Sept. 1, 1953 D. A. BROWN ET AL 2,650,766

SAFETY GAS VALVE

Filed Nov. 22, 1948

4 Sheets-Sheet 1

Fig. 1.

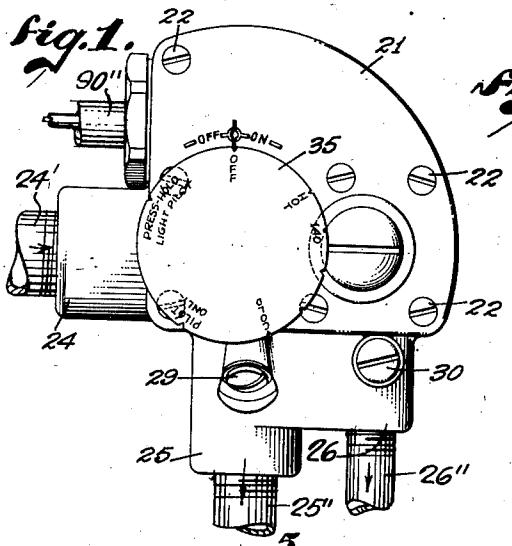


Fig. 1a.

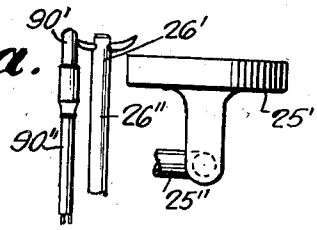


Fig. 2.

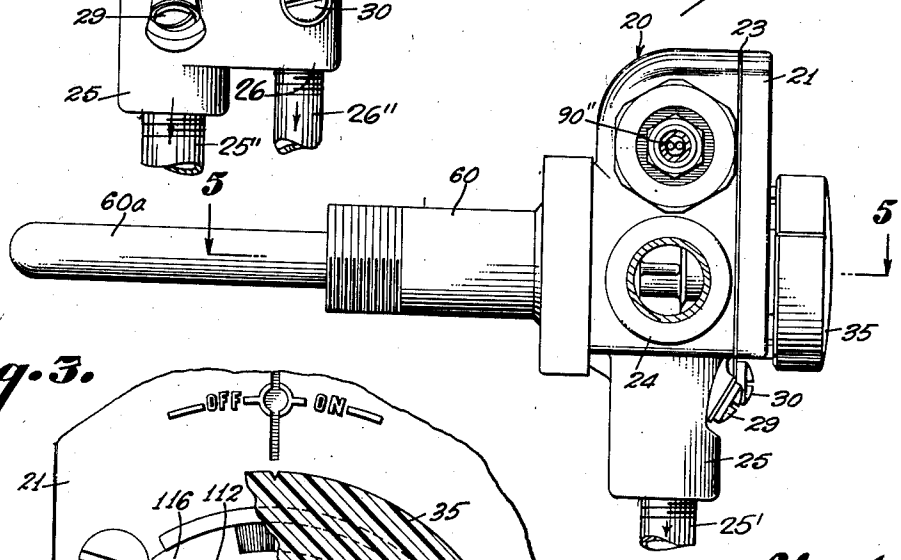


Fig. 3.

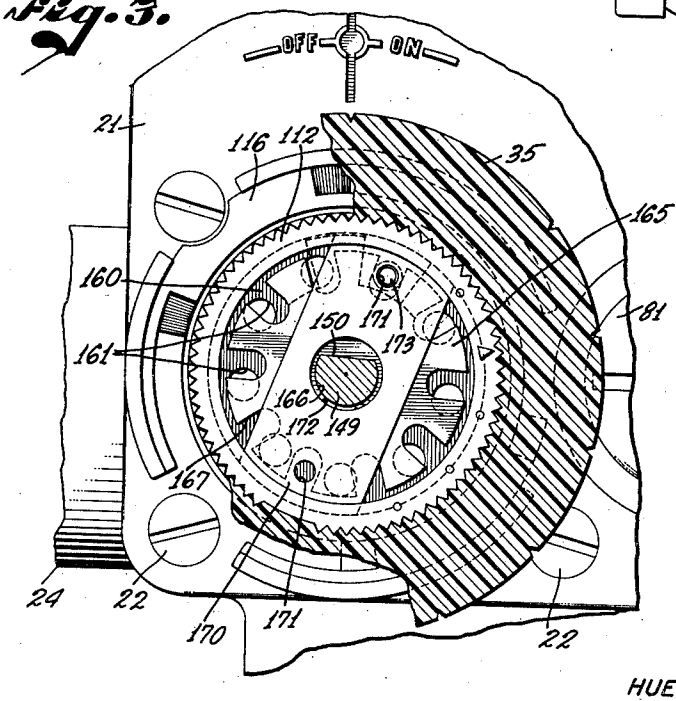
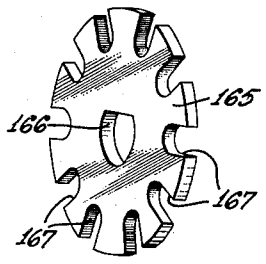


Fig. 4.



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Fig. 5.

