Oct. 6, 1964 D. A. NEWMAN 3,151,550

DUPLICATION

Filed March 27, 1961

Fig. 1

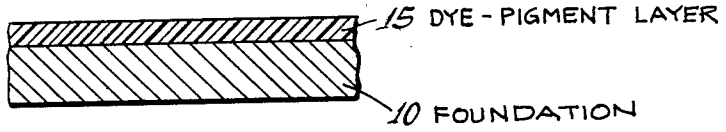



Fig. 2

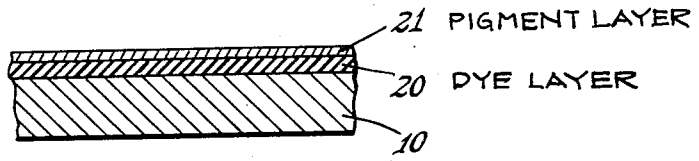



Fig. 3

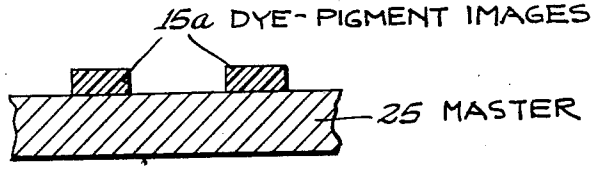
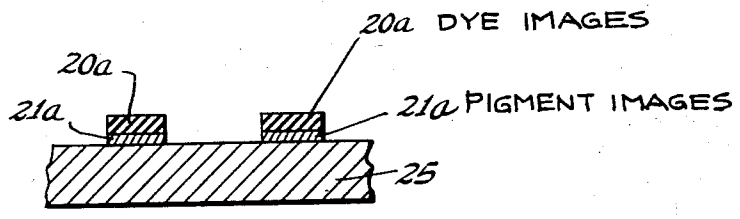



Fig. 4




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# DUPLICATION

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4 Claims. (Cl. 101—149.4)

This invention relates to hectograph transfer sheets containing magnetically sensible pigment, and to the novel master sheets prepared therewith.

The hectograph process is one of the most common duplicating processes currently employed. According to this process, a master sheet is typed or otherwise imaged with the desired subject matter in either positive or mirror-reverse form using as the transfer or imaging material one which contains a dyestuff which is soluble in the conventional spirit duplicating fluids. The imaged master sheet is then used with a gelatin pad or a conventional spirit duplicating machine where the dye images are repeatedly brought into surface contact with copy sheets in the presence of dye solvents or duplicating fluids. In this manner, several hundred exact copies can be made from the same master sheet which is then discarded.

One of the important disadvantages of the hectograph process is due to the extremely soluble nature of the dyestuffs used and their tendency to stain hands coming in contact therewith. Even casual contact is sufficient to cause much staining as well as destruction of the master sheet due to smearing of the images thereon. Thus once the master sheet has been imaged with dyestuff, it must be handled as little as possible and placed immediately onto the duplicating machine for the production of the duplicate copies. When the desired number of copies has been produced, the used master sheet generally is discarded since the number of times which the master would have to be manually handled during storage would insure the complications of staining of the hands and clothing as well as destruction of the master sheet due to smudging.

There are certain fields, however, in which the periodic duplication of data is essential, such fields including for instance the preparation of monthly billing statements or of address stickers for weekly magazine subscriptions and the like. These fields currently make use of hectograph master sheets or cards which carry the necessary information in the form of dye-containing images, and which are selected and refilled manually each time that they are used.

Such manual procedure has resulted in serious staining problems for the operator and serious smudge problems with the masters.

Attempts to overcome these problems using colorless dye components on the master have been unsuccessful since the colored dyes are developed on the master during the first use and present the stain problem during subsequent uses. Likewise the smudge problem is always present where masters are manually handled, sorted and filled.

Attempts to overcome the necesity for manual handling, sorting and filing of these masters using visual scanning devices to accompish these steps automatically have not been successful because of the tendency of the master images to smudge and spread, and stain the master foundation in areas surrounding the dye images. Thus the images are not sufficiently sharp or clear after the master has been used to allow them to be reliably scanned automatically using visual devices.

It is an object of the present invention to produce hectograph transfer sheets which may be used to image hectograph master sheets which may be filed, sorted and reselected automatically using magnetic sensing means and without the necessity of manual contact.



It is another object of this invention to produce hectograph master sheets which may be repeatedly filed, sorted and reselected automatically to produce a limited number of duplicate copies on each occasion as required.

It is still another object of this invention to prepare hectograph master sheets which may be sensed magnetically for record purposes without altering the duplicating properties thereof, and which may be used in the spirit or gelatin process without altering the magnetic properties thereof.

These and other objects and advantages are accomplished as described herein.

In the drawing:

FIGURES 1 and 2 are diagrammatic cross sections, to an enlarged scale, of hectograph transfer sheets according to the present invention.

