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TRANSFER ELEMENTS AND METHOD OF MAKING SAME

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Fig. 1

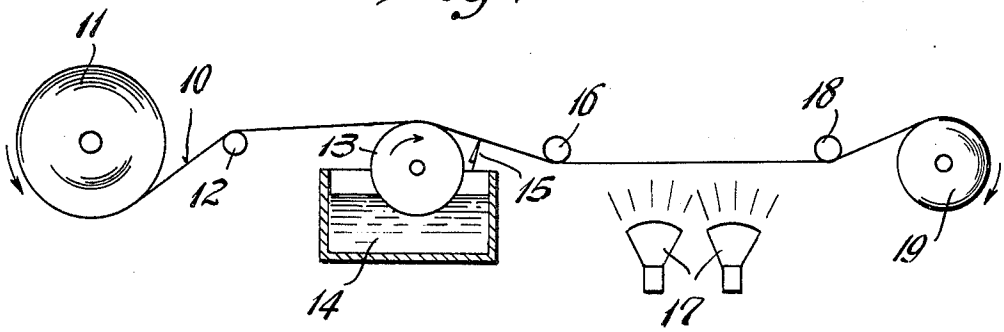
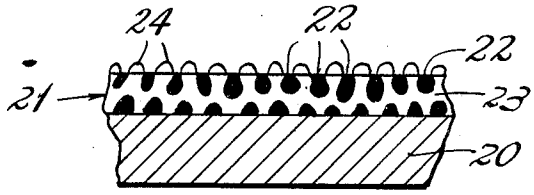


Fig. 2



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TRANSFER ELEMENTS AND METHOD OF MAKING SAME

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Continuation-in-part of application Ser. No. 623,322, Mar. 15, 1967. This application July 20, 1967, Ser. No. 654,729

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U.S. Cl. 117—36.4 8 Claims

ABSTRACT OF THE DISCLOSURE

Novel pressure-sensitive transfer elements of the squeeze-out type which are cleaner to the touch and resitant to producing typewriter roller marks on the copy sheet, made by treating the resinous ink-releasing surface of such transfer elements with a very thin layer of a dilute solution of a synthetic thermoplastic resin which is incompatible with the oily vehicle of the ink layer, the solvent of said solution being incapable of dissolving said resinous ink-releasing surface during said treatment.

This application is a continuation-in-part of our earlier copending application Ser. No. 623,322, filed Mar. 15, 1967, now abandoned.

The present invention relates to the field of the so-called "squeeze-out" carbon papers and ribbons in which the transfer layer comprises a microporous non-transferable resinous structure containing within the pores thereof a pressure-exudable ink comprising an oily vehicle and imaging matter. Such transfer elements are illustrated by United States Patents Nos. 2,820,717; 2,944,037; 3,037,879 and 3,117,018, among others.

According to our earlier copending application, we discovered that improved squeeze-out type transfer elements can be prepared by applying a thin resinous wash coat over the ink-releasing layer. We have now discovered that superior products of this type can be produced by selecting the resinous binder material of the ink-releasing layer and the volatile organic solvent used to apply the synthetic thermoplastic resin of the wash coat so that the former is insoluble in the latter or is at least so difficultly soluble in the latter that dissolution does not occur during the brief exposure thereto encountered prior to evaporation of the volatile organic solvent from the wash coat.

Other objects and advantages of this invention will be clear to those skilled in the art in the light of the present disclosure including the drawings in which:

FIGURE 1 is a diagrammatic illustration of the process of applying the present supercoatings; and

FIG. 2 is a diagrammatic cross-section, to an enlarged scale, of a transfer element produced according to the present invention.

The objects and advantages of the present invention are attained by treating the ink-releasing surface of a squeeze-out type resinous ink layer with a thin liquid wash coating consisting essentially of a dilute solution of a synthetic thermoplastic resin dissolved in a volatile organic solvent and then evaporating the solvent, the resin being one which is incompatible with the oily ink vehicle of the ink layer and the solvent being a material which does not significantly dissolve the synthetic thermoplastic resinous binder of the ink layer during the application of the wash coating.

