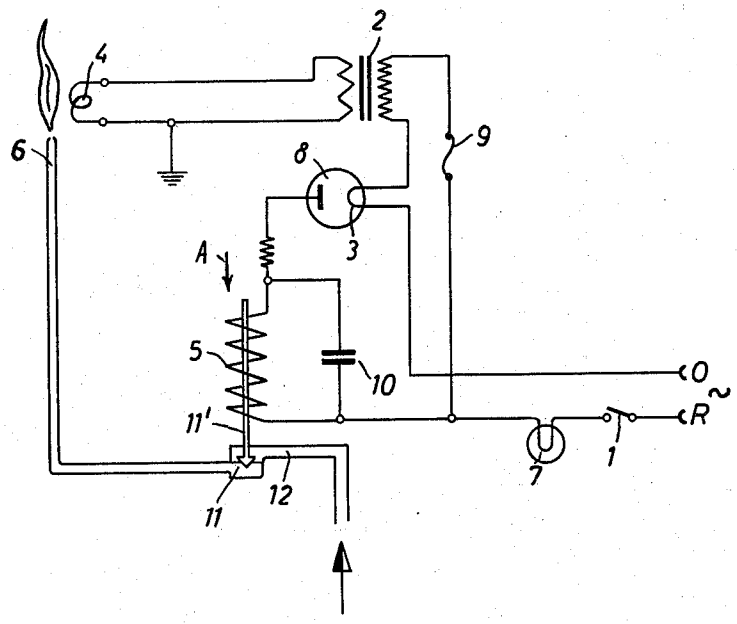
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ELECTRIC IGNITING AND FUEL SUPPLY CONTROL ARRANGEMENT FOR FUEL BURNERS

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ELECTRIC IGNITING AND FUEL SUPPLY CONTROL ARRANGEMENT FOR FUEL BURNERS

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The present invention concerns an electric igniting and fuel supply control arrangement for fuel burners which may operate for instance with gaseous or liquid fuel.

More specifically, the invention concerns an arrangement of the above mentioned type which at the same time acts as a safety device for preventing dangerous situations that may develop in the case of failures in the electric installation or in the case of interruption of the supply of electric energy.

Conventional electric igniting devices for fuel burners are operated by bimetal devices or thermo-elements, or they depend on the change of resistance in conductors carrying an electric current. It is a disadvantage of these conventional arrangements that their reaction to a change in the prevailing conditions is very slow and requires at least one to one and one-half minutes. The result of this characteristic behavior is that after the usually provided pilot flame has gone out, the fuel would still continue to flow from the burner and a mixture of fuel and air would develop which might explode when the igniting device is actuated again. On the other hand, in the reverse case the igniting device would be already in operation before the valve controlling the fuel supply is opened.

It is one object of this invention to provide for an electric igniting and fuel supply control arrangement for fuel burners which is free of the above mentioned weaknesses.

It is another object of this invention to provide for an arrangement of the type set forth which operates in such a manner that the fuel supply valve is opened only after the igniting device has been actuated effectively so that the fuel as it starts flowing from the burner is ignited immediately.

It is still another object of this invention to provide for an arrangement as mentioned above which cuts off the fuel supply immediately as soon as the igniting device is de-energized.

With above objects in view, the invention includes an electric igniting and fuel supply control arrangement for fuel burners, comprising, in combination, an electrically energizable igniter means arranged in the region of the fuel burner for igniting fuel emanating from the burner when said igniter means is energized; fuel valve means arranged in the fuel supply to said burner, said valve means being normally in closed condition and including electrical actuating means for being changed to open condition upon application of electric energy to said electrical actuating means; a source of electric energy; and electric circuit means connected between said source and said igniter means and said actuating means, and comprising electron tube means having a directly heated cathode operatively connected in series with said igniter means between the terminals of said source and having an anode connected in series with said electrical actuating means in circuit with said source, and switch means for controlling the input of electric energy into said circuit means.

It is a particular advantage of an arrangement according to the invention that not only the time sequence of the operation of the igniting device and of the fuel control valve is predetermined in accordance with the

above object of the invention, but additionally the whole arrangement is extremely simple in structure as compared with conventional devices for similar purposes. It is a further advantage that the arrangement does not contain in its circuit open contacts which are moved between current-passing and current-interrupting positions during continuous operation so that there is no mechanical wear to be expected in the control arrangement. Finally, the arrangement according to the invention has the advantageous characteristic that under all circumstances the fuel supply valve is immediately closed when the electric installation suffers any damage or when, for instance, the electrical supply from the mains should fail.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawing which is a schematic illustration of an embodiment of the invention, including a circuit diagram thereof.

As shown in the drawing, a burner **6** is connected with a fuel supply line **12**, with a fuel supply valve interposed between the supply **12** and the burner **6**. The valve comprises in conventional manner a valve stem **11'** carrying a closing head engaging a valve seat when the valve is in closed condition as illustrated. The valve stem **11'** has an extension serving as the movable armature of a solenoid **5**. In the arrangement as illustrated, the movable valve members would be normally in closing position alone under the action of gravity as indicated by the arrow A. However, biasing means, e.g., a spring, not shown, may be provided for exerting a closing force in the direction of the arrow A.

The arrangement further comprises an electrically energizable igniter, e.g., a wire or wire coil **4** which is electrically heatable to at least the igniting temperature of the fuel emanating from the mouth of the burner **6** in the region in which the igniter **4** is installed. Preferably, the arrangement comprises a transformer **2** having a primary winding and a secondary winding, the latter being connected in series with the igniter **4**. An electron tube, e.g., a diode **8** has a directly heated (filamentary) cathode **3** connected in series with the primary winding of the transformer **2** between the terminals O and R of a source of electric energy furnishing in this particular case alternating current for energizing the transformer **2**, the solenoid coil **5** is connected in series between the anode of the tube **8** and one terminal R of the source of electric energy.

For practical purposes a main control switch **1** and a tell-tale lamp **7** are connected between one source terminal O of the source and the primary winding of the transformer **2**. A fuse **9** may also be provided in the last mentioned circuit portion, and a capacitor **10** may be connected in parallel with the solenoid **5** for assuring proper operation of the latter.

When the main control switch **1** is closed, the small resistance of the still cold cathode **3** causes full energization of the igniter **4** so as to heat the latter to fuel igniting temperature before the cathode **3** is heated by the current flowing through the primary winding of the transformer to a temperature which renders the diode **8** conductive and creates an anode current through the solenoid coil **5** sufficient to move the valve stem **11'** against gravity or spring force so as to open the fuel supply valve **11** so as to cause fuel to reach the already effectively heated igniter **4** and to become ignited thereby. It is no difficulty for those skilled in the art to establish a predetermined relation between the parameters of the tube **8**, the igniter

4 and the solenoid coil 5, or also the transformer 2, in such a manner that the above described time sequence is assured.

It should be noted that if the arrangement is operated with alternating current, the operation of the solenoid valve 5, 11 is nevertheless noiseless because the direct current is rectified by the diode 8 and smoothened by a series resistor and the capacitor 10.

As can be seen from the above, the igniting arrangement will operate reliably and without any delays in the reaction of the arrangement to the start of input of electric energy. However, in addition the arrangement operates also as a safety device. Whenever the flow of current through the primary winding of the transformer 2 and/or cathode 3 is interrupted either by opening the control switch 1 or due to a damage to the diode 8 or to the transformer, the anode current of the diode 8 is immediately interrupted and the solenoid valve 11 closes automatically due to de-energization of the solenoid 5. Should a short circuit develop on the secondary side of the transformer 2 or on the primary side thereof, or even in the tube 8, the fuse 9 would blow and again the anode current feeding the solenoid coil 5 would be interrupted and the valve would close whereby a further supply of fuel is immediately prevented. Should a short circuit develop in the coil 5 of the solenoid valve 11 or in the capacitor 10, then the solenoid valve 11 would be promptly de-energized and again further fuel supply would be cut off. Should the solenoid coil suffer damage so as to prevent flow of energizing current therethrough, then again the valve would close automatically and cut off the fuel supply.

