

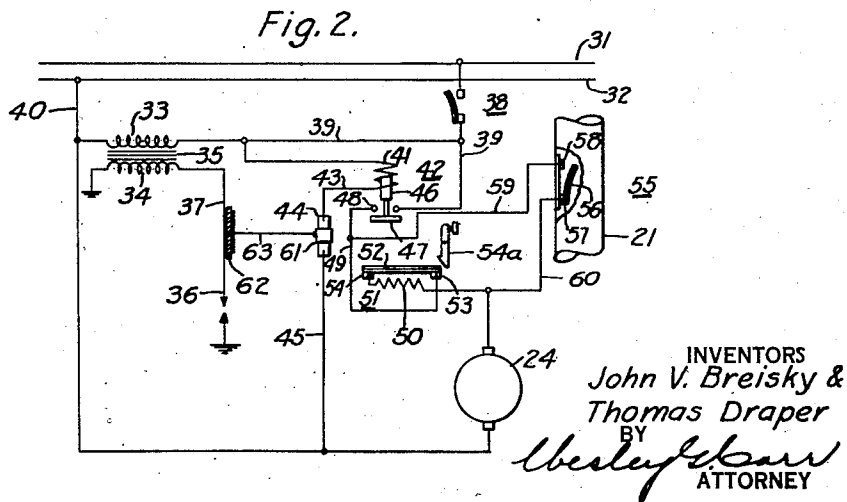
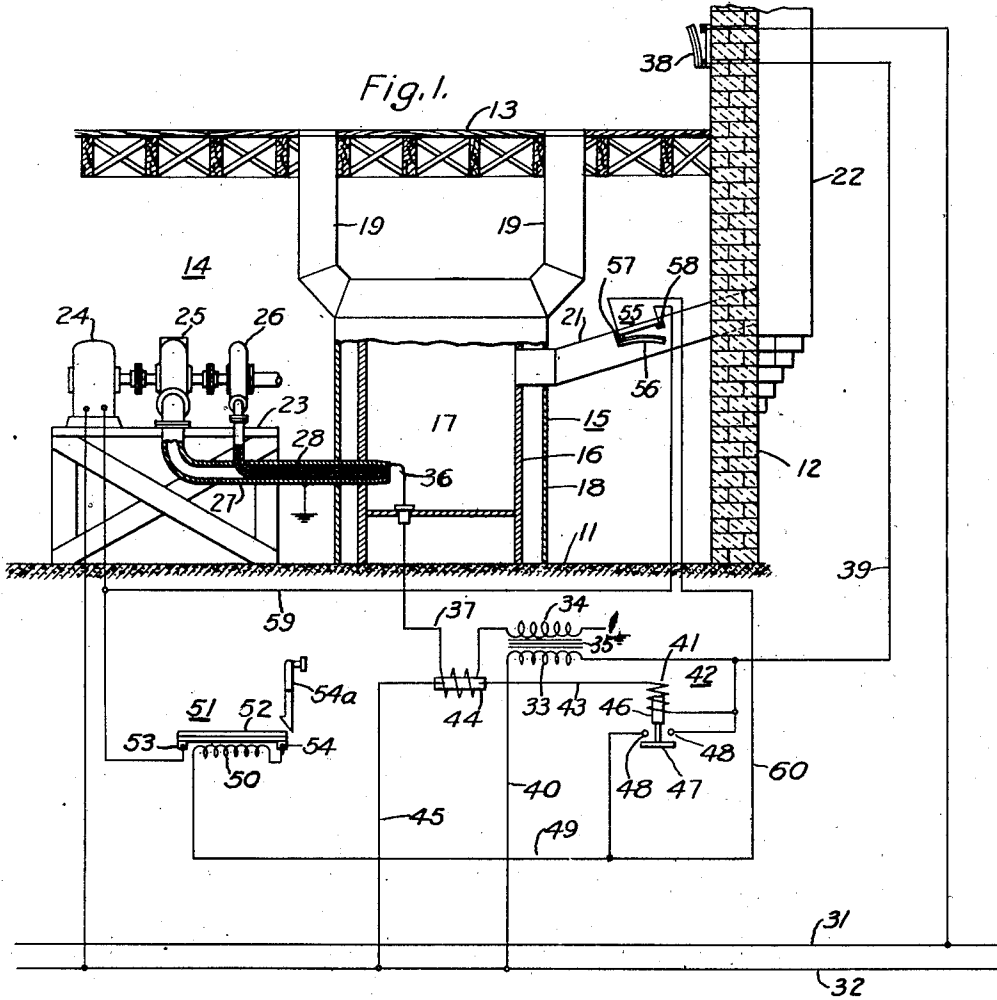
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FUEL BURNER SYSTEM

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FUEL BURNER SYSTEM

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5 Claims. (Cl. 158—28)

Our invention relates to fuel-burning systems and particularly to methods of control therefor.

