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MANUFACTURE OF IRON CASTINGS

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6 Claims. (Cl. 75—130)

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The graphite structure of a grey cast iron can exist in either of two forms. In the one, which is the more frequent, this constituent is in the form of flakes or lamallae. The other form consists of very finely divided graphite known variously as eutectiform, super-cooled or undercooled, etc. This form will be referred to here as undercooled graphite.

Undercooled graphite forms when a casting solidifies at a temperature below the normal solidification temperature. Undercooled graphite confers certain characteristic properties to the casting, including improved soundness, good machinability, good heat-resistance and, in irons of high carbon content, an improved tensile strength. This has been known for some time, but the methods hitherto proposed for producing it commercially have proved of limited application.

British Patent Specification No. 425,227 describes a process for the production of undercooled graphite structures which involves the treatment of the molten metal with titanium in the form of a suitable alloy, followed by bubbling carbon dioxide through the metal before casting.

The object of the present invention is to provide an improved method of enabling castings with undercooled graphite to be produced in a convenient and reliable manner. For this purpose the invention comprises the addition of a small amount of zirconium or bismuth to the molten metal before pouring, followed by (if enhanced effect is required) bubbling carbon dioxide through the melt for a short period.

In one manner of carrying the invention into effect, zirconium in a suitable form is added to the molten metal before pouring. Not more than 1% is required, and frequently 0.2% will suffice. The zirconium may be added in almost any form—as pure metal or as a ferro-alloy. Those most suitable are ferro-zirconium or ferro-silicon-zirconium. The ferro-alloy should be finely divided and packed in a sheet steel container. The influence of the zirconium may be enhanced by bubbling carbon dioxide through the molten metal, after making the addition, for periods of up to five minutes. For zirconium to give the desired effect, sufficient must be added to cause zirconium carbide to appear in the micro-structure and sufficient manganese must be present to balance the sulphur content (that is, the amount of manganese must be greater than $1.7 \times \%S + 0.3$).

Alternatively, the invention may be carried into effect by adding a small amount of metallic bismuth not exceeding 0.5% to the iron before pouring. The form of the bismuth, whether in the lump or powdered form, is immaterial. It should preferably be placed in the bottom of the ladle and the molten metal is then run on to it to ensure good mixing. During solution of the bismuth, some of the metal vaporises, giving a bubbling effect, and when this is sufficient no gain is obtained by the carbon dioxide bubbling above mentioned.

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The element bismuth is a carbide stabiliser and therefore it can only be used to produce a fine graphite structure in relatively large sections. But, the influence of zirconium is neutral and it can be used for thin and thick sections.

By this invention castings in a wide range of section sizes can be produced with the graphitic or free carbon entirely in the undercooled form, the castings being very dense, free from internal porosity and having good mechanical properties.

Having thus described our invention what we claim as new and desire to secure by Letters Patent is:

1. A method of producing iron castings having a finely divided eutectiform graphitic structure which comprises preparing a bath of sulphur-containing, high-carbon iron; introducing manganese into said bath in an amount greater than 1.7 times the percentage of sulphur in said bath plus 0.3; and adding to said bath at least one metal from the group consisting of zirconium and bismuth in an amount sufficient to form and introduce the carbide of said metal into the microstructure of the high-carbon iron, said amount of added metal being not less than 0.2%.

2. A method of producing iron castings having a finely divided eutectiform graphitic structure which comprises preparing a bath of sulphur-containing, high-carbon iron; introducing manganese into said bath in an amount greater than 1.7 times the percentage of sulphur in said bath plus 0.3; adding to said bath at least one metal from the group consisting of zirconium and bismuth in an amount sufficient to form and introduce the carbide of said metal into the microstructure of the high-carbon iron, said amount of added metal being not less than 0.2%; and agitating said bath by bubbling carbon dioxide gas therethrough for an interval of time approximating five minutes.

3. A method of producing iron castings having a finely divided eutectiform graphitic structure which comprises preparing a bath of sulphur-containing, high-carbon iron; introducing man-

ganese into said bath in an amount greater than 1.7 times the percentage of sulphur in said bath plus 0.3; and adding zirconium to said bath in an amount sufficient to form and introduce the carbide of zirconium into the microstructure of the high carbon iron, said amount of added zirconium being between 0.2% and 1%.

4. A method as claimed in claim 3 comprising the additional step of agitating said bath prior to casting by bubbling carbon dioxide gas therethrough for an interval of time approximating five minutes.

5. A method of producing iron castings having a finely divided eutectiform graphitic structure which comprises preparing a bath of sulphur-containing, high-carbon iron; introducing manganese into said bath in an amount greater than 1.7 times the percentage of sulphur in said bath plus 0.3; and adding bismuth to said bath in an amount not exceeding 0.5%.

6. A method as claimed in claim 5 comprising the additional step of agitating said bath prior to casting by bubbling carbon dioxide gas therethrough for an interval of time approximating five minutes.

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