April 3, 1945. G. B. CROUSE 2,372,767

METHOD FOR MAKING TEMPLATES AND THE LIKE

Filed July 8, 1941

Fig. 1

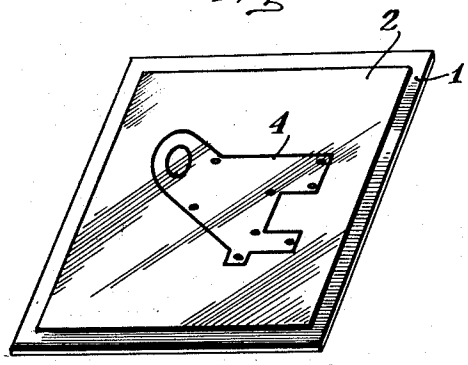


Fig. 2

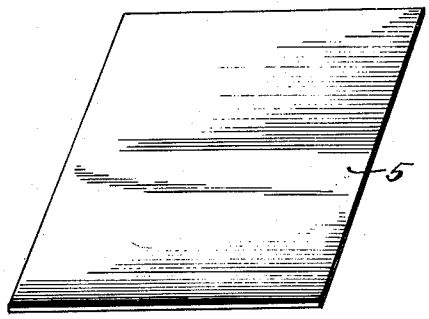


Fig. 3

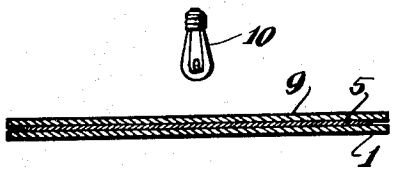


Fig. 2a

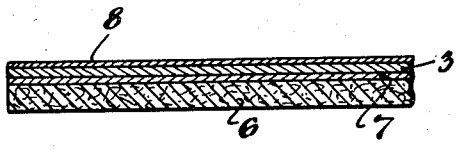


Fig. 4

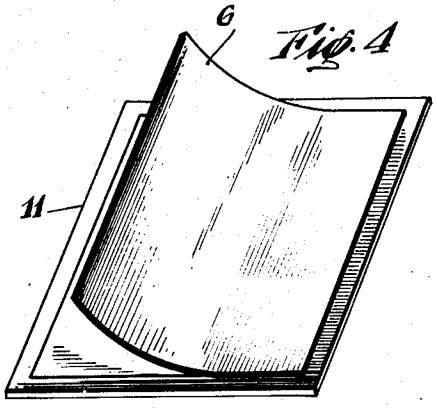


Fig. 4a

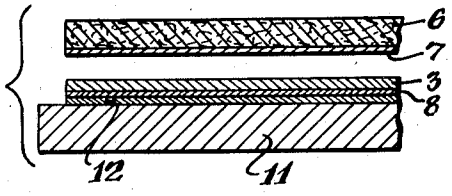
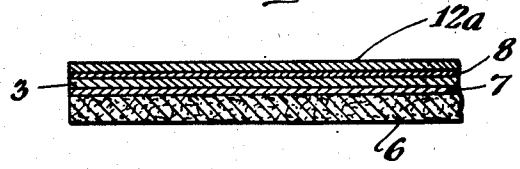


Fig. 5



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METHOD FOR MAKING TEMPLATES AND THE LIKE

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6 Claims. (Cl. 95—5)

The present invention relates particularly to an improved method for reproducing drawings on blanks to facilitate their manufacture into various articles.

The time required for making accurate scale drawings of parts for airplanes and other equipment occasions delays in the manufacture thereof and increases their cost. The present invention is a simplification of the methods heretofore used and a reduction in the time required and the cost of reproducing the drawings on blanks for templates and the like. Heretofore, the general practice has been to make scale drawings on the drafting board first and thereafter to copy over manually the scale drawings onto the template or other part to be manufactured. The time required is substantial and the chances of errors increase with the complication of the drawings, requiring numerous checking operations. In spite of all precautions, some errors are overlooked resulting in additional cost and loss of time in re-making parts and drawings.

