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3,532,532

REVERSE LITHOGRAPHIC PRINTING PROCESS
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3 Claims

ABSTRACT OF THE DISCLOSURE

A heat-sensitive hydrophilic imaging material has utility in the reverse lithographic printing process and can be transferred from a coated sheet to a polyethylene coated printing master by a thermographic imaging process. The novel composition comprises a shellac and polyethylene glycol and may additionally contain a wax or wax-like material to modify the physical properties to obtain improved coating, transfer and adherence characteristics.

FIELD OF THE INVENTION

This invention relates to lithographic printing and more particularly to recent developments in the so-called reverse lithographic mode wherein hydrophilic, glycol-based inks are used with a plate or master having an oleophilic background and hydrophilic image areas. More specifically, the invention relates to imaging compositions for use in this process which are particularly adapted for imaging a master by a thermographic transfer process.

DESCRIPTION OF THE PRIOR ART

A planographic method of printing is disclosed in U.S. Pat. No. 3,167,005 which uses a volatile aliphatic hydrocarbon as the fountain solution instead of water as conventionally used and hydrophilic glycol-based inks instead of the conventional oleophilic oily inks. Thus, to practice this process a printing master must have an oleophilic surface over which a thin film of hydrocarbon fountain solution may be applied which, because of the mutual immiscibility of volatile aliphatic hydrocarbon fountain solution and the hydrophilic glycol-based inks, repels the ink and prevents the ink from depositing on the non-image areas of the printing master. The printing plate used in this process also requires image areas thereon which will attract and retain the ink thereon. The printing masters heretofore disclosed for use in this process comprise a base metal plate coated with a cured thermosetting silicone, in which areas of the metal surface are exposed to become the image areas and remaining areas of the cured silicone coating has become non-image or background areas. Preparation of these plates is a complicated and expensive process and further, the materials used in the plates are relatively expensive. Hence, a simple, inexpensive master and method for preparing such a master is desirable.

Of course, a number of classes of compositions are known which have the oleophilic and hydrophilic properties required for the lithographic printing process and apparently could be readily adapted to the reverse lithographic process as would be readily understood by persons skilled in the art. However, attempts to image an inexpensive master by conventional methods have not met with any degree of success with the known lithographic materials and compositions. For example, known hydrophilic lithographic compositions have not been readily adaptable to the thermographic transfer process for imaging onto a non-metallic master sheet having an oleophilic surface. Attempts to accomplish this have been unsuccessful for several reasons: difficulty in adhering the transferred image composition to a suitable base ma-

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terial; lack of affinity of conventional hydrophilic lithographic materials for the glycol-based inks suitable for use in the process.

Further, the silicone resin materials previously suggested for the non-image (oleophilic) areas such as, for example, in U.S. Pat. No. 3,209,683 or the tetrafluoroethylene resin disclosed in U.S. Pat. No. 3,241,486 all had various shortcomings when attempts were made to transfer and adhere to known hydrophilic materials.

SUMMARY OF THE INVENTION

Now, in accordance with the invention it has been found that shellac can be combined with one or more ingredients to result in a composition which can be coated on a transfer base sheet and transferred image-wise by a well known thermographic method to a lithographic master base sheet comprising a matte-finished or grained polyethylene surface either laminated or coated on a suitable substrate, such as, Mylar, paper or other flexible material. Unexpectedly, it has been found that a composition containing shellac, polyethylene glycol and a wax especially synthetic or modified natural waxes, is hydrophilic and can be easily coated onto a transfer sheet base material and transferred to a lithographic master sheet in response to an image-wise heat pattern produced in the transfer coating; exhibits good adherence to the oleophilic polyethylene coating of the master base sheet; will not accept the hydrocarbon fountain solution and has an affinity for the glycol-based inks used in reverse lithography.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In accordance with the graphic process described in the previously mentioned U.S. Pat. 3,167,005, the master material should reject the ink used in the printing process; further, it should accept a film of the fountain solution in which the ink is immiscible. The lithographic master prepared in accordance with the practice of my invention comprises a base sheet material such as paper, plastic or the like, which has a surface characterized as being oleophilic, water repellent and ink repellent which may be in the form of a coating thereon or a lamination of suitable plastic material in film form. Various known polymeric materials, such as polyethylene, polypropylene, Teflon, silicones, Quilon (Du Pont chromic chloride-stearic acid complex) might be expected to be suitable in the sense that they are oleophilic. However, the only surface material which was found to be useful in the thermographic transfer process was polyethylene. The preferred lithographic master, therefore, comprises a 1 mil Mylar film having a ½ mil polyethylene film laminated thereon. It was further found that polyethylene which has a matte finish or a grainy surface has superior qualities of adhesion for the imaging material to be described below. Therefore, one aspect of the invention is to be found in the combination of the novel imaging material and a printing master surface material uniquely adapted for acceptance and adherence of the imaging materials.

In preparing a printing master, a novel, heat sensitive hydrophilic imaging composition is transferred to the oleophilic surface of the printing master base sheet. One of the requirements of the imaging composition is that it readily adhere fast to the oleophilic surface of the printing master base sheet. A composition comprising shellac, polyethylene glycol and a wax exhibit hydrophilic characteristics when applied to the oleophilic surface of a master and further, the composition is heat-sensitive, which permits transfer of discrete areas of the imaging compositions from a transfer sheet coated with this ma-

terial. Further, the novel composition is readily coated upon relatively impervious material such as, plastic or a closely-woven texture paper. Two such suitable papers are St. Clair carbonizing tissue manufactured by Port Huron Sulfitte Paper Co. and 5½ lb. Kraftex tissue, manufactured by Schweitzer, Division of Kimberly-Clark. A coated thickness in the range from 0.1 to 0.5 mil is suitable and transfer coatings in this range yielded copies having the highest resolution.

While a composition of shellac, 30–60% (wt.), 35–50% (wt.) polyethylene glycol and a wax at percentages (by weight) up to 30 achieved good results by thermal imaging process referred to herein below, it was also found that acceptable results were obtained with a composition of shellac and polyethylene glycol, or shellac and a mixture of polyethylene glycol and another glycol, e.g. diethylene glycol, triethylene glycol, ethylene glycol, etc. within specified narrower ranges of approximately 50 parts shellac and 50 parts glycol mixture.

The polyethylene glycol used in the imaging composition may be selected from among numerous commercially-available products as for example PEG-600 and PEG-400 (produced by Jefferson Chemical Co.) Carbowax 600 and Carbowax 400 (produced by Union Carbide Corp.) and Wyandotte's Pluracol E-6000, which are proprietary names for various molecular weight and viscosity grades.

The waxes used in the invention may be selected from among commercially-available synthetic or modified waxes or wax-like materials such as Castorwax (hydrogenated castor oil—Baker Castor Oil Co.); Acrawax (reaction product of hydrogenated castor oil and monoethanolamine—Glyco Products); Acrawax B (reaction product of stearic acid and monethanolamine—Glyco Products); Hoechst Wax W (halogenated tallow wax—Hoechst Corp.); Armid C (cocoa fatty acid amides—Armour & Co.) and Armid O (oleic acid amide—Armour & Company.) These low melting point waxes modify the heat-sensitive characteristics of the imaging composition and improve their ability to transfer thermally and adhere to the polyethylene surface of the printing plate.

The printing master to be used in the reverse lithographic printing process previously mentioned, may be prepared by transferring discrete areas of the imaging composition coated on the transfer sheet to the surface of the printing master in accordance with well-known thermographic imaging processes. For example, Raczynski et al., U.S. Pat. No. 3,122,998, discloses a process which may be used, wherein a graphic original, having infra-red absorbing images, is placed in pressure contact with a sub-assembly comprising a coated transfer sheet and a copy sheet and the entire assemblage exposed to a source of infra-red radiation. The images on the original absorb infra-red radiations, creating a heat pattern, which is then transferred to the sub-assembly whereby discrete areas of the wax coating on the transfer sheet are heated in accordance with the images on the original and transferred to the copy sheet.

It is further contemplated by the instant invention that the printing master may be imaged thermographically by either the reflex or shoot-through techniques disclosed in the above mentioned U.S. Pat. 3,122,998 and further that either a right-reading or reverse-reading image may be produced depending upon whether the printing master is to be utilized in a direct lithographic process or in an offset process.

By selecting the materials and the printing master base sheet in accordance with the present invention, the copy sheet may be used as a reverse lithographic printing master. To obtain multiple copies from the printing plate so produced, which now has image areas thereon comprising the novel imaging composition and corresponds to the image pattern on the original document, a fountain solution comprising a volatile aliphatic hydrocarbon is ap-

plied to the entire plate after which ink is applied to the plate and transferred by contact to a sheet or web of paper, all in a conventional manner. As will be understood from the description of the invention, the hydrocarbon fountain solution will be attracted only by the oleophilic non-image areas of the printing plate, or background, and repelled from the hydrophilic image areas. Consequently, when ink is applied in the printing step, the ink will be attracted to the layer of hydrophilic material in the image areas and the hydrocarbon film will prevent any ink from covering the non-image areas.

The inks utilizable in this process include inks having glycols such as, propylene glycol, dipropylene glycol, diethylene glycol, triethylene glycol, etc. as solvents. These inks are formulated with a binder, such as zein, which is insoluble in the hydrocarbon fountain solution. Particularly preferred are inks having lower moisture sensitivity obtained by incorporating therein small amounts of 1,5-pentanediol. A typical glycol-based ink formulation is as follows:

	Parts (wt.)
Triethylene glycol -----	57
Zein -----	15
Carbon black pigment-----	26
Alkali blue pigment -----	2

to which about 10 wt. percent of 1,5-pentanediol has been added.

The following examples will serve to illustrate the practice of the present invention:

EXAMPLE I

The material selected as the printing plate base sheet was a ½ mil film of polyethylene with a matte surface laminated, matte surface out, to a 1 mil Mylar base film, as manufactured by Dow Chemical Co. This laminated showed excellent thermal dimensional stability and the matte surface on the polyethylene exhibited the best adhesion for the imaging materials.

