United States Patent

Kaminstein

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[54] **METHOD AND MEANS FOR MAKING A DUPLICATING MASTER**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 668,262, June 12, 1967, Continuation-in-part of Ser. No. 612,170, Jan. 27, 1967, abandoned.

[52] **U.S. Cl.** **101/453**, 96/1.8, 101/401.1, 101/462, 101/471

[51] **Int. Cl.** **B41n 1/14**

[58] **Field of Search** 101/450, 460, 451, 471, 452, 101/401.1, 462, 453; 96/1.4, 1.5

[56] **References Cited**

UNITED STATES PATENTS

1,669,416	5/1928	Huebner	101/456
3,356,030	12/1967	Greubel	101/452
2,954,291	9/1960	Clark	96/1.5
3,107,169	10/1963	Bornarth	96/1.8
3,230,875	1/1966	Newman	101/471
3,247,793	4/1966	Beatty et al.	101/471 X
3,257,942	6/1966	Ritzerfeld et al.	101/471
3,289,579	12/1966	Block	101/471
3,315,598	4/1967	Owen	101/471
3,379,127	4/1968	Newman	101/471
3,426,678	2/1969	Carper et al.	101/450 X

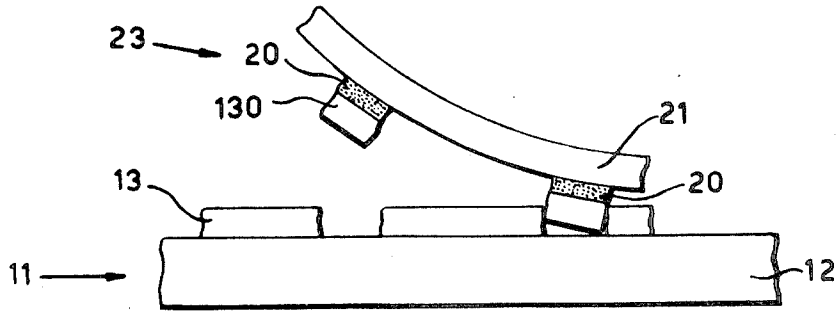
Primary Examiner—Edgar S. Burr

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[57] **ABSTRACT**

A duplicating master is produced from which multiple copies of an original may be made by first making a direct electrophotographic copy of the original. Thereafter, through the use of heat, the image portions of the electrophotographic copy are transferred to a transfer sheet. The transfer sheet with the image thereon, now constitutes a duplicating master and may be used as such.

