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ELECTROLYTIC POLISHING

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3 Claims. (Cl. 204—140)

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My invention relates to the electro-chemical treatment of metals and particularly to the treatment of stainless alloys containing nickel, or both chromium and nickel, such, for example, as the chrome-nickel steels.

The electrochemical polishing of metals is a relatively new art which is being developed in an attempt to find methods of surface polishing which are cheaper and better than mechanical buffing. Various acid electrolytes have been suggested in which the steel to be polished is treated as the anode. Some of these include expensive ingredients and none of them, so far as I am aware, has any unusual throwing power. The cathode must be specially shaped and maintained in carefully spaced relation to the anode if uniform results are to be attained so that it is practically imposibble to polish irregularly formed objects. Furthermore, large area sheet or strip products cannot be uniformly polished because disfiguring streaks and pits are formed in the polished surface for reasons which, at present, are not completely understood.

The principal objects of my invention therefore are to provide a process for the electrochemical treatment of metals which is economical in first cost because of the character of the electrolyte and the simple equipment required, which is cheap to operate because of the long life of the electrolyte, which will uniformly treat irregularly shaped metal objects without the necessity of special cathodes, and which may be used to polish the surface of metal alloys of the group consisting of "Monel" metal and the chrome-nickel stainless steels.

As an electrolyte I prefer to use a solution containing the following elements in about the proportions set forth:

	Percent by weight
Water	35–55
Chromic acid	2–20
Free sulphuric acid (1.84 sp. gr.)	15–55
Sulphates or bisulphates and impurities	Balance

While chromic acid per se may be added to the solution of sulphuric acid and water which constitutes the major part of my electrolyte, I prefer to form the chromic acid in the bath by incorporating therein sodium dichromate although it is to be understood that any of the chromates or dichromates may be used for this purpose. In addition to forming chromic acid in the bath, the chromate or dichromate will also form, by reaction with the sulphuric acid, a sulphate or bisulphate of the chromate or dichromate-forming element.

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Instead of chromic acid, vanadic or meta-vanadic acid may be added directly to the bath or formed therein by adding a vanadate or meta-vanadate of ammonium, potassium or sodium. These acids and salts are not only expensive but sometimes difficult to obtain commercially, and for these reasons I prefer not to use them.

Instead of chromic acid, manganic or permanganic acid may be formed in the bath by the addition thereto of any of the manganates or permanganates of the alkali metals of group I or any of the manganates or permanganates of the metals of group II. The stability of the electrolytes containing these last mentioned acids is not as high as with the other acids mentioned and therefore I prefer to use chromic acid formed as a reaction product by the addition of a chromate or dichromate to the bath.

The electrolyte is preferably contained in a tank of suitable size lined throughout with tellurium lead which may be used as the cathode. Where it is desired to give the metal a highly lustrous polish, the bath is heated to a temperature in excess of about 160° F., and preferably between about 185° F. and the boiling point, by any suitable means such, for example, as heating tubes or pipes immersed therein. The metal to be treated is simply immersed in the electrolyte as anode and treated at a current density of preferably about 1½ to about 15 amperes per square inch of anode. Only a very short period of treatment is necessary to produce a high, uniform polish thereon at 15 amperes. For example, small articles such as tubes, rods, watch cases and other regularly or irregularly shaped objects formed of chrome-nickel steel, or having some portions formed of chrome-nickel steel and other portions formed of "Monel" metal, may be immersed in any position in the tank and highly polished in from 20 to 60 seconds of immersion time. Because of the very short immersion time required to polish, wire, rod or strip products may be run continuously through a bath of proper length at a high rate of speed and small area products may be treated consecutively or in small groups for about a minute or less. Moreover, in such case, although the current density per square inch of anode is comparatively high the total current flowing need not be unreasonably great because of the comparatively small area of the anode.

Processes of the prior art using an electrolyte of orthophosphoric acid or a mixture of ortho-

phosphoric acid and sulphuric acid with a current density of about 1 ampere per square inch of anode require about 10 minutes of immersion time to polish 18–8 stainless steel. Furthermore, the average loss of metal from the surface of the object during this treatment is from 2.5% to 5.0% of the weight. With my process, due to the high speed at which it may be conducted, the surface metal loss does not exceed a maximum of from .25% to .50%.

The character of the surface which can be produced upon stainless steels varies with the analysis of the steel, the temperature of the bath and the current density employed. Thus, stainless steels containing nickel in appreciable quantities are brightly and uniformly polished at temperatures above about 160° F. (preferably above 200° F.), with the current densities described above.

While I prefer to use a current density of from 1½ to 15 amperes per square inch of anode surface where a highly polished finish is desired, much higher current densities, even up to 30 amperes, may be employed where adequate facilities can be provided for fast handling of the products during the treatment.

I also wish to point out that, in general, the higher temperatures produce the better polishes.

Straight chromium stainless steels or other stainless steels which do not contain appreciable quantities of nickel do not acquire the same extremely bright polish as the nickel-containing steels.

In other words, nickel in quantities of 2% or more, by weight, seems to be an essential ingredient of the steel if an extremely high reflecting luster is to be applied thereto.

What I claim is:

1. The method of polishing the surface of a metal alloy of the group consisting of "Monel" metal and the chrome-nickel stainless steels, which comprises subjecting the alloy to electrolytic action as anode at a current density of from about ½ to about 30 amperes per square inch and in an electrolyte containing a plurality of ingredients of which the following, in the percentages by weight stated, are the only necessary ingredients, free sulphuric acid from about 15% to about 55%, a second acid selected from the group consisting chromic, vanadic, metavanadic, manganic and permanganic from about 2% to about 20%, and the balance water; the temperature of said electrolyte being in execess of about 160° F.

2. The method of brightening and imparting a high polish to the surface of a chrome-nickel stainless steel which comprises subjecting the steel to electrolytic action as anode at a current density of from about 1½ to about 15 amperes per square inch and in an electrolyte containing a plurality of ingredients in which the following, in the percentages by weight stated, are the only necessary ingredients, free sulphuric acid from about 15% to about 55%, a second acid selected from the group consisting of chromic, vanadic, metavanadic, manganic and permanganic from about 2% to about 20%, and the balance water; the temperature of said electrolyte being in excess of about 160° F.

3. The method of polishing the surface of a stainless steel alloy containing chromium and at least 2%, by weight, of nickel, which comprises subjecting the alloy to electrolytic treatment as anode at a current density of from about 1½ to about 15 amperes per square inch and in an electrolyte containing, by weight, from about 15% to about 55% of free sulphuric acid, from about 2% to about 20% of chromic acid, and the balance being substantially water with minor quantities of sulphates, bisulphates and impurities; said electrolyte being maintained at a temperature between about 160° F., and the boiling point during said treatment.

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