

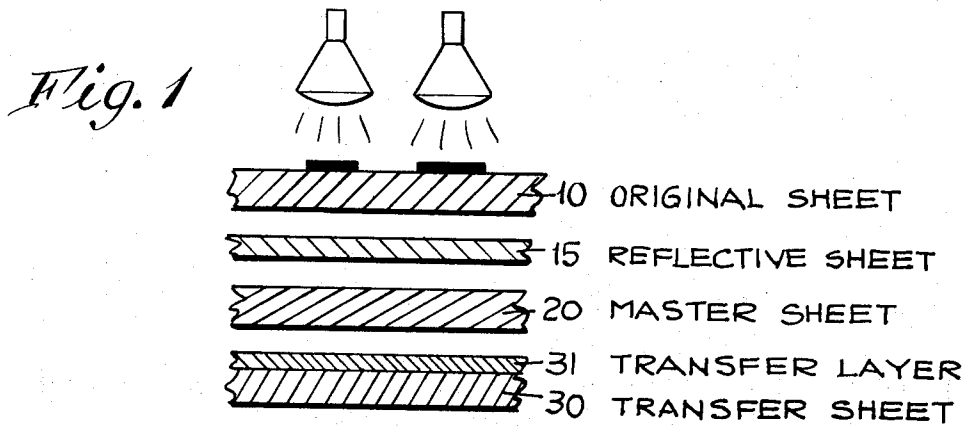
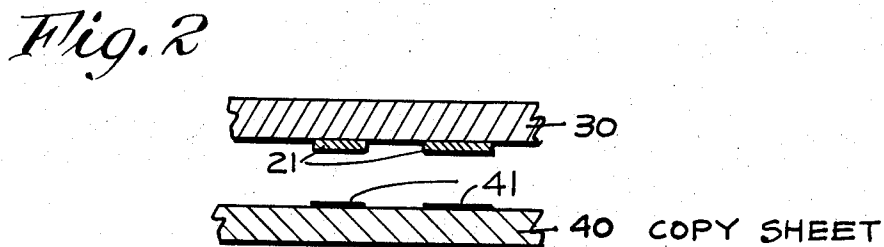
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HECTOGRAPH PRODUCTS AND PROCESSES

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HECTOGRAPH PRODUCTS AND PROCESSES
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ABSTRACT OF THE DISCLOSURE

Hectograph transfer sheets for the pressure-placement of spirit-soluble images on a hectograph master sheet. The pressure-transferable hectograph layer comprises a solid binder material and a particular aromatic amine salt which is spirit-soluble and absorbs infrared radiation. The spirit copies produced contain a sufficient amount of the amine salt that they are thermographically reproducible.

There are only a very limited number of materials which are capable of absorbing large amounts of infrared radiation and which also have the ability of dissolving to a sufficient degree in conventional spirit duplicating fluids to produce hectograph copies which are thermographically-reproducible in either the Thermo-Fax or Transofax processes. The former process employs heat-sensitive, chemically-reactive copy sheets while the latter employs a heat-transfer sheet in association with a receptive copy sheet.

The materials previously known for this purpose are the complex azine dyestuffs such as indulines and the nitrosines which have the disadvantages that they become tarred or form difficulty-soluble agglomerates on heating, thereby being incapable of producing the desired results in hot-melt wax transfer compositions. Even when used in solvent-applied resinous compositions, the solubility of the complex azine dyestuffs is so poor as to require their use in association with spirit-soluble resinous binder materials and conventional spirit-soluble hectograph dyestuffs so that sufficient azine dyestuff is carried over to the hectograph copies to produce thermographically-reproducible images, as taught by United States Patent No. 3,207,621.

It is the principal object of the present invention to provide a hectograph composition which may be of either the hot-melt or solvent-applied type and which contains a sufficient amount of a heat-resistance, spirit-soluble, infrared radiation-absorbing material whereby hectograph copy sheets imaged therewith in the conventional spirit duplicating process are thermographically-reproducible.

It is another object of this invention to provide an infrared radiation-absorbing material which is suitable for use in any conventional hectograph transfer composition independently of the spirit-solubility of the binder material and the presence of or nature of the other conventional spirit-soluble dyestuffs which may be present.

These and other objects and advantages of the present invention will be clear to those skilled in the present art in the light of the following description, including the drawings in which:

FIGURE 1 is a diagrammatic cross-section, to an enlarged scale, of a superposed original sheet, reflective sheet, master sheet and a transfer sheet according to the present invention, the sheets being superposed under the influence of infrared radiation but being separated for purposes of illustration.

FIG. 2 is a diagrammatic cross-section, to an enlarged scale, of the hectograph master sheet imaged according to FIG. 1 in association with a hectograph copy sheet which has been imaged thereby.

