SAFETY DEVICE FOR LIQUID FUEL BURNERS

William R. Hainsworth, Larchmont, N. Y., assignor to Servel, Inc., New York, N. Y., a corporation of Delaware

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This invention relates to a safety device for liquid fuel burners and constitutes a division of my application Serial No. 734,675 filed July 7, 1934, now Patent No. 2,111,774, granted March 22, 1938.

The object of this invention is to provide an improved safety device for liquid fuel burners which is reliable in operation and will effectively stop the flow of liquid fuel with an excessive rise in temperature or overflow of liquid fuel.

The invention, together with the objects and advantages thereof, will become apparent from the following description taken in conjunction with the accompanying drawings forming a part of this specification, and of which:

Fig. 1 is a front view of a liquid fuel burner embodying this invention shown in connection with a refrigerator;

Fig. 2 is a side view, partly broken away and in section, of the liquid fuel burner and parts of the refrigerator shown in Fig. 1;

Fig. 3 is an enlarged view, in section, taken at line 3—3 of Fig. 1 to illustrate the liquid fuel burner more clearly;

Fig. 4 is an enlarged view, in section, taken at line 4—4 of Fig. 2, to illustrate more clearly the float control for the liquid fuel burner;

Fig. 5 is a vertical view, in section, taken at line 5—5 of Fig. 7, to illustrate the safety device for the liquid fuel burner;

Fig. 6 is a horizontal section of the safety device taken at line 6—6 of Fig. 5; and

Fig. 7 is a detail vertical section taken at line 7—7 of Fig. 5.

Referring to Figs. 1 and 2, of the drawings, I have shown my invention in connection with a refrigerator provided with a cabinet 14 having a thermally insulated storage compartment, not shown, and a lower apparatus compartment 10, accessible at the front by means of a downwardly swinging door 26. The refrigeration apparatus employed may be of the continuous absorption type disclosed in Patent No. 1,609,354 to von Platen et al., and more particularly an air-cooled apparatus of the type disclosed in my Patent No. 2,037,782 to which reference may be had for a complete description of the refrigeration apparatus and assembly of the cabinet and apparatus.

The generator forming an element of the refrigeration apparatus comprises a substantially horizontal vessel 12 which is located within the lower apparatus compartment 10 and is provided with an inner heating flue 13 extending longitudinally therethrough. An outer heating flue 14 is located concentrically around the generator 12 in spaced relation therewith and projects beyond the rear ends of the generator 12 and the inner flue 13. The inner and outer flues join at the rear of the generator and communicate with an upwardly extending flue portion, as indicated in dotted outline in Fig. 2, having an outlet at the upper part of the refrigerator cabinet.

The generator 12 is thermally insulated by surrounding the outer flue 14 with suitable thermal insulation material 16, such as mineral wool, which is retained in position by a light sheet metal casing 17. On the front of the insulation retaining casing 17 is a plate 18 having an opening through which the outer generator flue 14 extends.

Below the forward end of the outer heating flue 14 is arranged a liquid fuel burner generally indicated by the reference numeral 19. The burner 19 is mounted on the lower part of the front plate 18 and projects upward into a recess 15 formed in the lower part of the outer heating flue 14 by cutting away a portion of the flue and bending the sides outward, as shown in Figs. 1 and 2.

To enclose the front end of the outer generator flue 14 and form a continuous enclosed passage from the upper end of the burner into the flue 14, I provide a removable closure member or hood 20 provided with a suitable handle 21 and suspension hooks 22. The hood 20 comprises a sheet metal casing 23 filled with a suitable thermal insulating material 24 and is formed with a recess 25. When in position, the hood 20 is suspended from the top of the front plate 18 by the suspension hooks 22, and the recess 25 encloses the forward projecting end of the outer heating flue 14 and the upper end of the burner 19.

In the apparatus compartment 10 is also located a liquid fuel reservoir or storage tank 21 having a filling cap 28 to which access may be had through the door 25. Liquid fuel, such as kerosene, is supplied to the burner, as will be hereinafter described, from the reservoir 27 through a supply conduit 29.

