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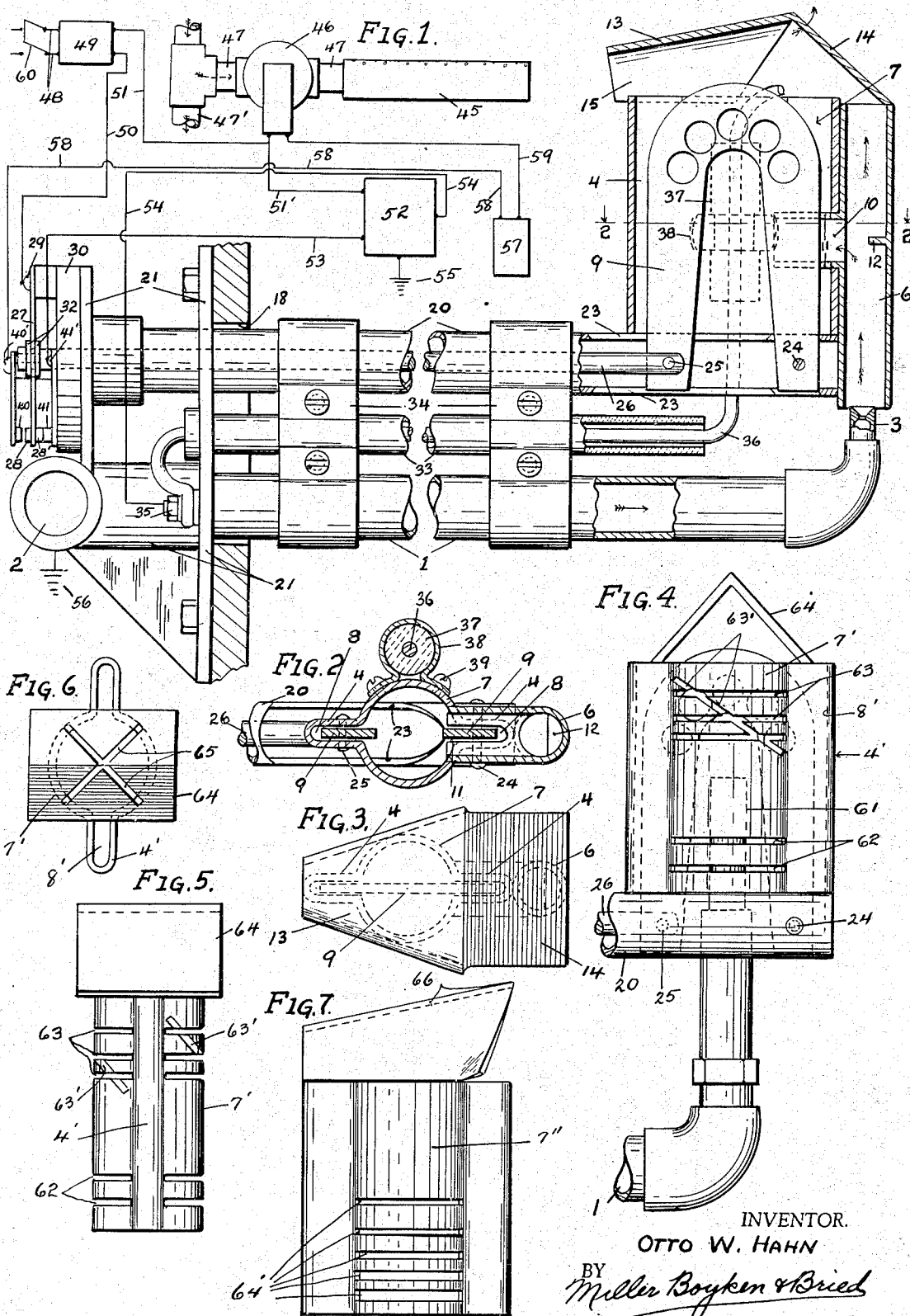
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FLUID FUEL BURNER DEVICE

