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METHOD OF MELTING AND CASTING MAGNESIUM AND ALLOYS RICH IN MAGNESIUM

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8 Claims. (Cl. 75—67)

This application is a continuation-in-part of our application Serial No. 101,083, filed September 16, 1936, which has issued as Patent 2,126,786, dated Aug. 16, 1938, for a Method of melting magnesium and its alloys and handling such material in a molten condition.

The main object of the invention is to provide a simple and commercially practicable process for protecting the magnesium and its alloys against the action of air during the melting and the subsequent handling of the molten batch of metal, without contaminating the melt with foreign body.

Another object is to provide a method of the above indicated character whereby magnesium and its alloys may be melted without taking up even traces of impurities which would give rise to corrosion of the compact metal resulting from the melt.

In melting down magnesium or alloys rich in magnesium, in the presence of air, the magnesium catches fire unavoidably during the melting process, with the formation of oxides and nitrides. The consequence is not only an appreciable loss of metal but also the danger that, on the pouring of the metal burning in the crucible, portions of the oxides and nitrides formed on the surface of the melt find their way into the casting, with the result that the mechanical properties of the casting are deleteriously affected.

Hitherto this drawback has been combated by either applying mixtures of salts to the surface of the melt, which salts are fused at the working temperature, or working in tightly closed crucibles with the exclusion of air, with the view of preventing the action of the air upon the material. Since the second of these expedients requires the use of means which are not available to the majority of foundries it has been as a rule necessary to have recourse to covering over the surface of the metallic material by the use of fused salt mixtures. Now these salt mixtures consist mainly of chlorides or contain the same in preponderating amounts. Thus, small portions of the salt melt often find their way into the casting and these particles cause the formation of tubercular corrosions. This is the more troublesome since from these starting points the dreaded corrosion of the metal, by which the mechanical properties of the casting are appreciably deteriorated, spreads further over the surface. When melting down and casting metallic material which is free from chlorine from the outset it is a still greater disadvantage if this metal takes up even traces of chlorides as a consequence of the employment of a salt coating containing chlorine.

The present invention obviates this drawback by applying to the melting or molten metallic material fragments of horny material, especially horn meal, which fragments burn with the formation of a froth inert to magnesium, and which yield, on carbonization, a hard crust of a nature not to become wetted by molten magnesium. This behaviour leads to the final result that a protective covering becomes formed over the entire surface of the melt. These fragments of horny material protect the molten metal from the action of the air first by means of the evolved combustion gases, then by the formation of froth, and finally by means of the resulting solid crust which does not become wetted by the liquid metal beneath it. The fragments are strewn upon the melt whereupon the process outlined above proceeds, up to the formation of the solid protective crust, in the course of a few seconds. It is advisable to increase the specific gravity of these fragments of horny material by the addition of inorganic chlorine-free loading material non-volatile at the working temperature which has no deleterious effect upon the molten metal, examples being fluorspar or dead-burned magnesite.

Before pouring, the coating is detached from the rim of the crucible and the metal poured from beneath the coating. The coating floats on the metal without crumbling. When the starting material used is free from chlorine there are obtained in this manner castings or ingots which are entirely free from chlorine, that is to say industrial material with which there is no danger whatever of corrosion resulting from local chloride inclusions. At the same time losses by burning are reduced to a minimum, since burning of the melt cannot occur.

The fragments of horny material may be in the form of cuttings, in particular for example, turnings, shavings, borings, millings, filings, etc. These cuttings may be used individually or in mixture with one another, and, if required in admixture with the inorganic chlorine-free loading material specified. Though horn meal has proved to give the best results, other horny material has shown itself to be also suited for the purpose. Thus for instance it has been found that filings of claws, with an addition of fluorspar, give a very useful coating although they do not form such a hard crust as horn meal.

In practising the method, for example, a mixture of one part by weight of pulverulent horn meal and two parts by weight of fluorspar is

strewn upon the smooth surface of the metal after the latter has been refined in the usual manner. Of this mixture a quantity amounting to about 2% of the weight of the metal is sufficient to form a coating which is completely impervious to air when using the usual crucibles.

The term "horn meal" is used in the specification and in the appended claims to mean, as customarily, a nitrogeneous manure, obtained from hoofs, horns and claws, by treating them with superheated steam, drying and grinding. Moreover, as used in the following claims, the term "magnesium" means not only magnesium but also alloys thereof wherein the magnesium content predominates.

We claim:

1. A method of preventing the action of air upon molten magnesium, which comprises applying to the metallic material fragments of horny material which combust in the air, at the working temperature, with the formation of a froth inert to magnesium, and allowing such a froth to be formed in contact with the heated metal, which froth becomes then converted, by carbonization, into a hard crust covering the freely exposed surface of the melt.

2. A method of preventing the action of air upon molten magnesium, which comprises bringing cuttings of horny material in contact with the heated metal under treatment to first produce a froth and then, by carbonization of the froth formed, a hard protective crust over the free surface of the molten metal.

3. A method of preventing the action of air upon molten magnesium, which comprises bringing horn meal in contact with the heated metal under treatment to first produce a froth and then, by carbonization of the froth formed, a hard protective crust over the free surface of the molten metal.

4. A method of preventing the acttion of air upon molten magnesium, which comprises applying to the metallic material fragments of horny material which combust in the air, at the working temperature, with the formation of a froth inert to magnesium, with an addition of a relatively smaller amount of an inorganic chlorine-free loading material non-volatile at the working temperature which has no deleterious effect upon the molten metal, and allowing such a froth to be formed in contact with the heated metal, which froth becomes then converted, by carbonization, into a hard crust covering the freely exposed surface of the melt.

5. A method according to claim 4 in which a relatively smaller amount of fluorspar is added to the fragments of horny material.

6. A method according to claim 4 in which the relatively smaller amount of dead-burned magnesite is added to the fragments of horny material.

7. A composition of matter for use in protecting magnesium during melting, and molten magnesium, against the action of air, which consists of a mixture of fragments of horny material and a relatively smaller amount of an inorganic chlorine-free loading material non-volatile at the working temperature which has no deleterious effect upon the molten metal.

8. A composition of matter for use in protecting magnesium during melting, and molten magnesium, against the action of air, which consists of a mixture of horn meal and a relatively smaller amount of fluorspar.

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