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HEAT REGULATING DEVICE

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Fig. 1

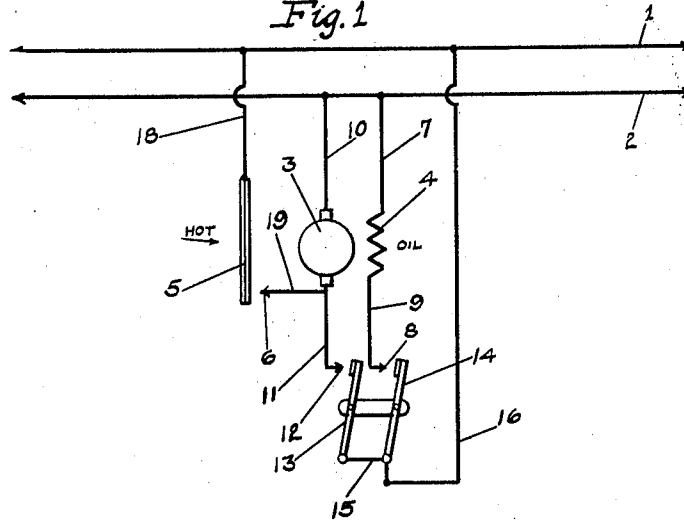
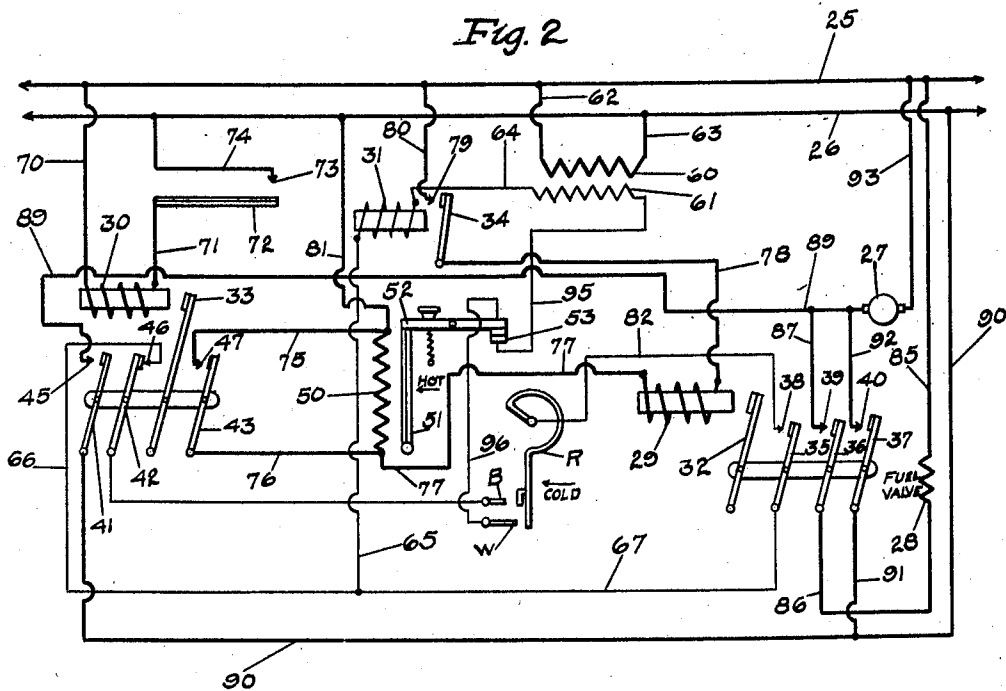


Fig. 2



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HEAT-REGULATING DEVICE

Application filed May 16, 1928. Serial No. 278,237.

This invention relates generally to improvements in apparatus for automatically controlling heat producing devices, and is particularly directed to a method and/or construction which will cause a burning of any fuel delivered to a burner apparatus after the fuel supply is cut off or discontinued. By the use of the method and/or device herein, carbon deposit resulting in smoky flame is avoided, due to the delivery of repeated small quantities of oil, for example after each normal shut-down of the apparatus, as when a control device in a room causes a shut-down due to a sufficiently warm room. By consuming all the residual oil in the above manner cracking of the oil (and carbon deposit therefrom) is also avoided.

