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ELECTROLYTIC STRIPPING OF PLATINGS FROM ALUMINUM AND ZINC ARTICLES

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The present invention relates to a process of electrolytically stripping off platings from articles formed of aluminum or zinc alloys and, more particularly, to an improved process for stripping from such articles platings of chromium, copper and nickel and mixtures thereof.

It has been customary to plate articles formed of aluminum or zinc with copper and thereafter to plate the upper coating with chromium and nickel to provide an attractive and durable plated surface on the articles. In many instances, due to the inherent difficulties of such plating processes, the article had imperfections on the surface thereof which could not be tolerated. Manufacturing economy forbids the scrapping of such articles and dictates stripping of the plating and replating the articles.

Heretofore, it has been proposed to electrolytically strip such platings of chromium, copper and nickel from aluminum and zinc articles immersed in an electrolyte consisting essentially of phosphoric acid. This process requires that the electrolyte be maintained at temperatures of 150° to 200° F. and that a current density of at least 100 amperes per square foot be applied.

It also has been proposed to electrolytically strip chromium and nickel from aluminum and zinc articles immersed in an electrolyte consisting essentially of sulphuric acid, but this resulted in severe etching of the articles which caused visible imperfections when the articles were replated.

It further has been proposed to electrolytically strip chromium, copper and nickel from aluminum and zinc articles immersed in an electrolyte consisting essentially of a major amount of sulphuric acid and a minor amount of phosphoric acid. Here again the process required that the electrolyte be preheated and maintained at a temperature of about 175° F., and that a current density of about 100 amperes per square foot be applied.

Accordingly, an object of the present invention is to provide an improved process of electrolytically stripping metal platings of the character indicated herein which is not subject to the prior objections and disadvantages.

Another object is to provide such a process which effectively strips the platings to leave a smooth clean surface free from etch marks.

Another object is to provide such a process which does not require a high current density or a heated stripping bath.

A further object is to provide such a process which is simple, practical and economical.

A still further object is to provide such a process which can be practised with inexpensive, readily available chemicals and without any high degree of technical skill.

Other and further objects will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

In accordance with the present invention, the foregoing objects generally are accomplished by the process which comprises preparing an aqueous bath consisting essentially of between about 25 and about 35 parts by volume of phosphoric acid and having a specific gravity of between about 1.579 and about 1.689, between about 5 and about 15 parts by volume of sulphuric acid having a specific gravity of between about 1.543 and about 1.706, and sufficient water to adjust the concentration of the bath to a specific gravity of about 1.550 (52° Baumé); placing the articles in the bath; connecting the positive terminal of a D.C. source to the articles to make the articles anodes in the bath; placing a cathode in contact with the bath; connecting the negative terminal of the D.C. source to the cathode; and subjecting the articles to electrolytic stripping for a duration of time and at a current density to remove all of the metal platings from the articles. Preferably, the bath regardless of its manner of preparation, consists essentially of the equivalent of 30 parts by volume of 85% phosphoric acid and 10 parts by volume of 77.7% sulphuric acid, and sufficient water to adjust the specific gravity of the bath to about 1.550.

Preferably, the phosphoric acid is a technical grade having a concentration of 85% and a specific gravity of 1.689 (59° Baumé); and the sulphuric acid is a technical grade having a concentration of 77.7% and a specific density of 1.706 (60° Baumé), whereby a substantial volume of water must be added to the acids to adjust the specific gravity of the bath to about 1.550.

However, if the acids are available only in weaker concentrations, they may be utilized in the volumetric ranges indicated herein to establish a bath having a specific gravity of about 1.550, provided the phosphoric acid has a specific gravity of at least about 1.579 and the sulphuric acid has a specific gravity of at least about 1.543.

For example, a bath of acids, having the weakest concentrations would be prepared by mixing 25 parts by volume of 1.579 specific gravity phosphoric acid, and 15 parts by volume of 1.543 specific gravity sulphuric acid, which bath would have a specific gravity of about 1.565 and would require the addition of a small volume of water to adjust the specific gravity of 1.550.

Likewise, for example, a bath of acids having the strongest concentration would be prepared by mixing 25 parts by volume of 1.689 specific gravity phosphoric acid, and 15 parts by volume of 1.706 specific gravity sulphuric acid, which bath would have a specific gravity of about 1.695 and would require the addition of a little more than 10 parts by volume of water to adjust the specific gravity to 1.550.

The equipment required to carry out the process includes a rack or wires for supporting the articles constructed of lead, steel or titanium; a stoneware crock, a polyethylene or similar acid resistant plastic tank or a lead lined tank for the bath; a lead cathode immersed in the bath; and a 5 to 6 volt D.C. source. In the event a lead lined tank is used the lead lining may serve as the cathode and a separate lead cathode is not required.

In the event the bath becomes extremely cold due to exposure to low ambient temperatures and is required to be heated, lead heat exchange coils may be immersed in the bath through which hot water or steam is passed.

As a specific example of carrying out the process of the present invention, 30 parts by volume of 1.689 specific gravity phosphoric acid, 10 parts by volume of 1.706 specific gravity sulphuric acid and 10 parts by volume of tap water were mixed in a tank to provide a bath having a specific gravity of a little more than 1.550; and more water was added slowly with agitation until the bath had a specific gravity of 1.550.

A lead cathode and a rack supporting plated zinc articles were immersed in the bath, the rack was connected to the positive terminal of the D.C. source, and the cathode was connected to the negative terminal of the source.

The D.C. source was caused to supply a current density of between about 25 and about 30 amperes at between about 5 and about 6 volts, whereby electrolytic stripping commenced.

At first, there was considerable noticeable gassing at the articles (anode) and at the cathode. As the plating was being stripped, gassing diminished and the flow of current decreased. When the articles had been stripped clean, gassing further diminished and the flow of current was very low.

The time required to strip a conventional 0.001 to 0.002 inch chromium, nickel copper plating from one square foot of article surface was from about 25 to about 30 minutes.

If the articles are permitted to remain in the bath, there will be no etch or attack upon zinc or aluminum articles.

The stripped articles were removed from the bath, were rinsed in cold water, then in hot water, and finally dried. The stripped articles can then be plated in the conventional manner, or if desired, the articles can be first tumbled or buffed, then plated. However, the articles were found to be so clean and smooth that tumbling or buffing of the articles before replating was unnecessary.

After long or continued use of the bath, the desired current flow may not be obtained because of loss of water from the solution. This may be remedied by slowly adding water to the bath while agitating the bath until the specific gravity is again adjusted to 1.550 or 52° Baumé. The bath can be used indefinitely when readjusted periodically in this manner.

While the process in accordance with the present invention is in no way limited to any particular theory of operation, it is believed that the chromium in the top layer of the nickel-chromium plating is first attacked by the acids and is stripped, and that the chromium goes into solution as trivalent chromium. The nickel is then attacked and stripped by the acids and goes into solution. The copper finally is attacked and stripped and builds up on the cathode. The attack by the acids on the nickel and the copper appears to be retarded because of the polarity within the bath.

When the zinc surface of the articles was exposed to the bath, the voltage dropped off because of the poor conductivity of the zinc. This lower voltage then has a polishing effect on the zinc and will not attack or etch the zinc.

It is also believed that the quantitive proportions of phosphoric acid and sulphuric acid at the specified specific gravity are instrumental in effecting the improved stripping of platings in a chromium-copper-nickel and zinc or aluminum system.

The copper which is deposited on the cathode is not harmful to the functioning of the stripping bath. Such deposits are very loose and spongy in nature and are readily washed and wiped off upon removal of the cathode from the bath.

Alternatively, a steel dummy may be placed in the bath with the terminals of the D.C. source reversed so that the dummy serves as the cathode and the copper is deposited thereon. This operation requires about 15 minutes at about 25 amperes per square foot of dummy area.

From the foregoing description, it will be seen that the present invention provides a stripping process having the following advantages:

(1) The stripping bath is inexpensive, has an indefinite life, is trouble free, does not require constant or frequent attention or adjustment, operates over a wide range of conditions at a relatively low current density.

(2) The bath is capable of stripping chomium-copper and nickel from aluminum and zinc as well as stripping brass or white brass (a high zinc copper alloy).

(3) The various metals are stripped in one operation without damage to the metal articles from which platings are stripped and provide the articles with an extremely smooth, clean surface.

It will be understood that the details and examples hereinbefore set forth are illustrative only, and that the invention, as broadly described and claimed, is in no way limited thereby.

What is claimed is:

1. The process of electrolytically stripping off metal platings of the group consisting of chromium, copper, nickel and mixtures thereof from articles made of alloys of the group consisting of aluminum and zinc, which process comprises preparing an aqueous bath consisting essentially of between about 25 and about 35 parts by volume of phosphoric acid having a specific gravity of between about 1.579 and about 1.689, between about 5 and about 15 parts by volume of sulphuric acid having a specific gravity of between about 1.543 and about 1.706, and sufficient water to adjust the concentration of the bath to a specific gravity of about 1.550; placing the articles in the bath; connecting the positive terminal of a D.C. source to the articles to make the articles anodes in the bath; placing a cathode in contact with the bath; connecting the negative terminal of the D.C. source to the cathode; and subjecting the articles to an electrolytic stripping for a duration of time and at a current density to remove all of the metal platings therefrom and to cause said articles to be provided with a smooth surface free from etch marks.

2. The process according to claim 1, wherein said bath consists essentially of 30 parts by volume of phosphoric acid and 10 parts by volume of sulphuric acid.

3. The process according to claim 2, wherein the phosphoric acid has a specific gravity of about 1.689 and the sulphuric acid has a specific gravity of about 1.706.

4. The process according to claim 3, wherein the current density does not exceed about 30 amperes per square foot at any time during the stripping of the platings.

5. The process of electrolytically stripping off metal platings of the group of metals consisting of chromium, copper, nickel and mixtures thereof from articles made of alloys of the group consisting of aluminum and zinc, which process comprises preparing an aqueous bath consisting essentially of the equivalent of about 30 parts by volume of 85% phosphoric acid and about 10 parts by volume of 77.7% sulphuric acid, and sufficient water to adjust the specific gravity of the bath to about 1.550; placing the articles in the bath; connecting the positive terminal of a D.C. source to the articles to make the articles anodes in the bath; placing a cathode in contact with the bath; connecting the negative terminal of the D.C. source to the cathode; and subjecting the articles to electrolytic stripping.

References Cited by the Examiner

UNITED STATES PATENTS

2,706,171	4/1955	Goral et al.	204—146 X
2,840,521	6/1958	Wasserman	204—146
2,907,700	10/1959	Kolodney	204—146 X

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