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METHOD OF METAL-CLADING

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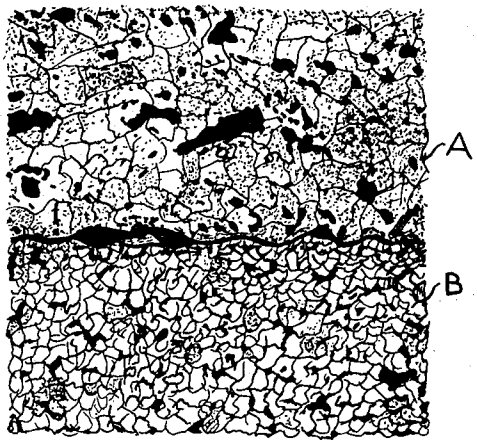


FIG 1

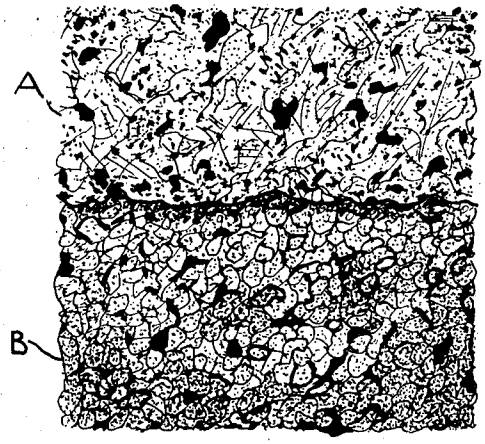


FIG 2



FIG 3

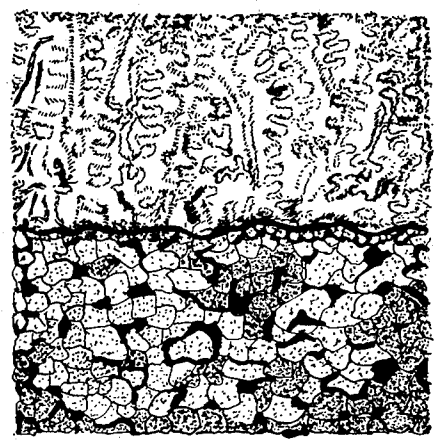


FIG 4

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METHOD OF METAL-CLADING

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5 Claims. (Cl. 117—22)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

This application pertains to a method of metal-clading. The purpose of metal-clading is to provide a metal object fabricated of a material having certain physical properties with a fused on coating of another metal whose physical properties may be different from those of the base metal but which, in addition, possesses another property, usually resistance to corrosion to certain liquids or gases, to a degree which far exceeds that of the base metal in regard to the useful life of the fabricated product.

The term metal-clad is understood by industry to apply to coating one metal with another in such a manner that the material which forms the clad or coating is in the rolled, wrought or cast form, and it is bonded to the base metal in a metallurgical union, which is known as a welded fusion.

Figs. 1 to 4 are reproduced photomicrographs, showing the coarse conglomerate of of metal A applied to the base metal B, held together by mechanical cohesion, at C in Figs. 1 and 2, whereas in Figs. 3 and 4, the coating is fused together and to the surface of the base metal.

The method of metal-clading described herein consists of two phases. The object to be metal clad is first covered by the metal selected for the purpose by means of metal spraying.

The preferred method is to apply first the clad-metal by spraying it on to the desired thickness and then coat that with aluminum deposited to form a layer only a few thousandths of an inch in thickness. Any other suitable deoxidizer can be applied in place of the aluminum if desired.

Following the above given operation the object is preheated and then the sprayed coating is remelted progressively by applicable means such as the carbon arc, the single or multiple jet oxy-acetylene flame, or, whenever the geometry of the object makes it permissible, high frequency induction.

The remelting must be carried out with a sufficiently high power imput to permit liquefying the sprayed on metal and causing it to fuse to the base metal without allowing the heat to dwell long enough to cause a metallurgical change in the base metal. Remelting the overlay progressively permits retaining the original contour and thickness thereof.

Metal deposited by means of metal spraying is only a conglomerate of small particles held together by partial fusion and by mechanical cohesion of the interlocked particles as seen in the reproduced photomicrograph Figs. 1 and 2. The adhesion of the sprayed on metal to the base metal is likewise purely mechanical.

The reproduced photomicrographs in Figs. 3 and 4 show that on remelting the sprayed on conglomerate a homogeneous, cast structure is produced which adheres to the base metal with a true brazed or welded-on fusion.

The structure of the metal in the Coating A' shows the more homogeneous characteristics resulting from the fusion of the conglomerate mass. At C' may be seen the result of the fusion of the coating to the surface of the metal body B', while the characteristics of the metal in the body are not materially changed.

In describing the first phase of the subject method it was mentioned that on completion of the building up of the sprayed on overlay another thin coat of aluminum is applied. The role of this secondary overlay is to act as a scavenger or deoxidizer in remelting the partly oxidized conglomerate. If desired, the aluminum may be applied in several thin layers: the first direct on the base metal, one at about the middle of the desired sprayed on thickness, and finally one over the final thickness of the sprayed on metal. While aluminum is the preferred substance for deoxidizing, any other metal of suitable characteristics may be applied.

The above described method is applicable to all shapes which may be successfully coated by metal spraying and with all metals which can be sprayed.

When it is desired to increase or alter the alloy content of any of the materials available in wire form for spraying, the following procedure is applicable.

A quantity of the metal or alloy which is required to obtain the desired alloy in the converted clad material is procured in finely divided form and is applied by means of a suitable vehicle and it is painted on the completed sprayed-on overlay and then it is covered with the final layer of aluminum. In remelting, the finely divided metal particles of the added metal or alloy dissolve in the body of the overlay forming the desired composition.

From the foregoing description it is evident that various modifications in the method may be resorted to without departing from the spirit of the basic invention or the scope of the appended claims.

The invention described herein, if patented, may be manufactured and used by or for the Government for governmental purposes without the payment to me of any royalty thereon.

What I claim is:

1. In a method of metal-clading a metal body, the steps of applying a clad-metal by spraying it on to the desired thickness, preheating the body below the melting temperature of any of the metals, and then progressively remelting the clad-metal with a sufficiently high power heat concentration to permit liquefying the sprayed on metal and causing it to fuse to the body without allowing the heat to dwell long enough to cause a metallurgical change in the metal of the body.

2. In a method of metal-clading a metal body, the steps of applying a clad-metal by spraying it on to the desired thickness, coating it with a thin layer of deoxidizer, preheating the body below the melting temperature of any of the metals, and then progressively remelting the clad-metal with a sufficiently high power heat concentration to permit liquefying the sprayed on metal and causing it to fuse to the body without allowing the heat to dwell long enough to cause a metallurgical change in the metal of the body.

3. A method of coating a metal surface with a layer of another metal, said layer having any desired thickness and shape or contour, comprising applying said layer in conglomerate form to the desired thickness and shape, then applying concentrated heat progressively in a manner to melt a comparatively small expanse of the layer at a time, with only sufficient heat to simultaneously melt only a microfilm of the metal surface in contact with said expanse and without causing a metallurgical change in the metal below the surface.

4. A method of coating a metal surface with a layer of another metal, said layer having any desired thickness and shape or contour, comprising applying said layer in conglomerate form to the desired thickness and shape, preheating the combination to a moderate temperature to reduce the heat gradient in the performance of the following step, and then applying concentrated heat progressively in a manner to melt a comparatively small expanse of the layer at a time, with only sufficient heat to simultaneously melt only a microfilm of the metal surface in contact with said expanse and without causing a metallurgical change in the metal below the surface.

5. In a method of metal-clading a metal surface, spraying a clad-metal in the desired thickness on the metal surface, applying a suitable deoxidizer by painting, then preheating the entire combination and then progressively remelting the metal coating by means of applied heat sufficiently concentrated to fuse the coating to the surface of the metal without dwelling long enough in one place to cause a metallurgical change in the base metal or to disturb the original contour and thickness of the coating.

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