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ART OF PRODUCING COATED ALLOYS

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This invention relates to improvements in the art of producing coated alloys.

In recent years color has become an increasingly important factor in effecting the sale of a manufactured article. Formerly the automobile buyer was satisfied to have the door handles and other hardware in the usual nickel or chromium finish. Now, however, the manufacturer is endeavoring to color the interior hardware so that it will match or harmonize with the color of the upholstery. At the present time this is being accomplished by ordinary enameling methods. Surface coatings of this type, however, chip and crack too readily, are not sufficiently durable, and the coating processes are expensive.

Heretofore several common forms of aluminum alloys have been treated with hot water merely to improve the physical properties thereof. These alloys have also been treated by immersion in solutions containing an alkali together with a metallic salt to attempt to produce a color effect. The coating thus produced is, however, merely an oxide of the aluminum itself. Oxide coatings have also been produced electro-chemically on aluminum by using the aluminum to be coated as the anode in a suitable electrolyte solution. All of the above-mentioned methods, however, produce results unsatisfactory for purposes such as the present invention is intended, that is, for hardware or the like wherein durability of color and coating under hard use is essential, as the coatings above referred to lack the necessary properties to make them withstand all conditions to which the finished product may be subjected. Furthermore, the coating is dull and does not form a uniform glossy protective film for the color.

The present invention is the result of extensive experiments which have shown that if an aluminum alloy is manufactured containing chromium and molybdenum, and if said alloy is polished and then immersed in boiling water, an entirely new type of film is produced on the metal, the said film being hard, transparent, and glossy in appearance, resistant to corrosion, and being capable of uniting with coloring material added to the water to produce a colored coating which will not fade, which is highly durable, and which has the unusual uniformly glossy appearance of the film.

It is therefore one of the objects of the present invention to produce a coated alloy as above described which alloy has the following desirable properties in addition to those previously mentioned:

Resistance to chipping and cracking under impact;

Insolubility in alcohol, and insolubility in alkalis and dilute acids.

A further object of the invention is to provide an improved method of manufacturing the above alloy.

With the above and other objects in view the invention consists of improvements in the art of producing coated alloy and all its parts and combinations as set forth in the claims, and all equivalents thereof.

In carrying out the improved method of producing the novel product, an aluminum alloy containing both chromium and molybdenum must be used. The following tabulation discloses the proportions of the various ingredients which it is preferred to employ:

	Per cent
Aluminum	85–96
Chromium	A trace–10
Molybdenum	A trace–5

In addition to the above, one or more of the following ingredients may also be employed in the alloy without adversely affecting the result: Copper, zinc, titanium, tantalum, and silicon. In some instances, the amount of aluminum may run lower than above and in other instances it may run as high as 98%.

The following formulas disclose the preferred ingredients for producing a number of special alloys which may be very effectively utilized in connection with the coating process:

(1) An alloy consisting of:	Per cent
Aluminum	85–96
Copper	3–10
Chromium	.75–5
Molybdenum	.10–5
Titanium	.05–1

One example of the preferred amounts of the various ingredients to produce the above alloy is: aluminum 95.10%; copper 3.5%; chromium 1.25%; molybdenum .10%; titanium .05%.

(2) An alloy consisting of:	Per cent
Aluminum	76–97.90
Molybdenum	A trace–5
Chromium	A trace–5
Zinc	2–14

One example of the preferred amounts of the various ingredients to produce the above alloy is: aluminum 90%; zinc 10%; molybdenum—a trace; chromium—a trace.

Optional:	Per cent
Titanium	.10–.50
Zirconium	.10–.50

The selected ingredients are mixed together and heated to a suitable temperature to form the alloy and a suitable flux may be utilized in the procedure. The molten mass is kept at a bright red heat at all times and is stirred well before being poured into ingot molds, non-electric heating means being preferably used.

Inasmuch as the coating is usually desired on some finished article, such as an automobile door handle, the alloy is ordinarily sand cast or die cast to desired form. The castings are then highly polished, this being an essential step in attaining proper results, and are next racked or suspended in boiling water and permitted to remain in this state for about three hours, although longer or shorter periods may be employed. Generally the longer the immersion the thicker the coating. The temperature may in commercial exploitation of the invention be maintained between 205° and 214° Fahrenheit.

It is found that the method above described will produce an extremely hard, transparent, glossy film on the alloy. A similar result may be obtained by subjecting the polished alloy to the action of steam instead of by immersing the alloyed article in boiling water.

Inasmuch as the film produced by the above-mentioned process will have no particular color it is desirable to utilize in the water a suitable pigment or coloring material. This may be any pigment or coloring material which will adhere to the casting during the boiling process and which will not dissolve or otherwise impair the film being formed.

Certain coloring materials may be applied to the casting prior to immersion in the water, said applied coloring cooperating during the boiling process to form a colored film. The use of certain metallic elements as a coloring agent is very satisfactory. For example, when chromium, preferably in pulverized form, is added to the water it will form a greenish color on the alloy; molybdenum, either in pulverized or solid form, will cause a brownish color; chromium, molybdenum and small pieces of copper added together produce a deep bronze effect; titanium dioxide, commonly known as rutile, and preferably in powdered form, imparts a tan color to the coating. If the immersion is carried out in a steel tank a very good black color will result, and tantalum preferably in powdered form, results in a very hard and durable iridescent reddish brown color.

The coloring medium is not necessarily limited to metals or metallic compounds inasmuch as certain chemicals such as mercurochrome in liquid form and potassium permanganate crystals have been found to impart desirable colors to the alloy.

Immediately after removal from the boiling liquid the film is relatively soft, and after it has been exposed to air for a few seconds it acquires an extreme hardness and durability. It is therefore important, if a polished surface is to result, that care be exercised to prevent rubbing against the casting before the coating has had an opportunity to harden in the air.

The above process may also be effectively employed in coating the alloy in sheet form.

The finished product is very desirable in view of the fact that the hard, transparent, glossy film seems to cover the coloring material and thereby protect the latter from fading. The film has an even shiny appearance very similar to enamel. It will not, however, chip or crack and is therefore considerably more practical for most purposes than ordinary enamel. While it has not been possible to analyze the exact nature of the film, experiments have shown that it will not form unless an aluminum alloy is employed containing chromium and molybdenum. The film because of its durability and hardness also protects the colors against wear and corrosion.

While the treating temperatures herein specified have been found to produce desirable results, it should be understood that it is not desired to limit the scope of this invention to any specific treating temperature. Furthermore, while it is contemplated in most instances to utilize a coloring agent, the film alone without additional coloring material may have utility and it is contemplated that a film produced in this manner is within the scope of this invention whether or not it is colored. The term "untreated" as used in the claims means untreated by anything except materials added for coloring purposes.

Various other changes and modifications may be made without departing from the spirit of the invention and all of such changes are contemplated as may come within the scope of the claims.

What I claim is:—

1. A coated aluminum alloy consisting of aluminum, a trace to 10% of chromium, a trace to 5% of molybdenum, and which alloy may contain relatively small amounts of one or more of the following ingredients: copper, zinc, titanium, silicon, and tantalum, said alloy having a hard, transparent, glossy film thereon formed by subjecting the metal to the action of untreated boiling water or steam.

2. A coated aluminum alloy consisting of aluminum, a trace to 10% of chromium, a trace to 5% of molybdenum, and which alloy may contain relatively small amounts of one or more of the following ingredients: copper, zinc, titanium, silicon, and tantalum, said alloy having a hard, transparent, glossy film thereon formed by subjecting the metal to the action of untreated boiling water or steam containing a metallic coloring material.

3. The method of producing a coated aluminum alloy consisting of forming an alloy which consists of aluminum, a trace to 10% of chromium, and a trace to 5% of molybdenum, and which alloy may also contain relatively small amounts of one or more of the following ingredients: copper, zinc, titanium, silicon, and tantalum, and subjecting the alloy to the action of untreated boiling water.

4. The method of producing a coated aluminum alloy consisting of forming an alloy which consists of aluminum, a trace to 10% of chromium, and a trace to 5% of molybdenum, and which alloy may also contain relatively small amounts of one or more of the following ingredients: copper, zinc, titanium, silicon, and tantalum, and subjecting the alloy to the action of untreated boiling water containing a metallic coloring material.

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