TRANSFER ELEMENTS AND METHOD OF MAKING THE SAME

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Fig. 1

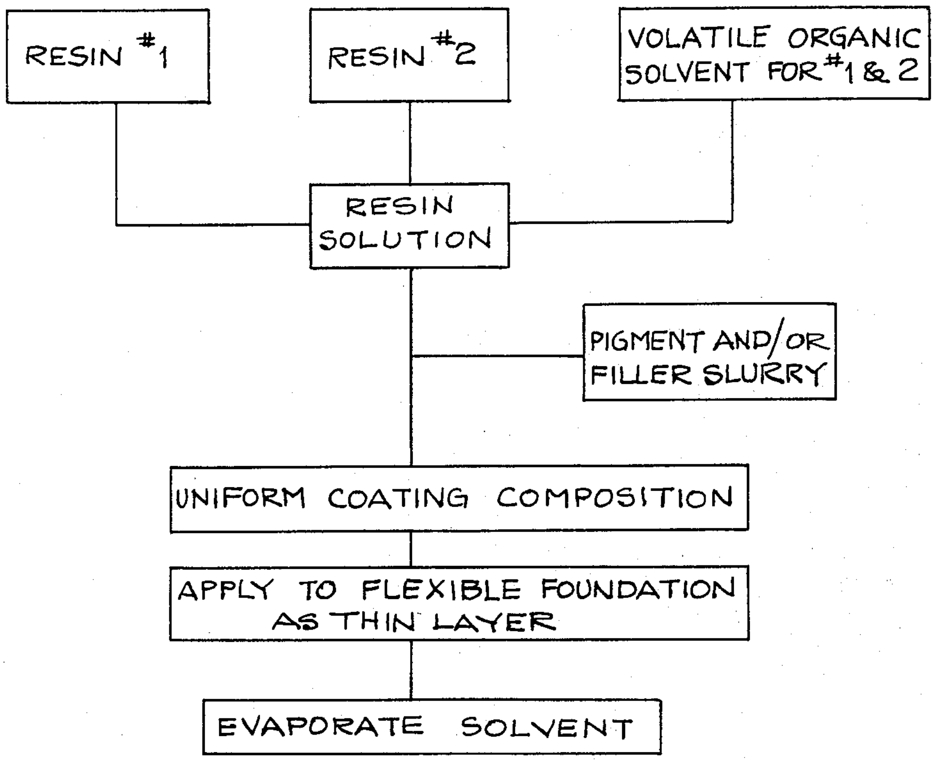

Fig. 2

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TRANSFER ELEMENTS AND METHOD OF MAKING THE SAME

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ABSTRACT OF THE DISCLOSURE

Preparation of novel transfer elements having a pressure-transferable imaging layer which is based on a mixture of incompatible resins and is free of oil, grease and wax. The imaging layer is applied by means of a volatile organic solvent system which codissolves the incompatible resins and which is evaporated after application.

The present invention relates to novel pressure-sensitive transfer elements for use in the fields of manifolding, hectograph duplication and magnetic sensing and the like, and to the process for preparing such transfer elements. More particularly this invention relates to transfer elements carrying frangible layers which are completely transferable under the effects of imaging pressure and which are based upon resinous binder materials applied by means of volatile organic solvents and at ordinary room temperatures.

While only a relatively few years ago substantially all carbon papers and ribbons were based upon wax binder materials and were prepared according to the hot melt process, a great amount of time and effort is directed today towards the use of synthetic plastics and resins in place of the conventional waxes. This revolution has given rise to a number of new products, some of which are similar and some of which exhibit dramatic differences.

The plastic or resinous transfer layers may be grouped into two distinct types. The first type is the so-called squeeze-out, porous layer illustrated by United States Patent No. 2,984,582 in which the resin is present in non-frangible or non-transferable form and functions merely as a spongy ink dispenser for oily or pasty ink compositions which are incompatible with the resin. The second type is as illustrated by United States Patents Nos. 2,872,340, 3,036,924 and 3,054,692 in which the plastic or resinous binder material is in frangible form and functions very similarly to a conventional wax binder material.

This invention relates to the latter type frangible transfer layer and thus is directed to the problem of overcoming the property of a plastic or resinous material whereby it tends to form a continuous film which is not frangible. This property has been overcome in prior known resinous transfer layers by a number of different methods with varying degrees of success. According to all prior known methods, the resinous binder material is converted to frangible form by the addition of waxes, oils, or the like materials to overcome the self-adhesive properties of the resin, or by blushing techniques whereby an incompatible volatile agent is added to leave voids or micropores in the resinous layer, thereby disrupting its continuity and rendering it frangible. While some of these known transfer sheets have been suitable for certain specific uses, the uses are generally limited because of the nature of the additives, the brittle and/or smeary properties of the final transfer layer or the poor frangibility of the transfer layer which necessitates its use in combination with a special

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receptor layer on the copy sheet or a special overcoating or undercoating on the transfer sheet or ribbon.

It is the main object of the present invention to produce a frangible transfer layer based upon plastic or resinous binder materials without waxes, oils or blushing agents which may detract from the natural advantageous properties of the resin per se with regard to cleanliness, smudge-resistance and resiliency or resistance to cracking, flaking or powdering and which result in processing problems in the manufacture of transfer sheets carrying such layers.

It is another object of this invention to produce a frangible resinous or plastic transfer layer which is suitable for use in the manifolding, hectograph and magnetic fields and which may be so compounded as to have excellent frangibility without depending upon the essential use of supplementary coatings to assist in the transfer thereof to a copy sheet, although such coatings may be employed for particular purposes as desired.

These and other objects and advantages of the present invention are accomplished in a manner which is clear to those skilled in the art in the light of the present disclosure.

In the accompanying drawings, FIG. 1 is a flow sheet illustrating the steps of the process of the present invention, and FIG. 2 is a diagrammatic cross-section, to an enlarged scale, of a transfer element produced according to the present process.

The objects and advantages of the present invention are accomplished by the discovery that resinous or plastic film-forming binder materials may be formulated, without the essential addition of waxes or oils, to produce coatings having a high degree of frangibility. We have discovered that film-forming binder materials, which per se normally form continuous non-frangible films, can be modified to form frangible films or coatings by using them in admixture with each other and applying them in codissolved form in a volatile organic solvent system which may involve one solvent or a mixture of miscible solvents, provided that at least two such plastics or resins are used in proportions such that at least about 10% by weight of the total resin content, and preferably about 50% by weight, is incompatible with the remainder of the resin content.

Thus, if at least two plastics or resins which are at least partially incompatible with each other are mixed together in proportions such that at least 10% by weight of one resin is incompatible with the other and the mixture is coated onto a flexible foundation, there results a film or coating having a relatively high degree of frangibility as compared to the lack of frangibility of coatings or films formed from either of the resins or plastics used alone or in combination with resins with which they are compatible.

The present invention is concerned with the production of carbons and ribbons containing additives such as pigments and dye-stuffs which make them useful for manifolding, hectograph and magnetic sensing. Such additives, as well as fillers included to reduce the cost of the coatings, have the effect of increasing the frangibility of the resinous transfer coatings.

It is an important aspect of this invention that the present transfer layers contain a relatively high proportion of the resinous binder material relative to the other ingredients and thereby produce images which are tougher, more uniform and more smudge-resistant than possible using prior known transfer layers which contain large amounts of additives essential to lend frangibility to the binder material.

The addition of large amounts of wax additives produces processing problems since wax is difficult to dissolve in organic solvents and some heat must be applied to induce dissolution. Such heat is difficult to maintain constant during the entire processing and also results in evaporation of the organic solvent and lack of control of the viscosity of the coating solution and lack of uniformity in the coating. Such coatings are also relatively soft and dirty to the touch and produce relatively soft, smeary images due to the presence of large amounts of wax.

The addition of large amounts of oil leads to a number of complications. If the oil is completely incompatible with the binder it tends to separate from the binder and form droplets which bleed from the binder on standing or under pressure. Thus the binder material tends to remain on the foundation while the oil is transferred under pressure or the oil bleeds into the foundation with aging so that none of the layer is transferable. If the oil is one which is compatible with the resin binder, it softens the binder so that the layer is dirty to the touch and produces soft, smeary images.

The resinous transfer layers of the present invention do not depend upon such additives for frangibility and therefore such materials may be omitted completely or, in cases where desired, such materials may be used in proportions which do not present the prior art problems with regard to smudging, bleeding or loss of frangibility, flaking or the like.

The most critical components of the present transfer layers are the film-forming binder materials. Such materials are all thermoplastic binder materials, some of which are conventionally regarded as plastics and others of which are conventionally regarded as resins. Suitable film-forming binder materials include the vinyl resins such as polystyrene, styrene copolymers with butadiene and the like, polyvinyl acetate, acrylic and methacrylic acids and esters and copolymers thereof, copolymers of methyl vinyl ether and maleic anhydride, polybutenes and the like; cellulose plastics including ethyl cellulose and ethyl hydroxyethyl cellulose, alkyd and rosin-modified alkyd resins, polyterpene resins, aryl sulfonamide-formaldehyde resins, urea-formaldehyde resins and others.

While some of the aforementioned thermoplastic film-forming binder materials are partially or completely compatible with one another, it is a simple matter for one skilled in the art in the light of the present disclosure to select combinations of incompatible binders or to determine the limits of compatibility of those combinations of binders which exhibit partial compatibility. The following table is set out to illustrate various combinations of suitable binder combinations in preferred ratios but it should be understood that other combinations and ratios are also suitable as will be obvious to those skilled in the art.

TABLE

Film-forming binders:	Ratio
Ethyl Cellulose N7 and Styron PS3	2:1–1:2
Ethyl Cellulose N7 and Acryloid B–66	1:1
Styron PS3 and Acryloid B–66	2:1–1:1
Styron PS3 and ethyl hydroxyethyl cellulose	1:1
Styron PS3 and Piccolite S–10	1:1
Parlon and Piccolite S–10	1:1
Acryloid B–66 and Piccolite S–10	1:1
Acryloid B–66 and Piccotex	1:1
Neolin and Beetle 227.8	1:1
Vinac ASB–10 and Gantrez AN139	1:1
Vinac ASB–10 and Santolite	1:1
Ethyl cellulose N7 and Klucel	1:1
Styron PS3 and Acryloid B–66 and Piccolite S–10	1:1:1
Styron PS3 and Acryloid B–66 and Ethyl Cellulose N7	1:1:1
Styron PS3 and Vistanex LM and Ethyl Cellulose N7	1:1:1
Styron PS3 and ethyl hydroxyethyl cellulose and Aroclor 5460	3.5:1:1

The various commercially available binder materials designated by trademarks in the above table are identified as follows:

Ethyl Cellulose N7 is ethyl cellulose
Styron PS3 is polystrene
Acryloid B–66 is an acrylic ester resin
Piccolite S–10 is a polyterpene resin
Parlon is a chlorinated rubber polymer
Piccotex is a styrene homolog copolymer
Neolin is a rosin-derived alkyd resin
Beetle 227.8 is a urea-formaldehyde resin
Vinac ASB–10 is a polyvinyl acetate resin
Gantrez AN139 is a copolymer of methyl vinyl ether and maleic anhydride
Santolite is a toluene-sulfonamide resin
Vistanex is a polybutene isomer resin
Klucel is a cellulose ether plastic
Aroclor 5460 is a chlorinated polyphenyl resin

The transfer elements of the present invention are prepared by solvent coating techniques in which the transfer composition is dissolved in one or more volatile organic solvents, coated onto a flexible foundation such as paper or plastic film at ordinary room temperature and allowed to set and solidify through evaporation of the solvent.

It is a critical feature of the process of the present invention that the incompatible film-forming binder materials must be codissolved in the solvent or solvents used so as to be present in the same solution as opposed to being present as separate strata. In most cases a single solvent can be found which will dissolve both film-formers. In other cases it is necessary to use a combination of miscible solvents, one of which dissolves each of the film-formers to form a single solution.

Any additive materials such as pigments, fillers, dyestuffs, oils or other materials which it may be desired to incorporate into the transfer layer are preferably premixed with a small amount of the solvent to form a slurry which is then added to the resin solution.

The flow diagram of FIG. 1 of the drawings illustrates the various steps of the present process discussed supra.

The following examples illustrates a few compositions of the invention containing various additives which adapt the compositions for their intended purposes. These compositions are illustrative and should not be considered limitative. In each case the particular compositions are suitable for coating onto a flexible foundation such as paper or plastic film by conventional solvent coating techniques at ordinary room temperatures and solidification of the coating occurs through evaporation of the volatile organic solvent. The final transfer element is as illustrated by FIG. 2 of the drawings.

Example 1

Ingredients:	Parts by wt.
Styron	1.2
Ethyl Cellulose N7	1.2
Magnetic iron oxide IRN100	18.1
Toluol	79.5

Example 2

Styron	1.2
Ethyl Cellulose N7	1.2
Clay	16.8
Milori blue	1.5
Toluol	79.3

Example 3

Piccolite S–10	1.0
Acryloid B–66	.9
Hectograph black dye	13.7
Toluol	84.4

Example 4

	Parts by wt.
Styron	2.4
Acryloid B–66	1.2
Magnetic iron oxide	20.0
Toluol	76.4

Example 5

Styron	0.73
Ethyl Cellulose N7	0.73
Vistanex LM	0.40
Lanolin	0.61
Milori blue	1.10
Clay	12.33
Toluol	43.20
Methyl isobutyl ketone	11.00

As mentioned supra, the essential aspect of the invention resides in the discovery that a frangible transfer layer may be formed from two thermoplastic film-forming binder materials, provided that they are present in such proportions that at least 10% by weight of either resin is incompatible with the remainder of the resin content. Thus in cases where two resins are used which are completely incompatible with each other, the second resin may be present in an amount equal to from 10% by weight up to 90% by weight of the total resin content. In cases of partial compatibility, such as 50% compatibility, the second resin must be present in an amount equal to from 20% by weight up to 80% by weight of the total resin content since at both 20% and 80%, 10% of the minor resin would be incompatible.

The resinous binder material of the present invention is used for the purpose of binding large amounts of dyes such as hectograph dyestuff, pigments including magnetic pigments or other functional additives. It has been found that the binder material must be present in an amount equaling at least about 10% by weight of the total dry transfer layer.

The present transfer layers are substantially completely free of additives which are not temperature-stable solids, such as oils, greases, waxes, or the like, since such additives tend to migrate or exude from the layer or change character when the layer is subjected to conditions of heat or cold thereby affecting the frangibility of the transfer layer.

Possibly the greatest advantage of the present invention resides in the elimination of additives heretofore necessary for the production of frangible resinous layers. The present invention makes it possible, for instance, to produce resinous transfer layers which contain as little as about 10% by weight of binder material and as much as 90% by weight of hectograph dyestuff or magnetic pigment. It is possible through the use of such transfer layers to produce hectograph master sheets for instance which will provide many more sharp and clear hectograph spirit copies than is possible with conventional hectograph transfer sheets which generally contain only about 25% to 50% by weight of hectograph dyestuff. According to this embodiment of the invention, the present hectograph transfer sheets preferably contain from about 10% to 20% by weight of the resinous binder material, from about 70% to 90% by weight of undissolved particulate dyestuff which is insoluble in the volatile organic solvent, and, if desired, up to 20% by weight of filler. These proportions have been found to be equally satisfactory in the case of magnetic pigments in place of

hectograph dyestuff for the production of magnetic sheets and ribbons.

While it is preferred in many cases to avoid the presence of excessively large amounts of fillers such as talc and clay which tend to render the transfer coatings somewhat brittle and dirty to the touch, such fillers may be added in various amounts, where desired, to increase the frangibility of the coatings and/or reduce the cost thereof without substantially disrupting the cleanliness and stability of the present transfer layers.

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

We claim:

1. The process of preparing pressure-sensitive transfer elements having a flexible foundation carrying a frangible transfer layer which is substantially completely free of oil, grease and wax and substantially completely transferable in image form under the effects of imaging pressure, which comprises the steps of dissolving in a volatile organic solvent from about 10% to about 20% by weight of at least two different synthetic thermoplastic film-forming materials which are at least partially incompatible with each other in the dry state and are codissolved in said organic solvent, such film-forming materials being present in such proportions that at least 10% by weight of the total film-forming material content is incompatible with the remainder of the film-forming material content in the dry state, adding thereto up to 90% by weight of coloring matter, applying said volatile organic solvent solution to a flexible foundation and evaporating the volatile organic solvent to form the frangible transfer layer.

2. The process according to claim **1** in which the first film-forming material is cellulosic and the second film-forming material comprises a vinyl resin.

3. The process according to claim **1** in which the first film-forming material is ethyl cellulose and the second film-forming material comprises polystyrene.

4. The process of claim **1** in which the coloring matter comprises an undissolved hectograph dyestuff which is insoluble in said volatile organic solvent.

5. The process of claim **1** in which the coloring matter comprises magnetic pigment.

6. A pressure-sensitive transfer element produced according to claim **1.**

7. A pressure-senitive transfer element produced according to claim **2.**

8. A pressure-sensitive transfer element produced according to claim **3.**

9. A pressure-sensitive transfer element produced according to claim **4.**

10. A pressure-sensitive transfer element produced according to claim **5.**

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