In accordance with one working embodiment, the support structure 10 is snap-fitted or screwed over the bolt 7 of the gas cooktop 55. In one aspect, there is a hole 3 provided in the "Support" structure 10, which allows the stem 6 of the gas supply valve of the gas cooktop 55 to pass through. The support structure 10 acts as a foundation for the placement of other components of the safety knob 50.

[0034] As is shown in [Fig.3], and demonstrated later, the support structure 10 holds the wheel 20, and helps in the free rotation of the wheel 20 around the stem 6 of the gas supply valve of the gas cooktop 55. Further, the lever assembly 30 is also hinged to the support structure 10 as shown in [Fig.4]. The solenoid part 45 of the thermocouple 40 with solenoid 45 is also attached to the support structure 10 via a holder 2 of the support structure 10 as can be seen in [Fig.5].

[0035] Next, referring to structure of wheel 20, Figs. 6(a), (b), (c) and (d) show structure of wheel 20 along with circular spring 25. As mentioned above, [Fig.3] shows wheel 20 resting on the support structure 10. The circular spring 25 is placed between wheel 20 and the support structure 10. Fig.6 (a) shows the exploded view of the circular spring 25 between the wheel 20 and the support structure 10.

[0036] As can be seen in Fig.6 (b), one end of a circular spring 25 is attached to the backside of the wheel 20. Accordingly, this end or the first end 25(a) of the circular spring 25 moves along with the rotation of the wheel 20, whereas the other end or second end 25(b) of the circular spring 25 is attached to the front side of the support structure 10 as shown in Fig.6 (c). This end 25(b) of the circular spring 25 is stationary.

[0037] Furthermore, Fig.6 (c) shows the way circular spring 25 is rested on the groove 8 of the support structure 10. This arrangement of the circular spring 25 on the wheel 20 and the support structure 10 ensures that whenever the wheel 20 is rotated in an anti-clockwise direction (rotational direction reference: when seen from the front side of the gas cooktop 55), the circular spring 25 is twisted and stores potential energy. Partial circle at the back side of the wheel 20 incorporates ratchet 26 as shown in Fig.6 (b). There is a projection on the front side of the wheel 20, termed as wheel projection 22,

as shown in Fig.6 (d). The wheel 20 has a hole 21 at the centre through which the stem 6 of the gas supply valve passes through in the mounted condition of the wheel 20.

[0038] Now, Fig. 7 details out the lever assembly 30 of the safety knob 50. Fig. 7 (a) shows the lever assembly 30. This lever assembly 30 is hinged 34 to the back side of the support structure 10. One end/first end 30(a) of the lever assembly 30 incorporates spring-plate loaded claw 32 and the other end/second end of the lever assembly 30 holds the metallic cylinder 33. A spring-plate 31 is attached to the claw 32 as shown in the enlarged view depicted in Fig. 7 (b). In one alternate embodiment, instead of claw 32, a pawl 32' can also be incorporated.

[0039] The spring-loaded claw 32 functions in such a way that it allows the tooth of the ratchet 26 to pass through it when the direction of rotation of the wheel 20 is as shown in Fig. 7 (c). This is because the tooth of the ratchet 26 presses the claw 32 away and passes through it. This passing of the ratchet 26 tooth through the claw 32 also bends the spring-plate 31, thereby energizing the spring-plate 31. After being pressed by the ratchet 26 tooth, the claw 32 again comes back to its original position due to push back from the spring-plate 31 as the spring-plate 31 de-energizes, shown in Fig. 7 (d).

[0040] Next, collectively referring to Figs. 8(a), 8(b) and 8(c), knob 35 is discussed. The knob 35 is attached to the top of the stem 6 of the gas supply valve. There is also a projection below the Knob known as Knob Projection 36, shown in Fig. 8(c). Additionally, [Fig.9] shows thermocouple 40 with solenoid 45. The sensing tip 41 of the thermocouple 40 is placed just above the burner 42. The solenoid part 45 is placed in the holder 2 of the support structure 10 as shown in [Fig.5].

[0041] Now, the safe working of the safety knob 50 shall be discussed. To begin with, in order to ignite the flame, the user turns the Knob 35 in anti-clockwise direction (rotational direction reference- when seen from the front side of the gas cooktop 55) from "Off" position to "On" position as shown in [Fig.10]. During this anti-clockwise rotation of the knob 35, the Knob Projection 36 engages with Wheel Projection 22, and therefore the wheel 20 also gets rotated along with the Knob 35 in anti-clockwise direction (rotational direction reference- when seen from the front side of the gas cooktop 55) as seen in [Fig.11].

[0042] During this anti-clockwise rotation of the wheel 20, the circular spring 25 gets twisted and stores potential energy. Once the Knob 35 is at "On" position, the user holds the Knob 35 in that position and tries to ignite the flame. Once the flame is ignited, small electric potential is generated at the coil terminal 43 of the solenoid 45 due to the thermocouple action. Due to the generated potential, a small electric current flows through the coil making the coil of the solenoid 45 behaving as an electromagnet. This solenoid 45 attracts the metallic cylinder 33 of the Lever assembly 30 due to the magnetic effect of the electromagnet coil of the solenoid 45.

