March 10, 1953 J. A. CERNY ET AL 2,630,860

BURNER CONTROL MEANS

Filed Aug. 31, 1946 4 Sheets-Sheet 1

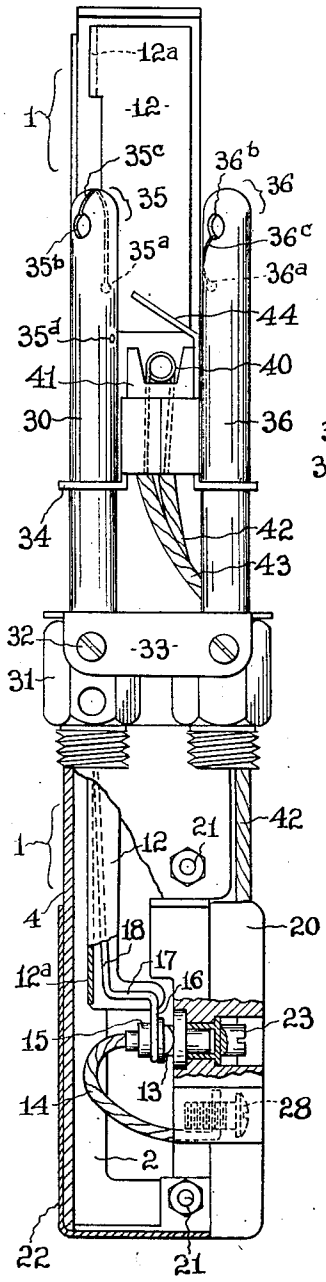


FIG. 1

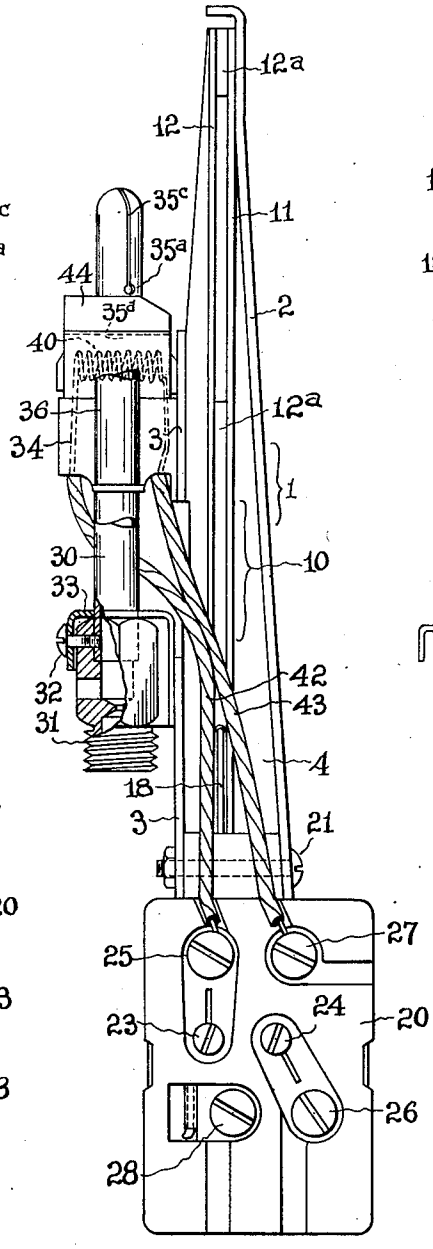


FIG. 2

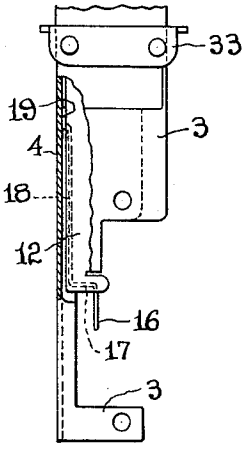


FIG. 3

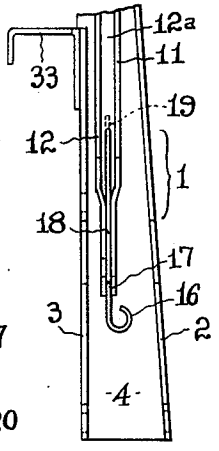


FIG. 4

INVENTORS:
JOSEPH A. CERNY
NOEL B. GREEN
BY Frank R. Higley
ATTORNEY.

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BURNER CONTROL MEANS

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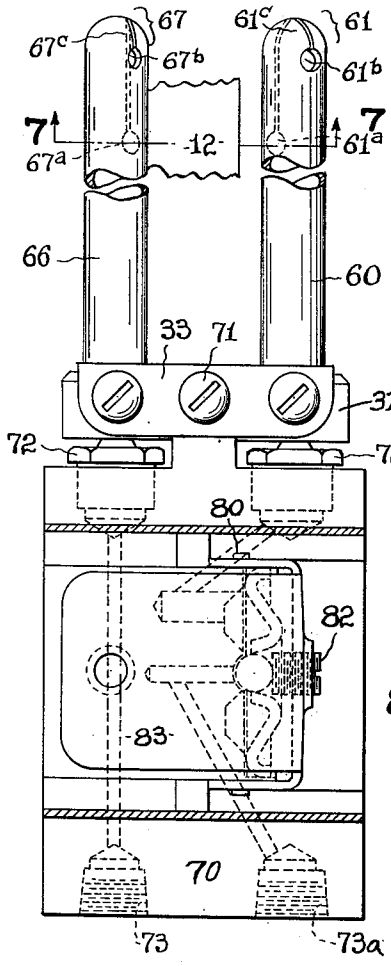


