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TEMPERATURE CONTROL SYSTEM

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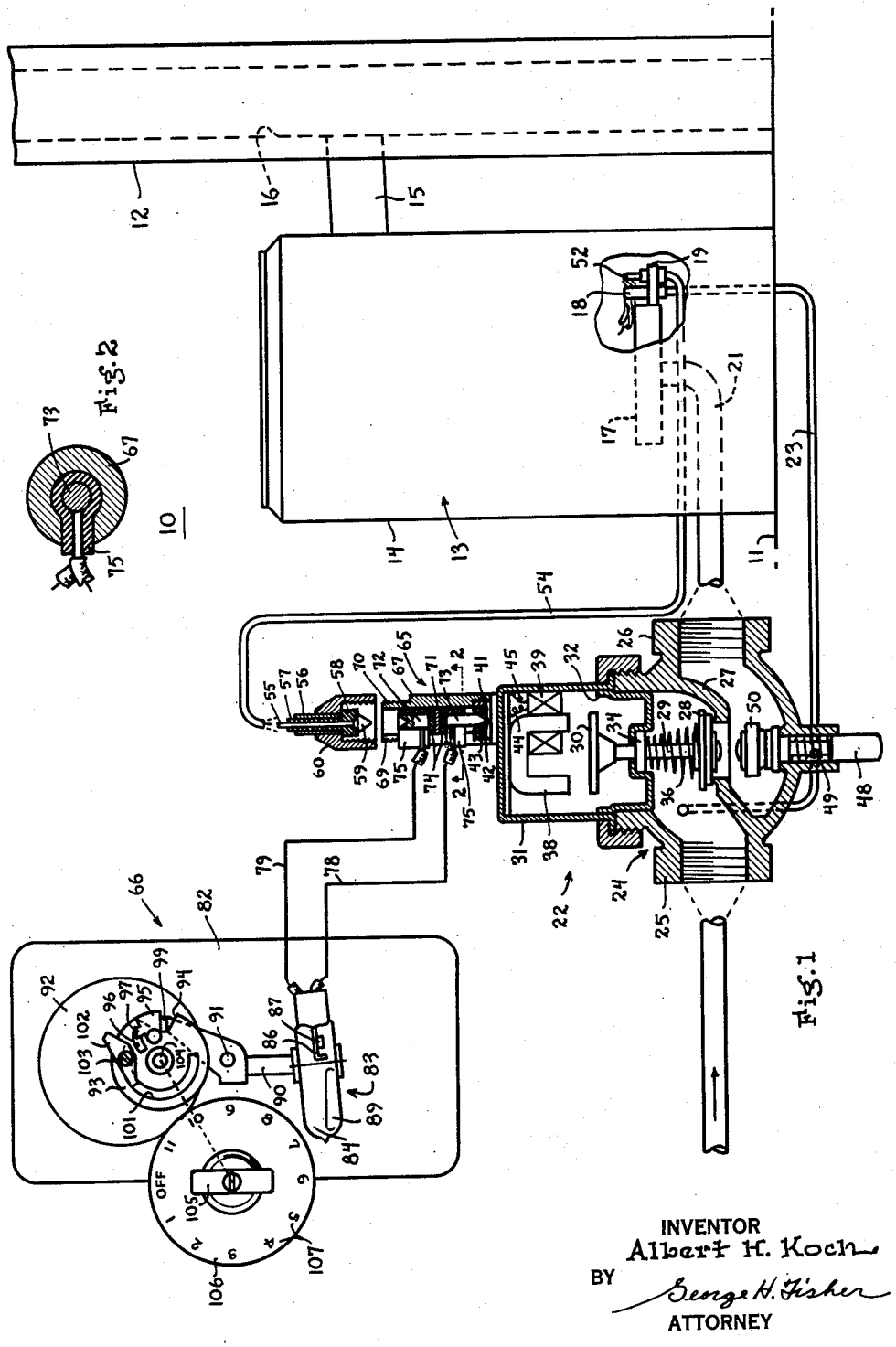


Fig. 1

Fig. 2

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TEMPERATURE CONTROL SYSTEM

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5 Claims. (Cl. 161—9)

The present invention relates to a temperature control system and more particularly to one which is independent of any external source of power.

