LINITNGS FOR STEEL INGOT MOLDS AND FOUNDRY MOLDS

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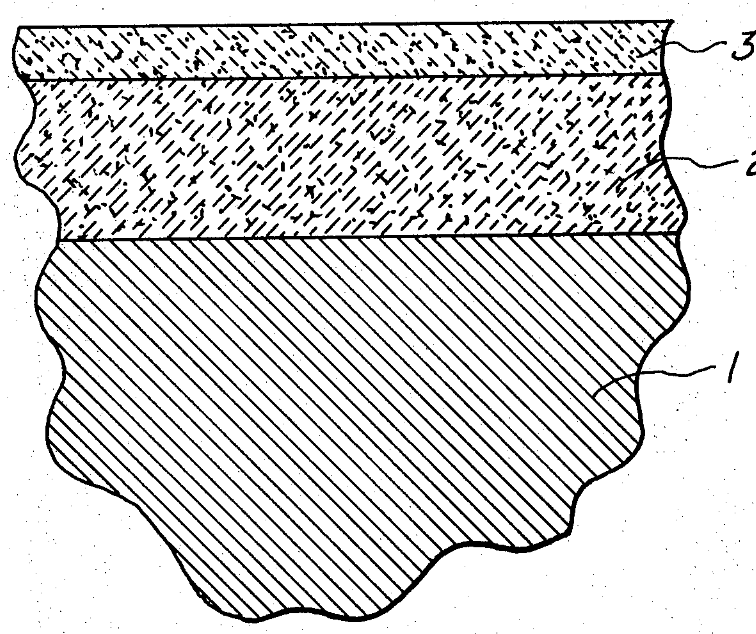

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LININGS FOR STEEL INGOT MOLDS AND FOUNDRY MOLDS

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Int. Cl. B28b 7/36

U.S. Cl. 106—38.22 1 Claim

ABSTRACT OF THE DISCLOSURE

A lining for a metallurgical mold comprising a layer of an agglomerated mixture of refractory particles of a medium particle size, of fibers, and of a small amount of an exothermic mixture of a small particle size, said mixture being agglomerated by means of a synthetic resin.

This application is a continuation-in-part of application Ser. No. 522,648, filed Jan. 24, 1966, now abandoned.

BRIEF SUMMARY OF THE INVENTION

The present invention relates to linings used in steel ingot molds and foundry molds to retard the solidification of the metal of the casting undergoing solidification.

It is more particularly concerned with exothermic linings for this purpose, comprising mixtures which participate in an exothermic reaction at the elevated temperature of the molten metal.

It has already been proposed to provide such exothermic linings, and numerous compositions have been suggested for this purpose. However, their cost is so high that they cannot be economically employed if a lining of appreciable thickness is to be applied.

Moreover, the thermal conductivity of a given wall is a function of its temperature and increases rapidly with temperature. It results that an exothermic lining which attains high temperature also becomes a very good conductor of heat from the cast metal to the metal wall of the mold, with serious heat loss. It has been proposed, therefore, to remedy this difficulty by providing an insulating layer between the exothermic layer and the metallic wall of the mold.

Such an insulating layer must satisfy a number of requirements. It must have a heat capacity and heat conductivity as small as possible so as, on the one hand, to reduce the heat flow therethrough and, on the other hand, to reduce the quantity of heat taken away from the metal or from the exothermic material. These two conditions dictate an insulating lining which is porous and of low density. At the same time, however, the insulating lining must have sufficient mechanical strength; and this last is especially desirable during fabrication and installation of the lining.

The present invention is the result of studies conducted with a view toward improving the nature of those layers which serve as insulating layers in mold linings. The present invention has for its objects the provision of a porous insulating lining of fine porosity providing a low coefficient of heat transfer, which thus attains a high temperature drop across the insulating lining and avoids large heat transfer from the metal or from the exothermic layer but which nevertheless has a desirable compactness which results in satisfactory mechanical strength, in contrast to the usual high porosity of thermal insulators.

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BRIEF DESCRIPTION OF THE DRAWING

The drawing shows a somewhat enlarged fragmentary cross-sectional view of a lining of the present invention in place on a mold wall.

DETAILED DESCRIPTION

The invention comprises the provision of a mold lining including a layer constituted by an agglomerated mixture of 60 to 80 parts in weight of refractory particles having an A.F.S. index lower than 100 and, interspersed in the interstices between said refractory particles, 7 to 15 parts in weight of particles having 70 mesh fineness, of a combustible organic material of natural vegetable origin, such as flaked husks, crushed husks, flakes from grain hulls, crushed residues of oil seeds, broken residues of oil seeds, pulps, fine sawdust and wood flour, 2.5 to 6 parts in weight of particles of readily oxidizable material selected from the class consisting of silicon-calcium alloys and siliconaluminium alloys and 2 to 7 parts by weight of particles of an oxidizer selected from the class consisting of manganese dioxide and iron oxide, said particles of oxidizable material and oxidizer having an A.F.S. index higher than 100. In speaking of "70-mesh fineness" and the like, it is meant that substantially all the material will pass through a 70-mesh screen.