It can be seen from the above that the arrangement according to the invention is free of all the disadvantages of conventional electric igniting and fuel supply control arrangements for fuel burners, and that it operates under all circumstances promptly and without any delays while at the same time offering maximum safety under all conceivable conditions of operation.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. A fuel burning system including a fuel burner and a fuel supply means for the burner, comprising, in combination, electrically energizable igniter means arranged in the region of the fuel burner for igniting fuel emanating from the burner when said igniter means is energized; fuel valve means arranged in the fuel supply means to said burner, said valve means being normally in closed condition and including electrical actuating means for being changed to open condition upon application of electric energy to said electrical actuating means; a source of electric energy; and electric circuit means connected between said source and said igniter means and said actuating means, and comprising electron tube means having a directly heated cathode operatively connected in series with said igniter means between the terminals of said source and having an anode connected in series with said electrical actuating means in circuit with said source, and switch means for controlling the input of electric energy into said circuit means.

2. A fuel burning system including a fuel burner and a fuel supply means for the burner, comprising, in combination, electrically heatable igniter means arranged in the region of the fuel burner for igniting fuel emanating from the burner when said igniter means is electrically heated to fuel igniting temperatures; fuel valve means arranged in the fuel supply means to said burner, said valve means being normally in closed condition and including solenoid means for being changed to open condition upon application of electric energy to said solenoid means; a source of electric energy; and electric circuit means connected between said source and said igniter means and said solenoid means, and comprising electron tube means having a directly heated cathode operatively connected in series with said igniter means between the terminals of said source and having an anode connected in series with said solenoid means in circuit with said source, and switch means for controlling the input of electric energy into said circuit means.

3. A fuel burning system including a fuel burner, and a fuel supply means for the burner, comprising, in combination, electrically heatable igniter means arranged in the region of the fuel burner for igniting fuel emanating from the burner when said igniter means is electrically heated to fuel igniting temperature; fuel valve means arranged in the fuel supply means to said burner, said valve means being normally in closed condition and including solenoid means for being changed to open condition upon application of electric energy to said solenoid means; a source of electric energy; and electric circuit means connected between said source and said igniter means and said solenoid means, and comprising electron tube means having a directly heated cathode operatively connected in series with said igniter means between the terminals of said source and having an anode connected in series with said solenoid means in circuit with said source, and switch means for controlling the input of electric energy into said circuit means, the electrical characteristics of said electron tube means, of said igniter means and of said solenoid means being related to each other so that upon application of electric energy by closing said switch means first said igniter means is heated to said fuel igniting temperature and only thereafter said solenoid means is energized to change said valve means to open condition.

4. A fuel burning system including a fuel burner, and a fuel supply means for the burner, comprising, in combination, electrically heatable igniter means arranged in the region of the fuel burner for igniting fuel emanating from the burner when said igniter means is electrically heated to fuel igniting temperature; fuel valve means arranged in the fuel supply means to said burner, said valve means being normally in closed condition and including solenoid means for being changed to opened condition upon application of electric energy to said solenoid means; a source of electric energy; and electric circuit means connected between said source and said igniter means and said solenoid means, and comprising transformer means having a secondary winding connected in circuit with said igniter means and a primary winding, electron tube means having a directly heated cathode operatively connected in series with said primary winding between the terminals of said source and having an anode connected in series with said solenoid means in circuit with said source, and switch means for controlling the input of electric energy into said circuit means, the electrical characteristics of said electron tube means, of said igniter means and of said solenoid means being so chosen in relation to each other that upon application of electric energy by closing said switch means first said igniter means is heated to said fuel igniting temperature and only thereafter said solenoid means is energized to change said valve means to open condition.

5. A fuel burning system including a fuel burner, and a fuel supply means for the burner, comprising, in combination, electrically heatable igniter means arranged in the region of the fuel burner for igniting fuel emanating from the burner when said igniter means is electrically heated to fuel igniting temperature; fuel valve means arranged in the fuel supply means to said burner, said valve means being normally in closed condition and including

solenoid means for being changed to open condition upon application of electric energy to said solenoid means; a source of electric energy; and electric circuit means connected between said source and said igniter means and said solenoid means, and comprising transformer means having a secondary winding connected in circuit with said igniter means and a primary winding, electron tube means having a directly heated cathode operatively connected in series with said primary winding between the terminals of said source and having an anode connected in series with said solenoid means in circuit with said source, tell-tale light means connected in series with said primary winding, and switch means for controlling the input of electric energy into said circuit means, the electrical characteristics of said electron tube means, of said

igniter means and of said solenoid means being so chosen in relation to each other that upon application of electric energy by closing said switch means first said igniter means is heated to said fuel igniting temperature and only thereafter said solenoid means is energized to change said valve means to open condition.

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