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MAGNETIC TEMPERATURE CONTROL SYSTEM

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Fig. 1.

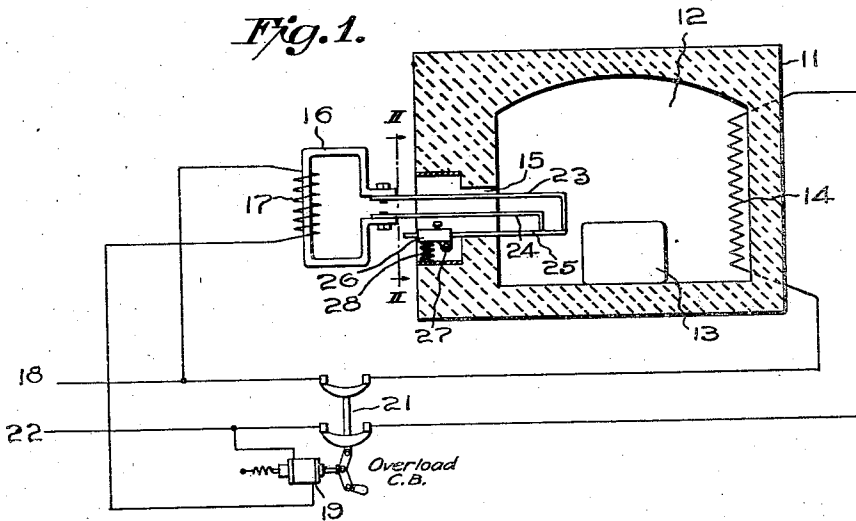
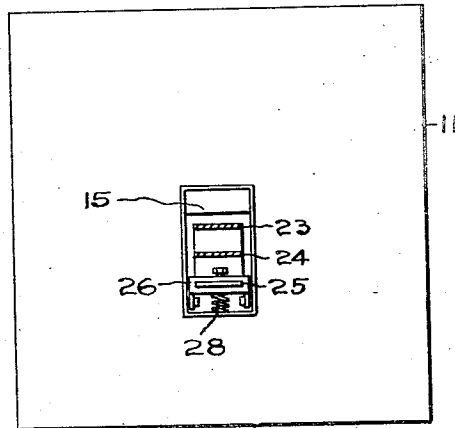


Fig. 2.



WITNESSES:

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MAGNETIC TEMPERATURE-CONTROL SYSTEM.

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My invention relates to electric furnaces, and particularly to temperature-limiting means therefor.

One object of my invention is to provide a relatively simple and compact means, comprising a minimum number of parts, for limiting the temperature of normally magnetic material being heated.

In practicing my invention, I provide an electric heating means for a furnace structure, an electromagnetic circuit-interrupting device therefor, and a core member of the same material as the mass to be heated. A portion of the core member is located in heat-interchanging relation to the mass of material and has a movable member to open the magnetic circuit of the core member. A magnetizing coil is associated with the core member and is connected in series-circuit relation to the trip coil of the circuit-interrupting device.

In the single sheet of drawings,

Figure 1 is a view of an electric furnace, in vertical section, comprising a device embodying my invention, together with a schematic diagram of connection, and

Fig. 2 is a fragmentary view, in vertical section, taken on the line II—II of Fig. 1.

The numeral 11 indicates a furnace structure of any suitable or desired type, here shown schematically only as comprising a plurality of walls, a roof and a floor structure, enclosing a furnace chamber 12 of any suitable or desired contour and dimensions. As the particular details of construction of the furnace constitute no part of my invention, no further detailed description thereof is believed necessary.

A mass 13 of a normally magnetic material, such as steel or iron, is adapted to be located within the furnace chamber 12 and to be heated by suitable electric means, here indicated as a resistor member 14. The resistor member 14 is illustrated schematically only, as it also constitutes no part of my invention and may be of any suitable or desired type usually employed in the art.

One of the walls of the furnace is provided with a suitable opening 15 extending

therethrough to receive a support and a circuit-interrupting means, to be described in detail.

A fixed magnetic core member 16 comprises a member of substantially U-shape that has associated therewith a magnetizing coil 17. The two terminals of the magnetizing coil 17 are connected, respectively, to one supply-circuit conductor 18 and to one terminal of a trip coil 19 of a circuit-interrupting device 21, the other terminal of the coil 19 being connected to the other supply conductor 22. The circuit-interrupting device 21 is of the usual construction employed for such purposes, is connected in series-circuit relation with the electric heating means 14 and is of the type which will be moved to the open position upon an increase of current through the coil 19.

Two relatively elongated members 23 and 24 are mechanically secured, at one of their respective ends, to the ends of the member 16 of U-shape. An open magnetic circuit is provided by reason of the fact that the inner end portions of the members 23 and 24, that are located within the chamber 12 and in heat-interchanging relation relatively to the mass 13 of material being heated, are bent at substantially right angles thereto. A third member 25, that is preferably in the form of a straight bar, has its inner end in operative engagement with the ends of the members 23 and 24, whereby the magnetic circuit thereof is normally closed.