Other objects are to provide means comprising an electro-magnetically operable device or its equivalent, controlling contacts in such manner that when closed the burner apparatus is started and fuel is delivered; to provide means controlled by the presence of flame or heat delivered by the burner apparatus; to maintain operation of the burner apparatus until any residual oil is burned; to combine with the above means an ignition timing device which will control a preliminary ignition period at the end of which if flame is not produced the fuel supply will be discontinued, as well as the operation of the burner per se, so that thereafter a normal restart of the apparatus cannot be made until after a manual resetting of the timing device to close the switch controlled thereby.

Features of the invention include the broad idea of providing a device which will cause a continued operation of the burner apparatus to burn residual oil after each shut-down; to the method as well as the general details of construction and arrangement of the device herein; and to the general arrangement and details of construction of means auxiliary to the above mentioned means, including a timing control device.

Features and advantages of the invention will be set forth in the description of the drawings forming a part of this application, and in said drawings

Figure 1 is a diagrammatic view showing a very simple application of the invention; and

Figure 2 is a diagrammatic view carrying forward the idea shown in Figure 1 in combination with a timing device, with the whole apparatus under the control of a device such as a room thermostat.

A simple embodiment of the invention is shown in Figure 1, in which the numeral 1 designates one power line and numeral 2 the other power line. The fuel burning apparatus is generally indicated at 3, as a motor, but it will be understood that this apparatus includes all the elements necessary for the production of flame and includes a fuel control element, herein an electro-magnetic device, designated 4. The numeral 5 designates a thermally operable device, as a switch, which is arranged to be affected by temperature changes in or at the burner apparatus, and to close only when the burner apparatus is operating to produce flame. The contact for this device is indicated at 6. One side of the fuel control device is connected by conductor 7 with the line 2 and the opposite side is connected to contact 8 by conductor 9. One side of the motor or control (for example draft control) part of the fuel apparatus is connected on one side by conductor 10 with line 2 and on the opposite side by conductor 11 with contact 12. Contacts 8 and 12 are controlled, in this instance, by a double switch respective elements of which are indicated at 13—14, the element 13 being engageable with contact 12, and the element 14 with contact 8. This device may be controlled manually or by some automatic means such as a room thermostat (see Figure 2 at R). Elements 13—14 are in circuit through conductor 15, and conductor 16 connects both elements with line 1. The thermally operable device 5 is connected by conductor 18 with line 1, and the contact 6 of this device is connected by conductor 19 with the opposite side of the motor or fuel apparatus.

Operation (device of Figure 1)

Suppose the switches 13 and 14 to be closed. The fuel apparatus will operate and the coil 4 of the fuel control device will be energized

to supply fuel. On the production of flame, the element 5 will make contact at 6. Then suppose the switches 13—14 to be opened (for example because of rise in room temperature). It will be seen that although the motor control contact 12 is now open, the motor continues to run (because presence of flame has closed the switch 5) but that the fuel supply is cut off because of de-energization of the coil 4. The motor or burner apparatus 3 will continue to operate until the oil which has been supplied to it has been completely burned. When this oil has been burned, there will be no flame, and the element 5 will cool, opening contact 6 to stop the motor. On reclosing contacts 8 and 12 to again obtain flame or ignition (as after a normal shut-down of the apparatus) there will be no residual oil but only that supplied after the restart. The device, therefore, provides a burner apparatus and a circuit along with fuel supply and fuel and motor control means for the apparatus, and also a switch arranged to separately control only the heating apparatus and/or motor, and operable as the result of temperature changes in the burner apparatus and/or motor to close only when the burner apparatus is operating to produce flame, to open only when no flame is present.

The embodiment of the invention shown in Figure 2, includes certain other features, some of which are shown in my co-pending application for heat regulating devices, Serial Number 233,888, filed November 17, 1927. Although there is no intention to be limited to the details of the device or devices now to be described, the details of connections and arrangement and use of the elements are all considered features of this invention.