13 Claims, 4 Drawing Figures



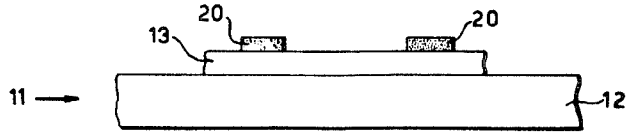


Fig. 1

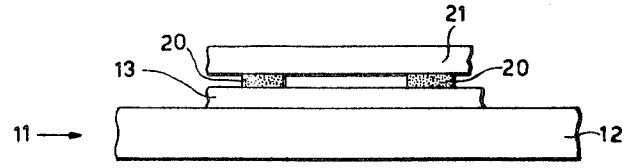


Fig. 2

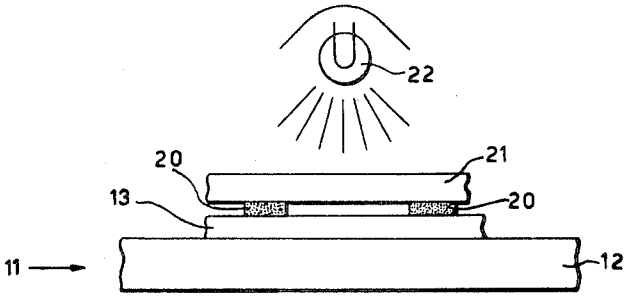


Fig. 3

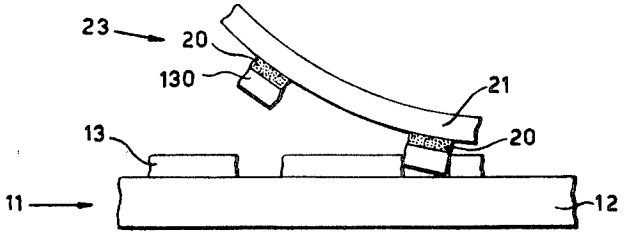


Fig. 4

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METHOD AND MEANS FOR MAKING A DUPLICATING MASTER

This application is a continuation-in-part of application Ser. No. 668,262 filed June 12, 1967, entitled "Method and Means for Making a Duplicating Master", which was a continuation-in-part of an application Ser. No. 612,170 filed Jan. 27, 1967, now abandoned.

BACKGROUND OF THE INVENTION

This invention relates to an improved method and means of making a duplicating master from an electrophotographically obtained copy of an original document. Also, this invention relates to a unique method and means for printing from said printing master.

Many copying machines are presently commercially available for producing copies of an original document. Some of these copying machines use the electrophotographic process which briefly comprises electrically charging a photoconductive layer, selectively dissipating the charge on this layer by exposure to a light image of an original desired to be copied, so as to obtain an electrostatic latent image. Finally, the latent electrostatic image is developed employing a liquid or solid toner which is fixed whereby a visible toner image of the original is provided.

In these known processes, if multiple copies of the original document are desired, it is generally necessary to repeat the entire copying process once for each copy to be made. This is time consuming where a large number of copies is desired. Furthermore, the associated control equipment for enabling multiple copy of an original increases both the cost of the equipment in which it is installed together with the power consumption required for multiple copying.

Other multiple copy reproduction methods are available which provide for the use of the electrophotographic process for making a master which can be subsequently reproduced many times on very cheap copy sheets using duplicating apparatus. More particularly, a copy sheet, obtained by a conventional direct electrophotographic process which has fixed on its surface a raised pattern of toner material representing the image of the original, is used as a convention offset master. Alternatively, the pattern of toner material may be transferred and fixed to a suitable sheet which thereafter is used as a conventional offset master. These arrangements, however, do not provide sharply defined raised images on the final offset master and there have been difficulties encountered in the step of inking. In order to reduce these difficulties, it has become necessary to use complicated and expensive methods for differentially controlling the adhesion and absorption properties of the imaged and non-imaged areas of the master with respect to the ink, preferably after completion of the electrophotographic step of the process. These requirements make the overall process and apparatus complicated and expensive.

Other methods have been suggested which provide for the use of the electrophotographic process to make spirit duplicating masters or mimeographed stencil masters, which are thereafter used for making multiple copies.

Exemplary of the prior art methods are U.S. Pat. Nos. 2,954,291 and 2,949,848. In U.S. Pat. No. 2,954,291 to Harold E. Clark, a method of making a spirit duplicating master is described which comprises making a direct electrophotographic copy of an original document on a special binder-type xerographic plate containing crystal violet as a photoconductor on which the latent electrostatic image is developed using a toner of plastic resin particles. A master sheet of paper is placed in contact with the developed image. The fixed toner image is then chemically "tackified" or reduced in viscosity by exposure to a solvent vapor which causes the toner to adhere to the adjacent or underlying areas of the master sheet and to the photoconductive material. Thereafter, upon separating the master sheet from the xerographic plate, the crystal violet present in the toner image areas is torn from the remaining regions and the toner image adheres to the master sheet providing thereby a raised image made of the toner image covered by the binder material containing crystal violet. This is then used as a spirit duplicating master.

Another method is described in U.S. Pat. No. 2,949,848 to G. R. Mott, and consists of making a xerographic copy on a conventional photoconductive material covered xerographic plate, and applying a transfer sheet to the toner which is in the image areas of the zinc oxide xerographic plate. Thereafter, the toner is "tackified" or softened either by exposure to chemical vapors, or to heat, indicated as being applied by placing the transfer sheet and plate between two hot platens. The toner image adheres to the transfer sheet which, when stripped from the plate, also takes with it the photoconductive material in the image areas. The photoconductive material or binder remaining on the plate is then "tackified" by any suitable means and a sheet of porous material is then applied to it. This sheet is the base for the stencil master. The "tackified" photoconductive material or binder is permitted to adhere to the porous base so that upon stripping, it adheres to it rather than to the plate. This is then used as a stencil.

