April 25, 1967 H. E. CLARK ET AL 3,315,602

FORMING OF PRINTING PLATES

Filed Dec. 16, 1964

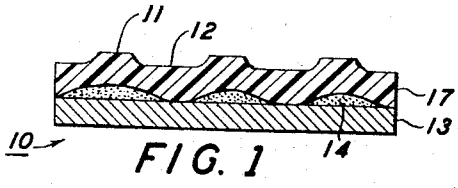


FIG. 1

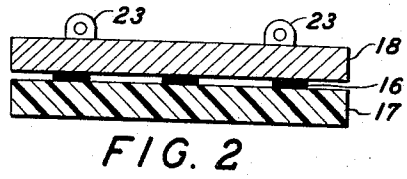


FIG. 2

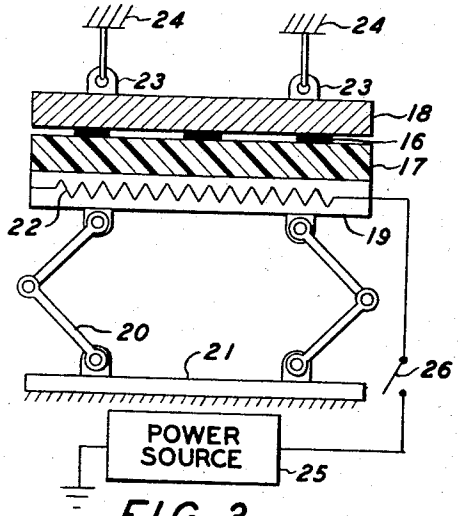


FIG. 3

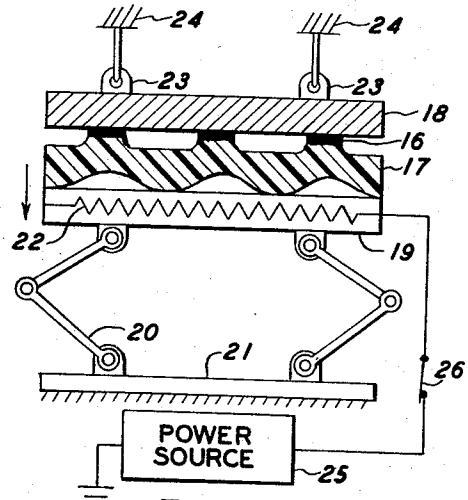


FIG. 4

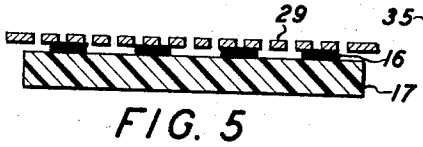


FIG. 5

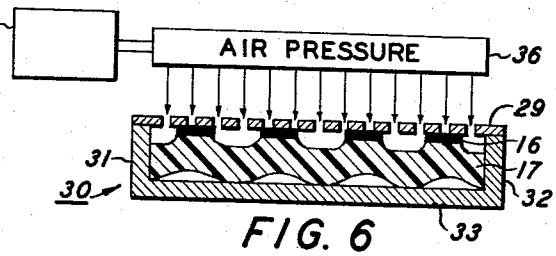


FIG. 6

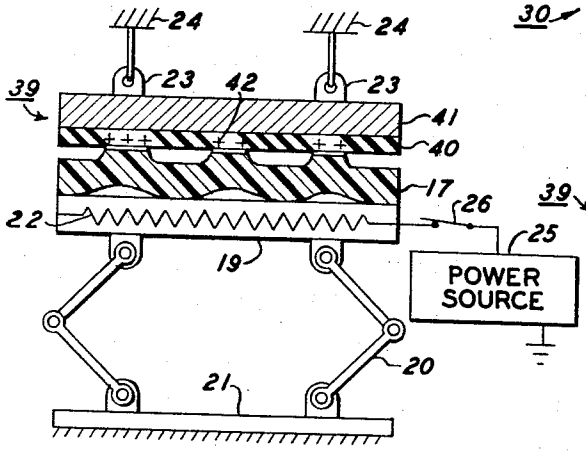


FIG. 8

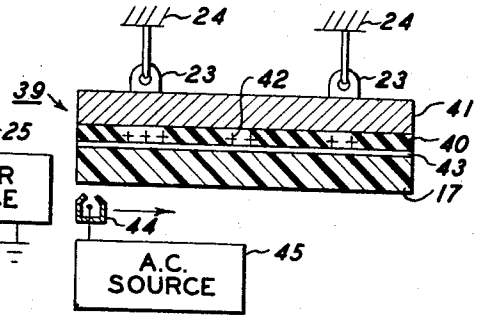


FIG. 7

INVENTORS.
HAROLD E. CLARK
ROBERT W. GUNDLACH
LEWIS E. WALKUP

BY Anthony H. Cieniawski

ATTORNEY

United States Patent Office 3,315,602
Patented Apr. 25, 1967

3,315,602

FORMING OF PRINTING PLATES

Harold E. Clark, Penfield, and Robert W. Gundlach, Victor, N.Y., and Lewis E. Walkup, Columbus, Ohio, assignors to Xerox Corporation, Rochester, N.Y., a corporation of New York

Filed Dec. 16, 1964, Ser. No. 418,720
11 Claims. (Cl. 101—401.1)

This invention relates to printing plates, and in particular to novel process for the fabrication of a stereotype master from which a relief image plate can be formed.

It is common in the publishing business, particularly with newspaper, to form relief letterpress plates by first producing a Lintotype cast slug composure of the lettered information which is then utilized as a master to form a stereotype paper mat. The mat in turn serves as a mold for casting the low melting metal of which the letterpress plate is comprised. Where it is desired to include associated advertising cuts having halftones or the like, the plate sections therefor are even more difficult to prepare requiring complex steps and utilizing expensive materials, both as intermediates and the final plate. Specifically, to prepare advertising plates in the usual manner, the copy is first imaged on photographic film, and the plate processed by photoengraving techniques which includes applying a photoresist and etching from zinc, magnesium, or Dycril, the latter being a tradename for a photopolymer material marketed by DuPont de Nemours.

Now in accordance with the instant invention, there has been discovered a novel process for forming stereotype masters directly from optical copy without regard to whether the imaging areas comprise lettering, half-tone, continuous-tone or the like. The master thus formed can then comprise a stereotype master completely eliminating the need for either or both the Linotype composure and the etch formed engravure and in some instances can even comprise the printing plate per se. The process is simple and rapid to perform and the economic advantages offered thereby should be readily apparent.

This is effected in accordance with the invention hereof by optically forming an image bond, as by xerographic techniques, between a rigid support and a layer of deformable master making material. The remaining unbonded, non-image areas thereof are then selectively deflected, bent, sagged, deformed or otherwise forced to be permanently relieved from the image plane in response to heat, solvent, pressure or the like. On subsequently breaking the bond the stereotype master is instantly formed or alternatively can be subject to additional simple processing steps to effect greater permanentization.

