

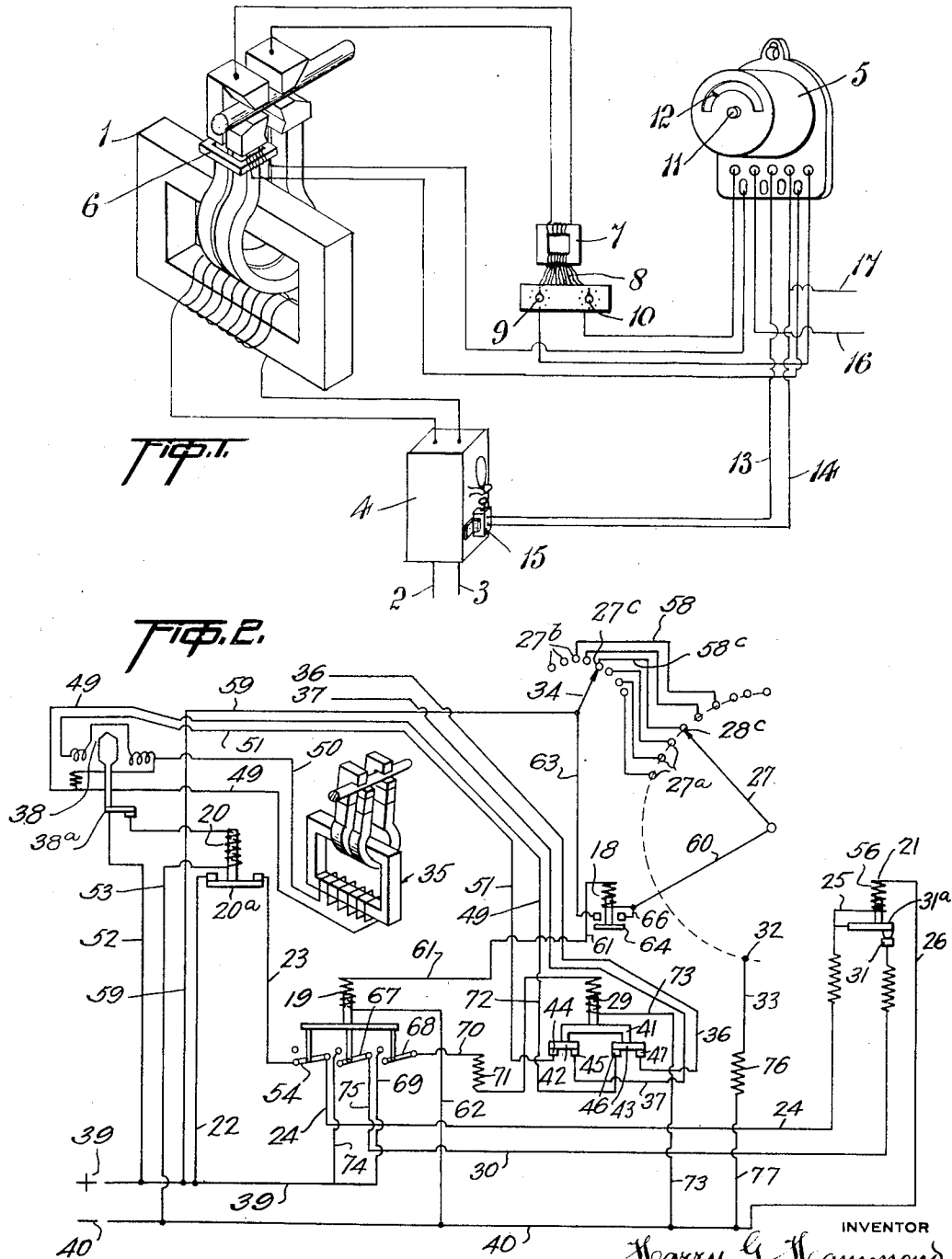
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TEMPERATURE CONTROL FOR ELECTRIC BAR HEATERS

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TEMPERATURE CONTROL FOR ELECTRIC
BAR HEATERS

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1 Claim. (Cl. 219—20)

This invention relates to the temperature control of electric furnaces, more particularly electric bar heaters, wherein it is desired the temperature to which the article is to be heated be limited and prevented from rising above a predetermined degree.

Hitherto it has been usual to provide thermostatic or similar means which would measure the actual temperature of the furnace in which an article is enclosed during heating or the actual temperature of the article being heated, or to use a pyrometer to determine the temperature.

The present invention has for its object to provide for the prevention of over-heating of the article by simply measuring the amount of current actually passed therethrough, and as the energy so supplied to the metal represents a known B. t. u. value, losses being taken into consideration, it is a simple matter to provide a relay or similar device which may be actuated whenever the kilo-watt hours input reaches a predetermined point.

Further objects and advantages subsidiary or incidental to the aforesaid objects, or resulting from the construction or operation of the invention as it may be carried into effect, will become apparent as the said invention is hereinafter further disclosed.

In carrying the device into effect, I may provide in combination with means for supplying electric current to an article to be heated, a watt-hour meter, a contactor driven by the rotation of the rotor of the meter, a step-down current transformer and a step-up voltage transformer to adapt the watt-hour meter to the values of current and voltage found in the circuit of the heater or furnace, and a suitable relay controlled by said meter and controlling the furnace circuit.

All of which is more particularly described and ascertained hereinafter, by way of example, having reference to the accompanying drawing wherein:

Figure 1 is a schematic diagram illustrating an arrangement embodying the said invention; and

Figure 2 is a wiring diagram illustrating a modified method of carrying the invention into effect.

Referring first to Figure 1, 1 indicates a bar heater of a conventional type receiving its current from leads 2 and 3 passing through an automatic release circuit breaker 4, and 5 is a watt-hour meter receiving current from the circuit of the bar heater through a step-down current transformer 6 and a step-up potential transformer 7. Taps 8 are shown as being brought

out of the secondary of the transformer 7, so that the watt-hour value per revolution of the meter may be controlled such as by means of suitable rotary switches 9 and 10.

The meter, of course, measures the electrical energy supplied to the bar or article being heated by the bar heater 1, and it is provided with an adjustable contact switch 11 and indicator 12 which may be set to close a circuit through the lines 13 and 14 and incidentally through a relay 15 controlling the operation of a circuit breaker 4, so that the moment a predetermined amount of energy has been supplied to the article being heated, the closing of the switch 11 of the meter will result in the opening of the circuit breaker 4 and the cutting off of the further supply of current to the article being heated. Consequently, over-heating of the article is thereby definitely prevented. 16 and 17 indicate leads for the controlling circuit.

The described arrangement has proved satisfactory in use and is entirely practicable but it will be readily understood that it may be modified in its details especially as to the substitution of conventional apparatus for the various elements of the general combination. For instance, as indicated in Figure 2, a fixed watt-hour per contact type of meter may be utilized together with a notching relay of the type used in automatic telephone systems with selective switches.

Thus, in the said Figure 2, 36 and 37 are leads from a suitable source of electricity through a circuit breaker 29 and watt-hour meter 38 to a bar heater 35. 20 is a relay in series with a contact circuit of the watt-hour meter. 21 is the notching relay the circuit through which is indicated by lines 22, 23, 24, 25 and 26.

27 is a contact arm of the notching relay moving over a series of contacts any one of which is preselected according to the amount of energy that it is desired to impart to the article being heated. In this case a selected contact is indicated, as at 28c. 39 and 40 represent leads from a suitable source of electricity for the control circuit, the lead 39 being arbitrarily designated as positive and the lead 40 as negative. Current may be A. C. or D. C.