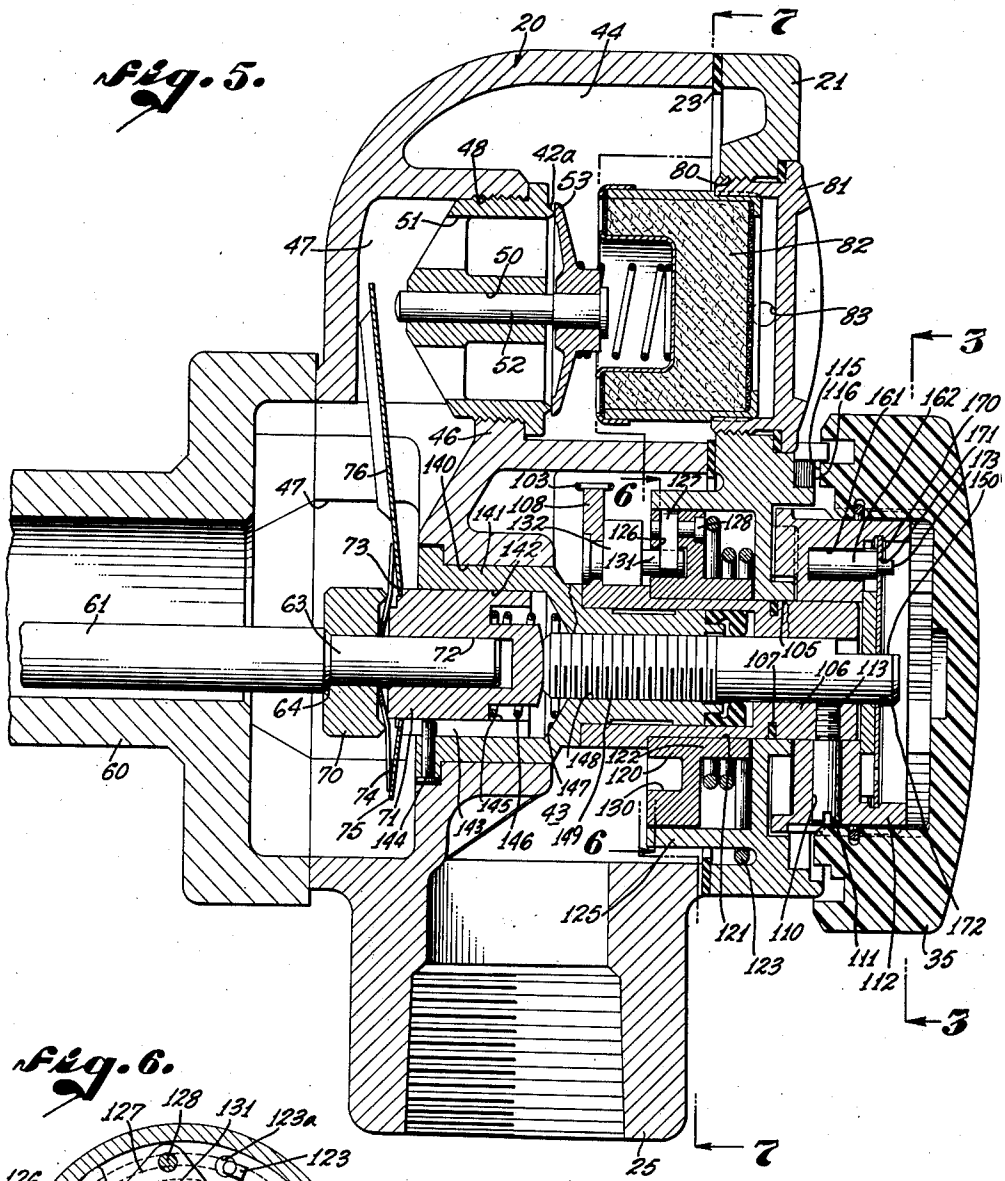
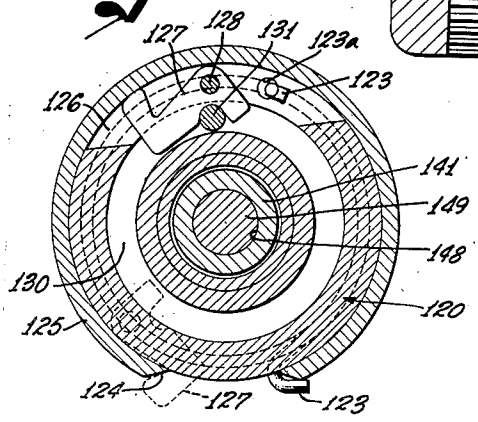


Fig. 6.



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SAFETY GAS VALVE

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Fig. 7.

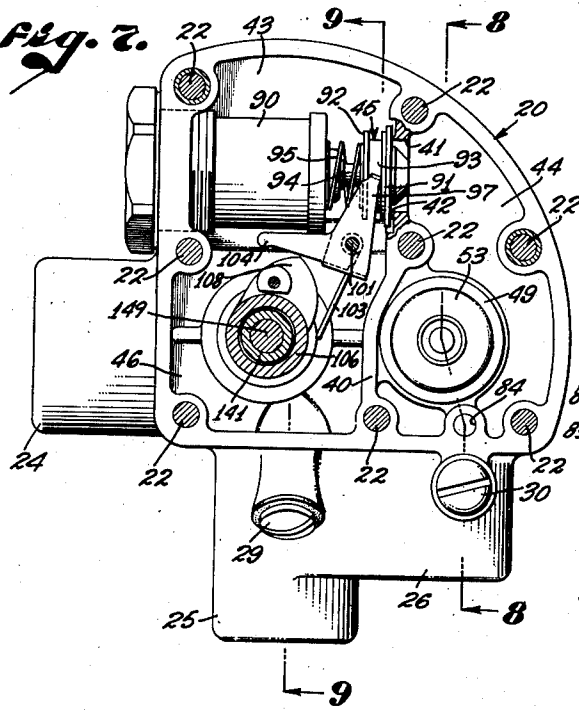


Fig. 8.

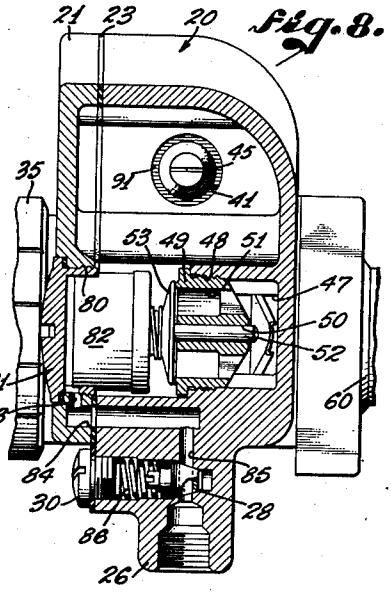


Fig. 9.

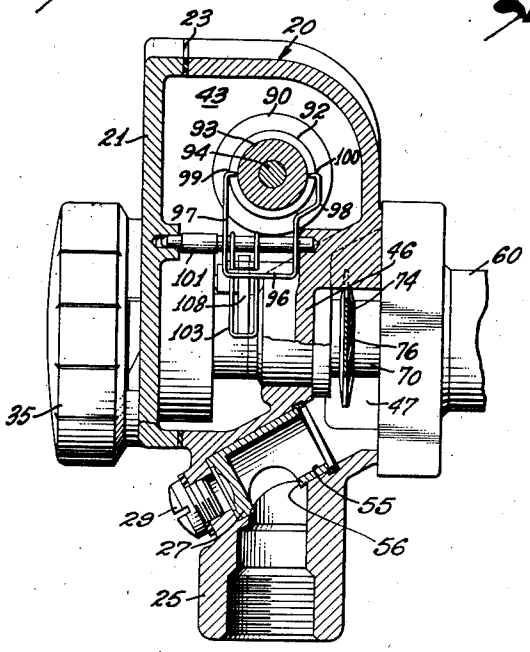
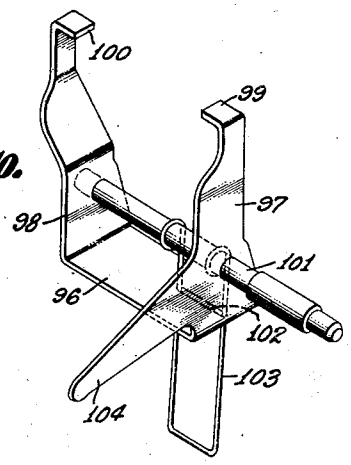


Fig. 10.



