

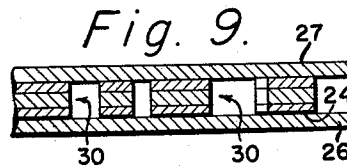
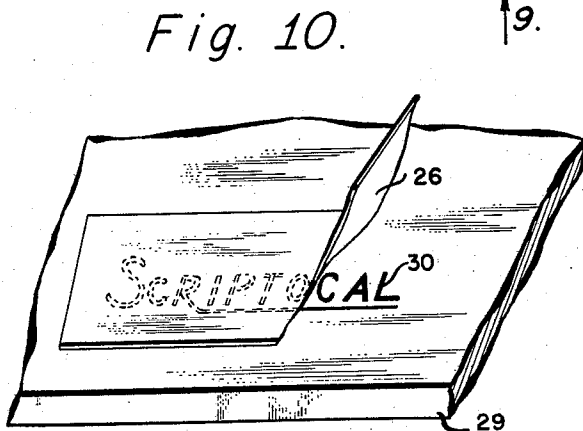
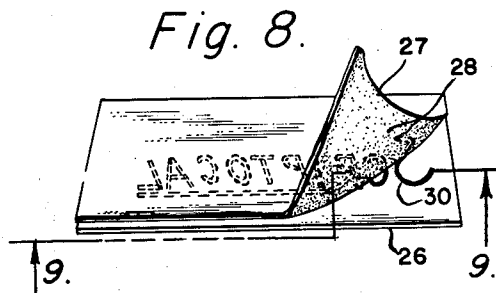
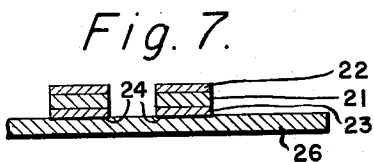
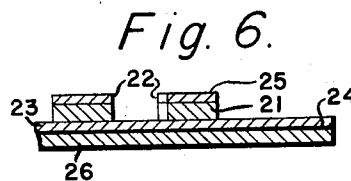
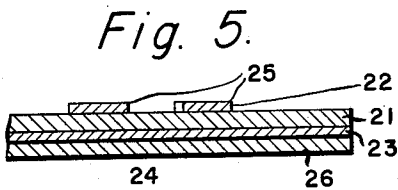
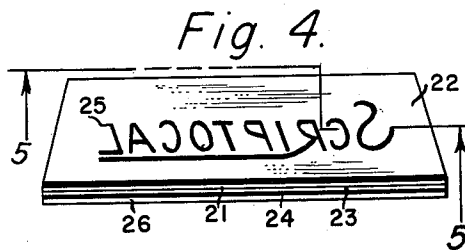
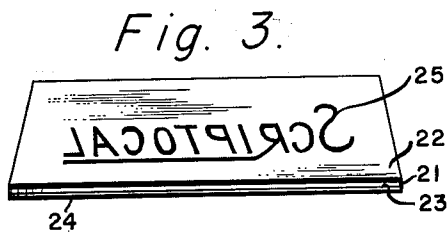
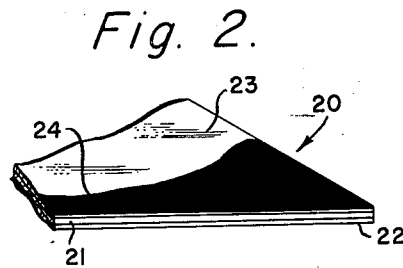
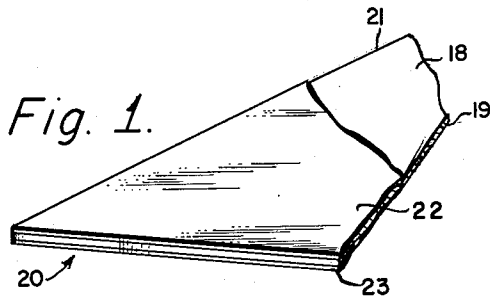
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J. A. COLFER ET AL

3,089,800

FOIL APPLIQUE STRUCTURE

Filed Oct. 7, 1958



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3,089,800

FOIL APPLIQUE STRUCTURE

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2 Claims. (Cl. 154-46.8)

The present invention relates to etched sheet metal objects and to a method for the manufacture thereof. More particularly the invention relates to aluminum sheets or foils which are provided with predetermined patterns and which are cut out and can be completely free from supporting background, for use particularly as metal appliques, stencils, or the like.

The etching of metals to form patterns or insignia thereon is in general well known. Such methods usually include the steps of forming a pattern or resist thereon adapted to resist etching agents, and subjecting the sheet to the action of etching or metal dissolving agents, such as acids or alkalies to dissolve away the unprotected metal. Aluminum in the form of sheet or foil is frequently utilized to form ornamental or other objects, such as labels and the like, particularly in the oxidized or anodized form in view of the receptivity of the oxidized film to dyes, pigments and other coatings. One method of utilizing aluminum in this manner is described in U.S. Patent 2,769,265. In general, such products are obtained by utilizing alkaline or acid solutions, however applicants have found that the anodized film, which is composed of aluminum oxide, is resistant to alkaline baths as well as certain acid solutions and thus particular acid materials are preferably utilized to etch or remove the oxidized surface from the aluminum prior to dissolution of the metal. On the other hand, it has been found preferable to utilize alkaline solutions or certain acid solutions for the etching or chemical milling of aluminum in order to obtain the most effective results. Certain other problems exist in the etching of aluminum sheet or foil due to the necessity for obtaining a clean etch which will not undercut the resist areas and which will result in a clean cut and well defined pattern without ragged edges.

Applicant has discovered a novel method for the manufacture of etched aluminum objects particularly applicable to the formation of stencils and cut out ornamental patterns without any metallic background from oxidized or anodized sheets or foils of aluminum. The process is carried out by providing a sequence of operations starting with sheets of aluminum having an oxide film formed on either or both surfaces thereon. The resist pattern is then applied to one of said surfaces and a protective layer is applied to the surface opposite to that having the design thereon. The unprotected surface areas which are not covered with a resist design are then subjected to an acid treatment, preferably with dilute hydrofluoric acid, for the purpose of removing the oxide film from the exposed surfaces. After this treatment, the exposed metal is then etched through to the inner surface of the oxide film on the other side of the sheet using any desired etching solution which will suitably dissolve aluminum without undercutting or forming ragged edges. Such solutions may be of acid or alkaline nature and dilute HCl solutions or concentrated solutions of NaOH have been found suitable. The oxide layer on the other surface is then removed by again etching in an acid solution, such as dilute HF to complete the chemical milling through the sheet. When the protective backing is removed, the design is thus exposed for use. Preferably the design is applied as a resist in reverse so that after the etch is completed, the side opposite that to which the design was applied represents the positive of the design pattern. When a

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colored product is desired, the anodized sheet is dyed or otherwise colored or pigmented, at least on the surface opposite to that to which the design is applied, so that on reversing the final etched product, the colored surface represents the desired pattern. By applying an adhesive, such as a pressure sensitive adhesive, plus a backing sheet, to the exposed surface of the etched product, the stencil or cut out member can be handled with both surfaces protected by sheet material until use, at which time the reverse surface may be exposed by removal of the sheet affixed thereto, the adhesive can then be bonded to the desired surface, and the protective sheet on the other surface can then be removed to expose the desired pattern. Of course other types of adhesives may be used, such as those activated by water or organic solvents as well known in the art.

It is, therefore, an object of the present invention to provide a novel ornamental structure or stencil of sheet aluminum having cut out areas formed therein in which the outer surfaces of the sheet are composed of colored or uncolored anodized or oxidized aluminum.

It is a further object of the present invention to provide a method for the manufacture of sheet or foil aluminum objects having cut out areas in which clean cut and faithful patterns are obtained in a simple and effective manner.

Other objects will become apparent from a consideration of the specification and drawings which are further described below.

In the drawings:

FIG. 1 is a detail view partly in cross section and partly in elevation, illustrating the structure of an anodized sheet preparatory to processing in accordance with this invention.

FIG. 2 is a view corresponding to FIG. 1 except that the anodized surface of the sheet is pigmented by dye or otherwise.

FIG. 3 illustrates the application of a resist design to a surface of the sheet of FIG. 1.

FIG. 4 illustrates the structure of FIG. 3 with a protective layer applied to one surface thereof.

FIG. 5 is a view in cross section taken along lines 5-5 of FIG. 4, showing the surface of the structure of the element after the first acid etch step to remove surface oxide film.

FIG. 6 is a view in tranverse cross section taken along a plane corresponding to line 5-5 of FIG. 4 illustrating the structure of the element after the metal of the sheet has been dissolved through, subsequent to the initial surface etch.

FIG. 7 is a view taken along a plane corresponding to line 5-5 of FIG. 4 showing the structure of the element after the second acid etch to remove the oxide layer adjacent to the protective film.

FIG. 8 is a view in elevation illustrating the application of an adhesive film to the upper surface of the etched product.

FIG. 9 is a view in cross section taken along line 9-9 of FIG. 8, showing the structure of the assembled unit prior to application to an object.

FIG. 10 is a view partly in elevation and partly in cross section illustrating the application of the final etched and cut out product to a surface and the removal of the protective film therefrom.

As shown in FIG. 1, a sheet or foil member 20 of aluminum is formed by coating the aluminum body portion 21 with a layer of aluminum oxide 22 and 23 on surfaces 18 and 19 respectively by a suitable oxidation treatment generally known as "anodizing." As shown in FIG. 2 the anodized sheet of FIG. 1 is preferably pigmented by dyeing or otherwise treating one or both of the anodized surfaces. As shown in FIG. 2, the anodized layer 23 of the sheet 20 is pigmented with a dye shown at 24.

A resist pattern 25 having a predetermined design is applied to the surface of the anodized layer 22 of the sheet 20. If desired, only one surface of the sheet 20 may be anodized and the resist pattern applied to that surface which is not so treated. In general, however, the oxide film is formed on both surfaces. By the same token, the pigment may be omitted so that the surface opposite the resist will possess the normal oxidized coloration. Where the design is intended to have a particular configuration as in the case of lettering or the like, it is preferably applied to the intended surface in reverse. One commonly utilized method is to form a suitable plate by photographic or other conventional means and then printing in reverse on the said surface utilizing a lacquer or polymer type of ink which will resist the action of acid and alkaline solutions to which the foil is to be subjected. After the application of the resist pattern, which is illustrated in FIG. 3, a protective layer 26 is applied to the bottom surface of the sheet 20 opposite to the surface to which the resist is applied as shown in FIG. 4. The purpose of the protective layer 26 is to protect the bottom surface against the action of the etching fluids to which the product is to be subjected. In order to permit ready removal to expose the surface of the final product, this protective layer is preferably applied in the form of a sheet material such as paper, plastic film, or fabric, applied to the surface with an adhesive which may be of the temporary or pressure sensitive type, or which may permit delamination or removal of the layer through the use of a solvent or softening agent. Such protective backings are well known in the prior art as represented, for example, by U.S. Patents 2,629,679, 2,647,849, 2,567,067, and 2,532,011.

At this point the element is immersed in a suitable acid bath for the purpose of etching around the resist pattern to remove only that portion of the oxide film layer 22 which is exposed, that is, not covered by the resist 25. Preferably this bath is composed of a dilute solution of hydrofluoric acid although other suitable acid materials may be utilized. HF concentrations of about 10% to 20% have been found satisfactory. This treatment results in the delineation of the pattern 25 by removal of that portion of the oxide layer 22 which is exposed to the acid. In cases where the oxide film is formed only on the surface of the sheet 20 opposite the resist, this etching step may be eliminated.

When the exposed portions of the oxide layer 22 have been removed, as shown in FIG. 5 the assembled unit is thoroughly rinsed to remove any traces of hydrofluoric acid and then introduced into an etching or chemical milling bath, which may be either chemical or electrolytic for the purpose of removing the aluminum metal which has now been exposed at the surface by the removal of the oxide. This treatment then serves to remove the aluminum so exposed, as shown in FIG. 6, further deepening the etch in conformity to the resist pattern which is unaffected. Suitable etching or chemical milling solutions particularly adapted for etching or chemical milling of metallic aluminum are dilute hydrochloric acid or concentrated alkali solutions. Such solutions include 10% to 30% HCl or saturated or supersaturated NaOH solutions used at elevated temperatures. Such solutions are effective for metallic aluminum, but are not desirable for the removal of aluminum oxide films.

The unit is then thoroughly washed to remove any traces of the alkaline or acidic etching solution and is then again immersed in a solution of hydrofluoric acid for the purpose of removing that portion of the oxide layer 23 which has been exposed by removal of the aluminum as shown in FIG. 6. This is carried out in a solution similar to that used in connection with the discussion of the step illustrated in FIG. 5. The product then consists of a completely cut out foil member having one surface thereof covered by the protective layer 26 as shown in FIG. 7. At this point, the ornamented or patterned surface of the unit consists of the cut out letters conforming to the de-

sign selected, for purposes of illustration, which in turn are supported upon protective layer or sheet member 26. The resist is removed by immersing the unit into a suitable solvent thus exposing layer 22. The unit is then thoroughly washed to remove any traces of HF on the exposed surface of the pattern or design. The surface of the remaining portion of layer 22 is then coated with a layer of adhesive preparatory to application to the surface to which it is to be affixed. Preferably the unit is coated with a layer of pressure sensitive adhesive overlaid with a protective sheet or film which may be removed, leaving the adhesive behind, when the unit is to be applied. Thus, as shown in FIG. 8, an adhesive 28 may be first applied to a carrier sheet 27 which is laid over the surface of the cut out design. Preferably this sheet may be of such a nature that the adhesive is transferred to the surface of the patterned unit when the carrier sheet is removed. If desired, a suitable adhesive may be applied directly to the surface of the cutout design and then a sheet of nonadherent material applied thereover for the purpose of protecting the adhesive surface to be used. Such types of sheet material are well known to the prior art and generally composed of paper or the like, coated or impregnated with a material having little or no cohesive properties for the adhesive utilized as shown, for example by U.S. Patent 2,532,011. The resulting assembly then consists of a sheet backing and protective member 26, the cut-out foil or sheet pattern 30 superimposed thereon, and a protective or release sheet 27 having adhesive 28 on the other surface thereof overlying the patterned surface which is still in reverse. This assembly is illustrated further in FIG. 9 in cross section.

When the assembly is ready for use, the upper surface of the cutout pattern 30 is exposed by removing sheet member 27, leaving adhesive 28 on the exposed surface of the pattern. The member is then laid with the adhesive side down against the surface of the object 29 to which the pattern is to be applied, as shown in FIG. 10. In this way, a positive view of the pattern is obtained since the reverse side is down against the object to which it is applied as shown. As illustrated in FIG. 10, patterned material is adhered to the surface of an article 29 in the manner described, then the protective sheet member 26 is removed thereby exposing the pattern or design in its desired positive form.

The sheet or foil utilized in making the appliques of this invention is of any desired thickness, although for best results, the material is within the range of 0.002 to 0.010 inch in thickness. The anodized film is of variable depth depending on the nature and extent of the treatment, but generally the oxide film thickness or depth should be at least 0.0001 to about 0.0004 inch in order to obtain satisfactory dye or pigment and color and uniformity. The manner in which the anodized film is obtained is well known in the art as exemplified by U.S. Patent 2,769,265 described above.

It is obvious that various changes and modifications may be made in the details of procedure and construction described herein without departing from the spirit of the invention.

I claim:

1. An individual applique separable from others with which it may be manufactured, for individual use on a desired surface to which it is to be adhered, said applique comprising the combination of: a metal foil having a predetermined configuration; a release sheet of protective disposable material; a first adhesive coating on said release sheet adhering one side of said foil to said release sheet, said first adhesive coating being less tenacious to said release sheet than to said foil whereby to coat said foil for adhesion to said desired surface upon removal of said release sheet; a protective sheet of disposable material; and a second adhesive coating adhering said protective sheet to the other side of said foil, said second adhesive coating providing a bond to said protective

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sheet which is weaker than the bond provided between said foil and said desired surface and stronger than the bond provided between said foil and said release sheet by said first adhesive coating.

2. An individual applique separable from others with which it may be manufactured, for individual use on a desired surface to which it is to be adhered, said applique comprising the combination of: an aluminum foil having an oxide coating on at least one surface thereof and comprising a predetermined configuration; a release sheet 10 of protective disposable material and of greater area than said foil; a first adhesive coating on said release sheet adhering one side of said foil to said release sheet, said first adhesive coating being less tenacious to said release sheet than to said foil whereby to coat said foil 15 for adhesion to said desired surface upon removal of said release sheet; a protective sheet of disposable material of greater area than said foil; and a second adhesive

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coating adhering said protective sheet to the other side of said foil, said second adhesive coating providing a bond to said protective sheet which is weaker than the bond provided between said foil and said desired surface and stronger than the bond provided between said foil and said release sheet by said first adhesive coating.

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