SUMMARY OF THE INVENTION

The present invention achieves superior results in a much simpler and less expensive manner than heretofore attainable. A duplicating master, in accordance with this invention, is achieved by first producing, in the usual manner, by electrophotography, a copy of an original. The copy usually comprises a base layer over which there is a photoconductive layer, such as zinc oxide, on which there is the developed and fixed image of toner particles. A transfer sheet, which is substantially transparent to infrared, is pressed into intimate contact with the image on the surface of the photoconductive layer. Only the image regions of the photoconductive layer are then heated through the transfer sheet whereby only the toner image is brought to the melting point. The heat of the toner image softens the adjacent portions of the plastic transfer sheet to the point where the toner image and the adjacent regions of the transfer sheet are fused. Thus, after removal of the heat source for a time to permit the toner image to cool, one can strip the transfer sheet from the electrophotographic copy and the toner image will adhere to the transfer sheet. Those portions of the photoconductive layer on which the toner image was developed, also adhere to the toner image to produce on the transfer sheet a raised image of the original document. The portion of the raised image adjacent to the transfer sheet comprises the toner of pigment powder particles which are coated on their outside surface with the photoconductive material which has been torn from the base layer.

In order to print with the duplicating master, the raised image in inked in well known fashion. The inked raised image is then brought into contact with a print receiving member. With some inks, pressure is sufficient to transfer the ink image to the print receiving member. With other inks, heat is required to be applied to the back surface of the transfer sheet to selectively heat the toner image, but to a temperature lower than its melting point, which succeeds in driving the ink, by expansion, out of the photoconductive material onto the print receiving member.

The objects, advantages and features of the invention will be apparent from the following description when read with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a diagrammatic cross-sectional view of a photoconductive copy sheet bearing a toner image;

FIG. 2 illustrates the positioning of a transparent sheet of material over the toner image of FIG. 1;

FIG. 3 illustrates the application of infrared to the back surface of the transfer sheet for selective heating of the toner image; and

FIG. 4 illustrates stripping of the transfer sheet from the photoconductive copy sheet to cause transfer of the image to the transfer sheet.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In accordance with this invention, a copy of an original is made in the well known manner according to the direct electrophotographic process, described for instance, in an article published in the RCA Review, Dec. 1954, Volume XV, No. 4, Pages 469 to 484.

More particularly, referring to the drawings, FIG. 1 represents a diagrammatic cross-sectional view of a portion of a copy of an original document which has been made by the electrophotographic process. As shown in FIG. 1, the resulting photoconductive copy sheet 11 comprises a photoconductive insulating layer 13, overlying a conductive base member 12, and bearing the toner image 20, as obtained by electrostatically charging, exposing and developing according to the aforesaid electrophotographic process. The structure and operation of the electrophotographic apparatus required for accomplishing the making of the electrophotographic copy will not be described, since this is well known.

Although various types of electrophotographic plates may be used for the copy sheet 11, a zinc oxide coated paper, as used in commercially available copiers, is presently preferred. A suitable zinc oxide coated paper of this type may comprise a paper base acting as the conductive base member 12, carrying thereon, as the photoconductive layer 13, a coating comprising finely divided zinc oxide particles dispersed in an insulating binder.

It will become apparent from the subsequent description of this invention, that it is desired to apply energy in the form of infrared for heating up the particles forming the toner image 20, in a preferential manner, so that not only are particles melted but they provide sufficient heat to melt the material in the transfer sheet adjacent thereto whereby the toner image effectively is fused to the sheet. Only the regions of the transfer sheet adjacent the toner image are so affected. Thus, a requirement for the toner which is to be used is that it be capable of absorbing the infrared heat which is transmitted to it through the substantially infrared transparent transfer sheet. It is believed that most commercially available toners have this property. However, pigment or toner particles which are used for toner which are reflectors of infrared, rather than absorbers, are not suitable for this particular process.

