April 4, 1939. J. K. CLARK 2,152,790

AUTOMATIC SAFETY PILOT BURNER

Filed Sept. 17, 1936 2 Sheets-Sheet

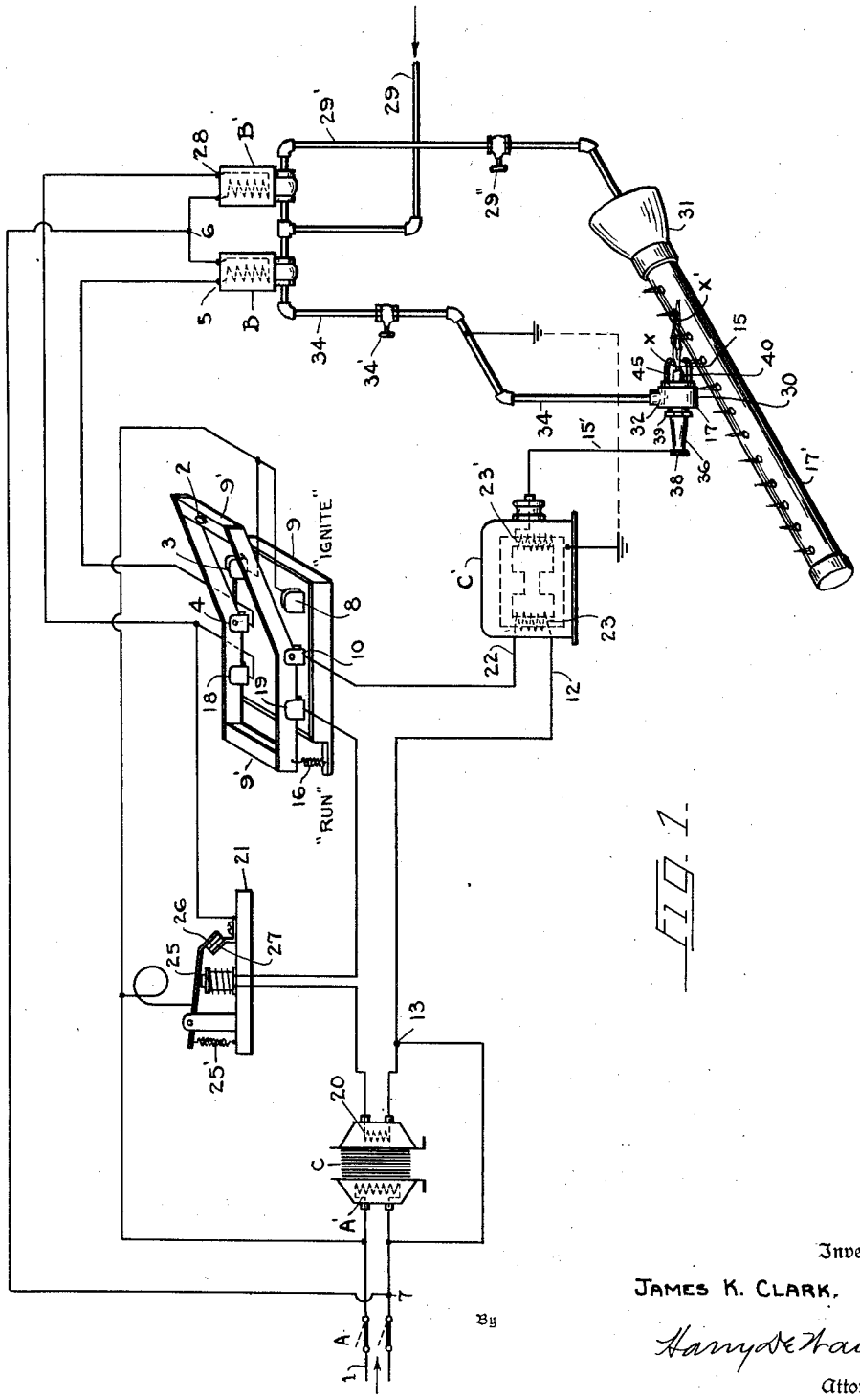


FIG. 1.

