METHOD OF MAKING A PRINTING PLATE

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ABSTRACT

A method of making a printing plate having an image formed in relief thereon in which a copy of the image is placed over a layer of a light sensitive emulsion carried on a rigid backing plate. The copy and emulsion are exposed to light, with the image masking the underlying portion of the emulsion. The masked portion of the emulsion is removed and the remaining emulsion is cured into a rigid state with a recess disposed therein corresponding to the size and shape of the image. The cured emulsion is then placed in contact with an uncured pliable plate-forming material, and said material is formed into a self-supporting state with a reproduction of the image projecting therefrom.

7 Claims, 6 Drawing Figures
Fig. 1

STEP 1

STEP 2

STEP 3

STEP 4

Fig. 2

STEP 5
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METHOD OF MAKING A PRINTING PLATE

This application is a continuation-in-part application of my copending application Ser. No. 208,857, filed Dec. 16, 1971 now abandoned.

BACKGROUND OF THE INVENTION

In the formation of printing plates, it has been the conventional practice to form said plates by first etching a reproduction of the desired image into a zinc plate. A thermoplastic mold material is then brought into contact with the etched plate to form the mold for the subsequent formation of the printing plate itself. After this mold has been formed, it is brought into contact with an uncured plate-forming material, and said plate-forming material is cured while it remains in contact with the mold to form the finished printing plate.

This process has certain inherent disadvantages. The etching step is a slow and laborious operation requiring the use of skilled craftsmen. Even with the use of such skilled craftsmen, mistakes and lack of proper definition between the image to be produced and the image subsequently produced on the plate arise. Further, if the etched zinc plates are to be re-used for forming a different printing plate, they must be melted and recast for the subsequent etching operation.

It is an object of this invention to overcome the difficulties and disadvantages of the conventional printing plate manufacturing method just described. More particularly, it is an object of the instant invention to eliminate the necessity for performing the etching step as practiced in such conventional methods.

SUMMARY OF THE INVENTION

In accordance with the preferred form of the invention, the image desired to be produced on the printing plate is photographed and a photographic positive is made thereof. The positive is placed on a layer of a light sensitive emulsion carried on a rigid backing plate with its image copy masking the underlying portion of the emulsion. The emulsion and positive are exposed to light, and after such exposure, the positive is removed. The exposed emulsion is washed with water to remove therefrom its masked portion and thereby form in the emulsion a recess corresponding in its configuration to the image.

In order to give the recess in the emulsion layer the desired depth, a subsequent layer of emulsion without a backing plate applied thereto is disposed over the first emulsion layer and bonded thereto. The positive is then mounted on the second layer, and the steps of exposing the positive and second emulsion layer to light and the subsequent removal of the masked portion of the second emulsion layer are repeated so that the first and second layers of the emulsion act in combination to provide a laminate having a recess corresponding to the size and configuration of the image and having a depth equal to the thickness of the two emulsion layers. This sequence of applying subsequent emulsion layers and exposing and removing their masked portions is repeated until an emulsion laminate having a recess of the desired depth is formed.

After the desired recess depth has been achieved, the emulsion laminate is cured into a rigid state and then placed in contact with an uncured pliable plate-forming material. The plate-forming material is cured under heat and pressure into the finished self-supporting plate having the image formed in relief thereon, which plate can then be stripped from the emulsion laminate.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings illustrate the invention. In such drawings:

FIG. 1 is a diagrammatic representation of a flow diagram showing the processing steps in carrying out the invention, with Steps 1 and 3 being shown in exploded form and Step 5 being shown in section;

FIG. 2 is a perspective view of the printing plate made according to the processing sequence shown in FIG. 1;

FIG. 3 is a diagrammatic representation of a flow diagram showing another embodiment of the invention, with Steps 1 and 3 being shown in exploded form and Step 5 being shown in section;

FIG. 4 is a perspective view of a printing plate formed according to the method illustrated in FIG. 3;

FIG. 5 is an enlarged vertical section taken on the line 3—3 of FIG. 4; and

FIG. 6 is a perspective view of a piece of art work containing the image to be produced.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

In carrying out my invention, I first form a photographic positive 12 from the art work containing the image to be reproduced on the printing plate 10. The positive 12, which contains a photographic copy 13 of the image, is formed by conventional photographic techniques.

After the positive 12 has been formed, it is placed over and in contact with a layer 14 of light sensitive emulsion fixedly bonded to a rigid backing, conveniently a metal plate 16. The emulsion consists of a conventional emulsion base to which is added a light sensitive agent such as ammonium dichromate. The agent per se may be added directly to the emulsion base or it may be combined with a carrier, preservative, and wetting agent such as in the Deep-Etch Positive Sinitizer sold by Lith-Kem Corporation of Lynbrook, New York. The sensitizing agent, when it is used alone, is added to emulsion base at the rate of about 1 ounce (avoidupois) of sensitizer per 160 fluid ounces of emulsion base, but when said Deep-Etch Positive Sinitizer is used, that material must be added to the emulsion base at the rate of about one fluid ounce per eight fluid ounces of emulsion base to get the proper amount of the active sensitizing agent.

For reasons that will become more apparent hereinafter, the back plate 16 is a heat conductive metal plate. I have achieved excellent results using aluminum for such a plate because of its heat conductive properties. The emulsion layer 14 is applied to the plate in a film having a thickness of about .005 to about .005 inches.

After positive 12 has been placed in intimate contact with the emulsion layer 14, they are exposed to light. The amount of such exposure will depend upon the intensity of the light source, the thickness of the emulsion layer, and the spacing between the light source and the positive 12. During such exposure, the image copy 13 on the positive 12 will, of course, mask the portion of the emulsion underlying it to shield said portion from the light while the light penetrates completely through
the unmasked portions of the emulsion. After such exposure, the positive 12 is removed from the emulsion layer and the exposed emulsion is washed with water. The water washes away the previously masked portion of the emulsion and thereby forms a recess 18 in emulsion layer 14 corresponding to the configuration of the image copy 13 on positive 12 as shown in Step 2 of FIG. 1. Desirably, the water is at a temperature of about 100°F. If the temperature is substantially lower, the washing step takes an excessive amount of time. If the water temperature is substantially higher, care must be exercised to prevent the emulsion from setting up into a rigid mass.

The light striking the emulsion causes it to partially cure. If a greater degree of cure is desired, the emulsion, after exposure, but before the water washing step, may have a developer sprayed thereon. One such developer which I have employed is sold under the name Deep-Etch Developer No. 3000 by theforesaid Lith-Kem Corporation, and employs a mixture of hydroxycetic acid, zinc chloride, calcium chloride, and potassium chloride as active ingredients.

In most applications, the single emulsion layer 14 will not form a recess 18 of sufficient depth for producing the desired printing plate configuration. Therefore, as shown in Step 3 of FIG. 1, a second emulsion layer 20 is placed over the layer 14. The emulsion layers are then heated to a temperature sufficient to bond them together, usually about 200°F. This forms an emulsion laminate on the backing plate 16.

After the laminate has been formed, the positive 12 is placed over and in contact with the second emulsion layer 20 with its image copy 13 aligned precisely with the recess 18 previously formed in layer 16. This multiple layer sandwich is again exposed to light, and after such exposure, the positive 12 is removed and the washing step or the developing and washing step is again repeated. This forms, as shown in Step 4 of FIG. 1, a recess 18' in layer 20 disposed in the previously formed recess 18 in layer 16. This sequence of applying subsequent emulsion layers and exposing and washing them is repeated until a recess having a desired depth is formed in the emulsion layers.

As shown in Step 4 of FIG. 1, the recesses 18 and 18' extend downwardly through the emulsion layers to the backing plate 16. I have found that if any of the layers have a greater thickness than about .050 inches, the light, during the exposure step, cannot penetrate for the full depth of the emulsion layer. Further, the washing step tends to break away portions of the emulsion that were exposed to light, thereby destroying the precise definition of the image projection on the finished plate. When emulsion layers having a thickness substantially less than about .005 inches are employed, it will, of course, be necessary to use an excessive number of emulsion layers to form a laminate having the desired recess depth.