After development of the latent electrostatic image on the copy sheet 11, using either liquid or dry toner, the surface of the copy sheet 11 bearing the developed image 20 is placed in intimate contact with a substantially infrared transparent transfer sheet. By way of illustration, and not by way of limitation, a sheet of plastic material preferably polystyrene may be used. Many other plastic or plastic coated papers that are infrared transmitters may also be used. Polyethylene may also be used. The transfer sheet, as shown in FIG. 2, is placed or preferably pressed in intimate contact with the developed image 20. Intimate contact may be easily secured in any suitable and well known manner, for example, by using rollers for pressing the two sheets together. If a liquid toner has been employed, the two sheets may be pressed together while the copy sheet 11 is still damp. One need not wait for it to completely dry in order to carry out the steps of this invention. It should be noted that the intimate contact or pressure of the toner image and transfer sheet need be maintained only during the heating process, as described below.

As shown in FIG. 3, the copy sheet 11 and the infrared transmitting transfer sheet 21, which have now been assembled together in intimate contact, are subjected to radiation from a heat source 22, which directs heat energy, preferably in the form of infrared radiation, at the transfer sheet and therethrough towards the developed copy sheet. As indicated, it is preferred that the intimacy of the contact be assured at this time by the application of pressure to the two sheets. The amount of such pressure is not critical, as long as it is below the amount of pressure at which the toner image would be smeared when it is melted by the infrared heat.

Due to the preferential absorption of energy by the pigmented toner material in the imaged areas, heat is preferentially generated in said image areas. As a consequence, the areas of the surface of the polystyrene sheet 21 and of the zinc oxide coating 13 facing said image areas are also heated. The heat has the effect of substantially melting both the toner and some of the polystyrene material immediately adjacent thereto so that a certain amount of fusing of the two occurs. Upon subsequent cooling, which occurs quite rapidly, it is found that the toner is fused quite strongly to the polystyrene sheet. The zinc oxide adjacent the toner adheres quite strongly thereto to such an extent that upon separating the polystyrene sheet from the copy sheet, as may be seen in FIG. 4, the toner 20 and the zinc oxide layer 13 are parted from the copy sheet and remain with the polystyrene sheet in the areas precisely corresponding to the image previously developed on the copy sheet 11. This adhesion is such that during the separation of the sheets, the portion 13 of the zinc oxide coating which underlies the toner image 20, is sharply torn from the remaining portion of the zinc oxide coating 13, which continues to adhere to the paper substrate 12. Therefore, the toner image 20 and the portion of the zinc oxide coating which effectively covers the other or outside surface of the toner image constitute a raised image of the original document, which image is firmly held by the polystyrene sheet 21.

It has been found that a very small stripping force is necessary for separating the copy sheet from the transfer sheet after the toner has been allowed to cool. It is believed that in the process of the melting of the toner particles, these particles probably diffuse into the interstices which are formed by the crystalline zinc oxide and thus secure a better mechanical grip thereto than is provided to the underlying substrate or to the adjacent zinc oxide.

In addition to the plastic sheet having the property that it must be substantially transparent to infrared radiation, it also should have the desirable property that it is a good thermal insulator and therefore, heat produced within the toner is not diffused but remains local to enable the toner to attain substantially a melting temperature and to also melt the adjacent surface of the plastic sheet. The temperature at which this melting occurs is believed to be at about 300° F. Infrared illuminating apparatus of the type normally used in commercially available thermographic copiers may be used for this purpose with this invention.

In summary therefore, in order to produce a duplicating master in accordance with this invention, a copy of an original document using electrophotography is first made. The copy, which comprises a substrate upon which photoconductive material is spread and over which the developed image made of pigment or toner exists, is placed in intimate contact with a substantially infrared transparent sheet which also has good thermal insulation properties. An infrared source of energy is applied to the back of the transparent sheet for the time required to melt the image toner particles whereby they can fuse with the associated regions of the plastic material and can obtain a good mechanical grip upon the photoconductive material adjacent thereto. The heat source is removed, the heated material is allowed to cool, and the transparent sheet is stripped from the copy sheet whereby it contains the image formerly on the copy sheet, covered over by the adjacent photoconductive material. It should be noted that the time required for heating the pigment material and also for cooling it, is quite short so that the steps of this method may be carried out on a continuous basis.