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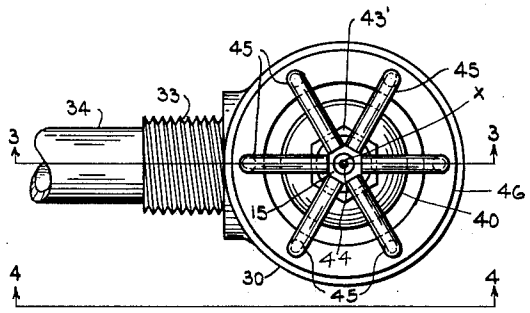


FIG. 2.

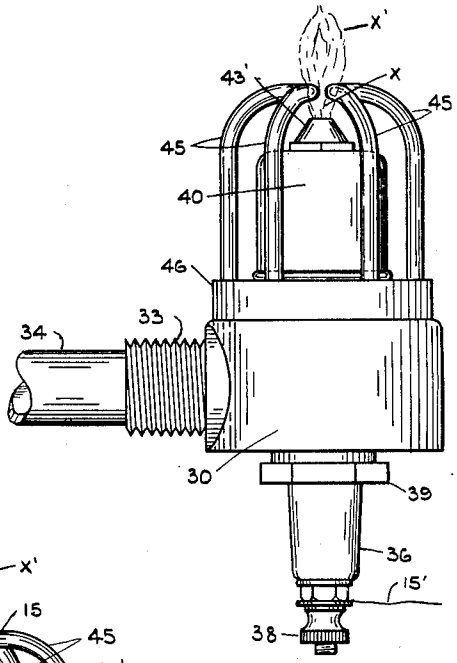


FIG. 4.

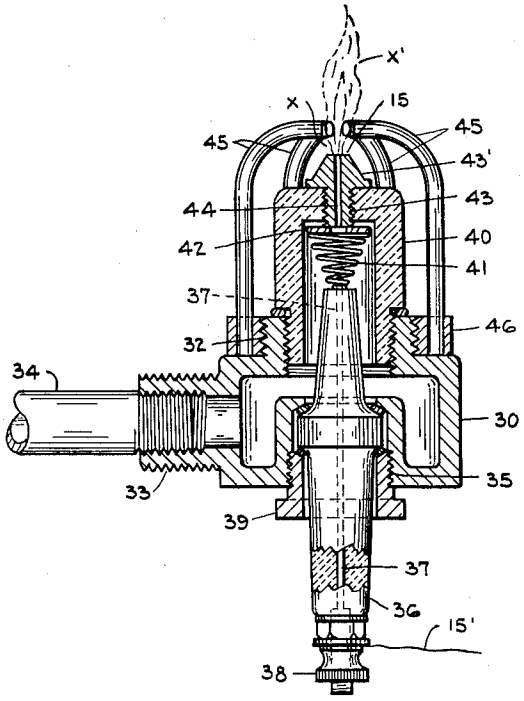


FIG. 3.

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Patented Apr. 4, 1939 2,152,790

UNITED STATES PATENT OFFICE

2,152,790

AUTOMATIC SAFETY PILOT BURNER

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Application September 17, 1936, Serial No. 101,247

6 Claims. (Cl. 158—117.1)

This invention pertains to gas-burning furnaces, ovens and the like.

A primary object of the invention is to provide a novel safety gas valve to shut off automatically the entire gas supply, in the event of a failure of gas, the extinguishment of a constantly burning pilot flame, or the failure of the electric current supply. The failure of any one of these might constitute a serious hazard, if permitted to continue.

Another object is to provide new and useful electrical means to ignite automatically the pilot burner and to turn on the main gas valve, in order to initiate the heating cycles.

