

Sept. 14, 1965

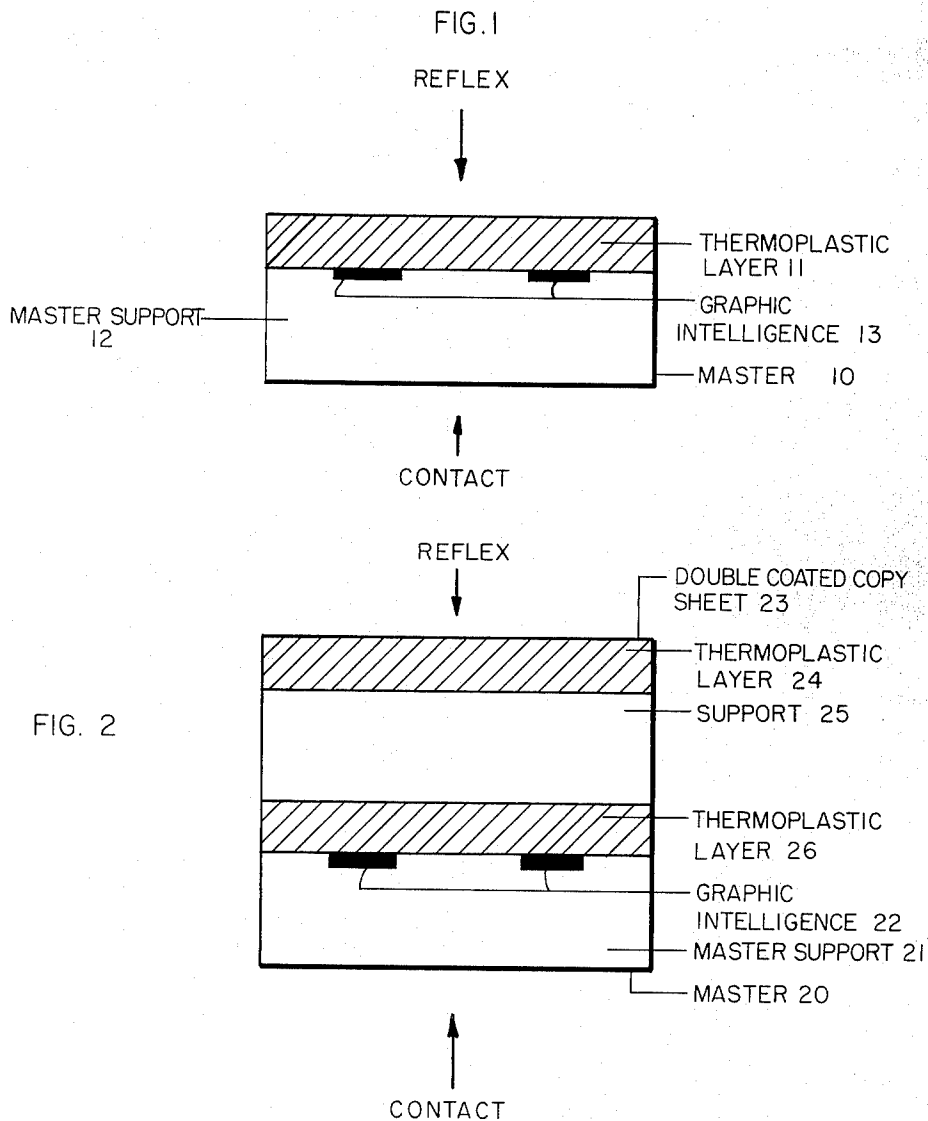
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3,206,599

