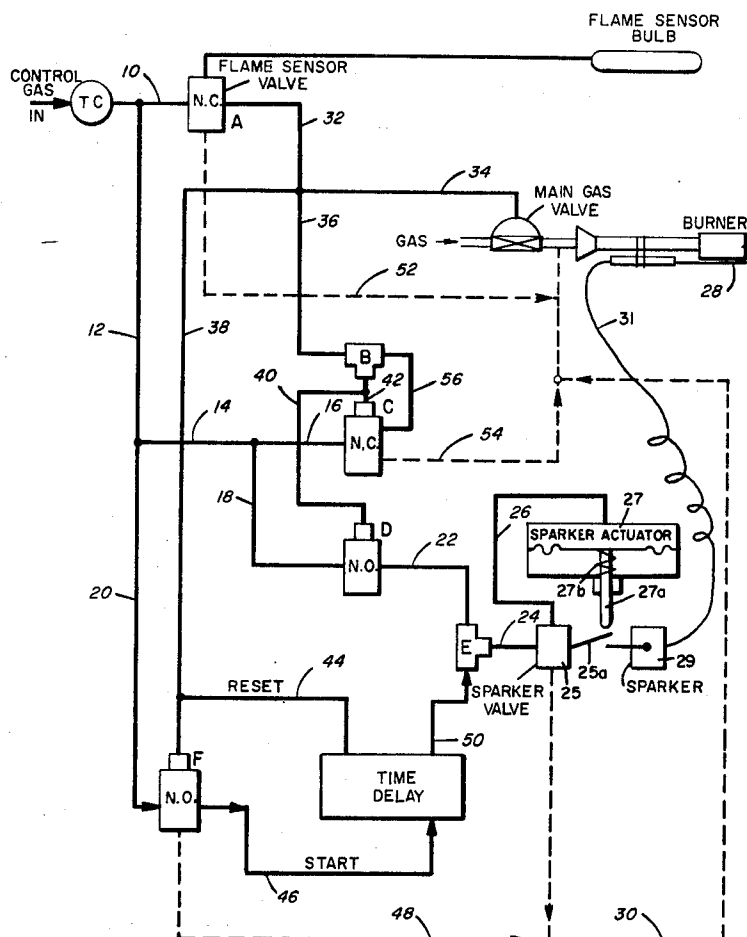


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[22] Filed **Dec. 26, 1968**
[45] Patented **June 1, 1971**
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[56] **References Cited**
UNITED STATES PATENTS
2,305,242 12/1942 English..... 431/44
3,172,456 3/1965 Glasgow et al..... 431/27
3,344,835 10/1967 Hodgson 431/74
Primary Examiner—Frederick L. Matteson
Assistant Examiner—Robert A. Dua
Attorney—Head and Johnson

[54] **PILOTLESS AUTOMATIC IGNITION DEVICE**
1 Claim, 7 Drawing Figs.
[52] U.S. Cl..... **431/74,**
431/27, 431/70, 431/44
[51] Int. Cl..... **F23n 5/02**
[50] Field of Search..... 431/74, 27,
70, 71, 44

ABSTRACT: The gas supply to a burner to ignite same is used as the source of energy for ignition eliminating the usual pilot light. A time delay and safety interlock provide for gas shut-off in the event of burner flame-out. The apparatus includes gas controlled flame sensor valve and time delay mechanism and the system is adaptable to existing equipment using a pilot light as the ignitor and in which the pilot does not continue burning.



