

Jan. 24, 1933.

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1,895,421

ELECTRIC INDUCTION FURNACE

Filed Oct. 7, 1929

Fig. 1.

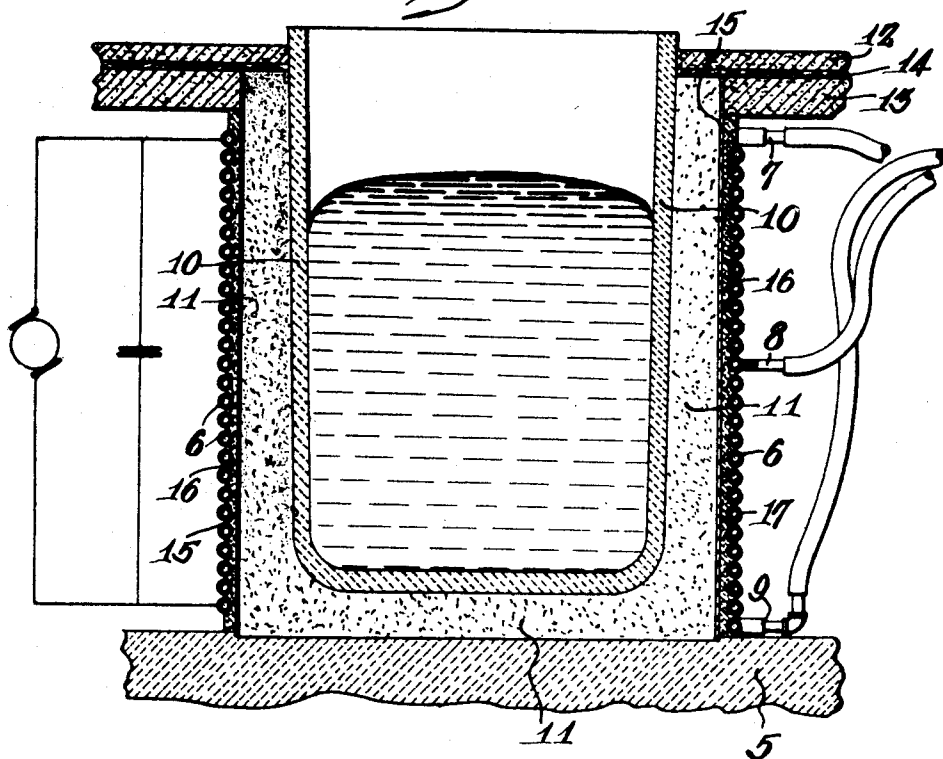
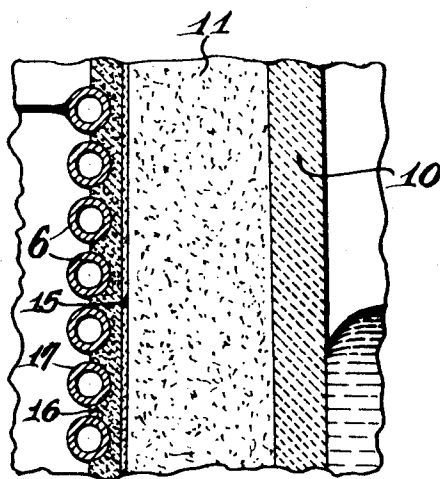


Fig. 2.



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ELECTRIC INDUCTION FURNACE

Application filed October 7, 1929. Serial No. 397,787.

My invention relates to the protection of induction furnaces against injury to the furnaces or to those operating them by reason of leakage of molten metal through the furnace walls.

The main purpose of my invention is to provide a highly refractory furnace lining to an inductor furnace coil which shall protect the coil from engagement by molten metal leaking from the furnace.

A further purpose is to provide an air dried refractory in intimate contact with a water-cooled inductor furnace coil and of such character that it shall become sintered by contact with it of molten metal and shall thus protect the inductor coil from the metal.

Further purposes will appear in the specification and in the claims.

I have preferred to illustrate my invention by but one form applied to a conventional furnace, selecting a form of illustration which has been highly successful and which at the same time well illustrates the principles involved.

Figure 1 is a vertical, central section of a furnace showing an application of my invention.

Figure 2 is an enlarged fragmentary section corresponding to part of Figure 1.

In the drawing similar numerals indicate like parts.

Because my invention is applied to electric furnaces of the induction type it is necessary to illustrate it in connection with some such furnace. I have selected a standard type of furnace for this illustration without intending to indicate that the invention is specially suited to the furnace shown and with knowledge that the invention is adapted for use with many other types of induction electric furnace.

Where water-cooled inductor coils are used any leakage of molten metal against the coils becomes dangerous because of the danger of explosion. Various efforts have been made to prevent this by the use of crucibles and surrounding protective refractory. The recent practice of using a shell of sintered refractory instead of a crucible has increased the danger. Cracking of the crucible or of this

shell throws the molten metal against the heat insulation whose sintering must there be relied upon to stop the flow. My invention is supplemental to whatever protection of this character may be provided and additionally protects the coil without interfering with the use of these existing protective means.

