

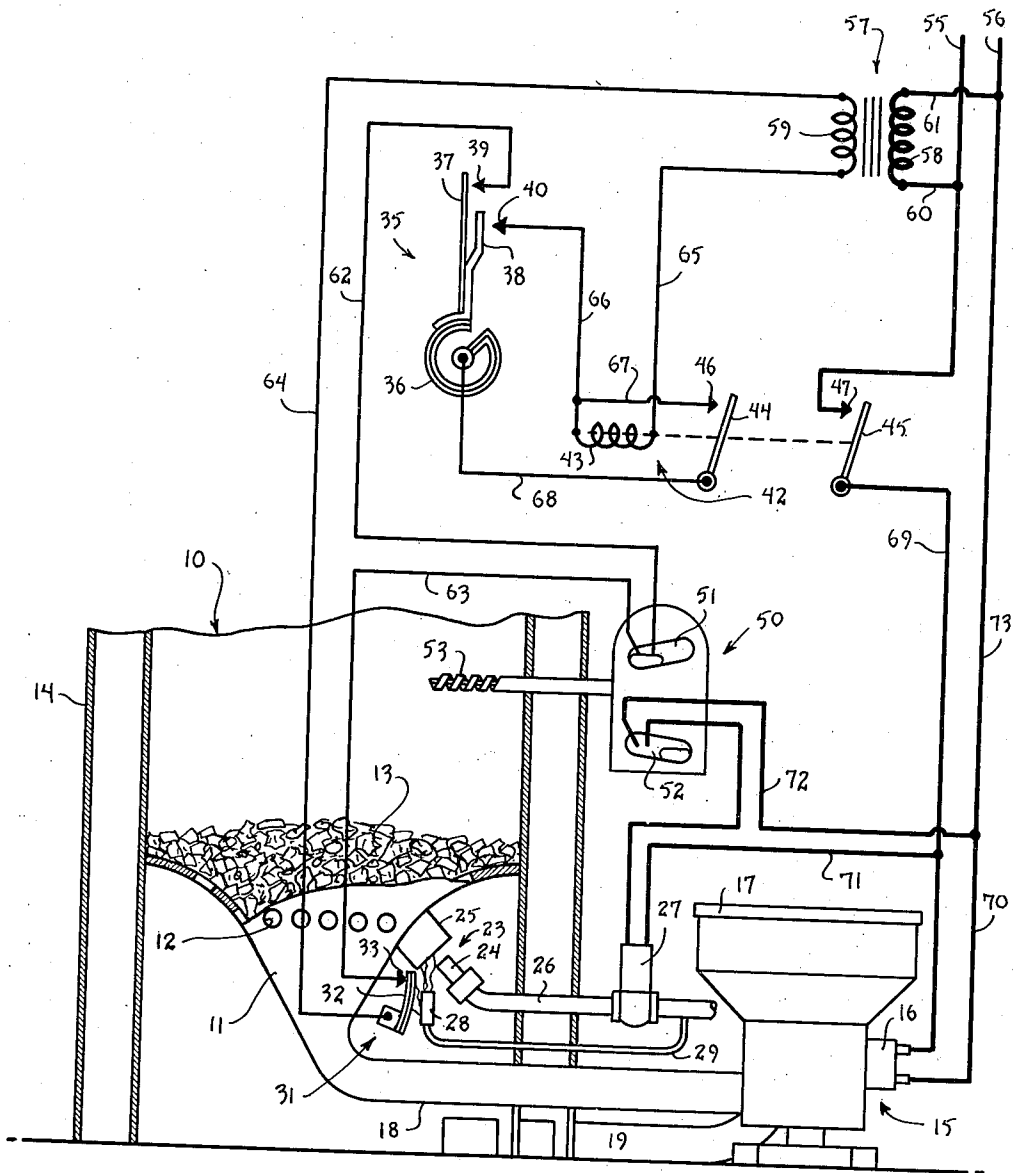
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IGNITION AND COMBUSTION CONTROL

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IGNITION AND COMBUSTION CONTROL

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Our invention relates to a system for automatically igniting solid fuel in combustion chambers, wherein the igniting apparatus is controlled in response to a thermostat or equivalent instrument.