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SAFETY GAS VALVE

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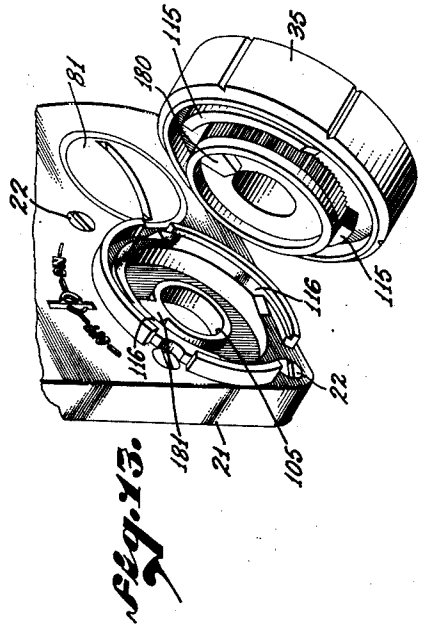


Fig. 13.

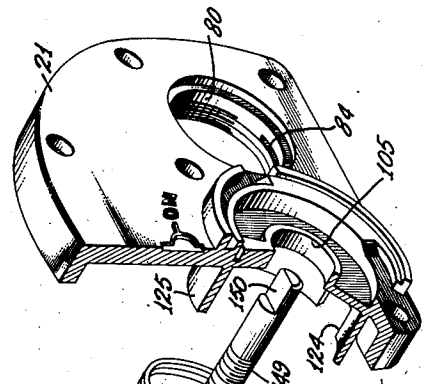


Fig. 11.

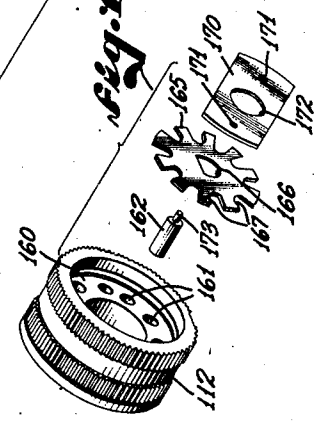


Fig. 12.

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Patented Sept. 1, 1953

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UNITED STATES PATENT OFFICE

2,650,766

SAFETY GAS VALVE

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Application November 22, 1948, Serial No. 61,364

13 Claims. (Cl. 236—21)

1

Our invention relates to an automatic gas safety control valve, and has particular reference to what has become known in the industry as the "100% safe" water heater valve, and constitutes an improvement thereon.

The valve hereinafter to be described is illustrated as a thermally responsive valve adapted to maintain a constant temperature in modern domestic water heaters. It will be understood, however, that the invention is subject to a much wider use and should not be confined solely to domestic water heater valves.

Most modern domestic water heaters are of the storage tank type wherein the main gas burner is positioned sub-adjacent the storage tank. The flow of gas to the main burner is controlled by a valve which is responsive to changes in temperature of the water inside the tank by means of a thermostatic element. A pilot light is usually positioned adjacent the main burner, which said pilot light is independent of the thermostatic valve. The purpose of the pilot light is to reignite the main burner when the temperature of the water falls low enough for the thermostatic element to actuate and open the thermostatic valve.

A serious problem arises in connection with this type of construction, namely, the danger of explosions in the event that due to some accident the pilot light becomes extinguished and an attempt is made to relight it. Provision must be made to interrupt the flow of gas in the event of extinguishment of the pilot.

We are aware that a great many valves have been devised which have been designed to accomplish the result desired. Some of the prior art valves have included in their combination an electromagnetic unit adapted to hold a safety control valve open so long as the pilot burner remained ignited. A thermocouple having a hot junction adjacent the pilot flame and heated thereby was used to energize the electromagnet so that upon extinguishment of the pilot burner the valve would be released, thereby shutting off the flow of gas to the pilot burner.

Such valves were deficient in that it was usually possible to cause a flow of gas through the main burner while attempting to relight the pilot. This condition was dangerous to the operator because of possible explosions. It is among the objects of our invention to construct a safety control valve which will prevent the flow of gas to either the main gas burner or the pilot burner after extinguishment of the pilot and to incorporate such safety features that it will be impossible to reignite the pilot burner without shutting off the main gas burner.

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We are also aware that this dual function has been accomplished in other control valves. Such valves, as heretofore known, are not entirely satisfactory in that several operations were necessary to accomplish the result which is often confusing to the average domestic user.

It is also among the objects of our invention to provide a safety valve which has but a single control, which said control is adapted to place the valve controlling the main burner in such a condition that it would be impossible for gas to flow to the main burner while resetting the safety control valve for the admission of gas into the pilot burner.

It is also among the objects of our invention to provide such a safety control valve having a single control knob and which is provided with a torque means tending to bias the control knob to a minimum position, which position will result in a closing of the safety control valve unless the pilot has been ignited a sufficiently long period of time to permit the electromagnetic means to hold the safety valve open. The purpose of such an arrangement is so that the safety valve cannot be set to open position, the pilot ignited and the operator leave the valve in that condition so that extinguishment of the pilot light will create an accumulation of gases subject to the danger of explosion. In other words, the operator must remain constantly in attendance until after the safe operating conditions have been re-established.

It is further among the objects of our invention to provide a safety control valve wherein the single control knob, which is used to reset the safety control valve, is also used upon further rotation to adjust the temperature response of the thermostatic control valve. In such event, it is necessary to provide some means whereby the torque bias on the knob during the resetting operation is automatically released from the knob during the temperature adjusting phase; otherwise, the knob upon being released will always return to a closed minimum position. Such objective has been accomplished in the valves embodying the principles of our invention.

Other and further objects and advantages of our invention will become apparent from the drawings and the specifications relative thereto.

In the drawings:

Figure 1 is a front elevation of a safety control valve embodying the principles of our invention.

Figure 2 is a side view of the valve shown in Figure 1.

Figure 1*a* is a diagrammatic illustration of a main burner, pilot burner and thermocouple used with the thermostat valve.

Figure 3 is a partial enlarged fragmentary sectional view showing the details of construction of the setting and control knob.

Figure 4 is a perspective view of an adjusting plate.

Figure 5 is an enlarged sectional view taken on line 5—5 of Figure 2.

Figure 6 is a detailed sectional view of the torque releasing mechanism.

Figure 7 is a front elevation of the valve shown in Figure 1 having the cover removed.

Figure 8 is a sectional view taken on line 8—8 of Figure 7.

Figure 9 is a sectional view taken on line 9—9 of Figure 7.

Figure 10 is a perspective view of the lever for resetting the control valve.

Figure 11 is an exploded perspective view of the resetting and temperature adjusting mechanism.

