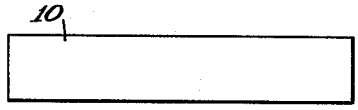
May 22, 1951 V. E. LEWIS ET AL 2,554,256

PROCESS FOR TREATING ALUMINUM TO PROVIDE SELECTIVE COLORATION OF PORTIONS THEREOF

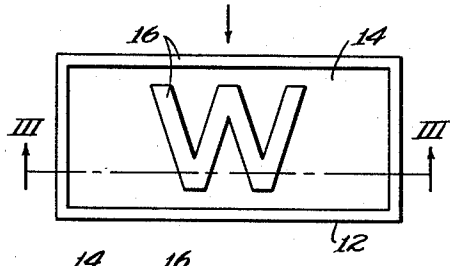
Filed May 15, 1948

Fig. 1.



Aluminum Blank

Fig. 2.



Coined Aluminum Plate

Fig. 3.

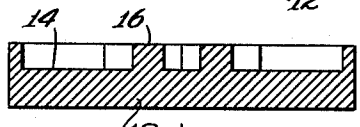
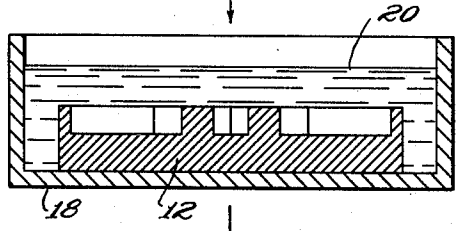
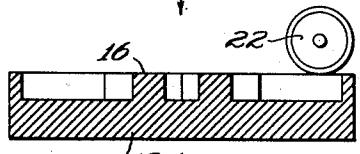


Fig. 4.



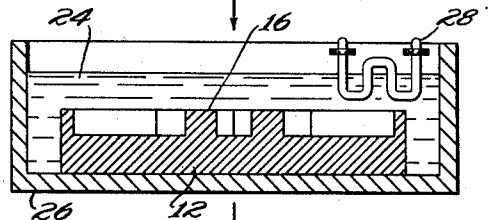
Cleaning Coined Aluminum Plate

Fig. 5.



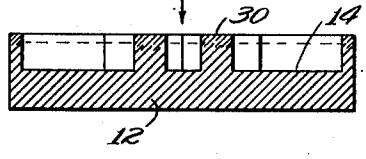
Abrading Raised Surface

Fig. 6.



Chemical Treatment of Abraded Aluminum Surface

Fig. 7.



Finished Aluminum Plate

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PROCESS FOR TREATING ALUMINUM TO PROVIDE SELECTIVE COLORATION OF PORTIONS THEREOF

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6 Claims. (Cl. 148—6.27)

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This invention relates to the treatment of aluminum members to provide for preferentially coloring selected portions of the surfaces thereof.

In the fabrication of numerous articles from aluminum and alloys of aluminum, it is often desirable to provide markings over predetermined or selected portions thereof in contrasting colors. Thus, trim for household appliances, counters, tables and the like is often wanted with selected portions thereof colored in a desirable manner. A particularly desirable coloration is black because of its contrast with the relatively silvery white surface of the natural aluminum and aluminum alloys. Furthermore, name plates, instruction panels, medallions, and other ornamental and instructional members are required to have indicia or markings of the high contrast for ease in reading and visibility.

Heretofore, processes consisting of a plurality of complicated steps have been known to the art for treating aluminum in such a manner as to provide indicia or markings thereon, but the steps were lengthy and required considerable care in processing to prevent smearing of various coloring agents. These prior art processes required considerable skill on the part of the worker and slight deviations would result in unsatisfactory work.

The object of this invention is to provide a relatively simple process for preferentially coloring selected portions of the surfaces of aluminum members.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

For a better understanding of the nature and objects of the invention, reference should be had to the following detailed description and drawing, in which:

Figure 1 is a view in elevation of an aluminum blank;

Figs. 2 and 3 are views showing the plan and cross-section on line III—III of Fig. 2, respectively, through a coined aluminum plate;

Fig. 4 is a vertical cross-section;

Fig. 5 is a vertical cross-section;

Fig. 6 is a vertical cross-section; and

Fig. 7 is a vertical cross-section through a finished aluminum plate.

It has been discovered that aluminum and aluminum alloy members may be colored a deep contrasting black by abrading any desired portion thereof to expose fresh aluminum and applying to such abraded surfaces an aqueous solution containing as its essential ingredients be-

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tween 1 to 120 grams per liter of ammonium molybdate and between 1 to 128 grams per liter of ammonium chloride. Optionally there may be added to the solution from 1 to 100 grams per liter of an acetate selected from the group consisting of sodium acetate, potassium acetate and ammonium acetate in order to increase the blackening effect. The solution is applied hot, preferably boiling, in order to secure the most rapid blackening effect. As little as 30 seconds in the solution produces a desirable coloration, from 1 to 3 minutes giving the optimum results and as much as 10 minutes application of the solution has given satisfactory results. Only the freshly abraded aluminum surfaces react with the solution; while the unabraded surfaces remain substantially unaffected.

Abrading of the aluminum surfaces may be accomplished in various ways as by applying a mask to an aluminum plate and abrading the surfaces exposed through the mask with a sand blast, wire wheel or sand paper. The most desirable method for many purposes is to depress the portions of the surface of the member by coining, milling or other operation and then to sand or otherwise remove the surface layer from the relief surfaces thus to provide a fresh aluminum surface. Aluminum trim or strip and aluminum extrusions having relief surfaces may be, and often are, produced during manufacture and no additional mechanical relief surface forming operations are required for the practice of the present process. The relief surfaces in such cases may be readily sanded or ground or milled to remove the surface layer, thereby exposing the reactive fresh aluminum. It is believed that the surface layers contain oxides and aluminum metal which is non-reactive with the aqueous compositions of this invention and their removal exposes fresh reactive metal. Only a very thin layer of the order of 0.0001 to 0.001 inch need be removed to expose the fresh aluminum. Obviously much more may be removed.

For the practice of this invention both commercially pure aluminum and aluminum alloys containing 90 per cent or more aluminum may be treated. The term "aluminum" as employed herein is intended to cover both pure aluminum and the commercial alloys thereof containing silicon, zinc, magnesium, manganese, copper and the like, and the balance, 90% or more, aluminum.

The process of this invention has given particularly good results in making aluminum name plates. Referring to the figures of the drawing, there is illustrated the consecutive series of steps

for treating an aluminum blank to produce therefrom an aluminum name plate having depressions of the normal silvery aluminum color and relief portions colored a dark contrasting black. The aluminum blank 10 in Fig. 1, which may be of any suitable thickness, size and shape, may be coined in a press to produce the relief-bearing plate 12 shown in Figs. 2 and 3 of the drawing. The coined plate 12 comprises depressed portions 14 and relief portions 16. Since the coined plate 12 may be covered with grease and other soil acquired before and during coining which may interfere with subsequent treatment, it is desirable to clean the coined blank 12 as shown in Fig. 4 of the drawing. The coined plate 12 is put into a tank 18 containing a solvent 20 for grease and other solvent soluble soil thereon. It will be understood that several cleaning steps may be required to properly clean the plate. Vapor de-greasing systems may be employed or any other suitable cleaning processes known to the art. However, the cleaning process should not remove the surface layer in the depressed portions 16 or alter it chemically to any appreciable depth.

The cleaned plate 12 is then abraded as illustrated in Fig. 5 by a sanding wheel 22 for removing from the relief surfaces the thin surface film thereby exposing fresh reactive aluminum metal at the surfaces 16. It will be clear that not all of the relief surfaces need be abraded. Thus, only a part of the surface may be abraded if it is desired only to color such selected part.

Thereafter, the aluminum plate 12 with the abraded surfaces 16 is immersed in the blackening solution 24 as disclosed herein contained in a tank 26. The solution is heated by the steam pipes 28 to keep it at or near the temperature at which it boils. After 30 seconds to 10 minutes immersion in the solution 24, the plate 12 is removed and is preferably rinsed in cold water to wash off the solution 24. To improve the corrosion resistance of the aluminum, the plates may be further dipped in a solution of a dichromate selected from the group consisting of sodium dichromate and potassium dichromate. Aqueous solutions containing from one ounce to fifty ounces per one hundred gallons of the dichromate, preferably hot, may be employed. As shown in Fig. 7 of the drawing, the finished plate 12 exhibits a blackened relief surface 30 resulting from the treatment. The black color is permanent and will withstand normal wear and tear and chemical attack from atmospheres to which it may be subjected. The contrast between the blackened surfaces 30 and the natural silvery color in the depressed portions 14 renders the name plates extremely legible and visible at a considerable distance.

In some cases it may be desirable to apply a paint or coloring material to the depressions 14 which will contrast with the black relief surfaces 30 produced by the practice of this invention. In this case, the coined blank 12 as shown in Figs. 2 and 3 of the drawing may be sprayed or dipped in a paint and baked to cure the paint, or it may be subjected to an anodizing and dyeing treatment to produce a colored surface in the depressions 14. During subsequent sanding by the drum 22 the relief surfaces 16 will be cleansed of any paint or dye present thereon exposing fresh aluminum at such surface. The chemical treatment in the solution 24 will not impair such paint or dye in the depressions 14. Thereafter the name plate will exhibit portions of contrasting color to suit requirements. If desired, only a part of the depressions in a name plate may be dyed and the others left uncolored for the purpose of securing certain effects. Masks and the like may be employed for this purpose. However, the process shown in Figs. 1 to 6 of the drawing is extremely simple and requires the minimum of skill and care and ordinarily will suit most needs. It produces extremely dependable results.

We have found particularly good results to be secured by employing solutions 24 having the following composition:

	Grams per liter
Ammonium chloride	5 to 30
Ammonium molybdate	3 to 15
Sodium acetate	5 to 15

Aqueous solutions of this composition when applied to a freshly abraded aluminum while at their boiling temperature give a dark, deep black coloration in from 1 to 3 minutes upon all freshly abraded aluminum surfaces. This solution has been effective on plates that have been cleaned and abraded as long as 15 hours previous to immersion. Abraded surfaces may be heated for a few minutes up to 300° C. without changing the reactivity with the solution.

If desired for the maximum protection, the aluminum members treated in accordance with the invention may be coated with a transparent organic finish such, for example, as cellulose acetate, ethyl cellulose, nitrocellulose lacquers and the like. The aluminum plates may be imbedded by impressing them into sheets of softened transparent plastic such, for example, as films of polystyrene, cellulose acetate and ethyl cellulose. The distinct coloration of the aluminum will be easily apparent through the plastic films and the utmost in resistance to wear and tear will be secured by such combinations.

Since certain obvious changes may be made in the above processes, and different embodiments of the invention could be made without departing from the scope thereof, it is intended that all material contained in the above description or taken in connection with the accompanying drawing shall be interpreted as illustrative and not in a limiting sense.

We claim as our invention:

1. In the process of preparing an aluminum member with markings of contrasting coloring thereon, the steps comprising providing an aluminum member having no surfaces that have been exposed to air for less than 15 hours, abrading a portion of the aluminum member to remove a surface layer, applying to the aluminum member, within 15 hours after abrading and without exposing the abraded surface to temperatures of above 300° C., a hot aqueous, non-alkaline solution comprising as its essential ingredients from 1 to 120 grams per liter of ammonium molybdate and from 1 to 128 grams per liter of ammonium chloride, for at least 30 seconds and not exceeding 10 minutes to blacken only the abraded surfaces whereby to provide said markings.

2. In the process of preparing an aluminum member with markings of contrasting coloring thereon, the steps comprising providing a depression in the aluminum member, exposing the surfaces to air for more than 15 hours, abrading the relief portion of the aluminum member to remove a surface layer, applying to the aluminum member, within 15 hours after abrading and without exposing the abraded surface to temperatures of

above 300° C., a hot aqueous solution comprising as its essential ingredients from 1 to 120 grams per liter of ammonium molybdate, from 1 to 128 grams per liter of ammonium chloride, and an acetate selected from the group consisting of sodium acetate, potassium acetate and ammonium acetate, for at least 30 seconds and not exceeding 10 minutes to blacken only the abraded surfaces whereby to provide said markings.

3. In the process of preparing an aluminum member with markings of contrasting coloring thereon, the steps comprising providing a depression in the aluminum member, the surfaces of the aluminum member after depression being exposed to air for more than 15 hours, abrading the relief portion of the aluminum member to remove a surface layer, applying to the aluminum member, within 15 hours after abrading and without exposing the abraded surface to temperatures of above 300° C., a hot aqueous solution comprising as its essential ingredients from 1 to 120 grams per liter of ammonium molybdate, from 1 to 128 grams per liter of ammonium chloride, and an acetate selected from the group consisting of sodium acetate, potassium acetate and ammonium acetate, for at least 30 seconds and not exceeding 10 minutes to blacken only the abraded surfaces, and applying an aquous solution of a dichromate selected from the group consisting of sodium dichromate and potassium dichromate.

4. In the process of preparing from flat aluminum stock an aluminum member bearing selected markings of contrasting coloring, the surfaces of the flat aluminum stock having been exposed to air for substantially more than 15 hours, the steps comprising coining a flat surface of the aluminum stock to provide relief portions, without exposing any substantial amount of fresh aluminum at the surfaces, cleaning the coined member to remove any grease and other soil from the relief portions, abrading the relief portions of the member to expose fresh aluminum, immersing the abraded member, within 15 hours after abrading and without exposing the abraded surface to temperatures of above 300° C., for a period of from 30 seconds to 10 minutes in a boiling solution composed of from 3 to 15 grams per liter of ammonium molybdate and 5 to 30 grams per liter of ammonium chloride whereby the abraded relief portions only are blackened, rinsing the aluminum member with water and applying to the member an aqueous solution of a dichromate selected from the group consisting of potassium dichromate and sodium dichromate.

5. The process of preferentially coloring selected portions of aluminum members all of whose surfaces have been exposed to air for more than 15 hours, the steps comprising abrading the selected portions to remove a surface layer, and applying to the abraded portions, within 15 hours after abrading and without exposing the abraded surface to temperatures of above 300° C., a hot aqueous, non-alkaline solution composed of from 1 to 120 grams per liter of ammonium molybdate and from 1 to 128 grams per liter of ammonium chloride for from 30 seconds to 10 minutes.

6. The process of preferentially coloring selected portions of aluminum members all of whose surfaces have been exposed to air for more than 15 hours, the steps comprising abrading the selected portions to remove a surface layer, applying to the abraded portions, within 15 hours after abrading and without exposing the abraded surface to temperatures of above 300° C., a hot aqueous solution composed of from 1 to 120 grams per liter of ammonium molybdate and from 1 to 128 grams per liter of ammonium chloride, and from 1 to 100 grams per liter of an acetate selected from the group consisting of sodium acetate, potassium acetate and ammonium acetate for from 30 seconds to 10 minutes.

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WILLIAM E. COLLAR.

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