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S. PEACOCK

PROCESS OF COATING SHEET STEEL WITH ALUMINUM

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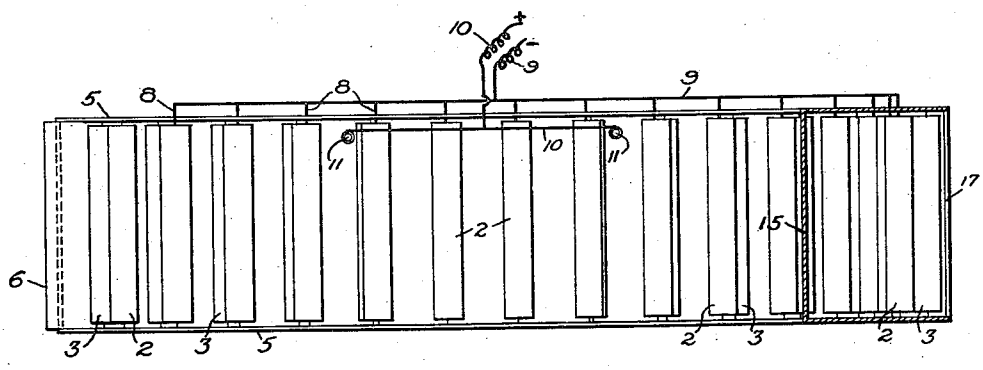


Fig. 1

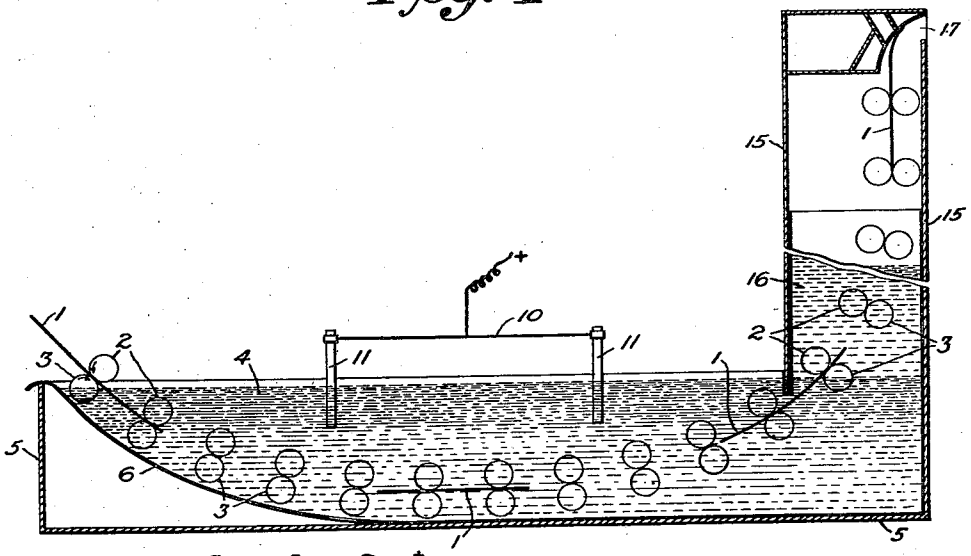


Fig. 2

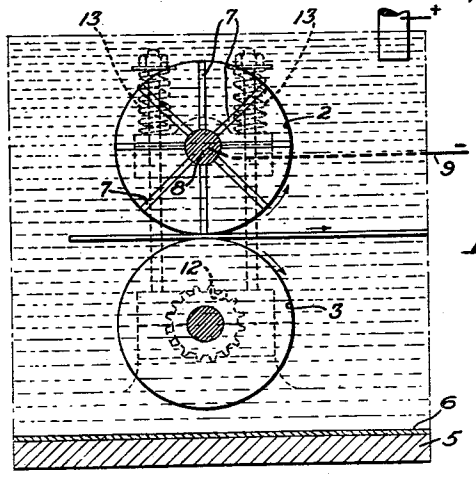


Fig. 3

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UNITED STATES PATENT OFFICE.

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PROCESS OF COATING SHEET STEEL WITH ALUMINUM.

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To all whom it may concern:

Be it known that I, SAMUEL PEACOCK, a citizen of the United States, residing at Wheeling, in the county of Ohio and State of West Virginia, have invented certain new and useful Improvements in Processes of Coating Sheet Steel with Aluminum; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

This invention relates to a process of coating sheet steel with aluminum, and has for its object to provide a procedure which will be more efficient in action and less costly in practice than those which have been heretofore proposed.

With these and other objects in view, the invention consists in the novel steps and combinations of steps constituting the process, all as will be more fully hereinafter disclosed and particularly pointed out in the claims.

Referring to the accompanying drawings forming a part of this specification, in which like numerals designate like parts in all the views:

Figure 1 is a diagrammatic plan view of an apparatus suitable for carrying out this invention;

Figure 2 is a sectional view of the parts shown in Figure 1; and

Figure 3 is an enlarged sectional detailed view of a pair of rollers between which the sheets to be coated pass.

In order to more clearly explain the invention, it is said: Light gage sheet steel for automobile bodies and other purposes when coated with aluminum possesses through the medium of the steel core, the strength of steel, while the surface is protected from excessive corrosion by the aluminum coating, and therefore it has a much longer life in use than would otherwise be the case. But as is also well known, it is exceedingly difficult and expensive to electrolytically deposit aluminum from aqueous solutions on sheet steel and at the same time get a satisfactory, smooth reguline deposit.

To avoid these objections, I therefore in carrying out this invention use a fused bath of an alkali metal aluminum fluoride. The concentration of the aluminum in the bath is maintained in any well known and suitable manner as by the addition of the solid alkali metal fluoride in such a way as to keep the bath saturated and in substantially the same manner as commonly employed in commercial practice in recovering the metal itself. Instead of a carbon cathode I employ a cathode of sheet steel. Further, the bath is maintained at somewhat below the usual temperature of 900° C. but above the temperature of 700° C., by making the bath consist of a mixture of sodium and potassium aluminum fluorides in suitable proportions. But nevertheless, the working temperature of the bath is still well above the melting point of aluminum. For very thin coatings, which have little or no industrial application, the properties of the molten bath alone seem to be sufficient to maintain an even coating of aluminum on the sheet steel even when vertical cathodes are used, but it is found that when rather thick coatings are desired, special precautions have to be observed. That is, if the sheet steel is to be well protected with a smooth and satisfactory aluminum coating, it is found necessary to pass the sheet steel cathode sheets 1 between rollers such as 2 and 3 submerged in the molten alkali metal-aluminum fluoride bath 4, and some times it is found desirable to pass them through such a bath one or more times. That is, I prefer to provide a suitable container 5 in which is mounted a plurality of rollers 2 and 3, as illustrated, and which accommodates the molten bath 4 by any suitable means, as for example a curved inclined bottom 6. The upper rollers 2 are preferably provided with a plurality of conductors 7 and suitably insulated from the rollers 2, and the axes 8 of which are all joined to the negative lead 9 of the circuit. The positive lead 10 of the circuit is conveniently joined to a pair of carbon anodes dipping into the bath 40 illustrated, and the lower rollers 3 are suitably provided with driving

means 12, by which they may be turned and caused to feed the cathode sheets 1. The upper rollers 2 are likewise conveniently spring pressed onto the cathode sheets 1 as illustrated, by the dotted lines at 13. As the molten bath is at a temperature higher than say 700° C. the sheets 1 are of necessity quite hot as they pass through the bath, and therefore they should be cooled before they emerge therefrom.

In order to accomplish this, the vessel 5 is provided with an extension or stand pipe 15 in which is placed an additional set of rollers 2 and 3 as shown, and these rollers are submerged in some suitable molten cooling liquid 16, such for example as a mixture of sodium and potassium nitrates or other low melting point bath which will not injuriously act upon the coated sheets 1. Each set of rollers 2 and 3 are so disposed that they form a continuous curved path for the sheets 1, as plainly shown in Figure 2, and they are so spaced apart that the positively driven lower rollers 3 will feed the sheets successively from one pair of rollers to the next, so that the said sheets never get out of control of the said rollers 2 and 3 until they emerge at the point 17 from the top of the stand pipe 15.

The operation of this apparatus will be clear from the foregoing, but may be briefly summarized as follows:

The sheets 1 are preferably fed by hand or in any other suitable manner between the first pair of rollers 2 and 3, whereupon the positively driven rollers 3 soon force the sheets forward to the next pair, and thus are the sheets propelled underneath the surface of the molten bath 4 and out through the stand pipe 15 at the point 17. In the meantime, current being fed into the bath through the anodes 11, aluminum is deposited on the surfaces of the sheets 1 as they pass through the bath and especially on the under surfaces of said sheets. The current having reached the said sheets 1 it passes along and through said sheets to the conductor 7 with which each of the rollers 2 are provided, and out of the axes 8 of said rollers 2 through the lead 9 and back to the source of supply, all as will be clear from Figures 1 and 3. As the conductors 7 and the surfaces of the rollers 2 and 3 themselves are apt to somewhat mar the coating on the sheets when especially thick and coherent coatings are desired, I find it convenient to take the sheets 1 after they have emerged from the point 17 of the stand pipe 15 and turn them upside down, whereupon the coating is found to be very satisfactory. It is very probable that the mechanical action of the spring pressed rollers 2 compressing the sheets onto the rollers 3 serves to compact the coating and to render it more smooth and even than would otherwise be the case. Especially is this found to be the fact when a comparatively large number of rollers 2 and 3 are provided, as is the case here. That is to say, any defects that may be found in the coating after passing through the first two or three pairs of rollers are mechanically pressed down and spread out over the surface of the sheet by the succeeding rollers so that before the sheet has emerged from the bath the mechanical smoothing and compressing of the coating has made it so uniform that the last rollers find a smooth and coherent surface for deposition, and they therefore give the sheet a pleasing and finished appearance.

It is obvious that those skilled in the art may vary the details of the process without departing from the spirt thereof, and therefore it is not desired to be limited to the above disclosure except as may be required by the claims.

What is claimed is:

1. The process of coating sheet steel with aluminum which consists in providing a molten bath consisting of a mixture of sodium and potassium aluminum fluorides at a temperature above 700 C.; passing said sheet steel beneath the surface of said bath while passing a current from said bath to said sheet steel and compacting the coating produced in the bath; and gradually cooling said coating out of contact with the atmosphere.

2. The process of coating steel sheets with aluminum which consists in passing said sheets through a molten bath containing an alkali metal-aluminum fluoride; plating out the aluminum from said bath onto said sheets; compacting the coating during the plating action; and passing said sheets through a cooling bath out of contact with the atmosphere.

3. The process of coating steel sheets with aluminum which consists in passing said sheets beneath the surface of a molten bath containing an aluminum fluoride admixed with an alkali-metal fluoride; passing a current of electricity into said bath with said sheets forming cathodes, while compacting the coatings thus produced; and cooling said sheets out of contact with the atmosphere.

4. The process of coating a steel sheet with aluminum which consists in passing said sheet through a molten bath of alkali metal-aluminum fluoride at a temperature above the melting point of aluminum; passing an electric current to said sheet as a cathode to coat the same with aluminum; compacting the coating thus formed at a plurality of points in the path of travel of said sheet; and cooling the coated sheet.

5. The process of coating a steel sheet with aluminum which consists in passing said sheet through a molten bath at a tempera-

ture above the melting point of aluminum, said bath containing aluminum in chemical combination and being of such a composition that metallic aluminum may be readily plated out of the same; making said sheet serve as a cathode in said bath; passing an electric current through said bath to plate out said aluminum onto said sheet; and mechanically compressing the coating thus obtained at a plurality of points in the path of travel of said sheet.

In testimony whereof I affix my signature.

SAMUEL PEACOCK.