Filed Dec. 8, 1934

.2 Sheets-Sheet 1



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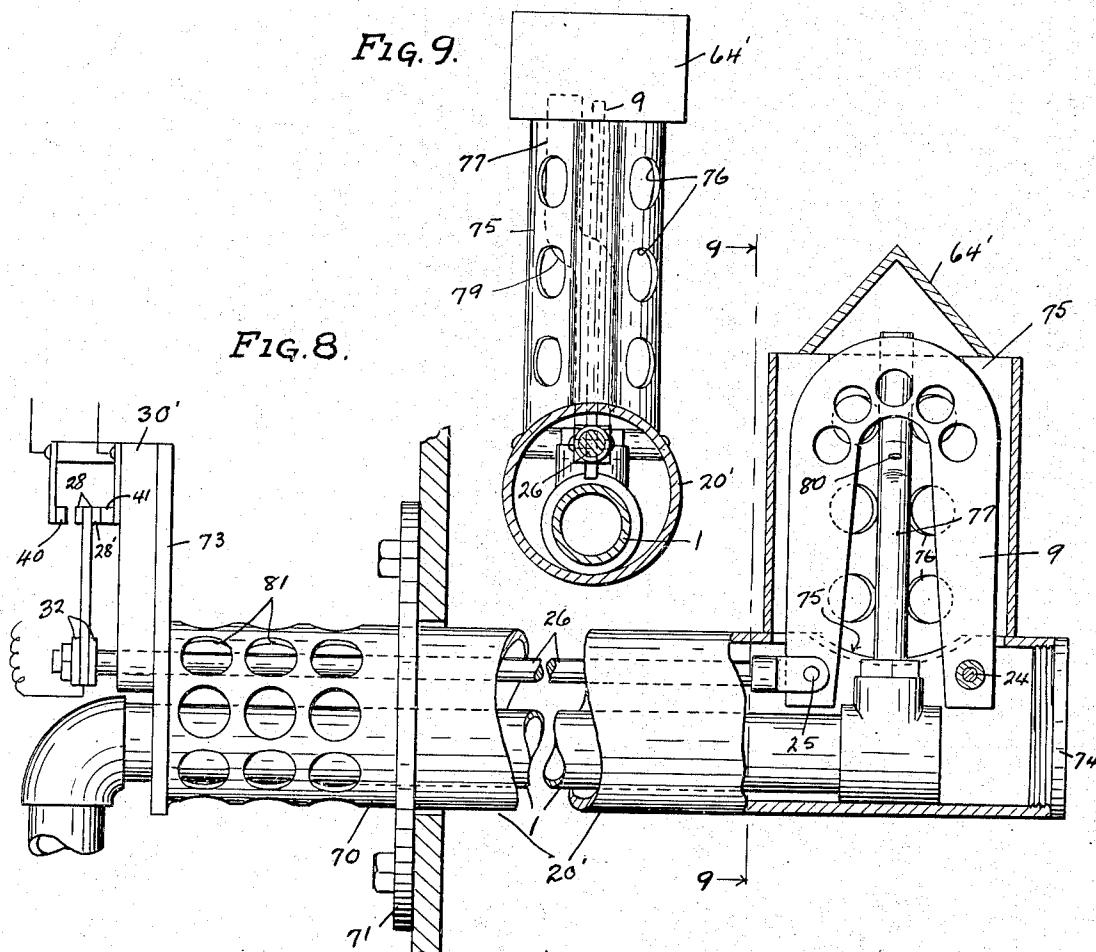
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UNITED STATES PATENT OFFICE

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FLUID FUEL BURNER DEVICE

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9 Claims. (Cl. 158—117.1)

This invention relates to gas pilot burners generally and has for one of its objects the provision of means associated with the pilot burner for rendering objectionable air currents ineffective for extinguishing the burner flame. Another object is to provide means for controlling the effective heating zone of the pilot flame for controlling the supply of gas to the main gas burner. Other objects will appear in the following specification.

