

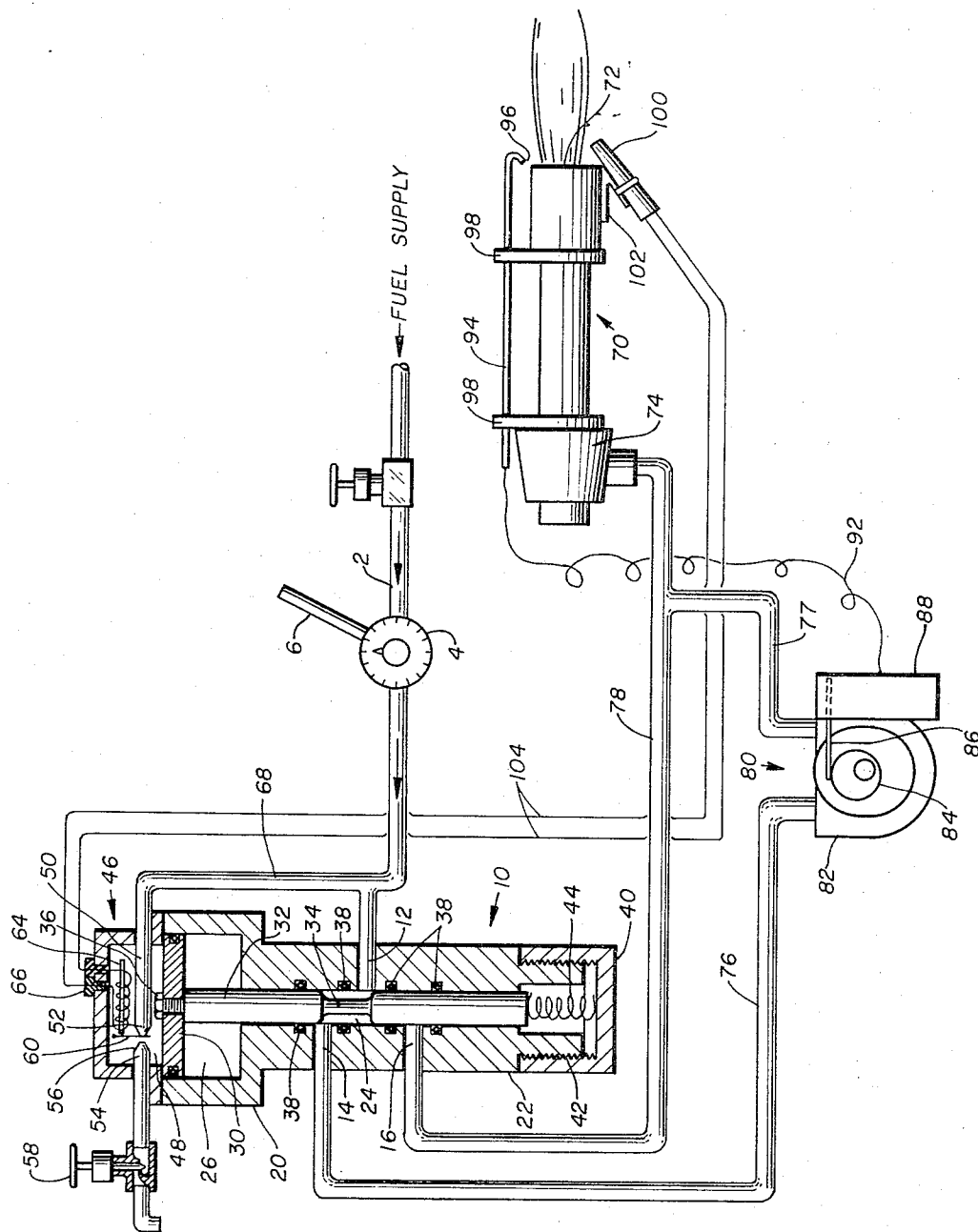
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PILOTLESS AUTOMATIC IGNITION APPARATUS

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PILOTLESS AUTOMATIC IGNITION APPARATUS
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This invention relates to improvements in fuel gas burning control systems, and more particularly relates to a burner ignition device employing a high voltage spark stream at the burner tip, said spark stream being generated by the flow of fuel.

