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METHOD OF HEATING A WORKPIECE BY HIGH-FREQUENCY CURRENTS

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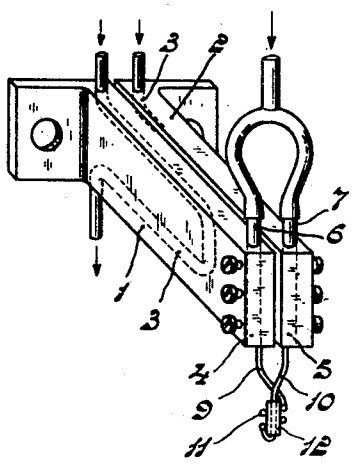


Fig. 1

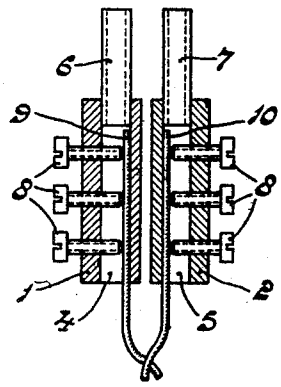


Fig. 2

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METHOD OF HEATING A WORKPIECE BY HIGH-FREQUENCY CURRENTS

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6 Claims. (Cl. 219—10.41)

The invention relates to a method of heating workpieces by high-frequency currents and more particularly to a method of heating workpieces by high-frequency currents by means of an inductor constituted by a coil wound from wire and preferably comprising a core which is made of material having an electric resistance of at least 10^5 ohm/cm. The coil is tightly secured to preferably cooled input terminals of the high-frequency generator and is characterised in that previously the coil is externally wetted by a liquid cooling agent and subsequently a workpiece whose diameter of the surface required to be heated is less than 12 mms. is heated by means of the high-frequency current in the coil.

This method is of particular utility for internally heating apertures formed, for example, in sheet materials and rod-shaped articles having a diameter which is less than 12 mms. but not less than 4 mms. In the first-mentioned case the small diameter of the aperture necessitates the use of comparatively thin wire so as to enable the coil to be inserted in the aperture. To ensure sufficiently intense heating, the high-frequency current must have a given value and be supplied to the coil for a certain period of time. It has been found that the heat thus rises to the extent of damaging the coil wire or even causing it to melt. Due to external wetting of the coil in accordance with the invention no damage is done to the coil upon a proper choice of current strength, period of time and wire diameter. In this regard, the wire diameter generally varies between 0.5 mm. and 2 mms.

Heating rod-shaped bodies of small diameter within a coil allows the wire diameter of the coil to be much larger, but in this event the skin effect is responsible for the transmission of energy being decreased and the coil requires an appreciable amount of material. This is also obviated by the use of the invention since the present invention permits the wire diameter to be reduced.

According to a further feature of the invention, if use is made of a core this is also previously wetted by the cooling agent. At the end of the heating period the core temperature may have risen to the Curie-point so that the initially high permeability has approached unity, but at that moment of time, the heating process has substantially been carried out already. Immediately upon heating, the workpiece may be quenched by a re-supply of the cooling agent. Generally the heating process is carried out in a manner such that the wetting agent just has evaporated at the end of the heating period.

The invention will now be described with reference to the accompanying diagrammatic drawing, given by way of example, in which:

Fig. 1 shows the input terminals of a high-frequency generator embodying the present invention and

Fig. 2 is a cross-sectional view thereof.

Referring now to the figures of the drawing, input terminals 1 and 2 which are insulated from each other comprise internal cooling ducts 3 shown by broken lines. At the ends, the terminals 1 and 2 comprise bores 4 and 5 which are connected to supply pipes 6 and 7 which

conduct the supply of a liquid cooling agent as hereinafter described. Bolts 8 enable two ends 9 and 10 of an inductor which is constituted by a coil 11 wound from wire to be secured with some spacing in the bores 4 and 5. This results in the coil connections also being cooled. The coil 11 is provided with a hollow core 12.

After the cooling agent is supplied by way of the supply pipes 6 and 7 and coil and core are thus wet, the workpiece is arranged so as to surround the coil and high-frequency current and power from 3.5 to 4 kw. is supplied for example for 0.75 of a second. On termination of this heating period the cooling agent has evaporated. Thereafter supplying the cooling agent a second time enables the workpiece to be quenched. The coil is readily interchangeable, if other dimensions are required.

While I have shown and described the preferred embodiment of my invention, it will be understood that the latter may be embodied otherwise than as herein specifically illustrated or described and that in the illustrated embodiment certain changes in the details of construction and in the arrangement of parts may be made without departing from the underlying idea or principle of the invention within the scope of the appended claims.

What is claimed is:

1. A method of heating a workpiece by high-frequency currents by means of a coil-wound wire inductor having an associated core comprising the steps of externally wetting said inductor and core by means of a liquid cooling agent, arranging said workpiece to surround said inductor, and heating said workpiece by means of the high-frequency current in said inductor.

2. A method of heating a workpiece by high-frequency currents by means of a coil-wound wire inductor comprising the steps of externally wetting said inductor by means of a liquid cooling agent, arranging said workpiece to surround said inductor, heating said workpiece by means of the high-frequency current in said inductor and further supplying said liquid cooling agent to said inductor to thereby quench said workpiece, the duration of the passage of current through said inductor conforming with the high-frequency energy so that the end of the period of the passage of current substantially coincides with the instant at which the liquid on the inductor has evaporated due to said heating process.

3. A high-frequency heating device for heating a workpiece comprising a high-frequency generator provided with at least two input terminals insulated from each other and a coil-wound wire inductor secured thereto and duct means for supplying a liquid cooling agent to said inductor to thereby enable said inductor to be externally wetted.

4. A high-frequency heating device for heating a hollow workpiece comprising a high-frequency generator provided with input terminals each having an internal cooling duct, and a coil-wound wire inductor associated with said input terminals having a core made of a material exhibiting an electrical resistance of at least 10^5 ohm/cm., and separate duct means for supplying a liquid cooling agent to said inductor to thereby enable said inductor to be externally wetted.

5. A high-frequency heating device for heating a hollow workpiece comprising a high-frequency generator provided with input terminals and a coil-wound wire inductor associated therewith having a core made of material exhibiting an electrical resistance of at least 10^5 ohm/cm., the diameter of said wire inductor being from 0.5 mm. to 2 mm., and separate duct means for supplying a liquid cooling agent to said inductor to thereby enable said inductor to be wetted.

6. A high-frequency heating device for heating a workpiece comprising a high-frequency generator provided

with a pair of input terminals, each having an elongated aperture therein, a coil-wound wire inductor associated therewith, means securing each free end of said inductor in one of said apertures with spacing remaining through the entire length of each of said apertures, and supply pipes communicating with the spacing in each of said apertures for externally supplying liquid cooling agent to said inductor.

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