A web 5½ lb. Kraftex tissue (Schweitzer) was hot melt coated using a #5 coating knife with the following composition:

	Parts
Commercial orange shellac (Bradshaw-Praeger) ---	40
Polyethylene Glycol (PEG-6000—Jefferson Chemical Company -----	35
Wax (Acrawax B—Glycol Products) -----	25

An image corresponding to the image on a graphic original was transferred from the coating on the transfer sheet to the polyethylene surface of the printing master base sheet by the thermographic image process previously described, using a Masterflex machine, manufactured by Ditto Division of Bell & Howell Company, which is similar in operation to the apparatus described in FIG. 2, of the previously mentioned U.S. Pat. No. 3,122,998.

When the transfer sheet was separated from the printing master base sheet, image areas, corresponding to the graphic original and consisting of the hydrophilic imaging composition, were adhered to the oleophilic polyethylene surface of the base sheet. The polyethylene surface constitutes the non-image areas of the printing plate, i.e., the background, while the transferred imaging material constitutes the image areas of the printing master. A fountain solution of Amsco "Super Naphtholite W-1" (VM&P Naphtha) was applied to the printing plate with a wool mollen cover on the fountain roller of a printing press. Using the ink formulation above, 150 copies of good character quality were made from a transfer sheet coated with a freshly-prepared shellac-polyethylene glycol-wax formulation with no background printing and good catch up characteristics. The identical image material formulation, aged several months, gave almost identical results of up to 150 good quality copies.

EXAMPLES 2 THROUGH 8

Example 1, was repeated using the following image material formulation:

Components	Example Nos.						
	2, percent	3, percent	4, percent	5, percent	6, percent	7, percent	8, percent
Shellac.....	40	40	40	50	40	50	50
PEG-6000 (Jefferson).....	40						
Carbowax 6000 (Union Carbide Corp.).....		40	35	40			
Pluracol E-6000 (Wyandotte).....					55	50	40
Ethylene glycol.....							10
Acrawax B.....	20	20	25	10			
Castorwax.....					5		

In each of the above Examples 2 through 8, inclusive, the quality of the image transferred by the thermographic process was judged to be good.

EXAMPLE 9

Example 1 was repeated using the following image material formulation:

	Parts (wt.)
Shellac.....	50
Polyethylene glycol (E-6000) (Wyandotte).....	40
Ethylene glycol.....	10

The imaging results obtained in this example were judged good.

EXAMPLES 10-15

Example 1 was repeated using the following image material formulation:

Components	Example Nos.					
	9, percent	10, percent	11, percent	12, percent	13, percent	14, percent
Shellac.....	40	50	50	50	50	40
PEG-6000 (Jefferson).....		45				30
PEG-4000 (Jefferson).....	40					
Carbowax 6000 (Union Carbide Corp.).....				30		
Carbowax 4000 (Union Carbide Corp.).....			40		30	
Acrawax B.....	20			20		
Acrawax.....			10		20	
Castorwax.....		5				
Armid C.....						30

In each of the above Examples 10 through 15 inclusive, the quality of the image transferred by the thermographic process was judged fair to good.

EXAMPLE 16

Example 1 was repeated using, instead of the polyethylene-Mylar laminated film, a gloss-finished untreated polyethylene-coated bleached kraft paper. The imaging results in this example were judged fair.

EXAMPLE 17

Example 1 was repeated using, instead of the Mylar laminated film, a matte-finished untreated polyethylene-coated paper designated Royal White by the manufacturer, Brown Company. The imaging results obtained in this example were judged fair.

While various changes and modifications in the above described embodiments of my invention may be made without departing therefrom, it is intended to cover all such changes and modifications as fall within the spirit and scope of the following claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method of imaging a lithographic printing master

formed of a base sheet having an oleophilic surface for printing with glycol-based inks comprising: placing said oleophilic surface of said base sheet in contact with a transfer sheet having a hydrophilic lithographic coating thereon with said coating in contact with the oleophilic surface of said printing master to form a two-ply assembly; placing an original document in contact with said assembly, said original document having infra-red-absorbing image areas thereon; exposing said original and assembly to an infra-red source whereby said transfer material is transferred and adheres to said oleophilic surface in areas corresponding to the image areas on said original document; the improvement characterized in that said transfer coating is a heat-sensitive composition comprising 30-60% by weight shellac, 30-55% by weight polyethylene glycol and 0-30% by weight wax.

2. The method of claim 1 further characterized in that said oleophilic surface is a matte-finished polyethylene film laminated to said base sheet.

3. The method of claim 1 further characterized in that said heat-sensitive composition comprises about 40% (wt.) shellac, about 35% (wt.) polyethylene glycol and about 25% (wt.) wax.

References Cited

UNITED STATES PATENTS

3,122,997	3/1964	Raczynski et al.	101-471
3,313,233	4/1967	Uhlig et al.	101-467
3,384,015	5/1968	Newman	101-467

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