In the prior art many kinds of fuel gas systems will be found using in combination, a main burner flame governed by a thermostatically responsive control means over the fuel supply conduit. To provide means for igniting the burner upon heat demand from the thermostatically responsive control means, a continuous burning pilot light is usually provided in the proximity of the main burner tip. Should the pilot light be extinguished by any means while the main burner is off, then when heat is called for, the main burner has an output of fuel gas without a pilot light to cause ignition. This causes an obvious dangerous situation.

To overcome the situation described above, it has long been the practice to provide a safety means such as a thermocouple located in the pilot flame connected electrically to a fuel valve of the fuel supply conduit that is held in open position so long as the pilot light is functioning, and upon failure of the pilot light to shut down the fuel supply to the burner. While for the most part such fuel gas burning systems are well enough protected by such thermocouple installations, it is to be noted that usually some kind of re-set operation must be taken to relight the pilot and bring the thermocouple up to heat so as to generate its holding power upon the main fuel supply valve before the system is again in operation. As pilot lights are usually very small flames and subject to being destroyed with relative ease, this re-set problem is not infrequent.

Accordingly, it is a primary object of this invention to provide a fuel gas burning system whereby a pilot light is not required, yet have a main gas burner responsive to on and off conditions as controlled by thermostatically responsive control means.

Another object of this invention is to provide a fluid fuel burning system whereby the ignition of a fuel at a burner is accomplished with a spark stream, said spark generator being driven by the flow of the fuel.

Still another object of this invention is to provide a fuel switching valve having a first flow position through the switching valve to actuate a spark generator, and a second flow position upon ignition of the fuel to switch the fuel flow so as to by-pass the spark generator.

And still another object of this invention is to provide a time delay means for the fuel switching valve that will time-delay the switching of the fuel valve back to its first flow position of activating the spark generator.

And another object of this invention is to provide a thermostatically responsive control means to make the fuel burning system responsive to variable heat demands upon the system.

Other objects and advantages of this invention will become further apparent when taken with the specification and the drawing which is a schematic view of the fuel gas system as set forth in the preferred embodiment of the invention, showing still further the fuel switching valve in section.

DETAILED DESCRIPTION

In describing the preferred embodiment of the inven-

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tion illustrated in the drawings, specific terminology will be resorted to for the sake of clarity. However, it is not intended to be limited to the specific terms so selected and it is to be understood that each specific term includes all technical equivalents which operate in a similar manner to accomplish a similar purpose.

Turning now to the specific embodiment of the invention selected for illustration in the drawings, the number 2 is a fuel supply conduit connected to thermostatically responsive control means 4 having heat demand sensing element 6 which is immersed in a fluid body to be heated (not shown on drawing).

Fuel switching valve 10 has fuel supply entrance port 12, first exit port 14, second exit port 16 in a body having piston end portion 20 and plunger end portion 22. Axial bore 24 in the plunger end terminates in a large-diameter portion 26 in the piston end portion. Operable therein is piston 30, connected to plunger 32 by means 36, the plunger having an elongated reduced size portion 34. Packing glands 38 are positioned to seal between body 18 and plunger 32. Spring housing 40 is engaged to the lower end of plunger end portion 22 with thread engaging means 42. Biasing spring force 44 works between spring housing 40 and the lower end of plunger 32 to normally maintain the plunger upward in the position shown. Pneumatic relay means 46 is sealably attached to piston end portion 20, forming chamber 48. Within the chamber is pneumatic entrance conduit 50 terminating with orifice nozzle 52 in working proximity to the bleed orifice 56 of pneumatic bleed conduit 54 which is controlled by needle valve 58. Flapper 60 works between orifice nozzle 52 and bleed orifice 56 being normally held by a biasing force (not shown) against orifice nozzle 52. Thermoelectric power energized solenoid 64 operates to pivot flapper 60 uncovering orifice nozzle 52 and covering bleed orifice 56. Solenoid 64 is electrically connected for use through suitable terminal insulation and seal means 66. Fuel supply conduit 2 connects through the thermostatically responsive control means 4 with fuel supply entrance port 12 of fuel switching valve 10. Conduit 68 connects entrance conduit 50 in pneumatic relay means 46 with the fuel supply conduit 2 downstream of said thermostatically responsive control means 4.