After the emulsion laminate has been formed containing an image recess of desired depth, it is placed over a layer of uncured pliable plate-forming material 22 as shown in Step 5 of FIG. 1. A conventional plate-forming material 22 may consist of a moldable rubber latex. The laminate is compressed against the plate-forming material 22 at a pressure of from about 400 to about 1,200 psi while the material 22 is heated to about 320°F for about 10 minutes to cure into a self-sustaining state. As shown in Step 5 of FIG. 1, the material 22 projects into the recesses 18 and 18' and is cured therein to thus form a projection 23 on the finished plate 12 having a printing face 27 corresponding in size and configuration to the image. After such curing, the finished plate 10 can be simply peeled from the emulsion layer laminate.

If the emulsion laminate does not have sufficient rigidity after its exposure and before it is brought into contact with the plate-forming material 22, the laminate may be cured. Such curing can be effected by simply storing the laminate until the emulsion has dried to the sufficient rigidity. Alternatively, it may be heated to about 400°F for at least an hour. I have found that if it is heated too rapidly, bubbles will be formed in the emulsion which will produce imperfections in the finished printing plate. During such heat curing, the backing plate 16, in addition to giving rigidity to the emulsion laminate, will serve as a heat sink to effect an efficient and uniform curing of the emulsion layers.

As shown in FIG. 4, it is frequently necessary to form a printing plate 30 from art work or copy which has small images, such as for example, fine printing. The projection 32 on the plate 30 for such small images must have a sharp definition of its image projections 33. An embodiment of my invention which is particularly well adapted to form such small image projections on a printing plate is shown in FIG. 3.

In carrying out the method sequence shown in FIG. 3, the art work containing the image is photographed twice to produce two photographic positives 35 and 36. In forming the positive 35, the image copy 37 on the positive is slightly distorted to make said copy slightly larger than the image on the art work being photographed, while the positive 36 is formed with its image copy 38 the same size as the image on the art work. Thus, the image copy 38 is smaller than the copy 37.

After the positives 35 and 36 are formed, positive 36 is placed on a light sensitive emulsion layer 40 mounted on backing plate 42, and said layer and positive are exposed to light with the image copy 38 masking the underlying portion of the emulsion. When the exposure has been completed, the positive 35 is removed, and the emulsion is washed to flush out its masked portions and thereby form a recess 45 in said emulsion which has the same size and configuration as the image.

A second emulsion layer 47 is placed over the emulsion layer 40, and they are heated to about 200°F to bond them together and form an emulsion laminate. The positive 35 is placed on the laminate with its image copy 37 disposed in a centered or aligned position over the recess 45. The positive 35 and laminate are exposed to light with the image copy 37 masking the underlying portion of the emulsion layer 47. The positive is then removed, and the laminate is washed to flush out the masked portion of the emulsion layer and thereby forms a recess 45' in said layer which is the same shape as, but larger than, the image to be produced.

As in the embodiment previously described, if the laminate is not sufficiently rigid, it is then cured into a rigid state in the manner previously described. After curing, the laminate is placed over a layer of uncured pliable plate-forming material 50, and said material is cured into a rigid state while being compressed against the laminate in the same manner as previously described in connection with Step 5 of FIG. 1 to thus form the printing plate 30.
As shown in FIGS. 4 and 5, because of the difference in the sizes of the image copies 37 and 38, the image projection 32 on plate 30 will have a tapered configuration. Thus, the base portion 52 of projection 32 will have a greater cross-sectional extent than the printing face 33. This creates a sharp definition of the image being printed and resists the tendency of the projection to bend as it is forced against the object that is being printed.

As with the embodiment shown in FIG. 1, any desired number of emulsion layers may be employed to form the plate 30, the number of such layers depending upon the depth of the recesses desired in the laminate. While two positives, such as positives 35 and 36, can be employed in producing the recesses in a laminate containing more than two emulsion layers, additional positives can also be employed. In such case, it is desirable to have the image copies on such positives vary in size between the largest such reproduction and the one corresponding to the exact size of the printing face 33 on the plate projection 32. In any event, the first positive to be exposed should be the one having an image reproduction size corresponding to the desired size of the printing face 33. When such successively sized image copies are employed with successive emulsion layers, the projections 32 will have a gradual and smooth taper along their length.

In the sequence shown in FIG. 3, it is to be understood that the recesses in the emulsion layers can be formed by the water wash alone or the combination of the developer and water washing operations as described in connection with the sequence shown in FIG. 1.

As shown in FIG. 6, if the art work 60 upon which the image 62 if formed is made from a sheet 63 of transparent or other non-opaque material, such as for example, acetate film, the art work itself can be employed without the necessity of forming a photographic positive. In such a process, the art work is laid directly on the emulsion with the image 62 masking the underlying portion of the emulsion during the exposure step. After such exposure, the portion of the emulsion which was masked by the image 62 is removed in the manner previously described to form a recess in the emulsion corresponding to the size and shape of the image. Of course, in using the art work in this manner, a positive sensitizer is used the same as with the positives 10, 35 and 36.

As will be understood, pairs of the art work sheets 60 having different sized copies of the images can be employed in the same manner as the positives 35 and 36 to produce tapered image projections on the finished printing plate like the projections 32 shown in FIGS. 4 and 5.

In the formation of any of the emulsion laminates wherein multiple layers of emulsion are employed, as the layers 14 and 20, and the layers 40 and 47, it is possible to eliminate the washing step in between the exposures of the layers. Thus, the first emulsion layer can be exposed, the second layer bonded to the first layer, and exposed, and then a single washing step is carried out to simultaneously form the recesses in both emulsion layers.

In the method described herein, it is to be understood that after the emulsion laminate has been used to form the finished plate 10 or 30, the emulsion layer or layers can be stripped from the backing plate 16 or 42 and said plate can be used for formation of subsequent laminates.

I claim:

1. A method of making a printing plate having an image formed in relief thereon, comprising the steps of forming a copy of a piece of work having said image thereon and placing said copy on a first layer of a light sensitive emulsion, exposing said copy and emulsion to light with the image copy masking the underlying portion of said emulsion, removing the masked portion of said emulsion, placing a second layer of said emulsion on said first layer and bonding said layers together, placing said copy on said second layer of emulsion and exposing said copy and second layer of emulsion to light with the image copy masking the underlying portion of said second layer, removing the masked portion of said second layer, placing the emulsion layers in contact with a pliable plate-forming material, curing said material into a self-supporting state while it is maintained in contact with said emulsion layers, and separating the cured plate-forming material from said emulsion layers.

2. A method of making a printing plate as set forth in claim 1 in which each of said emulsion layers has a thickness of from about .005 to about .050 inches, and said layers are bonded together by heating said layers to about 200° F.

3. A method of making a printing plate as set forth in claim 1 in which each of said emulsion layers has a thickness of from about .005 inches to about .050 inches, and said plate-forming material is cured by heating for about ten minutes at a temperature of about 320° F.

4. A method of making a printing plate as set forth in claim 1 in which said masked portions of the emulsion are removed by washing said layers with water.

5. A method of making a printing plate as set forth in claim 1 in which said masked portions of the emulsion are removed by applying a developer to said emulsion layers and then washing them with water.

6. A method of making a printing plate having an image formed in relief thereon, comprising the steps of making a first copy of a piece of work having an image thereon, making a second copy of said piece of work having the image thereon, the image on the first copy being larger than the image on the second copy, placing said second copy on a first layer of a light sensitive emulsion, exposing said second copy and emulsion to light with the image on said second copy masking the underlying portion of the emulsion, removing the masked portion of said emulsion to form a first recess in said emulsion corresponding to the image reproduction on said second copy, placing a second layer of said emulsion on said first layer and bonding said layers together, placing the first copy on said second layer with its image in alignment with said first recess and masking the underlying portion of said second layer, exposing said first copy and second layer to light, removing the masked portion of said second layer to form a second recess in said second layer corresponding to the image on said first copy and in alignment with said first recess, placing the emulsion layers in contact with a pliable plate-forming material, curing said material into a self-supporting state while it is maintained in contact with said emulsion layers, and separating the cured plate-forming material from said emulsion layers.
7. A method of making a printing plate having an image formed in relief thereon, comprising the steps of forming a copy of a piece of work having said image thereon and placing said copy on a first layer of a light sensitive emulsion, exposing said copy and emulsion to light with the image copy masking the underlying portion of said emulsion, placing a second layer of said emulsion on said first layer and bonding said layers together, placing said copy on said second layer of emulsion and exposing said copy and second layer of emulsion to light with the image copy masking the underlying portion of said second layer, removing the masked portions of said first and second layers, placing the emulsion layers in contact with a pliable plate-forming material, curing said material into a self-supporting state while it is maintained in contact with said emulsion layers, and separating the cured plate-forming material from said emulsion layers.