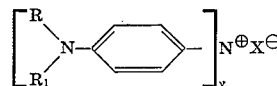
The objects and advantages of the present invention are accomplished by the discovery that acid salts of certain

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p-dialkylaminophenyl amines have the required degrees of spirit-solubility and infrared radiation-absorbency to function perfectly in the spirit duplicating process and provide spirit copies on which the images are thermographically-reproducible.

The amine salts of the present invention are substantially colorless and therefore require the presence of an additional conventional spirit-soluble hectograph dye-stuff or color-forming chemical reactant to provide colored images for conventional office copy work. Of course, the amine salts can be used alone for other applications where legibility of the spirit copy is either unnecessary or even undesirable. It may be desirable in some cases that portions of the spirit copy be invisible, such as the prices on an invoice copy, but that the total contents of invoice copy be determinable by making a thermographic copy thereof. In such cases the price figures on the master sheet may contain only the present amine salts while the other information on the master sheet may contain the present amine salts in combination with conventional hectograph colorant such as dye or color former.

The amine salts useful according to the present invention are identified as follows:



wherein Y equals a total of three similar or different radicals having the structure shown, R and R₁ are the same or different and are lower alkyl groups having from 1 to 5 carbon atoms, preferably methyl or ethyl groups, or are p-dialkylaminophenyl radicals in which each alkyl group contains from 1 to 5 carbon atoms, preferably methyl or ethyl groups, and X is an anion. The X⁻ radical is an anion such as picrate, benzenesulfonate, perchlorate, hexafluoroantimonate, fluoroborate, trichloracetate, hexafluoroarsenate, or the like.

The infrared radiation amine salts which are preferred due to their exceptional radiation-absorbing properties are those coming within the above formula in which two of the aminophenyl radicals are p-dialkylaminophenyl radicals and the third aminophenyl radical is a bis (p-dialkylaminophenyl) aminophenyl radical.

The amine salt may be used in either dissolved or undissolved condition although it is preferred, particularly with hot-melt wax compositions, to have it present in undissolved concentrated condition in the hectograph composition on the transfer sheet and on the hectograph master sheet. The amine salt is present in the hectograph composition in amounts ranging from about 1.0% up to about 15% by weight based upon the total dry weight of the solidified transfer layer. The preferred range is from about 4% up to about 10%.

The hectograph composition may be of the hot-melt wax type or of the solvent-applied type based upon resinous or plastic film-forming binder materials. The following examples illustrate suitable hectograph compositions and transfer sheets coming within the present invention, the selection of other alternative binder materials and additives being clear to those skilled in the art in the light of the present disclosure.

EXAMPLE 1

Ingredients:	Parts by weight
Ethyl hydroxyethyl cellulose	5.0
Lard oil	6.0
Oleic acid	4.0
Mineral oil	5.0
Crystal violet	17.0
Infrared radiation absorber I	3.0
Volatile solvent (toluol)	60.0

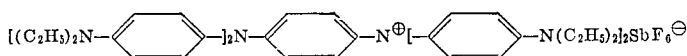
The above ingredients are mixed to a coatable consistency, spread evenly on a suitable flexible foundation such as paper and caused to set by evaporation of the volatile solvent to form a pressure-transferable layer.

EXAMPLE 2

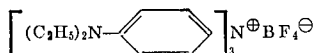
Ingredients:	Parts by weight
Carnauba wax -----	12.0
Raw montan wax -----	12.0
Beeswax -----	15.0
Lanolin -----	12.0
Mineral oil -----	15.0
Spirit black #3 (Du Pont) -----	25.0
Infrared radiation absorber II -----	9.0

The above ingredients are heated to melt the waxes and mixed to form a composition having a coatable consistency. The hot-melt composition is then applied to a suitable foundation such as paper and cooled to form a pressure-transferable layer.

Infrared radiation absorber I of Example 1 is identified as p-[bis (p-diethylaminophenyl) amino] phenyl bis (p-diethylaminophenyl) aminium hexafluoroantimonate and has the structure:



Infrared radiation absorber II of Example 2 is identified as tris (p-diethylaminophenyl) aminium fluoborate and has the structure:



It should be understood that other solvent and hot-melt binder compositions may be used with the same results as the compositions illustrated, the only critical requirement being the provision of a pressure-transferable layer as a carrier for the infrared radiation-absorbing amine salts of the present invention.

In place of the cellulose binder material of Example 1 other cellulosic film formers such as ethyl cellulose, hydroxyethyl cellulose, carboxymethyl cellulose and the like may be used as well as other film-forming binders such as polyvinyl acetate, polystyrene, vinyl chloride-vinyl acetate copolymers, and mixtures of such materials with each other or with the cellulosic binders.