Burner 70 furnishes heat for a furnace chamber. (Not shown.) Burner 70 includes a burner tip portion 72 and an air-fuel mixing portion 74. First conduit 76 connects between first exit port 14 of fuel switching valve 10 and the spark generator 80. The outlet conduit 77 therefrom connects to the air-fuel mixing chamber or to a second conduit 78. Second conduit 78 connects between second exit port 16 and the air-fuel mixing chamber 74.

Integrated in first conduit 76 between burner 70 and fuel switching valve 10 is spark generator 80 comprising fuel flow driven motor 82 which turns cam means 84 in turn operating lever arm means 86 operably attached to a piezoelectric cell 88 creating a spark stream which reaches spark-rod 94 through spark conductor wire 92.

Spark-rod 94 is positioned adjacent burner 70 in proper manner to create space gap 96 with burner tip portion 72, and is anchored to burner 70 by insulating means 98.

Thermocouple 100 is positioned adjacent burner tip portion 72 by anchor means 102 to produce thermoelectric power through conductors 104 to energize solenoid 64 in pneumatic relay means 46.

OPERATION

In operation, beginning with an installation as displayed in the drawing, but without a flame emanating from burner 70, heat demand sensing element 6 activates thermostatically responsive control means 4 thereby releasing fuel in conduit 2 to enter fuel switching valve

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10 through entrance port 12 which is in communication with first exit port 14 allowing fuel gas to travel in first conduit 76 through spark generator 80 driving motor 82 by the mass flow of the fuel. The outlet flow conduit 77 from fuel flow driven motor 82 thereafter admits the fuel gas into burner 70. The fuel gas pressure leaving fuel flow driven motor 82 is slightly less than at the entrance to the motor because of the energy used up in the motor to turn or rotate cam means 84. Resting upon cam means 84 is lever 86 extending from piezoelectric cell 88. When lever 86 is reciprocated, necessary pressure is exerted on the piezoelectric cell crystal stack to cause a substantially continuous high voltage spark at space gap 96, between spark rod 94 and burner tip 72, as transmitted by spark conductor wire 92. The foregoing produced spark stream ignites the fuel gas emanating from burner tip 72. Thermocouple 100 comes to operating temperature and generates thermoelectric power which is transmitted via conductor wires 106 to solenoid 64 located in pneumatic relay means 46. The solenoid 64 causes flapper 60 to uncover orifice nozzle 52 and cover bleed orifice 56 thus admitting fluid pressure to chamber 49 thereby causing piston 30 to move to a position whereby entrance port 12 admits fuel to second exit port 16 and thence to second conduit 78 connected directly to burner 70, thereby taking spark generator 80 out of operation.

As the body heated by the burner comes to a predetermined temperature, heat demand sensing element 6 sends its signal to thermostatically responsive control means 4 to cease-flow of fuel gas through fuel supply conduit 2 to burner 70. Thermocouple 100 cools and no longer generates power de-energizing solenoid 64 permitting flapper 60 to uncover bleed orifice 56 and cover orifice nozzle 52 cutting off the source of pressure for chamber 49. Pressure fluid in chamber 49 begins to dissipate through bleed orifice 56 permitting spring biasing force 44 to move plunger 32 into the position as shown in the drawing wherein communication exists between entrance port 12 with first exit port 14 of fuel switching valve 10. So long as there is no heat demand the fuel gas burner system is static.

It is to be noted that burner 70 can be used in conjunction with some suitable furnace chamber (not shown) as a heat transfer means to some fluid body (not shown). Heat demand sensing element 6 is usually immersed in that fluid body and transfers its signals to thermostatically responsive control means 4, which is pre-set for some temperature range at which the burner will shut off and become active again.

If thermostatically responsive control means 4 is a throttling type control then the fuel gas supply to burner 70 is throttled in an attempt to match the heat available through the furnace chamber, to the heat demand of fluid body. Sometimes the flame propagation rate at burner 70 becomes low and may for some unknown reasons be extinguished. To prevent raw fuel, being admitted into the furnace chamber, from building up until thermocouple 100 is cooled for reignition a time delay means is employed to guard against possibility of explosion. The rate at which piston 30, with plunger 32 attached returns to normal position, as shown in the drawing, thereby switching fuel to spark generator 80 depends upon the rate at which the pressure in chamber 49 dissipates through bleed orifice 56 and pneumatic bleed conduit 54 thereafter. To govern the rate at which the pressure in chamber 49 dissipates, needle valve 58 is employed with pneumatic bleed conduit 54 to restrict the flow therethrough as may be desired, thus creating a time delay at burner 70 between flame extinguishment and reignition.