It is, therefore, an object of the invention to provide novel method and apparatus for forming a stereotype master plate to be used in the graphic arts.

It is a further object of the invention to provide a novel stereotype master and/or relief printing plate for use in the graphic arts.

It is a still further object of the invention to form an imaging plate usable as a stereotype master formed by optical techniques as to eliminate the intermediate use of Linotype and photoengraving as has been common in the prior art.

These and other objects as well as the various features, advantages and limitations of the invention will become apparent from the following description and drawings, in which:

FIG. 1 is a cross-section through a type relief image plate formed in accordance with the invention hereof and usable as a stereotype master.

FIGS. 2, 3 and 4 sectionally illustrate the sequential steps respectively for forming the image plate of FIG. 1;

FIGS. 5 and 6 sectionally illustrate an alternative sequence of steps for forming the relief plate of FIG. 1, and

FIG. 7 and 8 sectionally illustrate still another sequence of steps for forming the relief plate in accordance with FIG. 1.

Basic to the invention is the initial selective bonding in image configuration of the plate forming material to a rigid support. This can be effected by various imaging techniques when employing adhesive imaging material such as applied through a stencil or the like. In a preferred embodiment, in order to also incorporate optical transmission, there is employed some or all of the usual steps of the xerographic process as disclosed for example in Carlson Patent 2,297,691 issued October 6, 1942. As disclosed in the Carlson patent, a xerographic plate comprising a layer of photoconductive insulating material on a conductive backing is given a uniform electrostatic charge over its surface and is then exposed to the subject matter to be reproduced, usually by conventional projection techniques. This exposure discharges the plate areas in accordance with the radiation intensity that reaches them, and thereby creates an electrostatic latent image on or in the photoconductive layer. As will be understood, the latent image thus formed may, for one of the embodiments hereof, serve as a bonding unit to secure the deformable master making material while relieving the other portions thereof. Alternatively, as will likewise be understood, the latent image may then be developed as disclosed in Carlson with an electrostatically charged, finely-divided material such as an electroscopic powder that is brought into surface contact with the photoconductive layer and is held thereon electrostatically in a pattern corresponding to the electrostatic latent image. Thereafter, the developed powder image in accordance herewith is transferred to either the rigid support or the master making material and is rendered adhesive to bond the latter material in a sandwich arrangement with the support.

Referring now to FIG. 1 there is illustrated a stereotype master or printing plate formed in accordance herewith designated **10** having raised image areas **11** surrounded by recessed or relieved areas **12**. After deformation, the shape thereof can be further set as by applying a quick setting resin, rubber, Wood's metal, stereotype metal or the like. Optionally, it can be mounted on a permanent support **13** as by cementing with a cement material **14** which also backfills underside surface irregularities as will be understood.

The material comprising plate **10** include various deformable materials such as waxes, and including thermoplastic materials such as vinyl, styrene, and other polymeric or non-polymeric resins capable of being deformed by heat and pressure or suitable solvents as will be described.

Typical non-polymeric deformable materials are esters of abietic acid made from the condensation of abietic acids and alcoholic compounds such as ethylene glycol, propylent glycol, butylene glycol, trimethylol propane, pentaerythritol, propanetriol, hexanetriol, xylylene glycol, amylene glycol, glycerine, diethylene glycol, triethylene glycol, sorbitol, and mixtures thereof. The term "alcohol" used throughout will be intended to include mono-, di- and polyalcohols. The term "esterification" as used throughout also includes polyesterification. Other typical non-polymers include sucrose esters such as sucrose octabenzoate, sucrose octaacetate, and mixtures thereof. Typical heat deformable thermoplastic polymers are low molecular weight polymers or oligomers.

Suitable polymers include aromatic polymers such as polystyrene, alpha methyl styrene; copolymers made from styrene and other materials such as vinyl toluene, methyl styrene, poly-alpha-methyl-styrene, chlorinated styrene, and polymers and copolymers made from petroleum cuts and indene polymers; phenolics such as phenol-aldehyde

resins, phenolformaldehyde and mixtures thereof; vinyl polymers such as polyvinylacetate, polyvinylalcohol, polyvinylbutyral, butylmethylacrylate-styrene polymers, butylmethylacrylate-alkylated styrene copolymers, styrene-methylacrylate-butadiene terpolymers; organo-polysiloxanes such as polydiphenylsiloxane; polyesters such as acrylic esters, bisphenol A type polyesters; bisphenol A copolymers such as bisphenol A-adipylchloride copolymers; complex hydrocarbon polymers such as hydrogenated Piccopale which is a polyethylene polymer (Pennsylvania Industries Chemical Corporation), Piccodiene Pennsylvania Industries Chemical Corporation), Nevillac Soft (Neville Chemical Corporation), Nirez 1085, 1100, 1115, and 1125 which are believed to be polyterpenes (Newport Company), and any of the above non-polymeric and polymeric materials in mixture with each other or copolymerized with each other.

In order to form the plate of FIG. 1 and in accordance with a first embodiment hereof, there is first formed as shown in FIG. 2, a sandwich arrangement consisting of a uniform layer of the deformable material **17**, a rigid durable support member **18** and between which is supported the xerographically transferred powder image **16**. The powder image, as is known in the art, is a resinous material characterized by becoming adhesively tacky when exposed to a softening media such as heat or solvent vapors. In removing the softening media, the image material readily and firmly bonds to the surface with which it is in contact. Thus, the powder image formed by the xerographic techniques described above, is transferred to either the deformable layer **17** or the support **18**. Either before or after forming the sandwich arrangement illustrated the powder image is caused to become tacky in order to adhere and subsequently bond to both of the sandwiching layers. Techniques for effecting a sandwich bond with xerographic powders between adjacent layers are more fully described in patents U.S. 3,143,066; 3,109,367; 3,109,366 and 3,093,068.

The entire sandwich arrangement is then placed as is shown in FIG. 3 on a removable heating platen **19** including an electrically energized coil **22** and supported on collapsible jack-like members **20** secured to a stationary support **21**. For this embodiment, deformable material **17** comprises a deformable thermoplastic layer about 0.001 to 0.25 inch thick. Support member **18** includes dog ears **23** by which it can be secured, suspended from stationary supports **24** as to resist any movement caused by the subsequent steps hereof.