In the drawings, Fig. 1 represents a side view of one form of the invention partly in section and partly in diagrammatic form.

Fig. 2 is a sectional view of Fig. 1 taken along the line 2—2 thereof.

Fig. 3 is a plan view of the device associated with the pilot burner of Fig. 1.

Fig. 4 is a side elevation of a different form of device for use in association with a pilot burner.

Fig. 5 is a side view of the pilot burner device of Fig. 4 as seen at right angles to Fig. 4.

Fig. 6 is a plan view of a device similar to that of Fig. 5, with slots in the top of the device.

Fig. 7 is a side view of a still different form of device from that of Figs. 1 to 6 inclusive, but closely resembling the previous showings in many respects.

Figs. 8 and 9 are views of another form of the invention.

Referring first to Figs. 1 to 3 inclusive, the gas to the pilot device is conducted through a pipe 1 having an inlet 2 at one end and a vertically disposed discharge nozzle or burner 3 at the opposite end, which nozzle is formed with a restricted neck and a flaring mouth as indicated in Fig. 1. The nozzle 3 discharges into the lower end of a vertically extending conduit 6 positioned parallel to and alongside a vertically extending, open ended tubular body 7.

The body 7 is generally cylindrical in cross section and has its two opposite sides formed with longitudinally extending outwardly extending portions 4 providing inwardly opening outwardly extending recesses 8 along opposite inner sides of the cylindrical body, which recesses extend from end to end of the body and are respectively adapted to receive one of the legs of a vertically disposed horseshoe-shaped heat responsive thermostatic element 9 of flat metal as described and shown in my United States Patent No. 2,064,909, dated December 22, 1936. The recesses 8 are sufficiently deep to permit movement of the legs of the horseshoe-shaped element in a direction outwardly of each other when the inner arch of the element is heated.

Conduit 6 is secured along the outside of one of the projections 4 and is open at its opposite ends, the upper open end of said conduit terminating close to the upper end of body 7, while the lower end may project below the lower end of said body or may terminate at some point below the level of the inner arch of the horseshoe-shaped element. Intermediate the open ends of conduit 6 is a laterally extending by-pass or duct 10, such as a short open ended pipe that communicates between the interior of conduit 6 and the inside of body 7 at a point below the inner arch of the horseshoe-shaped element 9. This pipe 10 extends at one end through the projection 4 on the body 7 and is slotted as at 11 to conform to the recess 8 to pass the one leg of the horseshoe-shaped element.

Conduit 6 is interiorly provided with a baffle 12 projecting inwardly from one side to a point opposite the opening of duct 10, which baffle extends only about half the distance across the passage through the conduit, so as to direct some of the gas passing through the conduit into duct 10 and to a point below the inner arch of the horseshoe-shaped element where combustion takes place, since air is free to pass into the body 7 through its lower open end and also some air is mixed with the gas at the burner nozzle 3 since the external diameter of the nozzle is smaller than the internal diameter of conduit 6. A portion of the gas also passes out of the upper open end of conduit 6.

Extending over and spaced above the upper openings of body 7 and conduit 6 is a plate of gable-like form comprising oppositely extending downwardly inclined plates 13, 14, the plate 13 extending over the body 7 and plate 14 extending over conduit 6, and the two plates being joined at the apex of the gable at a point above the body 7. Plate 14 is connected at its portion adjacent its lower edge to the outer side of the conduit, and plate 13 is connected to opposite sides of the body 7 by vertically extending plates 15 extending downwardly from the opposite inclined edges of plate 13. The side edges of plate 14 are free of any depending plates, thus permitting gas coming out of the open ends of conduit 6 and body 7 to pass out from under the gable at the opposite ends of the apex of the gable at the connection between plates 13, 14. Also the sides support the lowermost edge of plate 13 spaced above the upper edge of body 1 so as to provide a passage for gas between the lower edge of plate 13 and the body and between plates 15.