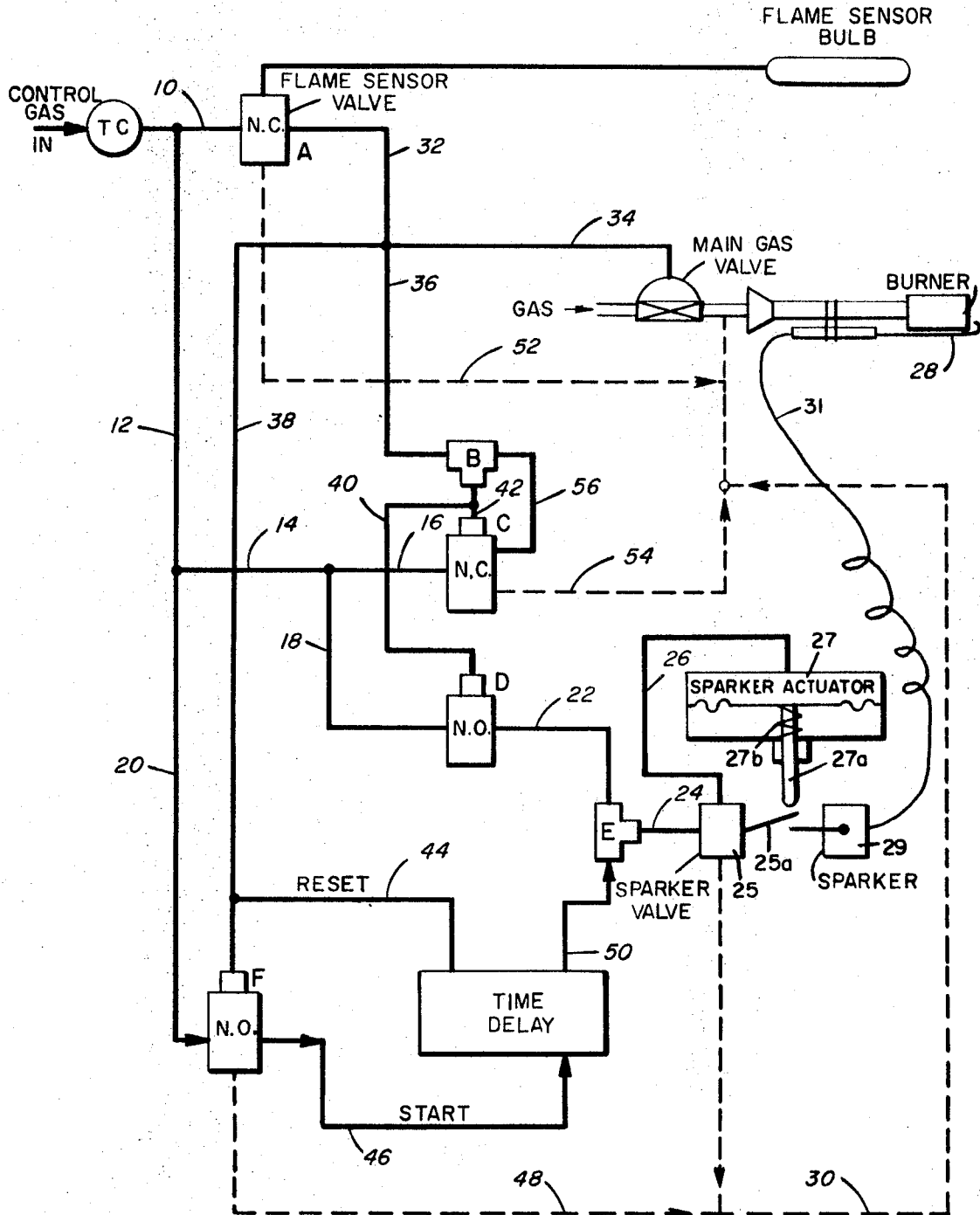


FIG. 1

_____ SUPPLY LINE
 - - - - - EXHAUST LINE
 N.C. NORMALLY CLOSED