FIG. 5

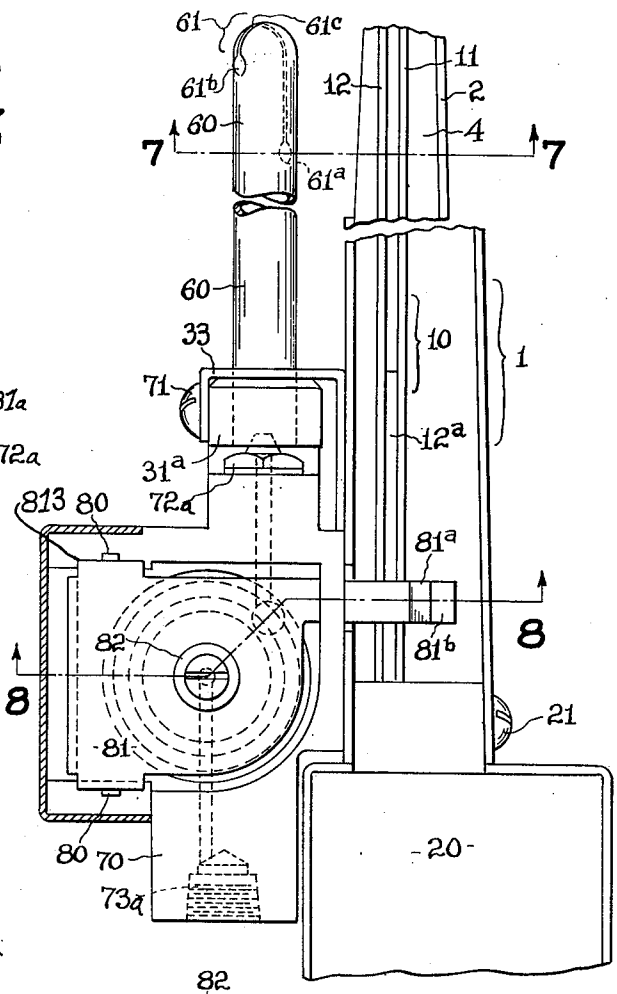


FIG. 6

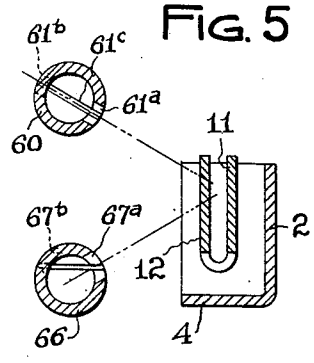


FIG. 7

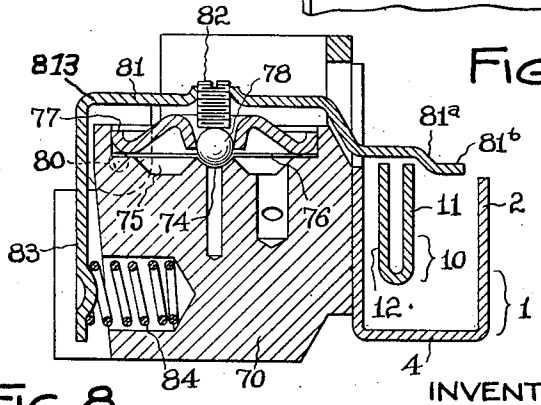


FIG. 8

INVENTORS:
JOSEPH A. CERNY
NOEL B. GREEN
BY Frank R. Higley
ATTORNEY.

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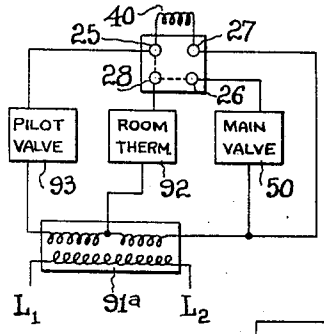


