Jan. 26, 1937. R. H. BEMAN 2,069,003

ELECTRICAL APPARATUS

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Fig. 1.

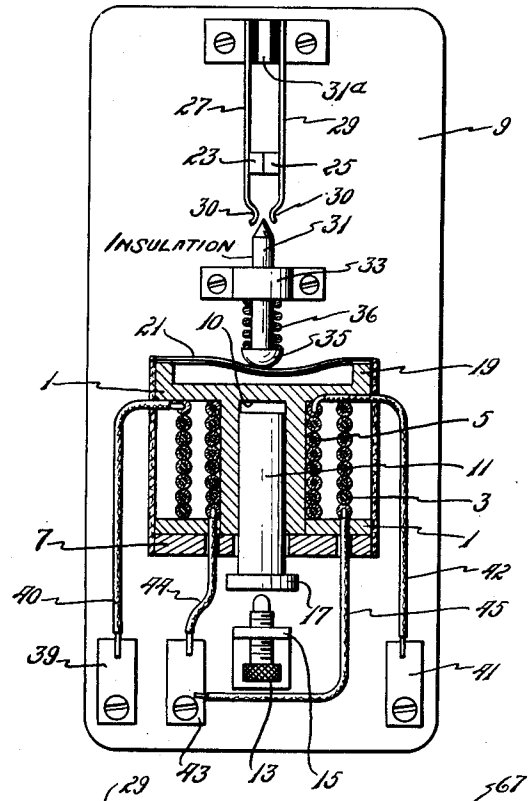
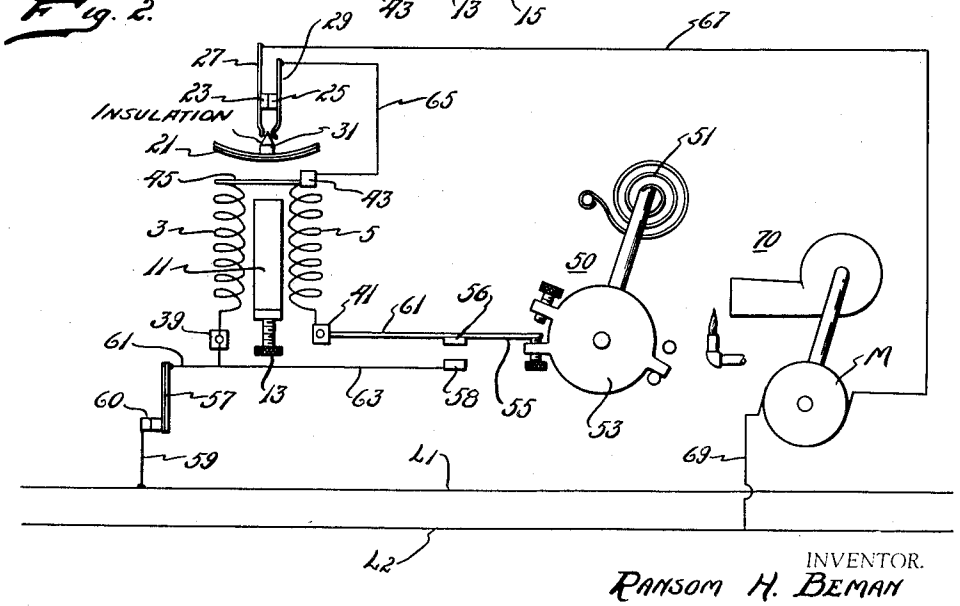


Fig. 2.



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ELECTRICAL APPARATUS

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5 Claims. (Cl. 200—122)

My invention pertains to time delay safety devices and more particularly to safety control devices for oil burner systems.

It is an object of my invention to provide a safety control device comprising an iron structure and means for heating the same by the hysteresis and eddy current losses induced therein by an alternating magnetic field set up by an initiated operation for actuating a thermally associated thermostatic device, a predetermined time thereafter and having means for opposing and neutralizing the magnetic field in response to a succeeding operation whereby the operation of the thermostatic device is avoided.

It is a further object of my invention to provide a time delay safety control device comprising a thermostatic switch heated by an electromagnetic solenoid comprising an iron core slidably disposed therein whereby the time characteristics and the impedance of the device in the controlled circuit may be adjusted.

It is also an object of my invention to provide a variable impedance time delay safety device for use in alternating current circuits comprising a thermostatic device heated by variable impedance means energized in motor circuit and including opposing electromagnetic means which is adapted to be subsequently energized under normal operating conditions to prevent the continuation of the heating of the thermostatic element to de-energize the motor.

The invention itself, however, both as to its organization and its method of operation, together with additional objects and advantages thereof, will best be understood from the following description of specific embodiments, when read in conjunction with the accompanying drawing, in which:

Fig. 1 is an elevational view of an embodiment of my time delay safety control device partially in section; and

Fig. 2 is a diagrammatic view representing a system controlled by my safety device.

Referring more particularly to Fig. 1 of the drawing my safety control device comprises a bobbin structure 1 of non-magnetic material, such as rubber or brass for example, for supporting a pair of separately insulated solenoid windings 3 and 5 thereon. The coil supporting bobbin 1 may be mounted upon a bracket 7 projecting from a suitable instrument board or panel 9 and it is of spool like conformation having an aperture 10 extending axially therethrough for slidably receiving a core member 11 of some magnetizable material such as iron. An adjusting screw 13 is threadably supported in a bracket 15 projecting from the panel 9 under the lower end of the core whereby its insertion into the bobbin 1 may be adjusted. The lower end of the core is preferably provided with a laterally projecting flange 17 for positively limiting its insertion into the winding.

The upper end of the bobbin 1 is provided with upwardly projecting flanges 19 upon which a thermostat 21 comprising a bimetallic element is supported across the upper end of the core. The bimetallic element 21 may consist of a pair of connected flat strips of unlike metal, or if a quick snap action is desired, it may be composed of a pair of cup shaped discs of unlike metal firmly secured together. If the material of the solenoid bobbin is a poor heat conductor, such as rubber or a phenolic condensation product, the core receiving aperture 10 may be extended through the upper end thereof to permit the core 11 to be elevated into intimate thermal coupled relation with the bimetallic element 21. If the bobbin structure is of some non-magnetic metal such as brass or copper the entire structure will be heated from the iron core thereby heating the thermostatic element 21.

Although my safety control device may be utilized for regulating mechanical elements, it is especially suitable for controlling electrical apparatus which is accomplished by a pair of electrical contact members 23 and 25 supported in engageable relation on resilient metallic arms 27 and 29 mounted in electrically insulated relation on a bracket 31a projecting from the panel board. The lower extended ends of the separate contact supporting arms 27 and 29 are provided with rounded loops 30 for smoothly engaging the adjacent end of a wedge shaped actuating member 31 which is slidably mounted in a bracket 33 projecting from the panel. The contact actuator 31 is disposed for free slidable movement through the bracket 33 and its lower end is provided with a smooth spherical terminal 35 for operatively engaging the bimetallic member. A compressional spring 36 may be concentrically disposed on the actuator 31 for reacting between the bracket 33 and the flange of the spherical terminal 35 for continuously biasing it downwardly. When the actuator is elevated by distortion of the bimetallic member, its uppermost end spreads apart the contact supporting arms thereby disengaging the contacts and interrupting any electrical circuit associated therewith. It will be understood that a mechanical regulating mem-

ber may be actuated by the thermostat if desired.

The electrical connection of the device into a system to be controlled is facilitated by three terminal connector members insulated upon the panel 9. One of the terminals 39 is electrically connected by a conductor 40 to one end of one of the separate windings 3, and a second terminal 41 is permanently connected through another conductor 42 to one end of the other separately insulated winding 5 on the bobbin 1. The other terminal 43 is connected jointly to the other ends of the two windings by permanently connected conductors 44 and 45.

My safety controller may be advantageously utilized for controlling a system wherein a certain operation must successfully follow an initiated operation and upon the failure thereof the initiated operation must be promptly terminated. Such a system may comprise an oil burner control system, as shown in Fig. 2. In the operation of such a system the decrease of ambient temperature to a predetermined degree causes the energization of a blower motor M which throws a blast of oil spray into an associated furnace (not shown). Normally the oil spray is successfully ignited by a continuous burning pilot flame or an electric spark, in a well known manner, and the oil spray is consumed as it enters the furnace. It is necessary however to provide for the contingency of failure of ignition which might be caused by extinction of the pilot flame or other conditions. For this purpose I provide a thermo responsive stack switch 50 which comprises a spiral bimetallic element 51 disposed in the stack, or closely associated therewith, for rotating a disc 53 operatively connected with a flexible contact arm 55 carrying a contact 56 toward or away from a stationary contact 58 mounted adjacent thereto. The stack operated electric contacts 56 and 58 are electrically connected by conductors 61 and 63 to the terminals 41 and 39 respectively connected to the separated ends of the separate windings on the safety control device.

In operation decreasing room temperature causes the room thermostat 57 to close its contacts thereby completing a circuit to energize the blower motor M from the alternating current service mains L1 and L2. The motor energizing circuit may be traced from main line conductor L1 through a conductor 59 to the contacts 60 of the room thermostat 57 and through a conductor 61 to terminal 39 on the safety controller thence to the winding 3 on the bobbin, and from the other end of the winding 3 by way of conductor 45 to the terminal connector 43, through a conductor 65 to the thermostatically controlled contacts 25 and 23 on the safety controller thence by way of a conductor 67 to the motor M and from the other terminal of the motor through a conductor 69 to the other main line conductor L2.

As the motor starts up it drives a suitable oil throwing blower or unit 70 which supplies a blast of oil spray to a furnace or other heating device (not shown).

In response to normal ignition of the flame the rising temperature variations affect the stack switch to close its contacts 56 and 58 within a very short time after the blower motor M has started. This connects the two separate windings 3 and 5 in parallel relation for simultaneous energization in the motor circuit.

The separate windings 3 and 5 are coiled in opposing relation or are so connected into their respective circuits that their magneto-motive forces oppose and neutralize, and when both are energized simultaneously the heating effects of eddy currents and hysteresis losses in the core 11 are eliminated. Hence, normally the iron core structure is subjected to the heating effect of the alternating magnetic field for only a very short time until the subsequent energization of the second winding in opposed parallel relation neutralizes this effect.

When the pilot flame fails, or other conditions arise which cause the flame failure when the blower motor starts, the stack switch will not receive heat and consequently will not close its contacts. Under this abnormal condition the iron core 11 associated with the safety device is continuously subjected to the heating effect of the hysteresis and eddy currents induced therein by the alternating magnetic field. As the temperature of the iron core 11 continues to rise, the thermally associated bimetallic element 21 is also heated, and as it is distorted it moves the actuator 31 between the electric contact arms 27 and 29, thereby opening the motor circuit and stopping the blower. This operation prevents the dangerous and undesirable conditions which would be caused by continuously supplying unignited oil or gas to the furnace.

Although the thermostatic stack switch responds promptly to the rising temperature in the stack, an appreciable time interval must be allowed for this effect to take place after the blower motor M has started. This is readily accomplished by adjusting the time intervals of operation in the safety control device by turning the adjustable stop screw 13 under the iron core 11. As the core 11 is projected upwardly into the winding, the heating effect of the alternating magnetic field is increased, and the thermo coupling of the core 11 with the bimetallic element 21 is also increased, thereby reducing the time interval required between the closing of the motor circuit by the room thermostat 57 and the reopening of the circuit by the safety device. If it is desired to lengthen this time interval, this is readily accomplished by adjusting the threaded stop member 13 to lower the iron core 11. If the bimetallic element 21 is of the quick snap acting type, it separates the electric contact members 23 and 25 quickly when the stack switch fails to close after a predetermined interval.

By adjusting the position of the iron core 11 within the windings 3 and 5 the impedance of the winding 3 in the motor circuit may also be varied to match the characteristics of the circuit. This adjustment may also be utilized to vary the circuit characteristics, to compensate for various motor loads or to compensate for different alternating current frequencies. In this manner my device may be adjusted in accordance with the particular installation in which the device is used.

It will be seen that I have provided a simple, positive acting, time delay safety control device which may be readily adjusted to control its time interval of operation and/or to match circuit operating characteristics or frequencies to which it is subjected.

Aside from the specific embodiments of the invention herein shown and described, it will be understood that numerous details of the construction may be altered or omitted without departing from the spirit and scope of the invention as disclosed and claimed, and that I do not

desire to limit the invention to the exact constructions herein set forth.

I claim as my invention:

1. In combination a heat responsive device, means actuated thereby, means for controlling said device comprising a member of magnetizable material, said material being in heat exchange relation with the heat responsive device, a source of magneto-motive force adjacent thereto, and a source of opposing magneto-motive force for opposing and neutralizing the effect of said first source in the vicinity of said member.

2. In combination a heat responsive device, means actuated thereby, heating means for controlling said device comprising a thermally coupled member of magnetizable material, said material being in heat exchange relation with the heat responsive device, an adjacent source of alternating magneto-motive force for heating said member by inducing eddy current and hysteresis losses therein, and means for varying the rate of heating said device.

3. In combination a heat responsive device, means actuated thereby, heating means for controlling said device comprising a thermally coupled member of magnetizable material, said material being in heat exchange relation with the heat responsive device, an adjacent source of alternating magneto-motive force for heating said member by inducing eddy current and hysteresis losses therein, means for varying the rate of heating said device, and an opposing source of alternating magneto-motive force for neutralizing and eliminating the effect of said first source in the vicinity of said member.

4. In combination in a variable impedance time relay controller, a heat responsive actuator; control means actuated thereby; heating means for said actuator comprising a thermally coupled member of magnetizable material, an adjacent source of magneto-motive force, means for varying the rate of heating said actuator; and an opposed source of magneto-motive force for limiting the heating effect of said first source in the vicinity of said member.

5. In combination in a variable impedance time delay controller, a snap acting heat responsive device comprising cupped discs of unlike metal, control means actuated thereby, heating means for operating said device comprising a thermally coupled member of magnetizable material, an adjacent source of alternating magneto-motive force, adjustable means for varying the rate of heating said device, and an opposing source of alternating magneto-motive force for neutralizing and eliminating the effect of said first source in the vicinity of said member.

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