The present invention aims to overcome or minimize the above and other objections and difficulties by providing an improved, relatively simple means and method for transferring reproductions of drawings to blanks adapted to be used for making templates, patterns and the like.

An object of the present invention is to reduce the time required for providing accurate scale drawings on blanks for templates and other parts to be manufactured.

Another object of the invention is to simplify the manufacture of airplane parts.

Another object of the invention is to provide a simple method which eliminates errors in the transfer of original scale drawings to a template or the like without impairing in the reproduction the accuracy of the dimensions in the original scale drawings.

Another object of the invention is to provide an improved method utilizing a light-sensitive film having a reinforcing backing adapted to retain the dimensional characteristics thereof during exposure and adapted to be removed after the exposed film is applied to a blank for a template.

Other and further objects of the invention will be obvious upon an understanding of the illustrative embodiment about to be described, or will be indicated in the appended claims, and various advantages not referred to herein will occur to one skilled in the art upon employment of the invention in practice.

A preferred embodiment of the invention has been chosen for purposes of illustration and description and is shown in the accompanying drawing, forming a part of the specification, wherein

Fig. 1 is a perspective view of a simple drawing on a rigid backing which prevents any material variations in the dimensions thereof;

Fig. 2 is a perspective view of the preferred embodiment of light-sensitive material for use in the method;

Fig. 2a is a fragmentary sectional view greatly enlarged and exaggerated to show the type and character of the laminations of the composite sheet shown in Fig. 2.

Fig. 3 is a diagrammatic view showing the exposure of the light-sensitive material to reproduce the drawing of Fig. 1 thereon.

Fig. 4 is a perspective view showing the exposed sheet of Fig. 2 adhered to a template with the reinforcing backing being removed.

Fig. 4a is an exploded view of the composite sheet of Fig. 2 adhered to a template with the reinforcing backing removed.

Fig. 5 is a fragmentary sectional view illustrating another embodiment of light-sensitive material.

Referring again to the drawing and more particularly to Fig. 1, there is shown a backing 1 of metal, glass or other suitable rigid material. A lacquer or other coating 2 is preferably applied to one surface of the backing to facilitate the making of a drawing 4 thereon. Paper secured to the backing by a suitable adhesive gives excellent results, but a lacquer or other coating may be utilized. The drawing 4 is accurately made to scale so that it may be reproduced on a blank and a template or other device made therefrom by cutting along the lines of the drawing. Heretofore it has been customary for a draftsman to reproduce, with the usual drafting instruments, the drawing shown in Fig. 1 on the surface of a template blank. Thereafter, the drawing had to be checked to avoid errors; the template was then formed by cutting away those portions indicated on the drawing. The drawing must be made accurately to scale on the template in order to have the part the proper size and in order to have the rivet holes and other irregularities accurately in position to fit with cooperating parts in the manufacture of the airplane or machine. In addition, a separate drawing had to be made on template blanks for each template required.

The present method contemplates the reproduction photographically of the drawing shown in Fig. 1 onto the template blank shown in Fig.

4 without material distortion of any of the scaled portions. In doing this, applicant provides a light-sensitive sheet of material 5 shown generally in Fig. 2 and shown in detail in Fig. 2a. The preferred embodiment of material comprises a sheet of relatively tough, smooth paper 6 coated with superimposed layers of a moisture resisting and water insoluble lacquer 7, a light-sensitive emulsion 3 of any suitable composition, for example, a gelatin-silver halide emulsion, and a protective layer or bonding layer 8 which may be made of collodion or a similar material.

Preferably the layer 8 forms a water resistant surface over the emulsion. The protective or bonding layer 8 may be omitted in certain instances but its use is preferred as the light-sensitive layer is thus enclosed between waterproof or water resistant layers. This prolongs the life of the light-sensitive layer.

In order to reproduce the drawing on the light-sensitive material shown in Figs. 2 and 2a the material is placed over the drawing shown in Fig. 1 with the protective or bonding layer 8 contacting the drawing. A suitable plate 9 of opal glass or the like may be placed over the sheet of material 5 to assist in holding it firmly and evenly against the drawing. A light source 10 of any suitable type may be utilized for producing a reflex print on the light-sensitive sheet 5. In view of the fact that only the protective or bonding layer 8 separates the drawing 4 from the light-sensitive emulsion 3, a contact print is obtained which must be accurate in all details. If the backing 1 for the drawing 4 of Fig. 1 is made of glass or other transparent or translucent material, the light 10 may be placed under the backing 1 to allow light rays to pass through the drawing 4 in obtaining a photographic reproduction on the light-sensitive material 5.

Preferably, the atmosphere in the room where the exposure is made and where the light-sensitive material is kept, is air-conditioned to avoid any contraction or expansion thereof. In order to guard further against contraction and expansion, the light-sensitive material is applied to the template blank immediately after exposure, allowing as little time as reasonably possible for any changes to take place. In order to effect this transfer the template blank, guide or pattern 11 shown in Figs. 4 and 4a is provided with an adhesive coating 12 which preferably is of the type described hereinafter. The light-sensitive material is applied to the template 11 with the protective or bonding surface 8 facing downwardly in contact with the adhesive 12. Suitable heat and a vacuum pad such as that illustrated in Fig. 9 of my prior application identified above may be utilized in securing the two together. Thereafter the paper 6 is stripped off and carries with it the lacquer coating 7, as shown more particularly in Fig. 4a. The stripping off of the paper leaves the light-sensitive emulsion exposed and adhered to the template 11. Since the template blank 11 is of rigid material it prevents distortion of the emulsion. While thus supported on the surface of the template blank the emulsion thereon may be processed and developed to reproduce the drawing 4 thereon. Since the processing operations, which require the use of liquids, are done after the light-sensitive material is secured to the template blank, distortion is minimized or completely prevented. Since the reproduction is made while the drawing and light-sensitive sheet of material are in contact, there is no opportunity for distortion in the reproducing operation. No lenses are required and no distances have to be measured. Hence, the usual errors of photography are avoided.

While in the preferred embodiment where the drawings are to be reproduced on a template blank, it is preferred to apply the adhesive coating 12 to the template surface, the adhesive coating may be applied to the light-sensitive material. Fig. 5 illustrates the coating 12a so applied. The light-sensitive material is identical with that shown in Fig. 2a, except that the adhesive 12a is added onto the bonding layer 8. When the light-sensitive material is applied to the template blank, the paper 6 and the lacquer coating 7 are stripped off in the same manner as shown in Fig. 4a.

By applying adhesive to the metal plate or template blank as shown in Figs. 4 and 4a, a coating may be utilized which is permanently tacky. This will permit the light-sensitive material to be adhered or bonded to the template blank in a vacuum or other suitable place without the application of heat. While this construction is not as desirable as one bonded with heat, it is simpler and gives satisfactory results for many purposes.

The adhesive used on the template blank 11 should meet certain requirements. The adhesive should retain its properties when subjected to the action of processing solutions and the bond formed thereby should be strong enough to withstand the stresses set up by the wetting. The adhesive also should soften at a relatively low temperature when the paper or a light-sensitive emulsion is applied in order to avoid using temperatures sufficiently high to impair the light-sensitive emulsion. In addition, the adhesive should not soften at the temperatures created in the metal plate by machining and grinding operations. The latter may run up as high as 475 degrees Fahrenheit. The preferred embodiment of adhesive utilizes a thermo-plastic adhesive whose softening point increases after the first application of heat. This result may be achieved by adding to the adhesive a volatile plasticizer which will not be appreciably volatilized by the temperature of the air used to remove the coating solvents. The presence of the plasticizer serves to lower the softening point of the plastic at the first heating, where a substantial portion of the plasticizer will be volatilized so that, thereafter, a temperature substantially higher, such as 475 degrees Fahrenheit will be required to soften the material. While there is no intention of limiting the invention to the particular examples given, the following two examples will be illustrative: First, six parts of polyvinyl acetate (medium viscosity), thirty parts methanol and one part diethylene glycol monobutyl ether; second, six parts polyvinyl acetate (medium viscosity), thirty parts toluene, and one part phenol formaldehyde resin of the thermo-setting type. The above adhesive may be applied to the paper by any desired method or it may be applied to the metal blank by flowing it evenly over the surface and drying.

By utilizing a vacuum press it is possible to apply the sheet of material to a template blank without wrinkles in it. In this way, a smooth surface is obtained which avoids any irregularities in the finished reproduced drawing.

In the operation of the method, the draftsman first makes a scale drawing on a surface 2 on a

backing 1. Thereafter the light-sensitive material shown in Figs. 2 and 2a is applied with the protective or bonding layer adjacent the drawing and with the paper 6 at the side remote from the drawing. A contact print is made by reflex printing or by having the backing plate 1 made of a transparent material and allowing the light rays to pass through it. If desired, a type of emulsion may be utilized which produces a positive instead of a negative in the reflex printing. Immediately after the exposure the light-sensitive material is adhered to the template blank 11 by the adhesive 12, preferably by utilizing a vacuum press such as illustrated in my prior application. The paper 6 and the lacquer coating 7 are then stripped off from the emulsion, leaving the emulsion and the bonding layer adhered to the template blank 11, through the intermediation of the adhesive 12. The emulsion is thus held firmly in place against distortion of any kind and is ready to be subjected to the processing, developing and fixing solutions, after which the drawing 4 will be reproduced accurately on the template. The template blank then may be cut away or ground away, using the reproduced drawing as a guide, in order to produce a finished template.

It will be seen that the present invention provides an improved method of reproducing drawings on template blanks without loss of accuracy and in minimum time. A single sheet of light-sensitive paper is sufficient to transfer a drawing onto a template blank. Since the exposed light-sensitive material is turned over, the reproduction of the drawing which appears on the template blank is not a reversed or mirror image but an actual positive reproduction of the original drawing. By using a suitable emulsion, the black and white may likewise be reproduced as upon the original drawings without being reproduced as negatives, although in most cases the reverse of the black and white portions are not objectionable. The reproduction is done without lenses by having the surfaces in actual contact which increases the accuracy and simplifies the operation. The final reproduction is adhered to the template with an adhesive capable of withstanding the high temperatures to which it may be subjected. The present method simplifies the operations and has unusual advantages with various types of work. Sheets of the preferred or modified material which carry the light-sensitive layer may be readily cut, packed and stored, or the material may be supplied in rolls. It is not necessary to take any extraordinary precautions in exposing the light-sensitive layer carried by the material.

As various changes may be made in the form, construction and arrangement of the parts herein without departing from the spirit and scope of the invention and without sacrificing any of its advantages, it is to be understood that all matter herein is to be interpreted as illustrative and not in a limiting sense.

Having thus described my invention, I claim:

1. The method of making templates, patterns and the like, which comprises applying an overcoating of material suitable for receiving a drawing to a relatively rigid surface, making a drawing on said coating, applying a water-proofing lacquer to a sheet of paper, securing a light-sensitive surface to the lacquered side of said sheet of paper, placing said drawing and said light-sensitive surface substantially in contact, transferring a reproduction of the drawing to the light-sensitive surface while they are superimposed, adhesively securing said light-sensitive surface to a template blank or the like immediately after exposure by a thermoplastic adhesive, which does not require wetting and which requires a higher temperature to soften after application by heat than before, with the exposed side thereof facing the blank, the transfer of the reproduction of the drawing to the light-sensitive surface and the securing of the light-sensitive surface to the blank being performed in an air conditioned atmosphere to prevent dimensional changes therein, thereafter processing said light-sensitive surface adhered to the template to develop and fix said reproduction of the drawing thereon and shaping said blank in accordance with the reproduction thereon to produce a template.

2. The method of making templates, patterns and the like, which comprises making a drawing on a relatively rigid surface, applying water-proofing lacquer to a sheet of paper, securing a light-sensitive surface to the lacquered side of said sheet of paper, applying water resistant coating over said light sensitive surface, placing said drawing and said light-sensitive surface with the coating thereover in contact, transferring a reproduction of the drawing while they are superimposed, adhesively securing said coated light-sensitive surface to a template blank or the like, prior to wetting, by means of a thermoplastic adhesive with the exposed side thereof facing the blank, removing the paper from said light-sensitive surface leaving the light-sensitive surface adhered to the template blank, processing said light-sensitive surface to develop and fix said reproduction of the drawing thereon and shaping said blank in accordance with the reproduction thereon to obtain a template.

3. The method of making templates and the like, which comprises securing a sheet of paper or the like suitable for receiving a drawing to a relatively rigid backing material, making a drawing on said sheet of paper, placing said drawing and a stiffened light-sensitive surface substantially in contact, transferring a reproduction of said drawing to said stiffened sensitized surface, adhesively securing said stiffened sensitized surface to a template sheet or the like, immediately after exposure, by a thermoplastic adhesive, which does not require wetting and which requires a higher temperature to soften after application by heat than before to prevent dimensional changes therein, the exposed side of the sensitized surface facing the template sheet and thereafter processing said sensitized surface on the template sheet to develop and fix the reproduction of said drawing thereon to minimize dimensional changes in the reproduction.

4. The method of making templates and the like, which comprises applying a coating material suitable for receiving a drawing to a relatively rigid surface, making a drawing on said coating, placing said drawing and a light-sensitive surface substantially in contact, said light-sensitive surface being on one side of a backing member, transferring a reproduction of said drawing to said sensitized surface, adhesively securing said sensitized surface to a template sheet or the like, immediately after exposure, by a thermoplastic adhesive, which does not require wetting and which requires a higher temperature to soften after application by heat than before to prevent dimensional changes therein, the sensitized surface being between the backing member and the template sheet, removing the backing member from the sensitized surface, and thereafter processing said sensitized surface on the

template sheet to develop and fix the reproduction of said drawing thereon to minimize dimensional changes in the reproduction.

5. The method of making templates and the like which comprises securing a sheet of paper or the like suitable for receiving a drawing to a relatively rigid surface, making a drawing on said sheet of paper, placing said drawing and a light-sensitive surface applied to a backing substantially in contact, transferring a reproduction of said drawing to said light-sensitive surface, adhesively securing said sensitive surface to a template sheet or the like, prior to wetting by a thermoplastic adhesive, which does not require wetting and which requires a higher temperature to soften after application by heat than before to prevent dimensional changes therein, the exposed side of the sensitized surface facing the template sheet, stripping the backing from the sensitized surface, thereafter processing said sensitized surface on the template sheet to develop and fix the reproduction of said drawing thereon to minimize dimensional changes in the reproduction, and shaping said template sheet in accordance with the reproduction thereon to produce a template.

6. The method of making templates and the like, which comprises applying a coating material suitable for receiving a drawing to a relatively rigid surface, making a drawing on said coating material, placing said drawing and light-sensitive surface applied to a backing member substantially in contact, transferring a reproduction of said drawing to said sensitized surface, adhesively securing said sensitized surface to a template sheet or the like prior to wetting by a thermoplastic adhesive, which does not require wetting and which requires a higher temperature to soften after application by heat than before to prevent dimensional changes therein, the exposed side of the sensitized surface facing the template sheet, stripping the backing member from the sensitized surface, thereafter processing said sensitized surface on the template sheet to develop and fix the reproduction of said drawing thereon to minimize dimensional changes in the reproduction, and shaping said blank in accordance with the reproduction thereon to produce a template.

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