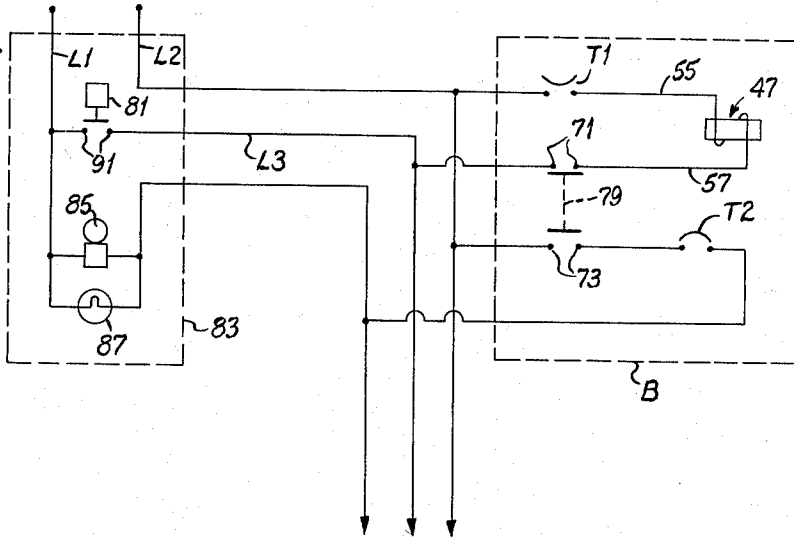
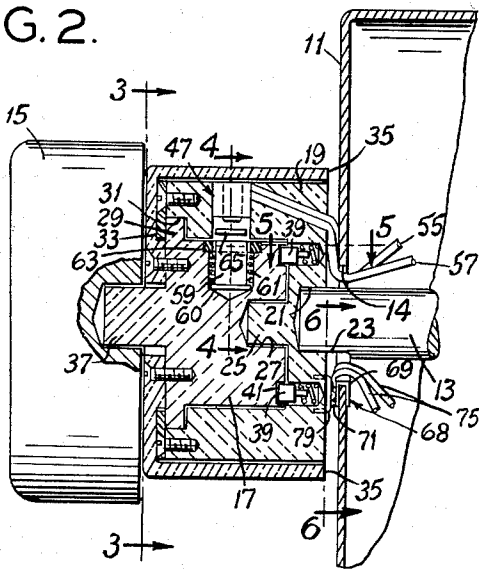
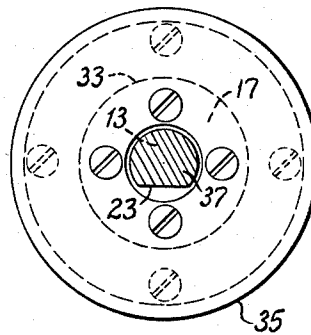


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April 6, 1965

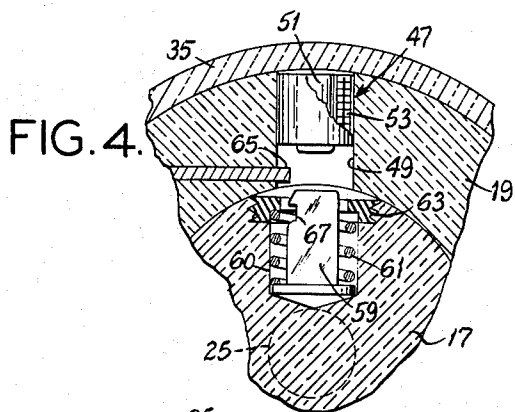
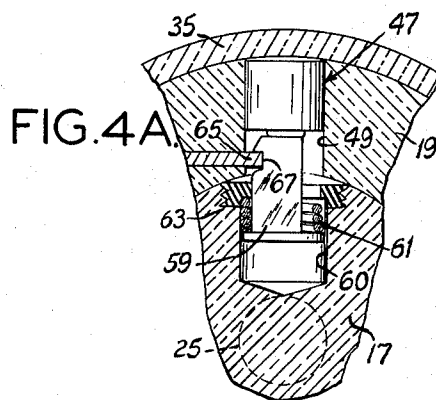
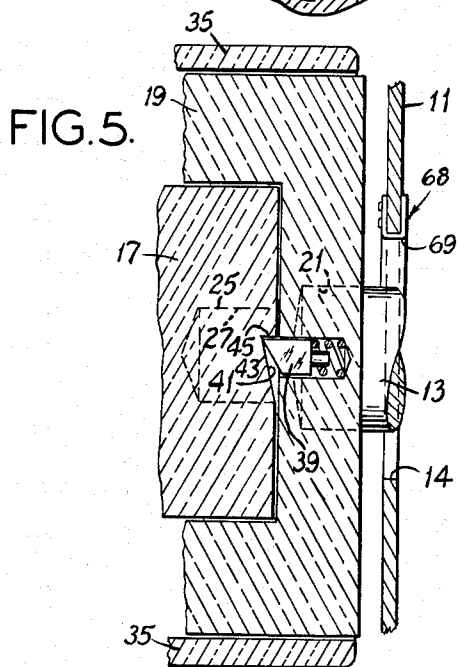
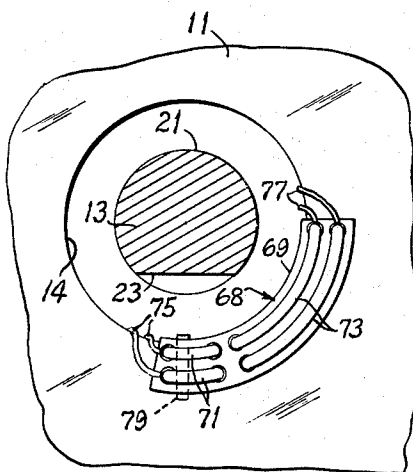
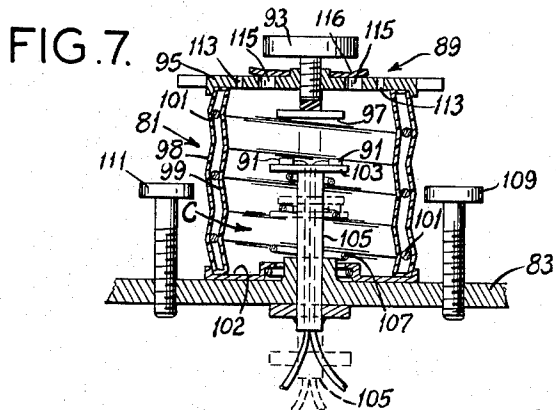
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SAFETY CONTROL FOR A RANGE

Filed Feb. 6, 1963

2 Sheets-Sheet 2



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3,176,754

SAFETY CONTROL FOR A RANGE
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Filed Feb. 6, 1963, Ser. No. 256,639
7 Claims. (Cl. 158-122)

This invention relates to a safety control for a range, and more particularly to a safety control system which prevents hazardous operation of a domestic range.

Among the several objects of this invention may be noted the provision of a novel safety control for preventing operation of the controls of a cooking range by a small child; the provision of a safety control for a gas range which prevents operation of the burner controls when an associated pilot burner is not burning; the provision of a control of the class described wherein one electric control provides the dual function of preventing operation of a burner control by a small child and preventing operation of this burner control altogether if an associated pilot burner is extinguished; the provision of a safety control for a range which provides an indication if a burner control has been turned through a preselected angle and the burner is not lit; the provision of safety apparatus of the class described which may be readily attached to existing ranges; and the provision of a safety control of the class described which is relatively inexpensive and reliable in operation. Other objects and features will be in part apparent and in part pointed out hereinafter.

Essentially, this invention relates to a safety control for a range having a burner, a rotatable operating member for controlling this burner, and an operating knob for this member. This control comprises a solenoid associated with the operating member and the knob, and adapted in a first state, for example, an energized state, to permit rotation of the operating member by the knob and in a second state, for example, a deenergized state, to prevent rotation of the operating member by the knob. The safety control further includes an electrical power source and an electrical circuit interconnecting this source with the solenoid. This circuit includes a time-delay switch for causing the solenoid to be actuated to its first state only during a preselected time interval after actuation of this time-delay switch whereby the operating member may be rotated by the knob to turn the burner on only during this preselected time interval after actuation of the time-delay switch.

If the range being controlled is a gas range which includes a pilot light for the burner, this electrical circuit preferably includes means responsive to this pilot light, for example, a temperature-responsive switch positioned adjacent this pilot light, for preventing actuation of the solenoid to its first state when the pilot light is not burning. In one preferred embodiment of the invention, the control further includes a signal circuit which provides an indication whenever the operating member has been turned through a predetermined angle and the burner is not burning.

