United States Patent

Lorenz

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[54] METHOD OF FIXING IMAGES CONSISTING OF DRY POWDERS ON PAPER

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[30] **Foreign Application Priority Data**

Mar. 14, 1968 Germany ..... P 16 71 644.2

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[51] **Int. Cl.** **B44d 1/094**, G03g 13/20, B44d 1/11

[58] **Field of Search** ..... 117/17.5, 28, 29, 33, 76 P, 117/155, 13

[56] **References Cited**

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[57] **ABSTRACT**

Dry powder images are fixed on paper by treating the powder image coated paper with an aqueous dispersion of a film forming synthetic resin.

5 Claims, No Drawings

METHOD OF FIXING IMAGES CONSISTING OF DRY POWDERS ON PAPER

The invention relates to a method of fixing images of dry powders on paper. Dry colored powders are used in different printing methods, particularly silk screening and electrostatic printing. The adhesion of such a powder to paper is only small. Unlike printing with liquid inks or pastes, the image obtained by a dry powder must always be fixed in a separate operation. Several methods of fixation are known.

Fixation by heat is widely used. In addition to the actual color pigment the powder contains a thermoplastic component and/or the paper to be printed is provided with a coating of material which softens upon heating. Upon softening of the resin component, the powder and the paper are permanently connected together. Heat can be applied to the material provided with an image of dry powder, for example, by hot air, infrared radiators, heated plates or drums. In a further method the paper surface bearing an image is provided by means of spraying, rolling or dipping, with a film consisting of a solvent having a low boiling point, which dissolves a certain component of the powder and/or the paper surface, and hence establishes an adhesion between paper and powder, after evaporation. Solvents suitable for this purpose are, however, either inflammable (for example toluene) poisonous (for example, trichloroethylene) or only slowly dissolve the active component in the powder or the paper and evaporate slowly (for example, water).

If the image powder does not contain components which can be softened by heat or can be dissolved in manageable solvents and if the paper does not include coatings which possess these properties, then it is alternatively possible to coat the paper provided with a powder image with a solution of a transparent substance which forms a film in the solid state. It must also in this case be possible for the solvent to be evaporated by heating. Known for this purpose is, for example, a lacquer solution which is commercially indicated as a fixative. All solvents usable for this purpose have, however, the previously mentioned drawbacks.

Other methods of fixation, for example, laminating of the printed paper with a foil are difficult, particularly in mass printing.

The said methods of fixation have great drawbacks which impede particularly their use in electrostatic high-speed printing machines which must cooperate with data-processing machines. Temperatures above 100° C. must be used for fixation by means of heating. The required heat is therefore 10–20 kw. per sq. m. of paper in which up to 5 g. of water per sq. m. of paper is simultaneously evaporated. When printing quantities of 0.5 to 1.0 sq. m. of paper per second, the working space is generally loaded to an inadmissibly great extent by exhausted heat and water vapors including decomposition products of the adhesive in the paper. Separate devices for removing the decomposition products require additional investments.

Due to the porous structure of the printing paper, the fixation by means of solvents or products containing solvents requires 10 to 20 g. of solution per sq. m. of paper to be provided. In practice only poisonous or inflammable organic solvents having a low evaporation heat are suitable. Here, too, the problem presents itself of the evaporation heat and the safe removal of the vapors.

An object of the present invention is to provide a simple method of fixing images consisting of dry powders on paper, by which the described drawbacks are obviated and in which, as a rule, no special devices for the removal of possible decomposition products are required.

The method according to the invention is characterized in that the paper provided with a dry powder image is coated with a dispersion of a synthetic resin in water.

For fixing a dry powder image on paper an aqueous dispersion of a synthetic resin is preferably used which forms a film at a low temperature.