PLASTIC FILM THERMOGRAPHY

Filed May 21, 1963

2 Sheets-Sheet 1



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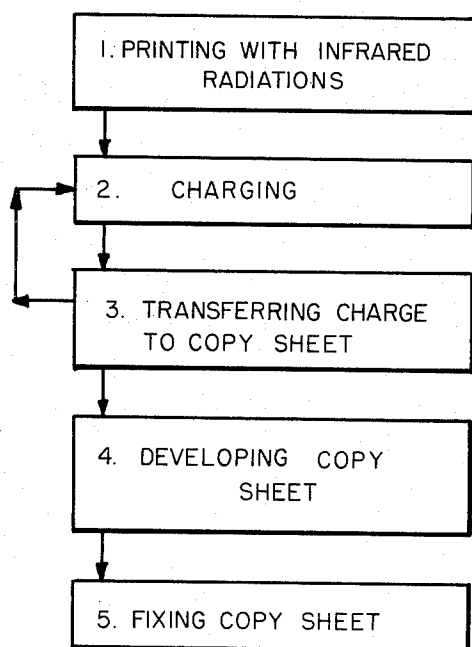
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PLASTIC FILM THERMOGRAPHY

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2 Sheets-Sheet 2

FIG. 3



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1

3,206,599

PLASTIC FILM THERMOGRAPHY

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17 Claims. (Cl. 250—65)

The present invention relates to the reproduction and intensification of graphic intelligence and more particularly refers to the reproduction and intensification of graphic intelligence on plastic films by means of infrared radiation or heat.

In the practice of making copies of graphic intelligence such as drawings, sketches, photographs, and the like, one well-known means is the thermosensitive reflex copying method. However, in this and in similar processes, copies are not entirely satisfactory because of retained sensitivity to heat. Other disadvantages include a high power requirement and a relatively narrow heat exposure range.

Electrophotographic processes require a material having specific photoconductive properties and conditions for use. For example, it is necessary to protect the material from exposure to ambient light before application of the electrostatic charge, before latent image formation, and also before development. Therefore special lighting conditions must be observed.

Heretofore the reproduction of some graphic intelligence was unsatisfactory because of the poor density of the originals. Therefore it was necessary to retrace insufficiently dense graphic intelligence to improve contrast between the graphic intelligence and the background. This contrast had to be above a certain minimum level for microfilming purposes to avoid loss of fine detail.

One object of the present invention is to provide methods, means and materials for reproducing and intensifying graphic intelligence which avoid the disadvantages of the prior art.

Another object is to provide methods, means, and materials for reproducing and intensifying graphic intelligence by means of infrared radiation.

Another object is to provide a method of making a permanent copy which is stable to subsequent exposure to heat.

Another object is to provide methods of developing a heat-created latent image in a layer of thermoplastic resin.

Another object is to provide a method of making a heat-created latent image which is developable at a later time.

Another object is to provide a method for making copies under ordinary lighting conditions.

Another object is to provide a method of making a lithographic printing plate.

Another object is to provide a method for making a heat-created latent image on a layer of resinous thermoplastic material, said image being substantially permanent and capable of accepting a static charge for transfer to another layer for subsequent development.

Other and further objects will become apparent from the specification.

In the drawings:

FIGURE 1 is a cross-sectional view of an assembly of

2

a master in heat-conductive contact with thermoplastic layer. The assembly can be exposed to actinic radiation through the master side by the contact method or through the layer side by reflux method;

FIGURE 2 is a cross-sectional view of an assembly of supported resinous thermoplastic layers in heat-conductive relation to a master; and

FIGURE 3 is a flow diagram illustrating the method of making multiple copies from a master.

Materials found to be suitable for the present invention were unsupported as well as supported layers of resinous thermoplastic materials. Cellulose acetate film is an example of an unsupported resinous thermoplastic layer and polyethylene coated on paper is an example of a supported resinous thermoplastic layer.

Other suitable materials are layers bearing a pencil-take surface, layers on one side of the support which has a pencil-take layer on the other side, pencil-take layers on a support bearing a photographic emulsion on the other side of the support and the like. Two thermoplastic layers may be coated on the same support.

In FIGURE 1 a master 10 comprising graphic intelligence 13 on the master support 12 is in contact with the unsupported thermoplastic layer 11.

The terms "contact" and "reflex" are borrowed from the photographic art to denote herein the manner in which an assembly is exposed to actinic radiations. In the contact exposure technique the actinic radiations are directed through the master to the thermoplastic layer. In the reflex exposure technique the actinic radiations are directed through the layer to the master.

The master support as well as the layer must be substantially transparent to the actinic radiations. When the developed image is viewed through the layer or the layer and its support, it or they must be substantially visually transparent. This is particularly required in intensification of graphic intelligence where the developed image is not on the same side of the layer as the original intelligence.

FIGURE 2 illustrates the exposure of a double coated copy sheet 23 in contact with a master 20. The copy sheet comprises a support 25 coated in one side with a thermoplastic layer 24 and on the other side with a thermoplastic layer 26. The master comprises a master support 21 and graphic intelligence 22 on one side of the master support. As shown in FIGURE 2 and as described in the examples, the graphic intelligence side of the master is in contact with the bottom layer 26 of the double coated copy sheet. The double coated copy sheet may also be used as a charge-transfer sheet. The support 25 of the double coated copy sheet must be substantially transparent to infrared radiation and is preferably visually transparent.

Any master comprising a support substantially transparent to infrared radiation and which bears infrared radiation-absorbing graphic intelligence may be used in the present invention. It is placed in heat-conductive contact with a resinous thermoplastic layer and exposed to infrared radiation to form a heat image corresponding to the graphic intelligence. The heat image is transferred by heat-conductive contact to the layer where a corresponding latent image is created. This latent image is developed with an electroscopic developer to produce a visible image which may be fixed to render it permanent. The layer of the present invention may be used as a re-

3

production layer, a charge-transfer layer, or an intensifying layer for graphic intelligence.

With reference to FIGURES 1 and 2, a master is placed in heat-conductive contact with a resinous thermoplastic layer and subjected to infrared radiation. Heat generated in the infrared absorbing graphic intelligence areas of the master by conversion of infrared radiation is transferred to the reproduction layer to form a heat-created latent image therein. The layer is then charged electrostatically, developed with a suitable electroscopic toner, and fixed by heating.

In one embodiment of the present invention, the layer is polyethylene and the support is infrared transparent glassine which is a highly hydrated cellulose film substantially transparent to infrared radiation. FIGURE 1 illustrates the graphic intelligence side of a master in contact with a layer of resinous thermoplastic material such as polyethylene. Exposure of the assembly to infrared radiations forms a heat-created latent image in the polyethylene layer.

Corona discharge wires may be used to charge the surface of the layer. The static charge acceptance and retention of the non-latent image area differs from that of the latent image areas. The layer is then developed with a toner of suitable polarity to produce a visible image. The image may be positive or negative depending upon the selection of the static charge and toner polarity. The toner is fixed to the layer by fusing.

The developed image may be laterally correct or reversed depending upon the contact relationship of master and layer. When a reverse or mirror image copy of the master is desired in the final copy sheet, the top layer of a double coated support is charged and the charge on such top layer is transferred to the final copy sheet. Negative images can be made by changing the polarity of the electrostatic charge or the polarity of the toner. It is thus possible to produce copies in which the image area is substantially clear and the background area is colored.

The electrostatic charge may be transferred from the layer bearing the latent image to a copy sheet thereby avoiding the necessity of a separate exposure for each copy made. The copy sheet may then be developed with toner and the layer recharged for further transfer.

The heat-created latent image is substantially permanent and has been developed months after the heat image was formed. The heat-created latent image is normally not observable by normal light and therefore is one way of making and storing secret writings.

It is believed that the resinous thermoplastic material must be in a highly disordered or highly plasticized state to be suitable for the present invention. This degree of disorder in the polyethylene, for example, is obtained by applying molten polyethylene to a base at a temperature of about 600° F. and rapidly cooling to form a resinous thermoplastic layer.

Materials suitable for this reproduction layer are resinous thermoplastic materials having the property of reaching a more disordered state with relative ease and the property of remaining in this state for a period of time necessary for development. Materials found suitable are polyethylene, nylon, cellulose acetate butyrate, cellulose acetate, polyvinyl butyral, polyvinyl acetate-chloride copolymers and the like. An unsupported layer of polyethylene may be obtained by dissolving away the paper base of a polyethylene coated paper. Suitable bases for the resinous thermoplastic material are paper, glassine (a highly hydrated cellulose), polyethylene terephthalate, polyvinyl polymers, and the like.