The invention accordingly comprises the constructions and circuits hereinafter described, the scope of the invention being indicated in the following claims.

In the accompanying drawings in which one of various possible embodiments of the invention is illustrated,

FIG. 1 is a circuit diagram illustrating schematically the electrical components of this embodiment and their interconnection;

FIG. 2 is a cross-sectional view of preferred form of a knob attachment employed in this embodiment;

FIG. 3 is a front view of this attachment taken on line 3-3 in FIG. 2;

FIGS. 4 and 4A are enlarged cross-sectional views

2

taken along line 4-4 in FIG. 2 illustrating a solenoid-plunger arrangement included in the knob attachment;

FIG. 5 is an enlarged cross-section taken on line 5-5 in FIG. 2;

FIG. 6 is an enlarged view of a portion of a preferred form of a limit switch taken on line 6-6 in FIG. 2; and

FIG. 7 is an enlarged view of a time-delay switch employed in the FIG. 1 system.

Corresponding reference characters indicate corresponding parts throughout the drawings.

Referring now to the drawings, and more particularly to FIGS. 2 through 6, the front panel of a domestic cooking range or stove is designated by reference numeral 11. This stove is of the type which includes a plurality of surface burners, usually four, and one or more oven burners. The system of this invention may be employed to control either a gas range or an electric range; it will be illustrated as being employed with a gas range having a plurality of gas burners each of which is controlled by a conventional valve. A valve stem or operating member for a typical burner is indicated at 13. This stem or shaft projects through an opening 14 in the front panel of the range and when rotated opens the valve of the burner, permitting gas to flow to the burner. It will be assumed hereinafter that counterclockwise rotation of shaft 13 opens the valve, turning the burner on, and that clockwise rotation thereof closes the valve, turning the burner off. Each burner has a continuously burning pilot light associated therewith (not shown) which initially ignites the gas as it flows through the burner.

Typically, i.e., in ranges not provided with the safety control of this invention, an operating or control knob is secured to or fitted on the end of stem 13 to permit rotation thereof. This knob is usually located within the reach of small children and thus gives rise to the possibility of a serious accident caused by the operation of a burner control by a small child in the absence of adult supervision. Also, since the control knobs in a typical range project beyond the front panel of the range, a burner may in some cases be turned on accidentally by an adult brushing against the control knob. Moreover, because there is usually no interlock between the burner control and the associated pilot light, a burner may be turned on whether the pilot light is burning or not. In the event that the pilot for a burner has become extinguished, turning this burner on results in the escape of highly inflammable and dangerous gas. The present invention provides, among other things, a knob attachment to be interfitted between the control or operating knob of a burner and the valve stem or operating shaft of this burner which, in combination with a control circuit, permits rotation of this shaft by the control knob to turn the burner on only under certain controlled conditions.

The knob attachment to be interfitted between the operating shaft 13 of the typical burner and the control knob therefor (indicated at 15) is illustrated as comprising a cylindrical inner member 17 and a cup-shaped outer member or housing 19. The end of shaft 13 is frictionally received in a recess 21 in the end portion of housing 19. Shaft 13 has a flat surface 23 which mates with a corresponding surface in recess 21 whereby rotation of housing 19 causes rotation of shaft 13. Inner member 17 is rotatably supported within housing 19 by an inwardly extending cylindrical boss 25 on member 19 which is received in a cylindrical recess 27 in the end of member 17, and by a radially extending flange 29 on member 17 which is received in an annular recess 31 at the outer end of housing 19. A washer 33 secured to the outer end of housing 19 maintains axial alignment between members 17 and 19. Secured to housing 19 is a shroud 35 which encloses housing 19. This shroud has a central opening through which projects a cylindrical boss or shaft

37 integral with member 17. Shaft 37 is provided with the same dimensions and configuration as the end portion of shaft 13 and is frictionally received in a recess in control knob 15. Stud or shaft 37 and the recess in control knob 15 are provided with flat mating surfaces whereby rotation of knob 15 causes rotation of inner member 17.