FIG. 10

FIG. 11

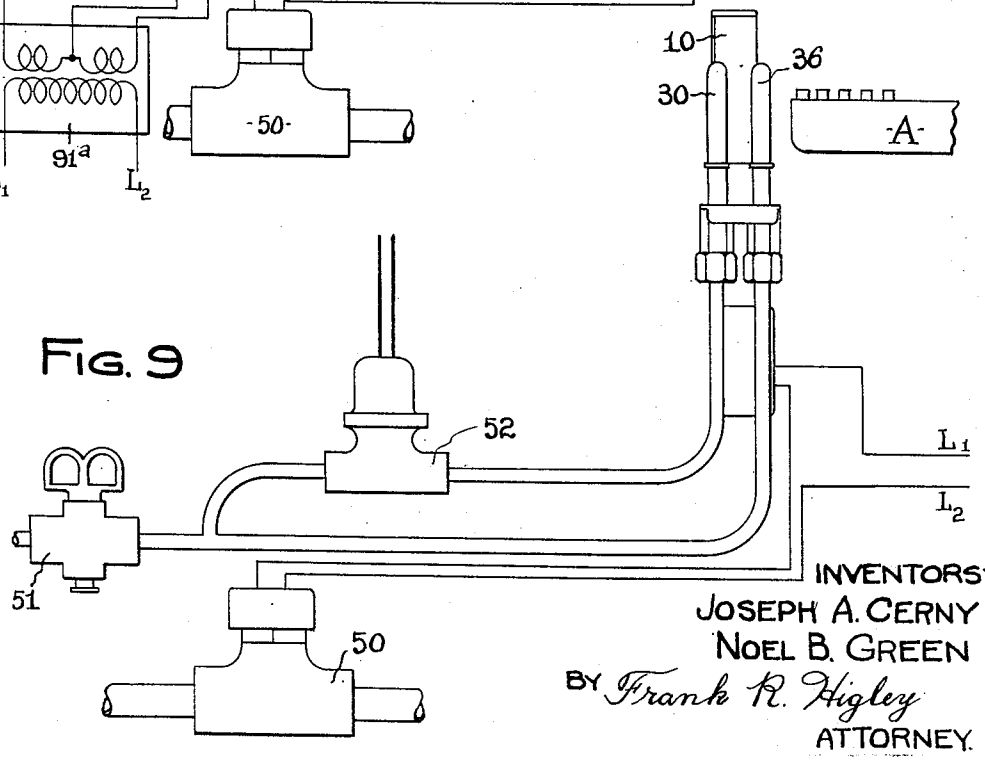


FIG. 9

INVENTORS:
JOSEPH A. CERNY
NOEL B. GREEN
BY Frank R. Higley
ATTORNEY.

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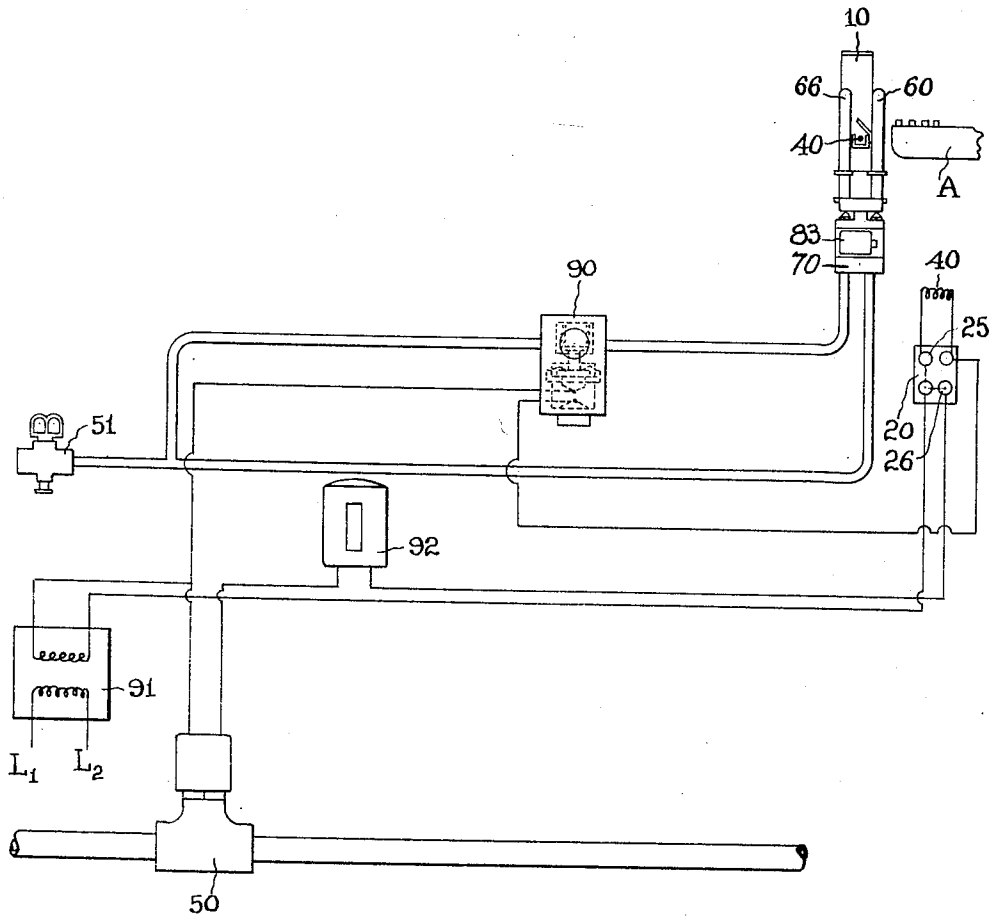


FIG. 12

INVENTORS:
JOSEPH A. CERNY
NOEL B. GREEN
BY Frank R. Higley
ATTORNEY

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UNITED STATES PATENT OFFICE

2,630,860

BURNER CONTROL MEANS

Joseph A. Cerny, University Heights, and Noel B. Green, Cleveland, Ohio, assignors, by mesne assignments, to Affiliated Gas Equipment, Inc., Cleveland, Ohio, a corporation of Delaware

Application August 31, 1946, Serial No. 694,268

6 Claims. (Cl. 158—124)

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This invention relates to control means, and more particularly to pilot means for control of gas burners.

Broadly, the invention comprises a pilot device for such purposes, having a number of features of novelty, the features being employable in various combinations, and the pilot being employable in a variety of novel circuits made possible thereby.

Briefly, the invention contemplates the provision of a starting pilot as auxiliary to the main safety, or service pilot heretofore known in the art; ignition of the burner to be served, from either pilot; electric ignition for the starting pilot; ignition of the safety pilot from the starting pilot; and means thermally responsive to both pilots for pilot control as well as control of the burner, as will appear.

Direct advantages therefrom, and important objects of the invention, include: first, protection of the ignition coil from prolonged operation of the pilot which it immediately serves, with consequent increase of coil life and possible faster starting by employment of more starting pilot gas than would otherwise be permissible; and secondly, optional provision that upon safety pilot outage, either all fuel including pilot fuel is cut off, or the safety pilot is automatically relit so that main burner operation is resumed.

