

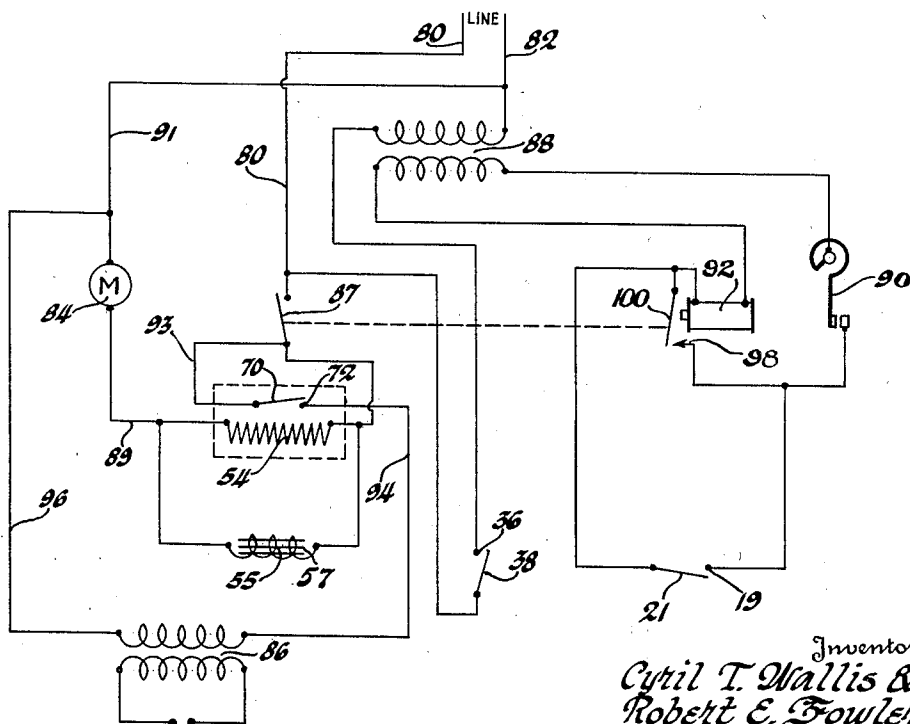
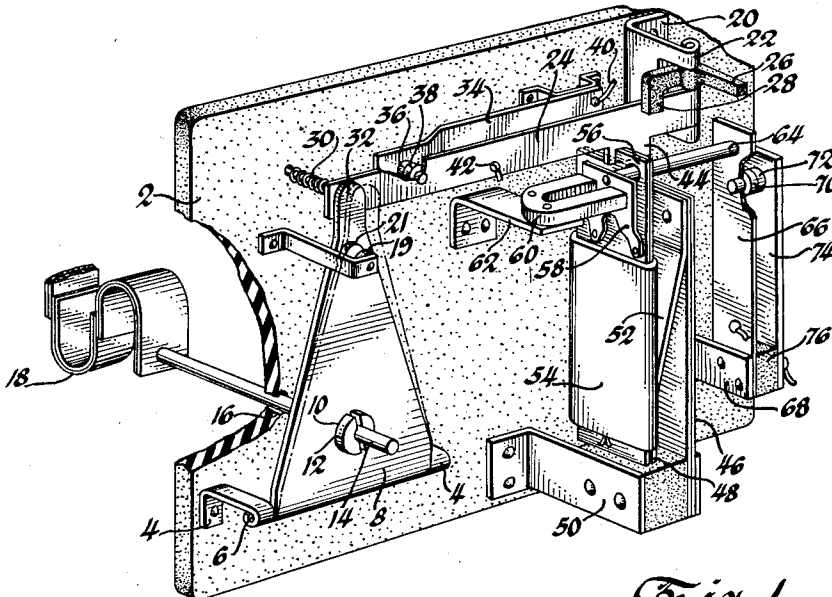
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OIL BURNER CONTROL

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OIL BURNER CONTROL

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This invention relates to control apparatus and more specifically to temperature responsive controlling means for operating a fluid fuel burner for heating purposes.

5 In the operation of any of the well known fluid fuel burners for domestic heating purposes, it is necessary to provide some time element which will operate for safety purposes after a certain period and in combination therewith some form of temperature responsive device should be used 10 which is actuated by the rise or fall of temperature within the combustion chamber. The combination of such two units provides safety features which are necessary in this type of apparatus, for over and above the normal off and on 15 positions of such burners as required by the thermostatic control from the space to be heated, it is necessary to have means provided to take care of abnormal conditions. Such abnormal conditions are the failure of the burner to ignite or to 20 remain ignited; the failure of the burner after it has been normally operating as to the flame, and a current failure of the burner while operating normally.

25 It is therefore an object of our invention to provide a simple, mechanically interlocking device for providing the necessary safety features of operation.

30 With this and other objects in view which will become apparent as the specification proceeds, one embodiment of our invention resides in the construction set forth in the following specification and claims and illustrated in the accompanying drawing, in which:

35 Figure 1 is a perspective view of the assembly of our invention.

Figure 2 is a schematic wiring diagram showing the hook-up of the control to a burner.

40 A backing plate 2, or supporting element of insulating material such as "Bakelite," is provided to support thereon the various elements of our control. This backing plate is adapted to be supported at a point convenient for its operation adjacent the stack or hood of a furnace, such 45 further support not being shown.

50 On one side of the plate 2 are secured two spaced angular brackets 4, the outer portions of which are coiled over to provide eyelets for a long pin 6 which extends through both and through the lower curled edge of a triangular plate 8 which is pivoted in the trunnions formed thereby. The central portion of the plate is provided with an opening 10 in which are inserted two semicircular spaced members 12 which frictionally 55 clamp the rod 14 between them since they are

snapped into the opening and press against the opposite sides of the rod. This rod 14 extends rearwardly through a further opening 16 in the insulated supporting plate and contacts a plurality of U-shaped bimetallic members 18 which are 5 adapted to be subjected to the heat within the combustion chamber and as they expand and contract they provide longitudinal movement to the rod 14 which pushes the pivoted triangular plate 8 back and forth about the pivot pin 6. 10 The two semicircular members 12 provide a universal joint and a certain amount of slip friction in case the plate 8 is stopped and the rod continued in its movement due to the temperature changes. 15

Adjacent the upper portion of the triangular shaped member 8 there is a stationary contact 19 carried on the plate 2 which is adapted to cooperate with a movable contact 21 on the front face of the member 8 so that as the same is pushed 20 forward the two contacts will be closed. The action of the bimetallic element is to force the plate 8 outwardly to the dotted line position when the member is cold, and to draw it inwardly to the full line position when hot. 25

Adjacent the upper right hand corner of the supporting plate 2 is provided an angled bracket 20 whose outer end is provided with a notch and the portions on each side of the notch are curled 30 around to provide eyelets as at 22 to support a vertical pin upon which is pivoted one end of an arm 24 and a multi-angled resetting arm 26, one extending tip 28 of which projects downwardly over the arm 24. The opposite end of the arm 24 is contacted by a compression spring 30 which 35 presses against the support 2 and the end of the arm 24 tending to force the arm outwardly from the base around its pivot. The upper end of the pivoted triangular member 8 is adapted to overlap the outer end of the arm 24 as shown at 32 40 and thus prevents the arm 24 from being forced outwardly when it is in contact therewith.

Directly in back of the arm 24 is supported a stationary arm 34 which supports adjacent its outer end a contact 36 adapted to cooperate with 45 a contact 38 on the rear face of the pivoted arm 24 to form the safety switch. Suitable electrical conductors 40 and 42 are provided on the stationary and movable arms to complete the electrical circuit. 50

A downwardly extending tip 44 is provided on the lower edge of the pivoted arm 24 and supported below this projection 44 are a plurality of bimetallic strips 46 and 48 on an angled bracket 50 secured to the plate 2. The bimetallic strip 55

48 is carried on the strip 46 by a spacing and connecting member 52 and there is provided on the bimetallic strip 48 a suitable heating element 54. The purpose of the two spaced bimetallic strips is to compensate for ambient temperature correction. On the upper edge of the strip 48, one portion 56 is higher than the other and is adapted in the normal cold position to contact the downwardly extending projection 44 of the arm 24 and act as a stop to prevent the same from swinging away from the support 2. If, however, the current is supplied to the heating element 54 and the strip 48 is caused to warp to one side, projection 56 will be moved out of contact with 44 to allow the pivoted arm 24 to swing outwardly.

Adjacent the upper end of the strip 48 is provided a small spaced spring armature 58 which is adapted to cooperate with a permanent magnet 60 supported on the base 2 by an arm 62. The upper end of the member 58 is provided with a rod 64 which goes through projection 56 and is rigidly connected to a vertical strip member 66 supported on a bracket 68 from the support 2. The member 66 carries one contact 70 of a switch and there is provided a second contact 72 cooperating therewith and carried by a parallel strip 74 supported in spaced relation to the strip 66 by a spacing block 76 on the same bracket 68. Thus as the bimetallic arm 48 moves over, it will come to some point at which there is a snap action of the spring armature member 58 against the pole of the permanent magnet 60 which will cause the rod 64 to open the contacts 72 and 70 with a quick snap action. The same will be true to some extent in closing as when the spring armature reaches the magnet it will do so with a snap to close the contacts above mentioned.

The last two contacts control the ignition circuit of the burner, the pair of spaced bimetallic elements with their heating coil and stop provide the safety switch operating means, said safety switch being actually contacts 36 and 38. The pivoted triangular member 8 provides a mechanical interlocking for the safety switch which is actuated by the temperature within the combustion chamber and also operates a pair of contacts necessary for control purposes.

The circuit in which the above control is connected for operating purposes is shown in Figure 2 and comprises a suitable pair of lines 80 and 82 for supplying the necessary current to which a motor 84 is connected which supplies the combustible mixture to the furnace. An ignition transformer 86 and a supply transformer 88 are connected to the source and a room thermostat 90 and relay 92 are also provided, completing the control device in addition to that already described.

The normal operating circuit of the motor includes line 80, motor switch 87 which is operated by a relay coil 92, the heating coil 54 wound around the bimetallic element 48, line 89, motor 84, line 91 back to incoming line 82. It will thus be seen that when the motor is in operation the motor switch will be closed and the heating coil 54 will be in operation.

As will be readily seen, the total motor current in this construction passes through the heating coil 54 for the warp member 56 and therefore the heating effect thereof is subject to the fluctuations in the amount of current drawn there-through by the motor. As the current through the motor circuit varies, the heat produced by the coil will vary with the motor current varia-

tion and therefore the time of operation of the bimetallic arm will also be caused to vary. In order to overcome this and to provide for a definite set time interval under any current variation, a reactor coil 55 is placed in a parallel circuit with the heating coil 54 to act as a regulator therefor. This reactor coil, since it is placed directly in parallel with the resistance element 54, is subject to the same voltage and the reactor therefore functions as an automatic voltage regulator. The core 57 of the reactor is so designed that when the motor current flowing in the circuit is high the core is nearly saturated and hence the impedance is low, keeping the voltage substantially constant. However, when the current drops the saturation of the core will also drop and the impedance will be high and the voltage will be maintained substantially constant. Therefore since the voltage drop across the reactor is a function of the impedance and current, the proper amount and grade of iron for the core may be selected to insure a substantially constant voltage for a specified current variation. Therefore since the voltage across the resistor coil is substantially constant the heat produced by the heating coil and the time of operation of the bimetallic arm will always remain the same.

Connected across the lines 80—91 and in parallel with the motor and heating coil there is provided the ignition transformer 86 and connections from the above mentioned lines are as follows: line 93, contacts 70—72, line 94, ignition transformer 86, line 96, back to line 91. The ignition switch 70—72 is closed in the cold position and as the bimetallic heating coil warps the element 48 the switch 70—72 will be snapped open by the permanent magnet 60.

Connected across the incoming lines 80—82 and in series with the primary of the transformer 88 is the safety switch 36—38 and connected in series with the secondary of the transformer 88 is the room thermostat 90, relay 92 and stack operated contacts 19—21. Connected in parallel with the last two mentioned contacts is a pair of holding contacts 98 and 100 operated by the relay.

The operation of the whole system is as follows: Room thermostat 90 closes and thereby closes an obvious circuit through the relay coil 92 and stack switch contacts 19—21 which are normally closed when the stack or combustion chamber is cold. This closes the holding contacts 98 and 100 to preserve the relay circuit in operation until the room thermostat is satisfied. It also closes switch 87 which completes the circuit through the heating element 54 and the motor 84 which starts discharging oil and air or any other combustible fuel into the furnace. Contacts 70 and 72 are also normally closed so that the ignition transformer 86 is also energized at this time providing the necessary igniting sparks for the fuel. Therefore the burner will normally start and the heating coil 54 will tend to warp the member 48 over to the left as shown in Figure 1 which will remove the stop 56 from the projecting point 44 of the pivoted arm 24 and at the same time the permanent magnet 60 will attract the armature 58 to cause snap action and break the ignition circuit through contacts 70—72. If at this time the burner has not heated the combustion chamber to a normal extent, the arm 24 will swing outwardly and open the safety switch contacts 36—38 thereby deenergizing the transformer which of course causes the deenergization of the motor relay and the motor switch will

drop open. However, if the burner has heated the combustion chamber to the desired extent, the bimetallic element 18 will have drawn in the member 8 which first breaks contacts 19 and 21 and later acts as a stop for the arm 24 so that when the bimetallic member 48 moves away from tip 44 the stack element will stop the arm 24 from swinging outwardly and the safety switch from opening. If this is the case the safety switch will remain closed and the burner will continue until a satisfactory amount of heat has been provided and the room thermostat will then normally cut off the circuit.

If there is a flame failure during the time of normal operation, the stack will immediately begin to cool and since the stack element is the one holding the safety switch in position, the switch will open to deenergize the whole system. If there is a current failure relay 92 will immediately drop its holding and motor contacts and it cannot be again energized until the stack contacts 19—21 are closed on cooling of the stack which will provide sufficient time to avoid any danger of explosion such as might result from the immediate supply of combustible fuel into a hot furnace or combustion chamber.

We claim:

1. In a control mechanism, a switch biased to open position, a bimetallic arm acting as a stop under normal temperature but adapted when heated to move out of the path and allow the switch to open, means to heat the arm, a spring armature secured to the arm, a magnet mounted adjacent the arm and adapted to attract the spring armature upon some movement of the arm due to the heat and a second switch operated by the movement of the armature.

2. In a control mechanism, a switch biased to open position, a bimetallic arm maintaining it closed and adapted when heated to move out of the path and allow the switch to open, heating means for the arm, a spring armature secured to the movable end of the arm, a magnet mounted in proximity to the armature so that as the arm warps due to an application of heat and approaches the magnet the latter will provide a snap to the movement as the armature comes nearer, a switch operated by armature movement and a second independent stop for the first switch, temperature responsive means for operating the second stop whereby as the bimetallic arm is heated it will release the first switch to open position and then the magnet will cause snap action of the second switch but the second stop may prevent operation of the first switch to open position depending on conditions.

3. In control mechanism, a base, an arm pivotally mounted thereon, spring biasing means to force the arm in one direction, a second arm pivoted to the base and having its end overlying the end of the first arm to act in opposition to the spring biasing means, means for moving the second arm about its pivot and a third movable arm overlying the first arm and also acting in opposition to the spring biasing means and a plurality of switching means carried by the base, at least one being operated by each of the arms.

4. In control mechanism, a base, a member pivoted to the base, spring biasing means to force

the member in one direction, a pair of separate members one pivoted on the base, the other movable with respect thereto and both overlying the first member to prevent the spring biasing means from actuating the same when either one of the latter two members are in a given position and means actuated by temperature changes to move either of the pair of members out of the path and allow the first named member to swing.

5. In control mechanism, a base, a member pivoted to the base, spring biasing means to force the member in one direction, a pair of separate members one pivoted on the base, the other movable with respect thereto and both overlying the first member to prevent the spring biasing means from actuating the same when either one of the latter two members are in a given position, means actuated by temperature changes to move either of the pair of members out of the path and allow the first named member to swing and switching means operated by the movement of each of the members.

6. In control mechanism, a base, a bimetal arm, one end of which is secured to the base, a switch arm pivoted on the base, spring means to bias the arm for one direction of rotation about its pivot, said bimetal arm overlying a portion of the switch arm and acting as a stop therefor in certain positions, a resilient member having one end secured to the bimetal arm and lying substantially parallel thereto, a rod secured to the free end of the resilient member, a pair of switch members secured to the base adjacent the bimetal member, one of which is connected to the rod, and a magnet mounted on the base adjacent the resilient member and causing snap-action in the plane of the axis of the rod to cause the switch actuated thereby to open and close quickly, said resilient member allowing the bimetal arm to move with respect thereto to effect or remove a stoppage of the rotation of the first-named switch arm.

7. In control mechanism, a base, a bimetal arm, one end of which is secured to the base, a switch arm pivoted on the base, spring means to bias the arm for one direction of rotation about its pivot, said bimetal arm overlying a portion of the switch arm and acting as a stop therefor in certain positions, a resilient member having one end secured to the bimetal arm and lying substantially parallel thereto, a rod secured to the free end of the resilient member, a pair of switch members secured to the base adjacent the bimetal member, one of which is connected to the rod, and a magnet mounted on the base adjacent the resilient member and causing snap-action in the plane of the axis of the rod to cause the switch actuated thereby to open and close quickly, said resilient member allowing the bimetal arm to move with respect thereto to effect or remove a stoppage of the rotation of the first-named switch arm, and a second pivoted switch arm spaced from the bimetal arm but also overlying the first switch arm and thermal responsive means for moving the second switch arm to prevent or allow said first switch arm to move outwardly.

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