It has been found that in the event some background is present on the copy sheet 11, by reason of any imperfection in the electrophotographic process steps used to obtain the toner image according to FIG. 1, or even by reason of a poor quality of the original to be copied, the step of applying the infrared to

cause the transfer of the image to the transparent sheet has the effect of cleaning up, to a large extent, this background. It is believed that the reason for this is because the heat built up in the background areas by absorption of the infrared radiations in the dark points of the background on the copy sheet is not sufficient to cause melting and fusion and thereby transfer of this undesired background to the transfer sheet in the process of stripping. As a result, a cleaner and more sharply delineated image is transferred to the polystyrene sheet in the step of stripping.

The transfer sheet carrying the transferred image, if desired, may be used as a positive transparency and projection therefrom or contact printing therewith may be done using well known photographic processes. In order to use the plastic sheet with the transferred image as a duplicating master, ink is deposited upon the raised image using any well known inking process, such as by applying the ink with a roller and then squeegeeing off the excess. It is preferable that the ink that is used should not wet the transfer sheet surface, but should wet the exposed zinc oxide. A number of commercial inks fully comply with this selective wetting requirement; that is, they do not wet the plastic material. Alternatively, selective application of the ink to the master may be carried out by means of inking rollers or by any other means known in the art of offset printing and duplicating.

In printing with the transfer sheet, it has been found that with some inks, which may be hereafter called "pressure" inks, the inked image may be readily transferred to a receiving sheet by merely pressing the inked duplicating master against the receiving sheet. Two examples of a suitable "pressure" ink formulation are as follows:

	Parts by weight	Material	Manufacturer
Formula I	5	Paraffin 134m./p	Humble
	2	Azo oil, blue black	Allied Chemical
	2	Paraplex G-60	Rhom & Haas
	3	Turpentine	
Formula II	5	Carbowax 400	Union Carbide
	1	Irgacet Black R1.	Geigy Chemical Corp.
	3	Ethylene glycol	Jefferson Chemical Corp.

Another type of ink, hereafter called "heat sensitive" ink, requires the use of heat for transferring an ink image from the duplicating master to the receiving sheet. Here, after inking the raised image on the duplicating master in usual and well known fashion, the image receiving surface has the inked image applied thereto under some slight pressure to assure intimacy of contact, while applying heat to the back surface of the printing master at a temperature preferably on the order of 200° F or lower than the temperature which causes melting of the toner image. The reason for the use of heat is because the ink, which is applied to the zinc oxide surface image, apparently enters the interstices which are formed between the crystals of the zinc oxide. As a result, the bringing of the printing master in contact with the image receiving sheet in and of itself does not result in the transfer of sufficient ink to provide an image. The application of the heat appears to cause the ink to expand out of the interstices in the zinc oxide and thereby to be transferred to the image receiving surface.

The selective heating of the raised image on the printing master through the back surface of the printing master occurs substantially instantaneously when a heating light source of the type previously mentioned is employed. Therefore, the printing operation can occur on a continuous basis with the printing master being first inked, and thereafter brought in pressure contact with the image receiving sheet while being heated to release the ink, and thereafter being moved back to the inking location again.

A violet ink formulation suitable for a heat and light pressure transfer is a mixture of 75 percent by weight of propylene glycol, and 25 percent by weight of methyl violet oleate, (a direct basic dye reacted with oleic acid). This ink also can be transferred by using a heavy pressure alone.

A black ink formulation, suitable for a heat and light pressure transfer is a mixture of 17.5 percent irgacet black RL (dye made by Geigy Chemical Corporation), 31.5 percent diethylene glycol, 31.7 percent propylene glycol, and 19.1 percent dimethyl formanate.

The examples of ink formulations given for the "pressure" and "heat sensitive" inks are merely by way of example, and should not be construed as the sole inks usable nor as a limitation upon the invention. It is believed that the more viscous inks which penetrate the zinc oxide interstices to a minimal degree, will be suitable for transfer by pressure alone, while inks having a relatively low viscosity will require the use of heat in order to be transferred from the duplicating master to the image receiving sheet. Then there is a range of viscosities of the inks in between these which may be transferred in response to some heat and some pressure, or which relatively heavy pressure alone may accomplish ink transfer. The requirements for ink transfer for a particular ink formulation may be easily determined by a simple trial.

Two techniques for using this printing master for printing with ink, which are most successful, both comprise the use of a liquid immiscible with water or an oil, together with a water miscible ink. The oil may be for example, Magie 400 oil, which is a kerosene fraction distillating between 398° and 435° F. The water miscible ink may be, by way of example, a mixture of 74 percent orange shellac solution (45 percent shellac, 2 percent water, and propylene glycol, 8 percent ethylenediamene, 99 percent pure, and 18 percent carbon black (United 3020L)).

In one printing technique the printing master is first wiped with the oil, and thereafter the ink is applied in any suitable manner such as by roller in a printing press. The aqueous ink adheres to the image areas only and does not adhere to the oil coated background and thus printing can proceed expeditiously, with the oil being wiped onto the entire printing master periodically after it begins to disappear from the background either by way of evaporation or for other reasons. This technique is described in more detail in an application entitled "Method and Means for Making a Printing Master," Ser. No. 711,519, Filed Mar. 8, 1968 by Schmutzler et al., now abandoned in favor of CIP 35,796, filed May 8, 1970.

Still another technique for printing using the ink and the oil technique is to mill or mix the oil into the ink. This may be done using the well known printing press wherein a small quantity of oil is distributed over one of the rollers in the ink roller train prior to the inking roller. The amount of oil which is used depends upon the viscosity of the ink. By way of illustration, 0.03 cc. of the Magie Oil may be dropped on an ink roller on which there is ink having an average viscosity of 120 poises for every five 8×10 prints which are made. With a heavier viscosity of ink, such as 300 poises, 0.02 cc. of oil may be used. It is to be understood that the viscosity of the oil is low, especially when compared with the viscosity of the ink with which it is used. This technique is described in further detail in an application for patent Ser. No. 807,325 filed Mar. 12, 1969, entitled "Inking System for Printing" by Bernard Kaminstein.

The printing master made in accordance with this invention, has the property that, whether the oil is applied separately or together with the ink, its background is oil wettable and retains the oil on the surface. The image areas appear to be oil absorbing and provide a surface to which the viscous ink can adhere and from which it can be transferred to paper.

The reasons for the printing master oil selective background is well understood since the type of materials selected therefor in accordance with this invention are of the type known to be oil wettable, having a smooth and nonabsorbent surface. However, the reason why the image regions are ink selective is not too clearly understood. By way of an explanation, but not to

be construed as a limitation upon the invention, the image regions are porous and have a rough surface finish. The pores readily absorb the low viscosity liquid and provide a gripping surface for the high viscosity liquid. Therefore, the oil, when applied to the image regions, is literally absorbed into the pores leaving the roughened surface free to grip the viscous ink. The background, being preferentially oil wettable rejects the ink.

Another theory which has been advanced is that the oil may possibly cause some dissolving of the binder material in which the zinc oxide is encapsulated. Since the zinc oxide absorbs oil it can then readily absorb this oil.

In any event, regardless of the reason for its behavior, the printing master made in accordance with this invention, either when oil and ink are applied separately by rollers, or when they are applied together, demonstrates the property that its background areas are not inked but rather retain the oil and its image areas are inked. It should be remembered that the image areas herein are made of the fused toner which is fused to the base sheet on one side and on the other side is covered by the zinc oxide encapsulated in the binder. The fused toner comprises homogenous non-particulate material.