Another object is to provide an electrical system embodying spaced electrodes, across which the current from the secondary winding of a transformer may jump, in order to light the pilot burner.

Other objects of the invention will become more apparent as the description of the invention proceeds.

The preferred manner in which I desire to disclose my invention is herein shown in the accompanying drawings, in which:

Fig. 1 is a diagrammatic representation of the preferred form of a furnace heater equipped with electrical means for controlling the fuel supply for both the furnace and the pilot burners;

Fig. 2 is a top plan view of the safety pilot burner;

Fig. 3 is a vertical section taken on the line 3—3 of Fig. 2; and

Fig. 4 is a side elevation of the pilot burner, taken in the direction of the arrows shown in Fig. 2.

Referring now to the drawings in detail, 1 represents the source of alternating current, which leads to the automatic safety pilot burner by means of a main line switch A, which leads to the primary winding A' of a step-down transformer C, whose secondary winding 20 connects with the coil of a series relay 21 which is provided with an armature 25. The secondary winding is also connected with a high voltage transformer C'.

9 represents a switch of the double pole, double throw, momentary contact type, which may be manually operated by means of push button 2, to initiate the heating cycles. This switch comprises two spaced arms or blades, connected by insulating cross-bars 9', said blades being pivoted respectively at contacts 4 and 10. The blades are adapted to make contact at one time with poles 3 and 8, and at another time with poles 18 and 19. In the running position of the switch 9, the blades are kept in contact with poles 18 and 19 by means of the spring 16; but when the blades are moved to the igniting position by pressing the button 2, the blades make contact with poles 3 and 8 and spring 16 is placed under tension. Immediately following the ignition cycle, and upon release of pressure on button 2, the blades return to the poles 18 and 19 under the action of the spring 16.

Band B' represents solenoid operated valves, which are operated to open position by solenoids but are self-closing. The valves are placed in branch pipes 34 and 29', forming branches of the main gas supply pipe 29. A valve 34' is interposed in the branch pipe 29' through which gas flows to the main burner 17' through a conventional gas and air mixer 31. The valves 29'' and 34' are intended for manually turning on and turning off the gas supply, to begin or end a heating interval.

The passage of current through the primary winding of transformer C, causes a low voltage to be induced in the secondary winding 20, said low voltage, the size or magnitude of the spark gap x and the main line voltage bearing such a relationship to each other, that, if said induced low voltage be applied to the primary winding of the transformer C', a voltage or potential will be set up in the secondary winding 23', of such a value that it is incapable of jumping across the spark gap x when air alone is present within said spark gap. If full line voltage be applied to the primary or transformer C', a voltage or potential will be set up in the secondary winding of the same, of such a value that it is capable of jumping across the same spark gap x when air alone is present within said spark gap. However, the presence of a flame within the spark gap x will reduce the electrical resistance of the spark gap x to such an extent that when the aforesaid low voltage is applied to the primary winding of the transformer C', the voltage induced in the secondary winding 23' is sufficient to cause a small current to flow in the secondary winding and through the flame x' and across the spark gap x.

Thus, the removal or extinguishment of the pilot flame x' causes the cessation of the electric current flow across the spark gap x. Furthermore, with the said small current flowing through the secondary winding of the trans-

former C' and through the flame and across the spark gap x, the current flow in the circuit of the primary winding of transformer C' and the coil of the series relay 21 and the secondary winding 20 of transformer C is approximately larger than the current of the flame gas as is the turn ratio of transformer C'. This current is sufficient to close the relay 21, thus joining the armature 25 with contacts 26 and 27 and completing a circuit from the electrical supply at A to the solenoid valves B and B', energizing them and causing them to open. Should the pilot become extinguished, current could no longer pass across the gap x and the current flowing in the aforesaid circuit of the primary winding of C', the coil of the series relay 21 and the secondary winding of C will be reduced to a very small amount due to the high resistance or impedence of the primary winding of C' when no current is flowing in the secondary winding of same. This will cause the relay to open, thereby, breaking the circuits to the solenoid valves B and B' and shutting off the entire gas supply.

The operation of the system is as follows:

When transformer C is energized by supplying current thereto from supply A, push button 2 is pressed down, to cause the blades on switch 9 to join the poles 3 and 4 and poles 8 and 10. The circuit then extends from source A to 3, through switch 9 to pole 4, thence to 5 and through the coil of the solenoid B to 6, thence back to 7 and to source A. During this interval, solenoid valve B is opened to admit gas from supply line 29, to the pilot burner 17. Simultaneously, another circuit is established from source A to pole 8, to pole 10, to 22, through the primary winding of transformer C' to 12, to 13 and back to 7 and source A.

Current flowing in this latter circuit excites the transformer C' to produce a high voltage at 15, to cause a spark to jump across the spark gap x and thence to the pilot burner 17, through the metal gas pipe to the ground connection on said pipe, and thence to the secondary winding of transformer C'.

The passage of the spark at spark gap x ignites the gas at the pilot burner 17. Pressure on button 2 is suspended and switch 9 is returned to the running position, that is, the blades connect poles 4 and 18 and 10 and 19 respectively. Current then feeds through the secondary winding 20, through the coil of the relay 21 to pole 19, to pole 10, to 22, through the primary winding 23 of C', to 12, through 13 to 20. Since the pilot burner is ignited, a small current flows across the spark gap x, which is sufficient to actuate the armature 25 of relay 21, so that armature 25 contacts 26 and 27, completing a circuit from source A to 26, to 27, to 28, through coil B' to 6, to 7, to A. Simultaneously, another circuit is established from A to 26, to 27, to pole 18, to pole 4, to 5, through coil B, to 6, to 7, to A. These last mentioned circuits cause solenoid valve B and B' to open, admitting gas from the supply pipe 29, to the pilot burner 17 and heating burner 17'. This condition continues until the pilot burner is actually or accidentally extinguished, in which event, the current in the circuit 20, 21, 22, 23, 12, 13, 20 is reduced to such an extent that the relay coil can no longer overcome the armature spring 25', whereupon contacts 26 and 27 are broken. This destroys the circuits A, 25, 26, 27, 28, 6, 7, and A, 25, 26, 27, 18, 4, 5, 6, 7, causing solenoids B and B' to operate to close the valves and shut off the gas supply for the pilot and main burner.

Solenoid valve B is held open by pressing button 2 of switch 9, and will close during the period of time required for the switch 9 to pass from the "ignite" position to the "run" position, and for relay 21 to close. This is a very short interval of time but there is sufficient residual gas remaining in the gas pipe between the solenoid valve and the pilot burner 17, to keep the latter ignited during this very brief interval.

By providing the type of switch shown at 9, it is seen that this switch functions constantly in one or more of the electrical safety pilot circuits.

The pilot burner 17 (see Fig. 3) comprises a hollow body 30, which is formed with an upwardly facing internally and externally threaded nipple 32, a lateral similarly threaded nipple 33 which is supplied with raw gas by the branch 34 of the pipe 29, and a downwardly facing internally threaded opening 35 in which is disposed a porcelain insulator 36 that protects a metal electrode 37, that extends axially in the porcelain, and whose bottom end is equipped with a binding-post 38 to which the line 15' connects and forms one side of the spark gap x. The porcelain 36 is held in place by a gland-nut 39, which threads into the bottom opening of the body 30. In order to further insulate the high tension electrical parts of the pilot burner 17, an inverted cup-shaped cylindrical lava part 40 whose reduced bottom end is threaded, screws into the nipple 32, which is axial to the porcelain 36. The top end of the electrode member 37 is fitted with a spring 41, which is capped with a washer 42 that frictionally engages the reduced lower end of a threaded metal conductor of terminal 43, having an axial gas passage or orifice 44, which forms one side of the spark gap x. This produces a continuous sole and free passage for the gas delivered by the branch 34 of pipe 29. The spark gap x is then completed by the top end 43' of the terminal 43 and a plurality of equally spaced metal electrodes 45, which are anchored in a threaded collar or nut 46 that screws onto the nipple 32. The upper ends of the electrodes 45 are preferably equally spaced and bent inwardly radially so as to facilitate the certain crossing of the gap as the various exigencies of the pilot burner arise. By the provision of the relatively large number of the electrodes 45 and the regular spacings of their free tips, a ring of metal is formed that alines axially with the terminal 43, and the other insulating supports render failure of the pilot burner 17 practically impossible.

