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PROCESS OF EXTENDING THE DURATION OF SERVICE OF INGOT MOLDS

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The present invention relates to a process of extending the duration of service of ingot molds.

The ingot molds used for the discontinuous casting of steel are traditionally castings of cast iron, the economic importance of the manufacture of which remains considerable, especially as substitute products only rarely prove advantageous.

Now despite the progress effected in the manufacture of these ingot molds, despite the well-recognized qualities of the specially used cast iron, which is imposed by its good thermal conductivity, the persistence of its characteristics under heat, its resistance to thermal shocks, and the fact of the particularly severe conditions of service of the ingot molds, the wear-resistance of these molds remains limited. Regarding the cost price, related to the ton of ingot steel, it remains important in the manufacturing cost of steel.

Endeavors have always been made to extend the duration of the average life of ingot molds and to reduce the cost of manufacture thereof, especially by endeavoring to reduce their unit weight by making them thinner.

However, apart from the abnormal waste pieces resulting from splitting or fracture of the ingot molds in service, it must be observed that their normal wear is due essentially to the fissuring of their internal walls, which incidentally is one of the causes of the production of defects on the surfaces of the ingots. It is possible for this phenomenon to become of such magnitude that the ingot can no longer be removed from the ingot mold.

The fissuring or cracking of the internal surface of the ingot mold is produced mainly by the effect of two reactions, on the one hand, the decarburization of the surface layers, and, on the other hand, the oxidization of the residual ferritic layers. These reactions occur for the most part after the removal of the ingot from the mold, when the internal wall of the ingot mold is still red hot and the mold is laid aside for cooling.

It is one object of the present invention to provide a process of extending the duration of service of ingot molds, which obviates these drawbacks by retarding the occurrence of these reactions.

It is another object of the present invention to provide a process of extending the duration of service of cast iron ingot molds, which comprises placing the still red-hot internal wall of the mold, immediately after the removal of the steel ingot from the mold and, during the cooling of the mold, into intimate contact with a reducing agent which retards the decarburization and oxidization of the cast iron.

It is still another object of the present invention to provide a process of extending the duration of service of ingot molds, which comprises the application, over the internal wall of the ingot mold, of a protective layer containing carbon or any other reductive substance, for the major part, and comprising, as secondary constituents, adhesives, catalysts and stabilizers, and also exothermic reaction products, this protective layer being applied in an aqueous solution.

It is yet another object of the present invention to provide a process of extending the duration of service of

ingot molds, wherein a variant of the process is carried out by placing the still hot ingot mold into an oxygen-deprived reducing atmosphere, or into a current of an inert gas, until the ingot mold is sufficiently cooled.

The proposed protective layer for the retardation of the decarburization and oxidization reactions, which can occur on the still red-hot internal wall of the ingot mold, comprises as essential constituent carbon-containing substances in a liquid of a pulverulent state, such as wood and bone charcoal, coal and lignite, coke of various origins, resins, wood sawdust, graphite, residues from the distillation of coal and petroleum, either in the pure state or in mixture.

As auxiliary constituents there are used, on the one hand, adhesives, such as sodium silicate, soluble derivatives of cellulose, soluble salts of lignosulphonic acid, sugars and amylaceous products, and others, and, on the other hand, catalysts and stabilizers such as alkaline or alkaline earth carbonates, especially barium carbonate, chlorides such as ammonium chloride, sodium nitrate or sulphate, or potassium ferrocyanide. To the mixture are added products, which generate exothermic reactions, such as powdered aluminum or magnesium, in order to reduce as far as possible the surface oxidization of the ingot mold.

By way of example of embodiments, the following mixtures give excellent results:

	Parts
Powdered aluminum	1 to 10
Clay	30 to 50
Graphite	30 to 50
Lampblack	10 to 15
Calcium lignosulphite	5 to 10
Barium carbonate	5 to 10
Potassium ferrocyanide	1 to 5

The protective layer to be applied to the still red-hot internal surfaces of the ingot mold, immediately after removal of the ingot from the mold, is produced from a mixture obtained either with ingredients previously ground to a fineness of below 1/10 mm., or with coarser ingredients ground to this fineness after mixing, and used in aqueous suspension at the concentration of 20 to 30% by weight. After homogenization, the suspension is for example sprayed regularly on to the still very hot faces of the ingot mold, immediately after removal of an ingot from the mold, with the aid of an appropriate sprayer permitting suitable orientation of the jet.

The hard and coherent varnish layer, which forms immediately upon the metal, protects the latter from all oxidization and decarburization during the period of cooling.

According to a variant of the execution of the process, to which the invention relates, immediately after the steel ingot is removed from the mold, the ingot mold is placed into an atmosphere freed of oxygen; however it is also possible to submit the ingot mold to an inert, protective gas for a sufficient time period, until a sufficiently low temperature is reached to preclude any oxidization phenomenon.

While we have disclosed several embodiments of the present invention, it is to be understood that these embodiments are given by example only and not in a limiting sense, the scope of the present invention being determined by the objects and claims.

We claim:

1. A process of extending the life of service of ingot molds for cast iron in a metal producing method, comprising the steps of

applying to the red-hot inner wall of an ingot mold

an aqueous suspension of a mixture consisting essentially of 10 to 50 parts of a first carbon-containing constituent selected from the group consisting of wood charcoal, bone charcoal, coal, lignite, coke, resin, wood sawdust, graphite, and residues from the distillation of coal and petroleum,

about 5 to 10 parts of an auxiliary constituent as adhesives selected from the group consisting of sodium silicate, soluble derivatives of cellulose, soluble salts of lignosulphonic acid, sugars and amylaceous products,

about 1 to 10 parts of catalysts and stabilizers, respectively, selected from the group consisting of alkaline carbonates, alkaline-earth carbonates, chlorides, sodium nitrate, sodium sulphate and potassium ferrocyanide, and

about 1 to 10 parts of products generating exothermic reactions selected from the group consisting of powdered aluminum and powdered magnesium.

2. The process, as set forth in claim 1, wherein said aqueous suspension contains 20–30% of said mixture of said constituents, catalysts, stabilizers and said products generating exothermic reactions by weight.

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