Aug. 28, 1945. B. RUDNICK 2,383,568

LIGHT STENCIL AND METHOD OF MAKING SAME

Filed May 10, 1943

Fig. 1

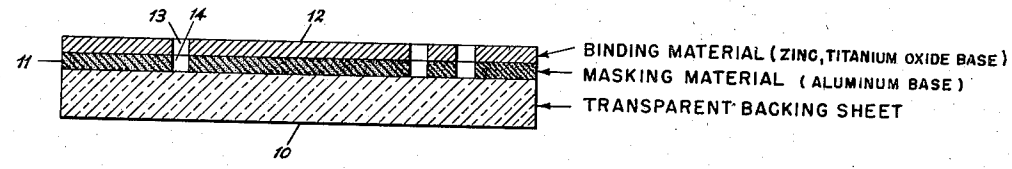


Fig. 2

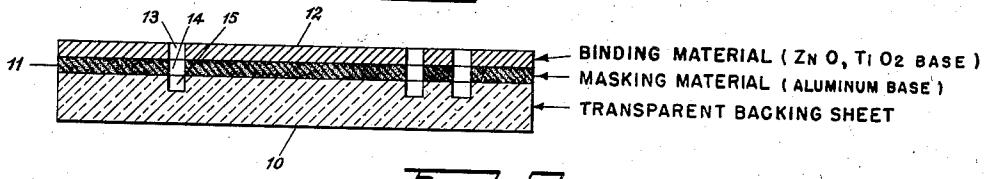


Fig. 3

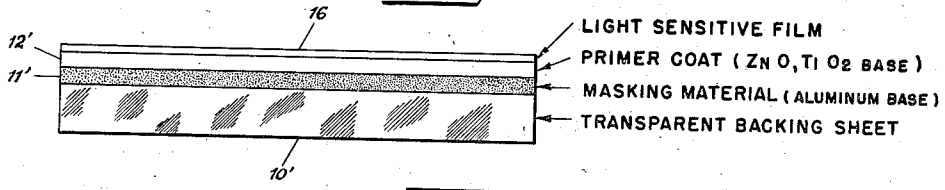
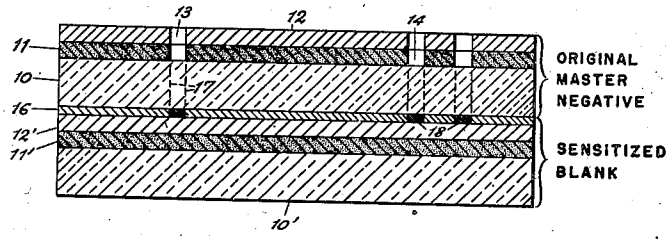
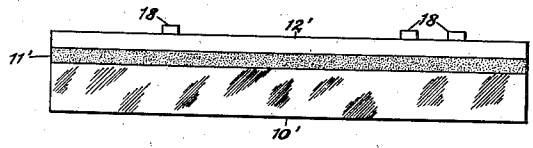


Fig. 4



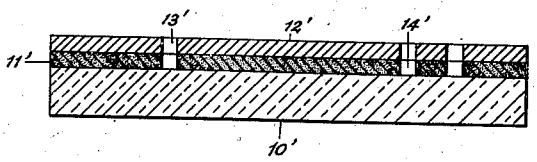
CONTACT EXPOSURE OF ORIGINAL MASTER NEGATIVE AND SENSITIZED BLANK

Fig. 5



DEVELOPED COPY

Fig. 6



DUPLICATE MASTER NEGATIVE

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LIGHT STENCIL AND METHOD OF MAKING SAME

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11 Claims. (Cl. 41—46)

This invention relates to stencils of the type carried on a transparent backing sheet or plate, which may hence be designated as "light-stencils," and particularly aims to provide an improved light-stencil of this type which can be used repeatedly as a negative for the photo-mechanical reproduction of line-drawings, mechanical layouts, templates, etc.

In general the present invention contemplates a light stencil or photo-mechanical negative having an opaque field in which the design to be reproduced may be delineated in transparent or clear lines, capable of repeated reproduction in positive prints or as the basis for the creation of duplicate negatives or secondary negatives embodying any desired changes, modifications or alterations in the delineated design.