 N.O. NORMALLY OPEN

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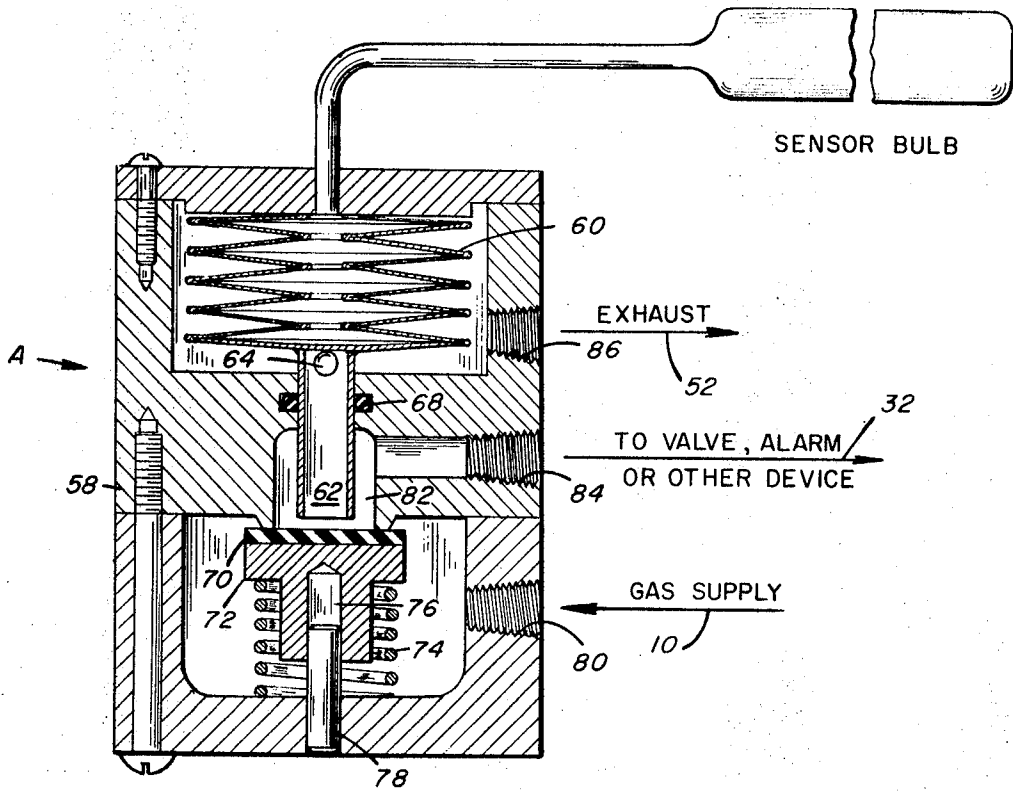


