

Nov. 25, 1958

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2,861,515

METHOD OF MAKING DUPLICATING MASTER

Filed Feb. 2, 1955

2 Sheets-Sheet 1

Fig. 1.

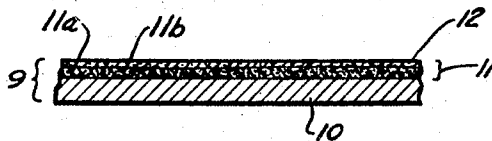


Fig. 2.

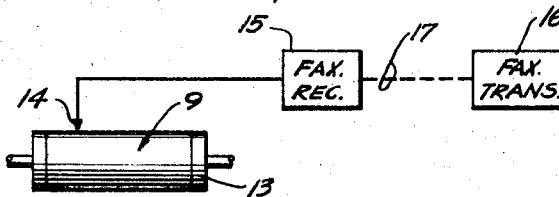


Fig. 3.

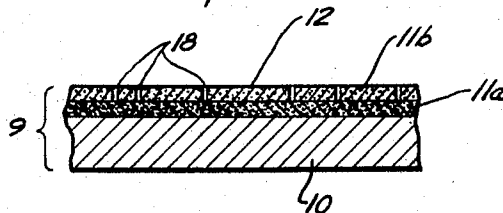


Fig. 4.

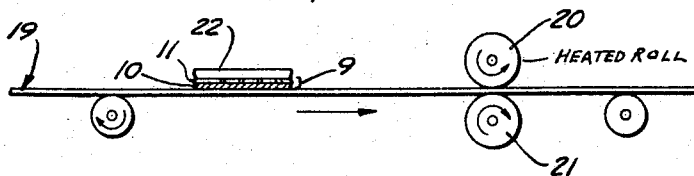
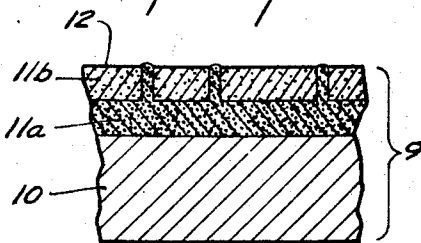


Fig. 5.



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Fig. 6.

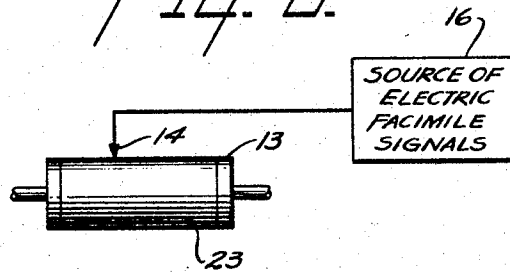


Fig. 7.

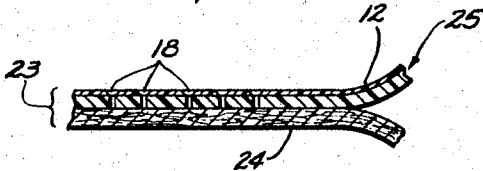


Fig. 8.

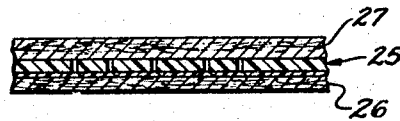
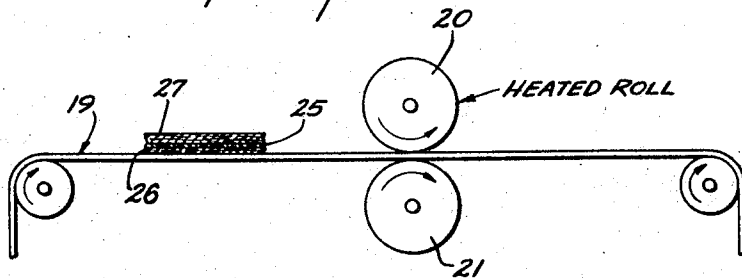


Fig. 9.