The layer of lining according to the present invention comprises a refractory network structure, and in the interstices of this structure are combustible materials and an exothermic mixture. It results that this layer has a compactness that gives the necessary mechanical strength but that, during the teeming of the metal, the exothermic mixture will ignite and will supply this layer with the heat necessary to maintain its temperature and simultaneously ignite the combustible constituents which burn with the entrapped air and give off hot insulating gases that occupy the finely porous network that the combustion of the said constituents creates in the mass of the layer.

The lining of the present invention thus is characterized by relatively large refractory particles, with their interstices filled with relatively small particles of combustibles and readily oxidizable materials and oxidizers therefor.

The lining according to the invention plays in consequence and in succession the triple role of a mechanically resistant layer during installation and teeming, of a semi-exothermic layer thereafter, and finally of an insulating layer until the final solidification of the melt. It is also to be noted that the total reaction time should be substantially less than the solidification time for the ingot.

The layer according to the present invention may be utilized either alone or in combination with a more highly exothermic layer or with a layer more exclusively refractory in nature. Such a more highly exothermic layer comprises from 3 to 35 parts in weight of a readily oxidizable material and from 8 to 22 parts in weight of an oxidizer therefor having an A.F.S. index higher than 100, 8 to 12 parts in weight of particles having a 70 mesh fineness of a combustible organic material 20 to 78 parts in weight of refractory particles having an A.F.S. index lower than 100 and up to 11 parts of asbestos fibers.

As the refractory substances that may be used in the construction of such layers, can be used pulverized fire clay, silica sand, silica flour, kieselguhr, siliceous fossil deposits in the form of particles the most part of which passes a 30 meshes sieve and having an A.F.S. index lower than 100, and refractory fibers such as asbestos.

As combustible material, can be used organic materials having fine particle size the most part of which passes an 80 mesh sieve and having an A.F.S. index above 100 to facilitate the combustion and giving a very fine porosity distributed in the mass, such as broken and crushed residues from the treatment of cereal grains, in the form of flaked husks and crushed husks such as husks of wheat, barley, corn, etc., flakes from grain hulls such as oat hulls, linseed hulls, rice hulls, etc., crushed and broken residues of oil seeds such as lineed, colza, etc., and pulps such as potato and beet and fine sawdust and preferably wood flour.

Crushed hulls are of particular interst as organic combustible material because they give, in the presence of water, a certain quantity of starch which augments the agglomerant normally used.

The exothermic products can be the usual exothermic mixtures, aluminium or magnesium and an alloy aluminium magnesium, but preferably they are those disclosed in French Pat. No. 1,388,898, Dec. 31, 1963, namely, silicon-calcium alloys or silicon-aluminium alloys mixed with an oxidizer from the class consisting of a metallic oxide such as manganese oxide and iron oxide, a salt, such as nitrate, a chlorate and a fluoride of sodium, potassium and barium.

The agglomeration is preferably effected by means of synthetic resin binders such as phenolic resins in powdered form or liquid resins such as urea-formaldehyde resins which are highly concentrated, which is to say, have a high percentage of solid materials on a dry basis.

By way of example, a semi-exothermic layer may have the following composition the percentage being given by weight.

	Percent
Silico-calcium or silico-aluminium (the silicon of the alloy being between 45 and 75% by weight) (being in the form of particles the most part of which passes the 80 meshes sieve with an A.F.S. index higher than 100)	2.5–6
Manganese oxide or iron oxide (being in the form of particles the most part of which passes the 80 meshes sieve with an A.F.S. index higher than 100)	2–7
Chamotte ((pulverized fire clay) (being in the form of particles the most part of which passes the 30 meshes sieve with an A.F.S. index lower than 100)	20–55
Silica sand or silica powder (being in the form of particles the most part of which passes the 30 meshes sieve with an A.F.S. index lower than 100)	0–60
Kieselguhr or siliceous fossil deposit (being in the form of particles the most part of which passes the 30 meshes sieve with an A.F.S. index lower than 100)	0–12
Fine organic materials such as wood flour or husks (being in the form of particles the most part of which passes the 70 meshes sieve)	7–15
Synthetic resin	(1)

[1] 5–11% of total amount of the above dry components.

Preferably, and according to another feature of the invention, the semi-exothermic layer is combined with an exothermic layer in contact with the cast metal and having the following composition, the percentages being given by weight:

	Percent
Silico-calcium or silico-aluminium (the silicon content of the alloy being between 45 and 75%) (being in the form of particles the most part of which passes the 80 meshes sieve with an A.F.S. index higher than 100)	6–35
Manganese oxide or iron oxide (being in the form of particles the most part of which passes the 80 meshes sieve with an A.F.S. index higher than 100)	8–22
Chamotte (being in the form of particles the most part of which passes the 30 meshes sieve with an A.F.S. index higher than 100)	20–55
Silica sand or silica powder (being in the form of particles the most part of which passes the 30 meshes sieve with an A.F.S. index higher than 100)	0–60
Kieselguhr or siliceous fossil (being in the form of particles the most part of which passes the 30 meshes sieve with an A.F.S. index higher than 100)	0–9
Finely divided organic materials such as wood flour, husks, etc. (being in the form of particles the most part of which passes the 70 meshes sieve)	8–12
Asbestos fibers	0–11
Synthetic resin	(1)

[1] 5–11% of total amount of the above dry components.

The percentage of water introduced may vary from between about 25–700% by weight of the solids. In general, the use of relatively high percentages of water is desirable when materials are used which are insoluble or only slightly soluble.

The lining elements may be built up by any known process. For example, filtration may be used. On the filter medium, there is first deposited a layer of the relatively exothermic mixture, after which a layer of semi-exothermic mixture is deposited on top of the exothermic layer by further filtration of a second solution or suspension. Of course, the layers could be laid down in the reverse of that order.

The elements can then be fired at 180° C. to eliminate retained water.

As another example, there may be cited a composition for use in fabricating the lining for an ingot of 2½ tons.

The exothermic layer has a thickness of 5 millimeters and a composition as follows, the percentages being given by weight and the granulometries being those indicated hereabove for the same materials:

	Percent
Silica sand	33.5
Chamotte	35.5
Silico-calcium	6
Manganese dioxide	8
Asbestos (fibers)	6
Wood flour	11
Powdered phenolic resin	(1)

[1] 7% of the total amount of the above dry components.

The semi-exothermic layer has a thickness of 15 millimeters and forms the rear or under portion of the lining, with the following composition, the percentages being given by weight and the granulometries being those indicated hereabove for the same materials:

	Percent
Silica sand	33.5
Chamotte	42
Silico-calcium	3
Manganese dioxide	3.5
Silica	6
Wood flour	12
Powdered phenolic resin	(1)

[1] 9% of the total amount of the above dry components.

The two given compositions are mixed with 700% water, based on the weight of the solids, and are deposited one on top of the other by means of filtration.

A completed lining of the present invention is shown in the drawing. On a metallic substrate **1** comprising an inner wall of a mold, there is secured a layer **2** of semi-exothermic material, and on top of that, a layer of **3** of more highly exothermic material.

From a consideration of the foregoing disclosure, therefore, it will be evident that all of the initially recited objects of the present invention have been achieved.

Although the present invention has been described and illustrated in connection with preferred embodiments, it is to be understood that modifications and variations may be resorted to without departing from the spirit of the invention, as those skilled in this art may readily understand. Such modifications and variations are considered to be within the purview and scope of the present invention as defined by the appended claim.

What is claimed is:

1. A lining for a metallurgical mold comprising a layer comprised of an agglomerated mixture of 60 to 80 parts in weight of refractory particles having an A.F.S. index lower than 100 and interspersed in the interstices between said refractory particles 7 to 15 parts in weight of particles having a 70 mesh fineness of a combustible organic material selected from the group consisting of grain husks and wood flour, 2.5 to 6 parts in weight of particles of readily oxidizable material selected from the class consisting of silicon-calcium alloys and silicon-aluminum alloys containing 45–75% by weight silicon, 2 to 7 parts by weight of particles of an oxidizer selected from the class consisting of manganese dioxide and iron oxide, said particles of oxidizable material and oxidizer having an A.F.S. index higher than 100, and a binder selected from the group consisting of phenolic resin and

urea-formaldehyde resin in an amount about 5% to about 11% by weight of the total weight of the other dry constituents.

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LORENZO B. HAYES, Primary Examiner

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106—38.23; 164—33; 260—39

Disclaimer

3,582,369.—*Henry Nouveau*, Saint Germain-les-Corbeil, Seine-et-Oise, France. LININGS FOR STEEL INGOT MOLDS AND FOUNDRY MOLDS. Patent dated June 1, 1971. Disclaimer filed July 15, 1970, by the assignee, *Societe Anonyme Produits Metallurgie Doittau S.A.*

Hereby disclaims the portion of the term of the patent subsequent to Oct. 3, 1984.

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