The graphic intelligence must convert infrared radiations to heat for conduction to the layer to produce a heat-created latent image therein.

Graphic intelligence comprising infrared radiation-absorbing marking substance disposed imagewise on an infrared radiation transparent support may be intensified by

4

utilizing a layer of resinous thermoplastic material provided in heat-conduction relation thereto. The layer may have a pencil surface; it may be provided on the support before or after the graphic intelligence is placed on the support; and it may be placed on either side of the support. The support must be an infrared radiation transmitting material and is preferably visually translucent or transparent. The support bearing the graphic intelligence and the layer are exposed to infrared radiation to form a heat-created latent image in the layer. This latent image is then developed into a visible image corresponding to the graphic intelligence to give a more intensified appearance to the original graphic intelligence. The developed image is then fixed.

The graphic intelligence is thus intensified without re-tracing, re-inking, or tedious manual re-touching of any kind. Errors are eliminated. The intensified graphic intelligence is now reproducible at faster speeds and with better quality.

The heat-created latent image according to this invention is formed by means of infrared radiators and thermal copying machines at relatively high speeds. The heat-created latent image is retained for an appreciable time after exposure, thus permitting subsequent development with a powder, liquid toner, or a dye. Secret information may thus be stored in latent image form for long periods of time before it is retrieved by development.

The examples herein are given for the purpose of illustration and it is to be understood that the invention is not limited to these examples.

Examples

(1) An infrared radiation-transparent paper base was coated with a layer of polyethylene by applying a molten layer of polyethylene to the paper base at a temperature of about 600° F. and rapidly cooling the layer to form a uniform coating of 0.3 to 0.5 mil on the paper base. A master was placed on the layer to form a sandwich which was then subjected to infrared radiation. Heat was generated in the infrared absorbing image areas of the master and transferred to the polyethylene layer to produce a heat-created latent image therein.

The layer was charged with a negative electrostatic charge by means of a corona discharge. Then a negative electrophotographic toner powder was applied to the layer where it was selectively retained in the image areas. The toner was permanently fixed to the layer by heat-fusing. A positive image of the master was produced.

(2) An unsupported layer of polyethylene was placed in contact with a master and exposed to infrared radiation by the reflex technique in a thermal copying machine. The layer was then brushed with a magnetic brush of fine iron particles to produce a charge on the polyethylene. At this point no image was observed although a negative charge was given to the non-latent image areas of the polyethylene. The polyethylene was then developed with a thermoplastic colored toner powder by means of another magnetic brush. A negative potential of 75 to 100 volts applied between the magnet and the polyethylene during development produced a positive image of colored powder toner in the image areas of the polyethylene. The developed positive image was fixed by heat.

(3) By repeating the process in Example 3 with a positive toner powder, a negative image was produced.

(4) With reference to FIGURE 2, a glassine support having a layer of polyethylene about 0.5 mil thick on each side was placed in contact with a master. The infrared absorbing graphic intelligence side of the master was placed in contact with the bottom layer of polyethylene to form a sandwich which was then exposed to infrared radiation. Both reflex and contact methods of exposure were used. Heat-created latent images were formed

in both layers of polyethylene. After separation from the master, one of the layers was uniformly charged negatively by corona discharge, and then developed with a toner powder by one of the cascade and magnetic brush methods. Toner with a negative charge was used on the top layer to produce a right reading toner image. A mirror image was formed by using the same toner on the bottom layer. The toner was fixed to the layer by heating.

(5) A polyethylene layer on a paper base like that described in Example 1 was exposed with a master to infrared radiation to form a heat-created latent image therein. This layer was then electrostatically charged negatively to form an electrostatic latent image which was transferred by contact to a polyethylene copy sheet which accepted and retained the charge image. The copy sheet was then developed with a negative toner to produce a right-reading positive image. The image was fixed by heat.

The heat-created latent image was developable up to one year after the exposure to infrared radiation.

For this purpose the image is considered permanent.

(6) Several different images were made on a single copy sheet by repetitions of the method described in Example 5. By using different masters in register, multiple images were developed on the copy sheet. By using different colored toners, multicolor images were produced on the same copy sheet.

(7) A polyethylene layer was placed in contact with a master and exposed to infrared radiation to produce a heat-created latent image in the layer. This was used as an intermediate master by charging it negatively with a corona discharge bar, placing it in contact with a second sheet of polyethylene to transfer the electrostatic charge to the second sheet, developing the transferred electrostatic charge image on the second sheet with a negative toner, and then fixing the developed image with heat to form a permanent positive image. The intermediate master was again charged without re-exposing and a duplicate image was produced on another sheet by the same process. Many duplicate positive copies were thus made from the same intermediate master in this manner thereby providing a method of making many copies without re-exposure.

(8) By transferring only part of the electrostatic charge on an intermediate master prepared as in Example 7, several copies were made from an intermediate master that was exposed only once and charged only once. This was accomplished by successive transfer of charge to several copy sheets. The transferred charge images were developed with toner and fixed with heat.

(9) A layer of polyethylene was subjected to a heat image by means of infrared radiation. The layer was then charged positively and treated with a dilute solution of quinizarine green base (CI 61565) in toluene. The dye was retained in the image areas more than in the non-image areas. Dye in the non-image areas was removed by solvent to obtain a clear positive image.

(10) A heat-created latent image was formed in a layer of polyethylene as in Example 9. The layer was then charged negatively and developed with a dilute solution of quinizarine green base dye (CI 61565) in toluene. The dye remained in the non-image areas after evaporation of the solvent. The layer was then treated with heptane which cause the dye to accumulate and penetrate into the image areas thus leaving a positive dye image upon evaporation of the heptane.

(11) A layer of polyethylene was subjected to infrared radiation through a master and then charged positively. Application of a dye solution such as Latyl Violet BN in heptane with a cotton swab produced a negative image.

(12) A layer of polyethylene was dyed with a solution of Oil Red O (CI Solvent Red 27) in toluene, exposed with a master to infrared radiation to produce a heat-created latent image therein, and then charged nega-

tively. Subsequent rubbing with steel wool removed the dye from the background areas to leave a positive dye image.

(13) A copy sheet comprising a layer of polyethylene on a support was dyed on its surface with Latyl Violet BN in heptane and subjected to a heat image by infrared radiations through a master. The master was then removed and the copy sheet of polyethylene was given a negative charge. The charged copy sheet was treated with a solvent which removed the dye from the background areas to leave a positive copy.

(14) A heat-created latent image was formed in a layer of polyethylene by exposure in contact with a master to infrared radiations. The layer was charged and then developed with a magnetic brush having a negative potential of 75 to 100 volts and a negative toner. The toner adhered to the image areas to produce a positive which was fixed by heating. By using a positive toner, a negative image was obtained.

(15) An unsupported film of cellulose acetate was exposed in contact with a master to infrared radiation. It was charged, developed, and fixed by one of the methods previously described. The film was then treated with a saponifying solution of 35 parts water, 8 parts potassium hydroxide, and 65 parts methyl alcohol to render the non-image areas water-receptive. The film was then used as a lithographic printing plate to make over 100 lithographic copies without noticeable wear.

The same results were obtained with a layer of cellulose acetate on a suitable base such as paper.

(16) A layer of cellulose acetate was slightly saponified over its entire area in the manner described in Example 18. The slightly saponified cellulose acetate was then exposed to infrared radiation with a master to produce a heat-created latent image on the saponified layer of cellulose acetate. The cellulose acetate was subjected to an electrostatic charge by a corona discharge bar, developed with a powdered toner which accepts greasy ink, and fixed by heat to produce a permanent image. The image-bearing saponified layer of cellulose acetate was then used as an offset printing plate with the toner accepting a greasy ink and repelling water while the saponified non-image areas accepted the water and repelled the greasy ink. A suitable powder toner accepting greasy ink and which is negative with respect to iron carrier particles is one having 1400 parts by weight of a dark colored, high melting thermoplastic resin commercially available as "Vinsol" and 133 parts of an azo oil black dye such as CI Solvent Black 12. Vinsol comprises acidic materials derived from resin acids and oxidized resin acids, neutral high molecular weight compounds, and acid phenolic materials in the form of substituted phenolic ethers, polyphenols, and other high molecular weight phenols. The softening point of Vinsol is about 120° C.