An object of our invention is to provide a relatively simple control system for a fuel-feeding means.

Another object of our invention is to provide a relatively simple means for a system of checking the operativeness of a fuel-igniting means.

Another object of our invention is to provide a relatively simple means for, and system of, controlling the fuel-feeding means in accordance with the operativeness of the fuel-ignition means.

In practicing our invention, we provide an electric fuel-feeding means, such as a motor, a continuously operating fuel-ignition means including a suitable transformer and a spark gap electrically connected thereto, a circuit controller for the fuel-feeding means which is actuated in accordance with the operativeness of the fuel-ignition means by the inclusion of a plural-electrode electrical-discharge device controlled by the fuel-ignition means. A room thermostat and a thermostat located in the stack of the furnace, as well as a time-delay circuit-inter-rupting device, are also provided.

Referring to the single sheet of drawing,

Figure 1 is a view, mainly in vertical section, through an installation with which is associated the system embodying our invention, shown schematically only, and,

Fig. 2 is a schematic diagram of connections of a modified system embodying our invention.

Referring more particularly to Fig. 1 of the drawing, we have there shown a view of a portion of a house including a basement floor 11, one side wall 12, which may be made of brick or concrete, and a room floor 13 above a basement chamber 14.

A furnace 15 is located in the basement chamber 14 and may be of any suitable or desired type usually employed for such purposes, being here shown as embodying an inner casing wall 16 surrounding a fuel chamber 17, an outer casing 18 and a plurality of hot-air outlets 19. A chimney pipe or flue 21 extends into the wall 12 and communicates with a suitable upwardly extending chimney 22. While we have illustrated and described a specific embodiment of our furnace, we do not desire to be limited thereto, as furnace of any type usable with a fuel burner may be employed.

A suitable supporting frame 23 is located on the floor 11 adjacent to the furnace and has mounted thereon an electric motor 24, a pressure blower 25 and an oil pump 26, which are here

shown as being suitably connected to, and driven by, the motor 24. The blower 25 forces air through a suitable conduit 27 which extends into the furnace chamber 17 and has located therein an oil conduit 28 connected to the pump 26 and provided with a suitable orifice, in order that the oil pumped therethrough may issue in an atomized condition to be burned in the furnace chamber 17.

While we have shown and described a specific embodiment of the fuel-feeding means, we do not desire to be limited thereto, as these are shown for illustrative purposes only.

A control system for the fuel-feeding means is energized from two supply-circuit conductors 31 and 32. A fuel-igniting means comprises a transformer having a primary coil 33, a secondary coil 34 and an iron core 35. The ignition transformer is shown schematically only, and it is to be understood that the primary coil 33 is of such design that it may be connected to the source of supply, and that the secondary winding 34 is provided with such number of turns of wire as will generate a relatively high voltage between the terminals thereof on the order of 10,000 volts.

One terminal of the secondary winding 34 is connected to ground, while the other terminal thereof is connected to one terminal 36 of a spark gap by a conductor 37. As the metallic conduits 27 and 28 are usually effectively grounded, we may provide a spark gap comprising an electrode terminal 36, located as shown in Fig. 1 of the drawing, spaced a small distance from a co-operating electrode secured to conduit 27 to permit of obtaining the proper sparking therebetween when the ignition transformer is suitably energized. However, if desired, a ground connection may be provided for the conduits 27 and 28, as is shown in Fig. 1 of the drawing.

A room thermostat 38, of any desired type but here shown as embodying a bimetal strip, is located in the room heated by the furnace and has one terminal thereof connected to the supply-circuit conductor 31, while the other terminal thereof is connected, through a conductor 39, to one terminal of the primary winding 33, the other terminal of which is connected, by a conductor 40, to the supply-circuit conductor 32.

One terminal of an actuating coil 41 of a contactor 42 is connected to the conductor 39, while the other terminal of the actuating coil 41 is connected, by a conductor 43, to one terminal of a plural-electrode electrical-discharge device 44, the other terminal of which is connected, by a conductor 45, to the supply-circuit conductor 32.

The device 44 may be a glow tube of any suitable type which comprises a suitable container initially exhausted and then partially filled with an inert gas, and two spaced electrodes extending into and through the casing wall. Under normal conditions, a device of this kind is electrically non-conducting, but, when ionized by suitable means, such as an electric field, preferably of high frequency, it becomes conducting, and current will traverse the device if connected to a suitable source of electric energy.