Referring to Fig. 2, the burner assembly 19 includes a removable combustion shield assembly or chimney 30 provided with a suitable handle 31, a float control assembly 32, a safety device 33, and an adjustment knob 34. About the burner assembly 19 is arranged a sheet metal casing 35, and below the burner is fixed a suitable drip pan 36. The adjustment knob 34 is on the outside of the casing 35 and is accessible from the front of the refrigerator cabinet 11. A sheet metal extension 37 provides a journal for the adjustment member 34 and also may be suitably inscribed with a dial or other desired index, as indicated in Fig. 1.

The burner construction will be more fully understood by reference to Figs. 3 and 4. In Fig. 3 are shown a safety cut-off valve 38, a control valve 39, the adjustment valve 40, the burner well 41, and the burner shield assembly 30. The control
valve 38 is adapted to be operated by floats 42 and 43 which are shown most clearly in Fig. 4. The floats 42 and 43 are contained in respective float vessels 44 and 45 which are provided with covers 46 and 47. The floats 42 and 43 are connected by suitable light rods 48 and 49 to opposite ends of a beam 50, and the control valve 39 is connected to the center of the beam 50 by a rod 51 which is provided with a guide member 52. The beam 50 is thus suspended from the floats and is located within a chamber 53 formed by a suitable casing 54. The float vessels 44 and 45 communicate at their lower portions with the beam chamber 53 and form therewith a float chamber.

Referring to Fig. 3, it will be seen that the casing 54 is also formed to provide a chamber 55. Communication between the portion 53 of the float chamber and the chamber 55 is controlled by the adjustment knob 30. Valve 40 is operated by the adjustment knob 30. Upwardly from the chamber 55 extends a conduit 56 having its upper end connected to the bottom of the annular burner well 41. Within a depression 56a in the burner well 41, a wick 57 is placed which extends only a relatively small distance around the circumference of the burner well and which is only used for lighting and starting the burner.

The burner chimney 39 comprises a pair of perforated cylinders 58 and 59. The perforation concentrically above the burner well to provide an annular combustion chamber 60 extending upwardly from the burner well 41. Concentrically around the perforated cylinders 58 and 59 and in spaced relation thereto is located an imperforate portion of the space 18 between the shield 51 and the cylinder 58 is open at the bottom and at the top, the space 60 between the concentric cylinders 58 and 59 is open at the top, and the space within the inner cylinder 59 is open at the bottom and closed at the top by a member 61. The fluid chamber assembly 30 is secured by mutually perpendicular bars 62 penetrating the perforated cylinders 58 and 59 and the shield 61, and these bars are retained by pins 67 at the outer ends thereof. The operation of the structure so far described, referring particularly to Figs. 1 and 3, is substantially as follows: Kerosene or other liquid fuel flows from the reservoir 27 through the supply conduit 25, the safety cut-off valve 38, a pipe 64, a valve chamber 65, and the control valve 39 into the portion 53 of the float chamber. The kerosene rises in the float chamber until it reaches such a level that the floats 42 and 43 raise the beam 50 and close the control valve 39. The control valve 38, operated by the floats 42 and 43, functions to maintain a constant level of kerosene in the float chamber at all times. From the portion 53 of the float chamber, kerosene flows through the adjustment valve 40, chamber 55, and conduit 56 into the annular burner well 41. When combustion is not taking place, kerosene stands in the conduit 56 and burner well 41 at a level corresponding to the height in the float chamber.

To light the burner, the depression 56a may be primed with kerosene and a flame applied to the wick 67 by removing the burner shield assembly 30 by its handle 31, it being assumed that the hood 20 has been previously removed. Due to the increased temperature produced by the burning of kerosene from the wick 57, general combustion of kerosene in the burner well 41 is instigated. The shield assembly 30 is then placed in position over the burner well, and the area of combustion is then more or less confined to the perforated cylinders 58 and 59. Air is supplied for combustion from the space 62 under the shield 61 and the space within the inner cylinder 59, the air entering the bottom of these spaces as indicated by arrows in member 20 is then placed in position and the heat is directed from the upper end of the burner, between the outer shield 61 and the member 63, into the generator heating flues 13 and 14. The size of the burner flame is controlled by turning the adjustment knob 30 which operates the adjustment valve 40.

In accordance with this invention, in order to shut off the flow of kerosene to the burner in case of fire outside of the burner, as in the drip pan 36, or in case of overflow of kerosene from the burner, which might occur due to faulty operation of the control valve 39, a safety device 33 for operating the shut-off valve 38.

Referring to Figs. 5 to 7, the safety device mechanism is housed principally in a casing 68 mounted on the casing of the cut-off valve 38. On a pivot 71 is located a wick 72 which projects from the inside of the casing and is pivoted what is herein referred to as a bucket lever 70. The short end of the bucket lever 70 is pivotally connected to one end of a lever 71 which is pivoted within the casing 68 at 72 and has its other end operatively connected to the cut-off valve 38 by a spring 85. Springs 85 extend through an opening 74 in the lower part of the casing 68 and into the cut-off valve casing, the entrance of the stem 73 into the valve casing being sealed by a suitable bellows 75. The long end of the bucket lever 70 extends through a slot 76 in one side of the casing 68 and from the end of the lever outside the casing there is suspended a bucket 77. Within the casing there is mounted, on the upper part thereof, a bracket 78, providing a pair of depending tabs 79 and 80 on opposite sides of the bucket 77, and a pair of more closely spaced pivot posts 81 and 82, as best shown in Figs. 5 and 6. Pivot ed on a rod 83 extending through a slot 84 in the bucket lever 70 is a substantially U-shaped lever 86. The legs of the U-shaped lever 86 rest in V-shaped portions of the pivot posts 81 and 82, and the rods 85 and 86 are connected between the outer end of the rod 83 and the tabs 79 and 80, respectively, of the bracket 78. The bracket 78, U-shaped lever 85, rod 83, and spring 86 and 87 provide a snap-action toggle leverage on the bucket lever 70 so that the long end thereof, to which is attached the bucket 77, may be moved upwardly or downwardly with a relatively quick action to effect a quick and positive opening and closing of the valve 38.

The long bucket end of the lever 70 is normally in its upper position, in which position the cut-off valve 38 is open and flow of kerosene from the reservoir to the burner is unobstructed. As may be seen in Fig. 2, and in more detail in Figs. 3 and 4, the bucket 77 is positioned under the discharge end of a tube or spout 88. One end of an annular space above that in the bucket 77 is connected to the portion 53 of the burner float chamber and the other end is connected to the tube or spout 88 at a level just above the maximum liquid level intended to be maintained in the burner by the floats. If, for any reason, the level of kerosene in the burner should rise, the increased mixing of kerosene will overflow through conduit 89 and the spout 88 into the bucket 77. When the weight of liquid in the bucket 77 is great enough to over-
come the resistance of the previously described toggle on the bucket lever 70, the bucket end of the lever 70 will be carried to its lower position, and, due to the snap-action of the toggle arrangement, the cut-off valve 38 will be snapped closed, cutting off the flow of kerosene from the reservoir to the burner.

Referring again to Figs. 5 to 7, I further provide a resettable thermal responsive device for moving the bucket lever 70 to its valve closing position. Referring to Fig. 7, a tube 90 is threaded through a bushing 91 in one side of the safety device casing 88. Within the tube 90 is journaled a rod 92 having secured on its inner end a ratchet wheel 93. The outer end of the tube 90 is closed and is formed with a slightly enlarged chamber which is filled with a fusible material 94. At ordinary temperatures the fusible material 94 functions as a bond between the tube 90 and the rod 92, preventing rotation of the latter. If desired, the end of the rod 92 may be provided with a small passage 95 to effect a more positive bond.

Referring now to Figs. 5 and 6, a lever 96 is pivotally connected to the safety device housing 88 on the inner end of the stationary tube 90, with one end overlying a stop or post 91 on the bucket lever 70 and the other end extending through a slot 98 in the housing 88. A spring-pressed pawl 99 on the lever 96 engages the ratchet wheel 93. A spring 100, coiled about the inner end of the bushing 91, has one end secured in the casing 88, and the other end is secured to the thermal trip lever 95. The spring 100 is coiled in such a direction as to resiliently bias and exert a torque on the thermal trip lever 95 in a clockwise direction as viewed in Figs. 5 and 6.

