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MEANS FOR PROTECTION AGAINST AND/OR INDICATION OF FAULTS IN CORELESS INDUCTION FURNACES, HEATING FURNACES AND THE LIKE

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Fig. 1

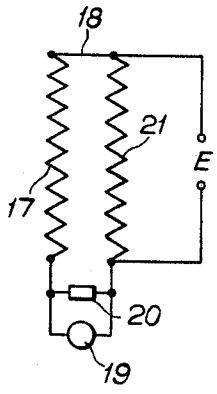


Fig. 2

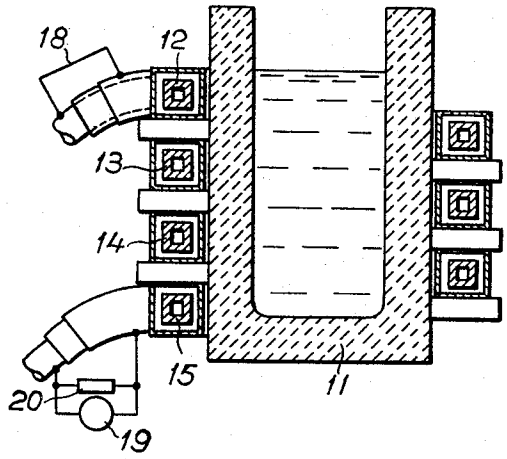
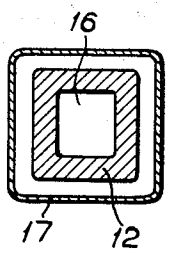


Fig. 3



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MEANS FOR PROTECTION AGAINST AND/OR INDICATION OF FAULTS IN CORELESS INDUCTION FURNACES, HEATING FURNACES AND THE LIKE

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1 Claim. (Cl. 13—27)

The present invention relates to a means for protection against and/or indication of faults in a coil or coils in induction furnaces of coreless crucible type, heating furnaces and the like.

Furnace coils in induction furnaces (for low or high frequency) for melting, or heating furnaces, are subjected to difficult operating conditions, which are often accompanied by short circuits between the winding turns of the coil. Such short circuits result in arcs which, when they have been active for a time, usually create holes in the water-cooled copper tubes of the coil, that is current conductors for the coil. It has been practically impossible to prevent this because of the absence of indication of these faults. The coils have been provided with insulation, but this has not resulted in the elimination of said disadvangages.

The device according to the invention gives a solution to these and other connected disadvantages, in which the coil turns are possibly surrounded by insulation and around this (or at a distance from, but concentrically with the conductor) an uninterrupted metal cover wholly or partially enclosing the conductor section and without insulating interruption in the longitudinal direction of the current conductors. The device is characterised in that the cover and conductor are joined at one coil end and joined across a relay and/or a voltage measuring device at the other coil end directly or through an insulating transformer, so that upon short circuiting or some other insulation faults between the coil turns the relay is actuated and the furnace feed is disconnected and/or the fault is indicated. Through this means disconnection of the feed and/or indication of the fault is carried out quickly, before further damage to the coil and insulation have developed.

The invention is further clarified in the accompanying figures, of which FIG. 1 shows a connection diagram of the invention, FIG. 2 a cross section of the coils with the cover and FIG. 3 an example in cross section through a coil conductor with completely closed metal cover.

In FIG. 2 a crucible **11** is shown, containing melt or material to be melted. The different coil conductors **12–15** are manufactured with central coolant ducts **16** (FIG. 3). Because there is normally no potential difference between conductor and cover and during faults this difference is limited in size, the insulation around the conductors can be made thin, since it does not need to withstand high temperatures. The insulation is surrounded by a metallic conducting cover **17**, manufactured in such a way that heating through the induction flux is small. The cover **17** can consist of thin plate or a band of non-magnetic material. It can also be applied by flame spraying so that it wholly or partially covers the conductors. At one end of the coils **12–15** the conductor and cover are joined together (see **18** in FIGS. 2 and 1) while at the other coil end the joining together is carried out across a voltage measuring device **19** and/or a relay **20**, possibly with an intercoupled insulating transformer (not shown). The relay **20** is arranged to disconnect the furnace feed upon actuation.

The connection of coil protection and coil indication means is evident from FIG. 1. The current conductors of the furnace coil is here denoted **21**, while as previously the metal cover is denoted **17**. The furnace measurer is connected at E. Because of different flux directions the voltages induced by the flux during the operation of the furnace in the conductor **21** and the cover compensate each other, so that the discharge of the measuring device **19** will be zero during normal operation. It may be desirable on account of certain differences between the fluxes through the cover **17** and the conductor **21** to arrange a compensation coil (not shown) with corresponding flux, with a view to reducing the flux through the conductors in order to obtain full compensation.

Upon a leak between the conductors, short circuiting of two cover turns is produced and the balance between the indicated voltages in **17** and **21** disappears, so that a certain voltage is indicated in the measuring instrument and thus a fault is indicated. At the same time voltage across the relay **20** is produced and the furnace feeding is switched off, after which the fault in the coil can be repaired. It is possible to arrange only indication or only use a relay.

This connection (FIG. 1) can also be complemented with a crucible supervisory connection according to U.S. Patent No. 3,185,894.

If the furnace coil is divided up into several part coils, the above can be applied on each individual part coil.

The invention can also be applied to heat induction furnaces with coils of water-cooled tubes.

The invention can be varied in many ways within the scope of the claim.

I claim:

1. Means for protection against faults in a coreless induction furnace, said furnace comprising a crucible surrounded by coil turns covered by insulation, comprising, at least partly around said insulation, an uninterrupted metal cover conducting in the longitudinal direction of the current conductor, the conductor of the coil and the metal cover being coupled together at one coil end, said conductor and metal cover being coupled together at the other coil end across a voltage sensitive member, said member being affected upon short circuits or other insulation faults.

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