The tube 44 is so located as to be within the electric field of the high-frequency current traversing the spark gap and the conductor 37. In order to increase the effect of the coupling, a plurality of turns of the conductor 37 may be placed around the tube 44, so that it is possible to effect actuation of the tube 44 only when the high-frequency sparking at the spark gap is of such nature as to effect ignition of the fuel. The tube 44 may be mounted adjustably relatively to the straight conductor 37 in order to be able to obtain this result.

The actuating coil 41 of the contactor energizes a core member 46 which has a contact bridging member 47 and a pair of fixed contact members 48 associated therewith. One of the contact members 48 is connected to the conductor 39 and the other contact member 48 is electrically connected to a conductor 49 which is connected to one terminal of a heating element or coil 50 of a thermal time-delay circuit-controlling device 51 embodying, in addition to the heating coil 50, a bimetallic strip 52, terminal members 53 and 54 and a latch 54a. The terminal member 53 is fixed in position, and the strip 52 is suitably secured thereto, so that the other end thereof may engage, or be disengaged from, the other terminal 54. The latch 54a holds the strip 52 in its open position and is manually operable to permit reengagement of the contact members when the strip 52 has cooled sufficiently. While we have shown a bimetallic element in combination with the heating coil, we do not wish to be limited thereto, as we may use a mercury switch so constructed as to have the proper time-delay action, or we may use a mercury switch actuated by a bimetal element. The other terminal of the heating coil 50 is connected to the contact member 54, while the contact terminal 53 is connected to one terminal of the energizing winding of motor 24, the other terminal of which is connected to supply-circuit conductor 32.

A thermostat 55, which may embody a bimetallic strip 56, is located in the flue 21 to be engaged by the heated products of combustion generated by the burning fuel. One end of the strip 56 is suitably mounted on a contact terminal 57, while the free end thereof may engage, or be disengaged from, a contact terminal 58. The contact terminal 58 is electrically connected, through a conductor 59, to the terminal 53 of the device 51. The contact terminal 57 is connected, by means of a conductor 60, to the conductor 49. The connection is such that the thermostatic device located in the flue 21 is connected in parallel-circuit relation relatively to the time-delay device.

Referring to Fig. 2, we have there shown a different coupling between the tube 44 and the conductor 37. A layer 61 of electric-conducting material, such as tinfoil, is placed around the container, and a plate 62 of electric-conducting material is located in adjustable proximity to the conductor 37, being held by any suitable means (not shown). A conductor 63 connects the mem-

bers 61 and 62, thereby providing a conducting connection therebetween. The coupling between the conductor 37 and the device 44 is a capacitative one and has been found to be particularly effective in controlling the operation of the tube 44. The element 62 is preferably adjustably mounted relatively to the conductor 37, by means not shown, so that the relative capacitance therebetween may be varied whereby it is possible to cause the tube 44 to be energized or actuated only when the high-frequency sparking at the spark gap is such as to effect proper ignition of the atomized oil.

The respective elements of our system are shown in their inoperative or deenergized positions in which the room thermostat is open for the reason that the temperature of it and of the room in which it is located is equal to, or higher than, a predetermined value. As no heated products of combustion are traversing the flue 21, the stack thermostat 55, located in the flue, is also in its open position so that the time delay device 51, embodying the heating coil 50 and the bimetallic element 52, is not short circuited and, therefore, not inactive.

The contact-bridging member 47 of the contactor 42 is not in engagement with the cooperating contacts 48. The motor is deenergized and no oil and air are being forced out, under suitable pressures, through the conduits 28 and 27 to be burned in the furnace chamber 17.

If it be assumed that the room temperature drops below a predetermined value, the room thermostat 38 will close, whereby a circuit is provided through the primary coil 33 of the ignition transformer. This circuit is easily seen from Fig. 2 and comprises the room thermostat 38, conductor 39, the primary coil 33, conductor 40 and the supply-circuit conductors 31 and 32, which are assumed to be suitably energized. This energizes the ignition transformer so that a relatively high potential is generated between the ends of the winding 34, and sparking will occur between the gap electrode 36 and the electrode on the conduit 28, this continuing as long as the room thermostat remains closed. This causes a high frequency current to traverse the conductor 37, and an electrical field will be generated therearound which will ionize the space between the electrodes of the glow tube 44.

The glow tube 44 is connected in series-circuit relation with the actuating coil 41 of the circuit-controlling device 42 for the fuel-feeding means 24 and is also connected across the supply-circuit conductors 31 and 32 through the room thermostat 38. If the ionization of the glow tube 44 is sufficiently strong, as will be the case if the high frequency sparking at the spark gap is of such character as to properly ignite the fuel, a current will traverse it and the coil 41, causing movement of the core member 46 to cause the bridging member 47 to engage the contact members 48 and to thereby close an electric circuit through the motor 24, as well as through the time-delay device 51. This causes operation of the motor, whereby oil is fed, under pressure, into the furnace chamber through the conduit 28, reaching it in an atomized condition.