Normally, the thermal trip lever 96 is detained from movement by the pawl 99 engaging the ratchet wheel 93 on the rod 92, which latter is held immovable or rendered inoperative by the bucket lever 70. After the bucket lever 70 overcomes the resistance of the previously described toggle, and the bucket lever 70 snaps downwardly, closing the cut-off valve 38 as previously described.

When the safety device has been operated by filling of the bucket 77, it may be reset by emptying the bucket and raising the outer end of the bucket lever 76. After the safety device has been operated by the thermal responsive arrangement as just described, it may be reset by pressing down the projecting end of the lever 96 and raising the bucket lever 76. The thermal responsive device cannot be reset until the temperature has decreased and the fusible material 94 again established a bond between the rod 92 and the tube 90. However, when the bond is reestablished, pressing down the projecting end of the lever 96 renews the spring 100 and replaces the pawl 99 on the ratchet wheel 93, whereupon the bucket lever 70 may be raised and the device is again ready for its protective operation.

Various changes and modifications will be apparent to those skilled in the art, wherefore my invention is not limited to that which is shown in the drawings and described in the specification but only as indicated in the following claims.

What is claimed is:

1. A safety device for a liquid fuel burner comprising a valve housing adapted to be connected in a liquid fuel supply line to the burner, a valve in said housing for controlling the flow of liquid fuel therethrough, a valve operating member extending through said housing, a flexible seal between said housing and valve operating member, a casing adjacent said valve housing, a first lever pivoted within said casing for vertical oscillation, a snap-action toggle for imparting snap-action to the vertical oscillation of said first lever, said first lever being connected to said valve operating member to open and close said valve when the lever is moved to its upper and lower positions respectively, a stationary member extending from said casing, a rotatable member journaled in said stationary member, a ratchet wheel in said casing rotatable only with said rotatable member, fusible material forming a bond between said stationary and rotatable members at normal temperatures, a second lever pivoted in said casing for vertical oscillation and having one end projecting through a slot in said casing and the other end associated with said first lever to cause only downward movement of the latter and, therefore, closing of said valve, a spring urging said second lever to its valve closing position and sufficiently strong to shift said toggle, and a pivot on said second lever engaging said ratchet to prevent operation of said second lever except upon release of said rotatable member and ratchet when said bond is broken by melting of said fusible material.

2. A safety device for liquid fuel burner comprising a valve housing adapted to be connected in a liquid fuel supply line to the burner, a valve in said housing for controlling the flow of liquid fuel therethrough, a valve operating member extending through said housing, a flexible seal between said housing and valve operating member, a first lever pivoted for vertical oscillation, a snap-action toggle for imparting snap-action to the vertical oscillation of said first lever, said first lever being connected to said valve operating member to open and close said valve when the lever is moved to its upper and lower positions respectively, a stationary member, a rotatable member journaled in said stationary member, a ratchet wheel rotatable only with said rotatable member, fusible material forming a bond between said stationary and rotatable members at normal temperatures, a second lever pivoted for vertical oscillation having one end associated with said first lever to cause only downward movement of the latter and, therefore, closing of said valve, a spring urging said second lever to its valve closing position and sufficiently strong to shift said toggle, and a pawl on said second lever engaging said ratchet to prevent operation of said second lever except upon release of said rotatable member and ratchet when said bond is broken by melting of said fusible material.

3. A safety device for a liquid fuel burner including a valve for controlling flow of liquid fuel to the burner, a first lever pivoted for vertical oscillation, a snap-action toggle for imparting snap-action to the vertical oscillation of said
first lever, said first lever being connected to open and close said valve when the lever is moved to its upper and lower positions, respectively, a stationary member, a ratchet wheel rotatable only with said rotatable member, fusible material forming a bond between said stationary and rotatable members at normal temperatures, a second lever pivotally secured to said first lever to its valve closing position and sufficiently strong to shift said toggle, and a pawl on said second lever engaging said ratchet to prevent operation of said second lever except upon release of said rotatable member and ratchet when said bond is broken by melting of said fusible material.