The main lines are respectively indicated 25—26. The burner apparatus motor or equivalent device is indicated at 27. Some sort of ignition means is assumed, which is operative at least whenever fuel is supplied. The coil of the magnetically operable fuel control means or equivalent device is indicated at 28. It is assumed that the fuel controlled by the coil 28 is delivered to a fire pot or burner the draft to which is controlled by the motor, or equivalent device, which can be electrically controlled. The coil of a relay is indicated at 29 and the coil of another relay is indicated at 30. The coil of a pilot relay is indicated at 31. The armature of relay 29 is indicated at 32, the armature of relay 30 is indicated at 33 and the armature of relay 31 is indicated at 34. The armature 34, for the purpose herein, may be considered a current carrying element. The relay 29 controls, in this instance, three switch elements, respectively designated at 35, 36 and 37, respectively cooperating with contacts 38, 39 and 40, respectively controlling the holding contact for the coil 31, energization of the coil 28, and a

similar control for the motor 27. The armature 33 also controls three switch elements respectively designated 41, 42 and 43, respectively cooperating with contacts 45, 46 and 47, respectively an auxiliary contact for controlling energization of the motor 27, a starting contact for the coil 31, and a control for the shunt circuit of the heating coil 50. The coil 50 is a heating coil of a thermally operable timing device, and this timing device has a thermally operable (for example bimetallic) switch controlling element indicated at 51. This element when cold assumes the position shown in the figure and holds the intermediately pivoted switch arm 52 in a position to close the circuit against contact 53. The movable element of a thermally operable switch is indicated at R, and this element cooperates with contacts B—W, in this instance by sequentially engaging the contacts. This device may be arranged to be affected by temperatures in a room, and to close its contact when the room is sufficiently cold, or when it is desired to operate the heating apparatus to supply heat. In this instance, a secondary circuit is used to energize the coil 31, which controls, through switch 34, energization of coil 29 and therefore the motor and fuel supply. The primary coil 60 of a transformer is connected respectively with lines 25 and 26 by conductors 62—63, and one side of the secondary 61 is connected by conductor 64 with one end of the coil 31, and the opposite end of the coil 31 is connected by conductor 65, and branch conductors 66, 67 with switches 35—42, which respectively control holding and starting contacts of the secondary circuit. In this instance, the coil 30 is connected on one side by conductor 70 with line 25 and on the other side by conductor 71 with a thermally operable device 72 cooperating with a contact 73 in turn connected by conductor 74 with line 26. It will be understood that the thermally operable device is placed to be effected by flame produced at the burner apparatus 27, and is adapted to close on the presence of flame and open in the absence of flame. It will, therefore, be seen that when flame is present a closure will take place and relay coil 30 will be energized to close armature 33 and contacts 45, 47, at the same time opening the starting contact 46. Elements 43 and 47 control a shunt circuit to the element 50, and when these elements are closing their contacts the element 50 is inoperative. The shunt circuit for the coil 50 includes contact 47, connected by conductor 75 with one terminal of the coil 50, and the switch element 43, connected by conductor 76 with the other terminal of the coil 50. This same terminal of the coil is connected by conductor 77 with one terminal of the coil 29 and the opposite terminal of coil 29 is connected by conductor 78 with switch arm 34 operating against contact 79, in turn connected by

a conductor 80 with line 25. The opposite side of the coil 50 is connected by conductor 81 with line 26. It will be thus noted that the coils 50 and 29, are in series, and their energization is controlled by switch 34 in turn controlled through coil 31 as the result of opening and closing movements of element R. The element R is connected by conductor 82 with the holding contact 38. It will, therefore, be seen that when R closes its contacts, coil 31 will be energized, switch 34 will close, and coil 29 will be energized, closing contacts 36, 39, 37, 40 controlled thereby and starting the burning apparatus, and supplying fuel. The circuits are traced herebelow.

The fuel control device 28 is connected by conductor 85 with line 25 on one side, and on the other side by conductor 86 with element 36. Contact 39 is connected by conductor 87 with conductor 89 which connects at one end with one side of the burner apparatus or motor and at the other end with auxiliary motor control contact 45. Element 41 co-operative with contact 45 is connected by conductor 90 with line 26, and a branch conductor 91 connects line 90 with the element 37 operating against the motor control contact 40, which is connected by conductor 92 with conductor 89. The opposite side of the burner apparatus is connected by conductor 93 with line 25.