The furnace shown comprises a base 5 of any refractory, such, for example, as silocel, upon which rests or is supported a furnace coil 6 which is water-cooled in any suitable way. In the form shown the water cooling is accomplished by central inlet and end outlet pipe connections 7, 8 and 9.

The invention is well suited to the protection of water cooled coils for the reason that it can be applied directly to or very close to the coils to be protected. It can be applied also to other coils.

Inside the water-cooled coils I have shown a container 10 which may be a separate crucible as shown and which is surrounded and heat-insulated by finely dividing refractory 11 about the outside and below the crucible. The top is completed and heat-insulated by suitable means such as asbestos in board or other form forming layers 12, 13 and 14.

The finely divided refractory is ordinarily surrounded by a shell of micanite 15 or other insulating material which, at the time, also serves the purpose of retaining the refractory material.

Whether such a shell of micanite or other material be used or not my invention consists in forming a protective layer of molded, highly refractory, preferably air-dried cement between the coils and the layer of finely divided refractory. This shell 16 is most useful and, therefore, most desirable when plastered against the interior surfaces of the turns 17 of the inductor coil, and is shown as inserted between the turns and about the entire inner surface of the coil.

This refractory cement is plastered upon the inside of the coil and may be formed of any highly refractory mixture which will air dry and which will bar any flow of leakage metal through it to the conductor coils.

Though I recognize that many other well-

known refractories will serve the purpose, and that even with the ingredients hereinafter described, the proportions may be greatly varied, in compliance with the requirement of the statute I give herein the composition of one mixture which serves the purpose well. I have used with great success a mixture of 70% sand, 20% alundum cement and 10% wet silicate of soda. It should be well mixed and is conveniently troweled in.

The mixture may be applied more effectively to the coil if the portion of the coil to be covered be first coated with a sticky material which will cooperate with or blend with the cement. With the materials above I have used silicate of soda very satisfactorily. The covering of mixture need not be thick though there is no disadvantage from using a rather thick coating except as it may involve increased spacing of the coil from the charge with consequent loss in coupling.

The coating is dried and forms a mechanical protection for the inside of the coil from the start. Because the shell formed is not brittle enough to crack the shell offers a complete sinterable refractory for engagement by the molten metal leakage, fully protecting the coil.

It will be evident that an air-dried shell or shield is less frangible than one which is baked. The support offered by the coil to the shell further protects the shell against mechanical injury.

It will be evident that the position of the sinterable protective shield adjacent to the coil spaces it sufficiently from the furnace charge and cools it sufficiently by the coil so that it will not be unduly hardened by the heat.

It will be further evident that this sinterable shield will perform its protective function independently of the character of the individual turns of the coil protected and of the type and extent of insulation within and of the presence or absence of a separate crucible, or sintered lining to hold the melt.

It will be further evident that my invention is applicable to any type of furnace in which the coil is in danger of injury from molten metal leakage flow, independently of the relative position of the coil and pool.

It will be further evident that the protective function of my shield is performed independently of the frequency and voltage of the current applied and is effective against leakage of both ferrous and non-ferrous metals.

In case of leakage through the crucible or sintered lining immediately engaged by the melt the leakage metal first comes in contact with the finely divided refractory. A moderate amount of leakage flow will be stopped by this, sintering the refractory and automatically sealing the fracture. Where this is not sufficient and the molten metal comes in contact with my shield or shell the metal

sinters the shield or shell, which, being solid, stands up against the molten flow more effectively than does the loose refractory material.

Where I have referred to the lining as moulded I mean merely that a plastic material has been shaped into the form desired and do not mean that the material need be pre-formed. It is most desirably plastered in position within and between the turns.

I have referred to airdrying to distinguish baking or sintering or to reduce danger from cracking while retaining the advantage of maintaining the material in sinterable condition.

In view of my invention and disclosure variations and modifications to meet individual whim or particular need will doubtless become evident to others skilled in the art, to obtain all or part of the benefits of my invention without copying the structure shown, and I, therefore, claim all such in so far as they fall within the reasonable spirit and scope of my invention.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In an induction electric furnace, a furnace inductor coil and a solid sinterable lining shield adjacent to the coil.

2. In an induction electric furnace, a coreless furnace inductor coil and a solid unsintered lining within the coil composed of sinterable material.

3. In an induction electric furnace, an inductor coil and a solid sinterable lining fitting into the spaces between the turns of the coil.

4. In an induction electric furnace, a coreless furnace inductor coil, a solid unsintered lining adjacent the coil composed of sinterable material and a finely divided sinterable refractory between the lining and the charge.

5. In an induction electric furnace, a coreless furnace inductor coil, a solid unsintered lining adjacent the coil of sinterable material, a finely divided sinterable refractory between the lining and the charge and a crucible within the sinterable finely divided refractory.

6. In an electric induction furnace, a holder for molten metal, a finely divided refractory outside of the holder and adapted to be sintered by the adjacent molten metal with leakage of the metal, an inductor coil surrounding the refractory and an unsintered dried refractory molded against the interior of the coil and in part surrounded by it.

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