A suitable toner for this purpose and which is positive with respect to iron carrier particles comprises:

Styrene and styrene homologs resin softening around 100 C. (Piccolastic D-100)—60 parts (wt.)

Styrene and styrene homologs resin softening around 125 C. (Piccolastic C-125)—40 parts

Carbon black (Elf 3)—5 parts

Carbon black (Mogul A)—2 parts

Black dye (Oil Black F-4160B)—2 parts

(17) A layer of nylon 8 such as Nylon 819 was exposed in contact with a master to infrared radiation to form a heat-created latent image therein. It was then charged, developed, and fixed to produce a printing plate which was used to make copies by offset printing methods.

(18) Light pencil drawings made on a drafting film comprising a polyester base and a resinous thermoplastic coating have a pencil-take material therein do not reproduce satisfactorily in microfilm reductions and even contact prints made therefrom are not always satisfac-

tory because of the lack of sufficient contrast between the lines and the background. In accordance with the present invention a drafting film bearing a light pencil line drawing was passed through a thermal copying machine to produce a heat-created latent image in the resinous thermoplastic coating under the pencil lines as result of conversion of infrared radiation to heat by the pencil lines. The drafting film was given a static charge by a corona charging bar and developed with a toner which adhered to the image areas and intensified the pencil lines. The toner was fixed by heating. The resultant copy was reproduced easily and with high quality by microfilming and other methods of reproduction such as diazotype reproduction methods.

(19) The method of intensifying lines as described in Example 21 was suitable for restoring old drawing which did not have sufficient contrast between the lines and the background for reproduction purposes. The old drawings which were on paper or other usual drafting materials were coated separately with one of the following resinous thermoplastic materials; nylon, polyvinyl butyral, cellulose acetate, and polyethylene. Various drawings were coated on either the front side, back side, or in some cases on both sides. The coated drawing was then exposed to infrared radiation to form a heat-created latent image corresponding to the drawing image in the coated layer. The coated drawing was then charged, developed, and fixed as previously described to produce a drawing with intensified lines which were more suitable for reproduction purposes than the original lines.

(20) Layers of nylon, cellulose acetate, and polyvinyl butyral were provided with a pencil-like material such as finely ground silica or the like in the layer so that a pencil drawing could be made on such layers. Pencil lines drawn on such layers were not sufficiently heavy for satisfactory reproduction by microfilming or contact printing and it was necessary to increase the density of the lines. These layers with the pencil line images were treated with infrared radiation in a thermal copying machine to produce heat-created latent images in the layers immediately adjacent to the pencil lines. The layers were then charged with a corona discharge and a suitable powder toner applied thereto. The toner adhered to the pencil line areas due to the difference in charge thereof with respect to the background areas. The toner was fixed to the layer by means of a thermal copying machine. The resultant drawings were then suitable for duplication by any of the known methods such as contact printing and microfilming.

(21) Pencil lines were drawn on the uncoated side of a paper base which was visually transparent, which was substantially transparent to infrared radiations, and which was coated on the other side with a layer of polyethylene. The polyethylene-coated base with the pencil image thereon was passed through a thermal copying machine to produce a heat-created latent image in the layer under the pencil lines. This heat-created latent image was developed by charging the layer and applying a toner which was retained on the polyethylene in the areas corresponding to the pencil lines. The contrast between the image and non-image areas was thereby increased or intensified. The image was fixed by heating the polyethylene layer in an oven or by passing through a thermal copying machine.

(22) The above methods were used to make changes in graphic intelligence between the master and a copy. A copy material comprising a resinous thermoplastic layer with a pencil surface was placed in contact with a master. Suitable copy materials were cellulose acetate film with a writing surface and polyethylene coated on glassine paper. The graphic intelligence to be changed was protected from infrared radiations by metal foil. Exposure of the assembly to infrared radiations produced a latent image of the desired graphic intelligence in the copy material.

Pencil lines for the new or changed graphic intelligence were then drawn on the pencil surface. Charging, toning and fixing of the latent image completed the revised copy.

