

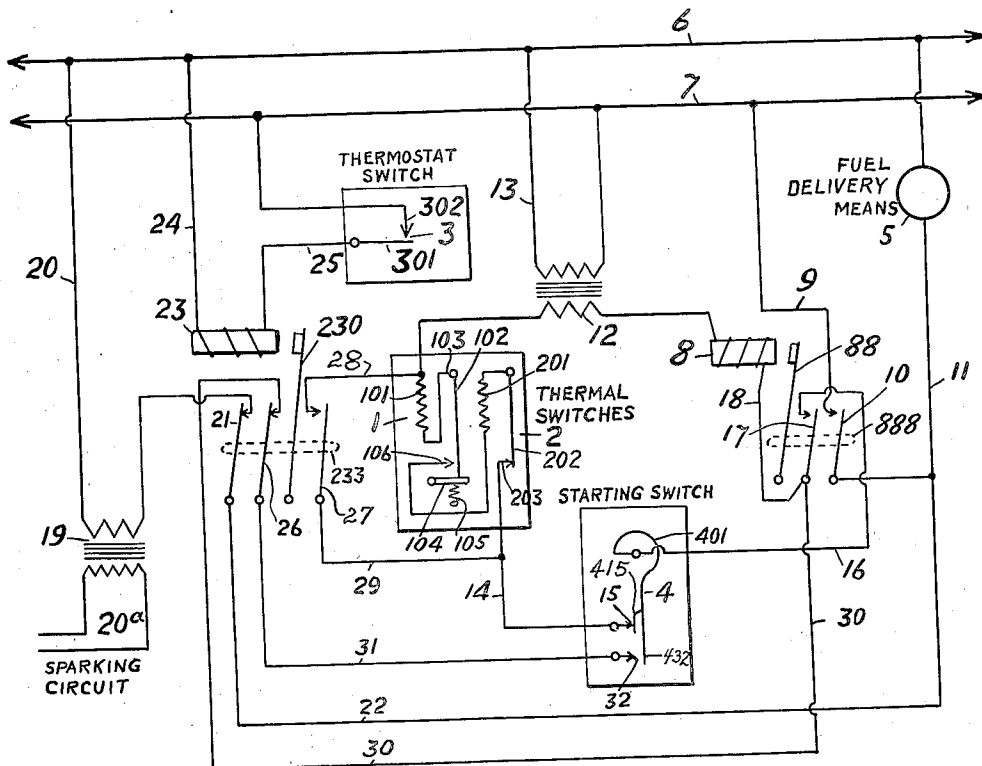
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SYSTEM OF ELECTRICAL DISTRIBUTION FOR CONTROLLING BURNERS

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WITNESS:

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SYSTEM OF ELECTRICAL DISTRIBUTION FOR CONTROLLING BURNERS

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In oil burning systems there is an electrically controlled pump which supplies oil to the burner and there is an electrically controlled igniter for the burner and there is a thermostat which controls the circuit. Assuming the burner to be unignited, the thermostat calls for heat and if it alone controlled the circuit the mixture might reach the combustion chamber and the igniter might fail for a time, which is quite common, and in that case the combustion chamber if the time is long enough fills with vapor and if then the ignition works there is trouble. Hitherto there was used a holdover shutdown switch which, in case of the failure of the ignition for an estimated period of time supposed to be limited to injection of only a safe quantity of mixture into the combustion chamber, shut down the whole apparatus and locked it in shut down position, until it was again made operative by the attendant. During the interval that the hold over switch was effective the igniter had an opportunity to operate. In other words, the thing tried once and if it failed it went out of business. There was also a switch which responded to the heat of the burner when it lighted properly and cut out or rendered ineffective the shutdown switch to which reference has been made while it was holding over and giving the igniter a chance to work.

In such systems for controlling oil burners there must be provided a combustible mixture which is lighted by an ignition spark, pilot light or the like. Necessarily the described operations, the provision of a combustible mixture of air and oil and the ignition of it, are not contemporaneous and frequently there is delay in ignition after the combustible mixture is provided and sometimes there is delay in the provision of the combustible mixture after the ignition spark is established. Such delays occur from many causes such as motor speed, spark plug troubles and other causes well known to those skilled in the art, for example, if the motor lags, the oil and air combustible mixture is not supplied to the burner in time for ignition, and if the supply of mixture is on time at the burner and the spark or ignition fails,

the burner does not function properly. Hitherto in order to overcome these difficulties a thermal switch adapted to hold the circuit closed has been provided and it was included in the circuit on starting and subsequently cut out after the mixture had been provided and ignited. The timing of the thermal switch was a compromise because sufficient time had to be allowed not only for the provision of the combustible mixture, but also for the ignition, frequently delayed, for igniting. The result was that at the expiration of this compromise interval of time the thermal switch broke the circuit and locked itself in open position so that it was necessary to reset that switch before again starting the apparatus. Again the compromise interval of time was made as long as possible to compensate for delay in ignition and it was frequently so long that enough unignited mixture had accumulated in the combustion chamber to cause upon ignition a puff or mild explosion which is objectionable in domestic use.

The principal object of the present invention is to avoid the above mentioned defects and disadvantages and to permit the apparatus to be started more than once and a number of times sufficient to compensate for delayed ignition without accumulating enough mixture to cause a puff or explosion and not more than can be readily carried off by the flue or draft of the combustion chamber, and upon completion of a sufficient number of trials to demonstrate that the equipment is out of commission, to permanently nullify further attempts to start it until after repairs have been made.

To these and other ends hereinafter set forth the invention, generally stated, may be said to comprise the employment of two thermal switches arranged in series relation and of which one is set to open at comparatively long intervals of time and to remain open, and of which the other is set to repeatedly open and close at comparatively short intervals of time until the first mentioned switch permanently opens, along with means for including the two thermal switches in the stopping and starting circuit when the

switch controlled by the combustion is open and to cut them out of that circuit or short circuit them when the burner control switch is closed.

The invention also comprises the improvements to be presently described and finally claimed.

In the description reference will be made to the single figure of the accompanying drawing which diagrammatically illustrates the invention in application to one type of oil burner circuit.

In the drawing 1 and 2 are two thermal switches arranged in series relation and of which one, 1, is set to open at a comparatively long interval of time and to permanently remain open until manually reset, and of which the other, 2, is set to repeatedly open and close at comparatively short intervals of time until the first, 1, permanently opens. These switches may consist of an element adapted to open upon the passage of current therethrough or may have, as shown, a separate heating coil associated therewith. As illustrated switch 1 comprises heating coil 101, switch blade 102 fixed at 103, latch 104, and spring 105 pressing on latch 104. Switch blade 102 is bimetallic and moves away from stationary contact 106 when coil 101 is sufficiently heated. Blade 102 is then held out of contact with stationary contact 106 until the blade is manually reset. Switch 2 is similar to switch 1 and has a heating coil 201, a fixedly mounted bimetallic switch blade 202, and a stationary contact 203. These switches in series relation are included in the starting circuit which controls fuel delivery means indicated at 5 and which in the case of pressure atomizing burners is a motor pump set, and in the case of gravity feed oil or gas burners is a magnetically operated valve. The starting switch 4, shown as a thermostatic switch having a fixed bimetallic switch blade 401, which has switch contacts 415 and 432 mounted thereon to cooperate with stationary contacts 15 and 32 respectively, but which for convenience may be regarded as operated by hand, operates to control element 5. When the starting switch 4 is operated to start the apparatus the operation of the described switches 1 and 2 may be explained as follows:

The switch 2 starts and stops the fuel supply at intervals of time so short that there is no objectionable accumulation of combustible mixture in case of failure of ignition. Failure to start after a number of repetitions of opening and closing the switch 2 indicates that there is something wrong with the apparatus requiring adjustment or attention. However, after such repetitions of operations of the switch 2, the switch 1 becomes hot enough to open and remain open permanently precluding the starting of the apparatus by the starting switch 4 until the manual

release of the switch 1 after the necessary adjustments and repairs have been made. If the burner functions properly and is ignited promptly, the switch 3 actuated by the burner or, more accurately the combustion, closes and the switches 1 and 2 are cut out. Switch 3 has a fixed bimetallic switch blade 301 and a stationary contact 302 cooperating therewith. If the burner after functioning properly fails, the thermal switches 1 and 2 are again put into the circuit by the opening of the switch 3. It may not be amiss to describe the circuits although they are merely typical.

The household circuit or main line is represented by the wires 6 and 7.

There is provided across this line a transformer having a primary 13 and a secondary 12 which supplies current for the thermal switches 1 and 2. There is also provided an electromagnetic switch having a coil 8 and a pivotally mounted armature 88 cooperating therewith and attached to a link 888 which serves to actuate the pivoted switch blades 10 and 17. Switch blades 10 and 17 and armature 88 are mounted so as to move the open circuit position under the pull of gravity or other means.

My device is also provided with a second electromagnetic switch having a pivotally mounted armature 230 and a switch actuating bar 233 connected thereto so as to actuate the pivoted switch blades 21, 26 and 27. Armature 230 and switch blade 27 are mounted so as to open under the actuation of gravity or a spring while switch blades 21 and 26 are moved to closed circuit position when armature 230 and switch blade 27 move away from coil 23 and the stationary contact which cooperates with blade 27.