To permit clockwise rotation of valve stem 13 by knob 15, i.e., to provide a clockwise interlock between member 17 and housing 19, two spring biased bolts or pawls 39 are provided, positioned in recesses in the inner end portion of housing 19. These are spring biased to fall into notches 41 formed in the end of member 17 (see FIG. 5). Notches or recesses 41 have a sloping surface 43 and a flat surface 45 parallel to the axis of rotation of member 17. The arrangement is such that on counterclockwise rotation of knob 15 pawls 39 are forced into their respective recesses by sloping surface 43, and inner member 17 merely rotates counterclockwise with respect to housing 19. On the other hand, upon clockwise rotation of knob 15 to turn the burner off, the surface 45 of the notches bears against bolts 39 to rotate housing 19 and shaft 13. Accordingly, it is seen that the pawls 39 and the notches 41 constitute a one-way clutch so that the burner of the range may always be turned off by clockwise rotation of knob 15, but that the burner may not, except under certain controlled conditions described hereinafter, be turned on since counterclockwise rotation of knob 15 merely rotates member 17 within housing 19.

To interlock members 17 and 19 and thereby permit counterclockwise rotation of shaft 13 by knob 15 under certain conditions, an electrically actuated solenoid 47 is secured within a recess 49 in housing 19 (see FIGS. 2, 4 and 4A). This solenoid includes a core 51 and a coil or winding 53. The leads of coil 53, indicated at 55 and 57, are carried through housing 19 and through the opening in the front panel of the range and interconnected in a control circuit illustrated in FIG. 1 described hereinafter. A plunger or catch 59 having a bottom flanged portion is positioned in a recess 60 in member 17 and spring biased therein by a spring 61 held in the recess by a retainer 63 threaded into member 17. Spring 61 biases catch 59 into this recess away from housing 19. Catch 59 is made of a ferromagnetic material and is adapted to be drawn into recess 49 upon energization of solenoid 47. A locking member or tongue 65 projects into recess 49 and catch 59 is provided with a groove 67 which is adapted to receive tongue 65.

Catch 59 and solenoid 47 provide a counterclockwise interlock between members 17 and 19 as follows: When recesses 49 and 60 are aligned, energization of solenoid 47 draws catch 59 into recess 49. Thereafter rotation of member 17 counterclockwise by knob 15 forces locking member 65 into engagement with groove 67 and provides an interlock which permits housing 19 (and shaft 13) to be rotated by knob 15 to turn the burner on. (See FIG. 4A.) Even though solenoid 47 be subsequently deenergized, the engagement between member 65 and catch 59 maintain catch 59 in recess 49 providing the above mentioned interlock; and only when member 17 is rotated clockwise is the catch released from member 65 and drawn into recess 60 to disengage housing 19 (assuming solenoid 47 is deenergized at this time). It will be understood that although bolts 39 and notches 41 provide a clockwise interlock between members 17 and 19 as explained above, there is some play in this interlock; sufficient to permit catch 59 to be drawn into recess 60 by spring 61 upon clockwise rotation of member 17.

A limit switch assembly 68 is provided to correlate the various functions of the control circuit with the position of valve 13 and housing 19. This assembly includes a contact strip 69 in the form of an arcuate channel member which clips onto the front panel of the stove at opening 14. The portion of member 69 exterior the range is made of a suitable insulating material and carries two sets of running conductive contacts indicated at 71 and

73. These contacts are connected by respective leads 75 and 77 carried through opening 14 to the control circuit of FIG. 1. A bridging contact or conductive brush 79 is secured to housing 19 to selectively interconnect contacts 71 or contacts 73. When the burner is off, brush 79 is positioned at the bottom of housing 19 and thus completes a circuit or conductive path between contacts 71; as this housing is rotated counterclockwise to turn the burner on, brush 79 moves off of contacts 71 and, after a small transition, serves to interconnect contacts 73 and complete a current path therebetween. In the particular arrangement illustrated, it is assumed that the burner valve is open all the way when shaft 13 is rotated through approximately ninety degrees. It should be understood that if this is not the case (for example, if 180° rotation is required to turn the burner fully on) contacts 73 should be extended around the circumference of the opening so that, except for the small angle at the bottom of assembly 68, brush 79 interconnects contacts 73 throughout the operating angle of shaft 13. Also, while contacts strip 69 is illustrated as being a one-piece unit which clips onto the front of the range, this strip may be a two-piece assembly if opening 14 is not large enough to accommodate installation of the one-piece assembly illustrated.

