

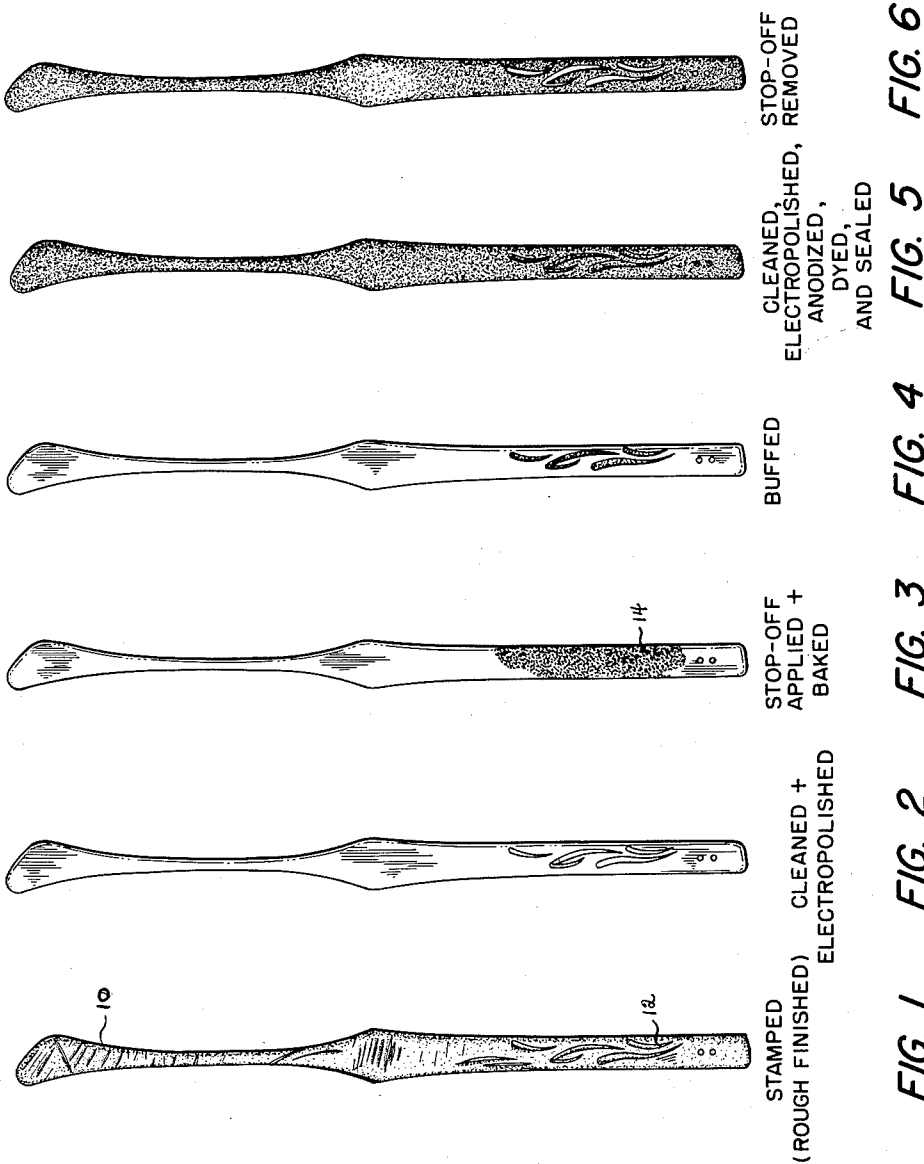
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METHOD OF ENGRAVING SPECTACLE FRAMES AND TEMPLE BARS

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**METHOD OF ENGRAVING SPECTACLE FRAMES
AND TEMPLE BARS**

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1 Claim. (Cl. 204-18)

This invention relates to the method of decorating aluminum surfaces and in particular to an improved method of producing design patterns in aluminum spectacle frames or temple bars having the appearance of hand engraving.

It is known that aluminum and aluminum alloys may be anodized to form an oxide coating upon the surface of the metal. The coating is a hard wear resistant porous film of aluminum oxide that accepts appropriate dyes if desired and the dyed coating is sealed by hydration to develop permanent retention of dye and stain resistance. The dyed coating may be sealed by immersion in a heated solution of an organo-metallic seal such as nickel acetate or if the natural color of the aluminum is desired the undyed anodic coating may be sealed by immersion in boiling water.