It is to be understood that the form of the invention herewith shown and described is to be taken as a preferred embodiment. Various changes may be made in the shape, size and arrangement of parts without departing from the scope of the appended claims. For example, the

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system of this invention is adaptable for use with waste gas flare stack burners and the like.

What is claimed:

1. In a fluid fuel burning control system comprising:
 - a main burner having a burner tip portion;
 - a fluid fuel supply conduit;
 - a fuel switching valve having a fuel supply entrance port, and first and second exit ports, said valve normally positioned to provide communication with said first exit port;
 - a first conduit connecting between said burner and said first exit port;
 - a second conduit connecting between said burner and said second exit port;
 - a spark generator integrated in said first conduit so as to be driven by said fuel flow through said first conduit on its way to said burner;
 - a spark-rod connected electrically to said generator and insulatively positioned adjacent said main burner tip portion to form a space gap therewith; and
 - an actuator means to operate said fuel switching valve to a position providing communication of said entrance port with said second exit port.
2. In a fluid fuel burning control system comprising:
 - a main burner having a burner tip portion;
 - a fluid fuel supply conduit;
 - a fuel switching valve having a fuel supply entrance port, and first and second exit ports, said valve normally positioned to provide communication with said first exit port;
 - a first conduit connecting between said burner and said first exit port;
 - a second conduit connecting between said burner and said second exit port;
 - a spark generator integrated in said first conduit so as to be driven by said fuel flow through said first conduit on its way to said burner;
 - a spark-rod connected electrically to said generator and insulatively positioned adjacent said main burner tip portion to form a space gap therewith;
 - heat responsive means adjacent said burner tip portion; and
 - an actuator means connected to said heat responsive means to operate said fuel switching valve to a position providing communication of said entrance port with said second exit port.
3. In a fluid fuel burning control system comprising:
 - a main burner having a burner tip portion;
 - a fluid fuel supply conduit;
 - a fuel switching valve having a fuel supply entrance port, and first and second exit ports, said valve normally positioned to provide communication with said first exit port;
 - a first conduit connecting between said burner and said first exit port;
 - a second conduit connecting between said burner and said second exit port;
 - a spark generator integrated in said first conduit so as to be driven by said fuel flow through said first conduit on its way to said burner;
 - a spark-rod insulatively positioned adjacent said main burner tip portion to form a space gap therewith and connected electrically to said generator;
 - a thermocouple means adjacent said burner tip portion; and
 - a switching valve actuator means electrically connected to said thermocouple to operate said fuel switching valve to a position providing communication of said entrance port with said second exit.
4. In a fluid fuel burning control system comprising:
 - a main burner having a burner tip portion;
 - a fluid fuel supply conduit;
 - thermostatically responsive control means for said fuel supply according to given heat demands;
 - a fuel switching valve having a fuel supply entrance

port from said control means, and first and second exit ports, said valve normally positioned to provide communication with said first exit port;

a first conduit connecting between said burner and said first exit port;

a second conduit connecting between said burner and said second exit port;

a spark generator integrated in said first conduit so as to be driven by said fuel flow through said first conduit on its way to said burner;

a spark-rod insulatively positioned adjacent said main burner tip portion to form a space gap therewith and connected electrically to said generator;

thermocouple means adjacent said burner tip portion; and

a switching valve actuator means electrically connected to said thermocouple to operate said fuel switching valve to a position providing communication of said entrance port with said second exit port.

5. A fluid fuel burning control system as in claim 4; and a time delay means wherein said switching valve actuator means includes means to time delay the operation of said fuel switching valve from the position of communication of said entrance port with said second exit port to said normal position.