Operation (device of Figure 2)

Suppose a normal operation, that one wherein the room thermostat closes at R on a call for heat, and wherein ignition is successful before the element 51 can move sufficiently to open the switch 52, and in which there is no residual oil in, for example, the burner pot. A closure of R with contacts B—W causes energization of coil 31 through the following circuit: 61, 64, 31, 65, 66, 46, 42, B, W, 96, 52, 53, 95 to 61. The armature 34 now closes with contact 79, and coils 29 and 50 are simultaneously energized through the following circuit: 25, 80, 79, 34, 78, 29, 77, 50, 81 to 26. On energization, three contacts are closed, holding contacts 35—38, fuel supply contacts 36—39 and burner motor contacts 37—40. It is, of course, assumed that the burner apparatus includes ignition means, and at this stage the burner apparatus and/or motor is operating and fuel is being supplied. At the same time, the holding contact is closed so that when the starting contact is broken at 42—46, coil 29 will remain energized, if R remains closed. As before stated, we are assuming a normal operation. Therefore, ignition has been successful and flame is forthcoming. The immediate result of supply of flame is the closure of 72—73 and energization of coil 30. In view of the simple circuit in this case, it is not deemed necessary to trace it. A closure of 33 closes shunt circuit contacts 43—47, and auxiliary

motor control contacts 41—45, and opens control circuit starting contacts 42—46. As a result, the coil 50 is shunted so that it does not receive sufficient current to cause it to operate, and therefore to cause it to eventually obtain an opening of the contacts 52—53 to de-energize the coil 29 and discontinue the fuel supply. Since by energization of 30, the starting contacts 42—46 are opened, a normal start cannot again be made until this contact is closed, as the result of absence of flame and therefore de-energization of the coil 30.

It will be noted that when both coils 29 and 30 are energized, both motor contacts, respectively 36—39 and 41—45 are closed. Thus the apparatus is conditioned, (in case contacts 36—39, 37—40 should be open for any reason) to continue operation of the burner motor until all residual oil has been burned, after which, because of the absence of flame, 72—73 will be opened, and coil 30 will be de-energized breaking the auxiliary contacts 41—45 to then, and only then, stop burner operation.

Continuing with the description of the normal operation, and assuming that the apparatus is furnishing flame. After a certain time a room, in which the thermostat R is placed, will become sufficiently warm. The element R will then assume the position shown in the drawing, resulting in de-energization of the coil 31 opening of contacts 34—79 and de-energization of coil 29 and therefore opening of the contacts 36—39, 37—40 to cut off the fuel supply. (because of the opening of the contacts 37—40). However, in view of the fact that there is flame and that coil 30 is energized and that, therefore, contacts 41—45 are closed, the opening of contacts 36—39 will not cause a shut down of the motor, but the operation will continue until whatever residual oil remains is burned. After this has taken place, (because of the absence of flame) contacts 72—73 will open, coil 30 will be de-energized, and contacts 41—45 will open, shutting down the apparatus, with no residual oil left in the pot.

A feature of the invention which is included with the means for burning residual oil after the fuel supply is cut off, includes the thermally operable timing switch including the elements 50—51—52 and 53, along with the shunt circuit including elements 75, 47, 43, and 76, as well as elements 81, 77, 29, 78, 34, 79 and 80. It must be again noted that the elements 50—29 are in series in this circuit, and that, therefore, both are simultaneously energized when the circuit receives current. Thus whenever 29 is energized (and 30 is not energized) element 50 is receiving current and if ignition is not successful element 51 will eventually move in this instance towards the left, to release 52 which will be drawn downwardly by the spring, to open contacts 52—53, deenergizing 31, and

opening switch 34, and, therefore, releasing 29, and interrupting current to the motor as well as to the fuel control means. To obtain a re-start, 52 will have to be manually re-set to occupy the position shown. It is understood that the operation just described only takes place when there is no flame, with R closed, and therefore when 30 remains de-energized.

Let it be supposed that R closes, the burner apparatus started and fuel furnished, and that ignition is successful, closing the contacts 72—73. Suppose that heat is furnished over a sufficient period of time to cause R to open and then suppose that the contacts 72—73 are fused together, and that there is flame failure. Ordinarily 72—73 would open to de-energize 30 and allow holding contacts 42—46 to make so that a restart could be had. However, under the abnormal condition imagined, this will not take place and therefore 42 and 46 remain open. Then suppose R to make at W—B. It will be seen that the magnet 31 cannot be closed because tracing the circuit 61, 64, 31, 65, 66 to contact 46, the current cannot pass because 42 is not making. Therefore, a restart cannot be made until the fused contacts are separated, or until repair is made.

I claim:

1. A burner apparatus including a fuel control device, a switch for controlling said burner apparatus and fuel control device, a second switch for independently controlling the burner apparatus, and operable to close when flame is obtained, and to open on discontinuance of flame.

2. A burner apparatus including a fuel supply device, a switch for controlling said burner apparatus and fuel control device, a second switch thermally operable for independently controlling the burner apparatus and operable to close when the apparatus is producing heat.