FIG. 2

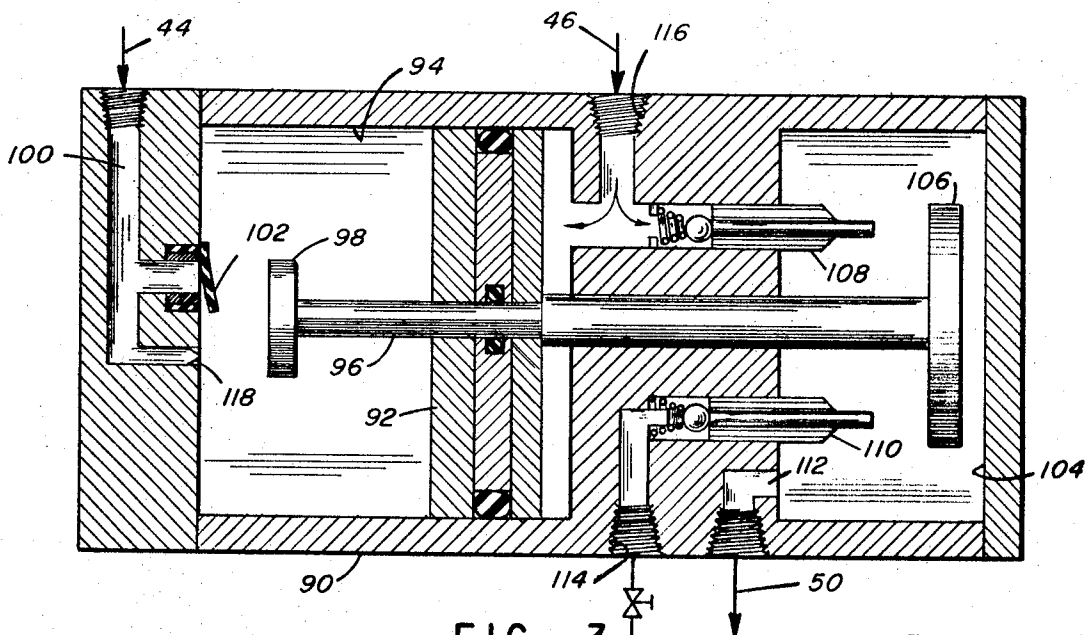


FIG. 3

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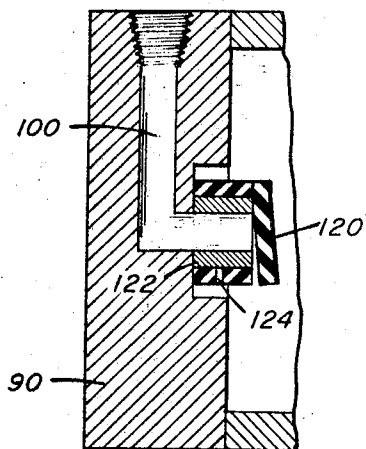


FIG. 4

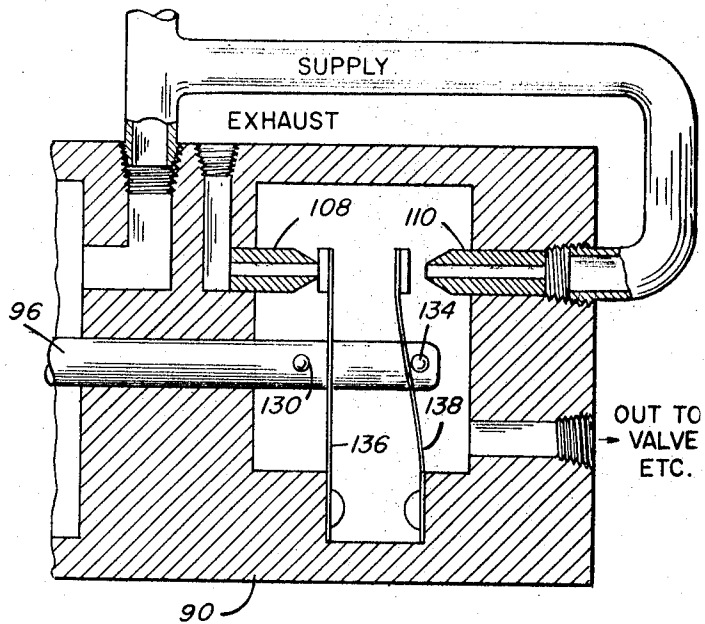


FIG. 5

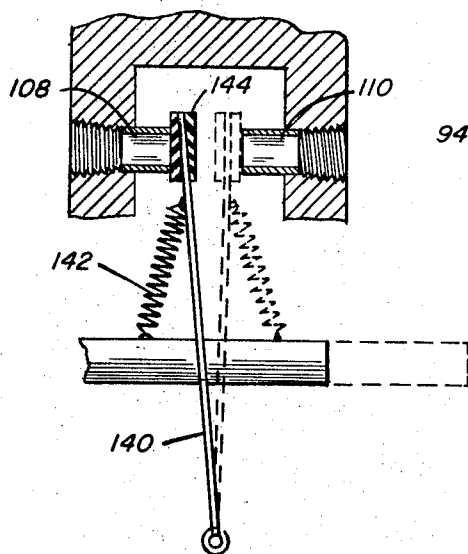


FIG. 6

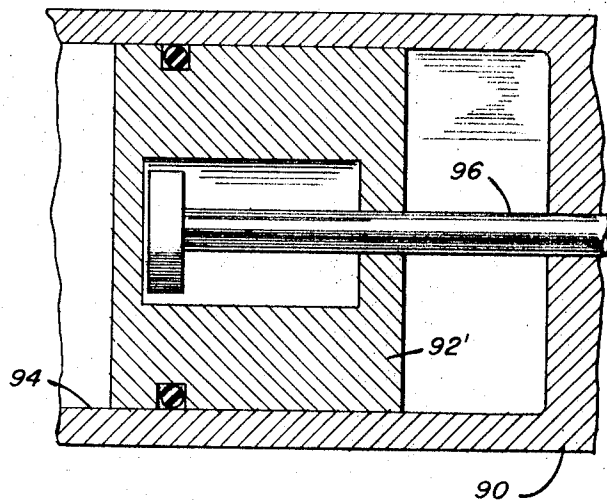


FIG. 7

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PILOTLESS AUTOMATIC IGNITION DEVICE

CROSS-REFERENCE TO RELATED APPLICATION

This application is an improvement over U.S. Pat. No. 3,344,835 issued Oct. 3, 1967.

BACKGROUND OF THE INVENTION

Others in the art heretofore, as U.S. Pat. No. 3,172,456 Glasgow, et al., and U.S. Pat. No. 2,305,242 English, have taught ignition and control systems for burners, but invariably have required a separate pilot light for the main burner. Such systems and others even using a pilot light have not provided for sufficient safety interlock and ignition time delay in the event of burner flameout. Burner ignition systems must be capable of initiating combustion at a burner for all conditions of accidental flameout and normal ignition upon heat demand yet be interlocked sufficiently to the particular condition.

SUMMARY OF THE INVENTION

This invention provides apparatus for igniting gas burners in the event of flame-out conditions and demand for gas continues. Suitable time delay and safety interlock mechanism prevents gas accumulations and explosion hazards prior to reignition.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a schematic view of the system incorporating the invention.

FIG. 2 is a schematic illustration of a flame sensor valve as used in this invention.

FIG. 3 is a sectional view of a gas powered time delay mechanism and valve for use in this invention.

FIG. 4 is a partial sectional view of an alternate restriction and check valve used in the time delay device of FIG. 3.

FIGS. 5 and 6 depict the alternate valve actuating mechanism used in the time delay of FIG. 3.

FIG. 7 is an alternate arrangement of piston and piston rod interconnection.

Before explaining the present invention in detail, it is to be understood that the invention is not limited in its application to the details of construction and arrangement of parts illustrated in the accompanying drawings, since the invention is capable of other embodiments and of being practiced or carried out in various ways. Also, it is to be understood that the phraseology or terminology employed herein is for the purpose of description and not of limitation.

DESCRIPTION AND OPERATION OF THE PREFERRED EMBODIMENT

Referring to FIG. 1, control gas is supplied to a temperature controller or thermostat, TC. If the temperature controller is placing a demand for heat and the burner is not lit, control gas to the burner is supplied through TC and conduit 10 to a flame sensor valve A, (normally closed) and through conduits 12, 14, 16, 18 and 20 to respective valves C (normally closed), D (normally open) and F (normally open). Because valve D is open, gas will flow through conduit 22 to a double check valve or shuttle valve E, thence through conduit 24 to a three-way sparker valve 25. Valve 25 includes actuator arm 25a to one of three positions: no flow, flow to exhaust 30, or flow to the diaphragm actuator 27. Gas flow through conduits 24 and 26 forces the diaphragm and arm 27a of spark actuator 27 downward against the spring 27b. The downward movement of arm 27a in turn actuates a piezo electric cell type sparker 29 of the type sold under the trade name "CLEVITE," creating electrical energy through electrical conductor 31 to a spark gap rod 28. The reciprocating action continues until ignition of the burner. The spark thus being created at the terminal end of the burner. On alternate strokes of the sparker valve arm, 25a, gas is exhausted into conduit 30 which enters the main burner downstream of the main gas valve which at this point is closed. After sufficient gas has accumulated at the

burner, ignition occurs. The flame sensor bulb reacts thence to open the flame sensor valve A which in turn causes the main gas valve to receive control gas by way of conduits 32 and 34. Because gas is further flowing through conduits 36 and 38, valves C, D and F are actuated. This occurs respectively by flow through shuttle valve B thence through conduit 40 to close valve D with subsequent pressure buildup actuating through conduit 42 to open valve C. In closing valve D the sparker system is shut off. Valve F further is closed and because flow is diverted from conduit 38 into conduit 44, the time delay mechanism is reset to a start position. Excess gas is exhausted through conduit 48 communicating with conduit 30 to enter the burner.

In the event that the burner flame should go out, accidentally or otherwise, and the thermostat TC is still demanding heat, valve A will close as the flame sensor bulb cools. The main gas valve thence closes and valve F opens permitting flow through conduit 46 to start the time delay. After the end of the given time delay, which will allow for adequate purge of accumulated gas, gas will flow from conduit 46 through the time delay through conduit 50 into the shuttle valve E and actuating the sparker system as previously described.

An important feature of this invention is the time delay until sparking is desired. This necessitates maintaining valves C and D in the operated condition, that is, respectively open and closed. This occurs by gas flow through conduits 14 and 16 through the open valve C, into conduit 56 through shuttle valve B and conduits 40 and 42 to maintain the valves in the aforesaid operating condition. Valve D is provided for the primary purpose of furnishing motive power for the sparking system when the thermostat TC calls for heat. Valve C is provided as a safety interlock to operate valve D and prevent premature ignition upon burner flame out. Hence the sparker system operates only after a desired time delay, and in this embodiment the gas flow is through the valve as described in FIGS. 3-7.

Although the sparking system shown in this invention is of a reciprocating type, it is to be understood that a fluid flow motor type as described in U.S. Pat. No. 3,344,835 may be substituted therefor. It is to be noted that the system permits exhaust gas from valve A through conduit 52 and exhaust from valve C through conduit 54 directly into the burner.

Although the system has been described and is preferred in new installations to be used only with a main burner and without a secondary pilot burner, it is to be understood that the invention is adaptable to existing installations which include a separate pilot light for the main burner. As such, the pilot may become the ignition system wherein exhaust and the spark gap ignitor are fed to the pilot in lieu of the main burner as shown herein. Once ignition has taken place the pilot burner will cease to function.

FLAME SENSOR VALVE

Referring now to FIG. 2, the flame sensor valve A is shown in greater detail. In operation when sensor bulb becomes heated the gases therein cause expansion of bellows 60. Attached to the lower end of the bellows is tubing 62 which is open at its bottom end and includes one or more openings 64 at its upper end adjacent the bottom side of the bellows. An O-ring seal 68 is provided in the passageway of bodies 58. The lower end of tubular member 62, upon further expansion of the bellows, strikes and seals closed against the rubber or resilient seat 70 of valve 72 which operates against spring 74. A guide opening 76 of the valve 72 telescopes about guide pin 78 to maintain the valve coaxially. Upon its movement communication of gas is provided from conduit 10 and its connection 80 into chamber 82 thence outward through connection 84 into conduit 32 to valve C, for example or in some instances other than the system described herein may be connected to an alarm or other mechanism adapted to operate upon heat being supplied to the sensor bulb. Upon cooling or in the event the burner has gone out the reverse cycle takes

place and upon contraction of the bellows 60 the valve member 72 will close the openings 82 and any gases remaining in conduit 32 or the chamber will be exhausted through opening 64 into line 52 at connection 86.

TIME DELAY AND VALVE

In FIG. 3 the gas operated time delay and valve is described and includes a housing 90 within which is a piston 92 operable within cylinder 94. The piston is appropriately sealed not only to the outer periphery but also about valve actuating rod 96, the piston sliding relative thereto until it strikes the end member 98 of the rod. In order to reset the mechanism of this invention in the cycle as heretofore described, gas enters through the conduit 100 of the body opening the flapper type check valve 102 and moving the piston to the right along the shaft 96 until an abutment on the shaft will move both piston and shaft. The other end of the shaft operates within a chamber 104 and includes a valve actuator 106 which is used in conjunction with the inlet valve stem 108 and exhaust valve stem 110. An outlet 112 is also provided from the chamber 104. When used in the embodiment of FIG. 1 there is no need for an exhaust valve, only the outlet 112 which connects with conduit 50 to the spark system. In other instances of use the exhaust valve may be desired to evacuate chamber 104 or to relieve pressure therein. Moving valve actuator 106 to the right will open exhaust valve 110 and close inlet supply valve 108. In this position the time delay mechanism is reactivated or reset upon demand. Upon appropriate supply of gas through conduit 46 to connection 116 the piston moves to the left as fast as gas can exhaust through the desired fixed restriction 118 where it is exhausted into the burner. Near the end of its stroke the piston 92 strikes the end portion 98 of the piston rod moving the valve actuator accordingly to open the inlet supply by removing the ball check valve therefrom and simultaneously closing the exhaust 110. As such gas will now flow through conduit 116, valve 108 through opening into chamber 104 and out opening 112 into conduit 50 to the spark system mechanism as heretofore described.