In another variation of the same procedure the pencil lines were put on the copy material before exposure of the assembly to infrared radiations. The desired graphic intelligence was then added before charging, toning and fixing to produce a revised copy.

The developed visible images were intensifiable by charging, toning and fixing.

(23) A latent image of desired graphic intelligence was produced and developed in thermoplastic layers having a pencil surface by exposure with a master to infrared radiation. Additions were made on the pencil layer. Since the materials were transparent, the images were viewable by projection of the image onto a screen. The transparent copy was also used for reproduction by means such as the diazotype reproduction process.

The advantage of the present invention in intensifying the lines and graphic intelligence images of many kinds permits intermediate masters to be made even from poor originals.

(24) An infrared radiation-transparent paper base was coated with a layer of polyethylene. Graphic intelligence was applied to the polyethylene layer by conventional means. To make changes in the graphic intelligence on the polyethylene, pencil lines were drawn on the base to modify the image. Pencil lines found lacking in density were intensified by passing the copy through a thermal copying machine to produce a heat-created latent image under the pencil lines, developing, and fixing. The image was developed by applying a toner of the type used in electrophotography with charging. The fixing of the toner was done by subjecting the toned copy to infrared radiations in a thermal copying machine. The resulting copy on the polyethylene was then suitable for use as a master in making additional copies which incorporated the pencil changes on the polyethylene layer. It was also possible to blank out part of the original image of the master by placing an infrared radiation reflector over the part of the graphic intelligence which was to be changed. The reflector was metal foil or other suitable material which was placed between the source of infrared radiations and the master during the infrared exposure, thus preventing the heat-created latent image formation of unwanted graphic intelligence on the copy sheet. The changes were then made in pencil in the blanked out portion of the copy and intensified as necessary to make the desired copy.

It is apparent that the described examples are capable of many variations and modifications within the scope of the present invention. All such variations and modifications are to be included within the scope of the present invention.

What is claimed is:

1. A method of forming an image, which comprises the steps of:

heat-imaging a layer of thermoplastic resin to form a permanent, developable, latent image thereon; charging said layer at a substantially later time to form a charge image corresponding to the latent image on said layer; and toning said layer to render the charge image visible.

2. A method of making an image on a layer, which comprises the steps of:

exposing a layer of polyethylene to infrared radiation in heat-conductive relation with a master to form thereon a permanent, developable, latent image corresponding to the master image; charging said layer with an electrostatic charge at a substantially later time to produce a charge image corresponding to the latent image; developing the charge image with a toner which selec-

- tively adheres to said layer to render the charge image; and
fusing the toner to said layer to produce a permanent image.
3. A method of making multiple copies of a master, which comprises the steps of:
- exposing a first layer of thermoplastic resin to infrared radiation in heat-conductive relation with a master to form thereon a permanent, developable, latent image corresponding to the master image;
 - charging the first layer at a substantially later time to produce a charge image corresponding to the latent image;
 - transferring the charge image to a second layer of thermoplastic resin by contacting the second layer uniformly with the charge image-bearing surface of the first layer;
 - developing the transferred charge image on the second layer with a toner which selectively adheres to the second layer to render the transferred charge image visible;
 - fusing the developed image to the second layer; and
 - repeating the steps of charging, transferring, developing, and fixing to produce multiple copies of the master.
4. A method in accordance with claim 3 in which the final step is repeating the steps of transferring, developing, and fixing to produce multiple copies of a master.
5. A method of making a composite image of several master images, which comprises the steps of:
- exposing a layer of thermoplastic resin to infrared radiation in heat-conductive relation with one master to form thereon a permanent, developable, latent image corresponding to the master image;
 - charging the layer at a substantially later time to produce a charge image corresponding to the latent image;
 - developing the charge image on the layer with a toner which selectively adheres thereto to render the charge image visible;
 - fixing the toner to the layer permanently by fusing; and
 - repeating the steps of exposing, charging, developing, and fixing with a different master for each cycle to produce a composite image of the several masters.
6. A method in accordance with claim 5 in which a different colored toner is used with each different master to produce a multi-color, composite image of the several masters.
7. A method of making a copy of a master, which comprises the steps of:
- exposing a layer of thermoplastic resin to infrared radiation in heat-conductive relation with a master to produce thereon a permanent, developable, latent image corresponding to the master image;
 - charging the layer electrostatically at a substantially later time to form a charge image corresponding to the latent image;
 - developing said image with a solution of dye which selectively adheres to the layer to render the charge image visible; and
 - removing the excess solution to produce a copy of the master.
8. A method of making a copy of a master, which comprises the steps of:
- exposing a layer of thermoplastic resin to infrared radiation in heat-conductive relation with a master to produce a permanent, developable, latent image thereon corresponding to the master image;
 - charging said layer electrostatically at a substantially later time to form a charge image corresponding to the latent image;
 - applying a solution of dye uniformly to said layer to develop the charge image;
 - drying said layer to remove solvent therefrom; and

