April 21, 1936. M. C. BEEBE 2,038,339

PROCESS OF MANUFACTURE OF A STENCIL

Filed July 11, 1934

Fig. 1.

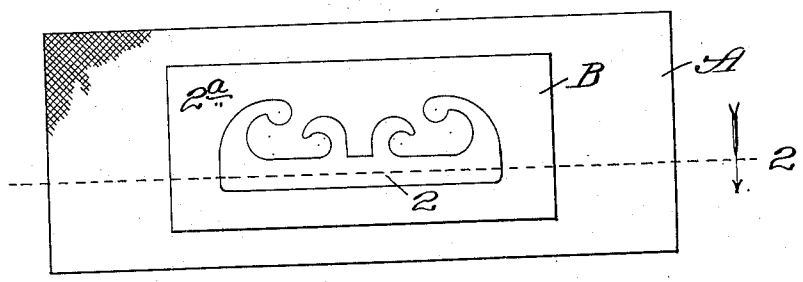


Fig. 2.

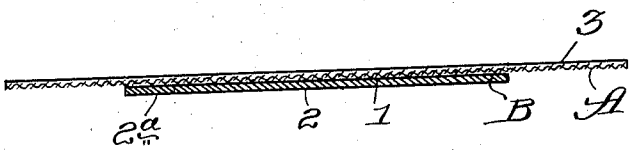


Fig. 3.

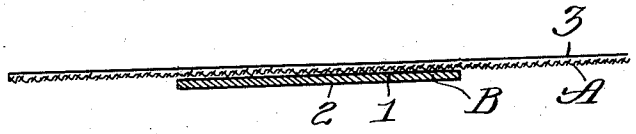


Fig. 4.

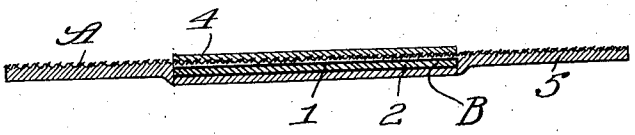


Fig. 5.

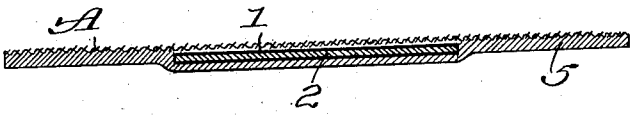


Fig. 6.

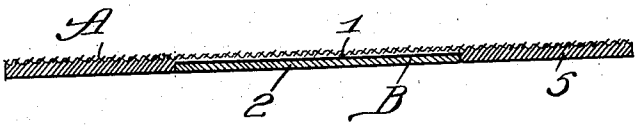


Fig. 7.

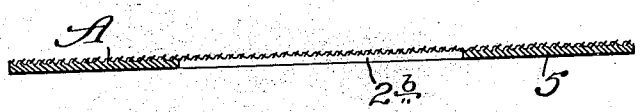
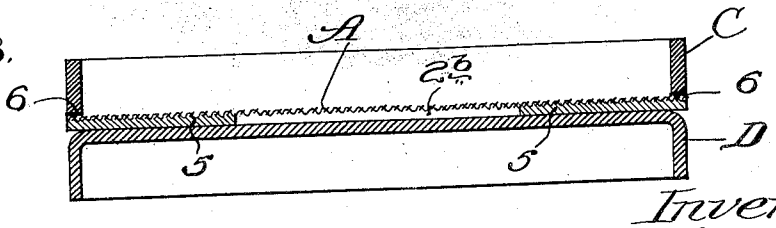


Fig. 8.



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PROCESS OF MANUFACTURE OF A STENCIL

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Application July 11, 1934, Serial No. 734,677

10 Claims. (Cl. 41—38.5)

This invention relates particularly to an improved stencil and a method of manufacturing same.

The primary object is to provide a stencil having clean-cut lines, which is capable of being manufactured at moderate expense and which is highly durable.

The invention renders it possible to produce, in a facile manner, a stencil having any desired design therein. A stencil of this character is useful, for example, in applying artistic designs to metal articles, or to any desired object.

Stated generally, the improved method comprises photographing a design on a plate coated with a light-sensitive film and securing said plate to one side of a fabric; etching away that portion of the plate not protected by the light-hardened portion of the film; providing a film of resin-like character on said fabric complemental to said design; and removing, or etching away, the metal corresponding with said design.

The resin-like film applied to the fabric to render impervious that portion of the fabric which is covered by the film, may comprise a heat-hardening synthetic resin which, after hardening, is extremely inert to solvents ordinarily employed in connection with lacquers, or pastes, of a kind which is desirable for printing designs on metal objects, or other objects. However, any suitable plastic material, or solution capable of yielding a plastic material which can be suitably hardened and still possess desired elasticity and continuity and be capable of withstanding the action of such solvents as may be employed in the lacquer, or paste composition, which is to form the ultimate print, or design, upon the article to be decorated, may be employed in lieu of a heat-hardening synthetic resin.

A very suitable heat-hardening lacquer for the purpose of forming a hardened film on the fabric, excepting the portion which corresponds with the design which is to be printed, may be produced from a urea-formaldehyde condensation product and salicylic acid, as described, for example, in Belfit Patent No. 1,898,709, granted February 21, 1933.

A suitable lacquer, or paste, for printing artistic designs on a metal object, for example, is a cotton lacquer composition of paste-like consistency, the paste being of any desired color. Such a paste may be pressed through the cut-away portion of the stencil (i. e., through the fabric not covered by the hardened film, by means of a squeegee, or roller. Any other suitable composition may be employed for printing upon the article to be decorated.

The improved stencil, and the method of making same, are illustrated in the accompanying drawing, in which—

Fig. 1 depicts a gauze-screen, or fabric, having secured thereto, as by means of glue, a metal plate bearing a photographically produced design; Fig. 2, a sectional view taken as indicated at line 2 of Fig. 1; Fig. 3, a similar section after the portion of the plate not bearing the light-hardened sensitized coating has been etched away, this view showing also a protecting film, such as cotton lacquer, applied to the upper, or back, surface of the fabric; Fig. 4, a similar section after removal of the cotton lacquer film and the application of an asphaltum film to the upper or back surface of the fabric, backing the plate and after the application to the front or lower surface of the fabric of a suitable film, such as the heat-hardening film mentioned above; Fig. 5, a similar section after a drying operation, followed by removal of the asphaltum film and after the final hardening of the film which is to form the impervious portion of the stencil; Fig. 6, a similar section after the films on the front (lower) face of the metal design have been removed, leaving the metal bare; Fig. 7, a similar section after the metal forming the design has been etched away, leaving the design cut in the hardened film on the lower or front side of the screen; and Fig. 8, a sectional view showing the stencil secured to a shallow frame which may contain the paste to be used in the printing, this view illustrating the manner in which a design may be printed upon an article.

It may be stated here that the metal plate may have a sensitized coating applied to one side thereof and have a design photographically produced in the sensitized coating either before or after the plate is applied to the fabric. Preferably, a silk fabric is employed, but any suitable fabric adapted to permit the paste to be squeezed therethrough may be employed.

In the illustration given, A designates a fabric; B, a metal plate secured to a surface thereof, as by means of glue 1; C, a box-like frame to which the stencil is secured; and D, an article, such as the cover of a metal box, to be decorated.

The plate B preferably is a thin metal plate. It may, for example, be a brass plate about .004" thick. Any other suitable material, capable of being etched away, may be used. Plate B is provided on its lower or front side with a sensitive film, the portion 2, in the form of a suitable de-

sign, having been hardened by light in a photographic operation, and the portion 2^a remaining unhardened and capable of being removed by a developing operation.

The glue, or other suitable adhesive, securing the plate to the fabric, is protected by a film **3**, such as cotton lacquer, applied to the upper or back surface of the fabric. **4** designates a backing for the plate which may consist of asphaltum, or any other suitable material adapted to prevent the glue from being attacked. A solution of asphaltum may be applied as a paint; or a sensitized asphaltum may be applied and hardened by light. This protection, or backing, is applied preparatory to applying the coating which is to form the impervious portion of the stencil.