Having thus described my invention, what I claim is:

1. In combination, a pilot burner, spaced electrodes disposed adjacent to said pilot burner and adapted to have gas pass around and between them, a heating burner capable of burning a mixture of gas and air, an electrical control system for said pilot burner including an electrically actuated valve for passing gas to said pilot burner, a second electrical control system having included therein said spaced electrodes and means for passing sparks across said electrodes for igniting the gas flowing to said pilot burner, a third electrical control system for said heating burner including an electrically actuated valve for passing gas to said heating burner, when and only when a flame is present at said pilot burner, said third electrical control system including means controlled by the resistance offered by the burning gas of said pilot burner between said elec-

trodes for varying all of said control systems to stop the operation of said burners, said control systems including a single biased rockable switch element serving when operated in one position to ignite said pilot burner and when operated in another position to maintain said pilot burner flame and the heating burner flame.

2. In combination, a pilot burner, spaced electrodes disposed adjacent to said pilot burner and adapted to have gas pass around and between them, a heating burner capable of burning a mixture of gas and air, an electrical control system for said pilot burner including an electrically actuated valve for passing gas to said pilot burner, a second electrical control system having included therein said spaced electrodes and means for passing sparks across said electrodes for igniting the gas flowing to said pilot burner, and a third electrical control system for said heating burner including an electrically actuated valve for passing gas to said heating burner, when and only when a flame is present at said pilot burner, said third electrical control system including means controlled by the resistance offered by the burning gas of said pilot burner between said electrodes for varying all of said control systems to stop the operation of said burners, said control systems including a common switch serving when operated in one position to ignite said pilot burner and when operated in another position to maintain said pilot burner flame and the heating burner flame.

3. In combination, a pilot burner, spaced electrodes disposed adjacent to said pilot burner and adapted to have gas pass around and between them, a heating burner capable of burning a mixture of gas and air, an electrical control system for said pilot burner including an electrically actuated valve for passing gas to said pilot burner, a transformer capable at one time of supplying a high voltage and at another time a lower voltage, said high voltage being of a value that will produce a spark to ignite the gas at said pilot burner or pass between said electrodes when no flame is present, said lower voltage being of such a value that a spark can pass between said electrodes when a flame is present at said pilot burner, a second electrical control system having included therein said spaced electrodes and means for passing sparks across said electrodes for igniting the gas flowing to said pilot burner, and a third electrical control system for said heating burner including an electrically actuated valve for passing gas to said heating burner, when and only when a flame is present at said pilot burner said third electrical control system including means controlled by the resistance offered by the burning gas of said pilot burner between said electrodes for varying all of said control systems to stop the operation of said burners.

4. The combination in accordance with claim 3, in which said control systems include a common switch serving when operated in one position to ignite said pilot burner and when operated in another position to maintain said pilot burner flame and the heating burner flame.

5. The combination in accordance with claim 3, in which said control systems include a single movable means in circuit therewith, serving when in one position to ignite said pilot burner and when in another position to maintain said pilot flame and the heating burner flame.

6. The combination in accordance with claim 3, in which said control systems include a single spring biased rockable element in circuit therewith, serving when in one position to ignite said pilot burner and when in another position to maintain said pilot flame and the heatng burner flame.

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