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METHOD OF MAKING METAL SCREEN STENCILS

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Fig. 1.

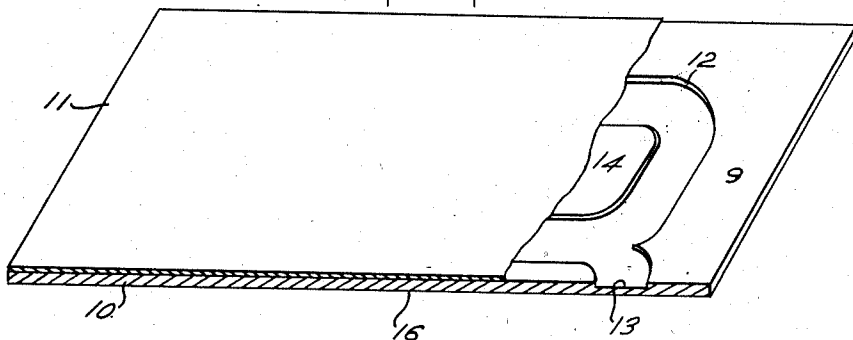


Fig. 2.

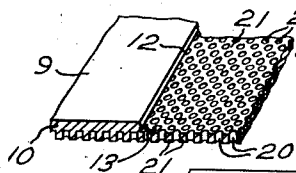
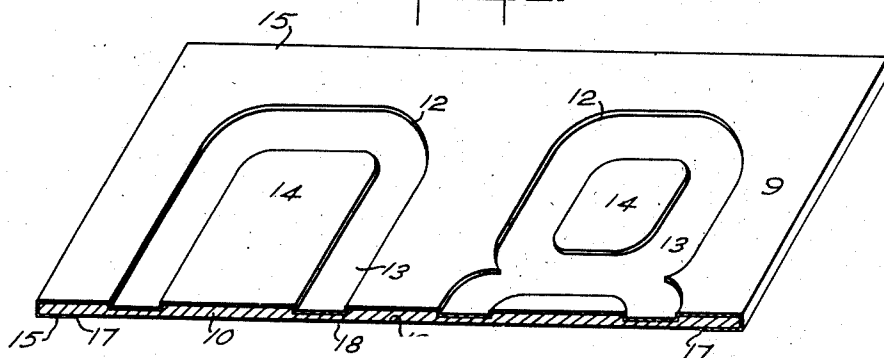


Fig. 4.

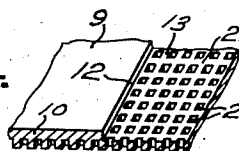


Fig. 5.

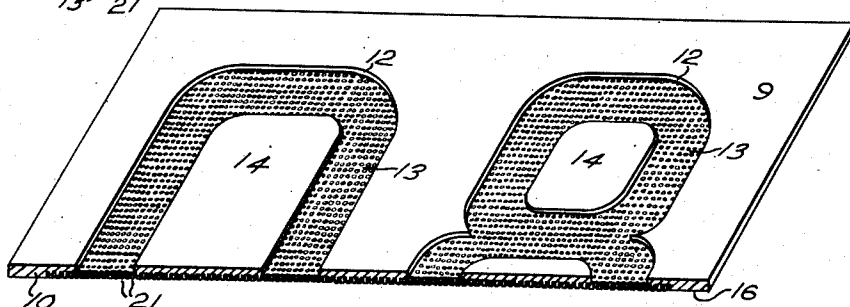


Fig. 3.

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METHOD OF MAKING METAL SCREEN STENCILS

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1

This invention relates to metal stencils, and particularly to metal screen stencils through which designs can be applied to an article, and to the methods for forming same.

For many purposes the conventional silk screens are too fragile for stencil purposes and have been replaced by metal stencils, a feature of which is a design area comprised of woven metal fabric joining areas of impervious metal to effect the transfer of pigment or paint or the like through the desired areas only. Such metal stencils have been found to be fairly accurate and also fairly wear-resistant, but as previously developed have been very complex and difficult to make. According to what may be considered the best of the prior art practices in this regard, there was provided a metal screen element of woven wire, with which a contrasting solid metal sheet was intimately associated. The respective metals were so selected that the etchant which would attack one element, say, the solid contrasting sheet of metal, and would eat through or into same to form an etched design therein would not appreciably attack the metal of the screen, so that the ultimate etched stencil would retain the screen structure connecting unetched portions of the solid sheet. This requires at least two chemically selective metals and critically selective etching. This, in addition to being critical and troublesome, limited the range of etchants and the range of materials available for the stencils. An illustration of such combinations of metals as used in the prior art would be a stainless steel woven mesh with a layer of aluminum or a layer of copper intimately associated therewith, either by forcing the aluminum into the interstices of the mesh under great pressure, or by soldering the copper sheet to the screen, or the like.

It is among the objects of this invention; to improve stencils; to overcome the disadvantages of the prior art; to provide a stencil of accuracy and of limited spread of the pigmenting material in passing through the stencil; to provide a metal stencil of strength and accuracy and formed of a single homogeneous metal; to simplify the manufacture and use of metal stencils; to provide a metal stencil of particular utility in applying designs to objects by means of radium paint or the like; to provide improvements in the method of making metal stencils; and many other objects and advantages of the invention will become more apparent as the description proceeds.

In carrying out the invention in a preferred embodiment, a selected solid sheet or plate of metal is first provided with a coating of "cold

2

top" or the like, a design is applied thereto by photographic process, the plate is then etched until the design has been etched about one-half way through the sheet. The plate is washed and dried, pursuant to which the finished upper half and the other surfaces of the plate are coated with a resist, except for a design area in the lower surface thereof, in which latter a coating of "cold top" or the like is applied; a series of half tone dots or the like is photographically applied to the lower surface, then the plate is placed in the etching bath and the dots are eaten into the metal until they have gone a distance inwardly sufficient to eat into the surface covered by the resist in the bottom of the previously etched design, and this completes a stencil in which the design area is etched about half way down from the top while the screen or mesh is etched about half way up from the bottom to penetration of the design to form a transverse through pigment-transferring channel. Alternatively, both designs may be etched simultaneously from opposite sides of the sheet.

In the accompanying drawing forming part of this description, Fig. 1 represents a fragmentary perspective partially broken away showing a solid sheet of metal from which the stencil is made, the coating of "cold top" or the like by which the initial design is etched, and progressively the design in fragmentary part etched part way into the upper surface of the plate.

Fig. 2 represents a similar fragmentary perspective of the plate at the completion of the initial etching of the surface and the application of a resist to the finished portions of the etched plate.

Fig. 3 represents a similar fragmentary perspective of the complete stencil as finished by etching half tone dots or the like from the under side of the plate.

Fig. 4 represents an enlarged fragmentary perspective of the completed stencil showing the preferred form of complemental dot etching.

Fig. 5 represents a similar fragmentary perspective of a complete stencil showing a modified form of complemental dot etching.

In carrying out the invention in the preferred form, a sheet or plate of metal 10 is provided which is preferably of strong metal but very thin, say, of the order of perhaps from .001" to .008". Although ordinary bronze or brass may be used, or sheets of copper or aluminum, or even compound or composite bi-metallic sheets can be used, it is preferred to use stainless steel or beryllium-copper for the stencils.

After being properly cleaned, this sheet 10 is

coated with a coating 11 of "cold top" or the like upon its upper surface 9 upon which a photographic impression of the desired stencil design is applied. The rest of the plate being suitably protected as by a coating of resist, not shown, the plate is placed in an etchant bath and the design 12 is etched in the upper surface of the plate. This is carefully timed to insure that the lower etched surface 13 of the design 12 extends only approximately one half way into the plate from the upper surface 9 thereof, although any over-etching or under-etching can be compensated for by the bottom etching time, to be described. This part of the etching may also find that very small elements of the design may take a little longer etching than the large symbols or elements, and it is therefore to be understood that in recognition of this fact, the etching of the large elements will be constantly watched by frequent visual inspections and when completed the plate will be removed from the bath, washed, and dried, and a coating of resist will be applied over the completed large units, then the plate will be returned to the etchant for a further period of etching to insure completion of small units, such as fine printing or the like. At the completion of this step, as indicated at the right side of Fig. 1, the design 12, illustratively including both an etched area designated by the lower surface 13 thereof, which is coextensive over the lower level, so to speak, of the design, and the surface 9 of the plate defining the edge of the design 12 on one side thereof, has an island or raised element 14 on the other side thereof, which is to be blank in the transferred design, but which is supported and held in place across the etched design surface area 13.

The plate completely finished with the design 12 etched into the upper surface 9, and possibly having islands 14, depending, of course, on the particular design, as shown in Fig. 2 has a preferably transparent layer of resist 15 applied to the entire upper surface and preferably around the edges of the plate and upon the marginal portion of the lower surface 13 terminating, illustratively, at a line 17 on the rear face of the plate 10. In the area defined or framed by the edges 17 of the resist 15, a coating of "cold top" or the like 18 is applied to the lower surface 16. Then photographically, or by some such means, the entire area under the design 12 is treated with a series of dots, such as round dots of standard half-tone processes of printing, or in any other shape or design to the end that the entire area is imparted a mesh-like or analogous impression. Then the photographically treated plate is again immersed in the etchant, and a series of holes are etched in the lower surface 16 and carefully timed or watched until they have completely eaten into the design lower surfaces 13, as shown in Fig. 3, upon which the etching is terminated, the plate is washed and dried and is ready for use as a metal screen stencil.

As shown in Fig. 4, if, for convenience, a conventional newspaper "half-tone" is used, there will be formed a series of more or less cylindrical through apertures 20 separated by integral metal portions 21, and in effect forming a mesh. The thickness of the metal as also the width of metal 21 between apertures 20 in Fig. 4 is exaggerated, as there is preferably appreciably more hole area than metal, and the metal is very thin, as previously recited, depending upon the requirements and upon the strength of the metal of the plate.

For many cases, it is preferred to use a rectangular print for the formation of the mesh, so that the photographic design will be such as to create, when etched, a series of rectangular through apertures 22, separated by integral strands or plate elements 23, as shown in Fig. 5, and such construction may well be preferred. This is especially true when ultra sharpness of definition of the transferred design is desired.

It is, of course, recognized that by this process there will be a number of blind apertures left in the bottom of the plate running up part way through the plate into the area thereof comprising the unetched top portion, but these make no difference except to furnish a lower surface which seems almost completely a mesh, but the only important part of the mesh is in line or in registration with the etched design 12. In this connection it will be apparent that in place of the "half-tone" process for forming the lower surface and design-piercing apertures, an actual desired mesh formation or semi-mesh formation, of any desired numbers of apertures can be photographed or projected upon the coating of the lower surface and this mode of formation is part of the invention herein.

It is an important part of the invention to simplify even the procedure just outlined. According to this improved technique, the thoroughly cleaned plate is coated on both surfaces with the cold top or the like. An exposure is made photographically or the like of the design on the cold top coated surface on one side which is to be transferred. Before subjecting it to the etchant, the exposure is made of the dotted area or half-tone impression on the other cold top coated surface of the plate. Then the plate is immersed in the etchant and both designs are simultaneously etched or eaten into the plate. The process is continued until registration and through apertures have been formed, which will be at a line approximately one-half way through the plate. The etching is then stopped, the plate washed and dried and the stencil is ready for use.

The quickness, ease, and simplicity of the invention, and the strength and wear resistance of the ultimate stencil formed thereby will be obvious.

Having thus described my invention, I claim:

1. The method of making a metal stencil screen, which comprises coating a plate with photo-sensitive resist material, photographing on one surface a design which the stencil is to reproduce, photographing on the other surface of the plate a multiplicity of small dots, subjecting the plate to etching in a bath to simultaneously etch in the design and a multiplicity of small apertures leading into the design to complete the stencil.

2. The method of making a metal stencil screen which comprises applying to a surface of a plate a photo-sensitive resist, treating the resist so as to enable an etchant to etch a design in the surface on which lies the treated resist, etching the plate and establishing an etched design on the treated surface thereof of a substantially predetermined depth in the plate, coating the entire etched surface with a resist, treating the other surface of the plate with a photo-sensitive resist, treating the last mentioned surface to enable an etchant to etch a design in said last surface, etching the design into said last mentioned surface for a predetermined depth transversely overlapping the design etched

5

in the opposite surface to establish through apertures in the plate, and in the treatment insuring that one of the said designs comprises a multiplicity of relatively small dots which when etched simulate a screen mesh.

3. The method of making a metal stencil screen, which comprises coating a plate on one surface with photo-sensitive resist material, photographing on said surface a design which the stencil is to reproduce, exposing said surface to an etchant to etch said design into said surface, coating the other surface of the plate with photo-sensitive resist material, photographing said other surface with a multiplicity of dots, exposing said other surface to an etchant having the same qualities as the first to etch said dots into said other surface until the designs overlap and intersect internally of the plate to form through apertures.

4. The method of making a metal stencil screen which comprises coating the respective sides of the plate with photosensitive resists, photographing designs on the respective sides, one of which is the design to be reproduced and the other of which is such as to impart a mesh-like appearance to the plate, subjecting the sides successively to etchants of the same characteristics until there is transverse overlap of the designs internally of the plate to form through apertures for the pigment.

5. The method of making a metal stencil screen from a unitary homogeneous plate, which comprises coating the respective sides of the plate with resist, treating the resist on one face of the plate so as to enable an etchant to etch a design in one face, treating the resist on the other face of said plate to enable an etchant to etch a sec-

6

ond design on the latter face, subjecting the faces successively to etchants of the same characteristics until there is a transverse overlap of the etched designs internally of the plate to form through apertures for the pigment, one of said designs comprising a simulation of a screen mesh and the other the design to be printed.

6. The method of making a metal stencil screen from a unitary homogeneous plate, which comprises coating the respective sides of the plate with resist, treating the resist on one face of the plate so as to enable an etchant to etch a design in one face, treating the resist on the other face of said plate to enable an etchant to etch a second design on the latter face, subjecting the faces simultaneously to a common etchant until there is a transverse overlap of the etched designs internally of the plate to form through apertures for the pigment, one of said designs comprising a simulation of a screen mesh and the other the design to be printed.

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