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D. A. NEWMAN ET AL
PLANOGRAPHIC PRINTING PLATES AND METHODS
FOR PREPARING THE SAME
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Fig. 1

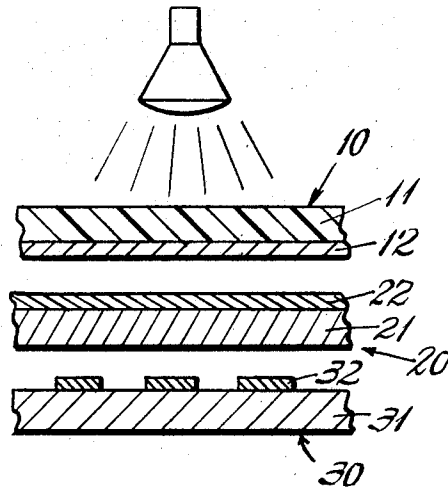


Fig. 2

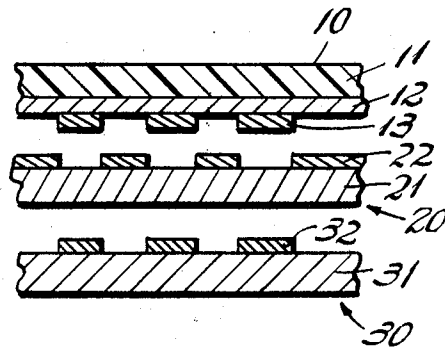
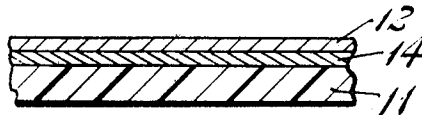


Fig. 3



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PLANOGRAPHIC PRINTING PLATES AND METHODS FOR PREPARING THE SAME

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Continuation-in-part of application Ser. No. 568,936, July 29, 1966, which is a continuation-in-part of application Ser. No. 517,882, Dec. 13, 1965, which in turn is a continuation-in-part of application Ser. No. 273,659, Apr. 17, 1963. This application June 7, 1967, Ser. No. 644,203

Int. Cl. B41m 5/04; B41n 1/00

U.S. Cl. 101—460

5 Claims

ABSTRACT OF THE DISCLOSURE

Film-base planographic printing plates for thermographic imaging having a synthetic thermoplastic hydrophobic plastic film foundation having thereon a hydrophilic intermediate layer covered by a hydrophilic polyvinyl alcohol planographic printing layer, each layer being applied as an aqueous composition containing a water-miscible aliphatic alcohol having from 1 to 5 carbon atoms.

This application is a continuation-in-part of copending application Ser. No. 568,936, filed July 29, 1966, which in turn is a continuation-in-part of application Ser. No. 517,882, filed Dec. 13, 1965, now abandoned, which in turn is a continuation-in-part of application Ser. No. 273,659, filed Apr. 17, 1963, now abandoned.

In the art of planographic printing, plates are provided having a surface coating which is hydrophilic and oleophobic in nature. When it is desired to produce copies of subject matter, the subject matter is inscribed on the hydrophilic coating of the plate in the form of oleophilic images, etching solution is wiped over the hydrophilic coating to wet the plate and render the unimaged areas water-receptive, and the plate is mounted on a planographic printing machine. On the machine the plate is continuously moistened with fountain solution containing dilute etching solution by means of a water roll and contacted with an oleous ink which adheres to the plate only in the oleophilic image areas. The ink is transferred from the image areas to an offset roller and then to a series of copy sheets to form one thousand or more copies of the original subject matter, as desired.

Planographic printing plates are conventionally formed of relatively heavy paper stock which is pretreated to give it wet strength properties. Due to the porosity and absorption properties of paper, plates based thereon must be treated with far more etching solution than is necessary to accomplish the intended function of rendering the hydrophilic coating ink-repellent. Most of the applied etching solution is absorbed by the paper stock and is wasted in this manner. Because of this, the etching solution must be manually applied to the plate surface before the plate is mounted on the printing machine. Also, most paper base plates do not have the necessary translucency to meet the requirements of the recent application of planographic plates to the field of thermography wherein the oleophilic images are automatically applied to the plate surface and/or fused in place by means of infrared radiation.

While it is possible to apply conventional planographic compositions in conventional weights to plastic film foundations, plates produced in this manner are completely unsatisfactory for thermographic imaging purposes. Most plastic film foundations are hydrophobic and repel an aqueous planographic composition and resist the formation of a good bond between the film surface and

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the dried planographic layer. This incomplete bond is not a serious disadvantage with film-base plates which are manually imaged because the typing or imaging pressure transfers the oleophilic imaging composition to the plate coating and secures it thereto. However such an incomplete bond renders film-base plates inoperative for thermographic imaging since the plate coating does not have sufficient strength to resist being stripped off onto the oleophilic imaging layer. In the thermographic process the oleophilic imaging layer and the planographic plate coating are fused together in the heated image areas and then the sheets are stripped apart. The plate coating must be sufficiently well-bonded to its film foundation to be able to pull the fused areas of the oleophilic imaging layer from its foundation.

Conventional planographic compositions are aqueous dispersions which generally contain a high amount of filler relative to hydrophilic binder, in the area of about five or more parts per part of binder, and are applied at a rate of at least 6 to 8 pounds per ream so that the formed coatings are very high in filler content per ream of foundation, a ream equaling 500 sheets 25" x 38". While such coatings produce excellent results on paper for manual imaging, they are completely unsatisfactory for use on plastic film for thermographic imaging since such coatings pick or transfer to the surface of the oleophilic imaging layer rather than vice versa during the heat-imaging step, and also pick or transfer to the ink roll of the planographic printing machine during the printing step.

Faced with these problems, we have attempted to produce a planographic plate which requires a minimum of etching solution and which is transparent so as to eliminate the diffusion and reflection of infrared radiation. The use of a plastic film foundation in place of paper showed promise except for the fact that conventional planographic coating compositions and conventional coating thicknesses do not adhere to thin plastic film foundations sufficiently well to resist stripping from the film during the imaging of the plate and/or during the production of printed copies in the planographic process.

Elimination of the opacifying filler from the planographic composition improved the adhesion between the film and coating and the translucency of the plates but resulted in plates which require more than simple machine moisture conditioning (require manual etching) and do not provide proper receptivity of the imaging material or retention thereof during printing. The use of conventional frosted or matte finish films also improves the adhesion between the film and the coating but insufficiently per se to overcome the problem.

The use of a separate intermediate layer between the film foundation and the planographic layer is useful in some instances but does not provide a reliable solution to the bonding problem. In order that the plate be correctable, the intermediate layer must be hydrophilic. As such it is repelled by the film foundation to nearly the same extent as the planographic coating composition. If the intermediate layer is not hydrophilic, then the plate is not correctable and there is no affinity between the planographic layer and the intermediate layer.

With all of these considerations in mind, the objections of the present invention are to produce a planographic printing plate which requires a minimum of etching solution capable of being supplied by the printing apparatus, which is sufficiently translucent to be reliably sharply imaged in the reflex thermographic process, and which has its planographic layer sufficiently well bonded thereto to resist being pulled from its foundation when the planographic layer is fused to an oleophilic layer in heated image areas and thereafter the sheets are stripped apart.

These and other objects and advantages are attained as

will be clear to those skilled in the art in the light of the present disclosure, including the drawing, in which:

FIGURE 1 is a diagrammatic cross-section, to an enlarged scale, of a transpicious film-base planographic printing plate according to one embodiment of this invention, superposed in the reflex process with a transfer sheet and an original sheet under the effects of infrared radiation.

FIG. 2 is a diagrammatic cross-section, to an enlarged scale, of the sheets of FIG. 1 after irradiation and separation, demonstrating the formation of oleophilic images on the planographic coating.

FIG. 3 is a diagrammatic cross-section, to an enlarged scale, of a transpicious film-base planographic printing plate according to another embodiment in which a hydrophilic intermediate layer is present.

The several objects and advantages of the present invention are accomplished by means of our discovery of a critical relationship between the surface of the hydrophobic plastic film being used and the intermediate layer used. We have discovered that hydrophobic film foundations form an exceptionally strong bond with hydrophilic polyvinyl alcohol coatings provided that the hydrophilic coating is applied as an aqueous composition containing from 1% to 10% by weight, based upon the total weight of the composition, of a water-miscible aliphatic alcohol containing from 1 to 5 carbon atoms. Hydrophilic coatings applied in this manner will not crack, flake or walk-off the plate surface during the imaging or printing steps.

The preferred hydrophobic plastic film foundations used according to the present invention are flexible films of styrene, polyethylene terephthalate polyester, chlorinated rubber, polyethylene, polypropylene, cellulose acetate, and the like.