The operation of the device illustrated in Figure 2 is as follows: 41 is a manually closed switch containing the two contact arms 42 and 43, the first of which is adapted to bridge the contacts 44 and 45 and the second, contacts 46 and 47 respectively. When the switch 41 is manually closed power is fed through the conductor 36 to contact 47, bridge 43, contact 46 and conductor

49, bar heater 35, conductor 50, the watt-hour meter 38, conductor 51, contact 44, bridge 42, contact 45 to conductor 37, thus completing the power circuit. The watt-hour meter 38 causes intermittent opening and closing of a switch 38a which completes the following circuit through the notching relay 21. The circuit starts at the positive lead 39 and passes through conductor 52, switch 38a, relay 20, conductor 53 and negative lead 40. The energization of the relay 20 closes the contact arm 20a and completes the following circuit. The circuit starts at the positive lead 39, goes through conductor 22, contact arm 20a, conductor 23, switch arm 54, conductor 24, conductor 25, actuating coil 56, conductor 26 and negative conductor 40. The energization of the actuating coil 56 causes the advancement of the arm 27 from one contact 27a to the next adjacent contact. Each successive closing of the switch 38a of the watt-hour meter causes the advancement of the arm 27 to the next succeeding contact. Each of the contacts 27a are connected to contacts 27b in a preselecting device by suitable conductors 58. This pre-selecting device has an adjustable arm 34 adapted to engage a predetermined contact 27b and, as shown, this contact is numbered 27c. Contact 27c is connected by conductor 58c to the contact 28c.

When the intermittently actuated arm 27 is advanced to the point where it contacts with the contact 28c, the following circuit is completed. The circuit starts at the positive lead 39 and passes through conductor 59, adjustable arm 34, contact 27c, conductor 58c, contact 28c, arm 27, conductor 60, relay 18, conductor 61, relay 19, conductor 62 and negative conductor 40. The completion of this circuit closes relays 18 and 19. When the relay 18 is closed it is automatically held closed by a circuit starting from conductor 59 and passing through conductor 63, switch arm 64, and conductor 66 which connects to the relay coil 18. Thus when the arm 27 advances beyond the contact 28c, the circuit through relays 18 and 19 is still maintained.

The energization of relay 19 actuates switch arm 54 to open the same and break the circuit between conductors 23 and 24, thus preventing further energization of the actuating coil 56 by the watt-hour meter. The energization of relay 19, however, closes the switch arms 67 and 68. Switch arm 68 completes a circuit through relay 29, thus opening the switch 41 and breaking the power circuit to the bar heater. The circuit through switch arm 68 may be traced from positive lead 39 through conductor 69, switch arm 68, conductor 70, coil 71, conductor 72, relay coil 29 and conductor 73 to the negative lead 40.

Although the arm 27 of the notching relay is no longer moved through the intermittent action of the switch 38a of the watt-hour meter, it is nevertheless caused to advance back to its starting position by a circuit through the switch arm 67. This circuit may be traced starting from the positive lead 39, through conductor 74, switch arm 67, conductor 75, conductor 30, stationary contact 31, movable contact 31a, conductor 25, actuating coil 56, conductor 26 and negative lead 40. The movable contact 31a is electromagnetically actuated by the coil 56 so that at each energization of the coil 56 the contact 31a is withdrawn from the contact 31, breaking the circuit through the coil 56. Thus the coil 56 is intermittently operated until the arm 27 is advanced to the starting point contact 32. The contact 32 is connected by conductor 33 through resistance 76 and conductor 77 to the negative lead 40. Thus when the arm 27 reaches the contact 32 it short-circuits the relay 18, deenergizing the same and consequently deenergizing the relay 19. This automatically places the relays 18 and 19 in their original starting position and resets the apparatus to its original circuit relationship in readiness for a further operation of the heater.

This invention may be developed within the scope of the following claim without departing from the essential features of the said invention, so that it is desired that the specification and drawing be read as being merely illustrative, and not in a limited sense, except as necessitated by the prior art.

What I claim is:

In combination with an electric bar heater, temperature control means including a circuit breaker controlling the circuit through said heater, a control relay, a meter measuring energy supplied to said heater, a notching relay, a contactor operating over a series of contacts and operated by said notching relay, a meter contactor controlling the operation of said notching relay, said control relay normally closing the circuit through the said meter contactor and said notching relay, and a further relay operable upon the contactor of said notching relay reaching a pre-selected contact, said second relay operating to energize the said first-mentioned relay to close a circuit through said circuit breaker and a further circuit through said notching relay, whereby the contactor of said notching relay will continue movement to its starting point, and means short-circuiting said second relay when said contactor reaches its starting point whereby said first-mentioned relay is again de-energized.

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