The electrical control circuit of the system is illustrated schematically in FIG. 1 as including a pair of input leads or conductors L1 and L2 which supply electrical power, preferably D.C., to the various components of the circuit. Connected to line L1 is one terminal of a time-delay switch 81, the other terminal of which is connected to a conductor L3. One preferred embodiment of switch 81 is illustrated in FIG. 7 and described hereinafter. This switch functions to interconnect lines L1 and L2 for a pre-selected period of time, for example, 15 seconds after the actuation, and then to automatically disconnect these conductors and deenergize line L3. Switch 81 is mounted on a control panel indicated at 83 which is preferably positioned at a location generally inaccessible to small children; it may be positioned, for example, on the back panel of the range or on a wall nearby. Lead 55 of solenoid 47 is connected by a normally open temperature-responsive switch T1 to line L2. Switch T1 is positioned in heat exchange relationship or thermal communication with the pilot light of the burner and the parameters of this switch are such that it is actuated to its closed position when this pilot light is burning. Lead 57 of solenoid 47 is connected to one of contacts 71 of the limit switch assembly, the other contact 71 being connected to line L3. A second temperature-responsive switch T2 is located at the burner being controlled. This switch is a normally closed switch positioned in thermal communication with the burner. The parameters of switch T2 are such that it remains closed unless the burner is ignited, at which time it opens. Switch T2 is connected in series with contacts 73 of assembly 68, and with indicating or signal means (illustrated as including a buzzer 85 and a signal light 87) across lines L1 and L2. Light 87 and buzzer 85 are located at the control panel, while switches T1 and T2, solenoid 47 and contacts 71 and 73 are located at the burner being controlled, indicated by box B. It will be understood the components illustrated at burner B are typical and are provided for each burner of the range, including the oven burner.

Time-delay switch 81 is illustrated in FIG. 7 as being mounted on panel 83. This switch includes a push button assembly 89 and a set of contacts 91. Assembly 89 in turn includes a push button 93 secured to, preferably threaded into, a circular top cover plate 95. A bridging contact 97, electrically insulated from push button 93, is carried by assembly 89 and is adapted to bridge or interconnect contacts 91. Plate 95 is supported by a pair of flexible curtain walls or bellows 98 and 99 which house a spring 101 positioned within these walls. Bellows are sealed at the top by plate 95 and at the bottom by base

member 102 to form a generally cylindrical chamber C. Contacts 91 are secured to or carried by a platform 103 which is attached to a hollow shaft 105. Platform 103 is made of any suitable electrical insulating material. Shaft 105 is slidable in a passage in panel 83 and is biased upwardly (as viewed in FIG. 7) by a spring 107. A stop secured to the bottom of shaft 105 limits upward movement thereof. Through shaft 105 are carried conductors connected to contacts 91. Suitable packing is provided in shaft 105 and a seal is provided where shaft 103 is carried into chamber C so that there are no air leaks at the bottom of chamber C.

Plate 95 contains a plurality of air passages or inlet orifices 113 and a plurality of outlet passages 115. The latter are provided with a flapper valve 116 which permits air to flow therethrough in only one direction, out of chamber C. Because of flapper valve 116, and because of the relative size of passages 113 and 115, air may be forced out of chamber C by compression of bellows 98, 99, i.e., by the actuation of push button 93 downwardly, at a rate considerably greater than the rate at which air is permitted to enter the chamber. A pair of set screws 109 and 111 are threaded into panel 83 to limit movement of plate 95 by providing stops for ears which project from this plate.

Operation of time-delay switch 81 is as follows: Actuation of push button 93 downwardly compresses chamber C forcing air out of passages 113 and 115. Bridging contact 97 concurrently interconnects contacts 91 and forces shaft 105 downwardly against the bias of spring 107 to the dotted line position illustrated in FIG. 7. Thereafter, springs 101 and 107 tend to force plate 95 upwardly to its original position; however because air can enter chamber C only through passages 113 at a measured rate, these forces are resisted. The result is that it takes some time, say 15 seconds, for plate 95 to return to its normal position. From the time bridging contact 97 initially interconnects contacts 91 until shaft 15 returns to its solid line position, an electrical circuit is completed between the conductors carried through shaft 105. This preselected time delay is determined in part by the parameters of the device, for example, the size of passages 113, etc., and in part by the setting of set screws 109 and 111 which determine the amount of compression of chamber C. In a typical system, this preselected time interval should be roughly 15 to 20 seconds.