It has been found that a synthetic resin film of approximately 2–4 μm. thick on the paper is generally amply sufficient for

fixation. The solid substance content of dispersions suitable for this purpose is generally more than 40 percent. Since the synthetic resin in the dispersion is present in the form of small particles of at least 0.2 μm. diameter the viscosity of even a very highly concentrated dispersion only differs little from that of pure water. On the other hand the paper is not soaked by the dispersion as in the case of a solution, and therefore not only a fraction but the entire solid substance content of the coating provided is available for the formation of a film. Quantities of provided coatings of 4 to 8 g. of dispersion per sq. m. of paper are therefore amply sufficient. With these small quantities the fixation process takes some tenths of a second, and the porous structure of the paper greatly contributes thereto. Immediately after providing, the water is sucked away from the dispersion in the paper under the influence of capillary forces, so that the dispersion breaks. The dispersed particles are, as it were, filtered off. The particles form a loose network on the paper in the pores of the surface and above the powder image provided, which network, however, flows together to a coherent transparent film when the lowest temperature at which a film is formed by the dispersed substance is below the operation temperature. The lowest temperature at which a film is formed is dependent on the kind of synthetic resin used, but by suitable choice this temperature is substantially arbitrarily adjustable between +3° C. and 100° C.

In the manufacture of art paper for refining paper surfaces it is widely known per se to provide a coating of a dispersion. As a rule, however, coatings of up to 20 g. of dry substance per sq. m. of paper are used, with approximately the same quantity of water being used. For refining a paper surface the brushable mixture mostly contains, in addition to the dispersed synthetic resin polymer, white pigments and binders which are soluble in water. For such thickly provided coatings and the conventional high brushing speeds of 100 to 600 m./min. a drying treatment by means of heat for the purpose of driving off the quantity of water is of course inevitable.

For the small thicknesses of the coatings provided for the fixation of images of dry powders according to the invention the added quantity of water is only approximately 2–4 g. per sq. m. of paper surface, that is to say, 5 to 10 percent of the quantity of paper. This quantity of water is approximately as large as the quantity which is normally present in the paper at the usual air humidities. The additional load of the paper by water caused by the fixation can therefore be accepted without further drying steps. If nevertheless an immediately dry paper provided with an image would be desired, then there is the possibility to use predried paper which not until fixing reaches a moisture content which is balanced by the air humidity.

The dispersions may efficiently be provided with the aid of a follower roller. Auxiliary rollers may apply the suitable quantity of dispersion to the roller by means of which the dispersion is provided. Spraying on the dispersions is only possible at a great mechanical stability of the dispersions, for otherwise the dispersion breaks in the spraying nozzle. Due to the low viscosity of dispersions which substantially corresponds to that of water the provision of the dispersion presents few difficulties. When providing the dispersion of occurrence of stripping forces must be avoided as much as possible in order that the powder image is not wiped out. An equalization of the film provided is, however, not necessary because freedom from pores is not required and because the thickness is very small anyway. When choosing the dispersions it should be taken care of that finished printed sheets do not stock together. It was found during tests that dispersions of copolymers of butadiene and styrene (more than 35 percent of butadiene) of acrylic acid esters and PVC copolymerisates are suitable. These products are commercially available under different trade names.

By mixing the dispersions with mineral fillers having approximately the same refractive index as that of the synthetic resin present in the dispersion, or pigmentation agents which are soluble in water, the properties of the transparent coatings

are adjustable with respect to color tone, gloss, writing possibility and smoothness.

According to known instructions for use for providing coatings on paper auxiliary substances such as substances suppressing the formation of foam, wetting agents and thickening agents can be added to the dispersions.

What is claimed is:

1. A method of fixing dry powder images on paper, said method comprising coating the side of a paper on which a dry powder image is present with an aqueous dispersion of a film-forming synthetic resin, said coating step being carried out at a temperature sufficiently high to cause the synthetic resin to form a film on the paper.

2. The method of claim 1 wherein for each square meter of paper 4 to 8 grams of the dispersion are employed and the synthetic resin employed forms a film below the temperature employed in the coating step.

3. The method of claim 1 wherein a predried paper is employed.

4. The method of claim 1 wherein the dispersion contains fillers and pigmentation agents in addition to the synthetic resin.

5. The method of claim 1 wherein the aqueous dispersion is applied to the paper by means of a follower roller.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,640,749 (PHD 894) Dated February 8, 1972

Inventor(s) RAINER LORENZ

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the title page, under "Foreign Application Priority Data" change "P 1671644.2" to -- P 44238 --.

Signed and sealed this 23rd day of January 1973.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents