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(58) Field of search
UK CL (Edition J) **D1B**

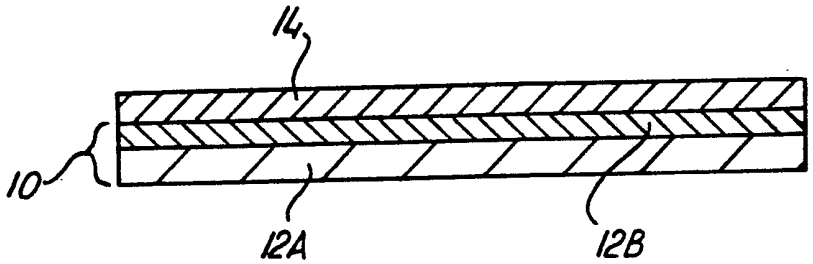
(54) Transfer printing with sublimatic dyes

(57) A dye image is sublimatically transferred to a coating layer of adhesive composition before (or, less preferably, after) said coating is applied to a printable surface, e.g. of a fabric. The adhesive composition typically comprises -

30 – 50 % adhesive, e.g. acrylic resin (n-butyl methacrylate)
10 – 40% mineral spirit or other solvent
1 – 35 % plasticiser, e.g. butyl benzyl phthalate
1 – 19% lubricant, e.g. oleine.

Preferably, sublimatic dye image 12B is screen printed onto backing paper 12A and coated with adhesive composition 14. Heating to 185 – 215°C sublimatically transfers the dye image into coating 14 which is then placed against the fabric at elevated temperature and pressure, thereby forcing the dyed coating between the fibres of the fabric. The backing paper 12A may be removed after cooling to room temperature.

The process is especially applicable to natural fibres (e.g. cotton) and blends thereof (e.g. polyester-cotton).



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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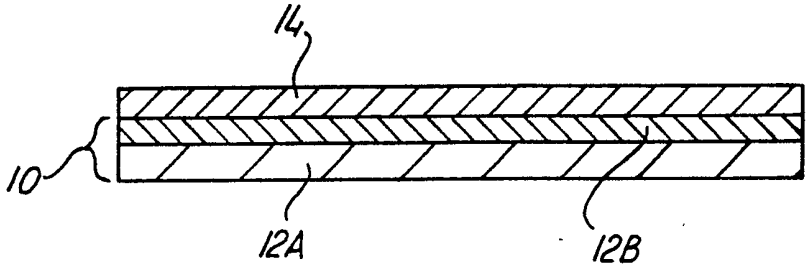

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Transfer Printing

The present invention relates to transfer printing, and in particular, to sublimatic transfers.

Previously proposed sublimatic transfers are used on man-made fabrics, in particular polyester. They are formed by printing an image in sublimatic dye on to a paper carrier or substrate. The image may be formed on the substrate by screen printing, for instance. In order to transfer the image to the fabric, the face of the substrate which bears the image is placed against the fabric surface. Pressure is then applied at elevated temperature, for instance by means of a heated press. This causes the dye on the substrate to undergo sublimation, changing to a gas which impregnates the fabric fibres, where the dye solidifies on cooling. The resultant image is extremely durable by virtue of the impregnation of the dye into the fibres, and is vivid.

The results obtained from sublimatic transfers on natural fibres and man-made fabrics other than polyester are found to be inferior, and in many cases unsatisfactory. Natural fibres have a structure which prevents impregnation by sublimatic dyes in a gaseous state, and in consequence only a faint image is produced and the image is easily removed by washing.

It is an object of the present invention to provide an improved sublimatic transfer which can be used more widely than previously proposed sublimatic transfers.

According to a first aspect of the invention, there is provided a composition for use in sublimatic transfer printing, the composition comprising an adhesive component and the material or materials of the composition being so chosen as to be receptive to sublimatic dye transferred thereto by sublimation, and to be adherable to a surface to be printed, thereby binding the dye to the surface to form an image thereon.

The composition may comprise an acrylic resin such as n-butyl methacrylate as an adhesive component. The coating may also include a solvent for the adhesive component. The solvent may be a mineral spirit. The mineral spirit may be a dilute benzene based solvent.

The composition preferably also includes a plasticizer. The plasticizer may be a phthalate such as butyl benzyl phthalate.

Preferably, when the image is to be formed on a fabric, the composition includes a lubricant for affecting the feel of the transfer after application to

the fabric. The lubricant may comprise oleine.

The composition may include 30 to 50% of adhesive component, 1 to 35% of plasticizer, 10 to 40% of mineral spirit and 1 to 19% of lubricant.

The invention also provides a sublimatic transfer comprising a substrate, an image formed by sublimatic dye, and a coating, the coating and the dye being so selected that on heating to a predetermined temperature the dye transfers the image to the coating by sublimation, the resulting transfer being capable of adherence to a surface to be printed, whereby the coating binds the dye to the surface to form an image thereon.

The dye image is preferably located between the coating and the substrate. Where a solvent is included the coating includes sufficient solvent for the adhesive component to allow removal of the substrate at a temperature in the range 10 to 200°C. The coating is preferably a composition as set out above.

In a further aspect, the invention provides a method of transfer printing with sublimatic dyes, comprising effecting sublimation of a sublimatic dye on to a coating receptive thereto to transfer an image to

the coating, and adhering the coated image to a surface to be printed, whereby the coating binds the dye to the surface to form said image thereon.

Preferably the sublimation is effected before the coating is adhered to the surface to be printed.

Preferably the coating is formed over an image which has been applied in sublimatic dyes to a substrate, the method including removal of the substrate after the coated image has been applied to said surface.

Preferably sublimation of the dye is effected by heating, to transfer the image to the coating before the coating is applied to said surface. The dye may be heated to a temperature in the range 185 to 215°C to transfer the image to the coating. The dye is preferably heated for a period of at least ten seconds to transfer the image to the coating.

The coating may be applied to said surface at an elevated temperature to cause the coating to adhere to said surface. The elevated temperature may be in the region of 180 to 220 °C preferably around 190 °C. The coating is preferably applied to said surface under pressure to cause the coating to adhere to the surface.

The application pressure may be in the region of 7 to 30 psi, preferably around 20 psi.

Preferably the elevated temperature and pressure are applied for a period of 7 to 25 seconds, preferably around 10 seconds.

The coating is preferably a composition as set out above.

A coating according to the invention and a method of using it will now be described in more detail, by way of example only, and with reference to the accompanying drawing, which is a diagrammatic section through a transfer incorporating the coating.

The coating to be described is intended for use in sublimatic transfer printing on natural fibres such as cotton and cotton mixtures, for example poly/cotton (polyester/cotton). The coating material consists of four components. An acrylic resin, preferably n-butyl methacrylate is used as an adhesive component. A mineral spirit is incorporated as a solvent for the n-butyl methacrylate which is normally a solid. Other suitable solvents include ethers, fluorocarbons, hydrocarbons, ketones and nitroparaffins. A plasticizer, preferably a

phthalate such as butyl benzyl phthalate is incorporated to improve the handling properties of the coating. Finally the material also includes a lubricant such as oleine or another animal fat derivative, or a mineral oil derivative, or a mixture of such components. This serves to improve the feel ("handle") of the transfer on the fabric.

Preferably the composition includes 30 to 50% of n-butyl methacrylate, 1 to 35% of plasticizer, 10 to 40% of mineral spirit and 1 to 19% of lubricant. A composition found to produce acceptable results comprises:

n-butyl methacrylate	-	48%
butyl benzyl phthalate	-	8%
mineral spirit	-	30%
lubricant	-	14%

The formulation of the coating begins by allowing the n-butyl methacrylate to soak in mineral spirit until it softens and dissolves. Gentle stirring at this stage results in a viscous liquid. The plasticizer and lubricant are then added and the resulting mixture is again stirred to an even consistency. The whole formulation process may take place at room temperature.

When the coating has been prepared, it may be applied to a sublimatic transfer 10 which consists of a paper substrate 12A on which an image 12B has been printed in reverse, using sublimatic dyes and a silk screen or other printing process. The coating 14 is then applied, for instance by roller, over the sublimatic dye image 12B which is therefore trapped between the coating 14 and the paper substrate 12A.

Once the transfer has been coated, the image may be transferred to the coating by heating the transfer. Raising the temperature into the range 185 to 215°C for a period of ten seconds is sufficient to cause the dyes to penetrate the coating by sublimation so that when the transfer is returned to room temperature, the image is permanently fixed in the coating.

To apply the transfer the substrate 12A and dyed coating 14, 12B are placed against the fabric to be printed with the coating 14 in contact with the fabric. Elevated temperature and pressure are then applied. The elevated temperature (preferably in the range 180 to 220°C, for example 190°C) softens the coating enhancing its adhesive properties and flow characteristics. The applied pressure (preferably in the range 7 to 30 psi, for example 20 psi) forces the dyed coating between the

fibres of the fabric. When room temperature and pressure are restored, the coating adheres to the fabric fibres, thereby binding the sublimated dyes to the fabric. Thus the durability and vivid colours of sublimatic transfer images can be achieved on fabrics whose fibres are not in themselves suitable for impregnation by sublimatic dye.

The formulation described above has the further advantage that, by varying the quantity of solvent included in the coating, the adhesive properties can be varied as may be required to apply the method to different fabrics. The adhesiveness is preferably reduced sufficiently to allow the backing paper to be readily removed at room temperature, or at a temperature in the range 10 to 200°C. Room temperature removal is expected to provide significant advantages when the transfers are used in presses for simultaneously printing a plurality of articles. Previously proposed sublimatic transfers required the backing paper to be removed before the transfer had cooled, so that a press operator may only have a period of a few seconds in which to remove the backing sheets from all of the transfers which have simultaneously been printed. This may prove to be impossible, especially if any difficulties are experienced with one or more backing sheets, and the resultant loss of production caused by failure to remove

backing sheets can be unacceptably high. By contrast, when the backing sheets can be removed at lower temperatures, it ceases to be necessary to remove all backing sheets within a few seconds of the press opening.

The coating formulation described above has also been found to increase the shelf-life of sublimatic transfers to which it has been applied. Untreated transfers which tend to degrade as the dyes in the image leach into one another. The presence of the coating is believed to inhibit leaching.

The use of the coating to bind the sublimatic dye to the surface to be printed allows sublimatic transfer printing to be extended to surfaces which are wholly inpenetrable by sublimatic dyes.

It will be appreciated that many modifications and variations to the formulation described above can be made without departing from the spirit and scope of the present invention. In particular, the choice of adhesive will depend on the surface which is to be printed, and will be made to ensure that the adhesive can adhere to the surface but can also take an image by sublimation. Other components such as lubricant, softeners, solvents, and plasticizers will be included or omitted according to

the characteristics of the coating which are required for particular applications.

In a modification of the method described above, the coating may be first applied to the article, following which the dyes are sublimatically transferred to the coating, to be bound to the article.

CLAIMS

1. A composition for use in sublimatic transfer printing, the composition comprising an adhesive component and the material or materials of the composition being so chosen as to be receptive to sublimatic dye transferred thereto by sublimation, and to be adherable to a surface to be printed, thereby binding the dye to the surface to form an image thereon.

2. A composition according to claim 1, comprising an acrylic resin as an adhesive component.

3. A composition according to claim 2, wherein the acrylic resin is n-butyl methacrylate.

4. A composition according to any of claims 1 to 3 and including a solvent for the adhesive component.

5. A composition according to claim 4, wherein the solvent is a mineral spirit.

6. A composition according to claim 5, wherein the mineral spirit is a dilute benzene based solvent.

7. A composition according to any preceding claim, and including a plasticizer.

8. A composition according to claim 7, wherein the plasticizer is a phthalate.

9. A composition according to claim 8, wherein the phthalate is butyl benzyl phthalate.

10. A composition according to any preceding claim, and including a lubricant for affecting the feel of a transfer after application to a fabric.

11. A composition according to claim 10, wherein the lubricant comprises oleine.

12. A composition according to any preceding claim, and including 30 to 50% of adhesive component, 1 to 35% of plasticizer, 10 to 40% of mineral spirit and 1 to 19% of lubricant.

13. A sublimatic transfer comprising a substrate, an image formed by sublimatic dye, and a coating, the coating and the dye being so selected that on heating to a predetermined temperature the dye transfers the image to the coating by sublimation, the resulting transfer being capable of adherence to a surface to be printed, whereby the coating binds the dye to the surface to form an image thereon.

14. A transfer according to claim 13, wherein the dye image is located between the coating and the substrate.

15. A transfer according to claim 13 or 14, and including sufficient solvent for the adhesive component to allow removal of the substrate at a temperature in the range 10 to 200°C.

16. A transfer according to claims 13, 14 or 15, wherein the coating is a composition according to any of claims 1 to 12.

17. A method of transfer printing with sublimatic dyes, comprising effecting sublimation of a sublimatic dye on to a coating receptive thereto to transfer an image to the coating, and adhering the coating to a surface to be printed, whereby the coating binds the dye to the surface to form said image thereon.

18. A method according to claim 17, wherein the sublimation is effected before the coating is adhered to the surface to be printed.

19. A method according to claim 17 or 18, wherein the coating is formed over an image which has been applied in sublimatic dyes to a substrate, the method including removal of the substrate after the coated image has been applied to said surface.

20. A method according to any of claims 17 to 19, wherein sublimation of the dye is effected by heating.

21. A method according to claim 20, wherein the dye is heated to a temperature in the range 185 to 215°C to transfer the image to the coating.

22. A method according to claim 20 or 21, wherein the dye is heated for a period of at least ten seconds to transfer the image to the coating.

23. A method according to any of claims 17 to 22, wherein the coating is applied to said surface at an elevated temperature to cause the coating to adhere to said surface.

24. A method according to claim 23, wherein the elevated temperature is in the region of 180 to 220°C.

25. A method according to claim 24, wherein the temperature is about 190°C.

26. A method according to any of claims 17 to 25, wherein the coating is applied to said surface under pressure to cause the coating to adhere to the surface.

27. A method according to claim 26, wherein the

application pressure is in the region of 7 to 30 psi.

28. A method according to claim 27, wherein the application pressure is about 20 psi.

29. A method according to any of claims 23 to 25 and any of claims 26 to 28, wherein the elevated temperature and pressure are applied for a period of 7 to 25 seconds.

30. A method according to claim 29, wherein the elevated temperature and pressure are applied for a period of about ten seconds.

31. A method according to any of claims 17 to 30, wherein the coating is a composition according to any of claims 1 to 12.

32. A coating composition for use in sublimatic transfer printing, substantially as described above.

33. A sublimatic transfer substantially as described above with reference to the accompanying drawing.

34. A method of printing with sublimatic dyes, substantially as described above.

35. Any novel subject matter or combination including novel subject matter herein disclosed, whether or not

within the scope of or relating to the same invention as any of the preceding claims.

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