A holder 26 is provided for the outer end of the bar 25 and is pivotally supported at 27. A spring 28 operatively engages the outer end of the holder 26 and tends to move the inner end of the member 25 out of engagement with the ends of the members 23 and 24, which action, however, is normally opposed and prevented by the magnetic flux produced by a current traversing the coil 17, which magnetic flux traverses the yoke or core member 16, the members 23 and 24 and a portion of the member 25.

While I have indicated a relatively large and solid mass 13 of normally magnetic material, it is to be understood that this is

illustrative only and may comprise a plurality of normally magnetic members, such as bars or rods. The members 23, 24 and 25 are of the same material as that constituting the mass 13 and, if relatively simple bars or plates are being heat treated, it is an easy matter to secure these members 23 to 25.

Upon energization of the heating means 14 and of the magnetizing coil 17 from the supply circuit conductors 18 and 22, it is evident that the positions of the parts in Fig. 1 of the drawing are the normal ones as long as the inner end portions of the members 23 to 25, inclusive, have not been heated to such an extent as to render them non-magnetic, a condition which obtains when steel has been heated to a relatively high temperature, which temperature is that usually employed in heat-treating operations.

When the mass of material 13 has been heated to a temperature just beyond its recalcrescent point, the temperature of the members 23 to 25, inclusive, particularly of the end portions thereof that are in heat-inter-changing operation relatively to the mass of material 13, will also be heated to substantially that temperature and will become substantially non-magnetic. The spring 28 will, therefore, when properly adjusted, be effective to cause a turning movement of the member 25 away from the outer ends of the members 23 and 24, whereby the magnetic circuit is interrupted. This results in a sudden increase in the value of the current traversing the coil 17 and, with the proper adjustment of the overload circuit breaker 21, it will be actuated to its open position, whereby the electric heating means 14 will be deenergized and heating of the mass of material 13 will be interrupted.

The device embodying my invention is of particular value and particularly applicable to the heat treating of relatively simple forms of normally magnetic material, although its use is not limited to the simple forms only, as it is possible to obtain magnetic materials 23 to 25, inclusive, that have substantially the same characteristics as that of the mass 13.

While I have shown the members 23 and 24 as of substantially L-shape, this is not an essential, as other cooperating shapes may be employed so long as a normally closed magnetic circuit is obtained, which may be interrupted as hereinbefore described.

Various modifications may be made in the device embodying my invention without departing from the spirit and scope thereof and all such modifications are intended to be covered by the appended claims which are to be limited only by the prior art.

I claim as my invention:

1. The combination with an electric heating means, and a circuit-controlling device

therefor, of a magnetic core member, an energizing coil disposed thereon and connected to said circuit-controlling device, and means operatively associated with said core member for effecting an increase in the current traversing said coil at a predetermined temperature of said means to actuate said circuit-controlling device.

2. The combination with an electric heating means, and an electromagnetic circuit-controlling device therefor, of a normally-closed magnetic circuit core member, a magnetizing coil therefor electrically connected to said circuit-controlling device, and means for effecting the opening of the magnetic circuit of the core member at a predetermined temperature, whereby the increased current traversing the magnetizing coil causes actuation of the circuit-interrupting device.

3. The combination with an electric heating means for heating a mass of normally magnetic material, a circuit-interrupting device for said heating means and an actuating coil for said circuit-interrupting device, of a magnetic core member of the same material as that being heated, a coil for magnetizing said core member, connected in series circuit relation to said actuating coil, means for normally closing the magnetic circuit of said core member, said magnetic circuit closing means being subjected to the heat from the mass of material being heated, and resilient means effective at a predetermined temperature of said magnetic circuit closing means to move the same to open the magnetic circuit of the core member, whereby the increased current traversing the actuating and magnetizing coils effects the actuation of the circuit-interrupting device.

4. In an electric furnace, the combination with a furnace chamber, and an electric heating means therein for heat treating material placed in said chamber, of an auxiliary circuit for controlling the energization of said heating means and comprising an overload circuit-interrupting device, a magnetic core member having a normally closed magnetic circuit, an energizing coil for said core member electrically connected to said circuit-interrupting device, and means operatively associated with said core member for opening said magnetic circuit.

5. The combination with an electric heating means, and a normally magnetic core member, of an electromagnetic circuit-interrupting device for controlling the energization of the heating means, and an electric coil member operatively associated with, and controlled by, the normally magnetic core member for effecting actuation of the circuit-interrupting device at a predetermined temperature of the core member,

6. The combination with an electric heating means for heating a mass of normally

magnetic material, and a core member of the same material as the mass being heated, of a magnetizing coil for said core member, and an electromagnetic circuit-interrupting device for controlling the energization of said heating means and electrically connected to the magnetizing coil and effective to cause deenergization of the heating element when the core member becomes non-magnetic.

In testimony whereof, I have hereunto subscribed my name this 20th day of April, 1925.

JAMES C. WOODSON.