May 21, 1963 W. H. HOLZBOOG ET AL 3,090,561

GAS SAFETY REGULATOR APPARATUS

Original Filed July 31, 1959 2 Sheets-Sheet 1

FIG. 1.

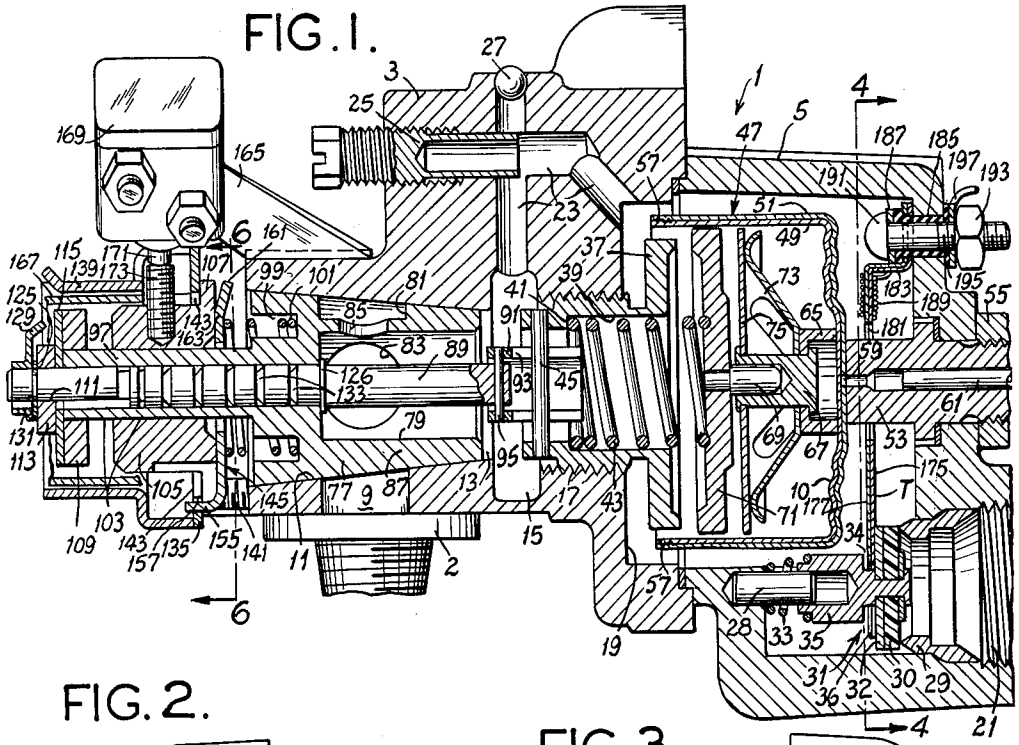


FIG. 2.

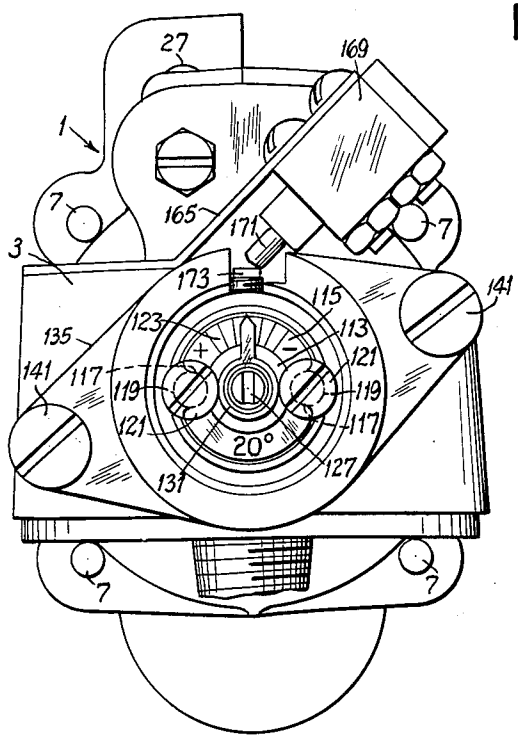
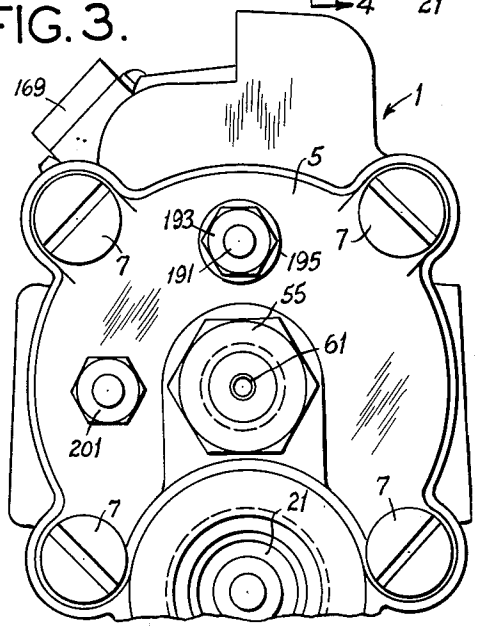