It should be made clear that the present wash coating does not form a continuous film or layer over the ink layer. This effect is to be avoided since such a continuous film seals the ink layer and prevents the ink layer from exuding ink under the effect of imaging pressure. Resins which are compatible with the oily ink vehicle have this effect and cellulose plastics in general also have this effect. Similarly the use of solvents to apply the wash coat which are good solvents for the resinous binder of the ink layer tends to produce this result by redissolving the binder and disturbing the porous structure of the ink layer so that there are no solid resinous peaks at the surface of the ink layer to which the resin of the wash coat can selectively adhere. The redissolved resin tends to spread over the exposed ink pores and causes the resin of the wash coat to settle thereover also so that the pores become sealed and ink-release is retarded.

The wash coating must be free of oils or other oleaginous materials which are incompatible with the resin of the wash coating since such materials separate from the resin to form unpigmented droplets through which the ink of the transfer layer must be transmitted. This results in a dilution of the ink and a reduction in its tone or imaging strength, and a lack of uniformity of imaging strength over the surface of the transfer element. The inclusion of pigment in such oil phase overcomes this problem but results in a transfer element which is dirty to the touch and produces roller marks during use.

The present thin wash coat appears to form a microporous screen on the ink-releasing surface due to the fact that the resin of the wash coat is incompatible with the oily ink vehicle of the ink layer. The ink vehicle is present at the surface of the microporous ink layer in the form of microscopic droplets. These droplets are incompatible with the applied resin and therefore the thin film of applied resin appears to be repelled by the oily ink vehicle so that it forms a skeletonized screen over the surface of the ink layer and contains micropores in areas corresponding to the location of the microscopic ink droplets present at the surface of the ink layer. This effect is made possible by the extreme thinness of the applied wash coating and the undisturbed porous structure of the ink-releasing layer. The thin film of applied resin does not have sufficient thickness or strength to form a continuous film and therefore contracts during evaporation of the solvent. This contraction causes the resin to be drawn away from the exposed oily pores of the ink layer, due to the lack of compatibility, and to form a microscopic beady appearance over the surface of the ink layer.

This theory is further supported by the fact that the disturbing of the pore structure by means of solvent action or the use of resins and plastics which are compatible with the ink vehicle result in the formation of a continuous skin over the ink layer and prevent the ink layer from exuding a sufficient amount of ink. Such skin is pressure-rupturable but requires a number of impressions over each area before images of normal intensity can be produced. This, of course, is entirely unsatisfactory. Cellulose plastics perform in this manner.

The present wash coating compositions consist essentially of solutions of from about 1% up to about 15%

by weight of a synthetic thermoplastic resin dissolved in a volatile organic solvent which is a non-solvent for the resinous binder of the ink layer during the period of exposure thereto, the resin being incompatible with the oily ink vehicle of the ink layer. Vinyl resins in general are suitable and include polyvinyl actate, vinyl chloride polymers and copolymers with vinyl acetate, polystyrene, polyvinyl butyral, acrylic acid and ester polymers and copolymers such as polymethyl methacrylate, methyl methacrylate-ethyl acrylate copolymers and the like. Polycarbonate resins are also suitable. Preferred volatile organic solvents are methyl ethyl ketone, ethyl acetate, acetone, chlorinated hydrocarbons and the like, depending upon the solubility of the resin of the wash coat and the insolubility or poor solubility of the resin of the ink layer. Small amounts of compatible plasticizers, fillers, colorants or the like may be included in the wash coat for economic or aesthetic purposes since such additives are contained within the wash coat and do not interfere with its intended performance.