While electrically operated temperature control systems have a number of distinct advantages for certain types of applications, these systems involve the disadvantage that it is necessary to employ an external source of power. While it is possible to use a battery of some sort as the source of power, this has the disadvantage that the battery must frequently be replaced. Accordingly, it is almost universal practice to employ power from a commercial source. This is usually at a relatively high voltage and it is necessary to use relatively expensive wiring. The installation of this wiring, because of the hazard involved, requires the use of relatively skilled labor and is subject to numerous regulations and restrictions. The present invention is particularly concerned with a temperature control system of the electrically operated type employing a fluid fuel burner in the heating plant, wherein the power is supplied by a thermocouple and hence is of such low voltage that the wiring is free of all hazard. This thermocouple is exposed to the heat of the pilot burner and not only serves to generate power for the control system but also serves to prevent the flow of fuel to the main burner unless the pilot burner is ignited.

An object of the present invention is to provide a system of the type described wherein the flow of fuel to the main burner is regulated by means of a time switch between the thermocouple means constituting the source of power and an electromagnet which in turn cooperates with a burner control device, the time switch being effective to terminate the energization of the electromagnet at the end of a predetermined period of time.

A further object of the invention is to provide such an arrangement in which the time switch is connected in series with the conductors leading from the thermocouple to the electromagnet.

A further object of the invention is to provide such an arrangement in which the control device is a main valve connected to the armature and positioned thereby.

A further object of the present invention is to provide such an invention in which the switch is operated between two positions by the timing mechanism and is moved by a manually operable means to a position in which the timing mechanism is effective.

Other objects of the invention will be apparent from the accompanying specification, claims and drawing of which:

Figure 1 is a schematic view of the improved temperature control system, and

Figure 2 is a sectional view taken along the line 2—2 of Figure 1 and showing one of the details of the system.

Referring to the drawing, the apparatus is shown located in a space 10 bounded on two sides by a floor 11 and a wall 12. The heating apparatus is shown in the form of a unit heater 13 located in the space 10. The details of this unit heater are not essential to the invention and for purposes of clarity are not shown in the drawing. It should be understood that the unit heater comprises a burner chamber over the outside of which air is free to pass. The burner chamber is in turn surrounded by an outer jacket 14. The burner chamber is connected by a stack pipe 15 which leads to a flue 16 indicated in dotted lines in the drawing. Located within the burner casing is a main burner 17 with a pilot burner 18. The pilot burner 18 is supported by a bracket 19 secured to the main burner 17 in any desired manner. Gas is supplied to the main burner 17 by a pipe 21 leading from a suitable source of supply. A valve 22 controls the flow of gas to pipe 21. The pilot burner 18 is supplied with gas by a pipe 23 connected to the inlet side of valve 22.

The valve 22 is of the electromagnetic type and is designed to permit the flow of fuel to the main burner only when the electromagnet is energized. As will be pointed out later, the energization of the electromagnet is controlled both by the thermocouple which constitutes the source of power and by a time switch.

Referring to the details of valve 22, this valve comprises a conventional valve body 24 having an inlet 25 and an outlet 26. Extending across the interior of the valve body 24 is the usual partition wall 27 which is apertured to provide a valve seat on which seats a valve disc 28. The valve disc 28 is provided with a stem 29 which is connected to an armature 30. The armature 30 is mounted within a cup-shaped housing 31 which is closed by a cup-shaped plate 32 through which the valve stem 29 extends. The closure member 32 is permanently secured to the housing 31 by brazing or some other similar process. The closure member 32 is deformed adjacent its midpoint to provide a pocket in which is placed a seating washer 34 through which the stem 29 slidably extends. The washer 34 may be of a composite form to act more efficiently as a seal-

ing means to prevent the passage of gas between the interior of the valve body 24 and the electromagnet housing 31. Interposed between the washer 34 and the valve disc 28 is a spring 36 which serves to bias the valve to closed position and urge the washer into better sealing engagement with the valve stem 29.

Located within the housing 31 is an electromagnet comprising a core member 38. This core is in the form of a horseshoe and on one leg of the horseshoe is located an electromagnet winding 39. One terminal 45 of this winding is connected to the casing 31 which acts to form a grounded connection. Projecting from the upper surface of the housing member 31 and conductively secured thereto is a hollow nipple 41 of conductive material. An insulating sleeve 42 is disposed within the hollow portion of the nipple. Within the insulating sleeve 42 there is a conductive member 43 provided with a conical recess at its upper end. This conductive member 43 is electrically connected to the other terminal 44 of the winding 39. The nipple 41 is provided for the purpose of facilitating the connection of leads from the thermocouple to the electromagnet, as will be explained later.