FIG. 3.



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Original Filed July 31, 1959 2 Sheets-Sheet 2

FIG. 4.

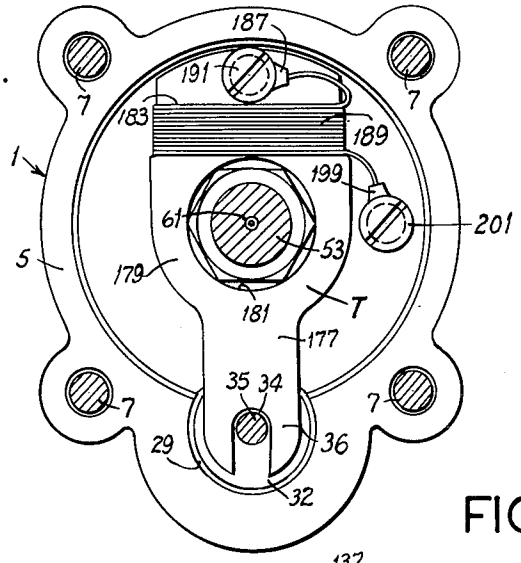

FIG. 6.

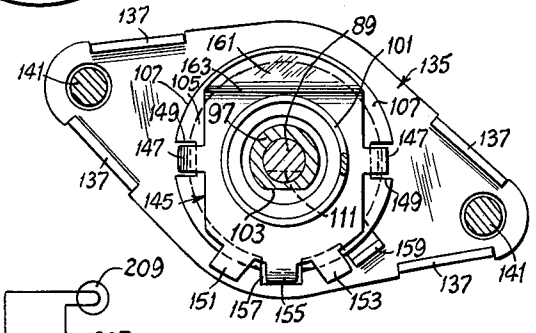

FIG. 5.

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GAS SAFETY REGULATOR APPARATUS

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Continuation of application Ser. No. 830,810, July 31, 1959. This application Apr. 10, 1961, Ser. No. 105,255

14 Claims. (Cl. 236—68)

This invention relates to gas safety regulator apparatus, and with regard to certain more specific features, to such apparatus for oven cooking ranges and the like. The invention is an improvement upon structures of the general class shown in United States Patent 2,885,150, dated May 5, 1959, and our United States patent application Serial No. 810,061, filed April 30, 1959, for Thermostatic Gas Valve Control, issued as Patent 2,980,386. This application is a continuation of our United States patent application Serial No. 830,810, filed July 31, 1959, now abandoned, for Gas Safety Regulator Apparatus.

Among the several objects of the invention may be noted the provision of a regulator control valve for a gas burner having a constantly burning pilot flame incorporating an electrically controlled safety valve; the provision of a regulator of the class described including such an electrically controlled safety valve as provides improved ignition; the provision of such a safety valve and thermostatic operating means therefor compactly located in the housing of the device; the provision of safety apparatus of the class described providing a signal indicating normal operations; the provision of safety apparatus of this class designed to ensure that gas can reach the burner only when the pilot light is on and to prevent gas from reaching the burner should the pilot light go out; and the provision of apparatus of the class described which may be manually or automatically timed with regard to burner operation. Other objects and features will be in part apparent and in part pointed out hereinafter.

The invention accordingly comprises the elements and combinations of elements, features of construction, and arrangements of parts which will be exemplified in the structures hereinafter described, and the scope of which will be indicated in the following claims.

