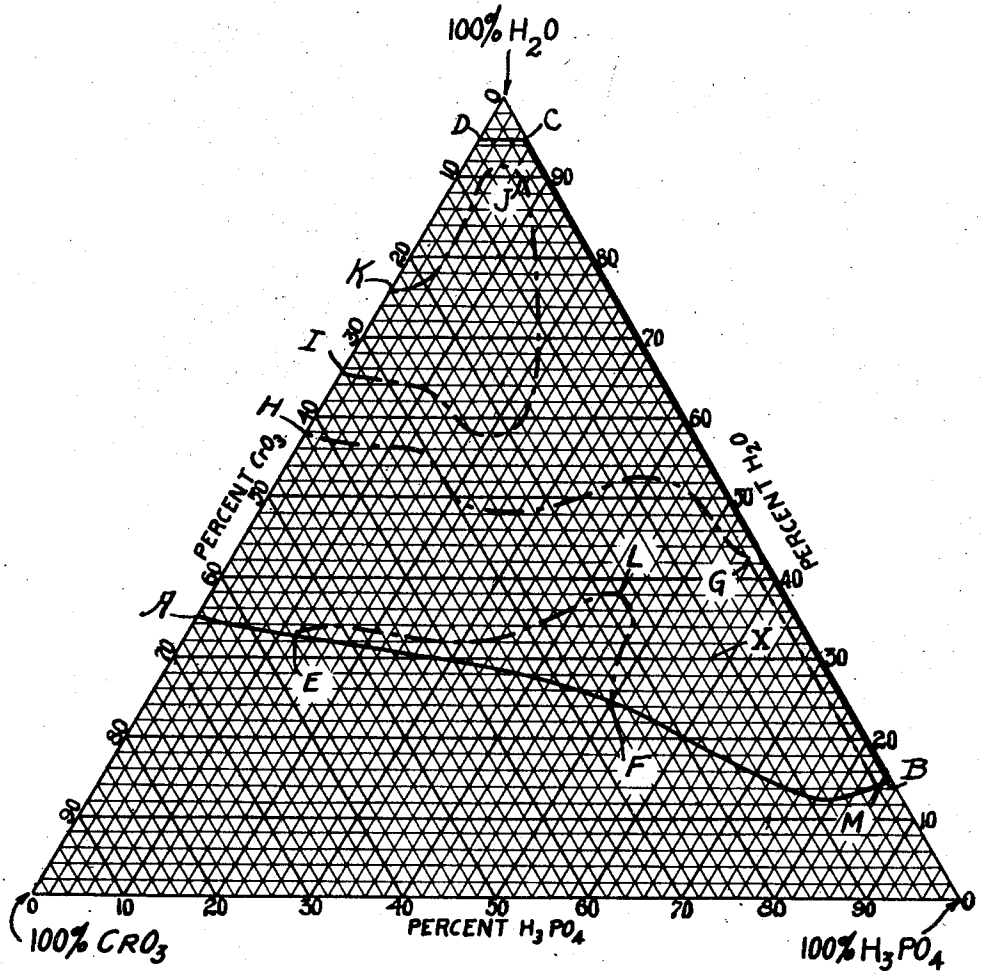
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METHOD OF ANODICALLY POLISHING BRASS

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Inventor

CHARLES L. FAUST

by Charles A. Hills Attys.

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METHOD OF ANODICALLY POLISHING BRASS

Charles L. Faust, Columbus, Ohio, assignor to Battelle Memorial Institute, Columbus, Ohio, a corporation of Ohio

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This invention relates to a method of and an electrolyte for anodically polishing brass. More particularly the invention relates to an aqueous electrolyte comprising chromic acid and water, or chromic acid, phosphoric acid and water, and to the use of such an electrolyte in the anodic polishing of brass.

I have now found that an aqueous electrolyte comprising chromic acid and water, or preferably chromic and phosphoric acids and water, can be very satisfactorily used in the anodic polishing of brass. If the relative proportions of the principal ingredients of the bath be kept within certain limits, which I have determined, surfaces can be produced that have relatively superior characteristics to those obtainable by mechanical polishing or buffing operations.

It is therefore an important object of my invention to provide an electrolyte containing phosphoric acid, chromic acid and water within certain limits as to their relative proportions, for use in the anodic polishing of brass to impart thereto a highly lustrous surface.

It is a further important object of this invention to provide a method of anodically polishing brass and using an electrolyte of novel composition that is operative through a wide range of anode current densities and temperatures.

Other and further important objects of this invention will become apparent from the disclosures in the specification and the accompanying drawing.

This invention (in its preferred form) is illustrated in the drawing and hereinafter more fully described.

On the drawing:

The figure represents a triaxial diagram showing the relative proportions of phosphoric acid, chromic acid and water for compositions of electrolytes coming within the scope of my invention.

In the accompanying diagram, the respective sides of the triangle indicate the percentages of phosphoric acid (H_3PO_4), of water (H_2O), and of chromic acid (CrO_3), from 0 to 100%. On the basis of experimental data, I have determined the relative proportions of phosphoric acid, chromic acid and water that give compositions of electrolyte that are operative for the anodic polishing of brass. The area representing operative compositions of electrolyte is defined on the accompanying diagram by the solid lines AB, BC, CD and DA. Within the area so defined, any composition selected will be found to be operative in the method hereinafter described for the anodic polishing of brass.

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In order to get the best polishing results, however, I have found that the range of proportions of phosphoric acid, chromic acid and water should be kept within certain narrower limits, and these narrower limits are represented on the accompanying diagram by the separate, lesser areas defined by the solid line AE, dot and dash line ELF, solid line FM, dot and dash lines MG and GH, and the solid line HA, and by the solid line IK and dot and dash line KJI. The preferred compositions of electrolyte, with respect to the relative proportions of phosphoric acid, chromic acid and water, lie within the two disconnected areas just described, both of which are wholly enclosed within the broader area first defined.

The reading of a triaxial diagram such as the accompanying one is well understood but the following will be given for purposes of illustration. The point on the diagram represented by the letter A, for instance, indicates a composition comprising 0% of phosphoric acid, 65% of chromic acid and 35% of water; the point indicated by the reference letter B a composition comprising 85% of phosphoric acid, a small but significant proportion, say 0.1% of chromic acid and the balance, somewhat less than 15%, water; the point represented by the reference letter C a composition comprising 5% of phosphoric acid, about 0.1% of chromic acid and the balance, somewhat less than 95%, water; and the point indicated by the reference letter D a composition comprising 0% of phosphoric acid, 5% of chromic acid and 95% of water.

It will be seen that the maximum phosphoric acid content is 85% and the minimum 0%; the maximum chromic acid content about 65% and the minimum about 0.1%; and the maximum water content 95% and the minimum about 13%. The preferred composition limits are from 0 to 85% phosphoric acid, from 2 to 65% CrO_3, and from 13 to 92% water. These relative percentages of the ingredients of my bath, however, are interdependent, so that in order to insure an operative bath, its composition should be selected by reference to the triaxial diagram and the areas defined thereon.

The triaxial diagram thus shows the relative proportions of chromic acid and water in a two component system (the phosphoric acid being 0%), or the relative proportions of chromic acid, phosphoric acid and water in a three component system. Suitable baths of these two or three component systems may nevertheless also include other ingredients, such as other acids and/or

salts. From the diagram, however, the relative proportions that chromic acid and water, or that chromic acid, phosphoric acid and water, should bear to each other may be determined for operative and preferred ranges of composition, regardless of what other non-essential ingredients may be present in the bath.

Thus, for instance, in making up an electrolyte for the anodic polishing of brass, one might select the point X on the triaxial diagram as being a bath of preferred composition. The composition represented by the point X would be 58% of phosphoric acid, 12% of chromic acid and 30% of water. During the continued use of such a bath in the electropolishing of brass, the bath composition would necessarily change, owing to the anodic dissolution into the bath of copper and zinc from the brass undergoing polishing. There might also be some change in the water content, such as an increase due to absorption by the bath of moisture from the air, or a decrease due to evaporation of water from the surface of the bath, to decomposition of water by electrolytic action, or to loss of water from the bath by entrainment thereof in gases given off from the bath.

Notwithstanding such changes in its composition as may occur during continued use, if the relative percentages of phosphoric acid, chromic acid and water, expressed as percentages by weight of the total weight of only these three ingredients in the bath composition, remain within the area defined by the solid lines AB, BC, CD and DA, the bath will continue to operate satisfactorily. Preferably, however, the bath composition should be maintained within the preferred areas of composition, which have been defined above.

Consequently, where the relative percentages of phosphoric acid, chromic acid and water in a given bath composition lie within either the preferred or less preferred areas defined on the accompanying triaxial diagram, such bath composition is intended to come within the scope of my invention, even though it may contain other acids than phosphoric and chromic and even though it may contain a substantial quantity of metallic salts.

Instead of chromic acid, soluble chromates and bichromates may be substituted therefor and are to be considered the equivalent of chromic acid on a stoichiometric basis. The term "chromic acid equivalent," as used in this specification and in the claims, is therefore intended to include chromic acid itself (CrO_3) and stoichiometrically equivalent weights of soluble chromates and bichromates.

Similarly, in place of orthophosphoric acid, other phosphoric acids, such as meta- and pyrophosphoric acids, may be used and are to be considered as included within the term "phosphoric acid."

In the method of anodically polishing brass, using a bath of a composition indicated to be suitable by reference to the accompanying triaxial diagram, the brass, or an article having a surface of brass, is made the anode in a bath of the selected composition and an electric current is passed therethrough of sufficient density and for a sufficient length of time to produce the desired high degree of luster, or polish, on the brass. By employing an electrolyte having a composition within the preferred areas, as defined on the accompanying triaxial diagram, a highly lustrous, mirror-like surface can be readily obtained. The highly lustrous surface obtainable by my method, using an electrolyte of preferred composition, is an important feature of my invention and one that sharply distinguishes it from prior art finishes produced in the electrolytic cleaning of brass.

The formation of highly polished and lustrous surfaces is undoubtedly associated with the presence of a polarizing film over the surface of the metal during the process of anodic dissolution. The nature of this film is such that selective attack on the various phases present in the brass is minimized. Anodic dissolution apparently takes place at a relatively high rate and at a high anodic polarization value, with the result that anodic dissolution of the metal acts to level the crystal surfaces thereof and to produce a mirror-like finish. These conditions do not prevail in the simple electrolytic cleaning treatment known to the prior art.

In order to obtain the best results in a reasonable length of time, it is preferable to use relatively high current densities, such as those of the order of magnitude of from 100 to 1000 amperes per sq. ft. It will be understood, however, that lower current densities, even as low as 10 amperes per sq. ft., may be employed with consequent prolongation of the time of treatment. Higher current densities, up to as high as 2000 or 3000 amperes per sq. ft., may also be used, but such high current densities imply, in general, larger currents, which require more expensive equipment. The length of time to effect the desired results depends upon the magnitude of the current densities employed and to some extent upon the particular analysis of the brass, and also upon the character of the surface of the brass initially. Rough surfaces, of course, require a longer time to polish than relatively smooth ones.

With any of the compositions of electrolyte lying within the preferred areas defined by the solid line AE, dot and dash line ELF, solid line FM, dot and dash lines MG and GH, and solid line HA, or by the solid line IK and dot and dash line KJI on the accompanying triaxial diagram, excellent polishes are obtained on brasses of any of the usual compositions.

The term "brass" is intended to cover copper-zinc alloys of varying compositions, some of which may contain small percentages of lead, tin, and/or other metals. With the more ordinary brasses, such as those containing around 70% copper, 29% zinc and up to 1% tin, I prefer to employ anode current densities of about 500 amperes per sq. ft., a bath temperature lying within the range of 80 to 175° F., and a time of treatment varying from 1½ to 12 minutes. In general, the temperature may be maintained at any point between room temperature and the boiling point of water, but temperatures of around 100° F. are found very satisfactory.

From the foregoing description of my invention, it will be apparent that I have provided a novel composition of electrolyte and a method whereby the same may be used to produce highly lustrous polishes on brass. My electrolyte and method avoid the disadvantages of the old methods of mechanically polishing brass and enable the production of brass articles having surfaces that are free from mechanical strain, dragging and "piling," and which are superior to those obtainable by mechanical polishing methods.

It will, of course, be understood that various details of the process may be varied through a

wide range without departing from the principles of this invention and it is, therefore, not the purpose to limit the patent granted hereon otherwise than necessitated by the scope of the appended claims.

I claim as my invention:

1. The method of anodically polishing brass, which comprises making brass the anode in a solution comprising from 5 to 65% CrO_3, the balance comprising essentially water, and at a temperature below 212° F. and a current density not in excess of three thousand amperes per square foot passing an electric current therethrough of sufficient density and for a sufficient period of time to effect the polishing of said brass.

2. The method of anodically polishing brass, which comprises making brass the anode in a solution comprising from 42% to 65% CrO_3, the balance comprising essentially water, and at a temperature below 212° F. and a current density not in excess of three thousand amperes per square foot passing an electric current therethrough of sufficient density and for a sufficient period to effect the polishing of said brass.

3. The method of anodically polishing brass which comprises making brass the anode in a solution comprising from 24% to 34% CrO_3, the balance comprising essentially water, and at a temperature below 212° F. and a current density not in excess of three thousand amperes per square foot passing an electric current therethrough of sufficient density and for a sufficient period of time to effect the polishing of said brass.

4. The method of anodically polishing brass which comprises making brass the anode in a solution comprising essentially a composition lying within the area defined in the accompanying diagram by the lines IJK and KI and at a temperature below 212° F. and a current density not in excess of three thousand amperes per square foot passing an electric current therethrough of sufficient density and for a sufficient period of time to effect the polishing of said brass.

5. The method of anodically polishing brass which comprises making brass the anode in a solution comprising from 5% to 65% CrO_3, the balance comprising essentially water, and passing an electric current therethrough at a current density of from one hundred to three thousand amperes per square foot at a temperature between 80° and 212° F. for a sufficient period of time to effect the polishing of said brass.

6. The method of anodically polishing brass which comprises making brass the anode in a solution comprising from 42% to 65% CrO_3, the balance comprising essentially water, and passing an electric current therethrough at a current density of from one hundred to three thousand amperes per square foot at a temperature between 80° and 212° F. for a sufficient period of time to effect the polishing of said brass.

7. The method of anodically polishing brass which comprises making brass the anode in a solution comprising essentially a composition lying within the area defined in the accompanying diagram by the lines IJK and KI, and passing an electric current therethrough at a current density of from one hundred to three thousand amperes per square foot at a temperature between 80° and 212° F. for a sufficient period of time to effect the polishing of said brass.

8. The method of anodically polishing brass which comprises making brass the anode in a solution comprising essentially a composition lying within the area defined in the accompanying diagram by the line AB, the straight line BC, the straight line CD and the straight line DA, and at a temperature below 212° F. and a current density not in excess of three thousand amperes per square foot passing an electric current therethrough of sufficient density and for a sufficient period of time to effect the polishing of said brass.

9. The method of anodically polishing brass which comprises making brass the anode in a solution comprising essentially a composition lying within the area defined in the accompanying diagram by the solid line AE, the dot-dash line ELF, the solid line FM, the straight dot-dash line MG, the dot-dash line GH, and the straight solid line HA, and at a temperature below 212° F. and a current density not in excess of three thousand amperes per square foot passing an electric current therethrough of sufficient density and for a sufficient period of time to effect the polishing of said brass.

10. The method of anodically polishing brass which comprises making brass the anode in a solution comprising essentially a composition lying within the area defined on the accompanying diagram by the line AB, the straight line BC, the straight line CD, and the straight line DA, and passing an electric current therethrough at a current density of from one hundred to three thousand amperes per square foot at a temperature between 80° and 212° F. for a sufficient period of time to effect the polishing of said brass.

11. The method of anodically polishing brass which comprises making brass the anode in a solution comprising essentially a composition lying within the area defined on the accompanying diagram by the solid line AE, the dot-dash line ELF, the solid line FM, the straight dot-dash line MG, the dot-dash line GH, and the straight solid line HA, and passing an electric current therethrough at a current density of from one hundred to three thousand amperes per square foot at a temperature between 80° and 212° F. for a sufficient period of time to effect the polishing of said brass.

CHARLES L. FAUST.