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METHOD OF MAKING DUPLICATING MASTER

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Application February 2, 1955, Serial No. 485,758

3 Claims. (Cl. 101—149.4)

This invention relates to duplicating methods and also to recording blanks. More especially the invention in one of its aspects relates to blanks which are particularly designed to be responsive to applied point electric discharges such as those produced by an electrically energized needle or stylus.

A principal object of the invention relates to novel methods of making a duplicating master or non-master copy by using a plastic sheet which has been perforated to produce a stenciled record of the subject matter, in conjunction with a reservoir sheet carrying wax or wax-like ingredient and a coloring ingredient such as carbon, black dye, or transferable dye. The stenciled plastic sheet, while sandwiched between the reservoir sheet and a third sheet, is heated to produce on said third sheet a duplicate of the record in the stenciled sheet which duplicate record itself may be either a duplicating master or a non-master copy.

Another principal object of the invention is to provide an improved record blank which can be used to record electric facsimile signals and the like, and when thus recorded the blank can act as a duplication master. It can also be used to produce another duplicating master which will be a mirror image of the original.

The blank according to this invention is in the nature of an improvement on the kind of electrosensitive facsimile recording blank disclosed in U. S. Patent No. 2,638,422 and in U. S. Patent No. 2,664,044.

A feature of the invention relates to a facsimile recording blank of the kind having a backing member coated with a conductive stratum which contains a coloring ingredient such as carbon or transferable dye, which stratum is arranged to be perforated by stylus-applied point electric discharges. In accordance with the invention, the said stratum also contains a special wax or wax-like ingredient for improving the transfer of the dye or coloring material through the perforated areas of the said stratum on to a receiving surface.

Another feature relates to a facsimile recording blank of the generic type disclosed in U. S. Patent No. 2,638,422, but which is specially prepared to enable it to be used to produce a duplicating master which will be a mirror image of the original.

Another feature relates to a novel method and apparatus for making a duplicating master containing a releasable coloring ingredient on a carrier, which carrier is relatively non-resilient as compared with the usual gelatin pad.

Another feature is to provide a method of making a blank of the generic type disclosed in U. S. Patent No. 2,638,422, which, however, has been specially prepared to enable the blank to be used to produce duplicating masters by the so-called spirit transfer process, as distinguished from the gelatin pad process.

A further feature relates to the novel combination of elements and other composition and relative arrangement whereby an improved electrosensitive recording and master-preparing blank can be obtained.

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Other features and advantages, not particularly enumerated, will be apparent after a consideration of the following detailed descriptions and the appended claims.

In the drawing, which shows by way of example certain preferred embodiments,

Fig. 1 is a magnified cross sectional view of a blank prepared according to the invention;

Fig. 2 is a schematic system diagram explanatory of the method of recording on the blank of Fig. 1;

Fig. 3 is a more highly magnified cross sectional view of the blank of Fig. 1 after it has been recorded on by the apparatus of Fig. 2;

Fig. 4 is a schematic diagram explaining the method of treating the recorded blank of Fig. 3 to render it capable of use in an alcohol or spirit dye-transferring process or for the production of a master which will be a mirror image of the original;

Fig. 5 is an even higher magnified view of the blank of Fig. 3 to explain the method illustrated in Fig. 4;

Fig. 6 is a schematic diagram of a recording system employing a modification of the blank of Fig. 3 on the recording drum;

Fig. 7 is a sectional view through the thickness of part of the recorded blank produced by Fig. 6;

Fig. 8 shows the recorded blank of Fig. 7 sandwiched between a reservoir sheet and the receiving sheet to which the record is to be transferred;

Fig. 9 is a schematic view of apparatus similar to that of Fig. 4, showing the manner of heating the assembly of Fig. 8 to produce the transferred record.

Referring to Fig. 1 of the drawing, the blank 9 according to the invention comprises a backing 10 of any suitable material, for example heavy paper, cardboard, and the like. It will be understood, of course, that the invention is not limited to any particular material for the backing 10 and preferably, although not necessarily, it is of a thinness to render it pliable and flexible so that it can be readily wrapped around a recording drum or other support. Merely for purposes of explanation, the view of Fig. 1 shows the blank in highly magnified form, for example Fig. 1 may represent a magnification of the order of ten times.