6. In a fuel gas burning control system comprising:

a main burner having a burner tip portion;

a fuel gas supply conduit;

thermostatically responsive control means for said fuel supply according to given heat demands;

a fuel switching valve having a fuel supply entrance port from said control means, and first and second exit ports, said valve normally positioned to provide communication with said first exit port, comprising;

a body having a piston end portion and a plunger end portion;

an axial bore therethrough said body having a large-diameter portion and a small-diameter portion;

said gas supply entrance port transverse to said axial bore providing communication to said axial bore small-diameter portion, said first exit port transverse to said axial bore providing communication to said axial bore small-diameter portion at a place between said gas supply entrance port and said plunger end portion of said body, said second exit port transverse to said axial bore providing communication to said axial bore small-diameter portion at a place between said gas supply entrance port and said piston end of said body;

a piston cooperatively engaged in said large diameter portion of said axial bore;

a plunger slidable within said axial bore small-diameter portion and affixed to said piston, said plunger having an elongated reduced size portion substantially midway the length of said plunger;

packing gland means within said axial bore small-diameter portion at said first and second exit ports to engage said plunger and thereby prevent backflow of fuel gas through said ports;

a spring housing threadably engaged to said plunger end portion of said body;

a biasing force means contained in said spring housing constantly urging said plunger towards said normal position whereby said elongated reduced size portion of said plunger will be positioned to provide communication between said gas supply entrance port and said first exit port;

a pneumatic relay means mounted on said piston end portion of said body to form a pressure chamber over said piston, said relay means energized by thermoelectric power to cause said plunger to move from its said normal position to a position providing communication of said entrance port with said second exit;

a first conduit connecting between said burner and said first exit port;

a second conduit connecting between said burner and said second exit port;

a spark generator integrated in said first conduit so as to be driven by said fuel flow;

a spark-rod insulatively positioned adjacent said main burner tip portion to form a space gap therewith and connected electrically to said generator; and

thermocouple means adjacent said burner tip portion to supply thermoelectric power to said pneumatic relay means and connected electrically therewith.

7. A fuel gas burning control system as in claim 6; and a time delay means wherein said pneumatic relay means includes means to time delay the operation of said fuel switching valve from the position of communication of said entrance port with said second exit port to said normal position.

8. In a fuel gas burning control system for heating a fluid body comprising:

a main burner adjacent to said body of liquid, having a burner tip portion;

a fuel gas supply conduit;

thermostatically responsive control means for said fuel supply according to given heat demands of said liquid body;

a fuel switching valve having a fuel supply entrance port from said control means, and first and second exit ports, said valve normally positioned to provide communication with said first exit port, comprising;

a body having a piston end portion and a plunger end portion;

an axial bore therethrough said body having a large-diameter portion and a small-diameter portion, said gas supply entrance port transverse to said axial bore providing communication to said axial bore small-diameter portions, said first exit port transverse to said axial bore providing communication to said axial bore small-diameter portion at a place between said gas supply entrance port and said plunger end portion of said body, said second exit port transverse to said axial bore providing communication to said axial bore small-diameter portion at a place between said gas supply entrance port and said piston end of said body;

a piston cooperatively engaged in said large diameter portion of said axial bore;

a plunger slidable within said axial bore small-diameter portion and affixed to said piston, said plunger having an elongated reduced size portion substantially midway the length of said plunger;

packing gland means within said axial bore small-diameter portion at said first and second exit ports to engage said plunger and thereby prevent backflow of fuel gas through said ports;

a spring housing threadably engaged to said plunger end portion of said body;

a biasing force means contained in said spring housing constantly urging said plunger towards said normal position whereby said elongated reduced size portion of said plunger will be positioned to provide communication between said gas supply entrance port and said first exit port;

a pneumatic relay means mounted on said piston end portion of said body to form a pressure chamber over said piston, said relay means energized by thermoelectric power to cause said plunger to move from its said normal position to a position providing communication of said entrance port with said second exit;

a pneumatic conduit connecting between said fuel gas conduit and said pneumatic relay means; and

a time delay means wherein said pneumatic relay means includes means to time-delay the operation of said fuel switching valve from the position of communi-

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cation of said entrance port with said second exit
port to said normal position;
a first conduit connecting between said burner and said
first exit port;
a second conduit connecting between said burner and 5
said second exit port;
a spark generator integrated in said first conduit so as
to be driven by said fuel flow;
a spark-rod insulatively positioned adjacent said main
burner tip portion to form a space gap therewith and 10
connected electrically to said generator; and

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thermocouple means adjacent said burner tip portion
to supply thermoelectric power to said pneumatic re-
lay means and connected electrically therewith.

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