- [0043] The rotational position/movement of Lever assembly 30 is shown in Figs.12 (a) and Fig. 12 (b). Once solenoid 45 attracts the metallic cylinder 33 of the lever assembly 30, the position of the lever assembly 30 changes to one shown in Fig. 12 (b). In this attracted position of the Lever assembly 30, the claw 32 of the Lever assembly 30 gets latched to one of the teeth of the ratchet 26 of the wheel 20 as shown in Fig. 12(b). Once the teeth of the ratchet 26 of the wheel 20 get latched, the user can leave the Knob 35 and can cook the food. It is to be noted that the latching of the ratchet 26 of the wheel 20 happens within few seconds after the flame is ignited because the response time of the thermocouple 40 and the solenoid 45 is very quick. Therefore, the user does not have to wait for the latching of the ratchet 26 of the wheel 20 and can leave the Knob 35 within few seconds after the flame is ignited.
- [0044] Next, rotation of knob 35 between 'high', 'medium' and 'low' position is discussed. Even in the latched condition of the wheel 20, the user can rotate the Knob 35 to any flame position of the Knob 35 i.e. "High", "Medium" or "Low". This happens as follows: When the user rotates the Knob 35 in anti-clockwise direction (rotational direction reference- when seen from the front side of the gas cooktop 55) from "High" position to "Medium" or "Low" position (as shown in [Fig.13]), the Knob Projection 36 engages the Wheel Projection 22 and starts rotating the wheel 20 in anti-clockwise direction as shown in [Fig.11].
- [0045] Even in the latched condition of the wheel 20, the wheel 20 gets rotated in anti-clockwise direction (rotational direction reference- when seen from the front side of the gas cooktop 55) because the spring-plate loaded claw 32 allows the passage of the latched tooth (due to the bending of the spring as shown in Fig. 7(c)) and gets latched to subsequent tooth of the ratchet 26 of the wheel 20 as shown in Fig. 7 (d). Thus, the Knob 35 rotates in anti-clockwise direction without any problem. When the user rotates the Knob in clockwise direction (rotational direction reference- when seen from the front side of the gas cooktop 55) from "Low" or "Medium" to "High" position, the Knob Projection 36 of the Knob does not engage the Wheel Projection 22 of the wheel 20 and thus gets rotated freely without any problem as seen in Fig.14 (a) and (b). This rotation of the Knob 35 from "Low" to "Medium" or "High" flame position does not disturb the latching of the claw 32 of the Lever Assembly 30 to the ratchet 26 of the wheel 20 as shown in Fig.14 (b).
- [0046] In the next section, closing of the knob 35 when the flame on the burner 42 is extinguished is discussed. During the course of cooking, when the flame on the burner 42 gets extinguished due to wind or food spill over, the Knob 35 immediately rotates to "Off" position. This is explained as follows: When the flame gets extinguished, the thermocouple tip 41 senses a low temperature and thus there is no electric potential existing at the coil terminal 43 of the solenoid 45 due to thermocouple principle.

Therefore, the electromagnetic effect of the solenoid 45 ceases and the metallic cylinder 33 of the Lever assembly 30 gets released from its attracted position with the solenoid 45. This operation is depicted in Fig. 15 (a) and (b).

[0047] This release of the metallic cylinder 33 of the Lever assembly 30 de-latches the tooth of the ratchet 26 of the wheel 20 from the claw 32 due to the principle of lever as shown in Fig. 15 (b). Due to the de-latching of the tooth of the ratchet 26, the wheel 20 gets released. Once released, the wheel 20 rotates in clockwise direction (rotational direction reference- when seen from the front side of the gas cooktop 55) under the influence of the energized circular spring 25 (circular spring 25 is energized due to its already stored potential energy). During this clockwise rotation of the wheel 20, the Wheel Projection 22 gets engaged to the Knob Projection 36 and therefore the clockwise rotating wheel 20 rotates along with the Knob 35 and pushes the Knob 35 to "Off" position (as depicted in Fig. 15 (b) and (c)) thereby cutting off the gas supply to the burner 42.

[0048] Now, closing of the knob 35 when the flame on the burner 42 is not ignited is discussed. Consider the case when the user rotates the knob 35 to "On" position and forgets to ignite the flame. In such a case, there is no electromagnetic effect at the solenoid 45 due to the low temperature sensed by the thermocouple tip 41 as there is no flame. Hence, the teeth of the ratchet 26 of the wheel 20 do not get latched to the claw 32 of the Lever assembly 30. This is shown in Fig. 15 (b). Therefore, under the influence of the energized circular spring 25, the wheel 20 rotates along with the Knob 35 (due to engagement of Wheel Projection 22 and Knob Projection 36) to "Off" position thereby cutting the gas supply to the burner 42.

[0049] The disclosure herein explicitly states that there can be slight change in the design and configuration in actual to conceive the proposed solution. The foregoing description is a specific embodiment of the present disclosure. It should be appreciated that this embodiment is described for purpose of illustration only, and that those skilled in the art may practice numerous alterations and modifications without departing from the spirit and scope of the invention. It is intended that all such modifications and alterations be included insofar as they come within the scope of the invention as claimed or the equivalents thereof.