In place of the wax binder materials specified in Example 2, other waxes conventionally included in hectograph compositions may be used, as will be clear to those skilled in the art.

It should be mentioned that the use of solvent-applied compositions such as that of Example 1 is preferred over the use of hot-melt wax compositions because the solvent-applied composition is more soluble in the spirit duplicating fluid due to the solubility of the cellulosic binder material, and therefore the amine salt can be more completely dissolved onto the copy sheets than in the case where it is partially masked or covered by spirit-insoluble waxes. In such compositions the volatile organic liquid is a solvent for the film-forming binder material but is a non-solvent for the hectograph dyestuff and the amine salt so that these materials will remain in the form of solid undissolved particles until contacted with the spirit solvent in the hectograph duplicating process.

While the present hectograph transfer sheets are pressure sensitive and intended primarily for manual use, they are also useful in the heat-imaging processes such as Transofax provided that a heat-conductive infrared radiation-reflecting element is interposed between the original images and the hectograph transfer layer as illustrated by FIGURE 1 of the drawing.

Thus, an original sheet 10 carrying infrared radiation-absorbing original images 11 is superposed with a conductive, reflective sheet 15 such as metallized Mylar poly-

ester film, a master sheet 20 and the present hectograph transfer sheet 30 carrying the infrared radiation-absorbing hectograph layer 31. Infrared radiation from lamps 50 is absorbed by images 11 and converted to heat while the non-absorbed radiation is reflected back by sheet 15 and prevented from reaching the hectograph transfer sheet. The heat pattern of images 11 is conducted to the transfer layer 31 causing it to soften and adhere to the master sheet 20 in areas corresponding to the imaged areas of the original sheet. When the master and transfer sheets are separated, the hectograph layer remains adhered to the master sheet in the heated areas to form mirror-reverse reading images 21 corresponding to the original images, as shown in FIG. 2.

FIG. 2 illustrates the duplication of the infrared radiation-absorbing images 21 of the master sheet onto a copy sheet 40 in the conventional spirit duplicating process. Thus, the copy sheet 40, one of a succession, is wetted with conventional spirit duplicating fluid such as methyl alcohol, ethyl alcohol or aqueous mixtures thereof, and contacted with the imaged side of the master sheet using sufficient pressure to insure intimate contact. The spirit fluid dissolves a portion of the hectograph

images 21 onto the copy sheet to form positive images 41 which contain a sufficient amount of the infrared radiation-absorbing organic amine salt to be thermographically-reproducible by any of the known thermographic duplicating processes.

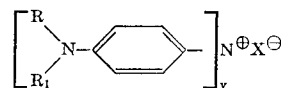
For instance the hectograph copy sheets imaged according to the present invention may be used in the same manner as conventional original sheets carrying infrared radiation-absorbing images and may be duplicated using Transofax or Thermo-Fax copying materials. Using Transofax copying materials, the imaged copy sheet is superposed with a transfer sheet carrying an infrared radiation non-absorbing heat-transferable layer and a receptor sheet and subjected to infrared radiation in a process such as disclosed in U.S. Patent No. 3,109,748 or No. 3,185,087. Using Thermo-Fax copying materials, the imaged copy sheet is superposed with a copying sheet carrying a layer of heat-reactive composition, the color of which changes in heated areas, and subjected to infrared radiation in a process such as disclosed in U.S. Patent No. 2,740,896.

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. The process of producing a hectograph transfer element which comprises the steps of:

(a) mixing to a coatable consistency a composition comprising a solid binder material and an amine salt which absorbs infrared radiation and which is spirit-soluble so as to function in the spirit process to provide spirit copies on which the images are thermographically reproducible, said salt having the formula:



in which Y equals a total of three radicals selected from the group consisting of similar or different radicals having the structure shown, R and R₁ are selected from the group consisting of identical or different lower alkyl groups having from 1 to 5 carbon atoms and p-dialkylaminophenyl groups in which the alkyl groups are identical or different

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lower alkyl groups having from 1 to 5 carbon atoms, and X is an anion;

- (b) applying the composition to a flexible foundation in the form of a thin layer; and
(c) causing the layer to harden to form a pressure-transferable layer.

2. The process of claim 1 in which the composition also includes an undissolved spirit-soluble hectograph dyestuff.

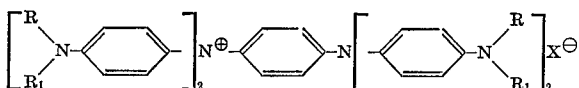
3. The process of claim 1 in which the solid binder material is wax and the composition is heated to give it a coatable consistency and is cooled to cause it to harden.