- removing dye from non-image areas of said layer with a second solvent to produce a copy of the master.
9. A method in accordance with claim 8 in which the second solvent concentrates the dye from the non-image areas into the image areas of said layer.
10. A method of making a copy from a master, which comprises the steps of:
- dyeing a layer of thermoplastic resin uniformly;
 - exposing the layer to infrared radiation in heat-conductive relation with a master to form a permanent, developable, latent image corresponding to the master image;
 - charging the layer uniformly at a substantially later time to produce a charge image corresponding to the latent image; and
 - removing dye from non-image areas to produce a copy of the master.
11. A method in accordance with claim 10 in which dye is removed by means of a solvent.
12. A method in accordance with claim 10 in which dye is removed by means of abrasion with steel wool.
13. A method of making an offset printing plate, which comprises the steps of:
- exposing a layer of cellulose acetate to infrared radiation in heat-conductive relation with a master to form thereon a permanent, developable, latent image corresponding to the master image;
 - charging the layer electrostatically at a substantially later time to produce a charge image corresponding to the latent image;
 - developing the charge image on the layer by applying a toner which selectively adheres to said layer;
 - fusing the toner to said layer; and
 - saponifying the surface of said layer with an alcoholic solution of potash to render the non-image areas hydrophilic to form a layer suitable for use as an offset printing plate.
14. A method in accordance with claim 13 in which the step of saponifying is performed before the exposing step.
15. A method of intensifying indicia on a document comprising a support transparent to infrared radiation and infrared radiation-absorbing indicia on said support, which comprises the steps of:
- exposing the document to infrared radiation to form a permanent, developable, latent image in a layer of thermoplastic resin provided in heat-conductive relation to the absorbing indicia;
 - charging said layer at a substantially later time to produce a charge image corresponding to the latent image;
 - developing said layer with a toner which adheres selectively to said layer to produce a visible image; and
 - fusing the toner to said layer to permanently fix the developed image, thereby intensifying the indicia on the document.
16. A method of making changes in graphic intelligence between a master and a copy, which comprises the steps of:
- exposing a pencil-accepting layer of thermoplastic resin to infrared radiation in heat-conductive relation with a master having unwanted graphic intelligence shielded from the infrared radiation to form on said layer a permanent, developable, latent image corresponding to the wanted graphic intelligence;
 - charging said layer electrostatically at a substantially later time to produce a charge image corresponding to the latent image;
 - developing the charge image with a toner which adheres selectively to said layer to render the charge image visible;
 - fusing the toner to permanently fix the developed image on said layer; and
 - making changes desired on the pencil-accepting layer

11

with a pencil to produce a copy with changes in graphic intelligence from master to copy.

17. A method in accordance with claim 16 in which the copy produced is further intensified by repeating the steps of exposing, charging, developing, and fusing.

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RALPH G. NILSON, *Primary Examiner.*

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,206,599

September 14, 1965

Robert M. Gold

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 6, line 33, for "18" read -- 15 --; column 7, line 16, for "21" read -- 18 --; column 8, line 28, for "poylethylene" read -- polyethylene --; line 40, for "orignal" read -- original --.

Signed and sealed this 20th day of December 1966.

SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents