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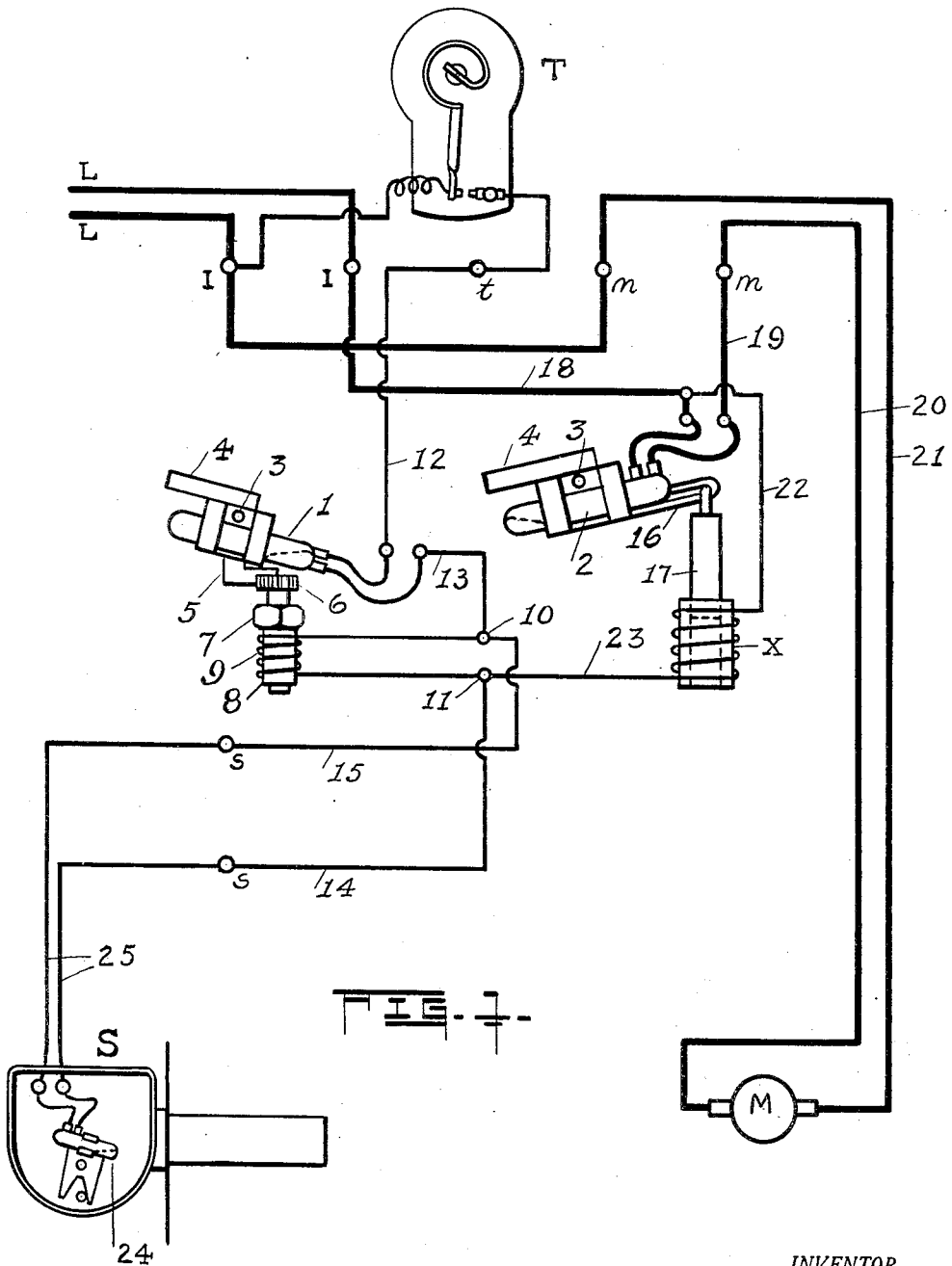
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SAFETY CONTROL DEVICE

Filed Dec. 12, 1925

2 Sheets-Sheet 1



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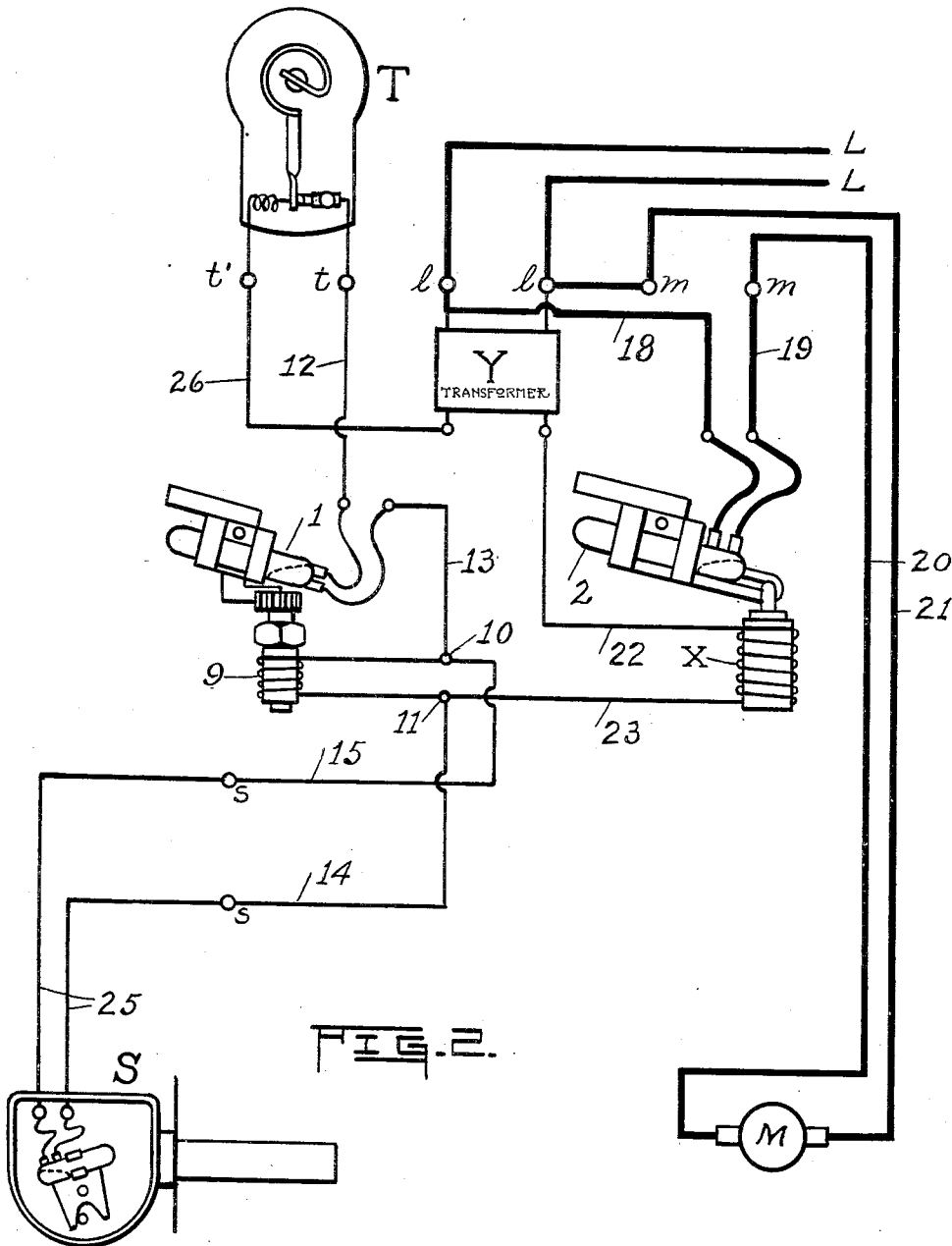
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SAFETY CONTROL DEVICE

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2 Sheets-Sheet 2



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SAFETY CONTROL DEVICE.

Application filed December 12, 1925. Serial No. 75,002.

This invention relates to control devices and more particularly to a device of this character for an electric circuit which will act as a safety control device when employed in a liquid fuel heating system.

While the embodiment of this invention is illustrated and described as applied to an electrically operated liquid fuel heating system for domestic purposes, this invention may be utilized for the same purpose in any electrical operated heating system for other purposes. An object of this control is to provide means preventing a continued operation of the burner mechanism if it fails to generate heat upon its initial operation and to further discontinue the operating mechanism if at any time during its operation it should fail to generate heat.

While the preferred form of this invention is illustrated upon the accompanying sheets of drawing, yet it is to be understood that minor detail changes may be made therein without departing from the scope of the invention.

Figure 1 is a view in side elevation of the panel carrying this improved control, illustrating in diagram the wiring connections between the control device, source of current, room thermostat, electric motor for operating the burner mechanism, and stack control, illustrating the positions assumed when the room thermostat has broken the circuit.

Figure 2 is a similar view of a modification.

For the purpose of convenience the elements of this improved control are mounted upon a panel preferably of commercial ebonny asbestos or other insulating material which includes binding posts for the attachment of the various leads, as illustrated in the wiring diagram. The construction of the mercury tube switches is of commercial form, and therefore need not be described in detail in the present application.

In electrically operated liquid fuel burners for domestic purposes it is customary to install the burner mechanism to generate heat in the ordinary domestic heating furnace which mechanism is operated by an electric motor indicated by the reference letter M on the diagram, the operation of which is controlled by a thermostat, indicated by the reference letter T, placed in the building where the temperature is desired to

be maintained constant, and the particular type of domestic oil burner system illustrated includes a stack control, indicated by the reference letter S on the diagram, of commercial construction having its actuating member arranged within the stack leading from the furnace to the chimney or otherwise located in proximity to the furnace or fire pot of the burner mechanism. Since the liquid fuel burning mechanism is not a part of this invention, merely the motor for operating the mechanism is illustrated. The source of current is indicated by the two leads L. The leads from the source of commercial current are connected to the binding posts indicated by the letter l upon the control panel. The motor M and stack control S are connected by leads to the binding posts m and s, respectively, upon the control panel. The left hand binding post letter l is connected by a lead to the left hand binding post m and that binding post letter l is also connected by a lead to the movable contact of the thermostat T, the other contact of the thermostat T being connected by a lead to the binding post t on the panel. The control elements carried upon the panel include two mercury tube switches 1 and 2 having terminals adjacent each other entering one end of the tube so that the circuit will be closed therethrough when the tube is tilted in that direction by the mercury accumulated at that end and closing the circuit between the terminals. These tubes are mounted upon pivots 3 and are provided with counterweights 4 which will normally act to rotate the tube about its pivot to cause the mercury to flow into the end away from the terminals and thereby break the circuit.

The mounting of the mercury tube switch 1 is provided with a pawl 5 extending therefrom adapted to engage a ratchet wheel 6 mounted to rotate thereunder, which ratchet wheel 6 is detachably mounted and normally held in fixed relation and is so arranged that it will engage the pawl and hold the mercury tube against the action of its counterweight when manually tilted to the closed position, as illustrated. The detachable holding of the ratchet 6 is preferably accomplished by mounting the shaft thereof in a cup 7 of heat transmitting metal containing solder which will normally maintain the ratchet 6 in fixed relation to the cup 7 but upon the application of heat will

melt the solder and allow the action of the counterweight 4 to rotate the ratchet 6 releasing the pawl 5 and rotate the switch to the open position. For the purpose of applying heat to melt the solder, the cup 7 is preferably provided with an extension 8 about which a coil of resistance or heat generating wire 9 is wrapped with one end of the coil secured to the binding post 10 on the panel and the other to the binding post 11. One terminal of the mercury tube switch 1 is connected by the lead 12 to the binding post *t* in circuit with the fixed contact of the room thermostat, and the other terminal of the mercury tube switch 1 is connected by the lead 13 to the binding post 10 of the heat producing coil 9. The other binding post 11 of the heat producing coil is connected by a lead 14 to one terminal of the stack control through the binding post *s* and the other terminal of the stack control is connected through the other terminal *s* and lead 15 to the coil connection leading from binding post 10.

The rotatable mounting of the mercury tube switch 2 is provided with a tilting arm 16 extending therefrom, the free end of which is pivotally and slidably connected to the free end of an armature 17 mounted to slide in a solenoid X mounted upon the panel thereunder so that when the solenoid X is energized and the armature drawn therein, the mercury tube switch will be rotated about its pivot to cause the mercury to close the circuit therethrough, as illustrated in Figure 2; and when the solenoid X is de-energized will allow the action of the counterweight 4 to rotate the mercury tube switch to the open position withdrawing the armature from the solenoid X, as illustrated in Figure 1. One terminal of switch 2 is connected by a lead 18 to the right hand binding post letter *l* which leads to the source of current. The other terminal of the mercury tube switch is connected by the lead 19 to the right hand binding post *m*, which in turn is connected to one pole of the motor M by a lead 20, the left hand binding post *m* being connected to the other pole of the motor M by the lead 21. The winding of the solenoid X is connected by a lead 22 joining lead 18 to the right hand binding post letter *l* and by a lead 23 to the binding post 11.

The stack control S is of any commercial type, but preferably includes a tilting mercury tube switch 24 similar in construction to the mercury tubes 1 and 2, the terminals of which are connected by leads 25 to the binding posts on the control panel, which mercury tube switch is moved into its closed and open positions to make and break the circuit therethrough in accordance with the temperature within the stack into which its operating member projects and so arranged

that as the temperature increases to a predetermined degree the circuit therethrough will be closed and thereafter maintained and when the temperature in the stack decreases from any degree the circuit therethrough will be broken and remain broken.

As illustrated in Figure 1, the mercury tube switch 1 has been manually set to the closed position, however, the movable contact of the thermostat T is in the open position, the solenoid X de-energized, the mercury tube switch 2 rotated by its counterweight 4 into the open position, the stack control switch in the open position, and the motor M non-operating as a result therefrom.

As shown in Figure 1, the mercury tube switch 1 which is in circuit with the thermostat T is closed but the circuit through the thermostat is open, the mercury tube switch 2 is open, the burner device is not operating and therefore generating no heat, so that the stack control switch is also open. These are the positions of the various elements of this control assumed when the desired temperature is produced in the building to cause the thermostat to operate to discontinue the further generating of heat by the burner mechanism. When the temperature has decreased below the desired predetermined degree, the movable contact of the thermostat will approach and engage the fixed contact thereof so that the circuit will be completed, as shown in Figure 2, from the commercial source through left binding post letter *l*, thermostat to binding post *t*, through lead 12 to mercury tube switch 1, thence through lead 13 and binding post 10, to heat coil 9, through binding post 11 and lead 23 to solenoid X, through the windings thereabout and lead 22 to the right hand binding post letter *l*, and from thence to the other lead L to the source of commercial current. This action will energize the solenoid X which will withdraw therein the armature 17 and rotate the mercury tube switch 2 to the closed position, shown in Figure 2. This switch in this position closes the circuit from the left hand binding post letter *l*, connected to the source of electric current, through its lead connecting to left hand binding post *m*, through the motor M by leads 21 and 20 to right hand binding post *m*, from this binding post through lead 19 to the mercury tube switch 2, and through lead 18 therefrom to the right hand binding post letter *l* connected to the other lead L of the commercial source of current. The energizing of the motor M will operate the domestic oil burner to generate heat which will cause the mercury tube switch in the stack control to be rotated into its closed position, and when this switch 24 is closed the current from the commercial source passing through the thermostat T, mercury tube switch 1, and binding post 10 will pass through lead 15, 130

upper binding post *s*, lead 25 therefrom, through said switch 24 and the other lead 25 to the other binding post *s* and lead 14 to binding post 11, from which binding post 5 through lead 23, solenoid X, lead 22 therefrom, right hand binding post letter *l* to the other lead L of the commercial source.