4. A safety device for a liquid fuel burner comprising a valve for controlling flow of liquid fuel to the burner, a casing, a lever within said casing and connected to open and close said valve when it is moved upwardly and downwardly, respectively, a fusible material forming a bond between said stationary and movable members at normal temperatures, a ratchet engaged with said movable member, fusible material forming a bond between said stationary and movable members when it becomes fused for rendering said resilient means operative to actuate said snap-acting means, said resilient means arranged to act directly on said pivot lever for actuating said snap-acting means to close said valve, structure for normally keeping said resilient means under tension and inoperative, and said structure including means responsive to a temperature above a predetermined normal value for rendering said resilient means operative to move said pivot lever to actuate said snap-acting means and close said valve, said snap-acting means being movable independent of said resilient means to close said member.

5. A safety device for a liquid fuel burner comprising a valve for controlling flow of liquid fuel to the burner, a casing, a lever within said casing and connected to open and close said valve when it is moved upwardly and downwardly, respectively, a fusible material forming a bond between said stationary and movable members when it becomes fused for rendering said resilient means operative to actuate said snap-acting means, said resilient means arranged to act directly on said pivot lever for actuating said snap-acting means to close said valve, structure for normally keeping said resilient means under tension and inoperative, and said structure including means responsive to a temperature above a predetermined normal value for rendering said resilient means operative to move said pivot lever to actuate said snap-acting means and close said valve, said snap-acting means being movable independent of said resilient means to close said member.

6. In a burner having a valve for controlling flow of fuel thereto, the combination of a pivoted lever and snap-acting means therefor to operate said valve, resilient means arranged to act directly on said pivot lever for actuating said snap-acting means to close said valve and maintain said resilient means inoperative, and said structure including means responsive to a temperature above a predetermined normal value for rendering said resilient means operative to move said pivot lever and said snap-acting means to close said valve.

8. In a burner having a valve for controlling flow of fuel thereto, the combination of a pivoted lever and snap-acting means therefor to operate said valve, resilient means arranged to act directly on said pivot lever for actuating said snap-acting means to close said valve, structure for normally keeping said resilient means under tension and inoperative, and said structure including means responsive to a temperature above a predetermined normal value for rendering said resilient means operative to move said pivot lever to actuate said snap-acting means and close said valve, said snap-acting means being movable independent of said resilient means to close said member.

9. In a burner having a valve for controlling flow of fuel thereto, the combination of a pivoted lever and snap-acting means therefor to operate said valve, resilient means arranged to act directly on said pivot lever for actuating said snap-acting means to close said valve, structure for normally keeping said resilient means under tension and inoperative, and said structure including means responsive to a temperature above a predetermined normal value for rendering said resilient means operative to move said pivot lever to actuate said snap-acting means and close said valve, said snap-acting means being movable independent of said resilient means to close said member.

10. In a burner having a valve for controlling flow of fuel thereto, the combination of means for closing said valve including a coil spring arranged to act directly on said pivot lever for actuating said snap-acting means to close said valve, and structure including fusible thermal means for keeping said coil spring under tension and inoperative at normal temperatures, said fusible thermal means becoming fused and permitting said coil spring to move said pivot lever to actuate said snap-acting means to close said valve when an abnormally high temperature.

11. In a burner having a valve for controlling flow of fuel thereto, the combination of means for closing said valve including a coil spring arranged to act directly on said pivot lever for actuating said snap-acting means to close said valve, and fusible thermal means becoming fused and permitting said coil spring to move said pivot lever to actuate said snap-acting means to close said valve when an abnormally high temperature.

12. In a burner having a valve for controlling flow of fuel thereto, the combination of means for closing said valve including a coil spring arranged to act directly on said pivot lever for actuating said snap-acting means to close said valve, fusible thermal means becoming fused and permitting said coil spring to move said pivot lever to actuate said snap-acting means to close said valve when an abnormally high temperature.