3. An electrically operable burner apparatus including an electrically operable fuel supply device, a switch for substantially simultaneously controlling both, a second switch thermally operable for independently controlling the burner apparatus, and operable to close when flame is obtained at the burner, and to open on discontinuance of flame.

4. A burner apparatus and fuel control means therefor, a switch adapted to close only when the burner is producing heat, a second switch adapted when closed to cause operation of the apparatus and fuel control means to produce flame, and circuit connections such that the circuit to the burner apparatus is maintained by the first mentioned switch after opening of the last switch, until all fuel is consumed.

5. A burner apparatus and circuit therefor, fuel control means for said apparatus, a

switch arranged to separately control only the heating apparatus and operable as the result of temperature changes at the burner apparatus to close only when said burner apparatus is operating to produce flame, a second switch, and circuit connections such that on closure fuel is supplied to the burner apparatus and said apparatus is started, the arrangement being such that on the production of flame said first mentioned switch closes and when the last mentioned switch is opened to interrupt fuel supply, said first mentioned switch remains closed and continues operation of the apparatus, as a result of flame produced by fuel delivered after interruption of the fuel supply.

6. A burner apparatus including a fuel control device, a first switch for controlling said burner apparatus and fuel control device, a second switch operable for independently controlling the burner and adapted to close when flame is obtained and to open on discontinuance of flame, a relay for controlling the first switch, a second relay controlled by the second switch, a timing device including a switch and having a heating coil in circuit with the coil of the first relay, a shunt circuit for the heating coil controlled by the second relay, said second relay having a contact for controlling the burner apparatus, and means in circuit with the switch of the timing device for obtaining energization of the first relay.

7. A burner apparatus including a fuel control device, a first switch for controlling said burner apparatus and fuel control device, a second switch operable for independently controlling the burner and adapted to close when flame is obtained and to open on discontinuance of flame, a relay for controlling the first switch, a second relay controlled by the second switch, a timing device including a switch and having a heating coil in circuit with the coil of the first relay, and a shunt circuit for the heating coil controlled by the second relay, said second relay having a contact for controlling the burner apparatus, means in circuit with the switch of the timing device for obtaining energization of the first relay, and starting and holding contacts for the last mentioned means respectively controlled by the second and first relays.

8. A burner apparatus including a fuel control device, a first switch for controlling said burner apparatus and fuel control device, a second switch operable for independently controlling the burner and adapted to close when flame is obtained and to open on discontinuance of flame, a relay for controlling the first switch, a second relay controlled by the second switch, a timing device including a switch and having a heating coil in circuit with the coil of the first relay, and a shunt circuit for the heating coil controlled by the second relay, said second relay having a contact for con-

trolling the burner apparatus, means in circuit with the switch of the timing device for obtaining energization of the first relay, and starting and holding contacts for the last mentioned means respectively controlled by the
5 second and first relays, the starting contact to close when the second relay opens, and a holding contact to close when the first relay closes.

10 9. A burner apparatus including a fuel control device, a first switch for controlling said burner apparatus and said fuel control device simultaneously, a second switch operable for
15 independently controlling the burner and adapted to close when flame is obtained and to open on discontinuance of flame, a relay for controlling the first switch, a second relay controlled by the second switch, a timing device including a switch and having a heating coil
20 in circuit with the coil of the first relay, and a shunt circuit for the heating coil controlled by the second relay to close when the relay closes, said second relay having an auxiliary contact for independently controlling only
15 the burner apparatus to close the motor circuit when the second relay closes, and means in circuit with the switch of the timing device for obtaining energization of the first relay.

10 10. A burner apparatus including a fuel control device, a first switch for controlling said burner apparatus and said fuel control device simultaneously, a second switch thermally operable for independently controlling
35 the burner apparatus, and operable to close when flame is obtained and to open on discontinuance of flame, a relay for controlling the first switch, a second relay controlled by the thermally operable switch, a timing device including a switch and having a heating
40 coil in circuit with the coil of the first relay, and a shunt circuit for the heating coil controlled by the second relay to close when the relay closes, said second relay having an auxiliary contact for controlling only the motor,
15 to close the motor circuit when the second relay closes, and means in circuit with the switch of the timing device, for obtaining energization of the first relay.

In witness whereof, I have hereunto set
50 my hand this 10th day of May, 1928.

HAROLD W. SWEATT.