The heat producing coil 9 connected to binding posts 10 and 11 is so adjusted that 10 when the switch 24 is in its open position and the full current passes through the coil 9, sufficient heat will be generated to melt the solder, to release mercury tube switch 1 to be acted upon by its counterweight 4 to 15 break the circuit therethrough, but when the stack control switch 24 is in its closed position the current passing through mercury tube switch 1, switch 24, and about solenoid X, will be sufficient to reduce the heat produced by coil 9 below the melting point of the solder and will allow the mercury switch 1 to be maintained through its pawl 5 contacting with ratchet 6 in its closed position.

With the elements of the control in the 25 running positions, the commercial current will continue to operate the oil burner mechanism until the temperature in the room to be heated has reached the predetermined degree causing the movable contact of the thermostat to move away from the fixed contact and break the circuit therethrough. Upon 30 the breaking of the circuit through binding post *t*, lead 12, mercury tube switch 1, lead 13, binding post 10, heat coil 9, and stack control switch 24, lead 23, solenoid X, and leads 22 and 18 through binding post letter *l* to the other lead L of the commercial, the solenoid will be de-energized and the 35 mercury tube switch 2 will be rotated by the action of its counterweight 4 to its open position, thereby breaking the circuit through the motor M and causing the oil burner mechanism to cease operating. Upon closing 40 of the thermostat T through the temperature in the room falling below the predetermined amount, this circuit will be closed as above described and the oil burner placed in operation. Should the oil burner mechanism fail to generate heat when its operation is started 45 through the closure of the circuit through thermostat T, the temperature in the stack control will not be raised to the predetermined degree to cause the mercury tube switch of the stack control S to close its circuit and, therefore, the full commercial current will pass through heating coil 9 which will generate sufficient heat to melt the solder and release the switch 1 to be moved by 50 its counterweight 4 to its open position, breaking the circuit through solenoid X, and allow mercury tube switch 2 to be rotated by its counterweight 4 to break its circuit through the motor. Should the oil burner be 55 operating properly and for any cause fail to produce heat the temperature in the stack

will immediately drop and cause the mercury tube switch 24 of the stack control S to break the circuit through mercury tube switch 1 and solenoid X and the motor M and the oil burner mechanism will discontinue operation. 70

One of the particular advantages of the construction of the switches carried on the panel is, as seen from the circuits as traced above, that the operation of the switches 1 75 and 2 which are controlled by the operation of the thermostat and stack control, are in a circuit with the source of electricity separate and distinct from that circuit which operates the motor, and therefore, the motor 80 when operating, is in a circuit independent of the solenoid which acts to hold the motor in circuit during its operation. The advantage of this arrangement is that while the motor circuit is subjected to varying loads, 85 the circuit which operates the control elements and maintains the motor in circuit during its operation, being in a circuit independent of the motor, is not subjected to any variation in load of the motor and 90 therefore, will be actuated by a uniform current passing through said circuit, which is particularly desirable in the operation of the solenoid.

At times it may be desirable to include the 95 safety switch, safety switch actuating control and motor switch actuator together with the two thermostatic actuated switches in a circuit of less voltage than required to operate the motor. In such cases a transformer Y is connected in parallel with the 100 motor circuit between the motor and the source of commercial current, as illustrated in Figure 2. In such cases the thermostat is connected in circuit to the binding posts 105 *t* and *t*¹ and the binding post *t*¹ to one pole of the transformer by lead 26. Lead 22 from the solenoid is connected to the other pole of the transformer Y instead of to the binding post letter *l*, as in the other constructions. The closing of the thermostat switch 110 T then closes the secondary circuit from the transformer Y, through lead 26 to movable arm of thermostat T, from fixed contact thereof through lead 12 to safety switch 1, 115 thence through lead 13 to binding post 10 and about coil 9 to binding post 11, thence through lead 23 to solenoid X and from the solenoid by way of lead 22 back to the transformer, the motor switch 2 being in circuit 120 from the left binding post letter *l* through switch 2 to the right hand binding post *m* and by lead 20 through the motor, thence by lead 21 to the left hand binding post *m* to right hand binding post letter *l*. 125

What I claim is:

1. In a safety control device, a source of electricity, a motor adapted to be placed in circuit therewith, an electrically controlled switch in the motor circuit, a shunt circuit, 130

actuating means for said motor switch in said shunt circuit, a safety switch in said shunt circuit in series with said motor switch actuating means, electrically controlled means for actuating said safety switch in series between said safety switch and motor switch actuating means, a temperature operated switch, in parallel with said safety switch actuating means adapted to control said safety switch actuating means, and a temperature operated switch in the shunt circuit in series between the source of current and safety switch.

2. In a safety control device, a source of electricity, a motor adapted to be placed in circuit therewith, a switch in the motor circuit, electrically controlled actuating means therefor in a shunt from the motor circuit, a safety switch in said shunt circuit, electrically controlled actuating means therefor in said circuit, a temperature actuated means for making and breaking the shunt circuit through said first electrically controlled actuating means, and additional temperature actuated means for making and breaking the shunt circuit about said safety switch to said first electrical control to control the operation of the safety switch actuating means.

3. In a safety control device, a source of electricity, a motor adapted to be placed in circuit therewith, an electrically controlled switch in the motor circuit, a shunt circuit, actuating means for said motor switch including a solenoid in said shunt circuit, a safety switch in said shunt circuit in series with said motor switch solenoid, electrically controlled means including a thermal connection and heat generating means thereabout for actuating said safety switch in series between said safety switch and motor switch solenoid, a temperature operated switch in parallel with said heat generating means adapted when closed to shunt the current therethrough and render the heat generating means inoperative, and a temperature operated switch in the shunt circuit in series between the source of current and safety switch adapted to open and close the circuit through the safety switch, actuating

means therefor, temperature operated switch and motor switch solenoid.

4. In a safety control device, a source of electricity, a motor adapted to be placed in circuit therewith, a switch in the motor circuit, electrically controlled actuating means therefor in a shunt from the motor circuit, a safety switch in said shunt circuit, electrically controlled actuating means therefor in said circuit, a temperature actuated means for making and breaking the shunt circuit through said first electrically controlled actuating means, and additional temperature actuated means for making and breaking the shunt circuit about said safety switch to said first electrical control to control the operation of the safety switch actuating means, so related that with the safety switch in closed position, a closure of the shunt circuit through the first temperature actuated means will operate the actuating means to close the motor circuit switch and a continued passage of current therethrough will operate the safety switch control to break the said circuit through the safety switch, and a closure of the additional thermostatic actuating means will close the shunt circuit about the safety switch actuating means to maintain the motor circuit closed and render the safety switch actuating means inoperative.

5. In a safety control device, a source of electricity, a motor adapted to be placed in circuit therewith, an electrically controlled switch in the motor circuit, a secondary circuit, actuating means for said motor switch in said secondary circuit, a safety switch in said secondary circuit in series with said motor switch actuating means, electrically controlled means for actuating said safety switch in series between said safety switch and motor switch actuating means, a temperature operated switch, in parallel with said safety switch actuating means adapted to control said safety switch actuating means, and a temperature operated switch in the secondary circuit in series between the source of current and safety switch.

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