While the foregoing description provides for a method of making a duplicating master from an electrophotographic copy, if it is not desired to make a copy but to create an original duplicating master, this can be done by directly painting or writing or drawing on the infrared transmitting sheet with a solution of a zinc oxide and binder with a suitable heat absorbing agent, such as carbon black, dispersed therethrough. The painted image is then dried to anchor it to the sheet. Ink can then be applied to the image, an image receiving sheet may be pressed in contact therewith and heat applied to the image through the back of the sheet, in the manner described. The carbon black acts as a heat absorber to expand the ink out of the pores of the zinc oxide, as described previously. The duplicating master sheet may be made of any one of Myler, acetate, vinyls, or acrylics, etc. It could also be composed of an infrared transmitting paper such as "Glasline" base, on top of which is extruded a thin layer of polystyrene.

A method and means of making copies as described hereinabove has been indicated as being directed to a process where multiple copies are required. This is achieved without requiring a re-imaging of the original for each copy, as is necessary in the electrostatic copiers presently available. With the method and apparatus in accordance with this invention, only one image is required to be made of the original. Thereafter, using the duplicating master, only the inking and ink transfer steps are required for obtaining multiple copies.

Accordingly, the present arrangement considerably reduces the operating and material costs normally encountered in making multiple copies. The costs of the materials such as polystyrene sheets, and of the standard printing inks and the image receiving paper which can be used by the present process, are substantially lower than the cost of electrophotographic paper now used for multiple copies. The inked image which is on the printing master can be reproduced onto any type of print receiving sheets compatible with the ink being employed, such print receiving sheets including ordinary paper.

I claim:

1. A duplicating master comprising an infrared radiation transmitting plastic sheet having the property that its temperature is uneffected by infrared radiation passing therethrough,

said sheet having a raised image on one surface thereof, some of the materials in said raised image and the plastic sheet material adjacent thereto both being melted over their interfaced regions by exposure to infrared radiation passing through said sheet, and

said raised image including an infrared radiation absorbing material and a photoconductive material.

2. Apparatus as recited in claim 1 wherein said infrared radiation transmitting sheet comprises polystyrene.

3. Apparatus as recited in claim 1 wherein said infrared radiation transmitting sheet comprises polyethylene.

4. Apparatus as recited in claim 1 wherein said infrared radiation transmitting sheet comprises acetate.

5. Apparatus as recited in claim 1 wherein said infrared radiation transmitting sheet comprises vinyl.

6. A duplicating master as recited in claim 1 wherein said raised image comprises a layer of an electrophotographic image developing toner having on the outer surface thereof a layer of a photoconductive material.

7. A duplicating master as recited in claim 1 wherein said infrared heat absorbing material is carbon black and said photoconductive material is zinc oxide.

8. A duplicating master comprising an infrared radiation transmitting and non-infrared absorbing plastic material sheet,

said sheet having at least one raised image on one surface thereof,

said raised image comprising a layer of zinc oxide mixed in a binder material, and

a layer of toner fused to a surface of said layer of zinc oxide mixed in the binder material, a portion of said toner material and said plastic material adjacent thereto both being heat melted over their interface regions.

9. In a system of printing wherein an oil which is applied to a printing master background has a viscosity which is low relative to the high viscosity of an aqueous ink applied to the printing master image regions, the improvement comprising

a printing master comprising a sheet having a plastic like, meltable, smooth liquid impervious oil wettable surface, and

raised image regions on said surface including photoconductive material in a binder having pores therein for absorbing relatively low viscosity liquid and a rough surface to which relatively high viscosity inks can adhere.

10. A printing master as recited in claim 9 wherein said image regions contain homogeneous non-particulate material.

11. A printing master as recited in claim 9 wherein said image regions includes fused toner material.

12. A printing master as recited in claim 9 wherein the photoconductive material of said image regions comprises zinc oxide.

13. A printing master as recited in claim 9 wherein said image regions are raised above the surface of said sheet and include fused toner melted together with said sheet over the interface regions therebetween, and

zinc oxide and binder material on said toner and to which said toner is fused.

* * * * *