In Fig. 4, a film **5** has been applied to the lower surface of the screen. It is shown as covering the lower surface of the plate, as well as the fabric. If a heat-hardening solution is employed in forming the film **5**, in accordance with the preferred method, the stencil is then subjected to a drying operation, say at about 210° F., which has the effect of initially hardening the coating **5**. This leaves the asphaltum coating **4** in such condition that it can be removed by means of a suitable solvent, such as naphtha or benzol. After removal of the asphaltum, the stencil preferably is baked at about 275° F. for about one hour, in case of the use of a urea-formaldehyde-salicylic acid film. This has the effect of completing the transformation of the compound into a hard, resistant film which will withstand the action of the usual solvents, such as alcohol, or other solvents commonly used in connection with lacquers.

After the film **5** has been completely hardened, that portion of the film which underlies the plate B (the design portion of the plate) is removed by means of sandpaper or other suitable abrasive. In this operation, the light-hardened sensitive film is removed, also, leaving the lower face of the plate bare. The design portion of the plate is then etched away in any suitable manner, such as by the use of ferric chloride. This removes the glue at the same time.

The stencil is then in the condition shown in Fig. 7, the space 2^b, indicating the cut-away portion of the hardened film **5**, corresponding, of course, with the space formerly occupied by the portion of the metal plate underlying the light-hardened film-portion **2**.

The stencil thus prepared is then secured to the open frame C by any suitable means, as for example glue **6**, or other suitable adhesive.

In the use of the stencil, a desired quantity of suitably colored paste which is to be used in the printing operation is placed in the frame which supports the stencil; and the printing is performed by means of a squeegee, or roller. If an ordinary cotton lacquer paste is employed for printing, it may be hardened by air-drying. If a more durable print is desired, one may employ a paste comprising a heat-hardening synthetic resin, for example. This may then be converted to the final infusible and insoluble state by a baking operation to which the decorated article is subjected. A print thus applied and hardened will withstand the action of solvents, such as alcohol.

Where a silk screen is employed in making the stencil, it is preferred to use, ordinarily, silk bolting cloth of about 137 mesh per inch. Such a cloth is known on the market as "thirteen double X (13XX)". The cloth may, if desired, be mounted on the frame in the first instance, and the plate which is to be etched away may be mounted on the fabric either before or after the photographing of the design thereon. The fabric should have the size removed therefrom by washing with an alkaline cleaner. The metal is cleaned in any suitable manner before the sensitized coating is applied. Any suitable light-sensitive coating may be used. Suitable processes are described, for example, in Beebe Patent 1,574,358, granted February 23, 1926, and Beebe and Murray Patent 1,587,271, granted June 1, 1926.

If, in the etching process, the glue is not all removed by the ferric chloride, the fabric may be further cleaned by the use of an alkaline cleaner. It is desirable, before applying the film **5**, to remove the cotton lacquer coating **3**, so that the solution which forms the film **5** may thoroughly impregnate the fabric and become interlocked in the fabric. As will be understood from Fig. 7, the film **5** is adapted to form a sharp outline of the design which is to be printed. That is, the silk lies somewhat above the lower surface of the film **5**, otherwise, the silk would tend to blur the outline in the printing operation. It is understood, of course, that the drawing very greatly exaggerates the thickness of the films, this being done to facilitate an understanding of the process.

A stencil produced in the manner described not only gives a sharp outline to the printed design, but is very durable. It is easily possible to produce 20,000 to 25,000 impressions from a stencil.

If, after etching away the metal design, the edges of the design which appear in the impervious film (forming the outline in the stencil) are in any way imperfect, the edges may be retouched in any suitable manner. For example, slight imperfections in the form of indents may be touched with lacquer to give a smooth outline, the lacquer being then hardened. Slight irregularities in the form of projections will be trimmed off, if they appear.

Instead of forming the impervious portion of the stencil from lacquer comprising urea-formaldehyde-condensation product and salicylic acid, for example, one may employ any other suitable composition which will withstand the action of solvents ordinarily used in lacquers, or lacquer pastes.

A composition which has been used with considerable success is composed of glue, glycerine and molasses in suitable proportions. Such a composition has a considerable degree of elasticity and toughness and resists lacquer-solvents very well. It is desirable, however, to introduce a little sodium dichromate, or some equivalent substance, to harden the composition upon exposure to light. Formaldehyde may be used as a hardener, also, the composition being subjected to fumes of formaldehyde.

Another modification is to use, in lieu of the heat-hardening lacquer for forming the impervious film of the stencil, what is known on the market as Thiokol. This is a synthetic plastic material, not unlike rubber in many of its properties, but much more resistant to solvents of the type used in lacquer pastes. This material is produced by the action of ethylene dichloride and sodium sulphide, forming what is known as ethylene polysulphide. The material precipitates in the form of a latex very much like rubber latex. When dried in the air the material changes to a rubber-like material, but is subject to such great

shrinkage as to form cracks. This can be corrected by adding approximately 1% of a saturated solution of diphenyl guanidine in alcohol (known as DPG in the rubber industry) and heating the mixture on a water bath for four or five hours. Thus prepared, the material may be spread upon the silk screen by means of a brush, a squeegee, or a spray gun. It is desirable, also, to add about 5%–10% of zinc oxide as a filler, which has the property of preventing the coating from hardening with age. This is important for stencils, since elasticity is necessary to permit the use of stencils on curved surfaces, without cracking. Pigments and fillers may be added to give desired colors and other desired characteristics.

The foregoing detailed description is given for clearness of understanding only, and no unnecessary limitations should be understood therefrom, but the appended claims should be construed as broadly as permissible in view of the prior art.

What I regard as new and desire to secure by Letters Patent is:

1. A stencil-making process which comprises: photographing a design on a metal plate coated with a light-sensitive film securing said plate to one side of a fabric; etching away that portion of the plate not protected by the light-hardened portion of the film; providing an impervious film on said fabric complemental to said design; and removing the metal corresponding with said design.

2. A stencil-making process which comprises: photographing a design on a plate coated with a light-sensitive film and securing said plate to one side of a fabric; etching away that portion of the plate not protected by the light-hardened portion of the film; applying to that side of the fabric which bears the plate an impervious film which is extended over the plate; removing the films from the design portion of the plate; and etching away the design portion of the plate.

3. A stencil-making process as set forth in claim 1, in which a heat-hardening film is employed to produce the impervious film mentioned.

4. A stencil-making process which comprises providing on one surface of a fabric a metal design; providing at the same side of said fabric an impervious coating complemental to said design; and etching away the metal design.

5. A process as set forth in claim 4, in which the impervious film is extended over the metal design, and the film is hardened and that portion of the film overlying the metal design is removed prior to etching away the metal design.

6. A process as set forth in claim 1, in which the impervious film comprises a composition of glue, glycerine, molasses and a hardening agent.

7. A process as set forth in claim 1, in which the impervious film comprises ethylene polysulphide.

8. A stencil-making process which comprises photographing a design on a metal plate coated with a light-sensitive film and securing said plate to one side of a fabric by means of an adhesive; applying a protecting film to the other side of the fabric; etching away that portion of the plate not protected by the light-hardened portion of said first-mentioned film; removing said second-mentioned film and applying a backing on the fabric opposite the metal design which remains; providing on the side of the fabric which bears said plate an impervious film complemental to the metal design; and etching away the metal design.

9. The process as set forth in claim 8, in which said film comprises a heat-hardened synthetic resin.

10. A stencil-making process which comprises photographing a design on a plate coated with a light-sensitive film and securing said plate to one side of a fabric; applying a protecting backing film to the fabric; etching away that portion of the plate not covered by the light-hardened portion of the first mentioned film; removing the protecting backing film and applying a protecting backing to the fabric over the design portion of the plate; applying to the design portion of the plate and the corresponding side of the fabric a heat-hardening film; removing the second-mentioned backing film from the fabric; completing the hardening of the heat-hardening film and removing the film from the outer surface of the design portion of the plate; and etching away the design portion of the plate.

MURRAY C. BEEBE.