Operation of the control of this invention is as follows: It will be assumed that the pilot light associated with the burner is lit, maintaining temperature-responsive switch T1 in its closed position. To turn the burner on, i.e., to permit rotation of shaft 13 by knob 15, time-delay switch 81 is actuated to close the circuit between contacts 91. This completes a circuit from line L1, through switch 81 to line L3, through contacts 71 of the limit switch assembly (which are closed when housing 19 and shaft 13 are in their burner-off positions) and through solenoid 47 and switch T1 to line L2. This energizes solenoid 47 and, when recess 60 in member 17 is brought into alignment with recesses 49 in housing 19, causes catch 59 to be drawn into recess 49. Thereafter, counterclockwise rotation of member 17 by knob 15 causes counterclockwise rotation of member 19 and shaft 13. Also, as explained above, tongue 65 is received in the groove in catch 59 to maintain this counterclockwise interlock (see FIG. 4A). Thereafter solenoid 47 is deenergized either by the rotation of housing 19 which causes brush 79 to move off of contacts 71 or by the automatic opening of time-delay switch 81 after a preselected interval after actuation thereof. Once catch 59 has become interlocked with tongue 65, however, the deenergization of solenoid 47 has no effect on the counterclockwise interlock between members 17 and 19 so long as member 17, if rotated at all with respect to member 19, is rotated counterclockwise with respect

thereto. On the other hand, if after solenoid 47 has been deenergized, member 17 is rotated clockwise, spring 61 draws catch 59 back into recess 60, thereby unlocking members 17 and 19. Under these latter conditions, the burner may be turned off because of the clockwise interlock between members 17 and 19 afforded by bolts 39 locking in notches 41, but the burner may not be turned on any further; rotation of knob 15 counterclockwise merely rotates member 17 within housing 19.

In summary, then, in order to open the valve for the burner, the operator must first actuate switch 81 which energizes solenoid 47 for a preselected period of time, say 15 seconds, in which shaft 13 may be rotated counterclockwise. If the valve is not turned on during this period, contacts 91 open and switch 81 must again be actuated to turn the burner on.

Because control panel 83 is located out of the reach of small children, operation of the burner valve by a child in the absence of adult supervision is prevented. Even if a child were to climb up and actuate time-delay switch 81, it is highly unlikely that the child could get back to the knob 15 to turn the burner on in less than the fifteen or so seconds during which the solenoid is energized. Moreover, the provision of thermostat T1 prevents the solenoid from being energized if the pilot light associated with the burner is not burning thereby maintaining switch T1 closed. This latter feature by preventing the opening of a burner valve if the associated pilot light has become extinguished, prevents the escape of highly inflammable and dangerous gas, and thereby obviates one of the major hazards of gas ranges.

Assuming that the burner valve has been turned on during the preselected period of energization of solenoid 47 after actuation of switch 81 (i.e., assuming housing 19 has been interlocked with knob 15), as this housing is rotated, brush or contact 79 moves off of contacts 71 and, after a small transition angle, bridges or interconnects contacts 73. This completes a circuit between temperature-responsive switch T2 and line L2. If at this time the burner is not burning, switch T2 is closed and a signal circuit is completed from line L2, through contacts 73, switch T2, and through buzzer 85 and light 87 to line L1. This energizes buzzer 85 and light 87 signalling that a burner valve control has been rotated through a preselected angle (determined by the placement of contacts 73) and that the burner is not burning. Since brush 79 interconnects contacts 73 throughout the operating range of shaft 13, if the burner should become extinguished after having been initially lit, switch T2 will be actuated to its closed position, thereby energizing signal means 85 and 87. The signal circuit including switch T2 thus continuously monitors the burner under control and produces an alarm or signal if the burner is turned on and is not burning.

Because the control or attachment for each burner is adapted to be interfitted between an operating shaft and the control knob therefor, and since the control panel need not be incorporated into the range but may be placed at a convenient location nearby, the safety control of this invention may be readily attached to existing ranges. The system thus possesses marked advantages over prior art arrangements wherein complicated and costly internal mechanisms are required to lock operating shafts of burners.

While the present invention is illustrated as being employed with a gas range wherein each burner is provided with a pilot light, it will be understood that it may be employed with an electric range as well. In this case, however, temperature-responsive switch T1 (which in a gas range monitors the pilot light) would not be provided at each burner; rather solenoid 47 and contacts 71 would be connected in series directly across lines L2 and L3. Also, it will be apparent that temperature-responsive switch T1 would not be necessary at the oven burner of a gas range, if this oven burner were not provided with

a pilot light. In an electric range, the signal circuit which includes switch T2 would function to provide an indication that the burner control has been turned through a preselected angle and the burner is not supplying heat; however rather than indicating a potentially dangerous escape of gas, this would merely indicate a malfunctioning of the burner. Buzzer 85 would therefore probably not be provided in a control for an electric range.

It will be understood that devices other than thermostats T1 and T2 could be employed to monitor the pilot light and the burner, respectively. Light responsive devices, for example, photocells, or other temperature-responsive elements, thermistors or thermocouples, could be employed to perform the monitoring function. Also, while time-delay switch 81 is illustrated as a compressible chamber or dash-pot type switch, it will be understood that other delay devices, either mechanical (e.g., spring or timer motor devices) or electrical (e.g., RC time-delay circuits), could be employed to maintain solenoid 47 energized for a brief interval after actuation of the switch. Moreover, if the range which is to be provided with the safety control of this invention already includes signal means, e.g., lights and buzzers, these could be used in place of indicators 85 and 87.

It is preferred that as many of the components of the system as possible be made of a plastic or synthetic resin material, as this will not only lessen the overall expense of the system, but also minimize electrical insulating problems.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As various changes could be made in the above constructions and circuits without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

What is claimed is:

1. A safety burner construction comprising:
 - a burner;
 - valve means including a rotatable operating member for controlling said burner;
 - a knob member concentric with and rotatable relative to said operating member;
 - an electromagnetic winding carried by one of said members;
 - means including a catch movable in response to energization of said winding to interlock said members thereby to couple them for rotation together to enable said burner to be controlled by said knob member; and
 - a time delay switch interconnected in a circuit for energizing said winding, said switch including a manually operable member and means responsive to the operation of said member for closing said circuit only during a preselected time interval following such operation, whereby said burner can be turned on by said knob member only during said preselected interval following operation of said switch member.
2. A burner construction according to claim 1 in which said burner includes a pilot light and said construction further comprises a thermostatic switch positioned contiguous said pilot light for detecting the presence of a pilot flame, said thermostatic switch being interconnected in said circuit for preventing energization of said winding when no pilot flame is present whereby said burner can be turned on by said knob member only when said pilot light is burning.
3. A burner construction according to claim 1 further including one-way clutch means between said knob member and said operating member whereby said knob mem-

ber can always turn said operating member in one direction for turning said burner off.

4. A burner construction according to claim 3 in which said one-way clutch means includes a plurality of pawls mounted on said operating member for engagement with respective notches in said knob member.

5. A burner construction according to claim 1 further comprising a thermostatic switch positioned contiguous said burner for detecting the presence of a burner flame and a switch associated with said operating member which is closed after said operating member is turned through a predetermined angle, the operating member switch and said thermostatic switch being connected in a circuit with an indicator for providing an indication if said operating member has been turned through a predetermined angle and said burner is not operative.

6. A safety burner construction comprising:

- a gas burner having a pilot light;
- valve means including a rotatable operating member for controlling the burner flame;
- a knob member concentric with and rotatable relative to said operating member;
- a plurality of pawls carried by one of said members and engageable with notches in the other of said members for coupling said knob member to said operating member for rotation in one direction for turning said burner off;
- an electromagnetic winding carried by one of said members;
- a means including a catch movable from a first position to a second position in response to energization of said winding to interlock said members thereby to couple them for rotation together to enable said burner to be controlled by said knob member to turn said burner on;
- a first thermostatic switch which is maintained closed during the presence of a flame at said pilot light; and
- a time delay switch connected in a series circuit with said winding and said first thermostatic switch for selectively energizing said winding, said delay switch including a manually operated member and means responsive to the operation of said manual member for closing said circuit only during a preselected time interval following such operation, whereby said burner can be turned on by said knob member only when a flame is present at said pilot light and during said preselected interval following operation of the manual switch member.

7. A burner construction according to claim 6 further comprising a switch which closes upon rotation of said operating member through a preselected angle and a second thermostatic switch positioned contiguous said burner which closes when a burner flame is present, the operating member switch and said second thermostatic switch being connected in a series circuit with an indicator for providing an indication whenever said operating member has been rotated through said preselected angle and said burner is not operative.

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