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PROCESS OF ALLOYING MAGNESIUM WITH CAST IRON

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When introducing metals or alloys having a high vapor pressure into other metals or alloys, difficulties arise very often because part of said metals or alloys with a high vapor pressure vaporizes and thus gets lost. Therefore, for the production of alloys containing such metals very often pre-alloys are used. In some cases, however, the solubility of the metal to be introduced is so inferior within the melt into which it is to be introduced, that also by way of using the pre-alloy either vaporization cannot be prevented and the process becomes uneconomic, or further alloying components must be introduced.

These difficulties of alloying arise, e. g., when introducing magnesium into molten iron with a view to producing spheroidal graphite cast iron. Various ways have been tried to decrease the magnesium losses during the introduction into the molten iron. When pre-alloys are used (e. g., with nickel) generally containing approximately 15% magnesium, losses occur whilst the pre-alloy is being put on the cast iron melt, which are especially high if alloys of a low specific weight (e. g., magnesium-silicon-iron alloys) are used. Therefore, several processes have been suggested to introduce the alloy into the iron melt with minor losses, for example, by means of immersion chambers (plungers) or by introducing the alloy with bottom chambers or bags which are opened for alloying after the iron melt has been filled into the ladle. It has also been attempted to effect the introduction of the alloys or of the magnesium in such a way that the magnesium must pass through the melt, for example, like a Bessemer-process. In all cases, however, considerable losses in magnesium were observed.

It has now been found out that these losses can considerably be decreased, if the alloying is not carried out as before in open vessels but in closed containers, the total inner walls of which have temperatures ranging above the condensation point of the metal to be introduced or of the alloy or alloy components to be introduced. If the quantity of the highly volatile material to be introduced does not exceed the quantity corresponding to the solubility and the absorptive power in the melt, respectively, the losses can be decreased to a minimum. If the process is carried out according to the invention, magnesium can, for example, be introduced into molten iron in the form of iron-magnesium-silicon alloys with a recovery of more than 80% of the used magnesium as compared with 30% or so in the former processes. Up till now it was not possible to introduce pure magnesium into iron melts economically but pure magnesium can be introduced economically with a high recovery in carrying out the present invention.

The process is, for example, carried out in such a manner that the cast iron melt and the magnesium or the magnesium alloy, respectively, to be introduced are arranged in a container in such a way that they first do not touch one another and that then the container is closed. For sealing, graphite, e. g., in the form of graphite rings, can be used. Subsequently, the total wall of the con-

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tainer is heated up to temperatures above the condensation point of the magnesium. This can be effected, e. g., by tilting or rotating the container so that the melt heats also the walls and the lid parts of the container, serving to contain the magnesium or the alloy. It is also possible to effect the required heating by another heat supply. Hereby the magnesium is also absorbed from the vapor area into the iron melt and no losses in magnesium can occur by condensation to the walls not covered by the melt. As soon as the forming of the alloy has finished, the container can be opened and the cast iron alloy can be poured.

When proceeding according to the invention, essentially higher contents of magnesium can be introduced than those required for the production of spheroidal graphite cast iron. It is, therefore, possible to produce such melts richer in magnesium and to mix them with magnesium-free or magnesium-poor, eventually hotter cast iron melts, and thus to produce cast iron melts which solidify with spheroidal graphite structure after the pouring. If for the introduction of the magnesium in the closed container no larger magnesium quantities are used than those which can be absorbed from the melt by solution or which are used up for reaction with sulphur or other components, the magnesium losses can be considerably decreased. Since pure magnesium can be introduced according to the invention, it is possible to treat a molten iron composition without otherwise changing it by addition of metals accompanying magnesium in a magnesium alloy.

The process can, for example, be carried through by using a rotary ladle, such as a drum type rotary ladle, to which a lid is positioned at the spout and which might be sealed with graphite. At the inside of the lid, the alloy or the magnesium is fastened. The magnesium is conveniently fastened in a container of sheet iron so that it does not drop into the melt when the lid is put on the filled ladle. After the ladle has been filled, the lid is put on and sealed. Then the ladle is rotated so that the melt can react with the alloy or with the magnesium. Hereby, the melt should cover the alloy or the magnesium at the inside of the lid. The ladle can, however, be so far rotated that the lid comes to the bottom of the ladle. When the reaction has finished, the ladle is turned back, the lid is removed and the melt is cast. It is also possible to introduce the alloy or the magnesium into the ladle by using a bag or the like, before the ladle is closed, and to bring this bag or the like in contact with the melt only after the sealing of the ladle. In the described examples the heating of the walls can be effected by the cast iron melt itself.

It is, however, not necessary to use rotary containers. The metal or the alloy to be introduced can also be molten and evaporated by a simple heating of the components to be introduced and of the inner walls not covered by the melt, or by another heat supply, so that it or they penetrate in liquid or vapor form into the base melt into which it or they are to be introduced.

I claim:

1. The process for alloying molten metal with a metal having a high vapor pressure at the temperature of said molten metal which comprises alloying said metals in a closed container having all the inner walls thereof heated above the condensation point of said metal having a high vapor pressure at the temperature involved.

2. The process for alloying magnesium with molten cast iron which comprises contacting magnesium and molten cast iron in a closed container having all the inner walls thereof heated above the condensation point of magnesium and maintaining the contact of said magnesium and said molten cast iron until an alloy of magnesium and cast iron is formed.

3. The process for alloying magnesium with molten

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cast iron which comprises placing the magnesium and the molten cast iron separately in a closed container and thereafter contacting said magnesium and said molten cast iron such that the heat content of said molten cast iron effects the heating of the inner walls of said container above the condensation point of magnesium whereby an alloy of cast iron with magnesium is formed.

4. The process for alloying magnesium with molten cast iron which comprises placing a quantity of molten cast iron in a closable, rotatable ladle; fastening a predetermined quantity of metallic material from the group consisting of magnesium and magnesium alloys to the lid of said ladle; closing said ladle; and rotating said ladle to contact said magnesium and said molten cast iron and to heat the inner walls of said ladle above the condensation point of magnesium whereby an alloy of cast iron with magnesium is formed.

5. The process for alloying magnesium with molten cast iron which comprises reacting molten cast iron with

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magnesium in a closable, rotatable ladle having the walls thereof heated above the condensation point of magnesium to provide molten cast iron containing a greater amount of magnesium than that necessary for the formation of spherulitic graphite in castings made therefrom, and then mixing said magnesium-containing molten cast iron with additional molten cast iron deficient in magnesium and thereafter casting the thus-treated molten cast iron to provide magnesium-containing cast iron castings containing magnesium in a quantity sufficient to produce spheroidal graphite.

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