A notable resultant object of the invention is the provision of electric or automatic ignition, with remote control if desired, together with complete shutdown of pilot as well as main burner upon pilot outage.

Further objects and advantages will be apparent from the following description taken in connection with the accompanying drawings wherein Figs. 1 and 2 are front and side elevations respectively of a pilot device embodying certain features of the invention, adapted for operation with electric automatic ignition, by remote control, parts being broken away to show details of construction.

Fig. 3 is a detail showing certain parts appearing in Fig. 1, and Fig. 4 is a view of the same parts as from the right, Fig. 3;

Figs. 5 and 6 are views corresponding to Figs. 1 and 2, but illustrating a modified pilot device providing complete gas shutdown on pilot outage, Figs. 7 and 8 being sections thereof as indicated by lines 7—7 and 8—8 of Fig. 6.

Fig. 9 is a schematic view indicating an elementary manner of use of the pilot device in an application thereof not involving its electric ignition.

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Figs. 10 and 11 are wiring diagram and composite schematic views respectively, together illustrating a manner of employment of an embodiment of the pilot device, including both its electric structure as illustrated in Figs. 1 to 4 and its additional features as illustrated in Figs. 5 to 8, and in particular the valve structure of the latter figures, to provide (*a*) full automatic main burner operation, including pilot lighting, responsive to remote thermostatic control, (*b*) complete automatic shut down of all gas to both pilot and main burner upon pilot outage, and (*c*) automatic re-establishment of operation, upon pilot outage during call for heat by the remote control.

Fig. 12 is a composite schematic view illustrating another manner of employment of the same pilot embodiment indicated in Figs. 10 and 11 and providing initial establishment of the pilot flame manually by push button control which may be remote from both the thermostatic controller and the pilot itself, and automatic shut down of all gas upon pilot outage.

In the drawings the same reference characters are applied to the same or equivalent parts.

With reference now to the drawings and first to Figs. 1 to 4 thereof:

1 is an elongated base member generally of channel section with its web member 4 somewhat tapering. A thermally responsive unit generally indicated at 10 is disposed within the hollow of the base means 1, the thermally responsive unit being of elongated form and disposed generally within the hollow of the base means, with one end secured to one of the flange members 2 of the base means at the smaller end of the base, its other end being adapted to have thermally responsive stroke between the flange 2 and the opposite flange 3 of the base adjacent the other end thereof, crosswise of the base web member 4.

More particularly the thermally responsive unit is itself generally of channel form, with a pair of spaced leg members 11 and 12 interconnected by spaced web means 12*a* at one edge of the unit, following the teachings of Patent No. 2,455,306, issued November 30, 1948, to Frank R. Higley, the leg member 11 being the "cold" member of the pair and that which is secured to the web member 2 of the base, and the other leg member being the "hot" leg member of the pair as will appear.

A switch block assembly including a block 20 of insulating material is mounted at the larger end of the base means 1 as by bolts at 21, to extend between the flange members 2 and 3 of the

base 1 adjacent the moving end of the thermally responsive unit 10, as a closure for that portion of the hollow of the base. The flange members 2 and 3 as shown Figs. 1 and 3, may be partially cut away adjacent the switch block, and a cover 22 provided to complete the enclosure.

The switch block 20 carries a pair of stationary contactors at 23 and 24, having associated binding posts 25 and 26 to which they are respectively connected by the straps indicated in Fig. 2, and another pair of binding posts 27 and 28. The contactors 23 and 24 have contact faces at the inner face of the block, and are located in spaced relation transversely of the base means 1. A moving contactor 13, having flexible connection 14 with the binding post 28, is carried by the corresponding end of the unit 10 for thermally responsive movement between its cooperative stationary contactors 23 and 24, to effectively connect either binding post 25 or 26 with the binding post 28.

More particularly for the purpose, the contactor 13 is mounted in an insulator 15 which in turn is carried by a loop 16 in a wire spring member having an offset portion 17 between the leg members 11 and 12 of the thermally responsive unit 10, a straight portion 18 extending along the unit, to an offset base portion 19 extending through and slightly beyond an opening in the member 12a of the unit, as indicated in full lines Fig. 3 and broken lines Fig. 4. The leg members 11 and 12 of the latter, adjacent the offset 17 in the wire, are brought together as indicated in Fig. 4, to just clear the wire; the arrangement being such that the assembly of the wire in the thermally responsive unit is made simply by inserting the wire end through the hole in the unit, after which, in the complete assembly, the spring arm portion 18 bears at its upper extremity, Figs. 1, 3, and 4, against the back of the web member 12a of the thermally responsive unit, to in turn bear the moving contactor 13 against its cooperative fixed contactor 23 or 24; the leg members 11 and 12 of the thermally responsive unit meanwhile locating the moving contactor strokewise of the unit while permitting sprung motion of the contactor to establish and maintain contact.

For actuating the thermally responsive unit by heating of its leg 12, pilot burner means including a pilot stem 30 are provided. This pilot burner as here illustrated extends from a fitting 31, being secured therein by a screw 32 passing through a bracket 33 welded to the near flange 3 of the base 1, the burner having further support from a bracket 34 also secured to the same flange member 3. The fitting 31 may be provided with a central restricted gas orifice, indicated in Fig. 2, and the side-air inlet indicated in Figs. 1 and 2 so as to produce a gas-air mixture within the pilot burner 30, when gas is admitted from the line to which the fitting has connection in service.

The pilot burner 30 is generally closed at its far extremity but there has porting generally indicated at 35, including a port portion 35a directed toward the hot leg 12 for energization of the thermally responsive unit, a port portion 35b adapted to be directed toward the burner to be served, and a slot 35c interconnecting the port portions 35a and 35b as a third port portion, so that in effect all three port portions act as a single porting 35, with coincident operation. The upper portion of the near flange member 3 of the base 1 is cut away as appears in Fig. 2, adjacent the end of the pilot burner stem 30, so as not to interfere with operation of its porting.

For ignition for the pilot burner 30, a coil 40 may be located between the pilot burner stems 30 and 36, mounted in a ceramic coil block 41, carried by the bracket 34 with insulated leads 42 and 43 leading from its opposite ends through the block 41 to the binding posts 25 and 27, the flange 3 of the base 1 being cut away to clear the leads as indicated in Fig. 2. Cooperative with the ignition coil 40 is a porting 35d in the pilot burner 30, and preferably a shield 44 is arranged to protect the coil and assist in ignition by deflecting discharge from the port 35d. The arrangement is such that the porting at 35d is effectively a fourth part of the porting at 35a, 35b, and 35c, so that the entire porting will have substantially simultaneous ignition from the coil 40, when the latter is energized and fuel is supplied to the pilot burner 30.

From what has thus far been described, the arrangement of parts may be seen to provide that in "cold" or "off" position, which is that illustrated, contact is made between movable contactor 13 and stationary contactor 23; and when ignition is had at the pilot burner 30, as by energization of the coil 40, the leg 12 of the thermally responsive unit 10, receiving heat by way of the port portion 35a, will expand and cause the thermally responsive element to move to the right, Fig. 2, carrying the contactor 13 off the contactor 23 and onto the contactor 24, igniting energization of the coil 40 being had by way of binding post 28, flexible connection 14, movable contactor 13, fixed contactor 23, binding post 25, lead 42, to the coil 40, and return through lead 43 to binding post 27. When the moving contactor has been shifted to "hot" or "on" position, the contactor 13 being off the contactor 23, the coil is automatically de-energized and a connection is established from binding post 28, by way of flexible connection 14, movable contactor 13, stationary contactor 24, and to binding post 26.

In short, the switch means illustrated and described constitutes a single pole, double throw switch arranged for actuation by the thermally responsive unit 10.

It will be apparent therefore that the pilot device, as thus far disclosed, is employable to serve a main burner, as a safety pilot with either manual or automatic electric ignition under remote control, as is well known in the art.

Examples of such employment widely known in the gas heating industry are fully disclosed in the following patents: 2,176,647, October 17, 1939, Thomson, "Fuel Igniting Device for Burners"; 2,192,632, March 5, 1940, Beam, "Burner Control System"; 2,231,986, February 18, 1941, Beam, "Ignition System for Burners"; 2,275,279, March 3, 1942, Beam, "Automatic Lighter."

According to this invention, a second pilot burner stem 36 is disposed alongside and mounted similarly to the pilot burner stem 30.

As will be appreciated by one familiar with the art, such second pilot burner 36 might, with suitable porting, be employed either as a simple flare or escapement pilot, or in the absence of the above described electric ignition, as a constant pilot as hereinafter appears in connection with Fig. 9.

However, according to this invention the pilot burner 36 may be arranged to have its ignition from the pilot burner 30, be effective on the thermally responsive unit 10, and in igniting relation to the main burner to be served.

To such purpose, as illustrated in Figs. 1 and 2, the pilot burner 36 is ported to include a port portion 36*a* to receive ignition from the pilot burner 30, a port portion 36*b* adapted to be in igniting relation to a main burner to be served, and a slot portion 36*c* interconnecting the portions 36*a* and 36*b*, so that all three port portions of the pilot burner stem 36 act as a single porting, with coincident operation. As will be more fully described hereinafter in connection with Fig. 7, ignition between the two pilot burners 30 and 36 is here indicated as had by way of the port portion 35*a* of the starting pilot burner 30 and the port portion 36*a* of the running pilot burner 36, these two port portions both being directed toward the same portion of the thermally responsive unit 10 to be effective thereon.

By this relation between the two pilot burners 30 and 36, it will be apparent that the burner 30 may serve the burner 36, the burner 30 having electric ignition and serving merely as a starting pilot, and the burner 36 serving as a running safety pilot; so that upon ignition of the running pilot by the starting pilot, operation of the starting pilot may terminate and its ignition coil thus saved from exposure to heat and combustion products during the running period.

As already suggested above, the pilot device may be employed without electric ignition, with the pilot burner 30 serving as a safety pilot, receiving its ignition from the pilot burner 36 and being effective on the thermally responsive unit 10, and the pilot burner 36 serving as a constant pilot, for ignition of the main burner to be served and of the safety pilot burner 30, and preferably without being effective upon the thermally responsive unit; the two pilot burners being suitably ported for such purpose, as well understood in the art. Such arrangement is indicated in Fig. 9 wherein A is the main burner to be served, 50 is its solenoid valve, in circuit with the contactor 24 (described in connection with Fig. 2 and there illustrated), 51 is a manual valve controlling gas supply to both pilot stems, and 52 is a magnetically or otherwise electrically motorized valve, in the gas line from the valve 51 to the safety pilot stem 30, and in circuit with a room thermostat.

In this application of the pilot, "on" operation of the main burner A will be as follows, assuming the valve 51 open, the pilot burner 36 in operation as a constant pilot and the safety pilot valve 52 closed. Energization of the valve 52, as responsive to room thermostat call for heat, admits gas to the safety pilot 30, which is promptly ignited from the constant pilot 36 serving as its lighting pilot. This heats the thermally responsive unit 10 to make contact at 24 and open the main gas valve 50 to admit gas to the burner A, which is promptly ignited from either or both pilot stems.

Upon outage of the safety pilot 30, either accidentally or by de-energization of the room thermostat circuit to close the valve 52, the main burner will be promptly shut down by breaking of its solenoid circuit at the contactor 24.

With reference now to Figs. 5 to 8 of the drawings, an important modification or second form of the pilot device itself is illustrated. The assembly of the base 1, thermally responsive unit 10, and switch parts 20 is retained as illustrated and described in connection with Figs. 1 to 4. However, a different pair of pilot burner stems is substituted for those previously disclosed, and a valve is added for control of one of the pilot

burner stems responsive to the thermally responsive unit, as will appear. The ignition coil might be retained in the assembly of Figs. 5 to 8 generally as before, but for clarity is omitted from these figures of the drawings.

In this modification two pilot burner stems 60 and 66 are mounted in the bracket 33 generally as before, except that a block 31*a*, having through openings as indicated in Fig. 6, is employed in place of the fittings 31 of the preceding form.

Further in this modification the pilot burner 60 is to serve as a running safety pilot, and the burner 66 as a starting or lighting pilot therefor, each preferably in igniting relation to the burner to be served, and each pilot effectively in igniting relation with the other. Moreover, the thermally responsive unit 10 is actuable responsive to either or both pilots, and may serve to effect such igniting relation therebetween.

For these purposes, the safety pilot burner 60 is provided with porting as illustrated in Figs. 5, 6, and 7, generally indicated at 61 and including a port portion 61*a* directed toward the hot leg 12 of the thermally responsive unit 10, an oppositely directed port portion 61*b* adjacent the upper extremity of the stem, to be in igniting relation to the burner to be served, and a slot portion 61*c* interconnecting the port portions 61*a* and 61*b*; so that all three portions of the porting will act coincidently as a single port. The starting pilot burner 66 is provided with generally similar porting 67, including a port portion 67*a* at the same elevation as the port portion 61*a* of the safty pilot, and directed to the hot leg 12 of the thermally responsive unit as a target common to both pilots, the porting also including a port portion 67*b* adapted to serve the same burner served by the port portion 61*b* of the pilot burner 60, and a slot portion 67*c* interconnecting the portions 67*a* and 67*b* for coincident operation thereof.

The arrangement is such that the unit 10 will be responsive to flame from either the port 67 of the starting pilot or the port portion 61*a* of the safety pilot, and ignition at the porting 61 may be had from the porting 67 because of impingement from both, at the same location on face of the hot leg 12.

Valve means are provided for control of the safety pilot 60, such means including a body 70. The valve body 70 is mounted on the assembly by the screw 21, which also serves in securement of the switch block 20, and by the screw 71 in the bracket 33.

The valve body 70 carries spuds 72 and 72*a* slightly spaced from the pilot burner stems 60 and 66 respectively, with orifices directed therealong so that air injection and mixing will be accomplished on gas discharge. Opposite the spuds the valve body is provided with threaded inlets 73 and 73*a* to receive fittings for gas supply tubing. For the starting pilot burner 66 the valve body is provided with a through passage from inlet 73 to spud 72 as indicated in Fig. 5.

For the spud 72*a* of the safety pilot burner 60, however, automatic thermally responsive valve means are provided, effective between its inlet 73*a* and spud 72*a*.

Details of the valve itself are immaterial here but appear in Fig. 8, the valve including an orifice at 74 surrounded by an annular recess 75, a diaphragm 76 secured by the annular retainer 77, and a ball 78 adapted to bear the diaphragm 76 against the annular seat between the orifice 74 and space 75 to close the valve, or permit raising of the diaphragm from its seat to permit

flow between the orifice 74 and the annular space 75. Suitable passageways, as indicated in broken lines in Figs. 5 and 6, are provided in the valve body 70, leading to the safety pilot 60 from its inlet 73a, by way of the port 74 and annular space 75 to its spud 72a, subject to control of the ball 78.

For control of the valve, a bell-crank lever generally indicated at 813 is provided, pivotally mounted at 80 and having an arm 81 carrying an adjustment screw 82 engageable with the ball 78 to yieldably maintain the valve in closed position. The bell-crank has another arm 83 alongside the body 70, which latter is recessed to receive a spring 84 to yieldably urge the ball-crank toward valve closing position.

It will be apparent that the valve may be opened manually by depression of the bell-crank lever arm 83.

Means are provided, however, for automatic control of the valve responsive to the thermally responsive unit 10. For such purpose the lever arm 81 is provided with an extension having a cam part 81a, engageable by the unit 10 to move the bell-crank lever in valve opening direction, as the unit 10 moves to "on" position responsive to pilot flame. The extension has its extremity 81b disposed to bear against the thermally responsive unit when the latter has attained "on" position, without exerting a force thereagainst tending to move the unit in the direction of its stroking. Thus with reference to Fig. 8, wherein the thermally responsive unit 10 is shown in "off" position, in moving to the right to "on" position, when energized by heating of its leg 12, the unit will first engage the cam part 81a of the arm but will ride from the cam part onto the straightened part 81b before completion of its "on" stroke. In other words, the cam part 81a serves in opening the valve and the part 81b serves thereafter in holding the valve open.

While not specifically illustrated in Figs. 5 to 8, it will be apparent that if desired the electric ignition parts disclosed in connection with Figs. 1 to 4 may be applied to the modification of Figs. 5 to 8, with provision of an igniting port cooperative with the ignition coil 40, in the starting pilot burner 66, similar to the port 35d in the burner 30, Figs. 1 and 2. For such purpose, of course, the parts actuated by the thermally responsive unit 10 are so proportioned and arranged that during the "on" stroke of the unit, the safety pilot valve will be opened by engagement of the cam part 81a to admit gas to the safety pilot, before the contactor 13 is moved off the face of the contactor 23.

As indicated in Fig. 12 such arrangement permits electric starting ignition under push button control, with complete automatic shutdown upon pilot outage, together with "on" and "off" main burner operation responsive to a remote room thermostat. In Fig. 12, as indicated, the switch part of the combined push button valve and switch 90 is in the circuit of the ignition coil 40 subject to the binding post 25 of the switch contactor 23, the transformer 91 constituting the source of electricity. The room thermostat 92 is in circuit with the binding post 26 of the contactor 24, which circuit also includes the main burner valve 50 as well as the transformer 91.

Operation in this arrangement of Fig. 12 will be as follows: To start, depression of the push button at 90 admits gas to the starting pilot 66 and coincidently energizes the ignition coil 40 to ignite the gas. Operation of the starting pilot energizes the thermally responsive unit 10 to admit gas to the safety or running pilot 60 through opening of its automatic valve and shifts the contactor 13 to de-energize the ignition coil and establish the main burner valve circuit which includes the room thermostat. The push button may then be released, operation of the safety pilot having been established. Thereafter the safety pilot 60 serves also as a constant pilot, leaving the main burner operation subject to the room thermostat 92 for its "on" and "off" operation, and igniting the main burner when gas is admitted thereto. Upon outage of the safety pilot 60, however, through the action of the thermally responsive unit, its own gas is cut off and the main burner valve circuit is broken.

As indicated in Figs. 10 and 11, full remote control, including automatic pilot ignition and reignition, with complete gas shutdown upon pilot outage may be had with the second form of the device.

In this arrangement the motor means of an electrically motorized pilot valve 93 is placed in the circuit of the room thermostat 92, the latter being in the circuit of the binding post 28 of the thermally responsive switch means, the transformer 91a having a double opposed output, with one secondary in the circuit of the pilot valve 93 and binding post 25, and having the other secondary which is in 100% out of phase relationship with the first, in circuit with the main burner gas valve 50 and ignition coil 40, the room thermostat 92 being in both circuits, all as shown in Figs. 10 and 11.

In this arrangement "on" operation will be as follows: Commencing with call for heat by the room thermostat 92, the motor means of pilot valve 93 is energized to admit gas to the starting pilot 66, and coincidently the ignition coil 40 is energized, each circuit being served by its part of the transformer 91a, the room thermostat 92 being in its common branch of both circuits.

Operation of the starting pilot 66 energizes the thermally responsive unit to admit gas to the safety pilot 60 by opening of its automatic valve, and throws the thermally responsive switch to de-energize the ignition coil and also de-energize the pilot valve 93, thus shutting down the starting pilot. Throwing of the switch places the main burner valve 50 in circuit for energization and de-energization responsive to the room thermostat 92, with main burner ignition from the safety pilot 60 acting as a constant pilot.

Upon outage of the safety pilot 60, the room thermostat 92 is relieved of control of the main burner valve 50, and put in control of the pilot valve 93. If the room thermostat is not calling for heat at the time, all gas is shut off pending such call. If and when the room thermostat calls for heat, the lighting cycle described above is repeated. Thus if pilot outage occurs while the room thermostat is calling for heat, automatic relight of both pilot and burner follows.

It is to be noted that in any of the above described applications wherein a lighting pilot is itself electrically ignited to serve another pilot, either constant, safety, or otherwise relatively a running pilot, the lighting pilot is energized only for a very short period. This permits use during such period of a relatively unlimited amount of pilot gas, resulting in quick ignition from the coil; whereas in the prior art, in order to save the coil from flame impingement after ignition, it has been necessary to employ only a minimum of gas in the pilot burner served by the coil.

Moreover, where ignition of the safety pilot

by the lighting pilot is had by way of jets coincidently impinged on the thermal element, the action of the thermal element is greatly accelerated, with corresponding rapid response of the main burner to the control, since heating of the thermal element commences immediately upon ignition of the lighting pilot, and is increased by the cumulative effect of the running or safety pilot. Such improved rapidity of action further saves the ignition coil by minimizing its period of energization.

Also it is notable that where a starting pilot is employed as described for ignition of a running pilot, both pilots are in igniting relation to the main burner served and controlled by the pilot device, to insure burner ignition coincident with supply of burner gas. Thus in practice, both running pilot and main burner may have simultaneous gas supply and simultaneous ignition from the starting pilot.

Likewise, where the described thermally responsive pilot valve is employed for automatic shutdown of the running pilot upon pilot outage, its mechanical actuation by the thermal unit 10 makes its operation independent of failure of electrical circuits normally under pilot control.

In conclusion, it will be observed that the complete pilot device itself includes essentially as a structural unit, the novel combination of a switch and a pilot gas valve, both actuated by a single thermally responsive unit, and two pilot burners, to one of which the pilot valve controls the gas supply, and for the other of which electric ignition is provided in a circuit including the switch, the pilot burners being related with each other by porting providing ignition between them and at least one of them being ported for energizing relation to the thermally responsive unit.

