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ELECTROPLATING STAINLESS STEEL

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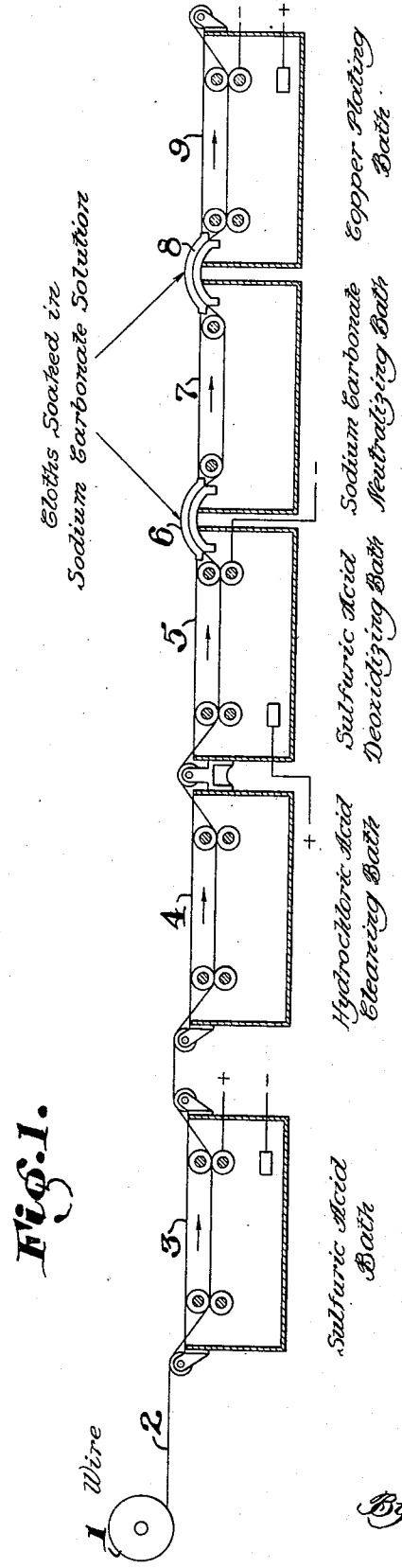


Fig. 1.

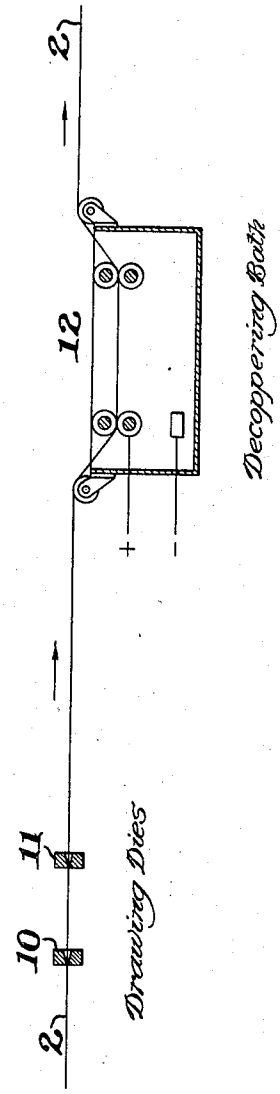


Fig. 2.

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ELECTROPLATING STAINLESS STEEL

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3 Claims. (Cl. 204—34)

This invention relates to a process for producing adherent electro-coatings upon stainless steel. This process has heretofore proved extremely difficult, and no method is known by which an adherent coating can be obtained upon a stainless steel surface. This is particularly true of coatings upon objects such as wires.

By means of the present invention it is possible to plate stainless steel, particularly of the austenitic or 18–8 type, with a metal, for example copper, in a uniform adherent coating of any desired thickness.

This invention is primarily applicable to the drawing of stainless steel wires of the 18–8 type or other high tensile strength materials particularly those including substantial percentages of chromium. Wires of this type are extremely difficult to draw and the drawing is considerably easier if a uniformly distributed lubricant can be provided on the wire.

In accordance with this invention, the wire is continuously cleaned and coated with an adherent lubricating metal such as copper and is then drawn with the copper on it, after which the copper coating is removed. The drawing diagrammatically illustrates the sequence of steps and is appropriately legended.

Figure 1 and Figure 2 represent consecutive operations, the wire passing from the right hand portion of Figure 1 to the left hand portion of Figure 2. The apparatus comprises a reel 1 from which a wire 2 passes first through a sulphuric acid bath 3, then through a hydrochloric acid cleaning bath 4; then through a sulphuric acid deoxidizing bath 5 from which it is passed through cloths 6 soaked in sodium carbonate to a sodium carbonate neutralizing bath 7; then through more cloths 8 soaked in sodium carbonate solution to a copper plating bath 9. The wire is then drawn through the dies 10 and 11 after which it is decoppered in the decoppering bath 12.

An example of the invention will be given in connection with stainless steel wire containing approximately 18% chromium and 8% nickel and having a tensile strength of approximately 200,000 lbs. per square inch. However, other stainless steel types, including stainless steel without nickel, for example, that having approximately 17% chromium and no nickel, are satisfactory.

The wire which has been annealed and is covered with scale is first cleaned to remove the scale, which may be accomplished by passing it continuously through a cleaning solution. This is preferably an acid bath in which the wire is made the anode for an electrical circuit. The preferred bath is approximately a 10% solution of sulfuric acid at room temperature and a direct current is employed using the wire as the anode.

While a wide range of current density may be employed, I have found 75 amperes per square foot most suitable. A reaction time of about one minute is sufficient under these conditions.

The wire then enters a 10% solution of hydrochloric acid at room temperature, and remains therein for about 20 seconds. It is then washed in cold running water, and again enters a 10% sulfuric acid bath at room temperature. In this bath the wire is the cathode and a current density of about 30 amperes per square foot is employed. Under these conditions a 30 second reaction time is satisfactory.

This bath removes oxygen from the wire by generating nascent hydrogen in contact therewith. After this treatment oxygen is excluded at all times from the wire until plating is complete.

The oxide-free wire is then passed into a plating bath. In practice this is preferably accomplished by enclosing the wire in a cloth wetted with sodium carbonate solution while passing from the deoxidizing bath to a neutralizing bath and similarly protecting it while passing from the neutralizing bath to the plating bath.

The preferred neutralizing solution is sodium carbonate with a concentration of about 8 ounces of crystals of commercial sodium carbonate per gallon of water. The bath is preferably kept warm (about 120° F.). The cloths are kept wetted with sodium carbonate solution of the same concentration as the bath. The make-up water added to the cloths to replace that lost by evaporation should be warm, in order to insure relative freedom of the water from air. The process is sensitive enough that if ordinary cold water is added as make-up, the adherence of the resulting coating will be adversely affected.

Other neutralizing solutions may be employed in the bath or other liquids may be employed on the cloths, the function being to keep the wires free from air.

From the neutralizing bath the wires pass through the cloths to a plating bath which, for copper, preferably comprises a copper-cyanide plating solution. A preferable solution comprises 35 grams per liter of metallic copper, approximately 25 grams per liter of free-sodium-cyanide, approximately 10 grams per liter of sodium carbonate, 5 grams per liter of thiosulfate. The bath is kept warm, but the sodium thiosulfate

also assists in keeping the bath free from oxygen. A satisfactory current density is 30 amperes per square foot of wire surface.

The wire is kept in the bath long enough to coat a thickness of any desired amount, but a thickness of 1/7000 to 1/50000 of an inch of copper has proved quite satisfactory for wire of .039 to .043 inch in diameter. Larger amounts are satisfactory but increase expense.

After the wires have been coated with copper they may be passed directly to the drawing dies and may be reduced in thickness as desired. A powdered sodium stearate lubricant is used in the dies, in addition to the copper. With a copper coating applied as herein described, the wires may be drawn practically as many passes as desired. For example, drawing from 1 to 5 passes is quite satisfactory.

After the drawing operation, the copper may be removed, if desired, from the wire in any desirable manner. The preferred manner is to pass it through a copper cyanide bath of the type herein described for plating and simply reversing the current. The wire may then again be annealed and cleaned.

The foregoing detailed description has been given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, but the appended claims should be construed as broadly as permissible in view of the prior art.

I claim:

1. In the continuous plating of stainless steel wire, the steps of passing a chromium-containing stainless steel wire continuously through a bath of dilute sulfuric acid while maintaining the wire as the anode of an electric current, cleaning the wire and then passing it through a bath of dilute sulfuric acid while maintaining the wire as the cathode of an electric circuit, maintaining the contact and electric current under conditions to generate nascent hydrogen until the wire has become adaptable for plating during passage through the bath, and removing the stainless steel wire continuously from the bath to an alkaline cyanide copper plating bath while preventing access of air thereto, by passing the wire continuously through a fabric wetted with an aqueous solution of sodium carbonate during the entire distance from the acid bath to the plating bath.

2. In the continuous plating of stainless steel wire, the steps of passing a chromium-containing stainless steel wire continuously through a bath of dilute sulfuric acid while maintaining the wire as the anode of an electric circuit, cleaning the wire and then passing it through a bath of dilute sulfuric acid while maintaining the wire as the cathode of an electric circuit, maintaining the contact and electric current under conditions to generate nascent hydrogen until the wire has become adaptable for plating during passage through the bath, and removing the stainless steel wire continuously from the bath to an alkaline cyanide copper plating bath while preventing access of air thereto, by passing the wire continuously while wetted with an aqueous solution of an alkaline salt during the entire distance from the acid bath to the plating bath.

3. The method as set forth in claim 2, in which the wire is passed from the acid bath to the plating bath through fabrics wetted with the alkaline salt.

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