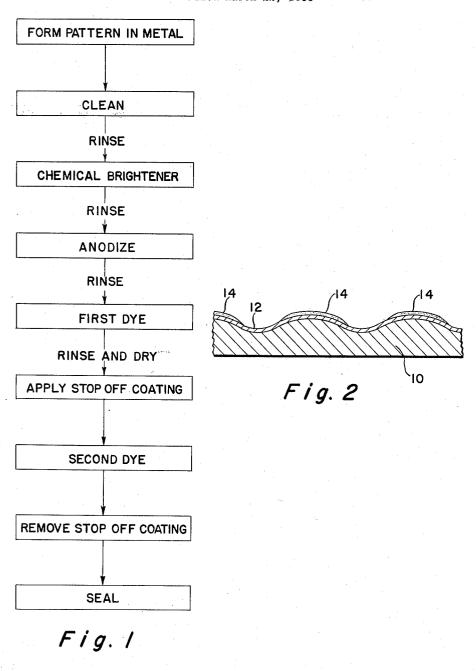


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METHOD OF FINISHING METAL SURFACES

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This invention relates to the manufacture of decorative 15 surfaces and in particular to multi-colored surfaces formed on metal by means of successive dyeing of anodized metal surfaces.

It is well known that various metals, as, for example, aluminum, may be anodized to form an oxide film on 20 example although it will be obvious that the basic method the surface thereof which in turn may be colored by various dyes. Various methods have also been developed for creating multi-colored effects on metal surfaces which involve dyeing only selected portions of anodized metal surfaces. In one method the wet anodic film is immersed 25 in a solution of antimony potassium tartrate and then in ammonium sulfide whereby a skin of antimony sulfide is formed over the anodic film. The thin sulfide film is then broken and immersed in a dye solution whereby the dye penetrates the anodic film at the points where 30 cleaning bath of a conventional type as, for example, a the sulfide film is broken. In subsequent operations other portions of the sulfide film are broken and the exposed anodic film is dyed. In another method, precise designs are stopped off on the anodic film prior to dyeing by means of lithographers ink or cellulose lacquer either 35 by means of an offset printing press, silk screen or by spraying through a stencil. In one method portions of the anodic surface are stopped off by a colored wax and the balance of the film is dyed in a contrasting color. In some methods, portions of a dyed anodic film are 40 bleached and the bleached portions are dyed another color. In another method, the anodic film is coated with a metal film by metal evaporation after which portions of the metal are coated with an acid resisting compound and the unprotected metal is etched away to expose the $_{45}$ specific results desired as is well known in the art. This anodic film which is then dyed. The various methods of creating multi-colored effects on metal surfaces involving dyeing of anodic film which are known to the inventor as, for example, those mentioned above, are relatively complicated and/or are lacking in permanence and 50 results are obtained using a 15% sulphuric acid solution durability.

It is accordingly an object of this invention to provide a relatively simple and inexpensive method of forming variegated metal surfaces which consists in providing an uneven or pattern configuration having raised and 55 phosphoric acid baths may be employed as is well known depressed portions in the surface of the metal, anodizing the pattern surface and dyeing the raised portions of the surface a different color or shade than the depressed portions.

It is a further object of this invention to provide a 60 method for producing decorative variegated metal surfaces wherein an uneven or patterned surface having raised and depressed portions is formed in the metal surface. the surface is anodized, and the raised and/or depressed portions are subjected to one or more dyeing operations and raised or depressed portions are coated with a substance impregnable to water before or between dyeing operations whereby raised and/or depressed portions are selectively dved.

Another object of this invention is to provide a method 70of forming variegated metal surfaces which consists in providing a metal surface with raised and depressed por2

tions, anodizing the metal surfaces, dyeing the metal surface a first shade or color and thereafter coating raised or depressed portions with a substance impregnable to water and successively bleaching and dyeing uncoated surfaces whereby the raised and depressed portions are selectively dyed.

Further objects and advantages of this invention will be apparent from the following description, reference being had to the accompanying drawings wherein pre-10 ferred embodiments of the present invention are clearly shown.

In the drawings:

Figure 1 is a flow chart showing major steps in forming a decorative surface in accordance with the present invention.

Figure 2 is an enlarged cross sectional view of a decorative metal panel having stop off material applied to the raised portions of the surface.

The invention will be described in terms of a specific has broad application.

A metal article is first provided with an uneven or patterned surface having raised and depressed portions. In the specific example to be described, a pattern is rolled or stamped into the surface of an aluminum sheet.

However, the patterned surface may be formed by any method and the invention is applicable to any metal capable of being anodized.

The aluminum panel is then immersed in an alkali solution of trisodium phosphate to free the patterned surface of grease and other extraneous materials without substantially etching the surface thereof.

The clean panel is then dipped in a brightening bath. This step is desirable since commercial grade of sheet, strip stock, etc. is not smooth enough to present a polished bright surface. The brightening bath operates to level the metal surface and provide a polished bright appearance. Suitable brightening baths include phosphoric acid and nitric acid in various proportions with or without sulphuric acid and nitric acid-hydrofluoric acid. The choice of brightening bath and its concentration and operating temperature will, of course, be made in accordance with the kind of metal to be brightened and the step is important in that it markedly influences the color of the final product.

After water rinsing the metal free of brightening bath solution, the metal surface is then anodized. Suitable at 80° F. with a current density of from 150 to 180 amperes a minute per square foot wherein an anodic coating in the order of .0001" to .0003" thick is obtained. Other anodizing methods using, for example, chromic and in the art. Anodic films having a thickness in the vicinity of .0003" are preferred as anodic coatings of this thickness produce superior light fast colors on dyeing as compared to thinner coatings.

The anodized surface is then water rinsed free of the anodizing acid bath and immersed in a suitable aqueous dye solution. Any of the dyes conventionally used to dye anodic films may be used which produce colors of light fastness and which may be used at temperatures which will not result in a sealing of the anodic film. 65Examples of suitable dyes which may be used are those of the "Neolan" series and the "oxanol" group.

The metal article is then water rinsed and dried, and the raised portions of the dyed metal surface are coated. This operation may be readily accomplished by merely brushing a cloth containing suitable stop off material over the surface of the pattern or by the use of a rubber

roller. The stop off material may be any relatively viscous substance which is readily applied but which will not readily flow into the depressed portions of the pattern on application to the surface of the pattern and which will serve to prevent the penetration of water to 5 the anodic layer. Examples of suitable substances which may be used include oil, wax and printers ink.

Figure 2 shows in enlarged cross section a metal panel 10 having thereon a patterned surface, an anodic film 12 on the pattern metal surface and oil or wax coating 14 10 applied to high spots or raised portions of the panel which has been applied as above described. As indicated above, a feature of the present invention is its simplicity whereby complicated and expensive methods of coating portions not to be dyed are eliminated in producing attractive variegated metal surfaces. Where relatively large panels are to be formed, the coating substance may be conveniently applied as, for example, by rubber or fibrous rolls as are conventionally used in painting walls and the like. Further, such rolls my be readily used in mechanical devices whereby mass production methods may be applied.

After application of the coating material the panel is again subjected to a dye whereby additional dye is absorbed by the uncoated or depressed portions of the ²⁵ panel. After conclusion of the second dyeing operation, the stop off material is removed and the anodic film may then be sealed by immersing it in hot water maintained in the neighborhood of 200° F. as is well known in the art whereby the anodic film becomes hydrated and seals ³⁰ the dye in the anodic pores. Sealing in the presence of nickel acetate may be employed to help fix the dye. Alternatively, the dyed anodic film may be sealed by exposing it to steam as is well known in the art.

The method above described is effective in producing 35 variegated surfaces having depressed pattern portions of relatively darker color than the raised pattern portions. A variation of this method may be used to create patterns having darker raised portions than the depressed portions. The anodized metal surface is first dyed a relatively darker color, raised portions are coated as previously described and the article is immersed for a few seconds in an acid bath which in effect bleaches the depressed portions of the pattern. Suitable acid baths include hydrochloric acid, nitric acid and sulfuric acid-nitric acid solu-45 tions. The article is then rinsed and immersed in a dye solution of lighter or second color whereby only the depressed portions of the pattern are dyed. The coating substance is then removed and the dyed surfaces are sealed. This variation not only permits a darker color 50but also a truer color on the depressed portions of the pattern since only single colors are applied to both depressed and raised portions.

The method of the present invention permits many variations. For example, the coating substance may be applied to both raised and depressed portions and then wiped off the raised portions by merely wiping the surface of the metal with a dry cloth or other suitable means whereby the raised portions only may be successively dyed. Where the metal has a naturally attractive color as, for example, aluminum, raised portions may be undyed and only depressed portions may be dyed by coating the raised portions may be dyed by coating the raised portions may be dyed by coating depressed portions, as above indicated, prior to a dyeing 65 treatment.

A variety of color effects may be obtained by the choice of dyes, the length of the first dyeing operation and the length of the second dyeing operation. For example, the dye may be of copper color and in the first 70 dyeing operation, a relatively light shade may be obtained. The same dye may be applied in the second dyeing operation for a substantially longer period of time than in the first dyeing operation whereby the resulting finish consists of raised portions having a light copper color and 75

the depressed portion a darker copper color. In another variation, the second dyeing operation may involve a different or dark dye such as black whereby the resulting finish consists of raised portions of copper color and depressed portion of a black color. Besides, the choice of dyes and the length of the dyeing operation, the dye bath operating conditions and the character of the brightening finish may all be varied to produce various effects. Conversely, these factors must be carefully controlled to secure uniform results in processing a batch of panels if identical panels are to be expected. It is obvious that the nature of the configuration of the uneven or pattern surface influences the nature of the finished product. Thus, if the raised surfaces of the metal break sharply with the depressed portions, the depressed portions of one color will be clearly defined from the raised portions of another color. Conversely, if the surface of the raised portions joins the surface of the depressed portions by more or less gently curved surfaces, the color definition will be less uniform and clear. To attain certain effects, it may be desirable to subject the anodized film to more than two dyeing operations and more than two dyes. The above described method is intended to described the basic features of the invention. It is obvious that the basic method may be modified in various ways without departing from the spirit of the invention.

While the embodiments of the present invention as herein disclosed, constitute preferred forms, it is to be understood that other forms might be adopted.

What is claimed is as follows:

1. In a method for making multi-colored designs upon a sheet of anodizable metal, said design having sharply defined boundaries between adjacent color areas, the steps comprising; forming a pattern having sharply defined raised portions and depressed portions in the surface of a sheet of anodizable metal, cleaning said surface, anodizing said metal surface, dyeing the anodized surfaces in a solution of soluble organic dye, applying a relatively viscous substance over said raised portions which is impregnable to water, said substance being of sufficient viscosity so that on application to said raised portions it will not flow beyond the sharply defined edges thereof, immersing said anodized surfaces in a solution of soluble darker and different organic dye than the first said dye, and removing said coating substance and sealing said dyes within the pores of said anodized surfaces.

2. In a method for making multi-colored designs upon a sheet of anodizable metal, said design having sharply defined boundaries between adjacent color areas, the steps comprising; forming a pattern having sharply defined raised portions and depressed portions in a metal surface, anodizing the metal surface, dyeing the anodized surface a relatively dark color by immersion in a solution of organic dye, applying a relatively viscous substance which is impregnable to water and acid to said raised portions, said substance being of sufficient viscosity so that an application to said raised portions it will not flow beyond the sharply defined edges thereof, immersing said anodized surfaces in an acid solution capable of bleaching the dyed anodized surfaces whereby only said depressed portions are bleached, dyeing the bleach anodized surfaces a relatively lighter color than said raised portions by immersion in a solution of soluble organic dye.

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