The construction comprising the conduit 6, 55

body 7, and its top plates 13, 14, comprises an integral structure that is supported in proper position relative to nozzle 3 on the outer end of a pipe 20, which pipe is above and parallel to gas pipe 1. The pipes 20 and 1 are supported at one end by a casting 21 which casting is formed with the inlet 2.

The outer end of pipe 20 is slotted on its upper and lower sides at 23 to receive the lower ends of the horseshoe-shaped element 9, one of the legs of said element being secured to the outer end of the pipe 20 by a pin 24, and the other leg being pivoted at 25 to the outer end of a shaft or rod 26, which rod passes through pipe 20 and projects from the inner end thereof where it is connected to a spring arm 27 at a point intermediate the ends of the arm. One end of arm 27 is provided on opposite sides with electrical contact members 28, 28' respectively, and the opposite end of the arm is secured at 29 to a block 30 of suitable electrical insulation material. Block 30 is suitably secured to the outer side of casting 21, which casting in turn is secured against the outer side of the furnace wall as indicated, the wall being provided with an opening 18 to pass the pipes 1, 20 to the inside of the furnace. The connection between rod 26 and arm 27 is suitably insulated at 32.

Between pipes 1 and 20 is a tube 33 of electrical insulation and refractory material, which tube extends through casting 21 at one end to outside the furnace and the opposite end of the tube terminates adjacent the body 7, said tube being secured in spaced relation to pipes 1 and 20 by suitable clamps 34, which clamps also serve to hold said pipes rigid in properly spaced relation.

The tube 33 carries through it a relatively heavy electrical conductor 36 of non-corrosive, heat-resistant material, the one end of the conductor being secured at 35 to the casting 21 outside the furnace, and the opposite end of the conductor extending upwardly alongside the body 7 and terminating at its upper end close to the upper open end of said body but with a gap between the body and the termination of the conductor so that a spark across the gap will ignite the gas should the burner be extinguished for any reason. An insulating member 37 is provided alongside the body 7 through which the conductor passes, which member is secured to the body by any suitable clamping means such as clamp 38 and screws 39, as best seen in Fig. 2.

Block 30 on casting 21 is provided with a pair of electrical contact members 40, 41 positioned respectively on opposite sides of contacts 28, 28', which contacts 40, 41 are suitably secured to block 30 by suitable posts 40', 41' respectively. When the pilot burner is extinguished, or the flame is not in the zone below the inner arch of the horseshoe shaped element 9, the contacts 28', 41 are in engagement. This condition also exists when the pilot and furnace generally are not being used, as in summer time, as will later be described.

The main gas burner of the furnace is diagrammatically shown at 45, together with an electrically operated solenoid valve 46 on main gas line 47, which valve controls the flow of gas to the main burner.

The electrical circuit comprises main incoming power lines 48 connecting with a transformer 49 from which one line 50 connects with contacts 28, 28' through post 29 and arm 27. The other line from the transformer, indicated at 51, con-

nects with one of the terminals of the solenoid of valve 46 and also by a branch 51' with one of the terminals of a primary coil in box 52. The opposite terminal of the primary coil connects by line 53 with terminal 41 through post 41'. One terminal of a secondary coil in box 52 connects with the inner end of the conductor 36 at a point outside the furnace by line 54, and the other terminal of the secondary coil is grounded at 55. Casting 21 is grounded at 56. The conductor 36 is, of course, suitably insulated from the casting.

The contact 40 is connected by line 58 with one of the terminals of a temperature responsive thermostat 57, positioned in one of the rooms of the building the furnace is intended to heat, and the opposite terminal of the thermostat connects by line 59 with the other terminal of the solenoid valve. A suitable switch 60 may be provided on the incoming power lines 48.

The particular type of valve 46 and thermostat 57 are not shown in detail, but may be one of the many types that are used in which the valve controlling the flow of gas to the main valve is controlled by temperature variations in the atmosphere in the rooms of the building, and closes by means of a spring, as is common in the art, when the electrical circuit is broken.

In operation, when the gas pressure in the lines is normal and safe, and the pilot is lighted, combustion takes place within the body 7 at a point below the inner arch of the horseshoe-shaped element 9 and also at the upper end of conduit 6, the flame being directed by the covering plates 13, 14 in opposite lateral directions from under the apex of the covering plates so as to direct the flame to burners 45 on either side of the body.

Air for combustion of the gas passes into the conduit and body 7 through their lower ends respectively as already described.

When the flame is burning normally below the inner arch of the horseshoe-shaped element, the inner edge of the element is always heated more than the opposite edge, and the legs of the element tend to move apart, thus the contact 28 is moved to engagement with contact 40 and the circuit is closed through thermostat 57 and the valve 46 and transformer 49, it being assumed that switch 60 is closed. Thus the valve 46 is free to open and close under control of the room thermostat.

Assume that the pilot flame is extinguished, by blowing of the gas under sudden excessive pressure or by failure of gas or for any other reason, the heat being removed from under the arch of the horseshoe-shaped element will result in the legs thereof coming together upon cooling of the element and contacts 40, 28 will be broken, while contacts 28', 41 will be made. Thus the circuit through the coil in box 52 will be made and sparks will be produced at the upper end of body 7 to ignite the gas as soon as the flow is resumed. The relative movement of the legs of the horseshoe-shaped member is very rapid, and only from about 6 to 8 seconds elapse after extinguishment of the pilot flame before contacts 28', 41 engage, and while the fire box is intensely hot.

It is manifest from the foregoing that the main gas valve 46 cannot possibly be actuated, other than manually, when the pilot burner is extinguished, since the circuit thereto is broken until reestablished through actuation of the horseshoe-shaped element.

It may now be assumed that the gas pressure drops to say about 1 inch of water, which is unsafe for furnace burner operation. This results

in the gas in the conduit 6 passing directly out of the open upper end of the conduit, since the baffle therein is not sufficient to direct the gas into the body 7. The flame thus being removed from below the inner arch of the horseshoe-shaped element, the circuit through the solenoid valve is broken, the valve is automatically closed, and all gas to the main burner is cut off until the gas pressure is increased sufficiently to make ignition safe.

On the other hand, should there be an abnormal increase in gas pressure, the point of combustion of the gas in body 7 rises and the combustion takes place at the upper ends of the body and conduit 6. Such increase sometimes results in the main burners being extinguished, with disastrous results. Immediately upon the zone of combustion rising above the inner arch of the horseshoe-shaped element said inner arch is cooled relative to the outer arch and the leg of said element that is connected to rod 26 moves toward the opposite leg of the element and the circuit through the solenoid valve is broken at contacts 23, 40 and the valve is automatically closed as by the heretofore-mentioned spring in solenoid valve 46 until a safe gas pressure is re-established. However, the pilot will not ordinarily be extinguished upon such rise, since the gas is deflected by the covering plate and there is adequate air to promote combustion at the upper open ends of the body 7 and conduit 6, and the electric spark between the conductor 36 and the body would be effective in any event to ignite the gas.

From the foregoing it is seen that the flow of gas to the main gas burner is controlled by my arrangement in a manner to preclude any dangerous condition existing in the furnace and to automatically reestablish the desired normal operation of the main burner when the gas flow is within safe limits. In the drawings, Fig. 1, it is thought clear that the gas line 47 leading to the main gas burner and inlet 2 to the pipe 1 leading to the pilot burner are connected with a common source of gas supply as through pipe 47'.

In Figs. 4 and 5, the same electrical hook-up including conductor 36 is used as in Figs. 1 to 3, a showing of the circuit and various electrical contacts and conductor 36 not being necessary, since such showing would be merely a duplication of elements already shown, the adaptability being obvious.