FIGS. 3 and 4 are diagrammatic cross sections, to an enlarged scale, of master sheets imaged with the transfer sheets of FIGS. 1 and 2, respectively.

The objects of the present invention are accomplished by incorporating magnetically sensible pigment into hectograph transfer sheets or ribbons, either as an additive to the dyestuff-containing layer as shown in FIG. 1, or as a separate frangible magnetic layer **21** as shown by FIG. 2.

When a suitable hectograph master sheet is imaged using the transfer sheets of the present invention, the single operation using a single transfer sheet adapts the master sheet to be used in both the hectograph duplicating process and in the magnetic sensing process.

According to the first embodiment of the invention, and as illustrated by FIG. 1 of the drawing, a suitable foundation sheet or ribbon **10** which may consist of paper or a suitable plastic film such as polyethylene terephthalate (Mylar), cellophane or the like, is provided with a single frangible transfer layer **15** which is based upon a suitable wax and/or resin binder and contains a conventional dyestuff such as crystal violet together with magnetic pigment such as iron oxide.

The transfer media according to this embodiment may be prepared by coating the foundation with the desired composition by either the hot melt method or by the solvent method depending upon whether the transfer composition is based upon wax or resin. Suitable transfer compositions may be formulated as illustrated in the following examples:

*Example 1*

| Ingredients: | Parts by weight |
|---|---|
| Carnauba wax | 10.0 |
| Raw montan wax | 10.0 |
| Beeswax | 15.0 |
| Lanolin | 10.0 |
| Mineral oil | 15.0 |
| Crystal violet | 20.0 |
| Iron oxide | 20.0 |

*Example 2*

| Ingredients: | Parts by weight |
|---|---|
| Ethyl cellulose | 5.0 |
| Lanolin | 3.0 |
| Mineral oil | 15.0 |
| Spirit Black #3 dyestuff (du Pont) | 17.0 |
| Metallic iron powder | 10.0 |
| Solvent (toluol or the like) | 50.0 |

*Example 3*

| Ingredients: | Parts by weight |
|---|---|
| Arochlor resin 5460 | 10.0 |
| Beeswax | 5.0 |
| Crystal violet | 25.0 |
| Iron filings | 15.0 |
| Carbon tetrachloride | 45.0 |

As illustrated in the foregoing examples, the binder for the hectograph transfer material may comprise any conventional wax binders or any suitable resin binders or mixtures thereof. Suitable resinous materials include cellulose binders such as ethyl cellulose, vinyl resins such as polyvinyl acetate, polyvinyl chloride and copolymers thereof, polystyrene and copolymers thereof such as Isopol P–114–RM (styrene isoprene), chlorinated polyphenyls such as Arochlor 5460, as well as the rosin modified alkyd resins such as Amberol 750 (unesterified rosin-maleic resin).

Any suitable magnetic pigment may be used including the various iron oxides such as Black, Brown and Red Iron Oxide, or the convenient forms of metallic iron such as iron powder, iron filings and the like.

According to the second embodiment of this invention, and as illustrated by FIG. 2 of the drawing, a suitable foundation sheet or ribbon **10** is provided with a first surface layer **20**, which may comprise any conventional hectograph transfer layer which is based upon wax and/or resin, and is then provided with a second layer **21** overlying said surface layer, the second layer being based upon resin and/or wax binder and containing magnetic pigment.

The transfer media according to this embodiment may be prepared by the same methods described hereinbefore and using the same ingredients disclosed in connection with the transfer sheets of FIG. 1, although the magnetic pigment and the hectograph dyestuff are present in separate transfer layers **20** and **21** as illustrated by FIG. 2.

Thus, transfer layer **20** may be any conventional hectograph layer or may be formulated using the ingredients and proportions set forth in Examples 1, 2 or 3 but omitting the magnetic pigment.

The magnetic layer **21** must be formuated so as to be transferable to a master sheet, together with the hectograph layer, under the effects of imaging pressure. It is also preferred that layer **21** be somewhat tacky so as to provide good adherence for both the master sheet and the hectograph layer **20**. The magnetic layer may be applied by either the hot melt or solvent coating methods depending upon whether it is based upon waxes or resinous binders. Suitable magnetic transfer compositions may be formulated as follows:

*Example 4*

| Ingredients: | Parts by weight |
|---|---|
| Polyvinyl butyrate (Vinylite XYSG) | 30.0 |
| Iron oxide | 30.0 |
| Methyl alcohol | 500.0 |

*Example 5*

| Ingredients: | Parts by weight |
|---|---|
| Carnauba wax | 45.0 |
| Indopol H–300 (polymerized butenes) | 9.0 |
| Beeswax | 6.0 |
| Mineral oil | 20.0 |
| Iron oxide | 20.0 |

*Example 6*

| Ingredients: | Parts by weight |
|---|---|
| Ethyl cellulose N–7 | 7.0 |
| Iron oxide | 10.0 |
| Methyl alcohol | 80.0 |
| Water | 3.0 |

FIGS. 3 and 4 of the drawing illustrate master sheets **25** bearing mirror-reverse images comprising transfer compositions released from the transfer sheets of FIGS. 1 and 2 respectively, under the effects of typing or simi-imaging pressure.

FIG. 3 illustrates images **15***a* which contain hectograph dyestuff and magnetic pigment. The magnetic pigment is not soluble in the conventional spirit duplicating fluids and so it is retained by the images **15***a*, although some of the hectograph dyestuff is dissolved from the images during the duplicating process.



In FIG. 4 the images on the master sheet are composed of two separate layers **20***a* and **21***a* which correspond to layers **20** and **21** of the transfer sheet of FIG. 2. Layer **21***a* contains the magnetic pigment and is adhered to the master sheet and the overlying dye-containing hectograph duplicating layer **20***a*.

The imaged master sheets or master cards may be sorted, filed, recorded and used in the duplicating process automatically, without the necessity of their coming in contact with the hands, through the use of conventional magnetic data processing equipment. The images on the master sheet or master card are sharp and clear since there is no necessity of typing on the reverse side of the master through a ribbon, carbon paper or magnetic transfer sheet. Where the master sheet or card is reverse-imaged, it may be passed through the sensing equipment face-down so that the sensing device makes contact with the unimaged reverse side thereof. In this way, the reverse images on the master are reversed with respect to the sensing device and are thus read or sensed in direct-reading positive form through the master foundation.

In place of the conventional hectograph dyestuffs contained in layer **15** of FIG. 1 and layer **20** of FIG. 2, there may also be employed colorless complementary color formers such as the gallic acid-iron chloride system as disclosed in U.S. Patent No. 2,872,863 or the colorless Azograph system in which colorless dye components are employed as disclosed for instance in U.S. Patent No. 2,634,677. Likewise crystal violet lactone provides excellent results when used together with acid treated copy sheets. For the sake of brevity, all of the foregoing color-forming materials will be encompassed by the phrase "hectograph dyestuff" in the appended claims.

The master sheets of the present invention may also be duplicated thermographically using well-known heat-reactive copy sheets of the Thermo-Fax type in that the master images contain magnetic pigment such as iron oxide which also has the property of absorbing infrared radiation and converting it to heat. This is in contrast to conventional hectograph images in which the dyestuffs do not absorb infrared radiation and which cannot be thermographically duplicated.

Variations and modifications may be made within the scope of the claims and portions of the improvements may be used without others.

I claim:

1. A hectograph transfer sheet for the placing of magnetically sensible, thermographically reproducible duplicating images on a master sheet, which comprises a flexible foundation having thereon a pressure-sensitive transfer layer comprising hectograph dyestuff and infrared radiation-absorbing magnetic iron oxide pigment dispersed in a binder material selected from the group consisting of wax and resin and mixtures thereof.

2. A hectograph transfer sheet for the placing of magnetically sensible, thermographically reproducible duplicating images on a master sheet, which comprises a flexible foundation having adhered thereto a pressure-transferable coating comprising hectograph dyestuff dispersed in a binder material selected from the group consisting of wax and resin and mixtures thereof and having adhered to said coating a surface layer which is also pressure-transferable and which comprises infrared radiation-absorbing magnetic iron oxide pigment dispersed in a binder material selected from the group consisting of wax and resin and mixtures thereof.

3. A hectograph master sheet comprising a flexible foundation having thereon magnetically sensible, thermographically reproducible duplicating images comprising hectograph dyestuff and infrared radiation-absorbing magnetic iron oxide pigment dispersed in a binder material selected from the group consisting of wax and resin and mixtures thereof.

4. A hectograph master sheet comprising a flexible foundation having thereon magnetically sensible, thermographically reproducible duplicating images consisting of two separate layers, the base layer being adhered to the foundation and comprising infrared radiation-absorbing magnetic iron oxide pigment dispersed in a binder material selected from the group consisting of wax and resin and mixtures thereof, and the surface layer being adhered to the base layer and comprising hectograph dyestuff dispersed in a binder material selected from the group consisting of wax and resin and mixtures thereof.



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# CERTIFICATE OF CORRECTION

Patent No. 3,151,550 October 6, 1964

Douglas A. Newman

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 1, line 14, for "oherwise" read -- otherwise --; line 47, for "refilled" read -- refiled --; line 58, for "filled" read -- filed --; line 59, for "necesity" read -- necessity --; same column 1, line 61, for "accompish" read -- accomplish --; column 3, line 70, for "simi-" read -- similar --.

Signed and sealed this 2nd day of March 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents