Patented Dec. 7, 1937 2,101,553

UNITED STATES PATENT OFFICE

2,101,553

COATING IRON OR STEEL WITH ALUMINUM OR AN ALLOY THEREOF

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No Drawing. Application February 28, 1935, Serial No. 8,722. In Great Britain March 5, 1934

5 Claims. (Cl. 91—70.2)

The invention relates to a method of coating or alloying with aluminium or an aluminium alloy the surface of an article of iron or steel by immersion of the article in a bath of molten aluminium or aluminium alloy.

It is known that the surface of articles to be treated in this manner must be clean and free from impurities during the treatment.

In order to ensure this cleanliness the following procedure has been proposed: The article to be treated is cleaned by mechanical means and/or corroded in a dilute acid and/or subjected to a treatment by which volatile products are formed which when heated volatilize, thereby removing the impurities. The article is thereupon immersed in a molten flux consisting of $CaCl_2$, NaCl, KCl, Na_3AlF_6 and $ZnCl_2$. The article heated in this flux is then removed to the molten aluminium bath.

In this procedure difficulties have arisen. First, it has been found necessary to immerse the article in the flux bath immediately after the mechanical cleaning or corroding operation, because the least quantity of oxide prevents the adhesion of the coating to the oxidized surface. Secondly, even if the utmost attention has been given to the thorough removal of oil, oxides or the like before immersion in the flux bath, the procedure has often failed to procure the necessary adhesion of the coating.

According to the present invention, in order to obtain a good coating the article to be treated is first immersed in a flux bath containing a molten mixture of alkali or other fluorides or fluorine compounds such as Na_3AlF_6, and alkali salts such as alkali chlorides, and optionally other salts, preferably chlorides such as $ZnCl_2$, but not containing any compound of calcium; the article is kept in this bath until oxides and the like have been removed and the article has been properly heated, after which the article is removed and immersed in the bath of molten aluminium or aluminium containing up to 5 per cent of other metal ingredients.

It is essential that the flux bath should contain no calcium compound, since calcium is apt to form insoluble compounds such as calcium carbide which prevent the proper adhesion of the aluminium to the metal. It is recommended that a substantial amount of fluoride (more than 5 per cent. of Na_3AlF_6) should be present in the bath. If this be the case and no calcium compound is present the flux will quickly remove rust and other oxides from the surface of the article to be treated. A pre-treatment for the removal of rust or the like as prescribed in the earlier art is thus made superfluous. Of course, if the articles to be treated are coated by a thick layer of oxides as a result of prolonged heating during the manufacture (as by casting) it may be serviceable first to remove this layer in any known manner in order to shorten the treatment in the flux bath, but once this is done the articles may be allowed to corrode and become rusty without this being any serious obstacle to obtaining a faultless coating of aluminium or aluminium alloy.

It has further been found that if potassium chloride is used along with sodium chloride the proportion of potassium chloride should not be too great. Preferably the proportion of the salts to each other should be according to their equivalent weights viz. about 40 parts by weight potassium chloride to 30 parts of sodium chloride. Other proportions, however, may be used, but when too great a quantity of potassium chloride is present the flux is apt to adhere to the article treated when the latter is transferred to the metal bath, instead of rising properly to the surface of the bath and leaving the article well cleaned and suitable for becoming coated with aluminium or its alloy.

Otherwise the proportions and number of ingredients of the flux bath may vary within wide limits. The temperature of the flux bath depends upon that of the metal bath which again may vary according to the kind of article to be treated and the kind of result to be attained, as known to those skilled in the art. The temperature of the flux bath should not be much lower and preferably a little higher than that of the metal bath.

The composition of the flux bath, therefore, will vary according to circumstances. As an example of a flux which has been found useful for several purposes is given below:

	Per cent by weight
Na_3AlF_6	10
$ZnCl_2$ (dehydrated)	20
NaCl	30
KCl	40

It is to be understood that this composition of the flux bath is given as an example only.

What I claim is:—

1. A method of aluminizing surfaces of ferrous metal bodies, which comprises cleaning and heating the body by immersing the body in a molten flux bath of the salt type containing about 10 per cent by weight of sodium aluminium fluoride,

about 30 per cent by weight of sodium chloride, about 40 per cent by weight of potassium chloride and about 20 per cent by weight of zinc chloride but free from any salt of calcium, removing the heated body from said bath and immersing same while in heated state in a molten bath containing aluminium.

2. A method of aluminizing the surface of a ferrous metal body which comprises cleaning and heating the body by immersing the same in a molten flux bath of the salt type the active ingredients of which consists of alkali metal fluoride and chloride selected from the chlorides of one or more of the metals of the group consisting of the alkali metals and zinc but free from any salt of calcium, removing the body from said bath and immersing the body in a molten bath containing aluminum.

3. A method of aluminizing the surface of a ferrous metal body which comprises cleaning and heating the body by immersing the same in a molten flux bath of the salt type the active ingredients of which consist of alkali metal fluoride and chloride selected from the chlorides of one or more of the metals of the group consisting of the alkali metals and zinc but free from any salt of calcium, removing the body from said bath and immersing the body in a molten bath containing aluminum, the amount of alkali metal fluoride being more than five per cent.

4. A method of aluminizing the surface of a ferrous metal body which comprises cleaning and heating the body by immersing the same in a molten flux bath of the salt type the active ingredients of which consist of alkali metal fluoride and chloride selected from the chlorides of one or more of the metals of the group consisting of the alkali metals and zinc but free from any salt of calcium, removing the body from said bath and immersing the body in a molten aluminum bath containing up to five per cent of metal ingredients.

5. A method of aluminizing surfaces of ferrous metal bodies which comprises cleaning and heating the body by immersing the same in a molten flux bath of the salt type consisting of sodium aluminum fluoride, sodium chloride, potassium chloride and zinc chloride but free from any salt of calcium and in which bath the sodium aluminum fluoride is more than five per cent and the proportions of the sodium chloride and the potassium chloride are substantially in accordance with their equivalent weights, removing the heated body from said bath and immersing the same while in a heated state in a molten bath containing aluminum.

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