An alternate reset opening and restriction mechanism is shown in FIG. 4. Reset gas supply is introduced into the reset port through conduit 44. A rubber flapper 120 is fastened on one side of a rubber tube or sleeve which covers a sintered metal restrictor sleeve 122. Opening of the rubber flapper allows gas to enter the cylinder pushing the piston to the right and resetting the time delay mechanism. During the time delay stroke of the piston, gas to the left of the piston is exhausting from the chamber through a calibration hole 124 in the rubber sleeve thence through the sintered metal restrictor 122 exhausting outward through conduit 100. Other forms of valve mechanism may be used, as for example a long tapered needle valve instead of the restriction 118 as shown in FIG. 3.

FIG. 5 shows a further embodiment for opening and closing the operating valve during the time delay sequence and the reset thereof. In this instance piston rod 96 includes transverse pins 130 and 134, which are operable in conjunction with metal spring valve levers 136 and 138 operable respectively to open and close valves 108 and 110. That is, when the piston

rod 96 is reset and moved to the right, this will open valve 108 and close exhaust 110 since pins 130 will strike leaf spring 136 while leaf spring 138 is biased to close the valve 110. The pins are positioned on the piston rod such that the exhaust port 108 is closed before the inlet port 110 opens. An additional embodiment is shown in FIG. 6 using a single leaf spring 140 which is attached to the piston rod by way of spring 142. A resilient pad is provided at 144 to open and/or close the respective valves 108 and 110. As such in this position the valve becomes a snap acting device upon movement of the piston rod in either direction.

The embodiment of FIG. 7 shows an alternate piston arrangement wherein piston 92' instead of sliding about the piston rod as shown describes a device which eliminates having any packing around the piston rod in its connection with the piston rod.

What I claim is:

1. An automatic fluid fuel burner ignition system comprising, under conditions of no heat from said burner:
 - a burner having a spark rod insulatively positioned adjacent said burner to form a spark gap therewith,
 - a main fluid fuel supply conduit to said burner controlled by a pilot or diaphragm actuated valve, and a control fluid fuel supply to actuate said ignition system,
 - means to sense heat from said burner interconnecting with a sensor valve (A) interrupting said control fuel supply and adapted to be normally closed under said condition,
 - means to create a spark across said gap using the flow of said fluid fuel as a motive force, the exhaust of which enters said burner for ignition,
 - time delay valve means operable in the event of accidental burner flame-out to delay passage of fluid fuel to said spark creation means,
 - a spark actuating conduit providing communication of said fluid fuel from upstream of said sensor valve (A) through a normally open pilot valve (D) to said spark creation means, and
 - to a normally closed pilot valve (C) used to control said normally open pilot valve (D), and
 - through a normally open pilot valve (F) to said time delay means;
 - a valve control conduit downstream of said sensor valve (A) providing fluid fuel pressure from said sensor valve, when open, to
 - the pilot of valve F to close same, and
 - reset said time delay means if demanded, and
 - a three-way shuttle valve B open in a first position to communicate with the pilot of valve D to close same, and to the pilot of valve C to open same, and
 - to the pilot of said main gas valve to open same;
 - conduit means from the outlet of valve C to said shuttle valve B in a second position closing said control conduit and communicating with said pilots of valves D and C to maintain same respectively closed and open, and
 - exhaust conduit to said burner from said valves F, C and sensor valve A.