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METHOD OF PLATING IRON WITH ALUMINIUM AND PRODUCT THEREOF

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When plating iron in the form of sheets or bands with aluminium or aluminium alloys according to any of the known methods, the further working of the material so as to transform it into drawn bodies and pressed bodies necessitates making the plated iron soft by glowing it. Experience has found that when this procedure is followed, the plated iron shows spots after it has been glowed. It has now been discovered surprisingly that the formation of the spots depends upon the composition of the aluminium, as well as of the iron employed. In this connection it is surprising that pure aluminium, even very pure aluminium, tends very strongly to form spots, even though the use of aluminium is of great advantage because it is not easily corroded. It is also true that pure iron, that is, any well oxidized iron, will tend very strongly to cause spotting. Moreover the commercial types of aluminium can not generally be used for the purpose in view. The spots are, for instance, particularly strong if the aluminium has a certain content of magnesium. It is also noted that aluminium alloys and the low-grade commercial aluminium types are subject to corrosion in a higher degree than is pure aluminium. The spots above referred to are due to the formation of an iron-aluminium alloy when the iron thus plated with aluminium is subsequently heated to a temperature at which it becomes soft, that is, a temperature of about 520° C. Such heating of the plated iron in order to soften it is resorted to in various operations, for instance when the plated iron is to be subjected to a deep-drawing process. The iron-aluminium alloy is brittle and therefore very liable to crack and to separate from, or peel off, the underlying metal. In my invention, I avoid the formation of this alloy and obtain a product which can be bent or deformed without breaking the connection between the iron and its plating. The principle of my present invention consists in applying aluminium to iron under conditions which prevent the formation of spots when the iron thus plated is subsequently heated to a temperature at which it becomes soft.

Now, according to the present invention, the arising of spots during the subsequent glowing or heating procedure in order to make the material soft can be obviated either by the employment of a pure aluminium to which from 0.2 to 15% of silicon has been added, or by the use of a known type of iron having a content of oxygen of from 0.03 to 0.15%. The contents of oxygen is in these cases ascertained by means of the method stated by Bauer-Deiss in their article "Probeentnahme und Analyse von Eisen und Stahl" (Taking Samples of, and Analyzing, Iron and Steel), published in the German periodical, "Stahl und Eisen" (Steel and Iron), II edition 1922, page 288, and corrected by Oberhoffer and Keutmann in the abovementioned periodical, volume 45 (1925), page 1557 (addition of antinomy), and volume 46 (1926), page 1045 (lumps instead of millings).

The progress attained by the use of such types of aluminium or of iron as stated in the preceding paragraph will now be made clear with the aid of an example, as follows: The aluminium-plated sheet-iron that has been hardened by cold rolling must thereafter be made soft by glowing. With the most suited qualities of iron the requisite temperature does not lie below 520° C. If the iron is plated with pure aluminium having a content of 0.09% of silicon, the spots will form at a temperature of about 450° C. It is impossible to obtain with this aluminium an aluminium-plated article that has no spots when it is heated to that temperature at which the iron becomes soft. The temperature at which spots arise must, at all events, be a little higher than the recrystallization temperature. When aluminium with 0.2% of silicon is used, the spots begin to appear at about 530° C. This percentage is, thus, the lowest content of silicon in an aluminium suited for plating and which permits the plated article to be glowed soft without forming spots. But it must be observed that the range of temperature between the recrystallization and the formation of the spots is only very small and can be used only with very great precaution. With a content of 0.6% of silicon in the aluminium the formation of spots arises only at about 580° C. With this temperature range which has now been attained the glow temperature may be increased to such a degree that the interior of aluminium-plated iron articles placed in a kiln for not too long a period will reach the recrystallization temperature of the iron, that is, will become soft, while at the same time the temperature of the outer surface of the article will not exceed the temperature at which spots begin to appear. The addition of silicon facilitates, therefore, considerably the work and decreases likewise considerably the waste.

In order to make matters still more clear, I am adding some more explanatory remarks:

There is also a certain relationship between the temperature and the amount of silicon used. Certain temperatures require a greater amount of silicon before the formation of spots could be

avoided. The temperature used must be so chosen that the iron will certainly be glowed soft, and the amount of silicon should vary in accordance with this temperature. Thus, glowing the material in such a manner that no spots arise can be carried out also with a smaller quantity of silicon, but in this case the iron will not become soft.

Finally, as regards the question whether or not the molten mass contains the requisite excess of oxygen, there is made, besides determining the percentage of oxygen, a practical test. This is carried out in this way that a piece of sheet-iron is plated in a rolling mill and is then heated to the desired temperature. If the aluminium plating adheres firmly to the iron and no black spots arise when the plated iron has been heated to 520° C. that will indicate that the requisite excess of oxygen according to this invention exists in the iron.

I claim:

1. The method of plating iron with aluminium, which consists in applying to iron, aluminium containing from .2 to 15% of silicon but substantially pure otherwise, whereby the resulting plated iron can be heated to a temperature at which it becomes soft, without the formation of spots.

2. A metal article capable of being heated to a temperature at which iron becomes soft without spotting comprising a base member of iron, and a superimposed plating layer of aluminium containing from .2 to 15% of silicon.

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