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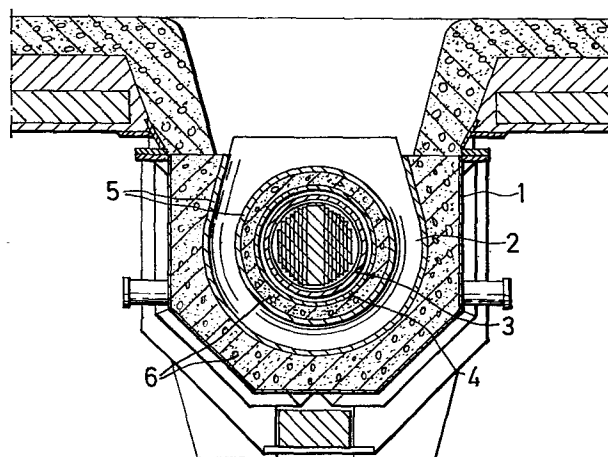
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㉙ **Lining of inductors for holding and melting of metals.**

㉚ The invention relates to lining of inductors for melting and holding of metal melts. The new lining consists of a channel or chute (2) of a thin (about 1 to 3 cm thick) monolithic shell (5) adjacent to the inductor made of a chemically or hydraulically bound refractory casting mass, and a suitably vibrated refractory mass (6) between said shell, the outer sheet mantle (1) of the inductor and the cooling jacket (4) protecting the primary coil (3) of the inductor. The thin, bound shell is suitably prefabricated by casting around a mould of the shape of the chute and made of metal or a combustible material, said mould after drying of the shell being burned away or smelted, in the case of the mould being of metal suitably after the vibrating into the inductor.



LINING OF INDUCTORS FOR HOLDING AND MELTING OF METALS.

An inductor for melting and holding of metals may briefly be said to consist of a channel or chute surrounding the primary coil of the inductor so that when filling the channel or chute with metal said metal
5 will constitute the conduit of the inductor. The invention relates to the lining of such channel.

Up to now the lining of these channels has been done alternatively by casting or stamping with refractory casting and stamping masses, respectively, around a
10 mould of the shape of the channel inserted in the inductor space and suitably made out of the same metal as is then to be melted or held warm. The refractory mass is cast or stamped around said mould and the mould, after drying of the mass if required, is removed by burning if
15 made of a combustible material (such as wood) or by melting same if made of metal. The burning or melting of the mould is performed at such a temperature as to make the lining ceramicly bound. The lining masses used have usually been based on a high content of alumina
20 with aluminate cement or phosphate as a binder.

The linings manufactured in this manner have some drawbacks which also mean that the desired lifetime cannot be reached. Thus, the stamping masses are subject to risk for layering between the different stamping
25 layers with concomittant risk for the formation of fissures in burning and use. Casting masses are also subject to risk for the formation of fissures or cracks when burning the lining. Molten metal penetrates into

the cracks and on the one hand this results in too high a temperature of the surrounding mantle giving raise to increased heat losses, on the other hand there is risk for failures if molten metal through cracks penetrates all the way up to the cooled protective sheet surrounding the inductor coil. Dry stamping masses have, particularly when used in aluminum smelt furnaces, too high a melting point to give sufficient erosion resistance at the sintering temperature reached when melting a channel mould of aluminum or burning away a wood mould. The above inconveniences are in accordance with this invention eliminated by such a lining for the chute or channel of the inductor which on the one hand has a sufficiently erosion resistant surface towards a melt, on the other hand prevents fissures or cracks in said surface to be propagated through the lining.

Such a lining in accordance with this invention is characterized thereby that it consists of two layers, namely adjacent to the channel (2) a first, relatively thin, such as about 1 to 3 cms, erosion resistant and monolithically coherent layer or shell (5) manufactured of a hydraulically or chemically bound refractory casting mass with strong bonds between the grains of the casting mass, and a second layer (6) between said shell (5), the sheet mantle (1) and the cooling jacket (4) of refractory mass with none or only minor binding between the grains.

The shell is erosion-resistant due to the fact that the first layer contains a binder resulting in strong bonds between the grains of the ceramic mass. In this erosion-resistant shell through-fissures or cracks may, however, appear. But these fissures or cracks will not be propagated through the second layer all the way up to the sheet mantle or the cooling jacket surrounding the coil due to the fact that there is no binding or

only minor bonds between the ceramic grains of the second layer.

The lining of an inductor in accordance with this invention is performed by preparing a mould of the shape of the inductor channel. The mould may be made of combustibile material or of the metal to be melted or held in the inductor. In this mould there is applied a refractory binder-containing mass to a thickness of the layer of about 1 to 3 cms, suitably about 1.5 cm. The application can be performed by spraying, casting or brushing. After drying and possible curing of the binder in the mass the mould with its refractory shell or layer is arranged at the site of the channel in the inductor. Then a dry refractory mass is vibrated around the shell so as to thoroughly fill the full space between the cured shell of the channel, the sheet mantle of the inductor and the protective sheet of the primary coil with said mass. Finally, the mould will be burnt away if it is of a combustibile material, for example wood, or molten away if it is of metal at a temperature resulting in sintering of the thin refractory shell adjacent to the channel. When using a wood mould the channel consisting of the refractory shell can be wholly prefabricated and fired outside the inductor, said thin-walled channel being then attached in place in the inductor and lined with the dry mass.

If there is used a metal mould which shall be inductively heated and molten away when the lining is finished one should apply the known and previously used method of compensating for the thermal expansion of the metal mould by wrapping it up with gauze and masking tape before the ceramic mass of what we above have called the shell has been applied.

The lining according to this invention could be defined as a compound lining consisting of an

erosion-resistant refractory shell adjacent to the cavity of the channel and therearound a refractory mass vibrated into place. The erosion-resistant shell consists of a hydraulically or chemically bound casting mass of for example alumina, magnesite, zirconia or olivin. The binder may for example consist of aluminate cement or a phosphate added in conventional quantities, for example 20 %. For the vibrated part of the lining a dry mass shall be used which if cracks arise in the sintered shell does not propagate same up to the sheet mantle or the cooling jacket of the primary coil. A dry mass of for example alumina, magnesite, zirconia, olivin, quartzite is preferred and it should have a suitable grain-size distribution (about 1 cm resulting in good density on vibration. The dry mass may be totally free from binder or may contain a minor amount of binder, for example boric acid or a dry phosphate in a quantity of for example 1 %. If a minor amount of binder is present in the dry mass in the second layer one may obtain the effect that the grains of said second layer will be weakly bound to each other in a zone adjacent to the first layer where the temperature is highest but remain practically unbound to each other at a greater distance from the first layer. Such structure is advantageous to the mechanical resistance of the lining and results in good guarantee against the formation of through cracks. The dry mass around the erosion-resistant shell results in a very short start-up period of about 1-2 hours as compared to 6-24 hours start-up period with linings according to conventional methods. The new lining has been found to result in a considerably improved span of life.

To elucidate the invention reference is had to the appended drawing where Fig. 1 and Fig. 2 show two

vertical sections through an inductor connected to the lower part of a ladle, crucible or the like for holding a metal melt warm, said sections being perpendicular to each other.

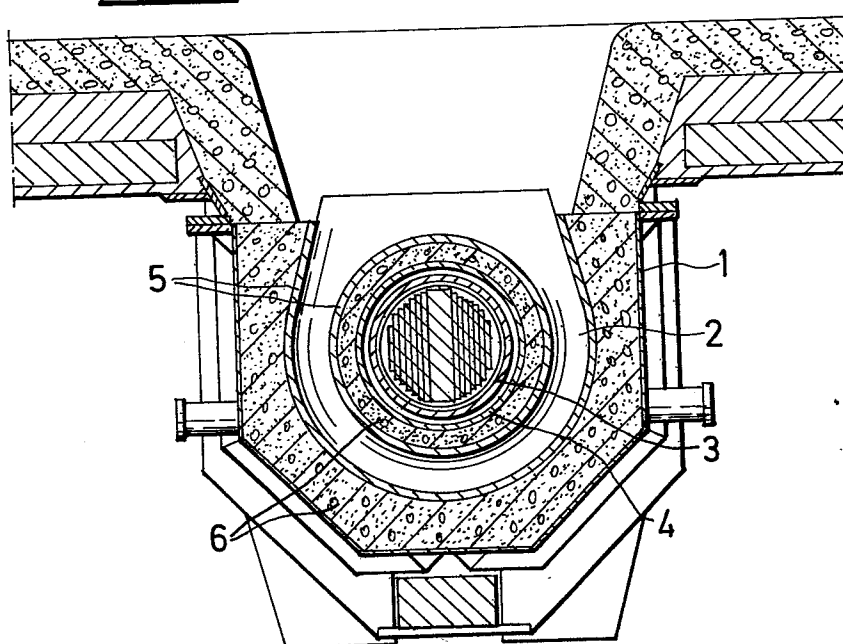
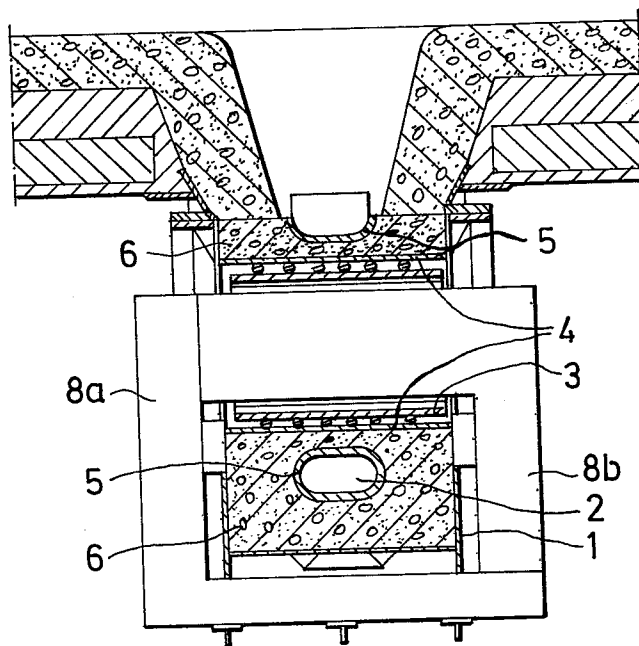
5 In the drawing 1 indicates the outer sheet mantle, 2 the channel proper, 3 the primary coil and 4 the cooling jacket of the primary coil, usually a divided copper sheet having electric insulation between the parts to prevent the formation of secondary currents in
10 the cooling jacket. The sintered erosion-resistant layer or shell adjacent to channel 2 is designated 5 and the vibrated part of the refractory lining around said shell is designated 6. The annularly closed iron core extending through the primary coil 3 is designated 8a, 8b. The
15 iron core is divided up into two L-shaped parts 8a and 8b. When replacing the lining the two parts are disassembled to such an extent that a mould or an erosion-resistant shell can be applied around the primary coil. Then the two parts of the iron core are
20 brought together and the complete lining is manufactured as described above.

PATENT CLAIMS:

1. Refractory lining for inductors used for melting and holding of metal melts and the main parts of which consist of a primary coil (3) arranged centrally in a sheet mantle (1) and surrounded by a metallic cooling jacket (4) enclosing a torus-shaped upwardly open channel (2) for the metal to be melted and held, characterized thereby that the refractory lining consists of two layers, namely a first relatively thin, such as about 1 to 3 cms, monolithically coherent, erosion-resistant layer or shell (5) adjacent to the channel (2) made of a hydraulically or chemically bound refractory casting mass having strong binding between the grains of the casting mass, and a second layer (6) of refractory mass with no or little binding between the grains between said shell (5), the sheet mantle (1) and the cooling jacket (4).

2. A process of preparing a refractory lining according to claim 1, characterized by coating a mould of the shape of the channel (2) and made of a combustible material or of the metal to be melted and held with a relatively thin, such as about 1 to 3 cms thick, layer of a hydraulically or chemically bound refractory casting mass, curing the mass, inserting the mould so treated at the site of the channel (2) in the inductor, vibrating dry refractory mass around the mould and finally removing the mould by burning or inductive melting if it is of a metal.

3. Modification of the process according to claim 2, characterized thereby that the mould is burned away before inserting the channel of the thin shell remaining after the burning in the inductor, and that the dry refractory mass is vibrated around said shell.

Fig. 1*Fig. 2*



European Patent
Office

EUROPEAN SEARCH REPORT

0069094

Application number

EP 82 85 0121

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)
Y	US-A-3 914 527 (OSTERHOLZ) *Claim 1; figure 2*	1	F 27 D 1/16 B 22 D 41/02 H 05 B 6/20
Y	DE-C- 526 606 (HIRSCH) *Claim; figures*	1	
Y	FR-A- 887 580 (DEUTSCHE EISENWERKE)	1	
A	US-A-1 596 736 (JETER) *Claim 9; figures*	2	
A	US-A-3 478 157 (LARKIN)		
A	FR-A-2 355 595 (FONDERIES ET ACIERIES ELECTRIQUES DE FEURS)		
			TECHNICAL FIELDS SEARCHED (Int. Cl. 3)
			F 27 D B 22 D B 22 C H 05 B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 28-09-1982	Examiner COULOMB J.C.
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons</p> <p>& : member of the same patent family, corresponding document</p>			