The heating element **22** is energized from a power source **25** via switch **26**. As the thermoplastic layer becomes soft from the applied heat, jack members **20** are caused concomitantly therewith to be lowered until platen **19** reaches a predefined spacing from the surface of support **18** as illustrated in FIG. 4. Since thermoplastic material **17** is soft and pliable from the heating affects, it follows or sags with the movement of platen **19** under forces exerted by gravity except in those areas where bonded via the images **16**. When platen **19** has dropped to its lowermost position, switch **26** is opened to disconnect the power source permitting the thermoplastic material to harden. After hardening, the thermoplastic is stripped from its bond either mechanically or alternatively by again softening the powder image by heat or solvent to permit removal of the thermoplastic therefrom. The image material **16** may then be removed as by solvent or grinding or the like and a master thus formed corresponds to that illustrated in FIG. 1. It should be appreciated for the purposes of this embodiment that the imaging material **16** should be one characterized by thermoset or having a melting temperature higher than required to deform material **17**. Also instead of capitalizing on gravity forces to effect deformation centrifugal forces can be utilized. Thus by securing support **18** to a rapidly rotating drum or the like, material **17** will be forced centrifugally outward in the unattached, non-image areas.

Where the powder image material includes a dispersed quantity of magnetic component, support **18** can be magnetic or electromagnetic for effecting a magnetic instead of an adhesive bond thereto. In this instance, the adhesive bond is effected only between the powder image and the thermoplastic plate material **17**. Electroscopic powder with magnetic components are disclosed in Rheinfrank patent U.S. 3,124,483. Where magnetic developer powder is employed for bonding the bonded powder can comprise a hard metallic material. Under such circumstances, the relief image plate can itself comprise a printing surface for short runs. Thus, it can be employed for dry offset, in which shallow relief is acceptable. For example, a plate of this sort can be mounted in a conventional type lithographic offset machine without using the water supply. The machine then operates with much greater reliability and with the use of a much wider choice of paper stock.

As a variation of the above the thermoplastic material is impregnated in bulk or has applied to its surface ingredients such as naphthalene or anthracene in a solvent which does not adhere to the powder image, but only to the deformable material and which is caused to sublime on the application of heat. With this arrangement, the sandwich is placed in a relatively pressure tight container (not shown) closely fitting about the sandwich sides. Applying heat to the thermoplastic sublimes the ingredients to generate gas between the surface layers to a pressure sufficient to cause deformation of the thermoplastic material as before to a degree defined by the container dimensions. This enables greater deformation in areas closely enclosed as in alphabet letters "*e*," "*a*," etc.

Referring now to FIGS. 5, 6, and 7, there is illustrated alternative step sequences for forcing or effecting sagging of the unbonded areas of the plate deformable material **17**. For purposes of this embodiment, material **17** may, but need not be, a thermoplastic material and may include such other materials as can be locally bent, forced, or otherwise deformed beyond its elastic limit. In this embodiment, a layer of deformable material **17** is bonded via the powder image **16** to a rigid durable support **29** having open interstices such as a screen, perforated plate, or other porous rigid material preferably of slightly greater length at each end than the length dimension of layer **17**.

As illustrated in FIG. 6, the bonded sandwich arrangement is placed in a shallow box container **30** having side walls **31** and **32** and a bottom wall **33**. The side walls receive the overlapping ends of support **29** to secure the position thereof. Pressured air, supplied from a source **35** on the order of 5 p.s.i. or greater than required to deform material **17**, is transmitted to a plenum chamber **36** to be directed outward via ports, as illustrated by the arrows, through the interstices of the screen or pores of support **29** against the deformable layer. In those unbonded areas of the material **17** subject to the pressured air, the material is caused to deform to an extent defined by the bottom wall **33**. In those areas bounded by the image, the position of the layer is retained in the manner shown to again form a stereotype relief image plate. After disconnecting the applied pressure, and permitting the materials to cool (if necessary) the plate thus formed is removed and may then be treated, and mounted on a plate **13** as described above.

As a variation of the last embodiment, a suitable suction pressure applied to the underside of the deformable layer can be employed instead of the positive pressure means described.