The conventional procedure for imprinting engraved design patterns on the metal surface of spectacle frames or temple bars is to hand engrave the design on the finished surface. This procedure has many disadvantages. The engraver must cut through the hard anodic coating to reach the underlying metal and in so doing the hard anodic coating causes the engraver's tools to quickly become dull and consequently they must be sharpened often. There is a tendency for the hard brittle anodic coating to become chipped during the hand engraving process. It is difficult to obtain identical design patterns due to the variations of hand engraving and the cost of hand engraving and the time required to finish the labor is often prohibitive.

This invention is based on the discovery of a method adaptable for mass production of anodized aluminum spectacle frames with design patterns having the appearance of hand engraving. The method is relatively simple and inexpensive. Control of the steps of the process by machine manufacturing results in standard finished products having identical design patterns of any desired type. The problem of chipping the anodic coating is completely eliminated and large quantities of finished products may be produced in a single assembly line operation. In addition the finished design patterns may be polished to give them a high luster.

Briefly described, this invention comprises stamping a design pattern on a cleaned aluminum surface with a die, electropolishing the surface to give it luster and then applying a stop-off paint to the design area. The stop-off paint protects the design pattern during subsequent treatment which includes anodizing by conventional methods, dyeing the surface to any desired color, and sealing the anodic coating by hydration. Thereafter the stop-off paint is removed by immersing the design area into a suitable solvent. The brilliant electropolished area that remains appears as the engraved design.

Details of the method of the present invention will be described in connection with the accompanying drawing in which

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FIGS. 1 through 6 illustrate a spectacle temple bar processed in a preferred manner in accordance with the present invention.

The process of the invention begins with a preliminary cleaning and rough finishing of the aluminum temple bar 10 that is to be engraved. This is accomplished by barrel tumbling the piece with an abrasive material and subsequent rough buffing under an abrasive wheel. These techniques are conventional and some of the commonly used abrasives for tumbling are silicon carbide, fused alumina, garnet, flint and emery. The extent to which the piece is rough finished depends somewhat upon the intricacy of the design pattern that is to be imprinted. A highly intricate design pattern when stamped upon the aluminum temple bar will disrupt the surface of the piece to a greater degree than one which is relatively simple. In general complex designs require more rough finishing prior to stamping than a simple design in order to insure smooth flat surface areas between the stamped out concave portions of the design.

After the piece has been rough finished it is washed free of any abrasive particles and the desired design pattern 12 is stamped upon the surface with a die. The stamped temple bar 10 is illustrated in FIG. 1.

Tooling of the sample die controls the extent to which the design pattern approaches the appearance of hand engraving. Accordingly, variations in the line characteristics of the design and simulated engraving tool marks are built into the die. With careful tooling of the die a stamped design pattern will be identical to a hand engraved pattern. Furthermore, highly intricate designs with any number of bright reflecting surfaces at different angles can be obtained with no increase in cost beyond tooling. Other advantages to stamping the pattern in soft un-anodized aluminum include reduction of tool wear and uniformity of the pattern throughout all of the stamped pieces.

Following the stamping operation the aluminum piece is cleaned in an alkaline bath and electropolished. These techniques are well known in the art for aluminum metals. For example, an alkaline bath composition is used which consists of an aqueous solution of sodium carbonate and trisodium phosphate. The two salts are dissolved in concentrations of 150 grams per liter and 50 grams per liter, respectively, and the aluminum piece is dipped into the bath for 3 minutes at 180° F. Alkaline electropolishing of the piece may be accomplished in the same bath by making the piece anodic and impressing a voltage of 12 volts thereon for about 10 to 15 minutes. Alternatively, the piece may be acid electropolished in the usual manner by making the piece anodic in a bath comprising an aqueous solution of sulfuric, phosphoric and chromic acids. A voltage of 12 volts for 3 minutes is maintained at a bath temperature of 170° F. The results obtained from both processes are equivalent so that either one may be used for practicing the invention.

After the piece is removed from the electropolishing bath it is washed and then it is given a light anodizing treatment for about 1 to 3 minutes. The light anodizing treatment is carried out in conventional manner in a conventional bath as later described for the heavy anodic coating. At this point temple bar 10 (FIG. 2) has a thin non-porous anodic coating which has a bright mirror-like appearance. The coating protects the luster of the finished

design pattern. It also provides a clean smooth base for adhesion of the stop-off paint which is to be applied over the design area. Alternatively, the light anodizing of the design pattern may be omitted, and the stop-off paint is applied directly to the clean, electropolished pattern surface.

The stamped design portion of the piece is painted with stop-off material in order to protect the design pattern and the polished surface thereof from deterioration during subsequent treatment. Only certain types of materials may be employed for protecting the design. These are soluble and fusible resins such as the thermoplastic resins which are insoluble and impregnable to water, acid, alkali and dye solutions and which are electrically non-conductive so that they withstand the electro-chemical reaction that takes place during anodization to remain in place on the aluminum metal to provide an insoluble and impregnable protective coating for the design. The soluble and fusible resins which have been employed include the vinyls, the acrylics, the mixed cellulose ester and mixed base phenolic cellulose ester or phenolic cellulose ether types of thermoplastic resins.

In carrying out the process of the present invention it has been found that it is possible to cause these resins to form a tenacious adhesive bond with the aluminum metal and the bond is such that it withstands the electrochemical reaction that takes place during anodization to protect the surface so that no additional anodic coating will be deposited on the polished surface of the design pattern. The stop-off materials firmly adhere to the beveled sides and bottoms of the stamped concave portions of the design so that the luster of the entire design is preserved throughout the remainder of the process. Another outstanding advantage of the stop-off materials of the present invention is that they are easily removed after processing, it being only necessary to wash the stop-off material in a suitable organic solvent in order to remove it from the surface of the design pattern.

The specified resins are dissolved in suitable solvents, applied over the design pattern with a brush, pallet knife or spray gun and subsequently air dried or baked to evaporate the solvents. As a result the stamped out portions of the design are entirely filled and covered by a tough impervious thermoplastic film which gives excellent protection to the design throughout subsequent treatment of the piece.

Best results have been achieved with resins of the vinyl type such as, for example, polyvinyl chloride, polyvinyl acetate and polyvinyl chloride-acetate copolymer. These are dissolved or dispersed in organic solvents such as ketones or a blend of ketones and aromatic solvents. Acetone and a blend of equal amounts of acetone and toluene are examples of suitable organic solvents. The resins are applied to the design pattern areas by any of the methods described heretofore and may be air dried at room temperatures for about 24 hours. Alternatively evaporation of the solvent may be accelerated by first air drying the stop-off for about 10 to 15 minutes at room temperatures and then baking the aluminum piece for about 15 to 30 minutes at temperatures of about 250 to 350° F.

Another class of resins which may be used as a stop-off are the acrylic resins such as, for example, the polymerized methyl, ethyl, and butyl esters of acrylic and α -methylacrylic acids. These resins may be dissolved with organic solvents such as acetone, ethyl alcohol, ethyl acetate, ethylene dichloride, carbon tetrachloride and toluene in a manner similar to that described above for the vinyl resins.

Another stop-off material that may be successfully employed in carrying out the process of the invention is the mixed cellulose ester polymers dissolved in suitable organic solvents. These are mixed cellulose esters such as cellulose acetate butyrate and cellulose acetate propionate which are dissolved in organic solvents such as low mo-

lecular weight esters and ketones, aromatics and chlorinated hydrocarbons. Ethyl and butyl acetates, acetone and methyl ethyl ketone, toluene and ethylene dichloride are examples of particular organic solvents that are suitable.

Finally the cellulose ester and cellulose ether resins modified with phenol-formaldehyde resin can be used as a stop-off. These resins are composed of cellulose esters such as nitrocellulose, cellulose acetate, formate, propionate, and butyrate in which a minor amount of phenol-formaldehyde resin is dissolved. The amount of phenol-formaldehyde in the cellulose ester can range up to 50% by weight and usually amounts to 30% in the commercial resins. Also phenol-formaldehyde resin can be dissolved in similar proportions in the methyl or ethyl ethers of cellulose. Alternatively, unreacted phenol and unreacted formaldehyde may be mixed with the cellulose esters or ethers and then polymerized in the presence of the cellulose material in conventional manner. Both the cellulose esters and cellulose ethers combined with phenol-formaldehyde resin are dissolved in organic solvents such as acetone, benzene, toluene, xylene and ethyl acetate or combinations thereof.

All of the thermoplastic stop-off materials described hereinabove are readily available on the open market and are made in conventional manner.

For best results the design pattern is covered with a thin anodic coating prior to the application of any of the foregoing stop-off materials and the tough impervious thermoplastic film deposited by such application firmly adheres to the design area. The clean smooth anodic coating provides an excellent base on to which the stop-off can flow and harden upon subsequent evaporation of the solvent. It is important that the stop-off not be loosened or stripped off the aluminum piece during subsequent treatment in order to preserve the brilliant appearance and sharp definition of the design pattern. The stop-off paint 14 of the temple bar 10 of FIG. 3 is a vinyl chloride, vinyl acetate copolymer dissolved in a blend of acetone and toluene which had a putty-like consistency. The material was pressed into the stamped out design by means of a pallet knife. Care was taken to apply an excess of the material which extended above the surface of the body of the bar. The bar was then air dried for 12 minutes and baked in an oven for 30 minutes at 300° F.

After the stop-off has been applied and hardened the design pattern area is buffed. The purpose of this step is to remove excess stop-off from the surfaces of the aluminum piece that are interwoven and adjacent to the stamped out portions of the design pattern. This will leave the stamped out portions filled with the stop-off and simultaneously reduces the level of the stop-off surfaces over the design pattern area so that it is flush with the surface of the entire aluminum piece. These conditions are necessary in order to insure sharply defined outlines between the electropolished stamped out portions of the design and the dyed surfaces of the finished piece. The perfectly formed outlines serve to distinguish and enhance the appearance of the design from the rest of the piece. The buffed temple bar 10 of FIG. 3 is illustrated in FIG. 4.

After the stop-off material has been buffed the entire piece is chemically cleaned, electropolished, anodized and dyed with any desired color. These steps may be accomplished with the techniques known in the art. For example, temple bar 10 of FIG. 4 was cleaned in the same alkaline bath that was used in the beginning of the process. The piece was also electropolished in the same bath with similar operating conditions.

During the buffing of the stop-off material all of the thin anodic coating is removed from the surfaces of the piece where it is not protected by the stop-off. By removing the thin anodic coating from the exposed surface a so-called orange peel appearance is prevented which would tend to occur during subsequent electropolishing and ano-

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dization. This orange peel effect is caused by any residual anodized coating which may remain on the exposed surface. After buffing the piece is electropolished a second time in order to restore a high polish to the entire piece.

When this is accomplished the piece is ready for standard anodization which will deposit a heavy anodic coating on the entire piece except for the areas coated with the stop-off. The anodic coating protects the entire piece and it also provides a porous base which will take a suitable dye. For example after cleaning, and electropolishing temple bar 10 of FIG. 4 was dyed black. First the bar was anodized by making it anodic in an aqueous solution of sulfuric acid containing about 15% by weight of acid. The current density at the anode was about 12 to 16 amperes per square foot and the piece was anodized for about 20 minutes at bath temperatures of approximately 70 to 75° F. Agitation was provided by bubbling air or any other inert gas through the solution.

After anodization temple bar 10 was rinsed with distilled water and then immersed in the aqueous black dye solution. The dye employed was a conventional dye customarily used for dyeing anodized aluminum. Sufficient penetration of the oxide coating by the dye was obtained by allowing the piece to remain in the dye solution for about 6 minutes as is conventional in the art. Thereafter the coating was sealed in conventional manner by immersing it in a heated aqueous solution of 5% by weight nickel acetate for about one minute followed by immersion in boiling water for about 10 minutes. These treatments result in hydration of the aluminum oxide coating which seals the coating to make the color fast. The appearance of the coating is a lustrous black surface which has a uniform gloss and polish throughout. (See FIG. 5.)

The stop-off material is now removed from the design pattern area by immersing it in a suitable solvent. For example, if the vinyl resins have been used they may be removed by immersing the piece in toluene or acetone or a blend of the two at room temperatures for about 5 to 10 minutes. For the acrylic, mixed cellulose ester, and modified cellulose ester and other resins any of the solvents that were used to disperse or dissolve these resins may be used to remove stop-off materials prepared from the resins.

The stop-off paint of temple bar 10 was removed by immersion in acetone for 10 minutes. After the stop-off was removed the stamped out concave portions of the design pattern appeared as polished aluminum colored surfaces (FIG. 6). The beveled sides and bottoms of the design pattern were in brilliant contrast to the rest of the dyed aluminum piece and protected by the thin anodic coating that was deposited after the first electropolishing step.

While the preferred form of method has been described in connection with a spectacle temple bar of aluminum it will be understood that the method may be applied broadly to any aluminum alloy metal to which a heavy anodic coating may be applied. In this connection the term anodized aluminum metal is intended to mean aluminum and its alloys which are provided with a heavy anodic coating.

The above description concerning the vinyl type thermoplastic resin is one example of a preferred stop-off material. Additional examples follow.

Example 2

In this example the procedure, ingredients and proportion of ingredients described in connection with the example given for the temple bar shown in the drawing are employed with the exception that the stop-off paint is polymerized methyl α -methacrylate dissolved in ethylene dichloride.

The stop-off is applied with a brush and air dried for 10 minutes and then baked in an oven for 20 minutes at 270° F. After anodization and dyeing it is removed

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from the temple bar by immersion in a blend of ethylene dichloride and carbon tetrachloride.

Example 3

This example is similar to Example 2 except that the stop-off is a cellulose acetate butyrate polymer dissolved in ethyl acetate. The stop-off is applied with a brush and air dried for 24 hours. It is removed from the finished temple bar by immersing the bar in a solvent comprising equal volumes of ethyl acetate and methyl ethyl ketone.

Example 4

As in Example 2 a stop-off consisting of 70% by weight nitrocellulose and 30% phenolformaldehyde resin, the two resins being dissolved in equal volumes of ethyl acetate and toluene, is applied by means of a pallet knife. The stop-off is air dried for 10 minutes and baked in an oven for 30 minutes at 300° F. After anodization and dyeing, the aluminum piece is immersed in toluene to remove the stop-off.

It will be understood that stamping of the temple bar or spectacle frame may be carried out at any stage in the process provided it is done before the heavy anodic coating is applied but as brought out hereinabove the results are materially better if the bar is stamped prior to the initial electropolishing.

It will also be understood that the design pattern with thin anodic coating in place thereon may be dyed in conventional manner as described hereinabove and then the stop-off may be applied to protect the design area. Thereafter buffing will remove the dye from the exposed surface of the piece which may then be dyed with a contrasting color to that of the design pattern as described hereinabove. In such case the finished piece will provide a design pattern in contrasting color to that of the exposed surface of the piece.

It will be further understood that it is intended to cover all changes and modifications of the preferred form of the invention herein chosen for the purpose of illustration which do not constitute departures from the spirit and scope of the invention.

What is claimed is:

A method of providing concave design patterns, having the appearance of hand engraving, including the markings simulating engraving tool marks, in anodized aluminum spectacle frames and temple bars, which comprises the steps of

- (a) stamping a concave design pattern with the appearance of hand engraving into the unanodized, soft aluminum surface,
- (b) electropolishing the surface of the soft aluminum, including the surface in the stamped out concave design pattern to provide a high luster to the surface, wherein the surface in the concave stamped out area obtains the bright reflecting surfaces indicative of hand engraving,
- (c) subjecting the soft aluminum to light anodization after the electropolishing step to harden the surface of the concave design pattern to preserve the luster and assist in protecting it during subsequent treatment,
- (d) filling the lightly anodized concave stamped out design pattern with a stop-off coating to protect the stamped out pattern during subsequent treatment,
- (e) buffing the uncoated exposed surface of the metal to remove the thin anodic coating from the exposed surface to prevent it from developing an orange peel appearance during subsequent treatment,
- (f) electropolishing the buffed metal to return a high polish to the buffed surface,
- (g) anodizing the exposed metal surface to take a dye and to harden the surface while the said stop-off coating is in the concave design pattern to prevent anodization of such concave pattern,
- (h) dyeing the anodized surface to the desired color

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while the said stop-off coating is in the concave design pattern to protect the stamped out design pattern from the dye,
 (i) as a final step, removing the stop-off coating from the metal in the concave design pattern to reveal the high luster of the lightly anodized surface protected during treatment.

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