The present plates are transpicious by which is meant that images of contrasting color on an underlying sheet in contact with the plate are clearly legible through the plate using incident light with no light required behind the underlying sheet. This definition includes only some translucent plates since degrees of translucency vary and those translucent plates which are not transpicious are found to diffuse and/or reflect infrared radiation to such a degree that they cannot be clearly or sharply imaged in the reflex thermographic process. The reflex process is as illustrated in the drawing.

The film foundation of the present plates should have a thickness which is no greater than about 2 mils and no less than about 0.5 mil. Greater thicknesses are unsatisfactory due to reduced flexibility, heat-conductivity and/or lateral radiation-transmissivity. Smaller thicknesses are difficult to handle, coat and use.

The film is preferably smooth but may be very lightly frosted or etched by chemical or mechanical means, if desired. Mechanically-frosted films are produced by casting the film against a lightly-etched drum. The frost or etch of the film must be so slight that the final coated plate is transpicious.

The planographic coating is applied in a thickness of from about 3 to no greater than about 5 pounds per ream so that the weight of filler per ream is kept as low as possible, within the range of from about 2 to 4 pounds per ream and preferably between 2 and 3 pounds per ream. The planographic coating composition generally has a solids content of 15% to 25%, over 90% of which consists of filler and polyvinyl alcohol binder material in a ratio of from a minimum of 1:1 to a maximum of about 5:1.

According to the present invention, the aqueous planographic composition includes a relatively small amount of a volatile lower aliphatic alcohol such as methanol, ethanol, propanol, butanol or pentanol or mixtures thereof, which is miscible with water and has a lower density and is more volatile than water. The volatile alcohol generally comprises from 3% to 6% by weight of the total planographic composition and appears to function

as a wetting agent for the intermediate layer, and reduces the surface tension of the aqueous planographic coating composition so that a more even coating can be applied. There is evidence also that the alcohol dissolves the oily plasticizer which is present at the surface of most plastic films. Such plasticizers are generally oily materials such as dioctyl phthalate which tend to repel an aqueous composition.

The hydrophobic film is coated with a continuous intermediate layer of aqueous polyvinyl alcohol composition which also contains said water-miscible aliphatic alcohol of from 1 to 5 carbon atoms. The hydrophilic layer has the ability to bond to the hydrophobic film much more firmly than any planographic printing coating due to the fact that the layer contains at most 25% by weight of filler and thus has more affinity for the plastic film than does the planographic layer which contains at least 50% by weight of fillers such as clay, silica or titanium dioxide which tend to disrupt the continuity of the planographic coating and mask the bonding properties of the binder material.

The hydrophilic intermediate layer has an affinity for the film surface due to the presence of the alcohol and for the planographic layer due to its hydrophilic nature. The intermediate layer composition comprises an aqueous solution of a hydrophilic polyvinyl alcohol binder material and up to about 25% by weight of filler based on the dry weight of the layer. The hydrophilic binder material is preferably polyvinyl alcohol, carboxymethyl cellulose, casein, methyl cellulose or starch, but any hydrophilic colloid or similar binder may be used. The filler is optional but is preferably included for providing increased tooth for the planographic layer. Materials such as clay, titania or silica are preferred.

EXAMPLE

A film of 2 mil polyethylene terephthalate polyester is provided with a hydrophilic intermediate layer by uniformly applying the following composition in a weight of about 2 pounds per ream of 500 sheet 38" x 25" in dimension.

Ingredients:	Parts by weight, gms.
Polyvinyl alcohol	20.0
Silicon dioxide	2.0
Clay	2.0
Water	70.0
Methanol	6.0

After drying to remove the water and alcohol and solidify the intermediate layer, the planographic composition specified below is applied over the intermediate layer in a weight of about 3 pounds per ream and dried to provide a planographic layer containing 2.4 pounds per ream of filler.

Ingredients:	Parts by weight, gms.
Polyvinyl alcohol	3.5
Clay	10.5
Syton (silica)	6.5
Glyoxal	0.4
Acetic acid	0.6
Water	73.0
Methanol	4.3
Butanol	1.2

The present plates are particularly adapted for use in the reflex thermographic imaging process as illustrated by the drawing, the sheets being shown out of contact for purposes of illustration. In the reflex process the original sheet, transfer sheet and planographic plate are superposed in the order shown, the transpicious plate 10 being nearest the infrared radiation source 40 with its planographic layer 12 in contact with the oleophilic heat-transferable layer of the transfer sheet 20. Original sheet 30 is furthest from the radiation source and has its infrared radiation-absorbing images 32 facing the radiation source.