The wash coating is applied to the surface of the ink layer and spread to form a wet film having a thickness of from about ½ point, applied by means of a 0 (zero) doctor blade, up to about 5 points, applied by means of a number 15 blade. This is the thickness of the liquid wash coating which consists mainly of the volatile solvent. The dried wash coating has an approximate thickness range of from 1% to 15% the thickness of the wet layer since the wet layer contains only from 1% to 15% solids. Broadly the dried wash coating may have a thickness ranging from 1% of ½ point (0.0005 mil) up to 15% of 5 points (0.075) mil). The preferred range is from 0.005 mil up to 0.05 mil. These are theoretically accurate mean ranges although it is recognized that the beading of the resin of the wash coating and its withdrawal from the ink pore areas of the ink layer increase the thickness of the peak areas of the dried wash coating. A point is equal to 0.1 mil and 0.0001 inch.

The present wash coatings may be applied in the manner illustrated by FIG. 1 of the drawing. The web of transfer element **10** is expended from supply roll **11** over idler roller **12** and against application roller **13** which is immersed in vat **14** containing a supply of the wash coating composition. The wash coating is applied to the underside of the web over the squeeze-out ink-releasing layer and is spread to the desired thickness by means of doctor blade **15**. The wet web then passes under idler roller **16** and over heat lamps **17** which cause evaporation of the volatile solvent and solidification of the thin resin structure. The web then passes under idler roller **18** and onto take-up roll **19**.

The structure of the final transfer element is somewhat uncertain as stated supra but appears to be as illustrated in FIG. 2 of the drawings. The transfer element has a flexible foundation **20** carrying a microporous squeeze-out type ink-releasing layer **21** and a thin non-transferable synthetic thermoplastic resin structure **24** over said ink-releasing layer. The ink-releasing layer comprises a non-transferable microporous synthetic thermoplastic resinous structure **23** containing droplets **22** of pressure-transferable oily ink within the pores thereof. The ink droplets **22** at the surface of the ink layer repel the liquid wash coating so that when it dries, the resin structure does not seal the ink pores. Thus while imaging pressure is sufficient to exude the oily ink to a copy sheet, the lesser pressure exerted by a typewriter roller or the like is not sufficient to cause the oily ink to exude beyond the surface of the resin structure **24**.

The following example illustrates the production of one type of transfer element according to the present invention and should not be considered limitative.

A film web of ½ mil polyethylene terephthalate polyester (Mylar) is first coated with a thin layer of polyvinylidene chloride (Saran) dissolved in methyl ethyl ketone to provide a receptive undercoating having a thickness of about 0.1 mil. After evaporation of the solvent, the undercoating is coated with the following ink composition.

Ingredients:	Parts by wt.
Styrene-methyl methacrylate copolymer (Zerlon 150)	12.0
Butyl stearate	7.0
Refined rapeseed oil	7.0
Sulfonated vegetable oil	1.7
Blue toning paste	2.2
Black toner pigment	6.6
Ethyl acetate	10.2
Methyl ethyl ketone	26.3
Toluol	27.0
	100.0

The applied ink composition is dried at elevated temperatures to form a microporous ink layer having a thickness of about 0.6 mil.

As shown in FIG. 1, the transfer element **10** formed as above is passed in contact with an application roller **13** so that the ink layer is provided with a thin layer of the wash coating composition in vat **14** which is a 10% solution of polyvinyl acetate (Vinylite AYAF) dissolved in methyl ethyl ketone. Doctor blade **15** is a 0 (zero) blade which spread the wash coating to a wet thickness of about ½ point (0.05 mil). Thereafter the transfer element is promptly heated to evaporate the methyl ethyl ketone and leave the dried polyvinyl acetate structure having a thickness of between 0.005 and 0.01 mil. The methacrylate copolymer is insoluble in the methyl ethyl ketone solvent of the wash coat during the brief exposure thereto.

The finished film web is collected on take-up roll **19** for cutting into sheets or ribbons of the desired dimensions. The present invention is principally concerned with the production of transfer sheets for typewriter use and transfer strips or wide ribbons for other business machine use.

The preferred binder materials for the ink-releasing layer are those which are insoluble in conventional organic solvents, such as the polycarbonate resins, and those which are so slowly soluble in such solvents that they are not dissolved during the brief exposure thereto, less than about 30 seconds, during the application of the wash coat and prior to the evaporation of the solvent. The acrylic resins, including polymers and copolymers of acrylic and methacrylic acids and low esters, fall into this latter category. Acrylic wash coats may be applied over acrylic ink layers with excellent results. However, the other more soluble vinyl resins such as copolymers of vinyl chloride and vinyl acetate can only be used in the ink-releasing layer in association with wash coats containing solvents which do not dissolve such copolymers. Polycarbonate-chlorinated hydrocarbon solvent wash coats provide good results over such copolymer ink layers. The vinyl copolymer is very suitable in the wash coat to be applied over acrylic or polycarbonate ink layers.

While pigments such as the carbon blacks, magnetic iron oxides, particulate dyestuffs and toned pigments having dyes of the desired colors precipitated and absorbed on the surface of porous pigments are the preferred coloring materials, other coloring materials are also useful including the substantially colorless color-forming reactive chemicals which form colored reaction products on contact with other colorless coreactive chemicals present on the copy sheet surface.

We claim:

1. The process of producing pressure-sensitive transfer elements of the squeeze-out type which are clean to the touch and resistant to exuding ink under the effects of pressures less than imaging pressure which comprises:

(a) applying to the surface of a thin flexible founda-

tion sheet a thin coating of a composition comprising a synthetic thermoplastic resin, an oily vehicle which is incompatible with said resin, coloring matter and a volatile solvent for said resin;

(b) evaporating said solvent to form a thin ink layer of pressure non-transferable microporous structure of said resin containing within the pores thereof pressure-exudable ink comprising said oily vehicle and coloring matter, some of said ink-containing pores being present at the surface of said layer;

(c) applying over the surface of said ink layer a thin layer consisting essentially of a dilute solution of a synthetic thermoplastic resin in a volatile organic solvent, said resin being incompatible with the oily vehicle of said ink layer and said volatile organic solvent being one which does not significantly dissolve the said binder resin of the ink layer during application of said dilute solution, whereby said synthetic thermoplastic resin is shed by the portions of the surface of the ink layer at which said ink-containing pores are exposed; and

(d) evaporating said organic solvent to solidify said layer of synthetic thermoplastic resin as a thin pressure nontransferable layer over said ink layer and containing ink-permeable openings in areas corresponding to the location of the ink-containing pores on the surface of said ink layer.

2. The process of claim **1** in which said dilute solution comprises from about 1% to about 15% by weight of said synthetic resin.

3. The process of claim **1** in which the synthetic resin of the ink layer is selected from the group consisting of acrylic resin and polycarbonate resins and said dilute solution comprises solvent and a resin selected from the group consisting of vinyl resins, acrylic resins and polycarbonate resins.

4. The process of claim **1** in which the dilute solution of synthetic thermoplastic resin is applied in a thickness of from about 0.05 mil to 0.5 mil and the dried resin layer has a thickness of from about 0.0005 mil to 0.075 mil.

5. A pressure-sensitive transfer element of the squeeze-out type produced according to claim **1**.

6. A transfer element according to claim **5** in which the binder resin of the ink layer is selected from the group consisting of acrylic resins and polycarbonate resins and said dilute solution comprises solvent and a resin selected from the group consisting of vinyl resins, acrylic resins and polycarbonate resins.

7. A transfer element according to claim **5** in which the said discontinuous layer has a thickness of from about 0.0005 mil to 0.075 mil.

8. A transfer element according to claim **7** in which the said discontinuous layer has a thickness of from about 0.005 mil to 0.05 mil.

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U.S. Cl. X.R.

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