It is to be understood that the electromagnet when energized is able to retain armature 30 in attracted position against the biasing action of spring 36. The electromagnet is energized by a thermocouple, however, and is hence never sufficiently energized to be capable of moving the armature 30 to its attracted position. As a result, it is necessary to provide means for resetting the armature into engagement with the electromagnet. This means is provided in the lower portion of the valve housing and comprises the plunger 48. Associated with this plunger is a spring 49 which serves to bias the plunger downwardly. At the upper end of the plunger 48 is a valve disc 50 which is of the same diameter as the opening through the partition wall 27. The upper end of valve disc 50 is designed to engage the lower end of valve disc 28 when plunger 48 is pushed up against the action of spring 49. It will be readily apparent that if plunger 48 is pushed up far enough, the valve 28 and armature 30 are moved to a position wherein armature 30 engages core 38. If it were not for valve disc 50, the upward movement of plunger 48 and consequently the movement of valve disc 28 to valve open position would permit a flow of gas to the main burner even though the conditions were not safe for the admission of gas to the main burner. The valve disc 50 however shuts off the flow of gas during the resetting operation. It will be apparent that when plunger 48 is pushed upwardly, the valve disc 50 enters the opening through partition wall 27 and closes off the flow of gas through this opening before the valve disc 28 moves away from the seat and would otherwise permit such flow.

Secured to the bracket 19 and located adjacent the pilot burner 18 is a thermocouple designated by the reference numeral 52. It will be understood that while a single thermocouple is shown, this may be replaced by a thermopile where more power is desired than is available from a single thermocouple. While the details of thermocouple 52 are not shown, it should be understood that the thermocouple may take any desired form, such as that shown in Figure 1 of the patent to C. G. Kronmiller No. 2,165,801 issued July 11, 1939. The construction shown in this patent is one wherein two concentric thermoelectric elements are employed, these elements being connected respectively to an inner and outer of two concentric conductors constituting a low voltage lead between the thermocouple and the electromagnetic device energized thereby. Referring to the structure shown in the drawing, the conductor member connecting thermocouple 52 with the electromagnet coil 39 is designed by the reference numeral 54. The details of this conductor are shown adjacent the point at which it is connected to the nipple 41. It will be noted that conductor 54 comprises an inner conductor 55 and an outer tubular conductor 56 separated by an insulating sleeve 57. The insulating sleeve 57 terminates in an insulating collar 58 through which the inner conductor 55 extends. The end of the inner conductor 55 is connected to a conical head 59. An internally threaded coupling sleeve 60, of copper or similarly good conductive material, surrounds the end of the outer conductor 56 and engages the insulating collar 58. It will be understood that the conductive collar 60 is rotatable with respect to the outer conductor 56 but remains in good conductive engagement therewith.

It will be apparent that the coupling sleeve 60 could be secured directly to nipple 41. If this were done, the valve 28 would be controlled solely in accordance with the energization of thermocouple 52 and would in no way function to affect the temperature of the space other than as would incidentally result from shutting down the valve if the pilot burner became extinguished. The present invention contemplates the provision of adapter and the inter-position of a time switch which enables the burner to be operated for predetermined periods of time. The adapter is generally indicated by reference character 65 and the time switch by the reference character 66.

The adapter 65 comprises a sleeve 67 of conductive material which is provided with a slot 69 running the full length thereof. At the upper end, the sleeve 67 is reduced and externally threaded as at 70 to be connected with the internally threaded coupling sleeve 60. At its lower end, the sleeve 67 is internally threaded to engage with the external threads of the nipple 41. Extending across the interior of the conductive sleeve 67 is a septum 71. A pin 72 is located above the septum 71 and a pin 73 below the septum. The upper pin 72 has a conical recess at its upper end to engage the conical head 59 secured to conductor 55. The lower pin is provided with a conical head at its lower end to engage the conical end of the inner conductive member 42. Insulating washers 74 are interposed between the ends of the conductive pins 72 and 73 and the septum 71. A sheet 75 of insulating material is wrapped around each of the pins 72 and 73, as best shown in Figure 2. These sheets of insulating material fill up the space between conductive pins 72 and 73 and sleeve 67 so as to firmly anchor the pins in position. Each of these sheets 75 of insulating material extends entirely through the slot 69 so as to provide an insulated passageway for the conductors 78 and 79 secured to pins 73 and 72, respectively.

As previously described, the lead 45 is connected to the casing 31 which in turn is connected to the outer member of nipple 41. The lead 44 extends through an opening in casing 31 and is connected to the inner pin 42. It will be readily apparent that the coupling sleeve 60, the outer sleeve 67 of the adapter and the nipple 41 together with casing 31 constitute a connection between the outer

conductor 56 of the lead 54 and the terminal 45 of the winding. It will be further apparent that the connection between conductor 44 and the inner conductor 57 includes the two pins 72 and 73 and that upon these two pins being conductively connected, the inner conductor 57 is electrically connected with the conductor 44 leading to coil 39. Since conductors 78 and 79 are connected to the pins 72 and 73, the connection of conductors 78 and 79 will serve to electrically connect pins 72 and 73 together. The connection between conductors 78 and 79 is controlled by the time switch 66 which will now be described.

The time switch 66 comprises a base portion 78 on which is secured the various portions of the timing mechanism. The switch proper is designated by the reference numeral 83 and is shown in the form of mercury switch having a glass envelope 84, electrodes 86 and 87, and a mercury globule 89. When this switch is tilted so that the right-hand end thereof is lowermost, the mercury globule 89 moves into bridging engagement with contacts 86 and 87 so as to close the circuit controlled by switch 84. It is to be understood that the conductors 78 and 79 are connected to the two-switch contacts 86 and 87 so that when the contacts 86 and 87 are electrically connected, the conductors 78 and 79 are likewise connected. The mercury switch 83 is secured to the lowermost end of a lever 90 which is pivotally secured to the base 82 at 91.

Also secured to base 82 is a spring wound clockwork mechanism 92. This clockwork mechanism when in operation drives, in a counter-clockwise direction, a cam disc 93. The disc 93 is provided with a notched portion 94 and a member 95 pivotally secured to the disc and having an outer arcuate surface which when the element 95 is in the position shown forms a continuation of the outer arcuate cam surface of disc 93. The disc 93 has a slot 96 in which projects a tongue of the pivoted member 97. This tongue serves to guide the movement of pivoted member 95. The lever 90 has an arm extending upwardly and which terminates in a tongue 99 extending forwardly into the notch 34. The lever 90 is biased by any suitable means, not shown, into the position illustrated in the drawing in which the tongue 99 extends into the notch 94. It will be obvious that if the disc 93 is rotated in a clockwise direction, the tongue 99 will bear against the pivoted member 95 and rock this member in a clockwise direction. Such clockwise movement permits the lever 90 to swing outwardly, permitting the tongue 99 to ride up on the arcuate portion of disc 93. As soon as the tongue 99 has ridden past the pivoted member 95, this member drops back into the position shown in the drawing. It is to be understood that a spring or other suitable biasing means may be provided to urge member 95 to the position relative to the disc in which it is shown. The disc 93 is supplied with a further slot 101, the purpose of this slot being to provide for adjustably mounting a stop member 102. This stop member is secured to disc 93 by means of a bolt 103 which extends through the slot 101. By loosening the bolt, it will be obvious that the stop member 102 can be moved to any desired position. The purpose of stop member 102 is to limit the rotation of disc 93 in a clockwise direction.

Secured to and projecting from the disc 93 is a winding stem 104. Secured to the outer end of winding stem 104 is a winding knob 105 which is associated with a dial 106. The dial 106 is provided with indicia 107 to indicate the number of hours operation which is desired. The dial normally assumes a position in which the word "off" appears uppermost. It will be obvious that upon the knob 105 being rotated in a clockwise direction, the cam disc 93 is similarly rotated causing the upper arm of lever 90 to ride upwardly out of the notch 94 onto the outer arcuate surface of cam 93. The amount of such clockwise rotation is limited by the stop member 102 previously described. The mechanism is so designed that upon disc 93 being rotated in a clockwise direction, the clock mechanism 92 is wound sufficiently to insure returning the cam 93 in a counter-clockwise direction back to the position in which tongue 99 drops down into notch 94. The numeral which is uppermost after the dial has been rotated indicates the number of hours required for such return movement. Upon such return movement, the pivoted member 95 will be in a position where it constitutes a continuation of the cam surface 93 so that the tongue 99 will not drop down into the notch 94 until it has reached the lower end of the outer surface of pivoted member 95.

For a more thorough understanding of the mechanism by which the lever 90 is actuated, reference is made to the patent of C. G. Kronmiller No. 2,172,820 issued September 12, 1939. The mechanism employed for actuating lever 90 in the present device is of the same form as the mechanism for actuating the lever 150 of the Kronmiller device.

Operation

The various elements of the system are shown in the drawing in the positions they occupy when the gas burner is out of operation and the pilot burner is ignited. Let it be assumed now that the user desires to have operation of the burner for two hours. The user turns the knob 105 in a clockwise direction until the Figure 2 is uppermost. This action rotates the cam disc 93 in a clockwise direction rocking the lever 90 to a position in which switch 83 is closed. This completes the circuit between conductors 78 and 79 and hence between conductive pins 72 and 73. With the pins 72 and 73 electrically connected, the thermocouple 52 is electrically connected to the magnet 39. It is assumed now that the pilot burner is properly ignited so that the thermocouple is generating power. Under these conditions, the electromagnet comprising winding 39 and core 38 is capable of holding the valve in its arcuate position but is incapable of moving it to this position. In order to move the valve to open position, the operator pushes button 48 upwardly causing valve 50 to enter the valve opening first and then engage the valve disc 28. Upon further upward movement of the reset button 48, the valve disc 28 and armature 30 are moved upwardly until the armature 30 engages the core 38. When this happens, the armature 30 is held in engagement with the core 38, providing that the pilot burner is ignited as previously mentioned. As long as push button 48 is held in its uppermost postion, no gas can flow to the main burner 17 because the valve seat 50 closes off the flow of gas to the valve opening even through valve disc 28 is held in open position. Thus, in case the pilot burner is not properly ignited when the push button 48 is moved upwardly, a flow of gas to the main burner is not permitted. Under these conditions the release of push button 48 merely causes the valve disc 28 to return into seating engagement with the valve seat just be-

fore the valve disc 50 moves out of the opening in the partition 27. If the armature 30 is properly held in engagement with the electromagnet due to the pilot burner being ignited, the release of push button 48 permits valve disc 50 to move out of the opening while valve disc 28 is held away from the valve seat. The result is that it is now possible for gas to flow through the valve opening to the main burner 17.

As soon as the knob 105 has been rotated in a clockwise direction as previously described, the clockwork mechanism 92 is placed into operation to rotate the cam disc 93 in a counter-clockwise direction. At the end of the predetermined period of time determined by the setting of disc 106, the tongue 99 of lever 90 drops down into the notch 94 thereby opening switch 83 and thus breaking the circuit between thermocouple 52 and electromagnet winding 39. As soon as this happens, the winding 39 becomes deenergized thereby deenergizing the electromagnet. This results in valve disc 28 being moved to closed position interrupting the flow of gas to the burner.

If at any time the pilot burner is extinguished, the valve will assume a closed position if it is not already in that position. This is due to the fact that the only source of energization for the magnet winding 39 is the thermocouple 52 which ceases to generate an electromotive force as soon as the pilot burner is extinguished.

The present type of system is characterized by its extreme simplicity and independence of any external source of power supply. It is of particular utility wherever an economical type of system, both from the standpoint of installation and the standpoint of operation, is desired. It has proved particularly valuable in large scale low income housing projects where the occupants are absent during the greater portion of the day. In such cases, the occupant rising in the morning need merely turn the knob to its desired setting and then actuate the knob 48 to place the burner in operation. The time period of operation may be set by the building operator so as to be no greater than that during which the occupant is normally in the quarters in the morning. This predetermined amount of time can be determined by the stop 102. During the period, the burner runs at full capacity but is of such size that it merely results in maintaining a comfortable temperature while in operation. At the end of the predetermined period of time, the occupants have presumably left the quarters and the burner is off during the entire day. Upon the occupant returning in the evening, he again repeats the procedure to turn on the burner and warm up the living quarters. The burner will be automatically turned off at the end of a predetermined period of time and in most cases the quarters will stay sufficiently warm thereafter to insure comfortable condtions until the occupants retire. If not, the occupants are of course at perfect liberty to again repeat the process and insure a further period of operation.

With the arrangement shown, there is no possibility of having the burner left in operation during the entire day when the occupants are not in the quarters.

While I have shown certain details of my invention for purposes of illustration, it is to be understood that the invention is not to be limited to these details and that the scope of the invention is to be determined by the appended claims.

I claim as my invention:

1. In burner control mechanism, a burner control device biased to one position, an electromagnet for holding it in another position, a thermocouple adapted to be exposed to a burner flame, a pair of concentric conductors connected to said thermocouple, a coupling member between said pair of concentric conductors and said electromagnet, said coupling member comprising a pair of spaced pins and a sleeve surrounding said pins, one of said pins being connected to the innermost of said concentric conductors and the other to one terminal of said electromagnet, said sleeve extending between and electrically connecting the outermost of said concentric conductors and the other terminal of said electromagnet, said sleeve having an opening therethrough, conductors connected to said spaced pins and extending through said opening in said sleeve, and a switch connected between said two last named conductors to control the connection of said thermocouple to said electromagnet.

2. In burner control mechanism, a burner control device biased to one position, an electromagnet for holding it in another position, a thermocouple adapted to be exposed to a burner flame, a pair of concentric conductors connected to said thermocouple, a coupling member between said pair of concentric conductors and said electromagnet, said coupling member comprising a pair of spaced pins, and a sleeve surrounding said pins, one of said pins being connected to the innermost of said concentric conductors and the other to one terminal of said electromagnet, said sleeve extending between and electrically connecting the outermost of said concentric conductors and the other terminal of said electromagnet, said sleeve having an opening therethrough, conductors connected to said spaced pins and extending through said opening in said sleeve, and a manually controlled time switch connected between said two last named conductors to control the connection of said thermocouple to said electromagnet.

3. In burner control mechanism, a burner control device biased to one position, an electromagnet for holding it in another position, a thermocouple adapted to be exposed to a burner flame, a pair of concentric conductors connected to said thermocouple, a coupling member between said pair of concentric conductors and said electromagnet, said coupling member comprising a pair of spaced pins, and a sleeve surrounding said pins, one of said pins being connected to the innermost of said concentric conductors and the other to one terminal of said electromagnet, screw threaded coupling elements clamping said sleeve between one end of the outermost of said concentric conductors and the other terminal of said electromagnet, said sleeve having an opening therethrough, conductors connected to said spaced pins and extending through said opening in said sleeve, and a switch connected between said two last named conductors to control the connection of said thermocouple to said electromagnet.

4. In a burner control system, burner means providing for a pilot flame and a main flame, means for controlling the flow of fuel in connection with said main flame, said flow controlling means being biased to a flow interrupting position, electromagnetic means for maintaining said flow controlling means in a flow maintaining position, said electromagnetic means comprising a relatively movable electromagnet and armature,

thermocouple means exposed to the heat of said pilot flame and connected directly to said electromagnet to energize the same, said thermocouple means being capable of energizing said electromagnet sufficiently to enable it to exert sufficient attractive force on said armature to enable said electromagnetic means to hold said flow controlling means against its bias but insufficient attractive force to enable said electromagnet means to move said flow controlling means from a flow interrupting position, a switch connected between said thermocouple means and said electromagnet, said switch being movable between a first normal position in which said thermocouple means is ineffective to energize said electromagnet and a second position in which said thermocouple means is effective to energize said electromagnet, spring driven timing means operable to cause said switch when in said second position to return to said first position at the end of a predetermined period of time, manually operable means to move said switch from said first position to said second position and to wind the spring of said timing means, and further manually operable means for moving said electromagnet and armature together while causing said flow controlling means to prevent a flow of fluid therethrough until said electromagnet and armature have been retained in engagement with each other as a result of the existence of said pilot flame and of said time operated switch being in said second position.

5. In a burner control system, burner means providing for a pilot flame and a main flame, valve means for controlling the flow of fuel in connection with said main flame, said valve means being biased to a flow interrupting position, electromagnetic means for maintaining said valve means in open position, said electromagnetic means comprising a relatively movable electromagnet and armature, thermocouple means exposed to the heat of said pilot flame and connected directly to said electromagnet to energize the same, said thermocouple means being capable of energizing said electromagnet sufficiently to enable it to exert sufficient attractive force on said armature to enable said electromagnetic means to hold said valve means against its bias but insufficient attractive force to enable said electromagnet means to move said valve means from closed position, a switch connected in series with said thermocouple means and said electromagnet, said switch being movable between open and closed positions, spring driven timing means operable to cause said switch when in closed position to return to open position at the end of a predetermined period of time, manually operable means to move said switch from open position to closed position and to wind the spring of said timing means, and further manually operable means for moving said electromagnet and armature together while causing said valve means to prevent a flow of fluid therethrough until said electromagnet and armature have been retained in engagement with each other as a result of the existence of said pilot flame and of said time operated switch being in closed position.

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