In Figs. 4 and 5 a pilot burner 61 extends into the cylindrical bore of a body member 7'. Recesses 8' are formed on opposite inner sides of said body within portions 4' the same as in Figs. 1 and 2. However, there is no separate conduit in the device of Figs. 4 and 5. The body 7' is transversely slotted along opposite sides as at 62 and 63, slots 62 being below the discharge end of the gas pilot burner and slots 63 being above the discharge end of the burner, while the space between the slots is imperforate. The covering plate in this form of device is an inverted V-shaped, roof-like hood 64 connected at the lower edges of the hood to opposite sides of the body 7'. The gas is free to pass out from under the hood at opposite sides for directing the flame to main burners at either or both sides of the body 7'. This hood can be disposed across the top of body 7' at right angles to the position shown, so as to direct the gas at a different angle such as in Fig. 7, or the hood may have slots therein as at 65 in Fig. 6. In Fig. 7 a slot 66 is shown along the apex of the walls of the covering plate and the

apex is slanted. Many such variations may be used according to how it is desired that the flame be directed. Attention is also called to the fact that the slots 63 in Figs. 4 and 5 may be eliminated, as in Fig. 7, where slots 64' are at the bottom of the body 7' and vary in width. These slots may be disposed in one position or another along the sides according to the character of the gas that is being used, and a diagonally extending slot 63' relative to slots 63 greatly assists in ignition of the gas.

I have found that with the use of the various devices disclosed that enclose the pilot burner, there is little if any objectional effect on the flame from external air currents, and a pilot such as shown in Fig. 4 burning about 24 feet of gas per 24 hour day will continue to direct the pilot flame under the element 9 in a side wind having a velocity of 15 miles per hour. This is an important feature, since a steady flame is desirable in order to properly restrict the flame to a fixed zone and the backfiring, or sudden ignition or extinguishment of the flame with abnormal force does not affect the pilot flame with my device.

In the devices of Figs. 4 to 7, it is manifest that the same control of the main gas valve is obtained in the event of excess gas pressure as in the devices of Figs. 1 and 2, although for low pressure it is not as accurate, except where there is insufficient gas to maintain the pilot lighted, since the flame is always directly under the inner arch of element 9.

It might also be noted that the pilot burner enclosing bodies 7 to 7', are formed to coact with the element 9, for positioning said bodies respectively and retaining them in proper relation to the pilot burner, and said bodies are easily removable merely by slipping them off the element 9 for adjusting or replacing the pilot burner.

It is also apparent that the movement of the rod connected to the leg of the thermostatic element 9 may be utilized to actuate an alarm or may directly operate a valve as illustrated in my copending application above mentioned, or may actuate some other device.

The device of Fig. 8 shows a form of the invention, partly in section and partly broken away and in section in which the gas supply line and operating rod 26 are enclosed within a large pipe 20', which pipe extends to the outside of the furnace wall at one end at 70. This pipe 20' may be a casting if desired, with a flange 71 thereon for securing to the furnace wall and for supporting the block 30' of insulating material at the outer end thereof on a plate 73 secured to the outer end of pipe portion 70. This block 30' supports electrical contacts similar to those shown in Fig. 1. The end of pipe 20' on which the tubular body enclosing the element 9 is positioned is closed as at 74, by a plug or other closure.

In this form of the invention the tubular body member 75 corresponding to the body 7 of Fig. 1 or the bodies 7', 7'' of Figs. 4 to 7 is formed with holes 76 along the sides instead of slots, and the lower end of the body is formed to fit the curvature of pipe 20' with an enlarged opening in the upper side of said pipe as defined by edge 75 indicated in Fig. 8 to pass the legs of the element 9 and a pilot burner 77 that connects with the outer end of the gas conduit. The burner 77 is tubular in shape as indicated, and extends upwardly between the legs of element 9. Thus the only admission of air inside the furnace to the gas outlets of burner 77 for promoting combustion of the gas is through holes 76 and under the

open ends of the inverted V-shaped covering plate 64', since the lower end of the body is blocked by pipe 20' on which the body is supported.

5 The burner 77 is of tubular form and is bent laterally at a point under the inner arch of element 9 as at 79 and then is straightened vertically to extend alongside the arched portion of the element to terminate in an open upper end at a point slightly above the upper open end of the body. The upper side wall of the bent portion 79 is provided with a relatively small opening 80 positioned directly below the inner arch of the element 9.

10 In actual practice and under normal conditions a relatively large flame will be produced at the upper open end of the burner for igniting the gas of the main burners, such as 45 in Fig. 1 (not shown in Fig. 8) and a small flame will burn from aperture 80 to keep the inner arch of element 9 heated more than the outer arch and thereby maintain the legs apart in expanded position for actuating the contacts on block 30' the same as described for Fig. 1.

15 With the structure as above described, in the event of a sudden back-firing or blowing of the main burners when coming on or when going out, there is an abnormal disturbance of currents within the furnace, such as the creation of a vacuum, which many times would extinguish the pilot burner and cause undesirable actuation of the element 9 if the burner were not protected against such conditions. To overcome this, the portion 70 of the pipe supporting the body 75 is provided with air inlets 81 which will admit air from outside the furnace at all times, these inlets coating with holes 76 to maintain a proper air mixture within body 75 under normal conditions, and also furnishing ample air to the pilot whenever the above indicated abnormal conditions exist. The body 75, of course, also acts as a shield to minimize the effect of such abnormal conditions.

20 It is thought obvious that the formation of the pilot burner itself acts similar in certain respects to the form of the invention shown in Fig. 1, in that the aperture 80 is so proportioned that a decrease in pressure in the gas line to say 1 inch of water, will result in the flame at aperture 80 being substantially extinguished, the main flow of gas going out of the open end of the burner. Thus the heat will be removed from under the inner arch and the element 9 will move to actuate the main gas valve through electrical connections and contacts as described in Fig. 1.

25 Having described my invention, I claim:

1. In combination, a vertically positioned tubular body, a pilot burner having a flame aperture in a gas pressure line, said pilot burner being disposed within said tubular body with its flame aperture at a point spaced from the ends thereof, the walls of said body being imperforate at the level of said flame aperture for shielding flame developed at said aperture against side drafts, a cover plate over the upper end of said body formed to provide a laterally directed flame outlet at the side of the body at its upper end and to dampen the effect of vertical drafts and an air inlet at the lower end of said body below said flame aperture for admitting air to said body for mixing with gas from said aperture to normally promote combustion within the upper end of the body below the flame outlet, means enclosed within said body below said flame outlet and extending over said flame aperture responsive

to heat developed at said flame aperture for movement for doing work.

2. In a device of the character described, a shield for a pilot burner comprising a vertically disposed tubular hollow body having an air inlet at its lower end and open at its upper end and formed to admit the upper end of a vertically disposed tubular pilot burner through the lower end to within the body, a cover plate extending over the upper open end of the body of substantially inverted V-shape forming a gable-like hood over the body providing flame outlet under the ends of the hood, the side walls of said body being provided with laterally directed air inlets adjacent the upper end thereof below the aforesaid flame outlets, said side walls being imperforate for a substantial distance below said laterally directed air inlet for insuring a space within the body against the influence of side drafts.

3. In a device of the character described, a shield for a pilot-burner comprising a vertically disposed, open ended tubular member, an inverted U-shaped hood over the upper open end of the member, said member having openings formed in the walls thereof and the walls having vertically extending inwardly opening channels on opposed sides thereof, a thermo-responsive element slidably fitting within said channels and extending across between the inner opposed sides of said member, a pilot burner extending vertically within said member, said pilot burner having a flame outlet positioned below the portion of the element that extends between the sides of said member.

4. A device of the character described comprising a substantially horseshoe-shaped thermo-responsive element, a tubular body substantially enclosing said element with the arched portion of the element extending transversely across the bore of the body at one end thereof with the ends of the legs of said element at the opposite end of the body, one of the sides of said body being formed to provide spaced guide means adapted to slidably receive the outer edge of one of the legs of the element therein for preventing relative rotation of the element and body about the axis of the bore of the body, the opposite ends of said body respectively being provided with an opening and gas supply means with the body adjacent the inner side of the arched portion of the element for supplying a gas flame to the arched portion for heating said arched portion.

5. A device of the character described comprising an elongated, substantially cylindrical tubular body formed on opposite inner sides thereof with elongated recesses extending longitudinally of the body, a horseshoe-shaped thermo-responsive element within said body with the legs thereof disposed within the recesses and the arched portion of the element extending across one end of the bore of said body between the recesses and the ends of the legs projecting outwardly of the opposite end of the body, a gas burner having a flame aperture, said aperture being positioned adjacent the inner side of the arched portion of the element between the legs of the arched portion for supplying a flame for heating the arched portion of the element.

6. In a device of the character described comprising a generally vertically extending tubular body, having a vertical bore therein extending from end to end and the ends of said bore opening outwardly of the body at the top and bottom

ends thereof, a thermoresponsive element positioned within said bore and extending transversely thereacross adjacent the upper end of the bore, means for a conduit for conducting fuel gas into the bore, said conduit being provided with a pair of flame apertures respectively positioned above said element and below said element and the upper aperture being formed and positioned to directly produce a flame at said aperture at a point outwardly of the upper end of said bore and the lower flame aperture being adapted to produce a flame at a point within the bore of said body for heating said element.

7. In combination, a fire box having a generally vertical side wall, a generally horizontally extending air conduit extending from said wall inwardly into the fire box, said air conduit being provided with an air inlet at one end opening outwardly of said wall and upwardly directed air outlet at the opposite end within the fire box, a generally vertical open-ended tubular housing supported on said opposite end of the air conduit with its lower open end over said air outlet, a gas supply pipe within said air conduit extending outwardly thereof at one end outwardly of said wall and provided with a vertically extending tubular gas pilot burner at the opposite end disposed within said tubular housing, a thermoresponsive element within said housing positioned over said pilot burner to receive heat from the burner when the latter is ignited and responsive to changes in temperature for movement, a member connected to said element for movement thereby upon movement of the element in response to changes in temperature, said member being disposed within said air conduit and extending outwardly thereof and outwardly of said wall, gas control means outwardly of said wall, and gas control operating means connecting between said member and said gas control means for actuating the control means upon movement of the member to control the flow of gas to said pilot burner said pilot burner being formed with a flame aperture adjacent the upper end thereof and an opening in the wall of said housing at a point below said flame aperture for admitting air from the firebox to said burner in addition to the air entering said air conduit.

8. In combination, a gas supply pipe provided

with a gas outlet, a generally vertically extending tubular pilot burner extending from said outlet provided with a pair of flame apertures at different heights, one being, lower than the other, said burner having a through passageway from said outlet to the uppermost aperture with the lower aperture communicating with said passageway, a thermo-responsive element positioned to receive heat developed from a flame at the lower aperture of the pair when the gas is ignited at said aperture, but out of direct influence of flame at the upper aperture, said element being responsive to heat developed at said lower aperture for movement for doing work, a cover plate extending over and spaced above said pair of apertures and generally vertical walls enclosing said apertures and depending from and supporting said cover, said walls and cover forming a housing and said housing having a laterally directed opening at substantially the level of said upper aperture and substantially at the juncture between the cover and said walls for emission of flame from said upper aperture.

9. A device of the character described, an elongated tubular gas pilot burner provided with a single, continuous through passageway and a flame aperture at one end and a gas inlet at the opposite end, a second flame aperture communicating with said passageway and positioned between the inlet and the flame aperture at said one end, a thermo-responsive element disposed over said second flame aperture responsive to heat from a flame at said second aperture, the walls of said passageway being formed adjacent the point of communication of said second aperture therewith to deflect a portion of the gas passing through said passageway toward said second flame aperture and the portion of the passageway between said second flame aperture and the aperture at the end of the burner being offset to one side of the said element and extending past said element for conducting the gas therein past said element, means substantially enclosing said thermo-responsive element and said second flame aperture and a flame deflecting cover plate spaced above and extending over both of said flame apertures.

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