The primary object of our invention is to provide an automatic system for initiating combustion of solid fuel and consequent heating in a combustion chamber whenever there is a demand for combustion.

Another object is to provide an automatic system having means for automatically initiating combustion of solid fuel in a combustion chamber in response to a demand for combustion, said means remaining inactive if combustion is already present.

Another object is to provide an automatic fluid fuel fired device for igniting solid fuel in a combustion chamber in response to a thermostat or the like.

Another object is to provide an automatically controlled solid fuel igniting device controlled by heat of combustion so as to cause the device to remain inactive when combustion is present.

Another object is to provide a gas fired solid fuel igniting device responsive to a thermostat and a stack switch or the like for igniting solid fuel in response to the thermostat, the stack switch preventing operation of the device if combustion already exists in the combustion chamber.

Another object is to provide a solid fuel retort arranged in combination with fluid fuel fired means for igniting fuel in the retort.

Another object is to provide a solid fuel retort arranged in combination with fluid fuel fired means for igniting fuel in the retort, the igniting means being exterior of the combustion space.

Another object is to provide a solid fuel retort in combination with fluid fuel fired ignition means for igniting the solid fuel, and safety means for the igniting means, the igniting means and safety means being exterior of the combustion space.

Another object is to provide automatically controlled solid fuel supplying means for a combustion chamber in combination with automatically controlled fuel igniting means.

The single figure of the drawing represents diagrammatically a stoker fired furnace system embodying our invention.

Referring to the drawing, we have represented at 10 a portion of a stoker fired furnace which may be of a conventional type having a retort

11 therein of a well known form familiar to those skilled in the art. The upper part of the side walls of the retort 11 has suitable openings 12 therein to permit the passage of air therethrough for purposes of combustion of the fuel 13. The furnace 10 may have a casing or jacket 14 enclosing it in a manner well known in the art. Numeral 15 designates an automatic stoker driven by an electric motor 16, the stoker being of a known type and having a hopper 17 into which the solid fuel is loaded. The stoker 15 supplies solid fuel to the retort 11 through a passage or conduit 18 within which may be located a screw conveyer or a conveyer of other suitable type. The motor 16 driving the stoker also drives a blower for providing forced draft for the furnace, the draft air being forced through a supply duct 19 communicating with the space around the retort 11 and underneath the grate 12.

Our invention is primarily concerned with means for automatically igniting the solid fuel in the retort. For this purpose we provide an igniting unit generally designated at 23 comprising a gas burner nozzle 24 and an element 25 projecting through a side wall of the retort, the arrangement of the burner nozzle 24 and element 25 being such as to form a Bunsen burner which in our particular invention may be called a gas torch. The element 25 is so arranged that air forced into the space around the retort 11 and the flame from the burner nozzle 24 are projected through the element 25 and directed so as to impinge directly on the solid fuel within the retort. The burner nozzle 24 is supplied with gaseous fuel through a conduit 26 and in the conduit 26 is interposed a magnetic type gas control valve 27. Adjacent the extremity of the burner nozzle 24 is a constantly burning pilot burner 28 which is continuously supplied with fuel through a tube 29 connected to the conduit 26 ahead of the control valve 27. Adjacent the pilot burner 28 is a safety pilot generally designated at 31 which takes the form of a bimetal element 32 which is normally heated and flexed into engagement with a fixed electrical contact 33. Whenever gas is admitted to the burner nozzle 24 it is ignited by the flame of the pilot burner 28.

Our system is primarily controlled by a thermostat 35 responsive to the temperature of air or other medium the temperature of which is affected by heat generated in the furnace 10. The thermostat 35 is of a known type comprising a bimetal element 36 arranged to actuate two flexible switch blades 37 and 38, the blade

37 cooperating with fixed electrical contact 39 and the blade 38 cooperating with a fixed electrical contact 40. The blades 37 and 38 engage their respective contacts sequentially, the blade 37 engaging contact 39 at a predetermined temperature which may be 70° for example, and the blade 38 engaging contact 40 at a predetermined lower temperature which may be 1° or 2° lower for example. Thermostat 35 controls a relay generally designated at 42 comprising the coil winding 43 which cooperates with an armature arranged to move switch blades 44 and 45 to the left into engagement with respective fixed contacts 46 and 47 when the winding 43 is energized.