There is also provided transformer 19 which supplies the current for the sparking circuit 20a.

Fuel delivery means 5 may be connected in the circuit across the mains 6 and 7 by wire 9, switch 10 and wire 11.

The starting circuit includes starting switch 4 having contacts 415 and 432. The starting circuit proceeds from switch contacts 32 through wire 31, switch 26, wire 30, coil 8, secondary 12, thermal switches 1 and 2, wire 14 and to switch contact 15.

The operation of my device will now be described.

It will be seen that when contacts 32 and 432 are closed current flows through the starting circuit just traced. Upon the passage of current through coil 8 armature 88 is attracted thereto and switches 10 and 17 close against their stationary contacts. Switch 10 closes the circuit including the fuel delivery means 5 and thus starts the operation of this fuel delivery means. Switch 17 throws a shunt 16 in parallel with 31, 26, 30. The circuit including wire 20, transformer 19 for the

sparkling circuit 20a, switch 21, wire 22, switch 10 and wire 9 is also closed so that sparks are provided for the ignition of the fuel. If the device operates properly combustion occurs at once and the heat of the combustion actuates switch 3 causing switch blade 301 to bend into contact with stationary contact 302 and to close the circuit including wire 24, coil 23 and wire 25. Passage of current through coil 23 attracts armature 230 which causes switch blade 27 to move to closed circuit position and also causes switch blades 21 and 26 to move to open circuit position. Switch 27 closes a shunt circuit including wire 28, switch 27, wire 29 and wire 14 which short circuits the thermal switches 1 and 2.

If, however, the device does not operate properly and combustion does not occur so that switch 3 is not actuated current passes through thermal switches 1 and 2 and heats the coils 101 and 201 respectively. The heat of coil 201 causes switch blade 202 to open contact at 203 at frequent intervals. Switch blade 202, however, quickly cools and again closes circuit at 203 so that frequent attempts to start the device are made. If these attempts continue in rapid succession for a predetermined time coil 101 becomes sufficiently heated and causes the switch blade 102 to open circuit at 106. Switch blade 102 is held by latch 104 in open circuit position until it is manually reset. It will, therefore, be seen that there would be no dangerous accumulation of fuel with a consequent possibility of an explosion if there is a failure of the device to start.

As shown the apparatus is out of operation.

I have shown and described the invention in application to an oil burner and from that description those skilled in the art will understand that it is applicable to a gas burner and to a pulverized coal burner and to any burner that uses fuel in gaseous, fluid or liquid form.

It will be obvious to those skilled in the art to which the invention relates that modifications may be made in details of construction and arrangement and in matters of mere form without departing from the spirit of the invention which is not limited to such matters or otherwise than the prior art and the appended claims may require.

I claim:

1. A system of electrical control for burners comprising two electrically heated thermal switches arranged in series relation and of which one is adapted on the passage of current therethrough to open after a comparatively long interval of time and to remain open and of which the other is adapted on the passage of current therethrough to repeatedly open and close at comparatively short intervals of time until the first permanently opens an igniter, an electrically

operated burner having a control switch therefor, a stopping and starting circuit including said thermal switches for closing said burner control switch and, a switch responsive to combustion to close for operatively cutting out said thermal switches when the combustion responsive switch is closed.

2. A control system for burners comprising igniter, a circuit including in series a starting switch, a normally closed electrically heated thermal switch which does not open on a passage of current therethrough until a period of time has elapsed, a normally closed electrically heated thermal switch which is adapted, on the passage of current therethrough, to open and close a number of times prior to operation of the first mentioned thermal switch, a source of power, an electrically operated fuel supply means for the burners and electrical means for controlling the same in series with said electrically heated thermal switches, means for retaining said first mentioned thermal switch in open relation once it has opened and permitting said switch to be reset manually; a thermal combustion device responsive to the combustion of the burner, a switch operated by said thermal combustion device to close and in a circuit which shunts said electrically heated thermal switches to short circuit them.

3. A control system for burners comprising a circuit including in series a starting switch, a normally closed electrically heated thermal switch which does not open on a passage of current therethrough until a period of time has elapsed, a normally closed electrically heated thermal switch which is adapted, on the passage of current therethrough, to open and close a number of times prior to operation of said first thermal switch, an electrically operated fuel supply means, an ignition device, and means for controlling the fuel supply means and the ignition device in series with said starting and thermal switches; means for retaining said first mentioned electrically heated thermal switch in open relation once it has opened and permitting said switch to be reset manually; and a circuit including a source of power, said circuit comprising a thermal combustion switch operative to close responsive to the combustion of the burner, and a switch operating means, a switch operated by said switch operating means connected in parallel with said electrically heated thermal switches to short circuit them; and a second switch operated by said switch operating means to deenergize said ignition device.

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