As the ignition means has been assumed to be properly effective, the atomized oil will be ignited and burned in the furnace chamber 17. The operation of the thermostat 55 in the flue 21 is quicker than the operation of the time-delay device 51 and, if the oil continues to burn properly, the strip 56 will move to engage its contact

58 and thereby short circuit and render inoperative the time delay device 51. If the above described sequence of operations has been effected, the furnace will be in proper operative condition and will so continue until the room heated thereby has been heated to the desired temperature, after which the thermostat 38 will operate to interrupt the circuit and return the system to its inoperative condition, as heretofore described.

If, on the other hand, after operation of the room thermostat and energization of the fuel-igniting means, the sparks should not be of the necessary volume or character or should be entirely absent, by reason of a gap that is either too large or too small, the glow tube 44 will not be properly ionized. In this case, the coil 41 of the fuel-feed control means 42 will not be energized, and the motor will not start. If, further, the fuel-igniting means should be properly operative, but the fuel be not ignited, or if there should be no fuel to be ignited, the thermostat located in the flue or the stack would not operate, and the time-delay device would become operative by reason of the motor current traversing the coil 50 heating the strip 52 and causing it to move to disengage the contact member 54, the result being that the electrical circuit through the fuel-feeding means is again opened and the system is, therefore, shut down. The latch 54a will hold the strip 52 in its open or disengaged position, and an operator must actuate the latch to release the strip 52 before the system will again be ready for operation.

If, for any reason whatever, the ignition means becomes ineffective during the operation of the system, the fuel-feeding means will be deenergized so that no unburned oil can accumulate in the furnace chamber. By ineffective, we do not necessarily mean that there is no sparking at the gap, but that the volume or intensity of such sparking is not sufficient to properly ignite the oil, as may be the case if the spark gap becomes too small.

The system embodying our invention, therefore, provides a relatively simple and highly efficient means for checking the operativeness of the fuel-igniting means, as well as providing a system of control for fuel burners in which the fuel feeding means, preferably of an electrical nature, is controlled jointly by a room thermostat and by electrical means energized in accordance with the operativeness of the fuel-igniting means and embodying a plural-electrode, electrical-discharge device.

Various modifications may be made in the system embodying our invention without departing from the spirit and scope thereof, and we desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art or are set forth in the appended claims.

We claim as our invention:

1. In a fuel burner of the type including fuel supply means and fuel ignition means that is of the type capable of producing high frequency currents, means, responsive only to the high frequency currents produced by said ignition means, for controlling said fuel supply means.

2. In a fuel burner of the type including fuel-supply means and fuel-ignition means that is of the type capable of producing a high frequency electromagnetic field, means, including an electric discharge gap to be traversed by the electromagnetic field produced by said ignition means, and responsive only to said electromagnetic field for controlling said fuel-supply means.

3. In a fuel burner system of the type including electrically operated fuel-supply means and electrical means including a circuit having spark terminals forming a spark gap for igniting the fuel to be delivered by said fuel supply means, means, including an electric discharge device comprising a plurality of electrodes immersed in a gaseous medium and means for subjecting said electric discharge device to the electromagnetic field excited by the spark circuit to produce an ionized condition in said gaseous medium when said spark has the proper character for ignition and thereby to produce an electric discharge between said electrodes; and means controlled by said electric discharge device to energize said fuel feeding means when a discharge passes between the electrodes of said device.

4. In a fuel burner system of the type including electrically operated fuel-supply means and electrical means including a circuit having spark terminals forming a spark gap for igniting the fuel to be delivered by said fuel supply means, means, including an electric discharge device comprising a plurality of electrodes immersed in a gaseous medium and means including a capacitive coupling for subjecting said electric discharge device to the electromagnetic field excited by the spark circuit to produce an ionized condition in said gaseous medium when said spark has the proper character for ignition and thereby to produce an electric discharge between said electrodes, and means controlled by said electric discharge device to energize said fuel feeding means when a discharge passes between the electrodes of said device.

5. In a fuel burner system of the type including electrically operated fuel-supply means and electrical means including a circuit having spark terminals forming a spark gap for igniting the fuel to be delivered by said fuel supply means, means, including an electric discharge device comprising a plurality of electrodes immersed in a gaseous medium and a coil in the spark circuit, to be energized by the current traversing the same when it is energized, positioned adjacent to said electric discharge device to subject said gaseous medium to its electromagnetic field to produce an ionized condition in said gaseous medium when said spark has the proper character for ignition, and thereby to produce an electric discharge between said electrodes; and means controlled by said electric discharge device to energize said fuel feeding means when a discharge passes between the electrodes of said device.

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