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

FIG. 1 is an axial section of a regulator control valve incorporating the invention;

FIG. 2 is a left end elevation of FIG. 1;

FIG. 3 is a right end elevation of FIG. 1;

FIG. 4 is a cross section taken on line 4—4 of FIG. 1;

FIG. 5 is an electric and fluid circuit diagram illustrating the invention; and,

FIG. 6 is a cross section taken on line 6—6 of FIG. 1.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Although the valve to be described has general use, a particular use is for thermostatic gas valves for oven temperature control, in relation to which the invention will be described as an example.

Referring now more particularly to the drawings, there is shown at numeral 1 a hollow casing formed of parts 3 and 5, held together by screws 7. At numeral 9 is shown a gas inlet which communicates with a conical valve seat 11 in part 3. A threaded inlet fitting 2 is connected to inlet 9. Inlet 2 is connected with a gas main M, the latter having a connection 6 with a pilot burner P located next to the main burner B. The small end 13 of the seat 11 communicates with a passage 15. Passage 15 communicates through a threaded outlet 17 with a compartment 19, the latter having a gas outlet 21. This outlet 21, by

means of suitable piping 4, is connected with the main burner B in an oven. The passage 15 is also connected with compartment 19 through by-passages 23 which are under control of an adjustable threaded sleeve valve 25. The passages 23 are composed of various cross drillings, one of which is plugged after drilling by a driven-in ball 27.

In the outlet 21 is a valve seat 29 for a valve 31, biased toward the seat by means of a spring 33. The valve consists of a bushing 35, slidable on a guide 28 and carrying a resilient facing material 30 backed by a washer 32. The bushing 35 is provided with a peripheral groove 34 behind the washer 32, for the reception of the forked end 36 of thermostatic plate T, the function of which will be described below.

At 37 is shown an outlet valve seat having a tubular stem 39 threaded in the opening 17. This tubular member 39 has a shoulder 41 for seating a spring 43. The shoulder at the left carries a crosspin 45. A bimetallic cup-shaped diaphragm 47 is located in the compartment 19. It has an inside wall 49 and an outside wall 51, the latter being soldered or otherwise attached to the end of a nipple and post 53 held by means of a nut 55 in an opening in member 5. The marginal portions 57 of the members 49 and 51 are sealed together as by welding or soldering, the remaining portions of the members 49 and 51 being unjoined. They are corrugated in their portions forming the inside bottom 10 of cup 47. The outside member 51 is provided with an opening 59, communicating through the hollow nipple 53 with a capillary tube 61 sealed thereto and extending to a bulb 63, also located in the oven. The bulb 63, tube 61 and available space between the bimetallic members 49 and 51 are filled with a thermally responsive liquid which is adapted upon thermal expansion in response to heating to enter in between the members 49 and 51, so as to force them apart. This drives the botttom of the member 49 to the left. The inner member 49 includes a support 65 which has a sliding engagement with a cup member 67 in which is a stem 69 of a valve 71. A fingered spring rosette 73 slides on 67 and abuts support 65, pressing marginally against a plate 75 riveted to the end of the member 67. The support 65 and inner portions of the rosette 73 are limitedly slidable to the left on member 67. Thus, in response to increased oven temperatures, the fluid in the system 63, 61, 49, 51 expands and presses to the left the following parts: inside bottom of 49, 65, 73, 69 and valve 71, tending to close off the passage between this valve 71 and its seat 37. The spring 43 provides reaction between the shoulder 41 and the valve 71 for valve reopening purposes when the fluid cools. In response to very high temperatures, the valve may close upon its seat 37, in which event further expansion of the fluid presses upon the inside bottom 10 of cup 47. Bottom 10 will push support 65, causing it to slide or overrun on member 67. As a result, the rosette spring 73 will deflect without damage to any parts. Upon cooling, the reverse action occurs and valve 71 moves away from the seat 37 to allow flow of more gas therebetween. The cup shape of the bimetallic parts 49, 51 is for ambient temperature-compensating purposes in a manner known in the art and requiring no elaboration herein.