The surface of blank 10 on which the recording is to take place is provided with a coat 11 which is electrically conductive, for example by having powdered conductive carbon intimately mixed therewith. Preferably, although not necessarily, the coat 11 is prepared in such a way as to have graded or stepped conductivity through its thickness. For example, the coat 11 may be prepared by first applying a base coat 11a containing a predetermined amount of powdered carbon mixed with a suitable binder so as to impart to the coat 11a a relatively high electric conductivity as compared with the coat 11b. For example, the base coat 11a may have a surface resistance of approximately 500 to 2,000 ohms when measured between two wire-like parallel electrodes in contact with the coat 11a, the wire electrodes each being 1 centimeter long and spaced apart 1 centimeter.

The base coat 11a is specially prepared so that it acts as a dye reservoir and for that purpose it has mixed therewith, prior to being cast or otherwise applied to backing 10, a suitable transferable dye such for example as methyl violet or any other similar dye such as is well known in connection with "Ditto" equipment. In accordance with this invention, the coat 11a includes a substantial percentage of wax or waxlike resin or a mixture thereof which must be water soluble or alcohol soluble, or both water and alcohol soluble, and which must be insoluble in the solvent for the coat 11b. For example, the coat 11a may be prepared from the following formulation

which is given merely as typical and not by way of limitation:

22.0 polyethylene glycol, for example "Carbowax 4000"
(Carbide and Carbon Chemical Co.)
10.0 methyl violet (2-B crystals)
9.0 acetylene black
50.0 methyl alcohol
1.0 glycerine

The above ingredients are placed in a ball mill and milled for a substantial length of time, for example 48 hours, or until the acetylene black has become thoroughly dispersed. This dispersion can then be cast or deposited to a thickness of the order of one mil on the backing 10 and then the solvent is evaporated. Preferably the finished film should have a surface resistance of approximately 500 to 2,000 ohms, measured as described above, and have a weight of 0.25 to 0.50 ounce per square yard.

The coat 11b is preferably of a type having a substantial percentage of a film-forming resin as one of its constituents, whereas the coat 11a, as pointed out hereinabove, is free from such resin. A typical formulation given by way of example and not by way of limitation for coat 11b is as follows:

10.0 methyl methacrylate polymer (P-1) (E. I. du Pont de Nemours and Co., Inc.)
120.0 toluene (solvent) (United Carbon Co.)
3.0 Dixie No. 5 powdered carbon
3.0 dioctyl phthalate (plasticizer)
4.0 No. 53 stabilizer (organic phosphate—Victor Chemical Co.)

The above ingredients for coat 11b are placed in a ball mill and milled for a substantial length of time, for example 48 hours, or until the powdered carbon has become thoroughly dispersed. This dispersion can then be cast or otherwise deposited over the previously dried coat 11a, whereupon the solvent for the coat 11b is evaporated. Sufficient carbon is mixed in the coat 11b to provide it with a specific surface resistance of a much higher value than the surface resistance of coat 11a. For example, the coat 11 may have a specific surface resistance of 1,500 ohms to 50,000 ohms with the coating 11b superposed on the coat 11a and measured by the method above described for measuring the specific surface resistance of coat 11a. From the foregoing it will be seen that the wax which is incorporated in coat 11a is soluble in water and is also soluble in alcohol, but is insoluble in the toluene or other solvent which is used for the coat 11b. If desired, a top whitish extremely thin masking coat 12 may be applied over the coat 11b, as disclosed, for example, in U. S. Patent No. 2,554,017.

A blank prepared by the above procedure is electro-sensitive to a fine point electric discharge such as that produced by an electrically energized stylus. For example, as schematically illustrated in Fig. 2, the blank 9 of Fig. 1 is wrapped around a suitable scanning drum 13 such as is conventionally used in electro-facsimile reproducers and the blank is scanned in successive minute elemental areas by a fine pointed stylus 14 which is energized by facsimile signals from any well known facsimile receiver 15 which may be supplied with the generated facsimile signals from a suitable facsimile transmitter 16. The receiver 15 and transmitter 16 may be remotely located with relation to each other and interconnected by a suitable electric signal transmission line 17 or these units 15 and 16 may be mounted closely adjacent to each other in the same machine, in which event the drum 13 of the facsimile recorder can be directly coupled to the corresponding drum (not shown) incorporated in the facsimile transmitter 16.

As a result of the characteristics of the blank 9 and the application thereto of minute signal-controlled point discharges, the coat 11b and also the masking coat 12, if such coat is present, are perforated in minute areas through the thickness thereof, as indicated by the numeral

18 (Fig. 3), but without any great perforation of coat 11a and with no perforation of backing 10. These perforations extend completely through the coat 11b and coat 12, if that is present, so as to expose the dye-bearing coat 11a. Because of the minute cross sectional area and length of the perforations 18, they are in the nature of capillary tubes. Such a blank, while it is capable of direct use in connection with the well known gelatin pad process to produce copies by placing a gelatin pad in contact with the perforated blank, is not directly suitable for use in the well known spirit or water process. I have found that when a copy sheet which is dampened by alcohol or water is placed in duplicating contact with the recording blank of Fig. 3, insufficient dye is transferred from the coat 11a to produce an entirely satisfactory copy. This is particularly true where the subject matter recorded on the blank 9 in the form of the perforations 18 is of very fine detail.

However, I have found that by incorporating the above noted wax or waxlike resin in the coat 11a and by subjecting the recorded blank to a heating operation, the wax or resin becomes melted and expands or otherwise flows upwardly into the perforations 18 and carries with it a certain amount of dye from the dye coat 11a on to the surface, thus producing a master, or, if during the heating process, it is placed in contact with another blank sheet a second master will be produced on that sheet which will be a mirror image of the first master. Either of these masters may be used as duplicating masters to produce the desired type of copy.

Fig. 4 shows in schematic form a typical method for this heat treating of the recorded blank of Fig. 3. As shown in Fig. 4, a suitable conveyor belt 19, which may be an endless belt, is arranged to pass between a pair of heated rollers 20, 21. The recorded blank 9 of Fig. 3 is placed on the conveyor 19 face up with a sheet of ordinary paper 22 on its surface, and both are passed between the heated roll 20. This roll is maintained at a suitable temperature sufficient merely to melt the waxy constituent of coat 11a but without affecting the chemical, electrical, or other characteristics of the remaining constituents of the blank. It will be understood, of course, that any other well known manner of heating the recorded blank 9 to melt the waxlike constituent may be used, and the heated roller method illustrated in Fig. 4 is merely typical thereof.

Fig. 5 shows in greatly magnified form a portion of the blank after its heat treatment according to Fig. 4. It will be seen that the recorded perforations in the coat 11b now contain through the major portion of their depth or even to a point extending to the top of the coat 11b, a column of the dye so that the blank represents a master and the paper, cardboard, or other sheet which was in contact with the blank has received a transfer of dye so that it becomes a second master, a mirror image of the first. Either master can be used to make copies by means of the alcohol process of copying.

The method of preparing the duplicating or non-duplicating master is not limited to the perforation of a conductive coating such as coating 11 (Fig. 1) which coating is a permanent integral unit with a backing sheet such as sheet 10. This perforated record can be made in a separate member which can then be sandwiched between the receiving sheet 22 (Fig. 4) and another sheet which carries a wax plus a coloring agent, such as carbon, black dye, or any well known transferable dye. Thus, as shown in Fig. 6, the modified blank 23 is supported on any suitable platen or drum, such as the drum 13, and it is subjected to electric discharges from the needle pointed electrode or stylus 14, which is energized by the signals from the source 16.

Blank 23 is shown in magnified cross sectional thickness in Fig. 7. It consists of a flexible paper or cardboard backing 24 which has had previously strippably attached thereto a layer 25 of conductive film-forming plastic,

preferably of graded conductivity through its thickness. If desired, the upper surface of the plastic 25 may be provided with a masking coat 12, although in certain cases this masking coat 12 may be omitted. The masking coat 12 need only be used where a contrasting visible record is required on the surface of the plastic film 25. As a result of the signals applied to the stylus 14, the masking coat 12 and the plastic film 25 are perforated in the desired pattern as represented by the perforated areas 18. When the complete stenciled record has been produced, film 25 is manually stripped from the backing 24. It will be understood that the surface of the backing 24, prior to the application of the film 25, is dense and smooth and substantially free from any fibrous protuberances and the like, so that when the film 25 is coated on to the backing 24 it does not form a permanent bond with the surface of the backing but is, on the other hand, readily strippable therefrom: It will also be noted that during the action of the recording stylus 14, only the plastic film 25 and the masking coat 12 are perforated. For a detailed description of this type of electrosensitive blank and method of perforation thereof, reference may be had to U. S. Patent No. 2,664,043.

After the recorded stenciled plastic blank 25 has been stripped from its backing 24, it is sandwiched between a receiving member or sheet 26 and a reservoir sheet 27. The sheet 27 is of a type which contains on its surface or in the body thereof a substantial amount of heat releasable or expandable wax mixed with a coloring agent such as carbon, or with a transferable or non-transferable dye. For example, sheet 27 may be of the kind known to the trade as "Ditto" carbon paper. This sandwiched assembly may then be placed upon a conveyor belt 19 and passed between a pair of heated rollers 20, 21. As a result of this heating operating, the wax and coloring matter from the reservoir sheet 27 is forced through the perforations 18 in the plastic stenciled record and on to the receiving surface or sheet 26 in the same manner as described above in connection with Fig. 4.

It will be understood, of course, that if the dye that is mixed with the wax contained in reservoir sheet 27 is of the non-transferable kind, such as carbon or black dye, then the record which is formed on the member 26 will be a non-duplicating master. On the other hand, if the coloring material mixed with the wax contained in reservoir sheet 27 is of the transferable dye type, then the sheet 26 can be used itself as a master duplicating sheet in any of the well known spirit transfer processes.

While certain specific embodiments, preparations, and materials have been mentioned herein, it will be understood that they are given merely by way of illustration and not by way of limitation. Various changes and modifications may, therefore, be made in carrying out the invention according to this disclosure without departing from its spirit and scope. For example, the wax-like ingredient may consist of any of the well known waxes which have a melting point of approximately 75 degrees C.-100 degrees C., or it may consist of any resin which

has the heat flowability and amorphous qualities of wax and becomes melted at 75 degrees C.-100 degrees C. Typical of such resins are polyethylene glycol and dimethyl hydantoin formaldehyde resin, or blend of such resins. The term waxlike as used in the claims is intended to cover such waxes and waxlike resins which are water soluble and alcohol soluble.

What is claimed is:

1. The method of making a duplicating master which comprises applying to a backing an electrically conductive coating in the form of a mixture formed from a dried solution containing a water soluble and alcohol soluble waxlike ingredient having substantial flowability at temperatures between 75° C. and 100° C., powdered carbon, and a dye, applying another coating which is dye-free over the first mentioned coating, applying a point electric discharge in selected areas to form capillary recesses in said dye-free coating, and then heating the blank to melt the waxlike ingredient in said dye-containing coating to facilitate the passage of dye through said recesses in said dye-free coating to the surface of the blank or on to a receiving surface in contact with the blank.

2. The method according to claim 1 in which the said blank is heated with the recessed surface in contact with a sheet to transfer dye from said recesses to said sheet.

3. The method of making a duplicating master which comprises applying to a backing two successive strata of electrically conductive material, one stratum being constituted of a mixture formed from a dried solution of a dye mixed with a water soluble and alcohol soluble waxlike ingredient and powdered carbon, the second stratum being formed from a dried solution of a film-forming resin containing powdered carbon, said waxlike ingredient being insoluble in the solvent for the second stratum and having substantial flowability at temperatures between 75° C. and 100° C., perforating the second stratum by applying thereto a point electric discharge in selected elemental areas to form capillary recesses therein, and then heating the recorded blank in contact with a sheet to melt the waxlike ingredient to expedite the transfer of dye from the said first stratum to the surface of the blank and the said sheet.

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