4. The process of claim 1 in which the solid binder material is a film-forming material dissolved in a volatile organic solvent and the solvent is evaporated to cause the composition to harden.

5. The process of claim 1 in which the amine salt is present in an amount ranging from about 1% by weight up to about 15% by weight based upon the total weight of the composition after evaporation of the solvent.

6. The process of claim 1 in which the amine salt is present in an amount ranging from about 4% by weight up to about 10% by weight based upon the total weight of the composition after evaporation of the solvent.

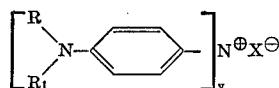
7. The process of claim 1 in which the amine salt has the formula:



in which R and R₁ are selected from the group consisting of identical and different lower alkyl groups having from 1 to 5 carbon atoms.

8. The process of producing a hectograph transfer element which comprises the steps of:

- (a) mixing to a coatable consistency a composition comprising a cellulosic binder material, a spirit-soluble undissolved hectograph dyestuff, a volatile organic liquid which is a solvent for the binder material and a non-solvent for the dyestuff and an amine salt which absorbs infrared radiation and which is spirit-soluble so as to function in the spirit process to provide spirit copies on which the images are thermographically reproducible, said salt having the formula:



in which Y equals a total of three radicals selected from the group consisting of similar or different radicals having the structure shown, R and R₁ are selected from the group consisting of identical or different lower alkyl groups having from 1 to 5 carbon atoms and p-dialkylaminophenyl groups in which the alkyl groups are identical or different lower alkyl groups having from 1 to 5 carbon atoms, and X is an anion;

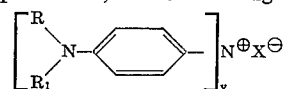
- (b) applying the composition to a flexible foundation in the form of a thin layer; and
(c) evaporating the volatile organic solvent to cause the layer to harden and form a pressure-transferable layer.

9. The process of claim 8 in which the cellulosic binder material is an ethyl cellulose.

10. A hectograph transfer element comprising a flexible foundation having thereon a pressure-transferable hectograph layer comprising a solid binder material and an amine salt which absorbs infrared radiation and which is spirit-soluble so as to function in the spirit process to

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provide spirit copies on which the images are thermographically reproducible, said salt having the formula:



in which Y equals a total of three radicals selected from the group consisting of similar or different radicals having the structure shown, R and R₁ are selected from the group consisting of identical or different lower alkyl groups having from 1 to 5 carbon atoms and p-dialkylaminophenyl groups in which the alkyl groups are identical or different lower alkyl groups having from 1 to 5 carbon atoms, and X is an anion.

11. A hectograph transfer element according to claim 10 in which the layer also includes an undissolved spirit-soluble hectograph dyestuff.

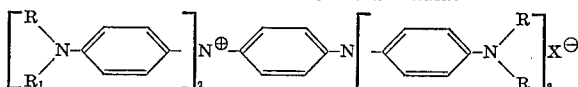
12. A hectograph transfer element according to claim 10 in which the solid binder material is wax.

13. A hectograph transfer element according to claim 10 in which the solid binder material is a film-forming material.

14. A hectograph transfer element according to claim 10 in which the amine salt is present in an amount ranging from about 1% by weight up to about 15% by weight based upon the total weight of the hectograph layer.

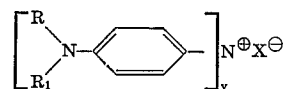
15. A hectograph transfer element according to claim 10 in which the amine salt is present in an amount ranging from about 4% by weight up to about 10% by weight based upon the total weight of the hectograph layer.

16. A hectograph transfer element according to claim 10 in which the amine salt has the formula:



in which R and R₁ are selected from the group consisting of identical and different lower alkyl groups having from 1 to 5 carbon atoms.

17. A hectograph transfer element comprising a flexible foundation having thereon a pressure-transferable hectograph layer comprising a solid cellulosic binder material, a spirit-soluble undissolved hectograph dyestuff and an amine salt which absorbs infrared radiation and which is spirit-soluble so as to function in the spirit process to provide spirit copies on which the images are thermographically reproducible, said salt having the formula:



in which Y equals a total of three radicals selected from the group consisting of similar or different radicals having the structure shown, R and R₁ are selected from the group consisting of identical or different lower alkyl groups having from 1 to 5 carbon atoms and p-dialkylaminophenyl groups in which the alkyl groups are identical or different lower alkyl groups having from 1 to 5 carbon atoms, and X is an anion.

18. A hectograph transfer element according to claim 17 in which the cellulosic binder material is an ethyl cellulose.

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MURRAY KATZ, Primary Examiner.