At numeral 77 is shown a cup-shaped conical plug valve in the conical seat 11. This valve has a hollow center 79 communicating with passage 15. The hollow center 79 is surrounded by a groove 81 which communicates with the center 79 through opposite passage 83 and also through an intermediate passage 85. Only one of the two passages 85 appears, as in FIG. 1. This leaves a solid portion 87 of the valve 77 for cutting off flow from the inlet 9. The valve may be turned from its initial open position throughout an angular range in

which one or both of a passage 83 and 85 are in communication with the inlet 9. The parts thus far described are known to the art (see, for example, Patent 2,757,871) and further description of them will be unnecessary herein.

Extending through the conical plug valve 77 is a control stem 89, to the right-hand end of which is attached a sleeve 91, slotted as shown at 93 for the reception of the pin 45. The sleeve 91 is held to the stem 89 by means of a pin 95. Thus if the stem 89 is turned with respect to the valve 77, the hollow stem 39 may be threadably turned in the threaded opening 17, thus adjusting the axial position of the valve seat 37 relative to the thermostatically controlled range of movement of the valve 71.

The left-hand end of the valve 77 is provided with a hollow stem 97. A counterbored seat 99 is arranged in valve 77 for the reception of the end of a spring 101. The control stem 89 extends through the hollow valve stem 97 and out beyond its left-hand end. The hollow valve stem 97 and an arbor 105 are splined by means of conjugate flats 103. The arbor 105 is flanged as shown at 107. Thus the hollow valve stem 97 and the arbor 105 are adapted to rotate together but to have relative sliding movements. Splined on the hollow valve stem 97 by means of an extension of the conjugate flat 103 is a washer 109. Thus the washer 109 and the stem 97 are adapted to rotate together.

The left end of the control stem 89 also has a flat, as shown at 111, where it extends from the hollow valve stem 97. This is for the splined reception of a washer 113 having a cooperating conjugate flat. Thus the washer 113 and the control stem 89 are adapted to rotate together.

At numeral 115 is shown a sheet-metal dial, located at the end of the hollow valve stem 97 and having a central hole interiorly clearing the control stem 89 without any splined relation therewith. The dial 115 is provided with opposite notches 117, accommodating the shanks of screws 119 threaded into the washer 109 (FIG. 2). The heads 121 of the screws overhang the washer 113 and are adapted to clamp it when the screws are tightened in washer 109. Thus by loosening the screws 119, relative rotation may be effected between the control stem 89 and the hollow valve stem 97. This is accomplished by applying a screwdriver to the slot 127 of the stem 89. During relative rotation, the washer 113 rotates with stem 89 while the washer 109 rotates with the valve stem 97, holding with it the dial 115. The dial is indexed, as shown at 123, to show angles of adjustment between stems 89 and 97 which accord to 20° steps in controlled temperature (see designation 20° carried on dial 115). The control stem 89 is prevented from moving axially by collar-forming horseshoe spring washers 125 and 126, clipped into grooves in the stem 89. The righthand one of these (126) becomes located adjacent the bottom of the hollow center 79 in the plug valve 77. The left-hand one of these (125) is located adjacent washer 113. The sum of the thicknesses of the washer 113 and dial 115 snugly infills the space between washer 125 and the end of the stem 97. The stem 89, with some clearance, freely floats with respect to the valve 77, both when the screws 119 are loose for adjustment and when they are tightened after an adjustment. A small pointer 129, having a central collar 131, is press-fitted onto the end of the stem 89 to indicate in connection with the indexing 123 the angular adjustment between stem 89 and the valve 77. Numerals 133 indicate lubricant-retention groooves in the stem 89.

At numeral 135 is shown a sheet-metal platform member, having struck-out supports 137 engaging the end of the member 3. Overlying this platform member 135 is a sheet-metal jacket 139. Parts 135 and 137 are held to member 3 on the supports 137 by means of screws 141. Members 135 and 139 form a cage for the arbor 105 and the extensions of stems 89 and 97. When assembled, the flange 107 of the arbor 105 lies between the platform member 135 and body 3. The body portion of the arbor extends through an opening 143 in platform 135, which hole is somewhat larger than the diameter of the arbor. This admits an extension sleeve 167 of a control knob K. Adjacent the right-hand end of the arbor 105 is a latch plate 145. This plate has ears 147, loosely interfitting with opposite notches 149 of the flange 107. It also has radially extending ears 151 and 153, flanking a tongue 155 which is struck out toward a notch 157 cut into the bottom of the opening 143. Tongue 155 is normally located as shown in FIG. 1. Ears 151 and 153 are adapted when plate 145 is rotated alternately to engage a lug 159, struck out to the right of the platform member 135.

The plate 145 has a bent-out ear 161 which, with the remainder of the plate, forms a rocking edge 163. This edge 163 is adapted for rocking of the plate on the flanged end of the arbor 105. The spring 101, reacting from valve 77, presses on the latch plate 145, normally forcing it flat against the flange 107, as shown in FIGS. 1 and 6. Thus upon moving the arbor 105 to the right, the spring is compressed until the ear 161 engages member 3. This rocks the plate 145 anticlockwise to withdraw the tongue 155 from the notch 157. This frees the arbor for rotation. Upon rotation of about 276° from the FIG. 6 position (wherein ear 153 engages stop 159), ear 151 will engage the other side of the stop 159. Such rotary action first opens the gas inlet 9 and maintains it open, the flow of gas being thereafter controlled by the thermostatic action of the valve 71 in connection with the valve seat 37.

Mounted on the member 3 is a bracket 165 which carries an electric microswitch 169. This has an operating plunger 171 normally biased by spring means within the switch in an outward direction, so as to close the switch. Details of the interior of the switch will not be necessary, since it is of conventional variety. It suffices to say that when the plunger 171 is pressed inward, as shown in FIG. 2, the switch is open. The plunger 171 is pressed inward to open the switch by a lug in the form of a set screw 173, threaded into the arbor 105. This occurs in the closed position of the valve 77. When the valve is opened by pushing in and turning the member 167 anticlockwise, the lug 173 moves from under the plunger 171, thus allowing the switch 169 to close. Thus it will be seen that the switch 169 is open when the valve 77 is in its initial closed position. The switch is closed throughout all positions of the valve 77 when it is turned open anticlockwise from the position shown in FIGS. 1 and 2.

Returning to the thermostat T, it consists of a cantilever form of a bimetallic plate having a sheet of metal 175 of relatively high coefficient of expansion, and a sheet of metal 177 of relatively low coefficient of expansion. This sheet contains the extension 36 and also wide portion 179, having an opening 181 surrounding the nipple post 53. At its upper end, the plate T is offset, as shown at 183, where it is anchored by means of a shouldered insulating sleeve 185, located in an opening in the body 5. At the end of the sleeve 185 is a wire terminal 187 of an insulated heater coil 189, which is wrapped around the enlarged portion 179 of the thermostat T. A bolt 191 clamps in position the parts 185, 187 and 183. The bolt 191 is held by a nut 193, the latter being insulated by means of a washer 195. The nut 193 also holds in position a lead wire 197. The other end of the insulated heating wire 189 extends to another terminal 199 and is grounded upon the member 5 by means of a bolt and nut connection 201.

Referring to FIG. 5, L1 and L2 indicate a supply circuit to the primary of a transformer R. The secondary of the transformer is grounded and wired through a timer C by means of a line 203 which extends to the switch 169. The timer C includes a switch 170 in line 203 automat-

ically operable by the timer. The switch 170 is of the type that its automatic operation by timer C may be overridden by manual closing operation from a manual control element 172. Further details in this regard are unnecessary, this type of manual override timing switch means being known. Switch 169 is connected through a lead 205 with a flame switch F, the latter being in heat-exchange relationship with the flame of pilot P. The line 205, through switch F, is connected to the heater 189 over the line 197, the heater being grounded through the connection 201. The switch F when closed also feeds a line 207, extending to a pilot lamp 209, which is also grounded.

Operation is as follows:

Assume that the pilot light P has been lighted. This in effect closes the flame switch F. To light the burner B, the knob K is pushed in to release the latch 155 and then turned anticlockwise, thus opening the valve 77 and retracting the lug 173 from the button plunger 171 of switch 169. This closes switch 169, thus closing the circuit through 203, 205, pilot switch F (if closed), 207 and lamp 209; provided the timer switch C or its equivalent has been set to on position. Lighting of lamp 209 indicates that pilot light P is on.

The above operation also supplies current through pilot switch F, line 197, heater 189 via connection 201 to ground. This bows the thermostat T concavely to the left, thus opening the safety valve 29, 30. Since the thermostat T is of the plate type, as above described and shown in the drawings, its action is gradual, as distinguished from the snap action obtained from snap-acting disc and like thermostats such as, for example, shown in United States Patents 1,895,591 and 2,125,473. Consequently, regardless of how rapidly the valve 77 is opened, the safety valve 31, because of its gradual opening action, will admit gas to the burner B in gradually increasing amounts, which avoids undesirable puffing action upon ignition, such as might be obtained with a snap-acting type of thermostat. In any event, opening action of the valve 31 admits gas through open valves 77, 37 and 29, 30 over line 4 to the burner B, which lights. Upon heating the oven, the bulb 63 is heated, expanding the liquid in line 61, thus upon overheating tending to close down the valve 71. Conversely, upon excessive cooling, the valve 71 opens and more gas is admitted to the burner B. Thus at a given setting of the knob K, a certain temperature is substantially maintained in the space surrounding burner B and bulb 63. The temperature in this space may be changed by rotating the knob K, thus changing the position of the seat 37 of valve 71. At very low temperature settings the valve 71 in its regulating operation may shut entirely, and it is the purpose of the by-passage 23 under such conditions to keep the burner B lighted with a low flame. It sometimes occurs that such a low flame will blow out. If it does so and the pilot light P remains lighted, the burner B will relight. If, however, this occurs along with the pilot light P being out or blown out, a dangerous condition is presented because upon cooling of the space around the burner the valve 71 will open widely and a large amount of unlighted gas escape. The invention prevents this, because under such conditions the flame switch F will open, thus opening the circuit through the heater 189. The thermostat T will then straighten and close the safety valve 29, 30. This safety valve will not thereafter reopen until the pilot light P is relighted, so as to cause closing of the flame switch F, reheating of the heater 189, bending of the thermostat T, and reopening of the safety valve 29, 30.

It will also be observed that when the plug valve 77 is turned to cut off position, the switch 169 opens, thus depriving lamp 209 of current, whether or not the flame switch F is closed. Therefore, the pilot lamp 209, when lighted, indicates both an open condition of the valve 77 (switch 169 closed) and a lighted condition of the pilot P (flame switch F closed). When the knob K is set to open position and the lamp 209 is lighted, the operator can be assured that the burner B is burning. On the other hand, if the knob K is set to open position and the lamp 209 does not light, this indicates that the space around burner B is not being heated. Moreover, a failure of current in the line L1, L2 will result in the lamp 209 being off and the safety valve 29, 30 remaining closed.

It will be observed that the manual control valve 77 and the regulator valve 37, 71 are collinear and operative on a common axis, to one side of which is the axis of the safety valve 31. The crosswise location of the thermostatic plate 175 in this environment provides a compact structure which minimizes the total length of the device. This is enhanced by the location of the support 53 of the regulator cup 47 being located in the hole 181 in the thermostatic plate 175.

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 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.

We claim:

1. Gas control and safety apparatus comprising a main burner and a constantly burning pilot burner, a hollow casing having an inlet and an outlet, a manual control valve and a regulator control valve, said main burner being in a space to be heated, said pilot burner being continuously supplied with gas from a supply line and said main burner being supplied with gas from said supply line in series flow through both said manual control valve and said regulator valve, a flame switch in heat-exchange relationship with the pilot burner adapted to close when the pilot burner is lighted, a safety valve connected in series flow with said manual control and regulator control valves between said regulator control valve and said outlet, said safety valve being adapted to control the flow of gas through said outlet, gradually operative thermostatic means adapted when heated to open said safety valve and when cool to close it, and an electric heater element for said thermostatic means, said heater element being connected to receive current when said flame switch is closed, said manual control valve, regulator control valve, safety valve, thermostatic means and electric heater element being located in said casing.

2. Gas control and safety apparatus according to claim 1, including a second switch connected to receive current when the flame switch is closed, and means operatively connecting said second switch with said manual control valve adapted to open said second switch when the manual control valve is in an off position and to close the switch when the manual control valve is in an on position.

3. Gas control and safety apparatus according to claim 1, wherein said thermostatic means is constituted by a thermostatic cantilever blade mounted at one end and free at the other end, said free end having a driving connection with said safety valve, a spring biasing said safety valve to closed position, said thermostatic means when heated being adapted to bow and move the safety valve against the biasing action of said spring.

4. Gas control and safey apparatus according to claim 3, wherein said heater element is constituted by a heater coil in heat-exchange relation to said thermostatic means.

5. Gas control and safety apparatus comprising main and pilot burners, a hollow casing having an end wall, a manual control valve and a collinear regulator control valve in said casing aligned on a first axis, said main burner being in a space to be heated, said pilot burner being continuously supplied with gas from a supply line and said main burner being supplied with gas from said

supply line in series through said manual control valve and said collinear regulator control valve operative on said first axis, a flame switch in heat-exchange relationship with respect to the pilot burner adapted to close when the pilot burner is lighted, a safety valve connected in series with said manual control and regulator control valves and operative on a second axis spaced from and to one side of said first axis, said regulator control valve being axially movable along said first axis and mounted in relation to said end wall so as to form a relatively flat space, a thermostatic plate anchored to said end wall on the other side of said first axis, said thermostatic plate extending through said space between said end wall and said regulator control valve to minimize the length of said casing, said plate extending into operative connection with said safety valve and adapted when heated to open said safety valve and when cool to close it, and an electric heater in heat-exchange relationship to said thermostatic plate, said heater being connected in series with said flame switch.

6. Gas control and safety apparatus according to claim 5, wherein said regulator control valve includes a support element mounted on said end wall of said apparatus on said first axis, said plate having an opening therethrough through which said last-named support element passes.

7. Gas control and safety valve apparatus comprising a body having a gas inlet and a gas outlet, main and pilot burners, said main burner being in a space to be heated, said pilot burner being continuously supplied with gas from a supply line, a manual control valve adapted in one position to close the inlet and adapted in several other positions to open said inlet, a flame switch adapted to be closed when said pilot burner is lighted, an electric switch mounted on said body, means connected with the manual control valve adapted to open said switch in said one position of the manual control valve and to close it in said other positions of the manual control valve, a thermostatic regulator valve operatively connected with said manual control valve, a safety valve adapted to control gas passing through the manual control and regulator valves, said safety valve being located between said regulator control valve and said outlet, said safety valve being adapted to control the flow of gas through said outlet, a bimetallic thermostat having a movable portion connected to the safety valve adapted to open the safety valve when the thermostat is heated, a heater in heat-exchange relation with said thermostat, and an electric circuit adapted to supply said heater with current through said switches when said switches are closed, said control valve, regulator control valve, safety valve, thermostat and heater being located in said body.

8. Gas control and safety apparatus comprising main and pilot burners, a hollow casing having an end wall, an inlet, and an outlet in said end wall, a manual control valve and a regulator control valve in said casing, said main burner being in a space to be heated, said pilot burner being continuously supplied with gas from a supply line and said main burner being supplied with gas from said supply line in series through said manual control valve and said regulator control valve, a flame switch in heat-exchange relation with the pilot burner adapted to close when the pilot burner is lighted, a safety valve connected in series with said manual control and regulator control valves and located between said regulator control valve and said end wall, said safety valve being adapted to control the flow of gas through said outlet, said regulator control valve being spaced from said end wall so as to form a relatively small space, thermostatic means located between said regulator control valve and said end wall and extending through said relatively small space to minimize the length of said casing, said thermostatic means adapted when heated to open said safety valve and when cool to close it, and an electric heater for said thermostatic means, said heater being connected in series with said flame switch.

9. Gas control and safety apparatus according to claim 8, including a second switch connected in series with the flame switch, and means operatively connecting said second switch with said manual control valve adapted to open the switch when the control valve is in an off position and to close the switch when the control valve is in an on position.

10. Gas control and safety valve apparatus comprising a body having a gas inlet and a gas outlet, a rotary manual valve having a closed position and several open positions, an electric switch mounted on said body, means connected with the rotary manual valve adapted to open said switch in said closed position of the valve and to close the switch in said open positions of the valve, a cup-shaped thermostatic regulator valve operatively connected with said manual valve, said regulator valve being located and axially movable on the axis of rotation of the manual valve, the bottom of said regulator valve being spaced from and generally parallel to an end wall of said body so as to form a relatively flat space, a safety valve adapted to control gas passing through the manual and regulator valves, said safety valve lying on and movable along an axis spaced from and to one side of the axis of rotation of the manual valve, a bimetallic plate anchored to said end wall at a point spaced from the axis of rotation of the manual valve and the axis along which said safety valve moves, said plate having a movable end extending through said space into operative connection with the safety valve, a heater in heat-exchange relation with said plate, and an electric circuit adapted to supply said heater with current through said switch.

11. Gas control and safety valve apparatus according to claim 10, wherein said circuit includes a flame switch adapted to close when heated.

12. Gas control and safety apparatus comprising a main burner and a constantly burning pilot burner, a manual control valve and a regulator control valve, said main burner being in a space to be heated, said pilot burner being continuously supplied with gas from a supply line and said main burner being supplied with gas from said supply line in series flow through both said manual control valve and said regulator valve, a flame switch in heat-exchange relationship with the pilot burner adapted to close when the pilot burner is lighted, a safety valve connected in series flow with said manual control and regulator control valves, gradually operative thermostatic means adapted when heated gradually to open said safety valve and when cool gradually to close it, an electric heater element for said thermostatic means, said heater element being connected to receive current when said flame switch is closed, a housing for said manual and regulator valves, a post mounted on an inside wall of said housing, said regulator control valve including a cup-shaped thermostatic control element the bottom of which is mounted on said post, the bottom being generally parallel to said wall and mounted in relationship to said wall so as to form a relatively flat space, said thermostatic means being in the form of a thermostatic cantilever blade extending flatwise through said flat space and being mounted at one end and free at the other end, said free end having a driving connection with said safety valve, said safety valve also being located in said housing, and a spring biasing said safety valve to closed position, said thermostatic means when heated being adapted to bow and move the safety valve against the biasing action of said spring.

13. Gas control and safety apparatus comprising a main burner and a constantly burning pilot burner, a manual control valve and a regulator control valve, said main burner being in a space to be heated, said pilot burner being continuously supplied with gas from a supply line and said main burner being supplied with gas from said

supply line in series flow through both said manual control valve and said regulator valve, a flame switch in heat-exchange relationship with the pilot burner adapted to close when the pilot burner is lighted, a safety valve connected in series flow with said manual control and regulator control valves, gradually operative thermostatic means adapted when heated gradually to open said safety valve and when cool gradually to close it, an electric heater element for said thermostatic means, said heater element being connected to receive current when said flame switch is closed, said thermostatic means being constituted by a thermostatic cantilever blade mounted at one end and free at the other end, said free end having a driving connection with said safety valve, a spring biasing said safety valve to closed position, said thermostatic means when heated being adapted to bow and move the safety valve against the biasing action of said spring, said heater element being constituted by a heater coil in heat-exchange relation to said thermostatic means, a housing for said manual and regulator valves, and a post mounted on an inside wall of said housing, said regulator control valve including a cup-shaped thermostatic control element mounted upon said post in relation to said wall so as to form a relatively flat space, said thermostatic means being of substantially flat form and extending flatwise through the space so provided.

14. Gas control and safety apparatus comprising a main burner and a constantly burning pilot burner, a manual control valve and a regulator control valve, said main burner being in a space to be heated, said pilot burner being continuously supplied with gas from a supply line and said main burner being supplied with gas from said supply line in series flow through both said manual control valve and said regulator valve, a flame switch in heat-exchange relationship with the pilot burner adapted to close when the pilot burner is lighted, a safety valve connected in series flow with said manual control and regulator control valves, gradually operative thermostatic means adapted when heated gradually to open said safety valve and when cool gradually to close it, an electric heater element for said thermostatic means, said heater element being connected to receive current when said flame switch is closed, said thermostatic means being constituted by a thermostatic cantilever blade mounted at one end and free at the other end, said free end having a driving connection with said safety valve, a spring biasing said safety valve to closed position, said thermostatic means when heated being adapted to bow and move the safety valve against the biasing action of said spring, said heater element being constituted by a heater coil in heat-exchange relation to said thermostatic means, a housing for said manual and regulator valves, and a post mounted on an inside wall of said housing, said regulator control valve including a cup-shaped thermostatic control element mounted upon said post in relationship to said wall so as to form a relatively flat space, said thermostatic means extending through the space so provided and having an opening therethrough through which said post passes, the support for the thermostatic means being located on one side of said post and its connection with said safety valve being located on the other side of said post.

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2,919,337	Brosseau et al.	Dec. 29, 1959