Figure 12 is a perspective exploded view of another portion of the resetting mechanism.

Figure 13 is an exploded perspective view showing a portion of the outer case and the position of the control knob.

In general, our invention as seen in Figures 1 and 2 comprises a main valve housing, designated generally **20**, having a face plate **21** secured thereto by means of a plurality of machine bolts **22**, and having a gasket **23** therebetween to effect a gas-tight seal. The main housing **20** has an internally threaded boss or nipple **24** which is the gas inlet fed by a pipe **24'**, an internally threaded nipple **25** adapted to supply fuel to a main burner **25'** through a pipe **25''**, and an internally threaded boss **26** adapted to provide fuel to the pilot burner **26'** through a pipe **26''**.

The bosses **25** and **26**, which supply fuel to the main burner and the pilot burner, are formed respectively with diagonal bores for the reception of metering valves **27** (Figure 9) and **28** (Figure 8). Threaded cap screws **29** and **30** are used to close the holes or bores into which the metering valves are positioned and also to provide access thereto.

A control knob **35** is rotatably mounted on the valve in front of the face plate **21** and serves to rotate the mechanism both for resetting and regulating the temperature as will be more fully disclosed later.

General construction

The valve housing **20** is formed with a wall **40** (see Figure 7) dividing the housing into two separate chambers or passageways, and is formed with an aperture **41** having a lip **42** peripherally disposed around the aperture **41**.

The diaphragm or wall **40** serves to divide the interior of the housing **20** into an entry chamber **43** and a distribution chamber **44**. The inlet **24** is in communication with the entry chamber **43**.

A valve, designated generally **45** (the details of which will be explained later), is disposed to close the aperture **41** under certain conditions to control the flow of fuel from the main entry chamber into the distribution chamber. As will be more clearly apparent in Figures 5 and 9, the valve housing is also formed with a false bottom **46** which defines a passageway **47** in communication with the distribution chamber through a

threaded aperture **48** (see Figure 8). A valve seat **49** is threadedly disposed into the aperture **48** and is formed with an axial bore **50** and a plurality of apertures **51**. The bore **50** is adapted to receive a valve stem **52** adapted to carry a valve **53** which is responsive to thermal conditions and is adapted to control the flow of fuel into the passage **47**.

The passage **47** communicates with the outlet **25** to the main gas burner through the metering valve **27**. The metering valve **27** is a cylindrical member having an axial bore **55** in communication with a radial bore **56**. By rotation of the cylindrical member, gases flowing from the chamber **47** can be metered as desired.

The plug **29** may be removed and the metering valve **27** regulated by the insertion of a screw driver into a slot formed in the top of the metering valve.

A thermally responsive member is provided for actuating the valve **53**. It comprises a housing **60** (see Figure 5) having a rod **61** inserted longitudinally therethrough. It will be understood that the temperature coefficients of expansion of the rod **61** and the housing **60** differ so that when the housing **60** and a projection **60***a* (Figure 2) are inserted into the medium to be heated, the temperature of the medium will cause a differential in the linear expansion of the housing and the rod **61**.

The rod **61** is formed with a reduced end portion **63**, thereby defining a shoulder **64**. Linear movement of the rod **61** is translated to a snap-acting valve control by the following mechanism.

An annular collar **70** having a bore corresponding in size to the reduced end portion **63** is slidably disposed over the reduced end portion **63** and abuts against the shoulder **64** so that it moves in conjunction with the rod **61**. An adjustable piston **71** having an axial bore **72** is disposed over the reduced end section **63** and is formed with a peripheral shoulder **73**.

A clicker ring assembly is disposed between the annular collar **70** and the piston **71** and comprises (see Figure 11) a spider **74** and a conical-shaped clicker ring **75** having a radial arm **76** disposed between the members **70** and **71**. Movement of the collar **70** closer to the adjustable member **71** causes the conical-shaped member to distort because the inner periphery is restrained against movement by the piston **71** and the outer periphery is urged to the right in Figure 5 in response to movement of the collar **70**. When the clicker ring **75** has assumed a position substantially flat, it will, due to internal stresses, rapidly assume a conical-shaped form in the opposite direction, thereby causing rotation of the arm **76** (clockwise in Figure 5). The end of the arm **76** will contact the valve stem **52**, thereby raising the valve **53** from its valve seat **42***a* to permit the flow of gas to the main burner.

When the medium which is being heated and in which the thermal responsive member **60** has been inserted, increases to a predetermined temperature, the greater expansion of the reduced end section **60***a* will cause the rod **61** to become relatively shorter, thereby permitting the collar **70** to move to the left in Figure 5 and release the tension on the clicker assembly to permit the closing of the valve **53**.

Pilot burner

The face plate **21** is formed with an aperture **80** (Figure 5) into which a hollow cap **81** is threadedly disposed. The hollow cap **81** is

adapted to receive a filter 82 and is positioned in the distribution chamber 44. The cap 81 is also formed with an aperture 83 adapted to communicate with a bore 84 (Figure 8) which, in turn, is in communication with the pilot valve through a bore 85. The pilot burner metering valve 28 is interposed in the bore 85 and is formed with a transverse bore therethrough adapted to register with the bore 85 when in proper position. It will, therefore, readily be understood that the amount of fuel which can flow through the bore 85 depends upon the rotational position of the valve 28. The valve 28 is also formed with a taper and is held in a tapered seat by means of a compression spring 86. The valve can be adjusted by removing the cap 30 and rotating the valve 28 by means of a screw driver.

It will thus be seen that fuel entering the main entry port 24 passes through the chamber 43, aperture 41 and into the distribution chamber 44. Therefore, regardless of the condition of the thermally responsive valve 53, the pilot burner will remain ignited. However, the main burner will be ignited or extinguished depending upon the temperature of the medium being heated through the action of the bi-metal thermal control unit 60.

Safety control valve

Means is provided to insure the interruption of the flow of gas to both the pilot and main burners in the event that the pilot light becomes extinguished. The means comprises essentially an electromagnetic unit 90 (Figure 7) which is adapted to be energized by means of a thermocouple 90' positioned adjacent the pilot light. It will readily be understood that the pilot when burning raises the temperature of the hot junction of the thermocouple, thereby generating electricity which is sufficient to energize the coil 90 as desired.

The valve assembly 45 comprises a relatively resilient valve facing 91 and a valve body 92 having an annular recess 93. The valve is also provided with a valve stem 94 adapted to project inwardly into the magnetic unit 90. A compression spring 95 is interposed between the valve body 92 and the face of the magnetic unit 90. The magnetic unit 90 is so designed that when energized it will hold the valve assembly 45 in open position against the bias of the spring 95, that is, attracted to the magnet, but is not strong enough to initially draw the valve assembly from closed to open position so that once the magnet has become de-energized and the valve is released into closed position, the magnetic unit will not of itself draw the valve to open position when the thermocouple is again heating. The valve must be reset. Means for resetting will be described in detail later.

The valve 45 is interposed between the entry chamber 43 and the distribution chamber 44, and since both the pilot and the main burners receive their fuel supply from the distribution chamber 44, interruption of the flow of fuel from the chamber 43 to the chamber 44 will interrupt the supply of fuel to both the pilot and the main burners.

Safety valve reset means

In order to reset the safety valve, means must be provided for urging the valve into open or retracted position against the magnet 90 and for holding it there while the pilot burner is relighted for a sufficient time to heat the hot junction of a thermocouple 90' connected to the magnet by an electric cable 90'', thereby energizing the magnet 90 sufficiently to hold the valve 45 in open position. The means for accomplishing this result comprises essentially a bell crank, which is illustrated in perspective in Figure 10. It comprises a U-shaped member having a base 96 and a pair of side arms 97 and 98. The ends of the side arms 97 and 98 are turned in to form fingers 99 and 100. As will be seen in Figure 7, the fingers 99 and 100 are adapted to fit into an annular recess 93 of the valve body.

The side arms 97 and 98 are also formed with apertures through which a pivot 101 is disposed. The base 96 is formed with a slot 102 and a resilient arm 103 is extended therethrough and connected with the pivot 101. It will be understood, as will be seen in Figure 7, that the pivot 101 is adapted to act as a bearing shaft between aligned bearings in the valve body 20 and the face plate 21. A force applied in a counter-clockwise direction in Figure 7 against the arm 103 will cause a counter-clockwise rotation of the arms 97 and 98, thereby moving the valve assembly 45 to the left to open the passageway from the entry chamber into the distribution chamber.

The arm 97 is also formed with an arm 104 extending outwardly at right angles thereto. The purpose of this arm will become apparent later.

Referring to Figures 5 and 11, it will be noted that the face plate 21 is formed with an aperture 105 which is adapted to receive a sleeve 106 rotatably therein. The sleeve 106 is formed with a peripheral groove 107 adapted to receive a resilient ring which acts as a gasket to prevent the escape of gas from the inlet chamber 43. The sleeve 106 is formed with a cam 108 as an integral part thereof which, upon rotation, is adapted to contact the arm 103 and thereby urge the bell crank in a counter-clockwise direction to open the valve assembly 45 and urge it towards the magnet 90, there to be held until the thermocouple has been heated a sufficient length of time to re-energize the magnet and hold the valve open in opposition to the spring 95.

The sleeve 106 is also formed with a radial bore 113 adapted to receive a set screw 111. A driving wheel 112 is formed with a radial bore 110 adapted to receive the outer end of the set screw 111, so that rotation of the driving wheel 112 will cause rotation of the sleeve 106. The outer surface of the driving wheel, as will be seen more clearly in Figure 12, is formed with a plurality of grooves or splines. The control knob 35 is formed on its interior surface with complementary groves or splines and is adapted to be positioned over the driving wheel in such a manner that rotation of the control knob 35 will cause rotation of the driving wheel.

It will thus be seen that rotation of the control knob acting through the driving wheel 112 of the sleeve 106 and the cam 108 will cause a resetting of the safety control valve.

It will be noted from Figure 13 that the underside of the control knob 35 is formed with a pair of circumferential bosses 115 and that the cover plate 21 is formed with a pair of circumferential bosses 116, which are concentric with the aperture 105 and are complementary with the bosses 115. The bosses are so positioned that the control handle will move inwardly, that is, with the bosses 115 between the bosses 116 when the rotation of position of the knob is correct to reset the control or safety valve.

Safety valve torque release

As was previously mentioned, means is provided for applying a torque to the resetting mechanism while the safety control valve is being reset so that in the event that the operator lets go of the control knob **35**, it will automatically return to closed position. This effectively prevents anyone from leaving the safety valve open while the pilot burner is not ignited.

The means provided comprises a torque plate **120** (see Figures 5 and 11). The torque plate is formed with an axial bore **121** and an axial sleeve **122**. A torque spring **123** is disposed around the sleeve **122** and has one end secured to the torque plate through a hole **123***a*, and the other end secured to the face plate **21** by hooking the end through a slot **124** in an inwardly extending sleeve **125**.

The torque plate **120** is formed with an arcuate slot **126** into which is disposed a trigger **127** which is rotatably secured therein by means of a pin **128**.

The torque plate is also formed with a peripheral groove **130**.

The cam **108** is formed with an outwardly extending dog **131** having an enlarged section **132**. The end **131** is adapted to fit into the peripheral groove **130**, and, as will be seen in Figure 6, into a notch on the trigger **127**.

It will readily be apparent that so long as the trigger **127** is held in the position shown in solid lines in Figure 6 by reason of the restraining sleeve **125**, the dog **131** and hence the cam **108**, is effectively locked to the torque plate **120** so that rotation of the cam **108** will cause rotation of the torque plate **120**, thereby increasing the tension on the spring **123**.

Referring to Figure 6, it will be noted that when the torque assembly is rotated counter-clockwise to a position where the trigger **127** is in registry with the slot **124**, it is free to rotate outwardly, thereby releasing the dog **131** from engagement therewith and permitting further turning of the cam **108** and its associated mechanism free of the torque spring.

The trigger **127** and the slot **124** are so positioned that the trigger is not released through the slot until after the cam **108** has separated from the arm **103**, or at least has rotated far enough clockwise (Fig. 7) to allow the arm **103** to rotate to a position where the valve **45** is closed (unless held open by energization of the magnet **90**). Registering indexes on the knob **35** and cover plate **21** indicate when the rotative position of the knob is such that the arm **103** is at the peak of the cam **108**, which is the position of maximum opening for the valve **45**.

Temperature regulating means

In view of the fact that the thermal responsive unit **60** is securely fastened to the housing **20**, it is clear that the relative position of the collar **70** will be determined by the temperature of the medium in which the temperature control element is immersed. It is, therefore, clear that the temperature at which the clicker ring **75** will respond will depend on the position of the piston **71**.

The false bottom **46** is formed with an aperture **140** adapted to receive in a press-fit a sleeve **141** which is also formed with an internal bore **142** adapted to reciprocally receive the piston **71**. The piston **71** is formed with a longitudinal groove **143** adapted to receive a guide pin **144** to prevent turning. The piston **71** is also formed with an annular groove **145** on the upper face thereof to receive a compression spring **146** which abuts against the bottom of the groove **145** and a shoulder **147** formed in the sleeve **141** by a reduced bore **148**.

The bore **148** is internally threaded and adapted to receive a threaded shaft **149** having a non-circular end **150**.

The inner end of shaft **149** thus constitutes in effect an abutment against which the piston **71** is pressed, through the intermediacy of the collar **70**, spider **74**, and clicker ring **75**, by the contraction of the housing **60** relative to the rod **61**. For a given setting of the shaft **149**, the piston **71** is pressed steadily to the right as the temperature goes down, until the pressure of the collar **70** on the spider **74** is sufficient to snap the clicker ring **75** past center and thereby actuate the arm **76** to press the valve stem **52** and open the valve **53**.

It will be seen that the temperature at which this snap actuation of the clicker ring **75** occurs is dependent upon the axial position of the shaft **149**, which in turn is determined by the screwing in or out of the shaft in the sleeve **141**. The angular or rotative position of the shaft **149** is in turn controlled by the knob **35** as will be explained hereinafter.

The shaft **149** is co-axial with the driving wheel **112**. As will be seen more clearly from Figure 12, the driving wheel **112** is formed with a recessed shoulder **160** and a plurality of circumferentially spaced, axially aligned holes **161** adapted to receive a pin **162**. A driving plate **165** having a non-circular aperture **166** in the center thereof is disposed within the recessed shoulder **160** and adapted to fit over the non-circular end **150** of the shaft **149** in non-rotational engagement. The pin **162** after being inserted in the apertures or holes **161** projects through a radial aperture **167** of the wheel **165**, thereby securely locking the shaft **149** in non-rotational relation with the driving wheel **112**.

In view of the fact that, from a practical commercial standpoint, it is extremely difficult to determine the beginning position of the threads on the shaft **149** with respect to the non-circular end **150**, some means must be provided for locking the shaft **149** to the driving wheel and, hence, the control knob **35**, in the proper position to give the proper temperature response.

This has been accomplished in the following manner: The number and spacing of the holes **161** do not correspond with the number and spacing of the apertures **167**. As an example, we have provided nine holes **161** spaced at 40 degrees around the circumference and have provided ten of the apertures **167** spaced at 36 degrees. It is, therefore, readily apparent that, after assembling, the position of the shaft **149** can be properly adjusted with reasonable certainty that one of the apertures **167** and one of the holes **161** will be in registry. This, in effect, is a vernier adjustment.

After securing the plate **165** in the recessed shoulder **160** and inserting the pin **162** through the aperture and corresponding hole in registry, a spring binding plate **170** formed with holes **171** and a central aperture **172** is disposed over the ends of the shaft with one of the holes **171** fitting over a reduced end **173** of the pin **162** to hold the assembly in place. The plate **170** is slightly larger than the inside diameter of the recessed shoulder **160** and, therefore, remains in tension and holds the assembly together.

Operation

In describing the operation, it will be assumed that the safety valve **45** has been closed because the pilot burner is not lighted and, hence, does not energize the magnet **90**. The control knob **35** should be turned counter-clockwise to its extreme limit, that is, where a boss **180** formed in the base of the driving wheel **112** contacts a corresponding boss **181** formed on the face plate **21** (see Figure 13). The cam **108** will then assume the position shown in Figure 7.

In order to relight the pilot, the control knob **35** is rotated clockwise until the cam **108** contacts the resilient arm **103**, thereby rotating the bell crank counter-clockwise and moving the valve **45** to open position or retracted so far as the magnet **90** is concerned. When the control knob **35** has been rotated to the correct position for maximum opening of the valve **45**, which occurs when the end of arm **103** is at the peak of cam **108**, the circumferential ridges **115** will be completely out of registry with the circumferential ridges **116** of the face plate. The inward or axial pressure which the operator instinctively exerts against the knob **35** will then cause the knob to move inwardly. This thus indicates to the operator that the knob is in the optimum position to permit lighting of the pilot. This position is indicated in Fig. 1 by the notation on the dial **35** "Press-hold-light pilot." The pushing in of the knob **35**, however, is nothing more than an indication to the operator and does not serve to lock the knob in position, because the ends of both the circumferential ridges **115** and **116** are slanted or beveled as best seen in Fig. 13. Should the operator release the knob from this position it immediately snaps counterclockwise, because of the urging of the spring **123**. Should the operator, instead, turn the knob further clockwise until the trigger **127** has been forced into the slot **124**, so that the knob **35** does not snap back, he will find that the safety valve **45** has returned to closed position, unless in the meantime the pilot burner has been ignited and has energized the thermocouple to in turn energize the magnet **90** and hold the valve **45** open. Thus, there is complete assurance that the safety valve cannot remain unattended in open position except when the pilot light is ignited. The knob must be so held manually while the pilot light is reignited and held in that position until the pilot has heated the thermocouple sufficiently to energize the magnet **90**. If the control knob **35** is released from this position, the torque spring **123** will cause a counter-clockwise rotation of the knob and the cam **108**, thereby closing the valve **45**.

After the pilot has been ignited sufficiently long to energize the magnet **90**, the control knob **35** can be turned clockwise until the trigger mechanism **127** has assumed a position shown in phantom in Figure 6, at which time the dog **131** is released from the trigger **127**, thereby releasing the torque spring from its operative connection with the control knob **35**.

Further rotation of the control knob **35** causes rotation of the shaft **149** and, hence, linear movement of the piston **71** for setting the temperature response of the snap-acting mechanism and the valve **53**.

In the event that it is desired to turn off both the main burner and the pilot burner, the control knob **35** should be rotated counter-clockwise until the dog **131** contacts the trigger **127**, thereby rotating the trigger counter-clockwise, as shown in Figure 6, and retracting the end thereof from the slot **124** to again cause the torque spring to become effective on the cam mechanism. Further rotation of the control knob **35**, either due to the torque spring or manually in a counter-clockwise direction, will cause the base of the dog **131** to contact the arm **104** to cause a clockwise rotation of the bell crank mechanism and a closing of the valve **45**.

It will be understood that the thread pitch and the initial adjustment of the shaft **149** are such that when the knob **35** has been rotated back to the position where the cam **108** holds the safety valve **45** open, the temperature response of the clicker assembly will be at such a low value that it will be in "off" position for all normal or expected conditions. It is, therefore, impossible for any fuel to flow to the main gas burner while the safety valve is being reset and the pilot burner ignited.

While we have herein shown and described our invention in what we have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of our invention, which is not to be limited to the details disclosed herein, but is to be accorded the full scope of the claims so as to embrace any and all equivalent devices.

Having described our invention, what we claim as new and desire to secure by Letters Patent is:

1. In a valve of the type described having a safety shut-off valve adapted to interrupt the flow of fuel to a main burner and a pilot burner upon extinguishment of said pilot burner, a thermally responsive valve adapted to control the flow of fuel to said main fuel burner to maintain preselected temperatures and rotatable reset means adapted to select said temperatures and to reset said safety shut-off valve when turned to a maximum reset position, the element of novelty comprising a torque plate rotatably associated with said reset means, a torque spring adapted to exert a torque on said torque plate, a rotatable trigger associated with said torque plate, a pin associated with said reset means and adapted to be held by said rotatable trigger during a portion of the rotation of said torque plate and said reset means, and means to release said pin to free said reset means from said torque after passing the maximum reset position.

2. A fuel valve device having an inlet chamber and a distribution chamber, a passageway communicating between said chambers and discharge ports adapted to supply fuel from said distribution chamber to a main burner and a pilot burner, a safety shut-off valve adapted to control the flow of fuel from said inlet chamber to said distribution chamber, electromagnetic means responsive to the heat of the pilot burner adapted to hold said safety shut-off valve in open position while said pilot burner is ignited and to release said safety shut-off valve for movement to closed position upon extinguishment of said pilot burner, a thermostat valve adapted to control the supply of fuel to said main burner discharge port, thermostat means adapted to control said thermostat valve to maintain preselected temperatures, rotatable means for adjusting said thermostat means, reset means associated with said adjusting means adapted to move said safety shut-off valve to open position after said adjusting means has been turned to a low temperature position, torque means releasably associated with said reset means adapted to urge said reset means to a position for closing said safety valve and releasable upon rotation of said reset means past the resetting position.

3. A fuel valve having an inlet port and distribution ports, a passageway communicating between said inlet port and said discharge ports adapted to supply fuel to a main burner and a pilot burner, a safety shut-off valve adapted to interrupt the flow of fuel from said inlet port to said distribution ports, a thermocouple having a hot junction adjacent the pilot burner, an electromagnet energized by said thermocouple and adapted to hold said safety shut-off valve in open position while said pilot burner is ignited and to release said safety shut-off valve to closed position upon extinguishment of said pilot burner, a thermostat valve adapted to control the supply of fuel to said main burner passage, adjustable thermostat means adapted to control said thermostat valve to maintain preselected temperatures, rotatable means for adjusting said thermostat means, reset means associated with said adjusting means adapted to move said safety shut-off valve to open position after said adjusting means has been turned from a minimum temperature position, said reset means comprising a bell crank arm adapted to move said valve to open position and a cam associated with said rotatable means for actuation of said bell crank, torque means releasably associated with said reset means adapted to urge said reset means to a position for closing said safety valve and releasable upon rotation of said reset means past the maximum resetting point, and means associated with said cam to release said safety valve to closed position upon movement of said rotatable adjusting means to a minimum temperature position.

4. A fuel valve having an inlet port and distribution ports adapted to supply fuel to a main burner and a pilot burner, a passageway communicating between said ports, a safety shut-off valve adapted to control the flow of fuel from said inlet port to said distribution ports, electromagnetic means responsive to the heat of the pilot burner to hold said safety shut-off valve in open position while said pilot burner is ignited and to release said safety shut-off valve for movement to closed position upon extinguishment of said pilot burner, a thermostat valve adapted to control the supply of fuel to said main burner, thermostat means adapted to control said thermostat valve to maintain preselected temperatures, rotatable means for adjusting said thermostat means, reset means associated with said rotatable means adapted to move said safety shut-off valve to open position after said adjusting means has been turned from a minimum temperature position, said means comprising a bell crank arm adapted to move said safety valve and a cam associated with said rotatable means for actuation of said bell crank arm, torque means releasably associated with said cam adapted to urge said reset means to a position for closing said safety valve and releasable upon rotation of said reset means past the maximum resetting point.

5. In combination, a main burner, a fuel supply line leading to said burner, a pilot burner in juxtaposition to said main burner, a thermostatic valve for regulating the supply of fuel to said main burner, thermostat means for adjusting said valve to maintain preselected temperatures, a safety shut-off valve for shutting off the supply of fuel to both the main burner and the pilot burner, electromagnetic means responsive to the heat of the pilot burner for maintaining said safety shut-off valve in open position while said pilot burner is lighted and adapted to release said safety shut-off valve for movement to closed position on extinguishment of the pilot burner, a rotatable dial for adjusting said regulating valve to select different temperatures to be maintained by said thermostat means, means associated with said rotatable dial adapted to open said safety shut-off valve for reignition of said pilot burner while said thermostat means is set at a minimum temperature value and torque means associated with said reset means to urge said rotatable dial and said reset means to a position for closing both said thermostat valve and said safety shut-off valve and releasable therefrom upon rotation of said rotatable dial past the said reset position.

6. In combination, a main burner, a fuel supply line leading to said burner, a pilot burner in juxtaposition to said main burner, a thermostatic valve for regulating the supply of fuel to said main burner, thermostat means for adjusting said valve to maintain preselected temperatures, said means comprising a bi-metal element having relative linear displacement responsive to temperature changes, a snap ring responsive to said linear movement, a piston adapted for linear movement to determine the temperature response of said snap ring, a rotatable shaft adapted to position said piston and a control knob adapted to rotate said shaft, a safety shut-off valve for shutting off the supply of fuel to both the main burner and the pilot burner, a thermocouple having a hot junction adjacent the pilot flame and adapted to be heated thereby, electromagnetic means responsive to said thermocouple for maintaining said safety shut-off valve in open position while said pilot burner is lighted and adapted to release said safety shut-off valve for movement to closed position on extinguishment of the pilot burner, means associated with said rotatable dial adapted to open said safety shut-off valve for reignition of said pilot burner upon adjustment of said thermostat means from its minimum temperature position and torque means associated with said reset means to urge said rotatable dial and said reset means to a position for closing both said thermostat valve and said safety shut-off valve, and means for releasing said torque means upon rotation of said rotatable dial past the said reset position.

7. A gas valve comprising a housing having an inlet for the supply of fuel thereto, an outlet to a main gas burner and an outlet to a pilot burner, a safety control valve adapted to interrupt the flow of fuel to both the main burner and the pilot burner, means responsive to said pilot burner adapted to maintain said shut-off valve in open position while said pilot burner is ignited and to release said safety shut-off valve for movement to closed position when said pilot burner becomes extinguished, a thermostatic valve adapted to interrupt the flow of fuel to the main gas burner only, thermostatic means responsive to a predetermined temperature to control said thermostatic valve, rotatable means for adjusting said thermostatic means, means associated with said rotatable means for resetting said safety control valve and adapted to reset said safety control valve when said thermostat means has been adjusted to a minimum temperature position, means adapted to bias said adjusting means to a minimum position during said resetting operation and releasable therefrom after said resetting means has been ro-

tated past said setting position, said last-named means comprising a sleeve associated with said housing formed with a longitudinal slot and concentric with said adjusting means, a torque plate rotatably disposed in said sleeve, a torque spring associated between said torque plate and said sleeve, a trigger rotatably disposed in said torque plate, a pin associated with said resetting mechanism, said trigger being restrained against rotation by said sleeve until said trigger is rotated to the position of said slot, said trigger being adapted to secure said pin against movement with respect to said torque plate until said trigger is free to rotate in said slot.

8. A gas valve comprising a housing having an inlet for the supply of fuel thereto, an outlet to a main gas burner and an outlet to a pilot burner, a safety control valve adapted to interrupt the flow of fuel to both the main burner and the pilot burner, a thermocouple having a hot junction adjacent the pilot burner, an electromagnet responsive to electricity generated by said thermocouple adapted to maintain said shut-off valve in open position while said pilot burner is ignited and to release said safety shut-off valve in closed position when said pilot burner becomes extinguished, a thermostatic valve adapted to interrupt the flow of fuel to the main gas burner only, adjustable thermostat means responsive to a predetermined temperature to control said thermostatic valve, rotatable means for adjusting said thermostat means, means associated with said rotatable means for rotation therewith for resetting said safety control valve and adapted to reset said safety control valve while said thermostat means is being turned up from a minimum temperature position, means adapted to bias said adjusting means to said minimum position from a resetting position during said resetting operation and releasable therefrom after said resetting means has been rotated past said resetting position, said last-named means comprising a sleeve associated with said housing formed with a longitudinal slot and concentric with said adjusting means, a torque plate rotatably disposed in said sleeve, a torque spring associated between said torque plate and said sleeve, a trigger rotatably disposed in said torque plate, a pin associated with said resetting mechanism, said trigger being restrained against rotation by said sleeve until said trigger is rotated to the position of said slot, said trigger being adapted to secure said pin against movement with respect to said torque plate until said trigger is free to rotate in said slot.

9. In a fuel valve adapted to control the supply of fuel to a main gas burner having a thermally responsive valve adapted to control the supply of said fuel and thermostatic means adapted to actuate said valve, rotatable means for selecting the temperature response of said thermostat means, said rotatable means comprising a threaded shaft adapted to select responsive temperatures upon rotation thereof and having a non-circular end, a rotatable control member, said member being formed with an axial bore through which the non-circular end of said shaft extends, an annular shoulder adjacent said bore and formed with a plurality of circumferentially spaced apertures, a coupling plate formed with a non-circular aperture concentric therein and conforming to the non-circular end of said shaft and adapted to fit thereover in non-rotational engagement, said coupling plate being formed with a plurality of circumferentially spaced notches having a different spacing therebetween than the apertures of said annular shoulder, and a pin adapted to fit into said apertures through said notches thereby coupling said rotatable member and said coupling plate against relative rotation.

10. In a fuel valve adapted to control the supply of fuel to a main gas burner having a thermally responsive valve adapted to control the supply of said fuel and thermostatic means adapted to actuate said valve, rotatable means for selecting the temperature response of said thermostat means, said rotatable means comprising a shaft having a non-circular end, a rotatable control member, said member being formed with an axial bore through which the non-circular end of said shaft extends, said control member being formed with a plurality of apertures circumferentially spaced concentric with said shaft, a coupling plate formed with a non-circular centrally disposed aperture therein conforming to the non-circular end of said shaft and adapted to fit thereover in non-rotational engagement, said coupling plate being formed with a plurality of circumferentially spaced notches having a different spacing therebetween than the apertures of said annular shoulder, and a pin adapted to fit into said apertures through said notches thereby coupling said rotatable control member and said coupling plate against relative rotation.

11. A fuel valve having an inlet and having an outlet in communication with a main gas burner and a pilot burner, a safety control valve adapted to interrupt the flow of fuel to said main and said pilot burners upon extinguishment of the pilot burner, a thermally responsive valve adapted to control the flow of fuel to said main burner, variable thermostat means adapted to actuate said thermally responsive valve, and means for varying the response of said thermostatic means, said last-mentioned means including a member having an internally threaded bore adapted to receive a rotatable threaded shaft, said shaft having a non-circular end, a rotatable control member coupled with said non-circular end adapted to cause simultaneous rotation, and a vernier coupling plate coupling said rotatable shaft and said rotatable member.

12. A gas control valve having a passageway therethrough adapted to supply fuel to a main gas burner and a pilot burner, a safety valve adapted to control the flow of fuel to both the main burner and the pilot burner, electromagnetic means responsive to heat generated by said pilot burner adapted to hold said safety valve in open position while said pilot burner is ignited and to release said valve for movement to closed position upon extinguishment of said pilot burner, a thermally responsive valve adapted to control the flow of fuel to said main burner, thermostat means adapted to actuate said thermally responsive valve to maintain preselected temperatures, adjusting means adapted to preselect said temperatures and to cause closing of said safety shut-off valve upon rotation to a minimum position and to cause resetting of said safety shut-off valve upon rotation toward operating position, means for applying a torque bias to said adjusting means between said minimum position and said resetting position and being releasable therefrom in operating position, said adjusting means comprising a piston forming an abutment for said thermostat means, an axially adjustable, threaded shaft having one end in engagement with said piston adapted to

cause linear positioning of said piston upon rotation of said shaft, a rotatable member disposed on the outer surface of said valve and coupled to said shaft by a vernier coupling plate, said torque means comprising a rotatable plate, a torque spring associated between said plate and the valve body, a pin secured to the resetting means, a trigger adapted to secure said pin against relative movement between said pin and said plate until said plate has been rotated past the resetting position.

13. A gas control valve having a passageway therethrough adapted to supply fuel to a main gas burner and a pilot burner, a safety valve adapted to control the flow of fuel to both the main burner and the pilot burner, electromagnetic means responsive to heat generated by said pilot burner adapted to hold said safety valve in open position while said pilot burner is ignited and to release said valve for movement to closed position upon extinguishment of said pilot burner, a thermally responsive valve adapted to control the flow of fuel to said main burner, thermostat means adapted to actuate said thermally responsive valve to maintain preselected temperatures, adjusting means adapted to preselect said temperatures and to cause closing of said safety shut-off valve upon rotation to a minimum position and to cause resetting of said safety shut-off valve upon rotation toward operating position, means for applying a torque bias to said adjusting means between said minimum position and said resetting position and

being releasable therefrom in operating position, said adjusting means comprising a piston forming an abutment for said thermostat means, an axially adjustable, threaded shaft having one end in engagement with said piston adapted to cause linear positioning of said piston upon rotation of said shaft and another end non-circular in form, a rotatable member disposed on the outer surface of said valve, coupling means adapted to cause simultaneous rotation of said shaft and said rotatable member, said coupling means comprising a disk having a concentric non-circular aperture corresponding to the non-circular end of said shaft and disposed thereover, said rotatable member and said coupling disk being formed with a plurality of apertures having different respective spacings, and a pin adapted to fit in interlocking engagement through any of said apertures in registry.

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