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Since the plate is transpicious and thus does not reflect or diffuse the applied radiation to any substantial degree, the radiation is able to penetrate to the original images 32 to be absorbed thereby and generate an image-wise heat pattern which is conducted back to the oleophilic transfer layer 22 causing corresponding areas thereof to melt or soften and adhere to the planographic coating 12. When the sheets are stripped apart, they appear as illustrated by FIG. 2 which shows mirror-reverse images 13 transferred from oleophilic layer 22 to the planographic layer 12.

The reflux process is important for the copying of original sheets 30 which have an opaque foundation 31 or carry images on the side opposite to the images to be copied. The transfer sheet 20 may be of the conventional radiation-transmissive type and comprises a foundation 21 such as tissue paper or plastic film and a heat-transferable oleophilic layer 22 which generally comprises an oleophilic wax binder material and a small amount of dissolved dyestuff for proofreading purposes.

The plate of FIG. 3 may be substituted for that of FIGS. 1 and 2 with equally excellent results. The plate of FIG. 3 has a film foundation 11 and a planographic printing layer 12 which may be identical to the corresponding elements of the plate of FIG. 1 but is further provided with a hydrophilic intermediate layer 14 according to the example. The intermediate layer improves the hydrophilic properties or wettability of the plate and extends its useful life so that more copies can be produced than when no intermediate layer is used.

Because of the infinite wet strength of the present plates and their ability to be adequately etched on the planographic printing machine, the present plates are suitable for use as direct-printing plates as well as for their more common use as offset-printing plates. In the direct-printing process the plates are imaged with mirror-reverse oleophilic images, mounted on a printing drum and continuously alternately contacted with moistening rollers and inking rollers. The plate surface makes contact with a succession of copy sheets which accept ink from the plate images to form direct-reading copies of the plate images. In the offset-printing process the plate images are direct-reading images and the printing ink applied thereto is continuously transferred to a printing roller which in turn transfers the images to a succession of copy sheets. Most printing plates are useful only as offset plates since they cannot accept and retain a sufficient amount of moisture or etch to withstand the continuous loss of moisture or etch by absorbency into the copy sheets.

We claim:

1. The process of making a transpicious planographic printing plate adapted to be imaged in the reflex thermographic transfer process which comprises the steps of;

- (a) providing a translucent flexible hydrophobic film having a thickness of from 0.5 to 2 mils;
 - (b) applying to the surface of said film a thin layer of an aqueous composition comprising a hydrophilic film forming binder material and a water-miscible volatile aliphatic alcohol having from 1 to 5 carbon atoms having an affinity for the surface of said film;
 - (c) evaporating water and said alcohol from said composition to form a dry hydrophilic intermediate layer bonded to said film and having an affinity for water;
 - (d) applying to the surface of said intermediate layer a thin layer of an aqueous planographic composition comprising 1 part by weight of polyvinyl alcohol binder material, from 1 to 5 parts by weight of a filler, water, and from 1% to 10% by weight, based upon the total weight of the composition, of a water-miscible aliphatic alcohol having from 1 to 5 carbon atoms; and
 - (e) evaporating water and said alcohol to form a dried planographic layer having a weight of from 3 to 5 pounds per ream and containing 2 to 4 pounds per ream of said filler, said planographic layer being sufficiently well-bonded to said intermediate layer and said intermediate layer being sufficiently well-bonded to said film to resist being pulled therefrom in areas where said layer is heater-fused to an oleophilic wax layer on a transfer sheet and the transfer sheet is stripped away.
2. The process of claim 1 in which the plastic film foundation comprises a film of cellulose acetate.
3. The process of claim 1 in which the alcohol is present in an amount ranging between 3% and 6% by weight of the planographic composition.
4. A transpicious planographic printing plate produced according to claim 1.
5. A printing plate according to claim 4 in which the film foundation comprises cellulose acetate.

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101—463; 117—3.4, 145

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,472,164

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Inventor(s) Douglas A. Newman and William E. Trecker

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 2, line 57, "composiiton" should read --composition--
line 61, "objections" should read -- objectives --. Column 4,
line 40, "sheet" should read -- sheets --. Column 5, line 12,
"reflux" should read -- reflex --. Column 6, line 28,
"heater-fused" should read -- heat-fused --.

SIGNED AND
SEALED
MAY 19 1970

(SEAL)

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