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3,595,683

PRESSURE SENSITIVE TRANSFER SHEET AND METHOD OF PRODUCING

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Fig. 1

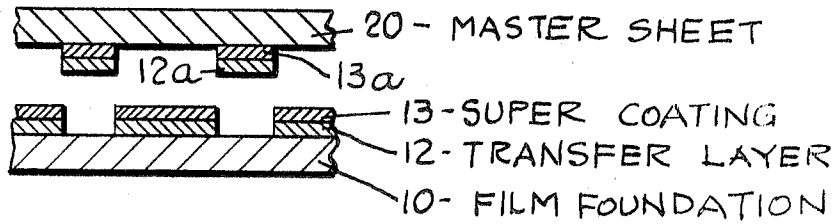
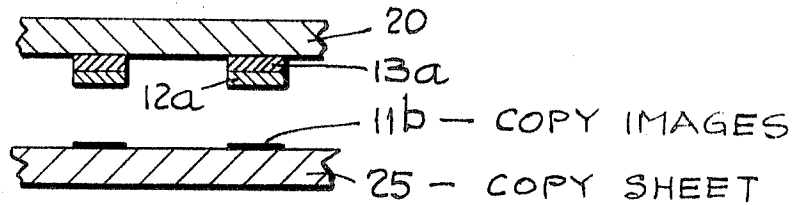


Fig. 2



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PRESSURE SENSITIVE TRANSFER SHEET AND METHOD OF PRODUCING

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The portion of the term of the patent subsequent to July 29, 1986, has been disclaimed
Int. Cl. B41m 5/10

U.S. Cl. 117—36.4

10 Claims

ABSTRACT OF THE DISCLOSURE

Process for producing novel transfer sheets having a flexible foundation carrying a pressure-transferable porous ink layer comprising a resinous binder material having dispersed therein a large amount of a porous filler and an incompatible liquid ink. The foundation has a smooth plastic release surface and the porous ink layer has thereon a frangible supercoating whereby the porous ink layer is rendered transferable under the effects of impact pressure to form squeeze-out type duplicating images on a master sheet.

This application is a continuation-in-part of application Ser. No. 677,539, filed Oct. 24, 1967, issued as U.S. Patent No. 3,458,339 on July 29, 1969.

The transfer sheets of the present invention are adapted for use in a duplicating system of the type illustrated by my United States Patent No. 3,359,900 for the production of a limited number of copies, up to about 25 or so, of original subject matter applied to a master sheet from such a transfer sheet under the effects of impact pressure. Such a system is not intended to compete with multi-copy systems such as hectography where several hundred copies can be produced from image master sheets.

The conventional hectograph process enjoys widespread commercial success but is too expensive and inconvenient for use in certain applications where only a small number of duplicate copies are required and only at spaced intervals. The spirit duplicating machine is rather expensive and the dye solvents used therein are volatile. If such a machine is used only occasionally and only for the production of a few copies each time, then the cost per copy is high. Also the volatile dye solvent evaporates over a period of time so that the supply must be checked and refilled frequently.

Dry copy systems have been proposed for the production of a limited number of copies but these also have disadvantages which restrict their use to certain limited fields of application where the quality of the copy produced is not critical. According to these systems, a conventional hectograph master sheet is typed and then pressed against copy sheets to transfer dyestuff to each copy sheet. In all of these processes the images typed onto the master sheet are conventional hectograph images containing a major amount of undissolved hectograph dyestuff in a frangible binder material.

According to one of these processes the copy sheets pressed against the master images are ordinary paper sheets and the images formed on each sheet are merely

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portions of the master images which are pressure-transferred to the copy sheets and contain undissolved dyestuff and frangible binder material. Such images are soft and easily spreadable or smearable upon contact with the hands and are exceptionally dirty to the touch due to the presence of the undissolved dyestuff which has a high staining power.

According to other of these processes, the copy sheets carry a solid coating which contains a material having a dissolving power for the hectograph dyestuff. Unless the dye solvent requires heat activation, the formed copies are of very poor quality due to a broadening of the duplicate images as solvation continues with time. On the other hand, heat-activatable dye solvents require the use of a heat source in addition to the higher cost of solvent coated copy sheets as compared to conventional uncoated hectograph copy papers.

With all of these considerations in mind, it is the main object of the present invention to provide transfer sheets which permit the user to make a limited number of high quality duplicate copies from a typed master sheet onto conventional untreated copy papers and in the absence of volatile dye solvents and expensive duplicating apparatus.

It is another object of this invention to provide duplicating transfer sheets which do not require the use of undissolved hectograph dyestuff and which therefore avoid the disadvantages thereof.

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

FIG. 1 is a diagrammatic cross section, to an enlarged scale, of a transfer sheet and a master sheet according to one embodiment of the present invention. The sheets are shown in spaced relationship, for purposes of illustration, and illustrate the images formed on the face of the master sheet as a result of applying imaging pressure against the back of the master sheet while it is in intimate surface contact with the transfer layer of the transfer sheet.

FIG. 2 is a diagrammatic cross-section, to an enlarged scale, of the master sheet of FIG. 1 together with a copy sheet imaged therewith. The sheets are shown in spaced relationship, for purposes of illustration, and the duplicate images on the copy sheet were formed by pressing the master sheet against the copy sheet surface while the master images were in intimate surface contact therewith.

The present invention is based upon the requirement that the imaging layer of the transfer sheet must have the apparently contradictory properties of being mass transferable from the transfer sheet under the effects of impact pressure and being non-transferable as a mass from the master sheet under the effects of overall pressure of lower magnitude than said impact pressure. Once the images are formed on the master sheet they must be capable of exuding liquid non-drying ink to a succession of copy sheets under the effects of overall pressure rather than transferring in mass to the first copy sheet against which it is pressed. While these properties may appear to be contradictory, they are not, because of the fact that the pressures involved are quite different, but more importantly because the affinity of the imaging layer for itself and for its foundation can be reduced while increasing the affinity of the imaging layer for the master sheet.

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According to the present invention, I have discovered that the physical characteristics of a normally non-pressure-transferable squeeze-out type resinous ink layer may be modified by the addition of a high proportion of a filler material, relative to the resin content, to produce a resinous ink layer which is frangible or pressure-transferable in mass under the effects of impact pressure but which retains the ability to exude or squeeze out liquid ink under the effects of overall pressures of lower magnitude than such impact pressure.

The novel impact-transferable layers of the present invention comprise a synthetic thermoplastic resinous binder material, a pressure-exudable ink comprising an oleaginous vehicle having dyestuff dissolved therein, and a porous filler material which comprises at least 25% of the solids content and which is present in an amount equal to at least 1.5 times the amount of the resinous binder material.

The present transfer layers are present on an inert smooth plastic film foundation which provides a release surface to permit the imaging layer to transfer to a master sheet sharply and cleanly. Polyethylene terephthalate polyester film is preferred because of its strength and inertness with respect to the coating solvents and the ingredients of the imaging layer. Films such as chlorinated rubber, oriented polyolefins, polyvinyl fluoride, and the like, are also suitable.

The present imaging layers also carry a supercoating which has better affinity for a master sheet than the imaging layer itself has. The supercoating improves the affinity of the imaging layer for a master sheet and prevents the imaging layer from transferring from the master sheet to the copy sheets during the duplication process.

According to FIG. 1 of the drawings, the transfer sheet has a smooth plastic film foundation 10 carrying the imaging layer 12 and a frangible supercoating 13. The imaging layer has good frangibility per se and the smooth surface of the foundation readily releases the imaging layer while at the same time the supercoating anchors it to the master sheet to enable the transfer and to prevent offset during the duplicating step. The supercoating 13 is a coating having good frangibility and having good adhesion properties for both the imaging layer and the master sheet. Under the effects of imaging pressure, portions of the supercoating 13a and imaging layer 12a transfer sharply and cleanly to the master sheet. The supercoating bonds to the surface of the master sheet and forms a strong anchor for the transferred portions of the imaging layer so that image portions 12a remain bonded to the master sheet and function to exude non-drying ink under the effects of the duplicating pressure. The smooth surface of the film foundation readily releases the imaging layer since it is not integrated therewith and is only weakly bonded thereto. A paper foundation will not function in this manner since it is porous and thus the imaging layer is able to penetrate the paper surface and form a strong bond therewith in the course of application. Of course the plastic film foundation must be inert, i.e. insoluble in the volatile solvent used to apply the imaging layer and insoluble in the ingredients thereof.

FIG. 2 of the drawings illustrates the copying process in which the master sheet, imaged according to FIG. 1, is brought into surface contact with one of a succession of copy sheets 25. The contacting sheets are subjected to an overall pressure, such as by compressing them between platens or preferably by drawing them between pressure rolls or under a pressure bar, whereby the ink from portions 13a of the images on the master sheet is exuded onto the contacting portions of the copy sheet to form duplicate images 11b which are correct-reading images since the images on the master sheet are reverse images.

In all cases the imaging layers of the present invention comprise a microporous structure or network of synthetic thermoplastic binder material which is rendered

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more brittle by means of the dispersion therein of a sufficient amount of a porous filler. Some amount of the filler apparently enters the ink phase and some amount appears to stay in the resin phase so as to disrupt the continuity of the resin phase and its cohesion and permit the resinous network to cleave and transfer under impact pressure.

The binder material is preferably a vinyl resin such as vinyl chloride-vinyl acetate copolymer, polystyrene, methyl methacrylate-ethyl acrylate copolymer, or the like. However other resins are also suitable such as alcohol-soluble nylon, polycarbonates, cellulose acetate-butyrate, and the like.

The oleaginous material of the ink phase contains at least about 20% by weight of a liquid oil so that the ink is pressure-flowable. Preferably the ink contains a major amount by weight of a semi-solid oleaginous material such as lanolin, petrolatum, glyceride or other material which is non-flowable or slowly-flowable at ordinary room temperature.

The coloring matter is preferably a dyestuff which is at least partially soluble in the oleaginous material. In many cases it is preferred that the dyestuff be a black dye composition such as conventionally used in the ball point pen field. Similarly the use of infrared radiation-absorbing dyes such as the complex azine dyes is important in cases where the copy must be thermographically-reproducible. Amounts of finely divided pigments may also be included.

The filler material is preferably one having internal porosity so that it is capable of absorbing the liquid ingredients of the ink layer such as dissolved resin and/or oily ink vehicle. In this regard fillers such as clay, bentonite, attapulgite, alumina and calcium carbonate in porous form are preferred. Other fillers having a surface porosity and capable of absorbing such liquid ingredients are also suitable. This includes fillers such as barytes, silica and titania. All of these fillers are referred to herein and in the appended claims as being porous.

The following examples are given as illustrations of compositions and methods suitable for the production of transfer sheets according to the embodiments of the present invention and should not be considered limitative.

EXAMPLE 1

This example illustrates the preparation of a transfer sheet of the type illustrated by FIG. 1 of the drawing.

Ingredients:	Parts by weight
Lanolin -----	6.3
Blown rapeseed oil -----	2.5
Oleic acid -----	1.0
Victoria blue base -----	0.4
Methyl violet base -----	1.6
Tergitol -----	0.5
Clay -----	10.2
Vinyl chloride - vinyl acetate copolymer (VYHH) -----	2.0
Toluol -----	15.5
Methyl ethyl ketone -----	20.0

The above ingredients were mixed to a coatable consistency and applied to an 0.5 mil thick polyethylene terephthalate polyester film in conventional manner and dried by evaporating the volatile solvents. Next an adhesive supercoating is applied over the imaging layer. The following composition is illustrative of a suitable supercoating composition:

Ingredients:	Parts by weight
Carnauba wax -----	58
Polybutene resin (Indopol H-300) -----	8
Beeswax -----	8
Mineral oil -----	26

The supercoating is applied to the surface of the imaging layer as a hot melt and cooled. Under the effects of

imaging pressure, the supercoating carries corresponding portions of the imaging layer to the master sheet as shown by FIG. 1.

EXAMPLE 2

This example illustrates another composition suitable for use according to this invention. This composition is applied to a smooth inert plastic film and supercoated according to the procedures outlined in Example 1.

Ingredients:	Parts by weight
Lanolin -----	6.3
Blown rapeseed oil -----	1.1
Mineral oil -----	1.0
Tergitol HP14 -----	1.0
Victoria blue base -----	0.4
Methyl violet base -----	1.6
Clay -----	10.2
Styron -----	4.0
Piccolite S100 (10% solution in toluol) -----	20.0
Toluol -----	4.0
Xylol -----	20.4

The master sheets 20 imaged according to the present invention, such as with the compositions of Example 1 or 2, are used to produce duplicate copies in any number of conventional pressure devices which provide an overall pressure of lower magnitude than impact pressure. A conventional hectograph duplicating machine may be used without the usual spirit solvent provided that the pressure between the master sheet, mounted on the rotating drum, and the copy sheets is increased, if necessary, so that exudation of the ink to the copy sheets results. Similarly a Thermo-Fax or the like machine may be used provided that it has pressure rollers to compress the master sheet and copy sheet to the extent necessary to cause ink exudation. In such machines the infrared radiation source may be retained since heating of the master images tends to render the ink more fluid and thus more easily exudable under the applied pressure. Other conventional pressure devices such as a flat press which applies overall pressure or a knife edge device which applies a moving line pressure may be used.

The supercoating compositions suitable for use according to the present invention are those frangible coatings which have a strong affinity for both the imaging layer and for the surface of a master sheet so as to provide a strong bond between the transferred portions of the imaging layer and the surface of the master sheet. The supercoating composition may be a hot-melt composition or a volatile solvent composition. Preferred in the case of the former are tacky waxes such as paraffin, beeswax or microcrystalline mineral wax, and mixtures thereof with tacky resins such as polybutene isomers. In the latter case solutions or dispersions of synthetic thermoplastic resins such as polyvinyl acetate, styrene, styrene-butadiene and the like dissolved or dispersed in a volatile solvent or vehicle such as ethyl acetate, methyl ethyl ketone, toluol or water are preferred. If desired a mixture of a volatile solvent and non-solvent may be used to blush the supercoat and render it more frangible, and a filler may be included to render the supercoat non-tacky to the touch.

According to one embodiment of this invention the master sheet may be provided with a special receptor coating having excellent receptivity and bonding strength for the supercoating present over the transfer layer. In this regard the receptor layer may be a thin solvent-applied resinous layer based upon a tacky resin such as a polybutene or a styrene-butadiene rubber latex. A large amount of filler is added to render the receptor layer non-tacky to the touch. Also suitable are thin hot-melt layers based on tacky waxes such as paraffin and/or beeswax. Generally the receptor layer is based upon one or more of the same binders present in the supercoating but is so thin as to be retained substantially completely within the surface porosity of the receptor paper, thereby having no frangibility.

While the present invention is concerned primarily with the production of transfer sheets, it should be understood that the invention broadly contemplates the production and use of transfer elements of all types, whether in sheet, narrow strip or ribbon form. For instance, one important application of the invention relates to the imaging of duplicate checks, such as credit checks, travelers checks or the like, wherein the purchaser writes his signature so that it is produced in reverse on the master sheet, after which the master sheet is impressed against a succession of checks to reproduce the signature on each.

I claim:

1. Process of producing a pressure-sensitive transfer element which comprises the steps of

(a) applying to a flexible inert smooth plastic film foundation a thin layer of a coating composition comprising a resinous binder material, a porous filler, an oleaginous material which is incompatible with said binder material, coloring matter which is at least partially soluble in said oleaginous material, and a volatile solvent for said binder material, said porous filler comprising at least about 25% by weight of the solids content of said composition and being present in a weight equal to at least about 1.5 times the weight of said binder material,

(b) evaporating said volatile solvent to form a frangible, pressure-transferable imaging layer comprising a porous network of said resinous binder material having dispersed therein a sufficient amount of said porous filler to render said network transferable under the effects of localized impact pressure, and also having dispersed within the pores thereof an ink which is exudable from said network under the effects of an overall pressure of lower magnitude than said impact pressure, said ink comprising said oleaginous material and said coloring matter, and

(c) applying a continuous supercoating of adhesive composition having an affinity for said imaging layer and for a master sheet over said imaging layer, said supercoating being impact-transferable along with said imaging layer to a master sheet.

2. Process according to claim 1 in which the resinous binder material of the imaging layer comprises a vinyl resin.

3. Process according to claim 1 in which the oleaginous material comprises at least 20% by weight of a liquid oil and a major amount by weight of a semi-solid material.

4. Process according to claim 1 in which said porous filler comprises a clay.

5. Process according to claim 1 in which said plastic film foundation is insoluble in said volatile solvent and in the ingredients of said imaging layer.

6. Process according to claim 1 in which said supercoating is applied as a hot-melt composition comprising a mixture of wax and resin.

7. A pressure-sensitive transfer element comprising a flexible inert smooth plastic film foundation having on the surface thereof a thin, frangible, pressure-transferable imaging layer comprising a porous network of resinous binder material having dispersed therein a sufficient amount of a porous filler to render said network transferable under the effects of localized impact pressure, and also having dispersed within the pores thereof an ink which is exudable from said network under the effects of an overall pressure of lower magnitude than said impact pressure, said ink comprising an oleaginous material which is incompatible with said binder material and coloring matter which is at least partially soluble in said oleaginous material, said porous filler comprising at least about 25% by weight of the solids content of said imaging layer and being present in a weight equal to at least about 1.5 times the weight of said binder material, and having over said imaging layer a continuous supercoating of adhesive composition, said supercoating having an

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affinity for both said imaging layer and a master sheet and being impact-transferable along with said imaging layer to a master sheet.

8. Pressure-sensitive transfer element according to claim 7 in which the resinous binder material of the imaging layer comprises a vinyl resin.

9. Pressure-sensitive transfer element according to claim 7 in which the oleaginous material comprises at least 20% by weight of a liquid oil and a major amount by weight of a semi-solid material.

10. Pressure-sensitive transfer element according to claim 7 in which said supercoating comprises a mixture of wax and resin.

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MURRAY KATZ, Primary Examiner

U.S. Cl. X.R.

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