More specifically, an object of the invention is to provide an opaque light-stencil or photo-mechanical negative on the surface of which any kind of line drawings may first be roughly sketched and outlined and may then be scribed by means of a stylus, so as to form a transparent master negative, which may be repeatedly used for the preparation of accurate positive copies or reproductions of said negative or for the reproduction thereof on metal sheets from which templates can be made. The use of this photo-mechanical stencil or negative is not, however, limited to this reproduction of master line-drawings but, as will become apparent hereinafter, will find great utility in machine and sheet metal shop practice in transferring said mechanical master layouts directly onto the work to be machined, metalsmithed or otherwise operated upon.

Another object is to provide, for a light-stencil, a surface which will form a suitable contrasting background for a pencil sketch or for an outline marked or printed in black lines on said surface so as to serve as a guide for the stylus when scribing the master drawing through said surface.

Another object is to provide a negative, opaque-surface which will form a suitable primer or sub-stratum for a coating of light-sensitive photographic emulsion.

A further object is to provide a light-stencil which can be readily duplicated in whole or in part with a high degree of accuracy and at a great saving of time.

Among its other objects the instant invention proposes the employment of a master negative as the basis from which derives the method for the production of one or more secondary negatives by photographic contact printing, each of which is a complete replica of the master negative except as to such portions thereof which may be changed, altered or corrected or such additions as may be made thereto, during the conversion of the positive print of the master negative into a definitive secondary negative all in accordance with the present invention.

Still another object is to provide a practical method of tracing directly from original drawings, on said light-stencil, an outline of certain parts or the entirety of the master line-drawing to be scribed.

Other objects and advantages will become apparent from the following detailed description of the preferred embodiment of my invention, reference being had to the accompanying drawing, in which

Figure 1 is a cross-sectional view of a light-stencil usable as a photo-mechanical master negative and prepared according to the preferred mode;

Figure 2 is a similar cross-sectional view showing a light-stencil prepared according to a modification of said preferred mode;

Figures 3 to 6 inclusive show different steps of the preferred mode of duplication of the light-stencils according to present invention, Figure 3 being a side view, showing the blank upon which the negative of Figure 1 is to be duplicated, Figure 4, a cross-sectional section, showing the preferred manner in which the negative of Figure 1 and the blank of Figure 3 are arranged during their exposure, Figure 5, a side view of the developed positive, and Figure 6, a cross-sectional section of the duplicate light-stencil or master negative thus obtained.

In Figure 1 of the drawing is illustrated a light-stencil usable as photo-mechanical master negative or pattern sheet, and comprising: a backing sheet 10, made of any suitable transparent material; an intermediate coating 11 of a suitable pulverulent masking material and a top coating 12 of a suitable binder for said masking material.

Preferably, this light-stencil is prepared with a clear, transparent plastic sheet .01 to 0.15 thick having a low linear coefficient of thermal expansion (0.000059), i. e. a high dimensional stability. Other desirable qualities of this base sheet are: waterproofness, non-flammability, and resistance to inorganic acids and alkalies, to alcohols, oils and aliphatic hydrocarbons. All these qualities are obtained by using for such base sheet, the plastic sheet material obtained by calendering the resins resulting from the co-polymerization of vinyl chloride (CH_2:CHCl) and vinyl acetate (CH_3CO_2CH:CH_2) in the presence of a suitable

catalyst. A plastic sheet of the foregoing is a standard article of commerce and is obtainable on the open market under the trade-name "Vinylite."

As this material is a thermoplastic, it becomes possible to groove or scribe thereon an outline of the design to be reproduced, using a wood-burning stylus or other heated tool for this purpose. On the clean top surface of this base-sheet 10 is laid a very thin layer of metallic, dark-colored masking material 11. This layer is preferably prepared by mixing thoroughly a certain amount of pure, metallic, elementary aluminum powder, ground sufficiently fine to pass a 400-mesh screen, into a lacquer, such as a mixture of 60% of cellulose acetate and 40% of methyl or methacrylate resin, so as to form a thick paste. This latter is then thinned to the desired consistency by means of a suitable mixture of solvents, such as a mixture of 60% toluol, 30% ethylene glycol and 10% of xylol, and is applied—preferably by means of a spray-gun—to said clean surface of the plastic sheet 10. This first coating, 11, dries in a few minutes and, when dry, renders the plastic sheet 10 completely opaque, but adheres thereto so lightly that it can be readily removed with a few strokes of a stiff brush or of a soft eraser. One important result of the use of such a metallic coating is that it enhances the heat-resisting quality of the base sheet and increases its rigidity.

Best results are obtained by mixing the following proportions (by weight) of said ingredients:

	Per cent
Aluminum powder	6.5
Lacquer	12.25
Solvents	81.25

In any event the nature of the masking coating 11, when dry, must be such that the sheet 10 is rendered completely opaque and the coating 11 so lightly adhered to the sheet 10 and the particles of aluminum so lightly cohered that the coating may be easily removed by erasing or brushing. It is to be noted that the use of aluminum powder as the masking agent in the coating 11 results not only in complete opacity but in an exeremely thin masking coating.

The material for the top coating 12 is prepared by mixing thoroughly, a certain amount of pulverulent white pigments, which consists mainly of zinc oxide, with a much greater amount of the same lacquer that was used for the first coating 11. To this mixture, is then added a smaller amount of the same mixture of solvents that was used in said first coating 11, in order to thin to the desired consistency.

The most satisfactory results have been obtained by using as pigment for this light-colored top layer 12, a mixture of 75% of zinc oxide (ZnO) and 25% of titanium dioxide (TiO_2) and by adhering to substantially the following proportions (by weight) in mixing the different ingredients entering into said top layer 12:

	Per cent
White pigment	16
Lacquer	30
Solvents	54

The liquid varnish thus obtained is substantially more adherent than the metallic lacquer used as masking material for the first coating 11. A very thin layer 12 of said varnish is then applied—preferably by means of a spray-gun—over the first layer 11 and is allowed to dry, which it does substantially more slowly than said first coating of masking material.

When dry, this top coating 12 has, in a high degree, the following essential characteristics:

1. It is scribable, i. e., of such a consistency that a sharp, hard pointed instrument, such as a stylus, will readily penetrate into it and will cut then through perfectly clean, sharp and smooth furrowed lines, while it will also "take" a sharp, softer-pointed instrument, such as a 4H pencil without being indented.

2. It forms a convenient white or sharply contrasting background for a pencil sketch or for a surface print or photographic reproduction in black lines to be used as a guide when scribing the permanent drawing with a stylus.

3. It forms a convenient primer or sub-stratum for a layer of light-sensitive photographic emulsion, which is spread over it—as will be described in more detail later on—when it is desired to make a preliminary photographic reproduction of the line-drawing to be scribed therethrough, or when it is desired to duplicate a master negative directly by contact printing.

4. It is of such a consistency that it acts as a binder for the more or less pulverulent masking material of the layer 11.

5. It is of such a flexible and homogeneous nature that, when spread over a furrowed, transparent backing sheet—as will be described later in reference to Figure 2—it delineates the corrugations, "ups" and "downs," of said furrows, without filling them.

6. It is strongly adhesive and resistant and therefore will not be accidentally scratched or rubbed off by the draftman's tools, or fingers, or cuffs.

When completely dry, and at any time later on—even after a long period of storage—the negative thus prepared may be used in a lofting department or in a shop to record a line-drawing or layout that it is desired to keep permanently as a master drawing or pattern.

The drawing is made on this white surface, 12, by first sketching, in pencil, a part or the whole thereof on the surface without penetrating or scratching into it at all, and then cuting through, or detaching locally, the top layer 12 by means of steel-pointed drawing instruments, such as a stylus, scribers, calipers, compasses, etc., so as to form furrowed lines 13 directly below said pencil lines. With a brush, or preferably, a soft eraser, the draftsman then brushes or rubs out simultaneously all the pencil "lead," all the binding coating thus detached, and all the aluminum powder 14 lying directly underneath the lines 13 over the transparent plastice backing 10.

The photo-mechanical master negative thus prepared may then be indefinitely preserved and any number of positive copies may be made therefrom as occasion demands. Due to the relatively low coefficient of thermal expansion of the base sheet 10, said copies will always be perfectly accurate.

Figure 2 shows a modification of the preferred mode of preparation of a photo-mechanical negative, in which the line-drawing 13, to be scribed through the top layer 12, instead of being first merely "laid on," or sketched in pencil, is instead put on by penetration, or scribed with a stylus in the top surface of the base sheet 10, now used as a tracing sheet so as to work in the top surface of said sheet—before the coatings 11 and 12 are applied—furrows, or indented lines, 15. At first,

due to the transparency of the plastic sheet 10, said lines 15 are almost invisible, but, when covered with a thin layer of masking material and a thin layer of white varnish—both of which follow the up and down of the furrows without filling them—they become clearly visible and form guides which can be easily followed by the draftsman, when scribing with a stylus, the corresponding line-drawing 13 through the layer 12.

As a precautionary measure, it is usually desirable to have a duplicate set of all the master negatives; often series of slightly different derived master negatives have to be prepared by making but a few changes in a basic master negative. Also, it is often desirable to make a change or correction in a master negative without destroying the parts thereof which are thus changed or corrected.

Figures 3 to 6 inclusive illustrate how such duplication—preferably—is carried out. Figure 3 shows a bare or blank negative 10', 11', 12', (prepared exactly as the negative 10, 11, 12 of Figures 1 and 2) adapted for duplicating a part or the whole of an existing master negative merely by addition of a thin layer 16 of light-sensitive photographic emulsion on the top layer 12'. This sensitized blank is then placed in direct contact with the original master negative to be duplicated, the arrangement being preferably that shown in Figure 4, and this latter is photographically exposed to parallel light rays 17, emanating from a suitable source of artificial light (not shown), arranged above the surface 12.

The parallel rays, 17, pass through the open lines 13, 14 and through the transparent backing sheet 10 and harden the corresponding portions 18 of the sensitized layer 16 of the blank 10', 11', 12'. The photographic layer 16 is then washed away, save for the hardened portions 18, which forms then a line drawing contrasting in black over the white background of the developed positive thus obtained (Figure 5). This drawing reproduces exactly, the line drawing 13 of the original master negative.

In order to make a duplicate master negative out of this developed copy, the draftsman, now following the black lines 18 as a guide, with his stylus, readily scribes the drawing through the top layer 12' and then brushes away or rubs out with a soft eraser, all traces of hardened emulsion 18, all the detached binding material 13', and all the pulverulent masking material 14'. The resultant duplicate master negative is shown in Figure 6.

Manifestly a secondary negative may be made as above described and have any desired changes, modifications or alterations incorporated therein. In short the delineated design reproduced from the negative 10—11—12 on the secondary negative 10'—11'—12' and represented by the lines 18 in Fig. 5 may be entirely and completely scribed through the binding-coating 12' in agreement with the lines 18 or part of it may be scribed through the coating 12' in agreement with the lines 18 and a modified or altered design created by scribing through the coating 12' new continuing and connecting lines. Thus a secondary negative 10'—11'—12' of a new design or layout incorporating part of the original design or layout is produced which in effect constitutes a master negative, all without making any change or alteration in the original negative 10—11—12.

This method of duplication assures a high degree of accuracy with a minimum of time consumed. Also, it effectuates considerable saving in the cost of the duplicate negatives, as highly skilled draftsmen are no longer required for the tracing or scribing of the line-drawing through the top layer 12'.

Should the draftsman make a mistake in scribing the master drawing, this may be readily corrected by painting over—and thus blacking out—the incorrectly placed lines, with a black mask identical with, or corresponding in composition to, that used for the layer of masking material 11, the correct lines afterwards being scribed through said black overcoating when it has dried.

The fact that the corrections thus made will stand out black on an otherwise white surface, far from being a defect, is, instead, an advantage greatly appreciated by the supervising and checking organizations which can thus recognize at a glance that a master drawing has been changed and at once localize and identify the corrections.

Manifestly any suitable material or combination of materials other than those above specified can be used for either the masking coating 11—11' or the binding coating 12—12' and various other modifications in the foregoing mode of preparing the light stencil or photomechanical negative may be made and employed without departing from the spirit and scope hereof as defined in the annexed claims.

(In these claims, the expression "light-stencil" is employed to concisely define a stencil comprising a transparent base and an opaque scribable coating and the expression "scribable" to concisely define a consistency and toughness of a coat such that a 4H pencil will not scratch it, while a stylus will readily cut through said coat, smooth and sharp clear lines).

I claim:

1. A blank for the preparation of a light-stencil, comprising: a transparent clear plastic sheet; a first coat of a cellulose acetate base lacquer thinned in suitable solvents and mixed with aluminum dust and spread in a liquid state over said backing member; and a second scribable coating of a light-colored lacquer overlying said first coat; the formulation of said first coat being such, that, upon evaporation of the solvents, said cellulose acetate base lacquer becomes an integral part of the plastic sheet, while the released aluminum dust forms a readily removable, opaque and dark-colored masking film evenly overlying said lacquer-coated backing sheet.

2. A light-stencil for reproducing designs, comprising: a transparent plastic backing sheet, the top surface of which is adapted for receiving preliminary designs traced from originals and scribed therein with a stylus; a film of masking material so high in surface-tension as to be evenly spreadable over said engraved surface to closely follow the incisions forming said preliminary designs without filling these incisions; and a scribable coating of a substantially white lacquer so homogeneous and so evenly spreadable over said film as to follow the furrows formed therein over said incisions without filling said furrows; the visible corresponding furrows thus formed in said coating serving as guides for facilitating the permanent scribing of the designs to be reproduced throughout said coating and said film.

3. A light-stencil, comprising: a transparent backing member; a first coat prepared of a mix of aluminum in a cellulose acetate base lacquer to form a thick paste, subsequently thinned with a mixture of solvents to a suitable consistency for spreading over said backing member; a second lacquer coat overlying and binding said film

and a design scribed through at least said second coat; said second coat being prepared of a mix of substantially pure-white pigments in a cellulose acetate base lacquer in a greater amount than was used for the first coat, to thereby form a thick paste subsequently thinned, with a smaller amount of the same mixture of solvents than was used for said first coat, to a suitable consistency for spreading over said masking film, to thereby form a scribable covering for said film and a white contrasting background for a pencil sketch or outline of said design or for a surface print in black thereof.

4. The method of making, on a transparent base, a light-stencil for reproducing designs, when traceable originals of said designs are available, which comprises: securing the transparent base upon said original design; tracing an outline of said latter in the top surface of said base with a stylus; spreading evenly a liquid film of opaque and dark-colored masking material over said engraved surface; allowing said film to dry to a substantially pulverulent state; binding said pulverulent film by spreading evenly over it a liquid film of white lacquer; allowing said lacquer to dry to a scribable consistency; scribing said marked outline through said film of lacquer; and removing all the particles of lacquer and pulverulent masking material left in the sharp and clear cut stencil lines thus formed, with the help of said outline.

5. The method of making a photo-mechanical negative consisting of covering a transparent sheet with a masking coating, overlaying a scribable binding coating thereon, depositing a light-sensitive photographic emulsion on said binding coating, contact printing a design on said emulsion, developing the latent image thus made, and scribing the delineated design through the binding and masking coatings in agreement with the outline of the image of the design aforesaid.

6. The method of making a photo-mechanical negative consisting in covering a transparent sheet with a frangible masking coating, overlaying a scribable binding coating of contrasting color thereon, depositing a light-sensitive photographic emulsion on said binding coating, light printing a design on said emulsion, developing the latent image thus made, scribing the design through the coatings aforesaid in agreement with a portion of the image, and scribing a modification of the original design disregarding the image so printed but in conjunction with and as continuation of the scribed portion thereof.

7. The method of making a photo-mechanical negative consisting in covering a transparent sheet with an opaque masking coating, depositing a scribable binding coating thereon, delineating a design by scribing the lines thereof through the aforesaid coatings, contact printing the design so scribed on a secondary negative also comprising a transparent sheet covered with an opaque masking coating, a scribable binding coating and a light-sensitive photographic emulsion deposited on said binding coating, developing the latent image thus made on the secondary negative, and scribing the design through the coatings of the secondary negative in agreement with the lines of the image so printed and developed.

8. The method of making a photo-mechanical negative consisting in covering a transparent sheet with an opaque masking coating, depositing a scribable binding coating thereon, delineating a design by scribing the lines thereof through the aforesaid coatings, contact printing the design so scribed on a secondary negative also comprising a transparent sheet covered with an opaque masking coating, a scribable binding coating and a light-sensitive photographic emulsion deposited on said binding coating, developing the latent image thus made on the secondary negative, and scribing through that portion of the image desired to be retained through the coatings of the secondary negative in agreement with the lines of the image, and scribing additions to the original design through the coatings of the secondary negative in conjunction with the first scribed portions of the original design.

9. The method of making a negative for line reproduction consisting in scribing lines to be reproduced through the masking coating of a sheet of negative material to create light passages, printing said lines by the passage of light through said light passages upon a second sheet of negative material having a light sensitive photographic emulsion and an underlying scribable masking coating thereon, developing the latent image so printed, scribing those portions of the image so developed to be retained in the masking coating of the second negative sheet, and scribing additions or continuations of such portions, as desired, also through the masking coating of the second sheet thereby creating a complete layout in the form of light passages in the second negative sheet.

10. A method of making a negative for line reproduction consisting of scribing the lines to be reproduced in a primary negative sheet having a scribable masking coating thereon, contact printing said lines on a secondary negative sheet having a scribable masking coating and on overlying layer of photographic emulsion, developing the latent image thus formed, scribing in said masking coating of the secondary negative sheet those portions of the image to be retained, and such additions, alterations or continuations as are to be incorporated in said secondary negative.

11. A negative for line reproduction comprising a backing member, a coating containing aluminum dust lightly adhered to said backing member by lacquer, and an overlying binding coating consisting of lacquer, zinc oxide and titanium dioxide.

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