Referring now to FIGS. 7 and 8, there is another embodiment utilizing a rigid support in the form of a xerographic plate **39** comprising a photoconductive layer **40**, such as vitreous selenium, on a conductive substrate **41**. In this embodiment the use of a powder image or other deposit to produce selective bonding is dispensed with. An electrostatic latent image if formed in accordance with the xerographic process on the surface of the selenium

surface 40, designated by the plus signs 42. The surface is coated with an adhesive film 43 such as silicone oil or a fluorcarbon spray application marketed as "S–122" from the Miller-Stephenson Chemical Co., Inc., San Francisco, California after which the deformable material 17 is placed in a sandwich arrangement thereagainst. The liquid film prevents adhesive contact between the xerographic plate and the thermoplastic material softened by heating. Layer 17 is then charged to a zero potential, as by A.C corona emitted from a moving corona charging unit 44 energized from a suitable potential source 45. This induces charge of opposite polarity in areas adjacent to the electrostatic latent image. With image potentials on the order of approximately 400–600 volts, those image adjacent areas of the deformable thermoplastic layer become bonded thereto. When subsequently heated in the manner illustrated in FIG. 8 the uncharged, unbonded areas are permitted to fall away, as before. For this purpose, it is regarded as immaterial whether the thermoplastic layer is electrically insulating or conducting, although a conductive film offers the advantage that corona methods would not be necessary to establish a low equipotential. Grounding the layer, as by a brush or roller, brings the entire layer to a zero potential. A subsequent uniform illumination of photoconductor 40, breaks the bond permitting the deformed plate to be removed and utilized.

By the above description, there have been disclosed novel method and apparatus for forming a novel type stereotype imaging plate. The process is relatively simple, straightforward and eliminating the use of Linotype as has been conventional in the art for years. The master thus formed is hardened on removal of the softening source and may be further hardened by pouring thereover a membrane of quick setting resin, rubber, Wood's metal, stereotype metal or the like. Whereas heat has been primarily emphasized for softening the deformable materials, it should be considered as exemplifying the invention since suitable solvents or the like can likewise be employed to lower the elastic limit of the material.

Since many changes could be made in the above construction and many apparently widely different embodiments of this invention could be made without departing from the scope thereof, it is intended that all matter contained in the drawings shall be interperted as illustrative and not in a limiting sense.

What is claimed is:

1. The method of forming a stereotype image plate comprising the sequential steps of:

(a) bonding a layer of deformable plate forming material in image configuration to a rigid support;

(b) causing said plate material to be permanently deformed away from said rigid support in the unbonded areas thereof; and

(c) removing the deformed plate material from said support.

2. The method according to claim **1** in which said plate forming material comprises a heat deformable material and deformation is effected by applying heat of sufficient temperature to exceed the elastic limit thereof while concomitantly permitting the unbonded areas to sag by gravity from said support.

3. The method according to claim **1** in which deformation is effected by means of fluid pressure acting against said plate material urging the unbonded areas away from said support.

4. The method according to claim **1** in which said bonding in image configuration is effected by an imagewise pattern of electrostatic charges.

5. The method according to claim **1** in which deformation is effected by subjecting said plates forming material to centrifugal forces for a controlled time period.

6. The method according to claim **1** in which said bonding in image configuration is effected with an imagewise deposit in an adhesive state.

7. The method according to claim **6** in which said imagewise deposit comprises a xerographically developed powder image.

8. The method according to claim **7** in which said developed powder image includes a magnetic component and said rigid support includes a magnetic member for securing the image by said component.

9. The method of forming a stereotype image plate comprising the sequential steps of:

(a) xerographically forming from graphic copy of which the image plate is to correspond a dry powder image capable of being rendered adhesively tacky;

(b) bonding a layer of deformable plate forming material to a rigid support with said xerographic image while tackified;

(c) causing said plate material to be permanently deformed away from said rigid support in the unbonded areas thereof; and

(d) removing the deformed plate material from said support.

10. The method of forming a stereotype image plate comprising the sequential steps of:

(a) xerographically forming from graphic copy of which the image plate is to correspond a dry powder image capable of being rendered adhesively tacky;

(b) forming a sandwich by bonding a layer of deform able plate forming material including a quantity of a releasable subliming agent to a rigid support with said xerographic image while tackified;

(c) heating said sandwich to generate a pressure with said agent sufficient to cause said plate material to be permanently deformed away from said rigid support in the unbonded areas thereof; and

(d) removing the deformed plate material from said support.

11. The method of forming a stereotype image plate comprising the sequential steps of:

(a) bonding a layer of deformable plate forming material in image configuration to a porous rigid support;

(b) applying a gas pressure through said support against said plate material causing said plate material to be permanently deformed away from said rigid support in the unbonded areas thereof; and

(c) removing the deformed plate material from said support.

No references cited.

DAVID KLEIN, *Primary Examiner*.