The invention also embraces a number of novel and improved control circuits made possible by the novelty of the combination of the pilot device.

The pilot device is equally employable in numerous known circuits not requiring all of the elements of its complete combination, which elements, therefore, may be selectively omitted from the device; the only changes therein, in addition to such omissions, comprising of porting of the pilot burner or burners suitable to the manner of service of the device in the intended control circuit, such porting being of elementary nature within the purview of anyone having ordinary skill in the art.

What is claimed is:

1. In a gas control device of the class described: thermally responsive means having a face portion adapted to receive actuating heat, starting pilot burner means and safety pilot burner means disposed adjacent said thermally responsive means and each ported to be effective at the same location on said face portion when operating, whereby said starting pilot burner means is in igniting relation to said safety pilot burner means by way of said location on said face portion, electric ignition means for said starting pilot burner means, said starting pilot burner means being also ported to have ignition service by said ignition means, the porting of said safety pilot means being arranged so that its flame avoids said ignition means, means admitting gas to said starting pilot burner means and coincidently energizing said ignition means by supply of current thereto, safety pilot supply valve means operatively associated with said safety pilot burner means and arranged to be actuated by said thermally responsive means, means for discontinuing operation of said starting pilot burner means following ignition of said safety pilot burner means, and means for de-energizing said ignition means responsive to heating of said face portion.

2. In a gas control device of the class described: thermally responsive means having a face portion adapted to receive actuating heat, starting pilot burner means and safety pilot burner means disposed adjacent said thermally responsive means and each ported to be effective at the same location on said face portion when operating, whereby said starting pilot burner means is in igniting relation to said safety pilot burner means by way of said location on said face portion, electric ignition means for said starting pilot burner means, said starting pilot burner means being also ported to have ignition service by said ignition means, the porting of said safety pilot means being arranged so that its flame avoids said ignition means, means admitting gas to said starting pilot burner means and coincidently energizing said ignition means by supply of current thereto, safety pilot supply valve means operatively associated with said safety pilot burner means and arranged to be actuated by said thermally responsive means, and means actuable by said thermally responsive means for discontinuing operation of said starting pilot burner means and deenergizing said ignition means upon operation of said safety pilot burner means.

3. Means for the purpose described, comprising safety pilot means adapted to be disposed in igniting relation to a burner to be controlled, starting pilot means in igniting relation to said safety pilot means, electric ignition means for said starting pilot means, thermally responsive means arranged to be heated by operation of either of said pilot means, safety pilot supply valve means operatively associated with said safety pilot means and arranged to be responsive to said thermally responsive means, starting pilot supply valve means operatively associated with said starting pilot means, means for coincidently opening said starting pilot supply valve means and energizing said ignition means, and means responsive to said thermally responsive means to close said starting pilot supply valve means and de-energize said ignition means upon operation of said safety pilot means.

4. Means for the purpose described, comprising safety pilot means adapted to be disposed in igniting relation to a burner to be controlled, starting pilot means in igniting relation to said safety pilot means, electric ignition means for said starting pilot means, thermally responsive means arranged to be heated by operation of either of said pilot means, safety pilot supply valve means operatively associated with said safety pilot means and arranged to be responsive to said thermally responsive means, starting pilot supply valve means operatively associated with said starting pilot means, circuit means to energize said ignition means and manual means associated therewith to open said starting pilot supply valve means, and switch means in said circuit means responsive to said thermally responsive means to de-energize said ignition means and close said starting pilot supply valve means upon operation of said safety pilot means.

5. Means for the purpose described, compris-

ing safety pilot means adapted to be disposed in igniting relation to a burner to be controlled, starting pilot means in igniting relation to said safety pilot means, electric ignition means for said starting pilot means, thermally responsive means arranged to be heated by operation of either of said pilot means, safety pilot supply valve means operatively associated with said safety pilot means and arranged to be responsive to said thermally responsive means, starting pilot supply valve means operatively associated with said starting pilot means, manual means to permit energization of circuit means to coincidently energize said ignition means and open said starting pilot supply valve means, and switch means in said circuit means responsive to said thermally responsive means to de-energize said ignition means and close said starting pilot supply valve means upon operation of said safety pilot means.

6. Means for the purpose described, comprising: safety pilot means adapted to be disposed in igniting relation to a main burner to be controlled, starting pilot means in igniting relation to said safety pilot means, electric ignition means for said starting pilot means, thermally responsive means arranged to be heated by operation of either of said pilot means, safety pilot supply valve means operatively associated with said safety pilot means and arranged to be responsive to said thermally responsive means, electrically responsive starting pilot supply valve means operatively associated with said starting pilot means, electrically responsive main burner supply valve means operatively associated with said main burner, room thermostat means, transformer means having a pair of secondary portions, double throw switch means responsive to said thermally responsive means, and circuit means including means interconnecting said switch means, by way of said room thermostat means, to both said transformer secondary portions to provide a starting circuit including said starting pilot supply valve means, one secondary portion of said transformer means, and one side of said switch means, an ignition circuit including said ignition means, the other secondary portion of said transformer means, and the same side of said switch means, and a running circuit including said main burner supply valve means, said other secondary portion of said transformer means, and the other side of said switch means, said switch means being arranged to provide thermally responsive selective energization of either said starting and ignition circuits coincidently, or said main burner supply valve circuit.

JOSEPH A. CERNY.
NOEL B. GREEN.

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