Numerals 50 designates generally a control instrument which is of a known type comprising two mercury switches 51 and 52, both of which are actuable by a helical thermostatic element 53 responsive to the temperature within the combustion chamber as shown. Mercury switch 51 is normally closed and is only open when the temperature within the combustion chamber reaches a relatively high value, this switch forming a high limit switch as presently will become apparent. Mercury switch 52 is only closed by element 53 when the temperature within the combustion chamber drops to a predetermined low value indicating that combustion has receded to such an extent that it would not recover upon the addition of fresh fuel to the retort. Instrument 50 might also be a stack switch rather than a switch directly responsive to the temperature within the combustion chamber.

Power is supplied to our system from line conductors 55 and 56 which may be connected to a suitable source of external power. Low voltage power for the various instruments and control devices is supplied by a step-down transformer 57 having a primary winding 58 and a secondary winding 59, the primary winding having a greater number of turns than the secondary winding. The primary winding 58 is connected to the line conductors 55 and 56 by wires 60 and 61 respectively.

In operation, the thermostat 35 automatically controls the heating apparatus so as to supply heat whenever there is a demand made by the thermostat. In other words, the supply of fuel to the combustion chamber is intermittent as determined by the thermostat and these calls for heat may be of long duration and closely spaced or of short duration and more widely spaced depending upon the heating load imposed upon the equipment. When the load is relatively light and the periods during which the thermostat is not demanding heat are relatively long, the fire in the combustion chamber may go out entirely or may recede to such a low condition that it would not recover upon the addition of fresh fuel thereto. Assuming that the fire has gone out or has practically gone out and the thermostat 35 indicates a demand for heat, upon this occurring blades 37 and 38 will be in engagement with their respective fixed contacts and a circuit for relay 42 will be established as follows: from thermostat blade 37 to contact 39, wire 62, mercury switch 51, wire 63, safety pilot 31, wire 64, secondary 59 of transformer 57, wire 65, relay coil 43, wire 66, fixed contact 40, blade 38 back to blade 37. As soon as this circuit is established relay 42 is energized causing blades 44 and 45 to move to the left into engagement with fixed contacts 46 and 47. Engagement of

blade 44 with contact 46 establishes a maintaining circuit for coil 43 as follows: from blade 37 to contact 39, wire 62, mercury switch 51, wire 63, safety pilot 31, wire 64, secondary 59, wire 65, coil 43, wire 66, wire 67, fixed contact 46, blade 44 and wire 68 back to the thermostat 35. As will be observed, this latter circuit is independent of blade 38 of the thermostat so that after having been energized relay 42 will not be deenergized until the temperature rises to a value above 70°, at which blade 37 engaged contact 39. Thus the thermostat 35 has a fixed operating differential and operates in a manner whereby chattering of the relay due to insecurely made contacts is eliminated. As soon as blade 45 engages contact 47 a circuit for energizing the motor 16 and starting the stoker and blower into operation is completed as follows: from line conductor 55 to contact 47, blade 45, wire 69, motor 16, wire 70, and wire 73 back to line conductor 56. As soon as motor 16 starts the supply of fuel to the retort and supply of draft air for combustion begins. At the same time as motor 16 is energized a circuit is completed for energizing and opening valve 27 providing mercury switch 52 is closed, it being recalled that it was assumed that the fire was out or practically out when the thermostat indicated the demand for heating. The circuit for valve 27 is as follows: from line conductor 55 to fixed contact 47, blade 45, wire 69, wire 71, valve 27, mercury switch 52, wire 72 and wire 73 back to line conductor 56. The opening of valve 27 admits fuel to the burner nozzle 24 where it is ignited by the pilot burner 28 and the flame from nozzle 24 and air forced into the space around the retort 11 are directed through the element 25 in the manner of a torch, the flame impinging directly upon the solid fuel in the retort and serving to ignite it. As soon as the temperature within the combustion chamber has risen to a predetermined value high enough to indicate assurance that combustion has properly been established, the element 53 will open the mercury switch 52 deenergizing the valve 27 and cutting off the supply of fuel to the burner 24. Operation of the stoker and the draft blower will of course continue as long as the relay 42 is energized. Whenever the thermostat 35 becomes satisfied blade 37 will separate from contact 39 deenergizing relay 42 and discontinuing operation of the motor 16. It will be observed that if the duration of time between thermostatic demands for furnace operation are relatively short the fire in all probability will not go out and under these conditions the mercury switch 52 will not be in closed position at the time the thermostat calls for heat. Thus if combustion already exists in the combustion chamber the igniting unit 23 will not be operated. Opening of the mercury switch 51 or of the safety pilot 31 will of course prevent energization of the relay 42 by thermostat 35.

From the foregoing it is apparent that we have provided a combustion control system for solid fuel having means for igniting the fuel whereby personal attention to the apparatus is made entirely unnecessary. The need of building a fire in the furnace after it has gone out as done in the past is eliminated and the necessity of opening fire doors and performing the various tasks incident to manually building a fire on the grate are avoided. It is a feature of our invention that the igniting means for the solid fuel are arranged exteriorly of the combustion cham-

ber so as not to be directly subjected to the heat of the combustion chamber and being otherwise protected from the solid fuel itself. With this particular arrangement it is noted that the safety pilot which is of course necessary to safe control is in an entirely protected position.

While we have shown an igniting unit comprising a gas burner it is within the realm of our invention to use other forms of fluid fuel burning igniting devices. The single embodiment of our invention disclosed is a preferred representative form but other forms, modifications and variations in the invention are within our contemplation and it is our intention that we be limited only in accordance with the scope of the appended claims rather than by our disclosure.

We claim as our invention:

1. In apparatus of the character described, in combination, means forming a combustion chamber adapted to contain a solid fuel, means associated with said combustion chamber constructed and arranged for igniting solid fuel in said combustion chamber, control means comprising a condition responsive control instrument capable of indicating a need for combustion for controlling said second mentioned means whereby combustion can be initiated in response to said control means, and means indicative of the presence of combustion in said combustion chamber controlling said igniting means so arranged that said igniting means is inoperative in response to said control means if combustion already exists in said combustion chamber.

2. In apparatus of the character described, in combination, means forming a combustion chamber adapted to contain a solid fuel, means associated with said combustion chamber constructed and arranged for igniting solid fuel in said combustion chamber, control means comprising a condition responsive control instrument capable of indicating a need for combustion for controlling said second mentioned means whereby combustion can be initiated in response to said con-

trol means, and means for terminating operation of said igniting means in response to a condition indicative of the presence of combustion, said last means being so constructed and arranged that said igniting means is inoperative in response to said control means if combustion already exists in said combustion chamber.

3. In apparatus of the character described, in combination, means forming a combustion chamber adapted to contain a solid fuel, means associated with said combustion chamber constructed and arranged for igniting solid fuel therein, means for feeding solid fuel to said combustion chamber, control means comprising a condition responsive control instrument controlling said fuel feeding means and igniting means whereby combustion can be initiated in said combustion chamber in response to said control means, and means indicative of the presence of combustion in said combustion chamber so constructed and arranged that said igniting means is inoperative in response to said control means if combustion exists in said combustion chamber.

4. In apparatus of the character described, in combination, means forming a combustion chamber adapted to contain a solid fuel, means associated with said combustion chamber constructed and arranged for igniting solid fuel therein, means for feeding solid fuel to said combustion chamber, control means comprising a condition responsive control instrument controlling said fuel feeding means and igniting means whereby combustion can be initiated in said combustion chamber in response to said control means, and means for terminating operation of said igniting means in response to a condition indicative of the presence of combustion, said last means being so constructed and arranged that said igniting means is inoperative in response to said control means if combustion already exists in said combustion chamber.

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