March 27, 1962 R. A. NICKOLA 3,026,606

HOT-DIP ALUMINUM COATING

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FIG. 2

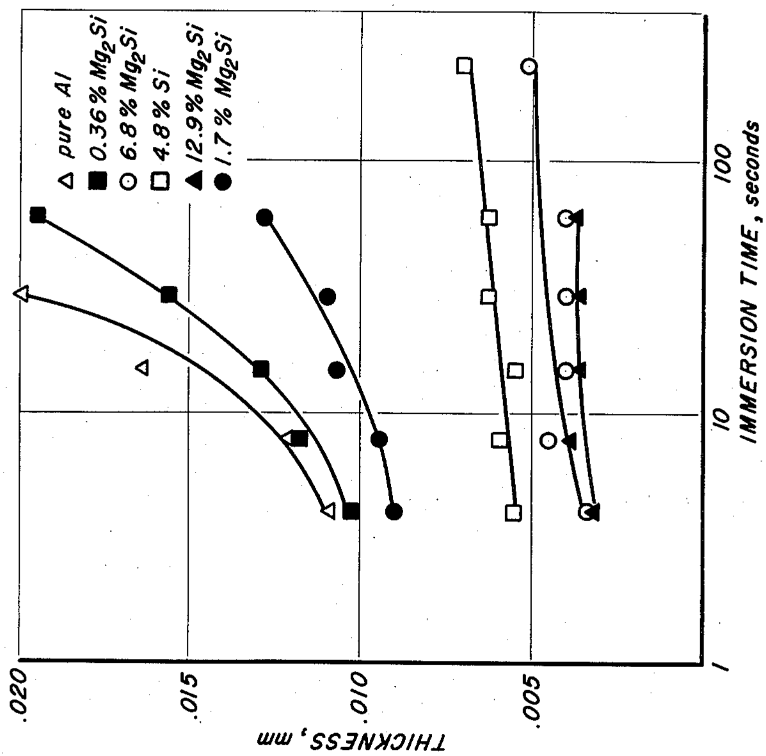
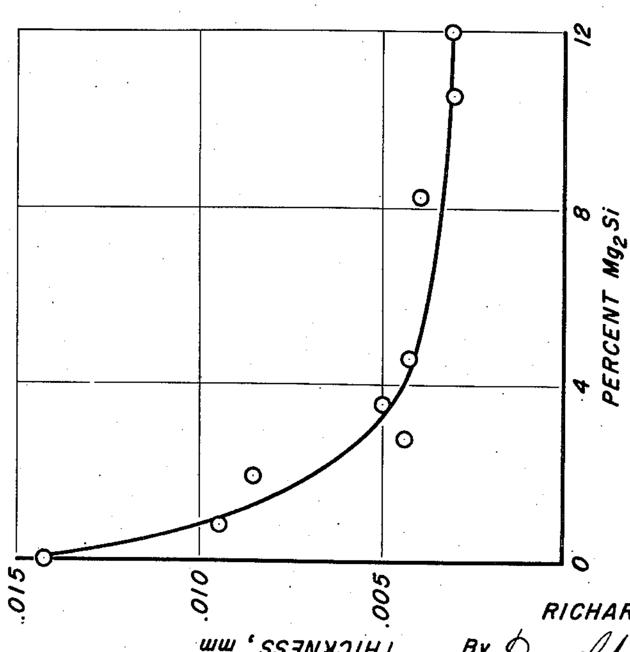


FIG. 1



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HOT-DIP ALUMINUM COATING

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This invention relates to hot-dip aluminum coating baths and ferrous articles coated therein.

Various ferrous metal products are coated with aluminum by hot-dip coating, i.e. immersing the articles in a clean condition in a bath of molten aluminum. While good coatings may be obtained by such process, a relatively thick iron-aluminum alloy layer is formed between the base metal and the aluminum coating. This precludes any substantial forming of the coated article due to poor adherence of the coating. The thickness of the alloy layer is largely determined by the time of immersion and temperature of the coating bath. However, even with these maintained as low as possible, objectionably thick and brittle alloy layers are obtained.

It has heretofore been proposed to add silicon in substantial quantities to aluminum coating baths to produce more ductile and adherent coatings. However, the silicon has an adverse effect on the appearance of the coating. It also results in the formation of aluminum-silicon and iron-aluminum-silicon compounds which are detrimental to corrosion resistance.

I have discovered that the alloy layer can be very materially reduced by the addition to the aluminum bath of magnesium silicide (Mg_2Si) in amounts in excess of 4% and for maximum benefits in excess of 6%. So far as I have been able to determine, increasing amounts have no additional beneficial affects nor do they detract from the appearance and corrosion resistance of the coating since magnesium silicide has substantially the same electropotential as aluminum. However, it is not desirable to add more than about 25% magnesium silicide to the coating bath. The remarkable effect of magnesium silicide in reducing the alloy layer thickness in ferrous articles hot-dip coated with aluminum containing various amounts of magnesium silicide with constant immersion times of 4 seconds is shown in FIGURE 1 of the drawing.

The effect of magnesium silicide in reducing the diffusion rate between ferrous objects and aluminum coating baths is shown in FIGURE 2. This figure shows the rate of alloy layer growth with aluminum baths containing various amounts of magnesium silicide and silicon as indicated thereon. It shows that unlike pure aluminum or silicon-aluminum alloys, the time of immersion has very little effect on the thickness of the alloy layer with concentrations of magnesium silicide of 4% or greater.

The coatings containing magnesium silicide are harder

than pure aluminum coatings and hence have greater resistance to scratching or scuffing during handling.

The magnesium silicide may be added to the bath as such or by adding silicon and magnesium separately in the proportions of magnesium silicide, i.e. ratio of 1 silicon to 1.7 magnesium so there is no excess magnesium or silicon in the bath.

While I have shown and described several specific embodiments of my invention, it will be understood that these embodiments are merely for the purpose of illustration and description and that various other forms may be devised within the scope of my invention, as defined in the appended claims.

I claim:

1. A hot-dipped article comprising a ferrous metal base, a coating of an abrasion-resistant aluminum alloy comprising essentially aluminum and 4 to 25% of magnesium silicide and a thin ductile intermediate alloy layer.

2. A method of coating ferrous articles with a predominantly aluminum coating including cleaning the ferrous body to remove foreign material and oxide therefrom and then submerging said article in a molten aluminum bath containing at least 4% magnesium silicide.

3. A method of coating ferrous articles with a predominately aluminum coating comprising cleaning the ferrous articles to remove foreign materials and oxide therefrom and then submerging the cleaned articles in a molten substantially aluminum bath containing between 4 and 25% magnesium silicide.

4. A hot-dipped article comprising a ferrous metal base, a coating of abrasion-resistant aluminum alloy comprising essentially aluminum and 6 to 25% magnesium silicide and a thin ductile intermediate alloy layer.

5. A method of coating ferrous articles with a predominately aluminum coating comprising cleaning the ferrous articles to remove foreign materials and oxide therefrom and then submerging the cleaned articles in a molten aluminum bath containing at least 6% magnesium silicide.

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